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Technology Innovation

Optimization Review
Peck Iron and Metal Superfund Site

Portsmouth, Virginia

www.epa.gov/superfund/remedytech | www.clu-in.org/optimization | www.epa.gov/superfund/cleanup/postconstruction

OPTIMIZATION REVIEW

PECK IRON AND METAL SUPERFUND SITE
PORTSMOUTH, VIRGINIA

Report of the Optimization Review and
Site Visit Conducted at the Peck Iron and Metal Superfund Site on
February 22, 2012

January 18, 2013

EXECUTIVE SUMMARY

The purpose of this optimization review was to evaluate site conditions and identify optimal approaches for conducting the remedial investigation (RI) of the Peck Iron and Metal (PIM) Superfund Site (the Site). It is expected that this report may form the basis for additional systematic project planning among the optimization review team, project technical team and stakeholders to develop, review and finalize RI-specific work planning and implementation documents.

The U.S. Environmental Protection Agency (EPA)'s Office of Solid Waste and Emergency Response (OSWER) and the Office of Superfund Remediation and Technology Innovation (OSRTI) define optimization as follows:

> *"Efforts at any phase of the removal or remedial response to identify and implement actions that improve the action's effectiveness and cost-efficiency. Such actions may also improve the remedy's protectiveness and long-term implementation which may facilitate progress towards site completion. To identify these opportunities, regions may use a systematic site review by a team of independent technical experts, apply techniques or principles from Green Remediation or Triad, or apply some other approach to identify opportunities for greater efficiency and effectiveness. Contractors, states, tribes, the public and PRPs are also encouraged to put forth opportunities for the Agency to consider."*

Optimization reviews include a "systematic site review," whereby the site as a whole is often considered. However, optimization can focus on a specific aspect of a given cleanup phase (or a particular operable unit [OU]), with other phases and site areas considered to the degree that they affect the focus of the optimization effort. For optimization reviews conducted before a Record of Decision (ROD) is issued, the focus is on developing the conceptual site model (CSM) by leveraging existing data and exploring potentially applicable sampling and analysis tools and strategies that facilitate a comprehensive systematic planning process.

The recommendations in this report are intended to help the site team identify opportunities for an optimized RI approach. Where noted in this report, further analysis of a recommendation may be needed before the recommendation can be implemented. The recommendations are based on an independent evaluation and represent the opinions of the optimization review team. These recommendations do not constitute requirements for future action, but rather are provided for consideration by the Region and other site stakeholders. While the recommendations may provide some details to consider during implementation, the recommendations are not meant to replace other, more comprehensive, planning documents such as work plans, sampling plans and quality assurance project plans (QAPP).

Site-Specific Background

The Site is a 33-acre property located in Norfolk County, Portsmouth, Virginia. PIM (Figure 1) is the site of a former scrap metal storage and recycling facility that began operation in the 1940s. The Site borders Paradise Creek, a tidal tributary to the Elizabeth River. As a result of Site operations, elevated concentrations of lead, poly-chlorinated biphenyls (PCBs), arsenic and other contaminants are present in site environmental media, particularly surface soil. In accordance with a January 11, 2007 EPA, Region 3 (Region 3) Administrative Order for Removal Response Action, the site owner conducted an investigation to determine the extent of contamination. Based on a review of this and previous investigations, Hydrogeologic, Inc. (HGL), on behalf of Region 3, prepared a Response Action Contract (RAC) RI Work Plan (HGL Plan) to address identified data gaps in the existing Site characterization and to generate the data necessary to support the assessment of remedial options. The purpose of this optimization review is to evaluate Site conditions and identify opportunities, if any, to optimize the planned RI of the PIM site.

Summary of Conceptual Site Model

Based on review of available documents and a site visit conducted on February 22, 2012, a preliminary conceptual site model (PCSM) has been developed to describe the optimization team's interpretation of dominant processes responsible for the release and transport of site constituents to the environment.

As a result of approximately 50 years of scrap metal processing and recycling operations, contaminants, primarily PCBs and metals, were released over broad areas to surface soil at the Site. In addition, a secondary source of potential subsurface soil contamination is the large amount of fill material of various forms (construction rubble, debris, etc.) used to raise land surface elevations, particularly in the southern central portion of the Site. Contact of precipitation with contaminated soil potentially resulted in the transport of contaminated soil through surface runoff. Surface water transport of contaminated soil has potentially resulted in elevated levels of site constituents in Paradise Creek. As a result of the downward migration of contaminated groundwater recharge, the potential also exists for offsite migration of contaminated groundwater.

Summary of Findings

The following are the primary findings from this optimization review.

- Although mostly vacant, portions of the Site are being used for various ad hoc purposes that may contribute to, or result in human exposure from, Site contamination. For example, a construction contractor appears to use a portion of the Site as an operations base and materials used for automotive painting and maintenance were identified during the site visit.

- Most of the Site is blanketed by a fill layer that locally can attain thicknesses approaching 10 feet (ft). The fill appears to consist of soil mixed with various forms of rubble (wood, concrete, asphalt, glass) and metal scraps. Previous investigations have indicated that the fill may contain minor amounts of munitions and explosives of concern/munitions debris (MEC/MD).

- Historic processing of decommissioned electrical transformers for scrap metal recovery at the Site is the likely source for elevated PCB concentrations observed over much of the Site. Results from the extensive amount of soil sampling conducted at the Site indicate that PCB concentrations exceeding 5.4 milligrams per kilogram (mg/kg) or 10 times the most stringent EPA Regional Screening Level (RSL) for PCBs in industrial soil (0.54 mg/kg for Aroclor[1] 1221 and 1232) are common. Additionally, concentrations exceeding 100 times the Aroclor 1221 and 1232 RSL have been identified in many areas.

- Elevated concentrations of metals and PCBs are present in Site soils over broad areas. Although somewhat limited, Site groundwater data suggest that Site related metals and PCBs are either present at relatively low concentration levels or are non-detect.

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[1] Aroclor is a registered trademark of the Monsanto Chemical Company.

- As a result of previous investigations, the level of characterization of Site media attained to date is significant. However, the following data issues were identified by the optimization review team:
    - Surface soils characterization data are based on composite samples taken from the top 18 inches of soil, an interval that is inconsistent with Region 3 procedures for risk assessment.
    - Polychlorinated dibenzodioxins (PCDD) and polychlorinated dibenzofurans (PCDFs) are compounds that are released into the environment from several industrial processes including combustion and metal processing (EPA, 2012). PCDDs and PCDFs were detected at relatively low levels (less than 0.664 ppb, screening level for industrial or commercial property, www.epa.gov/superfund/health/contaminants/dioxin/dioxinsoil.html) in soil samples collected in three areas where combustion-based processing of decommissioned electrical transformers occurred. The available data, however, are insufficient for determining overall concentration levels and extent of these constituents.
    - With few exceptions, sampling of Site media has been limited to PCBs and seven metals (arsenic, cadmium, total chromium, lead, mercury, nickel and silver). To ensure that the list of Site constituents is complete, selected environmental samples from the Site areas with elevated concentrations for the existing constituent list should be analyzed for a more comprehensive constituent list.

- A total maximum daily load (TMDL) for PCBs is in development by the Virginia Department of Environmental Quality (VDEQ) for the Elizabeth River Watershed and is scheduled to be issued in 2014. A TMDL is the maximum amount of a pollutant that a water body can receive and still meet water quality standards. The Elizabeth River PCB TMDL could potentially be identified as a future applicable or relevant and appropriate requirement (ARAR) for the Site.

Summary of Recommendations

The HGL Plan describes an extremely thorough and well-reasoned approach for closing data gaps identified in the Site CSM. This optimization review team, however, identified some potential opportunities for expediting the RI while maximizing its effectiveness. The following recommendations are offered:

- Access to the Site should be limited to authorized individuals and entities only. Any currently existing unauthorized use of Site buildings or grounds should be evaluated and potentially terminated.

- In recognition of the hazards posed by MEC/MD, a trained unexploded ordinance (UXO) technician should be present during drilling operations. A protocol should be developed by UXO technicians for conducting down-hole magnetometer screening incrementally during borehole advancement through the fill layer.

- The RI should be structured so that data collection for each environmental media follows an adaptive sampling strategy. Low cost, rapid turnaround field analyses can be more fully employed in the RI to identify priority sampling locations for fixed-base laboratory analyses.

- DMAs are recommended to be conducted for each of the selected field technologies planned for use in the field investigation. Information on the design and performance of DMAs is provided in www.brownfieldstsc.org/pdfs/Demonstrations_of_Methods_Applicability.pdf (EPA, 2008). In addition, OSRTI is available upon request to provide technical assistance in the design and implementation of a DMA for X-ray fluorescence (XRF) or any other real time, field screening technology that Region 3 might consider for the PIM Site.

- Prior to conducting extensive analyses for PCDD and PCDFs in Site soil, groundwater and sediment samples, preliminary surface soil sampling for these constituents should be conducted in the Site areas most likely to be contaminated with PCDD and PCDFs. It is recommended that the sampling be performed early in the RI, possibly during the MEC/ MD avoidance and utility clearance sampling task. Based on the results of this initial sampling, the extent and scale of follow-up PCDD and PCDF characterization sampling can be defined. If elevated concentrations are observed in the initial sampling, more extensive sampling for PCDD and PCDF constituents is warranted. If concentrations are below applicable regional screening levels (RSLs), more limited sampling for these constituents may be sufficient.

- For the characterization of Paradise Creek sediments, a key task objective should be to directly evaluate the Site's impact on the benthic environment in Paradise Creek. Consistent with this objective, consideration should be given to performing benthic enumeration, sediment pore water sampling and sediment sampling at selected locations adjacent to and up-stream from the Site.

- As a recommended precursor activity to conducting benthic enumeration, pore water sampling and sediment sampling, a groundwater discharge survey of the Paradise Creek channel offshore from the Site should be performed. It is recommended that the aforementioned sediment characterization activities include any identified zones of preferential groundwater discharge identified by the survey.

- For the characterization of surface soil, incremental composite sampling (ICS) methods can be considered to provide better spatial coverage, help control matrix heterogeneity, lower analytical costs and if acceptable to Region 3, meet risk assessment needs.

- PCB congener (a PCB congener is any single, unique compound in the PCB category of compounds; there are 209 unique PCB congeners [Narquis et al., 2007]) analyses can be performed on a limited number of soil, on-Site sediment and groundwater samples for comparison to PCB congener data from Paradise Creek sediments. The results of these analyses will help to assess potential attribution of Site constituents to observed contamination in the creek sediments. For general characterization and for the purpose of risk assessment, analysis of PCB Aroclors is necessary to compare with RSLs.

- A review of municipal and/or state-maintained well permit databases should be performed to identify, to the extent possible, the extraction wells located in the vicinity of the Site. The results of the permit database review may help to understand the cause of low groundwater levels observed in a portion of the Site.

- Selected soil, groundwater, surface water and sediment samples (onsite drainages and Paradise Creek sediments) targeted for PCB congener analyses should use an analytical method (such as EPA 1668A) with a method detection level sufficiently low to demonstrate compliance with the PCB TMDL requirement currently in preparation by VDEQ.

NOTICE

Work described herein was performed by Tetra Tech EMI for the U.S. Environmental Protection Agency (EPA). Work conducted by Tetra Tech EMI, including preparation of this report, was performed under Work Assignment 2-58 of EPA contract EP-W-07-078. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

PREFACE

This report was prepared as part of a national strategy to expand Superfund optimization practices from remedial investigation to site completion implemented by the United States Environmental Protection Agency (EPA) Office of Superfund Remediation and Technology Innovation (OSRTI). The project contacts are as follows:

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LIST OF ACRONYMS

ATSDR	Agency for Toxic Substances and Disease Registry
bgs	below ground surface
CIP	Community Involvement Plan
CLP	Contract Laboratory Program
cm	centimeter
COC	contaminant of concern
CSM	conceptual site model
DAA	Draper Aden Associates
DMA	demonstration of method applicability
DO	dissolved oxygen
DU	decision unit
EOD	explosive ordnance disposal
ERP	Elizabeth River Project
ESC	Environmental Science Connector
eV	electron-volt
FS	feasibility study
ft	foot
GPS	global positioning system
HGL	Hydrogeologic, Inc.
HGLTW	Hydrogeologic, Inc. Temporary Well
HHRA	Human Health Risk Assessment
HRS	Hazard Ranking Score
IA	immunoassay analyses
IC	institutional controls
MCL	maximum contaminant level
MD	munitions debris
MECmg/kg	munitions and explosives of concern milligrams per kilogram
MPI	Malcolm Pirnie, Inc.
msl	mean sea level
ng/kg	nanogram per kilogram
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List
ORP	oxidation-reduction potential
OSRTI	Office of Superfund Remediation and Technology Innovation
OSWER	Office of Solid Waste and Emergency Response
OTW	Optimization Temporary Well
OU	operable unit
P&T	pump and treat
PAH	polycyclic aromatic hydrocarbons
Peck	The Peck Company, Inc.
PIM	Peck Iron and Metal Superfund Site
PCBs	polychlorinated biphenyls
PCSM	preliminary conceptual site model
PCDD	polychlorinated dibenzodioxins
PCDF	polychlorinated dibenzofurans
PID	photo ionization detector

ppb	parts per billion
QAPP	quality assurance project plan
RA	Remedial Action
RAC	Response Action Contract
RAP	Response action plan
RCRA	Resource Conservation and Recovery Act
RI	Remedial investigation
RI/FS	Remedial investigation/feasibility study
RPM	Remedial Project Manager
ROD	Record of Decision
RSLs	Regional Screening Levels
RSE	Remediation System Evaluation
SOP	Standard operating procedure
SPP	Systematic project planning
SPS-RDF	Southeastern Public Service Authority's Refuse Derived Fuel
SQuiRTs	Screening Quick Reference Tables
SVOC	semi-volatile organic compound
TAL	target analyte list
TCE	trichloroethene
TCL	Target compound list
TDS	Total dissolved solids
TEL	Threshold effects level
TMDL	Total Maximum Daily Load
TOC	total organic carbon
TPH	total petroleum hydrocarbon
TSCA	Toxic Substances Control Act
TSS	Total suspended solids
µg/kg	microgram per kilogram
µg/L	microgram per liter
USACE	United States Army Corps of Engineers
EPA	United States Environmental Protection Agency
UST	underground storage tank
UXO	unexploded ordnance
VC	vinyl chloride
VDEQ	Virginia Department of Environmental Quality
VDOT	Virginia Department of Transportation
VOC	volatile organic compound
VRP	VDEQ Voluntary Remediation Program
XRF	X-Ray Fluorescence

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1.0 INTRODUCTION

1.1 PURPOSE

The Peck Iron and Metal (PIM) Superfund Site (the Site) is a 33-acre property located in Norfolk County, Portsmouth, Virginia. PIM (Figure 1) is a former scrap metal storage and recycling facility that began operation in the 1940s.

As a result of Site operations, elevated concentrations of lead, polychlorinated biphenyls (PCBs), arsenic and other contaminants are present in Site environmental media, particularly soil. In accordance with a January 11, 2007 U.S. Environmental Protection Agency (EPA), Region 3 (Region 3) Administrative Order for Removal Response Action, the site owner conducted an investigation to determine the extent of contamination. Based on a review of this and previous investigations, Hydrogeologic, Inc. (HGL), on behalf of Region 3, prepared a Response Action Contract (RAC) Remedial Investigation (RI) Work Plan (HGL Plan) to address identified data gaps in the existing Site characterization and to generate the data necessary to support the assessment of remedial options

The purpose of this review is to evaluate Site conditions and identify optimal approaches for conducting the planned RI of the PIM site. EPA's emphasis on the optimization of site investigation on this project is based on the on-going program of evaluating operating remedies at Fund-lead sites. During fiscal years 2000 and 2001 independent Remediation System Evaluations (RSEs) were conducted at 20 operating pump and treat (P&T) sites (i.e., those sites with P&T systems funded and managed under Superfund by EPA, other federal agencies and by the States). Due to the opportunities for system optimization that arose from those RSEs, the EPA Office of Superfund Remediation and Technology Innovation (OSRTI) has incorporated RSEs into a larger post-construction complete strategy for Fund-lead remedies as documented in the Office of Solid Waste and Emergency Response (OSWER) Directive No. 9283.1-25, *Action Plan for Ground Water Remedy Optimization*. Concurrently, the EPA developed and applied the Triad Approach to optimize site characterization strategies, methods and technologies, including the increased use of conceptual site models (CSMs) as the basis for identifying project data gaps and using those gaps to guide the development of site characterization objectives and work plans. The EPA has since expanded the reach of optimization to encompass reviews at the investigation stage of projects (such as for the PIM Site).

EPA OSWER and OSRTI define optimization as follows:

> *"Efforts at any phase of the removal or remedial response to identify and implement actions that improve the action's effectiveness and cost-efficiency. Such actions may also improve the remedy's protectiveness and long-term implementation which may facilitate progress towards site completion. To identify these opportunities, regions may use a systematic site review by a team of independent technical experts, apply techniques or principles from Green Remediation or Triad, or apply some other approach to identify opportunities for greater efficiency and effectiveness. Contractors, states, tribes, the public and PRPs are also encouraged to put forth opportunities for the Agency to consider."*

Optimization reviews include a “systematic site review,” whereby the site as a whole is often considered. However, optimization can focus on a specific aspect of a given cleanup phase (or a particular operable unit [OU]), with other phases and site areas considered to the degree that they affect the focus of the optimization effort. For optimization reviews conducted before a Record of Decision (ROD) is issued, the focus is on developing the CSM by leveraging existing data and exploring potentially applicable sampling and analysis tools and strategies that facilitate a comprehensive systematic planning process.

A strong interest in green remediation and sustainability has also developed in the private sector and within Federal, State and Municipal governments. Consistent with this interest, OSRTI has developed a methodology for environmental footprint evaluation (www.cluin.org/greenremediation/methodology/index.cfm) and now routinely considers environmental footprint reduction during optimization reviews.

For a site in the investigation stage, the optimization review process includes reviewing site documents, potentially visiting the site for one day and compiling a report that includes recommendations for design and execution of a comprehensive, efficient and cost-effective investigation strategy.

The recommendations in this report are intended to help the site team identify opportunities for an optimized RI approach. Where noted in this report, further analysis of a recommendation may be needed before the recommendation can be implemented. The recommendations are based on an independent evaluation and represent the opinions of the optimization review team. These recommendations do not constitute requirements for future action, but rather are provided for consideration by the Region and other site stakeholders. While the recommendations may provide some details to consider during implementation, the recommendations are not meant to replace other, more comprehensive, planning documents such as work plans, sampling plans and quality assurance project plans (QAPP).

The national optimization strategy includes a system for tracking consideration and implementation of optimization recommendations and includes a provision for follow-up technical assistance from the optimization team as mutually agreed on by the site management team and EPA OSRTI.

The optimization review and site technical teams participated in a site visit and early systematic project planning (SPP) on February 22, 2012. This optimization review report provides findings and recommendations resulting from review of site documentation and data in conjunction with the site visit and SPP efforts. Suggestions provided for sample quantities, collection/analytical methods, locations and other parameters may be adjusted to meet project-specific schedule, budget and logistical considerations.

This document reviews the PIM Site CSM and identifies data gaps in the existing Site characterization as a means to focus and streamline the sequence of RI activities. It is recognized that sampling for multiple parameters will be necessary to assess total risk and that sampling to assess exposure routes and areas for human and ecological risk assessment are integral components of any RI. Where appropriate and timely, suggestions include these considerations, however, it is expected that this report will form the basis for additional SPP efforts among the optimization review team, project technical team and stakeholders to develop, review and finalize RI specific QAPP and implementation documents.

1.2 TEAM COMPOSITION

The optimization review team consisted of the following individuals:

Name	Affiliation	Phone	Email
Steve Dyment	EPA OSRTI	703-603-9903	dyment.stephen@epa.gov
Mark Shupe, PG	Tetra Tech EMI	703-390-0653	mark.shupe@tetratech.com

1.3 DOCUMENTS REVIEWED

The key documents that provided significant basis for the formulation of the preliminary conceptual site model (CSM) components included:

- *Letter Report to Mr. B. Webber (Chesterfield Auto Parts) and B. D. Peck (Peck Co.) from Messrs. T.A. LaMaskin and R.F. Hatcher, Hatcher-Sayre, Inc., Subject: Site Investigation Results, The Peck Company, Portsmouth, VA*, (Hatcher-Sayre, Inc., 1999). This report documents the results of a field investigation conducted during 1999, the year that the facility ceased operations. The investigation included the sampling of surface soil, subsurface soil and groundwater. Surface soil samples were collected on a 250 x 250 foot (ft) grid. Subsurface soils were collected in the interval just above the observed depth of the water table.

- *Letter report to J. Bernard [Virginia Department of Environmental Quality (VDEQ)] from S. Werner* [Draper Aden Associates (DAA)], *Subject: Site Characterization Report, Proposed Pull-A-Part Site, 3500 and 3850 Elm Ave., Portsmouth, VA*, (Draper Aden Associates, 2003a). In this site characterization report, DAA discussed the collection of additional groundwater data; presented the existing environmental data collected at the site, including the 1999 Hatcher-Sayre (Hatcher-Sayre, Inc., 1999) investigation results; presented re-use plans for the Site as a self-service auto parts salvage yard; performed a human health risk assessment based on the available data; and proposed remedial design consisting of soil capping and deed restrictions. Based on results obtained using VDEQ’s Risk Exposure Analysis Modeling System, DAA determined that remedial measures to address arsenic and lead contamination in soil would be necessary to support future development of the Site. DAA observed that Site constituent concentrations (metals and PCBs) are not elevated in Site monitoring wells and that public water supply in the area is provided by the City of Portsmouth. Since groundwater is not consumed in the area and human contact with Site groundwater is unlikely, DAA concluded that human health risk associated with the Site groundwater was not a concern.

- *Letter report to J. Bernard (VDEQ) from S. Werner (DAA), Subject: Site Characterization Addendum, Peck Recycling/Pull-A-Part, Inc., 3850 Elm Ave., Portsmouth, VA*, (Draper Aden Associates, 2003b). In response to the VDEQ’s and the EPA’s comments on the site characterization report, DAA conducted additional investigations to better characterize lead and PCBs in soil, screen soil for dioxin compounds and sample sediments from the two western drainage ways and the discharge points of these drainage ways to Paradise Creek. Soil sampling was conducted by random selection of sampling locations from a 150 by 150 ft grid covering the Site. Soil and sediment samples were collected at depths ranging from the ground surface to a depth of 2 ft below ground surface (bgs).

- *Sheet A-1: PCB Soil Sampling Results, February–May 2005, 50 x 50 ft Grid, 0–18-inch Depth, Pull-A-Part, Inc. VRP Site, Elm Ave., Portsmouth, VA (Stand-alone map of PCB concentrations* *for 0–18 inch depth; a second stand-alone map [Sheet B] presented PCB concentrations distributed over the same grid for the 18–36-inch depth)*. (Draper Aden Associates, 2005). DAA conducted additional sampling for PCBs in early 2005. Samples were collected from selected locations based on a 50 x 50 ft sampling grid covering the site. Samples from both the surface (0–18 inch bgs depth interval) and subsurface (18–36 inch bgs depth interval) were collected.

- *Concentrations of Polychlorinated Biphenyls (PCB) and Polycyclic Aromatic Hydrocarbons (PAH) in Sediment Samples from Paradise Creek, a Tributary to the Elizabeth River in Virginia, January 2005*, (Unger, M.A., Vadas, G.G., Harvey, E. and Reiger, J., 2005). In 2005, sediment sampling of Paradise Creek in the area adjacent to the Site was conducted. A total of 19 surface sediment samples and one core sample (divided into three depths) were collected from the creek.

- *Draft Extent of Contamination Study Report, Peck Iron Metal Site, 3850 Elm Avenue, Portsmouth VA, 23704, October 24, 2008*, (Malcolm Pirnie, Inc., 2008). On behalf of the Peck Company, Malcolm Pirnie, Inc. (MPI) prepared this report in accordance with a 2007 EPA Administrative Order for Removal Response Action for The Peck Company, Inc. The report documented soil, sediment and groundwater sampling conducted to address data gaps identified in the available characterization data.

- *Site Management Plan, Remedial Investigation/Feasibility Study, Peck Iron and Metal, Portsmouth, Norfolk County, Virginia, December 2011*, (Hydrogeologic, Inc., 2011). HGL prepared this Remedial Investigation/Feasibility Study (RI/FS) work plan as a task under the EPA Region 3 RAC. The objectives of the RI were to refine the CSM, address identified data gaps, define the nature and extent of contamination at the Site and assess the potential risk to human health and ecological receptors from identified site contaminants.

1.4 QUALITY ASSURANCE

This optimization review utilizes existing environmental data to interpret the CSM, evaluate principle study questions, identify data gaps and support SPP efforts to make recommendations for streamlined sequencing, sampling and analytical strategies. The quality of the existing data was evaluated by the optimization review team prior to using the data for these purposes. The evaluation for data quality includes a brief review of how the data were collected and managed, the consistency of the data with other site data and the use of the data in the optimization review. Data that are of suspect quality were either not used as part of the optimization review or are used with the quality concerns noted. Where appropriate, this report provides recommendations made to improve data quality.

1.5 PERSONS CONTACTED

A kickoff meeting with stakeholders was held on February 22, 2012, at the U.S. Army Corps of Engineers (USACE) field office at the former Atlantic Wood Treating Superfund Site (Atlantic Wood) located adjacent to the Site. In addition to the optimization review team, the following persons were present for the stakeholders meeting, including members of the project technical team:

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Debra Rossi	Region 3	215-814-3228
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Brett Brodersen	HGL	703-736-4526
Mark Shupe	Tetra Tech	703-390-0653

Following the kickoff meeting, the team toured the Site. Tetra Tech, Inc. (Tetra Tech) prepared a trip log memorandum and photographic log of the site walk. Both were posted to the EPA Environmental Science Connector (ESC) web site (https://ssoprod.epa.gov/sso/jsp/oblogin.jsp). Note that access to the ESC requires EPA authorization. For access support, contact Stephen Dyment. The trip log memorandum is included as Attachment A to this report; a photo log from the site visit (photos by Stephen Dyment) is provided as Attachment B.

2.0 SITE BACKGROUND

2.1 LOCATION

The PIM Superfund Site (the Site) is a 33-acre property located in Norfolk County, Portsmouth, Virginia. PIM (Figure 1) is the site of a former scrap metal storage and recycling facility that began operation in the 1940s. As a result of Site operations, elevated concentrations of lead, PCBs, arsenic and other contaminants are present in site environmental media, particularly soil.

The Site is bordered by Paradise Creek to the south, Elm Avenue to the north and east and Victory Boulevard to the east. An ARREFF Terminals, Inc. facility, a trans loading and bagging facility specializing in agricultural commodities, borders to the north. The Southeastern Public Service Authority's Refuse Derived Fuel (SPS-RDF) facility borders the Site to the southeast and the Norfolk Naval Shipyard partially borders the Site to the west, southeast and northeast. The Atlantic Wood Preserves Superfund Site is also located east of the Site, across Victory Boulevard. A Sherwin-Williams paint facility is located to the west of the Site. Paradise Creek is a tributary of the Southern Branch of the Elizabeth River. In 2003, a 6-acre parcel of the Site bordering Paradise Creek was donated to the Elizabeth River Project (ERP) for permanent conservation as a wetland buffer (HGL 2011). In the spring of 2003, ERP completed a wetland restoration of this 6-acre area. Currently, only a small segment of the Site borders Paradise Creek.

General Site conditions were assessed during the February 22, 2012 site visit. The primary site structures observed included cinderblock and brick slab-on-grade buildings located in the northwestern portion and eastern portion of the Site. The buildings present in the eastern portion of the Site include a former maintenance building, former locker/change room facility and former office; all of which appeared abandoned and unused at the time of the site visit. In addition, the former maintenance building was flooded by several inches of water. Although the buildings in the northwestern portion of the Site are in a dilapidated state, they are subject to ad hoc usage by various unidentified parties. Such uses include but are not limited to: antique vehicle storage, hydraulic equipment and vehicle servicing and storage of miscellaneous materials including children's bicycles, material storage drums and various equipment.

A construction contractor is currently using a portion of the property adjacent to the buildings located in the northwestern portion of the Site as a lay down yard and for material and heavy equipment staging. Also present in this area are numerous abandoned roll off containers, shipping containers and construction vehicles and equipment. During the site visit, several apparent employees of the contractor were performing tasks in an outdoor work area located adjacent to the buildings in the northwestern portion of the Site.

Miscellaneous surficial debris is present on the surface of much of the Site. The debris typically consists of brick, glass, wood, broken asphalt and concrete and scrap metal. The majority of the Site is unpaved. Shallow standing water was present in intermittent puddles throughout much of the Site, particularly in areas south of the contractor occupied portion of the Site. The standing water was presumed to be the result of a winter storm that moved through the area three days prior to the site visit. During the site visit, however, a number of areas with phragmites (perennial grasses found in wetlands) vegetation were identified on the east and west portions of the Site indicating more consistently wet conditions, particularly along drainages in these areas (Figure 2).

2.2 SITE HISTORY

This section discusses historic land use and former operations conducted at the Site. In addition, the enforcement actions and the chronology of remedial activities are described. This section is based primarily on the information provided in the RI/FS Site Management Report (HGL, 2011).

2.2.1 HISTORIC LAND USE AND OPERATIONS

PIM operated as a scrap metal processing facility from approximately 1945 to 1999. Operations at the Site included metals processing, storage and shipping. Sources of metals handled at the Site included local businesses, the federal government and the state of Virginia. Scrap metal reportedly came from old equipment and parts, naval vessels, military bases and PCB-containing transformers (HGL, 2011).

Prior to 1980, operational activities took place primarily in buildings located in the central portion of the Site. Uses of these buildings were as a locker room building, a machine shop building, a metal storage and sorting building that contained a small aluminum scrap metal furnace and a building that contained a hydraulic guillotine for shearing steel (HGL, 2011).

An analysis of historic aerial photographs of the Site was conducted by the EPA (HGL, 2011), from which it was inferred that solid waste management and scrap metal storage at the Site started in the northeastern portion of the Site in 1937. Until 1990, these activities were conducted over the entire Site. Two former surface water impoundments and associated drainage ditches were also identified on aerial photographs (Figure 2). By the late 1990's, solid waste management activities were limited to the southwestern and west-central portions of the Site.

Aerial photographs also showed locations of brick fill areas, a burn pit, debris and ground scarring dating back to 1937. The majority of ground scarring and presence of debris was observed in the years 1998 and 2009. Potential release areas onsite were also identified from aerial photographs. The potential release areas are numerous and widely distributed across the central, south-central and eastern portions of the Site and generally correspond with the fill/ground scar areas. The potential release areas include drum storage areas, staining and possible underground storage tank (UST) areas, mostly observed in the years 1998 and 2009 (HGL, 2011). These areas were primarily located in the central, south-central and eastern portions of the Site. In addition, a potential release area, identified by EPA as an area with soil staining, is located along the northwestern boundary of the Site, west of the block of masonry buildings and near the front gate.

The Site is currently owned by The Peck Company, Inc. (Peck). The adjacent property, upon which the Sherwin-Williams facility is currently located, was historically a part of the Site (EPA Hazardous Ranking Score [HRS], 2009). The year in which the property was transferred from Peck to Sherwin-Williams is not documented in the Site information reviewed.

2.2.2 CHRONOLOGY OF ENFORCEMENT AND REMEDIAL ACTIVITIES

Enforcement and remedial actions at the Site were initiated in approximately 2003 and are ongoing. To facilitate redevelopment plans for the Site, Peck entered the Site in the VDEQ Voluntary Remediation Program (VRP) in 2003. In August 2003, Peck and a prospective buyer of the property (Pull-A-Part, Inc.) submitted an initial remedial design based on data generated during the 1999 Hatcher-Sayre investigation (DAA, 2003a). In response to VDEQ requests for additional data, Peck performed several field investigations under the supervision of VDEQ and EPA (DAA, 2003b and DAA, 2005). The investigations included soil sampling to improve the delineation of PCB contamination.

In January 2004, VDEQ received written guidance from the EPA that the Toxic Substance Control Act (TSCA) is the regulatory authority regarding PCBs. The EPA instructed Peck in April 2004 to prepare a Self-Implementing PCB Cleanup Plan to the EPA Region 3 Regional Administrator. EPA reviewed the plan in November 2004 and requested the collection of an additional 2,500 samples for the analysis of PCBs and dioxin. This sampling was not performed. As an alternative, a revised soil characterization sampling grid (50 ft by 50 ft) was established for the Site. In January 2005, the EPA approved the revised Self-Implementing PCB Cleanup Plan upon the condition that the sampling results based on the new grid be submitted to the EPA for review and approval prior to the initiation of any remediation activities.

In 2007, the EPA implemented an Administrative Order for Removal Response Action (AO) requiring Peck to complete a response action plan (RAP) for the delineation of extent of contamination at the Site. The objective of the RAP was to characterize the distribution of Site concentrations of arsenic, cadmium, chromium, lead, mercury, nickel, silver and PCBs. The results of the RAP field investigation are presented in the Extent of Contamination Report (MPI, 2008). The EPA added the Site to the National Priorities List (NPL) in November 4, 2009. In May 2010, both the EPA and the Agency for Toxic Substances and Disease Registry (ATSDR) conducted interviews with local residents to gain their input on the development of a Community Involvement Plan (CIP). The EPA initiated a Fund-lead RI/FS at the Site in September 2011.

2.3 POTENTIAL HUMAN AND ECOLOGICAL RECEPTORS

Previous Site investigations indicate that, compared to the EPA Regional Screening Levels (RSLs) for industrial soil, Site soils exhibit elevated concentrations of PCBs and metals, including arsenic, cadmium, total chromium, lead, mercury and nickel. Sediments contain elevated concentrations of these same constituents relative to National Oceanic and Atmospheric Administration (NOAA) Screening Quick Reference Tables (SQuiRTs) threshold effects levels (TELs) for sediment. PCBs and metals (arsenic, total chromium, nickel, lead and mercury) were detected in Site groundwater. Constituents exceeding criteria included arsenic and nickel (tap water RSL), lead (EPA lead action level and mercury (maximum contaminant level [MCL]). With the exception of Paradise Creek surface water sampling conducted by CH_2M Hill (CH_2M Hill, 2001) on behalf of the Navy, previous Site investigations have not included the characterization of Site surface water. Data from the CH_2M Hill sampling event were unavailable for this optimization review. Site sediments are presumed to contain detectable concentrations of PCBs and metals through storm water erosion and surface water transport of contaminated fine-grained soils. Based on the results of the optimization review, concentration data from Site surface water and sediment analyses have not historically been compared to EPA Region 3 Biological Technical Assistance Group (BTAG) ecological screening levels. The concentration data for Site media are summarized in the Sections 2.4.3 through 2.4.8.

The RI will evaluate human health and ecological risks associated with these media. Generic pathway-receptor network diagrams for human health and ecological risk are shown in Figures 3 and 4, respectively. The primary media and associated potential receptors at the Site include:

- <u>Groundwater</u>: Human health risk is likely low because groundwater is not used as a source of drinking water supply and existing data suggest that groundwater is relatively unimpacted by Site operations. An ecological risk, however, may exist to indigenous fauna as a result of the contamination of surface water and sediments from the discharge of potentially contaminated groundwater.

- <u>Soil</u>: Human health risk likely exists due to potential ingestion, inhalation and dermal adsorption through direct contact of contaminated soil by site workers, construction workers and trespassers.

Ecological risks that are likely posed by the soil include foraging animal direct contact of soil and food chain exposure and plant uptake.

- Surface water: Human health risk may exist due to potential dermal adsorption through direct contact and ingestion through consumption of contaminated fish and/or waterfowl. Ecological risks posed by surface water include direct exposure / contact and food chain exposure.

- Sediment: Human health risk exists due to potential dermal adsorption through direct contact/ingestion through consumption of contaminated finfish and shellfish. Ecological risks posed by sediment include direct exposure / contact, food chain exposure and ingestion by indigenous fauna.

On behalf of Peck, DAA (DAA, 2003a) completed a human health risk assessment (HHRA) based on the results of the 1999 Site investigation conducted by Hatcher-Sayre (Hatcher-Sayre 1999). DAA used the Risk Analysis module of the Risk Exposure Analysis Modeling System (REAMS) developed by VDEQ. The HHRA examined residential and industrial exposure risks associated with the minimum and maximum concentration of each inorganic constituent. DAA determined that the exposure risk for each of the scenarios exceeded the target allowable risk level of 1×10^{-6} for one carcinogen (arsenic) and one non-carcinogen (lead). In addition, DAA determined that the total hazard indices for the remaining constituents (all considered non-carcinogenic) were greater for each scenario than the target level of 1.0. Based on the results of the risk assessment, DAA concluded that arsenic and lead are the primary constituents of concern and will require further consideration for the development of the Site. Although considered, PCBs were not identified as primary constituents driving site risk.

2.4 EXISTING DATA AND INFORMATION

The information provided in this section is summarized from existing site documents reviewed as part of the optimization review effort. Interpretations included in this section are generally taken from the documents from which the relevant information was obtained. Particular attention was paid to CSM elements and conclusions that may warrant consideration during the RI/ FS.

2.4.1 SOURCES OF CONTAMINATION

Sources of contamination at the Site are attributable to various operations associated with scrap metal salvaging, processing and storage. As reported by HGL (2011), EPA conducted a study of historical aerial photographs to identify potential Site constituent release areas. As a result of this study, EPA delineated historic drum storage, ground stained (classified as light, medium and dark toned) and possible underground storage areas. Potential contamination release areas were identified in the central, south-central, eastern and northwestern portions of the Site.

In discussions with EPA and VDEQ, Mr. R.D. Peck, a former principal of Peck Co., stated that PCB-containing transformers were disassembled and their wiring burned at the Site as a method for removing the wiring insulation and recovering the copper wire. Although PCB contamination in Site soil exists over broad areas, the specific location(s) of transformer processing operations is unknown. In 2003 discussions between the EPA and Mr. David B. Peck (owner of Peck), Mr. Peck indicated that any burning conducted at the facility was performed at the rear of the property, not in the front where scrap metals operations were ongoing on a daily basis (DAA, 2003b). Available literature (EPA, 2012) also indicates that industrial combustion activities can potentially create dioxin or furan compounds.

Potential offsite sources of contamination to groundwater, surface water and sediment include each of the properties (Norfolk Naval Shipyard, Sherwin-Williams, ARREFF Terminals and the SPS-RDF facility) that border the Site. The Norfolk Naval Shipyard borders to the west, the Sherwin Williams facility borders to the north and west, the ARREFF facility borders to the north and the SPS-RDF facility borders to the east of the Site. Monitoring wells are sparsely distributed at the Site, resulting in a relatively poor understanding of hydrogeologic conditions that influence groundwater flow direction. Based on the available groundwater elevation data (discussed further in Section 4.2.1), portions of the Sherwin-Williams, ARREFF and SPS-RDF facilities are potentially located hydraulically up gradient from portions of the Site. For example, based on measured groundwater levels (as opposed to a specific contour interpretation), the Sherwin Williams property is located up gradient of the block of buildings and front gate area in the northwestern portion of the Site. The RDF and ARREFF sites are located up gradient of the east-northeastern portions of the Site. The four adjacent properties are all situated at a higher topographic elevation relative to the Site. Surface water features were also identified at each location during the site visit including a 10-inch pipe extending from the Sherwin Williams facility that appears to introduce surface or facility run-off to the PIM property and a concrete lined vault/channel extending along the property boundaries of the PIM Site and the ARREFF facility.

2.4.2 GEOLOGY SETTING AND HYDROGEOLOGY

The Site is located on relatively low-lying land adjacent to Paradise Creek, a tributary of the Southern Branch of the Elizabeth River. Topographic elevations range from sea level along the Site’s southern boundary to approximately 10 ft above mean sea level (msl) near the northern Site boundary. A northeast to southwest-trending, approximately 25–ft-high berm is located along the southeastern Site boundary.

The Site is situated on the Atlantic Coastal Plain physiographic province and is underlain by unconsolidated formations. Figure 5 shows a representative cross section for the Atlantic Coastal Plain in Virginia. Beginning at ground surface, the uppermost of these units consists of interbedded sand, silt and clay units of Holocene and Pleistocene age. Tertiary formations, consisting predominantly of interlayered sands and clays, underlie these deposits and are, in turn, underlain by the Cretaceous-age Potomac Group. The Potomac Group, comprised primarily of thick, interbedded clay, silt, sand and gravel units, overlies the basement rock complex, which consists of massive igneous and highly deformed metamorphic rocks of Precambrian and Lower Paleozoic age. The aggregate thickness of the unconsolidated formations in the general area is approximately 2,500 ft (Meng and Harsh, 1988).

The Columbia aquifer is the uppermost water bearing zone in the Site vicinity. The Columbia outcrops at land surface and occurs within the Holocene and Pleistocene deposits. The aquifer is underlain by the Yorktown confining unit. Based on hydrogeologic unit correlations provided in Meng and Harsh (1988), the top of the Yorktown confining unit in the Portsmouth, Virginia vicinity is encountered at depths ranging from 25 to 44 ft bgs. The Yorktown-Eastover aquifer underlies the Yorktown confining unit (Meng and Harsh, 1988). At the Atlantic Wood Treating Site, adjacent to the eastern boundary of the Site, the Yorktown confining unit ranges up to 44 ft in thickness (HGL, 2011).

Figure 6 shows a geologic cross section oriented from the southwest to northeast across the Site. As stated by HGL (2011) lithologic characterization conducted previously at the PIM site is limited to a depth of 15 to 20 ft bgs. The following description of the Site geology is summarized from MPI (2008). Lithologic conditions are highly variable across the site. The Site is underlain by fill ranging in thickness from 1.5 ft of sandy-clay fill in the northwestern portion of the Site to 12 ft in the central portion of the Site. As is generally true of the eastern and southern portions of the Site, the fill in this area consists of varying proportions of building demolition rubble, miscellaneous debris and scrap metal. In the northwestern portion of the Site and southward toward Paradise Creek, the fill layer is underlain by stiff clay to soft sandy clay. In the west-central and central portion of the Site, the fill is underlain by fine to medium grained sand that becomes slightly clayey toward the east. In the eastern portion of the Site, fill is underlain by clay grading downward to interbedded clay and sand. In the north-eastern Site area, fill is underlain by clayey sand overlying clay.

Figure 7 shows the water table elevation at the Site based on groundwater level data collected on July 24, 2008 (MPI, 2008). The water table ranged in elevation from -5.37 ft msl to 7.46 ft msl. To avoid an unaccounted for tidal influence in the measured groundwater levels, the data shown on Figure 7 were collected synchronously and thus are consistent with the ambient tidal level (MPI, 2008). The highest groundwater elevation was measured in monitoring well MW-4, located in the central portion of the Site where an apparent groundwater mound is present. From the apparent groundwater mound area, flow is generally southwestward toward Paradise Creek or northeastward toward the intersection of Elm Avenue and Williams Avenue. City utility maps indicate the presence of a storm drainage ditch paralleling Elm Avenue along the northern Site boundary and northern boundary of the ARREFF property. Near the northeastern corner of the Site, at the intersection of Elm and Williams Avenues, the ditch discharges to a southward flowing drainage pipe that parallels the eastern boundary of the Site. Drainage to the ditch and drain pipe may act to passively lower water levels in the eastern portion of the Site. Passive drainage alone, however, would only account for the lowering of groundwater to levels slightly greater than msl datum. The below sea level datum water levels consistently observed in MW-6 (-5.37 ft), if accurate[2], suggest off-site influences on groundwater, such as pumping.

For the surficial unconsolidated deposits, MPI derived an average hydraulic conductivity of 0.9 ft/day based on slug tests conducted in the Site monitoring wells. Given an assumed porosity for fine-medium sand of 20 percent and a hydraulic gradient of 0.012 ft/ft (measured from the October 2008 potentiometric surface map from MPI [2008]), the average linear groundwater flow velocity is approximately 20 ft/year toward the southwest. The above velocity calculation is representative of native shallow formation material; given that the observed fill includes zones containing large fragments of rubble and debris, the groundwater flow velocity may be higher in some areas where coarse fill is saturated.

Based on a comparison of the Site's typical topographic elevation with the October 2008 potentiometric surface map (MPI, 2008), the depth to the water table ranges from approximately 2 to 3 ft bgs in the west central portion of the site to 5 ft bgs in the east central portion of the Site and declines to 0 ft bgs along the Paradise Creek shoreline. During the February 22, 2012 site visit, saturated ground and frequent surface water puddles were observed throughout the western-central, central and eastern portions of the Site. The ponded surface water likely reflected the effects of a winter storm that had passed through the area three days prior to the field visit and likely represented locally perched water conditions. The presence of phragmites in the western drainage and in the swale at the toe of the berm separating the Site from the SPS-RDF facility suggests the prolonged recurring presence of surface water or persistent shallow groundwater conditions in these areas, unrelated to storm events.

Figure 2 shows the locations of existing and former drainage features at the Site. As reported by HGL (2011) the EPA's review of historical aerial photographs revealed the presence of two former surface water impoundments. One surface water impoundment was located in the central portion of the Site and appears to have been active from 1937 to 1963. A drainage channel leading to this impoundment potentially received water from an on-site clarifier located immediately south of the Sherwin-Williams property. The second impoundment was located in the central portion of the Site and extended from the northern property boundary to the southern property boundary. This impoundment was active primarily between 1947 and 1963, with small surface water ponds present within or near the impoundment footprint

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[2] A surveyed reference point elevation could not be identified in the available documents for MW-06 thus preventing independent verification of the reported groundwater elevation in this well.

in 1998. Linear drainage patterns from the ARREFF property abutting the Site were observed in 1980 and in 1998. Based on these patterns, surface drainage flowed to two surface water impoundments and then ultimately to Paradise Creek.

HGL (2011) identified two main surface water drainage channels at the Site. The western drainage is approximately 600 ft in length and extends along the western Site boundary from the Sherwin Williams property south through the ERP wetland area at the southwest corner of the Site to Paradise Creek. It receives drainage from the western portion of the Site and the Sherwin Williams facility. The northern, approximately 150 ft of the western drainage, consists of a shallow, open ditch. Along the remaining portion of the western drainage, the ditch is lined with an approximately 24-inch diameter terra cotta surface drainage pipe. During the Site visit, the northern portion of the pipe appeared discontinuous and broken in many places and contained several junction boxes. The southern portion appeared to be in better condition and to terminate at Paradise Creek.

The second channel is an approximately 3 to 4 ft wide concrete trough that appears to originate at the northern boundary of the Site and continue northward, first on the ARREFF property then on the Site, parallel to the boundary between the northwestern portion of the Site and the ARREFF property. At the time of the site visit, the western drainage ditch appeared to be partially filled with water to within approximately 1 to 2 ft of ground surface. The water was turbid and appeared to flowing northward toward Elm Avenue.

Paradise Creek in the Site vicinity is tidally influenced. NOAA maintains a water level gauging station at Money Point, located on the Southern Branch of the Elizabeth River, approximately 2 miles south of the Site. Surface water levels at Money Point typically vary by approximately 3 ft over a typical tidal cycle.

2.4.3 MUNITIONS AND EXPLOSIVES

During the 2008 MPI investigation, unexploded ordnance (UXO) was discovered during the collection of soil samples. Following UXO discovery, an MPI UXO specialist surveyed all new intrusive sampling locations for UXO and was present onsite on each day that soil sampling and soil boring construction for monitoring well installation activities were conducted. All munitions and explosives of concern and munitions debris (MEC/MD) were logged and photographed. The types of MEC/MD discovered included a 3-inch naval round fused, inert/training 0.50 caliber bullets, a machine gun and shell casings. Upon discovery, all MEC/MD were removed by local Navy explosive ordnance disposal (EOD) technicians for appropriate disposal.

2.4.4 SOIL CONTAMINATION

Extensive PCB (DAA, 2005 and MPI, 2008) and metals (MPI, 2008) characterization sampling of soils has been conducted at the Site. The sampling performed has been for PCB Aroclors and for a limited list of metals (arsenic, cadmium, total chromium, lead, mercury, nickel and silver). Based on a 50 by 50 ft sampling grid covering the Site, DAA sampled 524 sample grids for PCB Aroclor analyses. Prior to performing the extent of contamination field investigation, MPI subjected the DAA sampling results to independent data validation in accordance with *EPA Region III Modifications to the Laboratory Data Validation Functional Guidelines for Inorganics* and the *EPA Region III Modifications to the National functional Guidelines for Organic Data Review*. A minimum of Level II data quality and the correct analytical method were required for existing data to pass validation. For the extent of contamination investigation, MPI collected an additional 569 soil samples for PCB Aroclor and metals analyses and validated these data to the same standards noted above for the DAA data.

Environmental investigations conducted at the Site identified PCBs and metals contamination in surface and subsurface soils at the Site. For the DAA and MPI Site investigations, surface soil was defined as soil from a depth of 0 to 18 inches bgs. Subsurface soil was defined as soil from a depth of 18 inches bgs to the water table. Surface soil characterization results for Site contaminants of concern (COCs) from the DAA and MPI investigations are discussed below. Screening levels for soil are shown in Table 1. Although some correlation exists between elevated lead and elevated PCBs in Site soils, inspection of Site metal and PCB concentration trends do not suggest a specific source of the metals and PCB contamination. In addition, no direct link of metals and PCB concentrations above screening criteria was observed to former USTs, tank fields, solid waste disposal areas, surface water impoundments, or ground scarred areas.

2.4.4.1 SOIL CONCENTRATIONS COMPARED TO RSLS

Figures 8 through 15 show the surface soil concentrations for PCB total Aroclors, arsenic, cadmium, total chromium, lead, mercury, nickel and silver, respectively. The figures depict color-flood contours based on the MPI 50 x 50 ft sampling grid with the MPI-measured concentration posted at the center of each grid cell. In the following discussion, the term “elevated” denotes concentrations that exceed the April 2012 RSL for residential soil. For total chromium, concentrations are screened against the hexavalent chromium RSL. It should be noted that specific residential RSLs for each COC as noted on the figures are from an earlier RSL table (June 2011) and, therefore, may not match the RSLs noted in this section’s text and Table 1. Additionally, the term “hotspot” refers to relatively isolated areas (red shaded sampling grid blocks on the figures) with elevated concentrations that exceed a specific elevated screening threshold defined for each COC (typically the industrial soil RSL or the industrial soil RSL multiplied by 10 or 100).

Figure 8 indicates that PCB concentrations in soils exceed 10 times the minimum PCB RSL (5.4 milligram per kilogram [mg/kg]) across most of the Site. In addition, arsenic, lead, mercury and nickel concentrations in soil are elevated Site-wide (Figures 9, 12, 13 and 14, respectively). Hotspots for these COCs exceed the industrial soil RSL by one or more orders of magnitude. PCB hotspots (>100 mg/kg) and lead hotspots (>8,000 mg/kg, 10 times the industrial soil RSL) occur in the central, eastern and northeastern portions of the Site. Arsenic hotspots (>160 mg/kg, 100 x industrial soil RSL) are distributed Site-wide. Mercury and nickel each exhibit one hotspot. The nickel hotspot (>20,000 mg/kg, 10 x industrial RSL) is located on the Site’s western boundary, at a point along the western drainage. The mercury hotspot (>43 mg/kg, 10 x industrial RSL) is located adjacent to the Paradise Creek shoreline.

Total chromium exhibits elevated concentrations in soils across the Site (Figure 11) while cadmium concentrations are elevated Site-wide with the exception of the northwestern portion of the Site (Figure 10). Silver concentrations are generally below the residential RSL Site-wide (Figure 15). The total chromium hotspots (>20,000 mg/kg, the industrial soil RSL) are observed along the Site’s western boundary, one of which is in close proximity to the above-noted nickel hotspot. Cadmium exhibits hotspots (>80 mg/kg) in the central, eastern and northeastern portions of the Site.

In October 2003, DAA (DAA, 2003b) sampled soils for PCDDs and PCDFs (also referred to herein as “dioxins and furans”) at three areas on site where cables were burned for copper wire recovery. The documents available for this optimization review did not include information regarding the locations of these samples. The soil samples were analyzed for dioxins and furans and the results for all three areas (maximum of 0.42 parts per billion [ppb] equivalent total 2,3,7,8-tetrachlorodibenzo-p-dioxin [2,3,7,8-TCDD]) were below the latest threshold screening level of 0.664 ppb for industrial/commercial property (www.epa.gov/superfund/health/contaminants/dioxin/dioxinsoil.html). However, the observed equivalent 2,3,7,8-TCDD concentrations at two of the three areas exceeded the latest threshold screening level of 0.050 ppb.

2.4.4.2 SOIL CONCENTRATIONS COMPARED TO SOIL ECOLOGICAL SCREENING LEVELS

The surface soil concentrations data shown on Figures 8 through 15 were compared to soil ecological screening levels. For screening PCBs, the EPA Region 3 Draft BTAG level of 0.1 mg/kg was used (EPA, undated reference). The EPA Office of Solid Waste and Emergency Response (OSWER) defined separate ecological screening levels for plants, invertebrates, birds and mammals for arsenic (EPA, 2005), cadmium (EPA, 2005), chromium (EPA, 2008), lead (EPA, 2005), nickel (EPA, 2007) and silver (EPA, 2006). To maximize protectiveness of the screening, the lowest of the four ecological levels was selected for the screening of these constituents. The selected levels therefore were 18 mg/kg for arsenic (plants), 0.36 mg/kg for cadmium (mammal), 26 mg/kg for chromium III (birds), 11 mg/kg for lead (birds), 38 mg/kg for nickel, (plants) and 4.2 for silver mg/kg (birds). For screening mercury, the EPA Region 3 Draft BTAG Screening level of 0.058 mg/kg was used (EPA, undated reference).

Figure 8 shows PCB concentrations measured in surface soil. Because the minimum contour defines PCB concentrations of 1 mg/kg or greater (compared to a screening level of 0.1 mg/kg), all shaded areas shown on the figure exceed the PCB screening level. Review of the non-shaded areas (PCB concentrations below 1 mg/kg) reveals that, with only a few exceptions, all non-shaded grid blocks with a posted concentration also exceed the lead screening level. Two or more contiguous grid cells with less than screening level posted concentrations include several areas in the northwest portion of the Site (Y40–AA40 and Y38–Z38) and the south-southwestern portion of the Site (Y24–Z24, FF14–HH14, Y16–Z15 and T10–U10).

Figure 9 shows arsenic concentrations measured in surface soil The gold/red-shaded areas, encompassing most of the northeastern, eastern, central and northwestern portions of the site, denote areas where the arsenic concentration exceeds 16 mg/kg. Although some of the gold-shaded grid cell concentrations are less than the 18 mg/kg arsenic screening level, the posted concentrations for most exceed this level.

Figure 10 shows cadmium surface soil concentrations. Because the minimum contour defines cadmium concentrations of 7 mg/kg or greater (compared to a screening level of 0.36 mg/kg), all shaded areas (northeastern, eastern and central portions of the Site) shown on the figure exceed the cadmium screening level. Review of the posted concentrations in the non-shaded grid cells shows that only in a very small number of the cells are concentrations less than screening level.

Figure 11 shows chromium surface soil concentrations. Yellow, gold and red shaded grid cells indicate Site areas that exceed 56 mg/kg and thus define areas in which chromium concentrations exceed the screening level of 26 mg/kg. The remaining grid cells are all shaded green denoting chromium concentrations ranging from 5.6 to 56 mg/kg in surface soil. With the exception of single cell occurrences, green-shaded grid cells with posted concentrations less than the screening level are concentrated in the extreme northwestern portion of the Site (cells Y38–Y41, Z38–Z49 and AA39), the cells just south of the Sherwin Williams property (EE27 and FF27), cells in the southern wetland area (DD7, DD4, DD5, EE4, EE8) and cells in the extreme northeastern corner (C34–C37).

Figure 12 shows surface soil concentrations for lead. Because the minimum contour defines lead concentrations of 400 mg/kg or greater (compared to a screening level of 11 mg/kg), all shaded areas shown on the figure exceed the lead screening level. Review of the non-shaded areas (lead concentrations below 400 mg/kg) reveals that with only a small number of exceptions, all non-shaded grid blocks also exceed the lead screening level. Contiguous cells with posted concentrations less than the screening level include cells Y38–Y39 in the northwestern portion of the Site.

Figure 13 shows the surface soil concentrations for mercury. Because the minimum contour defines mercury concentrations of 1 mg/kg or greater (compared to a screening level of 0.058 mg/kg), all shaded areas shown on the figure exceed the mercury screening level. Review of the non-shaded areas (mercury concentrations below 0.058 mg/kg) reveals that with only a small number of exceptions, all non-shaded grid blocks also exceed the mercury screening level. Contiguous cells with posted concentrations less than the screening level include the following cells: FF14–GG13, BB3–CC4, Z20–AA20 and Y38–Z38.

Figure 14 shows surface soil concentrations for nickel. Yellow, gold and red shaded grid cells encompass Site areas that exceed 150 mg/kg and thus define areas in which nickel concentrations exceed the screening level of 38 mg/kg. Review of the non-shaded areas (mercury concentrations below 0.1 mg/kg) reveals that with some exceptions, most non-shaded grid blocks also exceed the nickel screening level. The principal areas of non-exceedance include the southwestern portion of the Site (between rows 3–8 and columns DD–FF), south of the block of masonry buildings in the northwestern portion of the Site (between rows 26–31 and columns Y–BB) and in the northwestern corner of the Site (between rows 38–42 and columns Y–AA).

Figure 15 shows surface soil concentrations for silver. Because the minimum contour defines silver concentrations of 39 mg/kg or greater (compared to a screening level of 4.2 mg/kg), all shaded areas shown on the figure exceed the silver screening level. In addition, large areas of unshaded cells also exceed the screening level including cells in the northeastern portion of the Site (between rows 25 to 33 and columns B–E), in the central and eastern portion of the Site (between rows 13 and 22 and columns A through V) and in the southern portion of the Site (between rows 2 and 13 and columns X through EE).

2.4.5 SOIL VAPOR / INDOOR AIR CONTAMINATION

The previous site investigations did not include the collection of soil vapor or indoor air data. Previous site activities have potentially resulted in the release of constituents that may contribute to soil vapor contamination and potentially contamination of indoor air. It should be noted however, that all site buildings and structures identified during the site visit appeared to have limited current use and were observed to be open to the elements via missing bay doors, entry doors and windows (see photo log in Attachment B). The potential risks associated with soil vapors at the Site, therefore, are dependent on the extent of volatile organic compound (VOC) contamination encountered in shallow soil and groundwater and the spatial relationship of the locations of any detections or screening level exceedances to buildings that are used on site.

2.4.6 GROUNDWATER CONTAMINATION

Site groundwater sampling has been conducted at nine existing monitoring wells (MW-1R through 7, 9 and 10), one historic monitoring well (MW-1) (HGL, 2011) and four direct push locations (Hatcher-Sayre, 1999). For the previous investigations, groundwater was analyzed for three to four rounds of PCBs and metals analyses. The metals analyses included arsenic, cadmium, total chromium, lead, mercury, nickel and silver. One round of groundwater samples collected in 1999 was also analyzed for VOCs (Hatcher-Sayre, 1999). VOC sampling locations included six monitoring wells (MW-1 through MW-6) and four direct push sample locations (B-1 through B-4). In total, 24 VOC analytes were detected at relatively low concentrations with three compounds exceeding tap water RSLs (benzene, trichloroethene [TCE] and vinyl chloride [VC]). With the exception of B-4, detections and screening level exceedances were isolated. At B-4, located in southwest of the former maintenance building in the east-central portion of the Site, 18 VOC detections and two exceedances were observed. The two B-4 exceedances included benzene (15 micrograms per liter [µg/L]) and VC (13 µg/L). The benzene and VC tap water RSLs are 0.39 and 0.015 µg/L, respectively. The other VOC exceedance was TCE at 20 µg/L in MW-2 (versus the tap water RSL of 0.44 µg/L).

Figure 16 shows the PCB and metals results for the constituents detected in three Site-wide groundwater sampling events (July 1999, July 2003 and July 2008). Applicable screening levels for groundwater are shown in Table 2. PCB homologues were detected in July 2008 in three monitoring wells MW-7, MW-9 and MW-10 all of which are located down gradient from the areas with maximum PCB concentrations in shallow soils. Detected concentrations ranged from 0.007 to 0.1944 µg/L, which are below the EPA MCL of 0.5 µg/L (source: EPA Consumer Factsheet on PCBs available at the web address www.epa.gov/ogwdw/pdfs/factsheets/soc/pcbs.pdf).

The metals detected in Site monitoring wells include arsenic, total chromium, nickel, lead and mercury. Considering the elevated metals concentrations observed in Site soil, metals screening level (tap water RSL) exceedances are at relatively low concentrations and exhibit no obvious trends or patterns. Arsenic was detected in all monitoring wells with the exception of MW-2. The maximum arsenic and chromium concentrations (28 and 93 µg/L unfiltered) were observed at MW-7. The corresponding tap water RSLs are 0.045 µg/L (arsenic) and 0.031 µg/L (hexavalent chromium), respectively. The maximum nickel concentration was observed at MW-2 (800 µg/L, unfiltered) which exceeds the tap water RSL (30µg/L). The maximum lead and mercury concentrations (50 µg/L and 0.24 µg/L, both unfiltered) were observed at MW-7. No tap water RSL exists for lead; the MCL is 15 µg/L. The tap water RSL for elemental mercury is 0.063 µg/L.

As discussed in Section 4.0, the City of Portsmouth provides potable water service to the Site vicinity and discourages the installation of private wells for the purpose of water supply. A search for potential private wells in the vicinity of the Site was not conducted for this optimization review and an inventory of water supply wells in the Site vicinity was not identified in the Site documents used for the optimization review. These activities are recommended for consideration during RI activities to understand potential exposure pathways for groundwater.

2.4.7 SURFACE WATER CONTAMINATION

With the exception of Paradise Creek surface water sampling conducted by CH_2M Hill (CH_2M Hill, 2001) on behalf of the Navy, previous Site investigations have not included the characterization of Site surface water. Data from the CH_2M Hill sampling event were unavailable for this optimization review. In accordance with the state requirements under the Clean Water Act, the VDEQ has identified the water bodies in the state that do not meet water quality standards and, therefore, are declared to be impaired. Paradise Creek, located to the south and southeast of the Site, has been identified in Virginia's *Draft 2012 305(b)/303(d) Water Quality Assessment Integrated Report* (VDEQ, 2012) as an impaired water body due to the following:

- 2009 advisory for dioxin contamination in Blue Crab tissue
- 2004 advisory for PCB contamination in fish tissue
- 2006 declaration for recreational use impairment due to elevated bacterium levels of Enterococcus
- 2006 declaration of dissolved oxygen (DO) concentrations below acceptable criteria for open water

A total maximum daily load (TMDL) for PCBs is currently under development for the Elizabeth River watershed to address fish tissue impairment. A TMDL is the maximum amount of a pollutant that a water body can receive and still meet water quality standards. The TMDL must account for loading among the various sources of the given pollutant. In order to characterize PCB loadings for TMDL development, VDEQ is implementing low-level PCB monitoring (VDEQ, 2009) at permitted point source discharge facilities (municipal and industrial waste water facilities and industrial storm water facilities) within the state. The Elizabeth River PCB TMDL could potentially be identified as a future ARAR for the Site. The target date for PCB TMDL implementation is 2014. Screening Levels for surface water are shown in Table 3.

2.4.8 SEDIMENT CONTAMINATION

Sediments from the western drainage and from Paradise Creek adjacent to the Site have been sampled to date. Four sampling events have been conducted including a 2001 event performed by CH_2M Hill for the Navy (CH_2M Hill, 2001), a 2003 event performed by DAA and VDEQ, a 2004 event conducted by Unger et al. (2005) and a 2007 event conducted by MPI (MPI, 2008). Screening Levels for sediment are shown in Table 4. The screening levels are generally derived from NOAA SQuiRT TELs for freshwater which are equivalent or lower than the Region 3 Ecological Screening Benchmarks available at the web address: www.epa.gov/reg3hscd/risk/eco/index.htm.

As a result of discussions at a 2003 meeting between Peck, VDEQ, Elizabeth River Project (ERP) and EPA; DAA and VDEQ jointly collected three sediment samples from the Site in 2003 (DAA, 2003b). One sediment sample was collected from the open ditch portion of the western drainage, at a location approximately 500 ft upstream from the drainage discharge point to Paradise Creek. A second sample was collected from the western drainage channel at the downstream end of the drain pipe, approximately 65 ft upstream of Paradise Creek. A third sample was collected at the confluence of the western drainage channel and Paradise Creek. The samples were collected from the surface to a depth of approximately 6 inches. The objective of the sampling effort was to confirm the 17.7 mg/kg PCB concentration obtained by CH_2M Hill from a sediment sample collected from Paradise Creek near the southeast corner of the Site (DAA, 2003b). CH_2M Hill (CH_2M Hill, 2001) conducted the sampling for an ecological risk assessment performed on behalf of the Navy. The location of the CH_2M Hill sediment sample is unknown because the associated documentation was unavailable for this optimization review. The DAA/VDEQ samples were analyzed for PCBs (Aroclors) only. The open ditch western drainage sample and the sample from the western drainage channel below the drain pipe were both non-detect at the method detection level of 0.033 mg/kg. A PCB concentration of 0.044 mg/kg was obtained from the sample collected from the confluence of the western drainage and Paradise Creek (DAA, 2003b).

On behalf of ERP, Unger et al (2005) collected 19 surface sediment samples and one 60-centimeter (cm) sediment core. The samples were collected in June, 2004 from Paradise Creek adjacent to the Site. A petit ponar sampler was used to collect the surface sediment samples; samples were collected to an approximate depth of 16 cm. A subset of eight samples was submitted for grain size analyses, total organic carbon (TOC), PCB (congeners) and PAH analyses. PCB analyses were performed to a method detection level approaching 0.1 nanogram/gram (ng/g). The analyses included over 100 individual congeners. Total PCB concentrations, calculated as the sum of all congeners at each location, ranged from 0.001 to 1.5 mg/kg. Total PAH concentrations ranged from 11 to 52 mg/kg. Concentrations of both constituent groups decreased with depth. The maximum concentrations were measured in samples collected near the confluence of the western drainage and Paradise Creek. The results of this investigation also indicated that total PCB and PAH concentrations were only marginally correlated (R square = 0.57) and that no correlation exists between either constituent group and TOC.

For the extent of contamination study performed for Peck, MPI conducted a 2007 sediment sampling event in Paradise Creek adjacent to the Site (Figure 17). The sample domain was partitioned into 50 ft by 50 ft grids resulting in the collection of 37 samples which were analyzed for PCB homologues and seven metals (arsenic, cadmium, total chromium, nickel, lead, mercury and silver). The samples were collected from the surface to a depth of 6 inches. PCBs were non-detect at all sampling locations with the exception of two samples (0.075 mg/kg for both) near the western drainage channel/Paradise Creek confluence and one sample located near the southeastern corner of the Site (0.14 mg/kg). All detected concentrations exceeded the NOAA SQuiRTs freshwater TEL of 0.0216 mg/kg for total PCBs. The homologue analyses, however, are reported at detection levels that are elevated relative to the screening level (>0.075 mg/kg compared to the 0.0216 mg/kg NOAA SQuiRT TEL). The elevated detection levels, therefore, may mask other potential exceedances. With regard to metals analyses for the 37 samples, all 37 exceeded SQuiRT TELs for six of the seven metals. Silver exceeded the SQuiRT TEL at just six of the 37 locations.

3.0 DESCRIPTION OF PLANNED OR EXISTING REMEDIES

To date, no remedial actions have been taken to address Site conditions. However, several remedies have been proposed by the Site owner in effort to achieve Site reuse objectives. To facilitate redevelopment of the Site as a self-service auto parts salvage yard, Peck entered the Site in the VDEQ VRP in 2003. In May 2003, on behalf of Peck, DAA proposed a remedial design (DAA, 2003a) consisting of the installation of a fill barrier and implementation of institutional controls (IC) including deed restrictions and excavation prohibitions. The remedy design called for compaction of the existing ground surface followed by placement of at least 3 inches of granular material (Virginia Department of Transportation [VDOT] #3 aggregate or equivalent), 3 inches of compacted clayey sand to sandy clay fill, a 2- to 3-inch layer of crushed stone in areas of proposed automobile staging and access areas and 2 inches of topsoil in lieu of crushed stone in areas of planned landscaping (DAA, 2003a). The minimum combined thickness of the proposed cap would be 8 inches.

VDEQ issued a response to the remedy proposal in June 2003, noting that although additional characterization sampling was needed, it agreed in principal with the concept of capping as a remedial approach for the Site. VDEQ also requested additional sampling to better delineate the extent of PCB contamination, evaluate potential dioxin contamination and characterize PCB concentrations in on- and off-Site sediments. Other actions requested included the installation of a perimeter security fence and a removal action to address localized areas of soil with elevated lead concentrations. VDEQ indicated areas with lead concentrations in excess of 10,000 mg/kg or PCB concentrations in excess of 100 mg/kg would require a soil cap with minimum thickness of 10 inches.

In October 2004, Peck submitted a revised Self-Implementing PCB Cleanup Plan to the EPA Region 3 Regional Administrator (DAA, 2004a). The plan called for the excavation of areas with PCB concentrations exceeding 10 mg/kg; backfilling of the excavations with clean fill; appropriate disposal of the excavated PCB-contaminated soil; engineered regrading; and placement of a 10-inch thick soil cap over the Site. Areas to be overlain by concrete floor slabs or pavement would not require capping. Areas requiring excavation were based on sampling conducted on a 150 ft by 150 ft sampling grid with a single discrete sample collected from within each grid cell.

In January 2007, EPA Region 3 issued an Administrative Order (AO) for the Site. Consistent with the terms of the AO, Peck completed the extent of contamination investigation which included soil PCBs and metals concentration characterization on a 50 ft by 50 ft grid (MPI 2008). Again, a single discrete sample was collected from within each grid cell. In subsequent discussions with Peck, the EPA indicated that all soil with PCB concentrations greater than 25 mg/kg or lead concentrations greater than 1,000 mg/kg would need to be removed from the Site. Peck maintained that since the Site was considered a Low-Occupancy property, TSCA PCB regulations allowed soil with PCB concentrations between 25 mg/kg and 100 mg/kg to be left on Site provided they were capped. MPI's site remedy recommendation included removal and off-site disposal of PCB contaminated soils with concentrations greater than 500 mg/kg. Soils identified at PCB concentrations less than 500 mg/kg would be excavated and consolidated. These consolidated materials would then be capped on Site (MPI, 2008).

Selection of a final Site remedy design must await the completion of the Site characterization activities that will be performed for the RI and the completion of the associated FS.

4.0 CONCEPTUAL SITE MODEL

This section discusses the optimization review team's interpretation of historical information and existing characterization data to explain how historic events and site characteristics have led to current conditions. Section 4.1 provides a brief summary of the optimization review team's interpretation of the CSM. Identified data gaps are discussed in Section 4.2. Section 4.3 reviews the existing investigation as documented in the HGL Plan and provides potential strategies for optimizing the investigation.

4.1 CSM OVERVIEW

In accordance with the information obtained from the document review and from discussions with Region 3 and VDEQ, the optimization review team developed a CSM for the release and migration of constituents from the Site. The CSM states that as a result of approximately 50 years of scrap metal processing and recycling operations, contaminants, primarily PCBs and metals, were released over broad areas to surface soil at the Site. A source of potential subsurface soil contamination is the large amount of fill material of various forms (construction rubble, debris, etc.) used to raise land surface elevations, particularly in the southern central portion of the Site. Contact of precipitation with contaminated soil likely resulted in the transport of contaminated soil through surface runoff and the potential migration of Site constituents with recharging water to shallow groundwater. Surface water transport of contaminated soil has potentially resulted in elevated levels of Site constituents in Paradise Creek sediments. As a result of the downward migration of contaminated groundwater recharge, the potential also exists for offsite migration of contaminated groundwater.

Water levels in Paradise Creek exhibit diurnal tidal fluctuation with a typical amplitude of approximately 3 ft. Groundwater levels near a tidal shoreline typically exhibit some fluctuation corresponding to tide changes with the tidal influence dissipating with distance from the shoreline. Based on the relatively small amount of tidal fluctuation in comparison to the higher groundwater level at MW-4 (location of maximum groundwater elevation observed on Site [Figure 7]), groundwater is expected to move a greater distance down gradient over each tidal cycle.

4.2 DATA GAPS

The CSM is the primary tool for identifying significant data gaps in the existing characterization data. In the discussion that follows, general site condition data gaps are discussed, followed by discussions of the data gaps for each environmental media. Strategies to address the data gaps are then discussed at the end of this section.

Ideally optimization reviews are conducted prior to the development of any draft work plans as a means to inform the development of planned site activities. In the case of the PIM optimization review, EPA Region 3 did receive a draft work plan from HGL prior to soliciting an optimization review for the site. At the request of the RPM, the optimization team has included Table 5 which provides a crosswalk highlighting differences between site activities proposed by HGL in the draft RI work plan and suggested RI activities from the optimization review.

4.2.2 GENERAL SITE CONDITIONS

Data gaps exist with regard to the understanding general site conditions. Specifically, additional data is needed with respect to fill thickness, extent and thickness of the uppermost aquifer, Site surface water drainage structures, Site groundwater flow directions and potential contamination in the vicinity of the Site buildings.

Fill Thickness. As indicated in the background discussion presented in Section 2, extensive portions of the Site are underlain by various types of fill that are present in apparent thicknesses exceeding 10 ft. Fill present below the water table can impact groundwater flow directions, velocity and groundwater quality. From a sampling access perspective, fill containing a high percentage of concrete, wood, metal and other non-native materials can restrict the use of hand auguring, drive point methods and other of the more cost-effective drilling technologies.

Site Surface Water Drainage Structures. HGL (2011) identified two main surface water drainage channels at the Site. The western drainage ditch is located along the western boundary of the Site and receives drainage from the western portion of the Site and the neighboring Sherwin Williams facility. The second channel (the northwestern drainage ditch) is a concrete trough-like structure that appears to originate at the northern boundary of the Site and continues northward, first on the ARREFF property then on the Site, parallel to the boundary between the northwestern portion of the Site and the ARREFF property. Potential impacts to western drainage ditch surface water and sediment quality from the upstream Sherwin Williams facility are unknown. Upstream sediment and surface water contributions to the western drainage ditch have not been characterized. With respect to the northwestern drainage ditch, confirmation of the direction of flow is necessary. Associated with this data gap is the determination of the source and fate of water to this ditch and what, if any, buried Site sewer lines, drain tiles, or other structures drain to this structure. Addressing these data gaps is necessary for designing a meaningful sampling strategy for the northwestern drainage ditch.

Extent of Uppermost Aquifer and Site Groundwater Flow Directions. Groundwater level data collected from the existing monitoring well network consistently result in water table elevation maps depicting a groundwater mound located in the central portion of the Site in the vicinity of MW-4. Additional soil borings may be useful in delineating the extent and saturated thickness of the uppermost aquifer. Flow directions based on the map show that a portion of site groundwater flow is toward the northeast, toward MW-6 near the intersection of Elm and Williams Avenue. City utility maps indicate the presence of a storm drainage ditch paralleling Elm Avenue along the northern Site boundary and northern boundary of the ARREFF property. Near the northeastern corner of the Site, at the intersection of Elm and Williams Avenues, the ditch discharges to a southward flowing drainage pipe that parallels the eastern boundary of the Site. Drainage to the ditch and drain pipe may act to passively lower water levels in the eastern portion of the Site. In addition, as noted in the previous section, passive drainage alone would only account for the lowering of groundwater levels to levels slightly greater than mean sea level datum. The water levels consistently observed in MW-6 in recent monitoring events are below sea level datum suggesting the presence of some form of off-site influences on groundwater, such as pumping. These uncertainties, suggest that additional characterization of the extent of the groundwater mound and confirmation of the groundwater low near Elm and Williams Avenues is warranted. Existing groundwater contour interpretations project the local high at MW-04 as a northwest-trending groundwater high resulting in a divergent flow pattern across the central and northwestern portions of the Site. Because manually constructed groundwater contours can be subject to the personal bias of the interpreter (Kresic 2007), contouring results can vary between different analysts. For example, due to data scarcity, a plausible alternative contour interpretation places the groundwater high in a more westerly orientation, cresting at MW-2 rather than trending to the northeast of MW-2 as shown in Figure 7. Based on this interpretation, groundwater flow in the northwestern portion of the Site would be more northerly instead of toward the northeast, as shown on Figure 7. An improved understanding of groundwater flow direction is essential for accurate evaluation of the fate and transport of Site constituents in groundwater.

Preferential Groundwater Discharge Zones in Paradise Creek. A data gap exists regarding the location of preferential groundwater discharge zones in Paradise Creek offshore from the Site. In addition, the extent of the medium to fine-grained sand zone (Figure 6), which may structurally affect flow directions, has not been fully characterized. Although groundwater discharge to the creek is expected to occur along the full length of Site's shoreline and adjacent creek bottom, the presence of discrete areas with convergent groundwater flow and relatively higher groundwater discharge rates are also expected. Such zones of preferential discharge likely reflect the presence of zones of higher hydraulic conductivity in the adjacent aquifer sediments and associated preferential groundwater flow paths. Preferential groundwater discharge zones, therefore, should be considered in the selection of locations for the characterization of Site sediments as sediment contamination levels may be related to the discharge of contaminated groundwater.

Potential Contamination near Existing Structures. A number of buildings are present on Site and numerous others existed historically. Buildings and other structures are centers of manufacturing and material processing operations and thus are potential locations for the release of Site contaminants. The following specific data gaps were identified:

- A small catchment basin was observed during the site visit at the northeastern corner of the block of masonry buildings located near the entrance gate at the northwestern portion of the Site. Several below grade pipes enter the basin from the direction of the buildings. Any standing water and sediment in the basin can be easily sampled.

- As reported by HGL (2011), a vent pipe, possibly associated with an UST is located adjacent to the former maintenance garage in the eastern-central portion of the Site. The presence of an UST at this location should be confirmed. If confirmed, the UST should be removed and the potential for contamination (soil and groundwater) should be evaluated in accordance with Virginia UST regulations.

- Staining was noted on the floor slabs of the buildings and materials indicative of automotive repair/detailing were identified in the largest building in the northwestern portion of the Site. The potential for sub-slab contamination or contamination from recent activities should be considered.

Munitions and Explosives of Concern and Munitions Debris (MEC/MD) Identification and Clearance. MEC/MD has been discovered at the Site during soil sampling and soil boring construction operations performed in previous Site investigations. Site operational data regarding the extent of historical processing operations involving MEC/MD are unavailable. In addition, Site data characterizing the occurrence of MEC/MD at the Site are nonexistent and will need to be generated at each proposed intrusive sampling location.

4.2.3 ENVIRONMENTAL MEDIA

Environmental media of concern include soil, soil vapor, groundwater, sediment and surface water. With the exception of the 1997 and 1999 Hatcher-Sayre investigations, chemical analysis of Site samples have been restricted to eight Resource Conservation and Recovery Act (RCRA) metals and PCBs (Aroclors in soil; homologues and congeners in sediment). Across all media, therefore, a significant data gap to be addressed is the need for a more complete analytical scan to ensure that all Site COCs are identified. At selected locations for each media, samples may be analyzed for target compound list (TCL) and target analyte list (TAL) analyses. In addition to those identified above in the general characterization discussion, analytical data gaps for each media are discussed below. Input from the project risk assessors and BTAG group can be used to further focus analytical options on human health or ecological risk drivers.

Soil. In addition to sampling for a more complete analytical scan, soil data gaps include surface soil quality data collected at the appropriate depth for use in risk assessments, the expansion of the soil sample coverage to include the previously unsampled areas and limited sampling to identify specific PCB, PCDD, and PCDF congeners in Site soil. Surface soil characterization data are available for the top 18 inches. For human health and ecological risk assessment purposes, however, surface soil data is required for the top 6 inches. Sampling consistent with risk assessment data requirements should be conducted. With regard to soil data coverage, samples should be collected from the areas not covered by the DAA and MPI sample grids. These areas include the western Site boundary and the berm located along the Site's southeastern border with the SPS-RDF facility. To provide a basis for comparing specific PCB compounds in Site soils to those identified in Paradise Creek sediment, PCB congeners may be analyzed in samples from Site areas with the most elevated PCB concentrations. High PCB concentration areas may more completely represent the diversity of PCB congeners at the Site.

Soil Vapor. Previous investigations have not included the collection of soil vapor samples. If reuse scenarios include the construction of new buildings or the reuse of existing structures, a soil gas sampling event may be conducted to evaluate the potential presence of elevated VOCs in soil vapor. The necessity of a soil vapor sampling event is contingent on initial findings for any areas that exhibit elevated VOCs in soil or groundwater. Guidance for evaluating vapor intrusion (VI) potential given Site VOC soil and groundwater concentration data is provided in the EPA Subsurface Vapor Intrusion Guidance (EPA, 2002).

Groundwater. The primary groundwater data gaps are the need to improve the characterization of the variability of groundwater flow directions at the Site. The groundwater divide in the vicinity of MW-04 may be the result of deeper pumping east of the Site. Additional deeper monitoring wells may be useful to examine groundwater flow paths in this direction. Groundwater quality along the Site's up gradient boundaries should also be examined. Following confirmation of Site groundwater flow, groundwater sampling is recommended to better characterize potential impacts to groundwater quality from adjacent properties. Specifically, sampling is recommended in the northeastern and eastern portions of the Site adjacent to the ARREFF property and SPS-RDF properties, respectively (Figure 7).

Sediment. Sediment samples have been collected from the western drainage ditch and from Paradise Creek. Data for the western drainage ditch is limited to three samples, two of which were non-detect for PCBs (Aroclors). In a sample collected at the confluence of the western drainage ditch and Paradise Creek, PCBs were detected at a concentration of 0.044 mg/kg which exceeds the SQuiRT TEL of 0.0216 mg/kg for total PCBs. Additional sampling of the western drainage should be conducted for full TCL and TAL analysis and to confirm the PCB results from the previous sampling event. Paradise Creek sediment PCB data consist of one sample analyzed for Aroclors at the discharge point of the western drainage ditch and relatively broad sample coverage for PCB congeners and homologues. The homologue analyses, however, are reported at detection levels that are elevated relative to the screening level (>0.075 mg/kg compared to 0.0216 mg/kg NOAA SQuiRT TEL) thus potentially masking exceedances. Data gaps include the need to analyze sediment samples for PCB Aroclors. The Aroclor data are needed for comparison to risk-based standards. A subset of samples (the highest detected values) can be analyzed for PCB congeners for comparison to congener analysis for shallow soil on site. In addition, consideration should be given to conducting limited sampling and analysis for PCDD and PCDF compounds in the western and northwestern drainage ditches to evaluate the potential for contaminated sediment transport from the former transformer burn areas.

Surface Water. Previous investigations for this Site did not include the sampling of surface water. Surface water is present onsite in ponds and puddles, in the western drainage ditch and in the northwest drainage ditch located at the boundary of the Site and the ARREFF property. To address this data gap, surface water samples should be collected from these features and from Paradise Creek. It is recommended that this sampling be timed to coincide with the collection of sediment samples and include the same suite of analyses for site COCs.

4.3 IMPLICATIONS FOR THE REMEDIAL INVESTIGATION

As a task under the EPA Region 3 RAC, HGL prepared the RI/FS work plan (HGL Plan [HGL, 2011]) for the Site. The HGL Plan documents an effective investigation to address site data gaps. The HGL investigation will include an MEC/MD avoidance and utility clearance task and soil, groundwater, surface water and sediment sampling. After a brief summary of the HGL-planned sampling approach, potential strategies for optimization are identified. Table 5 summarizes the optimization recommendations for each of the field sampling tasks presented in the HGL Plan. The strategies are offered to the RI Team (Region 3 staff and its supporting contractors) for consideration for the implementation of a potentially more expedited and effective RI.

4.3.1 MEC/MD AVOIDANCE AND UTILITY CLEARANCE

This section describes currently planned MEC/MD avoidance and utility clearance activities contained in the HGL Plan. Section 4.3.1.1 summarizes the HGL-planned activities. Section 4.3.1.2 provides suggested changes as a result of the optimization review team’s site visit, preliminary CSM development and site data/report reviews.

4.3.1.1 HGL Planned Field Activity

Prior to the start of the RI field events, trained MEC/MD technicians will perform a visual survey and will construct boreholes for MEC/MD avoidance in areas of planned investigative work. The survey will include a 34-acre area including the entire Site (with the exception of the northern half of the northwestern portion of the Site) and a portion of the ARREFF property. Any MEC/MD identified will be visually inspected, photographed, surveyed using a hand-held global positioning system (GPS), its location marked in the field and mapped.

During the visual survey, locations of boreholes for MEC/MD avoidance will be sited in each of the planned boring locations in the areas of future investigation. Using a hand auger, a UXO technician will advance a boring to a depth range of 2 to 6 ft bgs. A magnetometer will be used to determine the presence of magnetic and/or magnetically susceptible items in the soil. If a magnetic or magnetically susceptible item is detected in a boring, the boring will be abandoned and a new boring will be drilled within 5 to 10 ft of the abandoned boring. All MEC/MD and potential MEC/MD locations will be avoided during the RI.

4.3.1.2 Recommended Strategies for Optimization

The MEC/MD visual survey by trained UXO technicians is important for identifying areas where the field investigation can safely proceed. The thick, metal-laden fill layer that blankets a large portion of the Site, however, may limit the effectiveness of the MEC/MD avoidance borehole installation task. Frequent hand auger refusal should be expected. Since MEC/MD might be encountered at any depth in the fill and drilling for soil sampling will be accomplished using sonic methods, preliminary screening of drilling locations using hand auguring will likely be challenging.

The RI Team should consider modifying the proposed MEC/MD avoidance activities. To achieve the objective of avoiding MEC/MD, a UXO technician should be present during drilling operations. A protocol should be developed by UXO technical staff for conducting down hole magnetometer screening incrementally during borehole advancement through the fill layer. Initial, pre-intrusive RI activities should focus on the location and mapping of buried utilities with UXO surveying provided to the extent necessary for support of utility clearance.

PCDD and PCDF Sampling Strategy. The MEC/MD avoidance and utility locating task provides an opportunity for preliminary soil screening sampling for PCDD and PCDF compounds. The HGL plan specifies that extensive sampling for PCDD and PCDF compounds will be performed for soil, groundwater, surface water and sediment. PCDD and PCDF analyses are relatively expensive (approximately $800–$1,000 per sample); the optimization of the prescribed number of these analyses can lead to significant project cost savings while ensuring that the PCDD and PCDF data generated by the investigation meet the requirements for risk characterization. Given that PCDD and PCDF compounds are relatively immobile in soil and are likely introduced at ground level through direct release or airborne deposition, they are most likely to occur in surface soil as a result of their tendency to strongly sorb to soil particles. The results from a preliminary sampling of Site surface soil, therefore, can provide critical input for refining the sampling design for other media. For example, if the observed PCDD and PCDF concentrations in surface soil are not a significant environmental concern, lower density sampling can be considered for the other media (groundwater, surface water and sediments) since contaminated soil is the likely dominant source for any observed PCDD and PCDF contamination in these media.

A significant source of PCDDs and PCDF compounds is the incomplete combustion of chlorine containing wastes. Previous sampling (conducted in 2003 and discussed in Section 2.4.4) for these compounds in electrical transformer burn areas at the Site yielded concentrations that were below the PCDD and PCDF industrial/commercial property threshold screening level. The locations of the burn areas, however, were not included in the available Site documentation reviewed. The working assumption of the CSM is, therefore, that the highest PCDD/PCDF concentrations at the Site occur in shallow soil in the burn areas and that the burn areas correspond to the locations with the highest observed PCB concentration.

The recommended approach for resampling the burn areas is based on the incremental composite sampling (ICS) soil characterization method. The ICS methodology is a composite sampling approach that statistically reduces data variability associated with discrete sampling and provides mean concentrations of contaminants within a specified area or volume of soil referred to as a decision unit (DU). As a result of “short-scale heterogeneity” (the existence of large differences in soil concentrations over short distances), a strong likelihood exists that any discrete sampling approach for the preliminary PCDD and PCDF soil sampling can result in a false positive or false negative conclusion (e.g., concluding that elevated PCDD and PCDF concentrations are more pervasive or less pervasive, respectively, than is the true situation). The ICS approach reduces the chances for a false conclusion by collecting incremental samples from each DU that are comprised of a statistically determined number of increments (typically 30-60) to provide an estimate of the mean concentration for that DU. ICS samples can also be collected in triplicate to allow other statistical analyses such as development of an upper confidence level (UCL) for the mean. Additional resources including a QAPP template and user guide for employing ICS techniques when sampling dioxin/furan compounds in soil can be found at www.epa.gov/superfund/health/contaminants/dioxin/dioxinsoil.html.

Using the ICS sampling approach, soil increments of equal mass are collected from multiple, un-biased locations across the DU. The sampling locations within the DU must be evenly distributed to ensure representativeness. The soil increments are then mixed together and homogenized to produce one uniform sample. A sub-sample is collected from the homogenized soil increments and submitted to a fixed-base laboratory for analysis. The analytical results of the sample are referred to as average or mean concentrations for the DU.

Since the locations of the 2003 PCDD and PCDF sampling are unavailable in the report documenting this sampling, the preliminary PCDD and PCDF sampling, as noted above, is proposed for Site areas where the maximum PCB concentrations are observed in surface and subsurface soil. Using the established 50 x 50 ft grid system at the Site, a minimum of eight[3] to 10 of the highest PCB concentration grid cells may be selected as ICS DUs for the preliminary PCDD and PCDF sampling task. To evaluate the CSM assumption that the highest PCDD and PCDF concentration locations correspond to the locations with the highest observed PCB concentrations, sampling should also include a subset of grid blocks with low and non-detect PCB concentrations. Based on the results of this initial sampling, the extent and scale of follow-up characterization sampling in the RI tasks for soil, groundwater, surface water and sediment characterization can be defined.

4.3.2 SOIL INVESTIGATION

This section describes soil sampling activities and recommended strategies for optimizing the characterization of Site soil. Section 4.3.2.1 summarizes the HGL-planned activities (HGL, 2011). Section 4.3.2.2 provides suggested changes as a result of the optimization review team’s site visit, preliminary CSM development and site data/report reviews.

4.3.2.1 HGL Planned Field Activities

The HGL-planned investigation of Site soils includes three phases: (1) the assessment of potential offsite contamination, (2) hotspot evaluation and (3) sampling to confirm the results of the 2008 MPI investigation. Figure 18 shows the proposed soil sampling locations.

Assessment of Potential Offsite Contamination. A total of 23 off-site delineation soil borings (designated XRF-01 through XRF-23 on Figure 18) will be completed utilizing a sonic drill rig for x-ray fluorescence (XRF) lead screening. Seventeen of these borings (XRF-01 through XRF 17) will be advanced to 8 ft bgs on the ARREFF property. These 17 borings will be located approximately 25 ft north of the fence line and be spaced approximately 100 ft apart along the fence line where lead concentrations were previously identified at 400 mg/kg or higher. The remaining six off-site delineation borings (XRF-18 through XRF-23) will be advanced to 8 ft bgs every 100 ft along the Site/SPS-RDF property boundary. During borehole advancement, soil samples will be collected continuously for lithologic logging, field screening with an 11.7-electron-volt (eV) photoionization detector (PID) and visual inspection. In addition, a total of 92 soil samples will be collected from the following soil depth intervals bgs for XRF screening: 0 to 6 inches, 6 inches to 2 ft, 3 to 5 ft and 6 to 8 ft bgs. Ten percent of the 92 screened soil samples will be submitted as confirmatory samples to an EPA off-site laboratory for TAL metals analysis. A soil sample will be collected from the depth interval of 0 to 6 inches bgs and 6 inches to 2 ft bgs from each of the 23 borings for offsite analysis at an EPA-approved laboratory for TCL PCB analysis.

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[3] Eight samples are the minimum number recommended for quantifying the variance in a background data set (EPA 2009). On this basis, the eight sample minimum is adopted in this document as the minimum number of required samples for statistical characterization of non-background data sets.

Hotspot Evaluation. A total of 13 hot spot soil borings, designated SB-01 through SB-13, will be completed utilizing a sonic drill rig (Figure 18). Eleven of the soil borings will be completed in areas of known potential impacts on site (SB-01 through SB-11) while the remaining two hot spot soil borings (SB-12 and SB-13) will be completed on the ARREFF property. The locations of the 13 hot spot soil borings are depicted on Figure 18. To assist with the hot spot investigation, soil samples will also be collected from 18 of 24 planned temporary well locations (introduced in Section 4.3.3.1). A continuous soil core will be collected from each of the 13 soil borings and the 18 temporary wells to 10 ft bgs. Each core will be visually inspected, lithologically logged and field screened with an 11.7-eV PID. Upon completion of the visual inspection and PID field screening, soil samples will be collected from the following soil intervals for laboratory analysis: 0 to 6 inches, 6 inches to 2 ft, 4 to 6 ft and 8 to 10 ft bgs. Hotspot soil samples will be analyzed for TCL VOCs, TCL semivolatile organic compounds (SVOCs), TCL pesticides and PCBs, TAL metals and total organic carbon (TOC). In addition, 50 percent of the samples collected will be analyzed for dioxins and furans, explosives, hexavalent chromium, grain size and asbestos.

Malcolm Pirnie Confirmatory Sampling. Ten percent of the 555 soil borings completed during the 2008 MPI soil investigation will be re-sampled for the collection of soil samples at specific sample depths (Figure18). The MPI confirmatory sampling event will involve completing a soil boring at 55 of the former MPI 50-by-50 ft sampling grid locations. The re-sampled grid locations were randomly selected to represent the full range of lead concentrations (non-detect to 10,000 mg/kg). One soil boring per re-sample grid will be completed using a sonic drill rig. The soil boring within each grid selected for re-sampling will be biased toward areas of potential contamination (e.g., stained areas, areas of known pits, or mounds of debris). Without identifiable areas of potential contamination, the soil boring will be collected from the center of the 50- by 50-ft sampling grid location. A continuous soil core will be collected from each boring. Each core will be visually inspected, lithologically logged and field screened with an 11.7-eV PID. Soil samples will be collected at the following interval from each of the 55 soil borings for laboratory analysis: 0 to 6 inches, 6 inches to 2 ft, 4 to 6 ft and 8 to 10 ft bgs. MPI confirmation soil samples will be analyzed for TCL VOCs, TCL SVOCs, TCL pesticides and PCBs, TAL metals and TOC. In addition, 50 percent of the samples will be analyzed for dioxins and furans, explosives, hexavalent chromium, grain size and asbestos.

4.3.2.2 Recommended Strategies for Optimization

The soil sampling described in the HGL plan is designed to address three characterization objectives: (1) assess the potential for offsite contamination, (2) evaluate potential hotspots and (3) verify the previous sampling conducted by MPI. To address the first two objectives, a more adaptive approach is recommended. For the third objective, the ICS sampling procedure is recommended.

Optimization of HGL Plan Soil Sampling Objectives 1 and 2: Assessment of the Potential for Offsite Contamination and the Evaluation of Potential Hotspots. An adaptive approach for the offsite and hotspot soil characterization tasks is recommended. Adaptive sampling consists of the collection of a relatively large number of field-analyzed samples and the use of the results of the field analyses to select locations for confirmatory fixed-base laboratory analyses. Follow-up sampling decisions are made in the field following decision logic defined in the work plan. Field analysis methods are screened for applicability/effectiveness through the performance of a demonstration of method applicability (DMA). A typical DMA involves the collection of paired samples for analysis by the field method and by fixed-base laboratory methods. The general applicability of a field method is based on the quality of the correlation between the results from the field and laboratory-analyzed samples.

The HGL plan provides for the collection of laboratory verification samples in which paired samples over the range of observed concentrations are submitted for field XRF analysis of lead and fixed-based laboratory analyses for TAL metals. A goal of 10 to 20 percent fixed-base laboratory collaborative samples can also be maintained by targeting samples where the field XRF results indicate one or more metals are near the RSLs. It should be noted that XRF analyses for metals and immunoassay analyses (IA) for PCBs have both been subjected to collaborative analyses with a fixed-base laboratory (Hatcher-Sayre, 1999 and DAA, 2003a, respectively). Somewhat reasonable correlations were obtained by Hatcher-Sayre (1999) for XRF; results of the DAA comparison of PCB IA results with fixed-base laboratory results were unavailable for this review (i.e., results were not included in the documents provided).

For the assessment of potential offsite contamination, the HGL plan is not truly adaptive because the selection of step-out sampling locations depends in part on laboratory-based PCB analyses results from the set of initially defined locations with the results reported within the standard turnaround time for the laboratory. The decision to step out, therefore, may be delayed until fixed-base laboratory results are available, which, assuming normal turnaround time would require approximately 10 business days. For the same amount of time spent in the field, a greater number of samples can be collected if the step-out decision is fully field-based compared to a sampling effort based on a non-field step-out decision.

To increase flexibility of the soil characterization, it is recommended that soil sampling be conducted in two phases within a single field event. In the first phase, samples from the prescribed depths at each boring are field analyzed and a percentage of the samples are submitted for fixed-base laboratory analysis. In addition, all first phase soil samples are archived for potential future PCDD and PCDF analysis. In the second phase, based on the field-based analyses results generated from the first phase borings, a subset of the borings are selected for further characterization using step-out borings and field analytics. Using defined logic, a percentage of the samples from the step-out locations can then be selected for fixed-based laboratory analysis.

The specific approach is described below and shown on Figure 19 in flow-diagram format. At the HGL plan-prescribed 23 offsite and 31 hotspot locations, install soil borings and collect soil samples at the plan-defined depth intervals. Each of the soil samples collected is then analyzed via PID, XRF, PAH IA and PCB IA and is archived. Based on an evaluation of the field analysis data from the initial borings, select a percentage (20 percent) of the soil samples for fixed-base laboratory analysis and a subset of the initial boring locations (3 to 5) for follow-up step out boring installation. Identify the optimal number of adaptive step out borings that can be installed given project budgetary constraints. Install the step out borings with the goal of placing at least one boring per each of the 3 to 5 follow-up locations. Screen cores and field analyze over the required sampling intervals used for the initial borings. Archive all samples from the prescribed sampling depths. Select for submission for fixed-base laboratory analysis all samples from the final step out boring associated with each initial phase boring.

Based on a review of field analyses and associated fixed based laboratory analyses results, the project team may select from the archived soil samples (from both the initial and step out soil borings) the appropriate samples for laboratory analyses of PCDD and PCDF compounds. In addition to PCDD and PCDF compounds, it is also recommended that selected samples also be analyzed for PCB congener concentrations via EPA Method 1668B (EPA, 2008) which is capable of achieving PCB detection levels to the low ng/kg (nanogram per kilogram) range. The resulting data in Site soil can be used for comparison to PCB congener composition data for Paradise Creek sediments. Determining the relative similarity or dissimilarity between the congener mix in the soil versus the sediment will assist in source attribution efforts. Archive sample selection for the analyses of PCDD and PCDF compounds and PCB congeners should occur in accordance with the laboratory-specified holding time for these constituents.

The above approach requires that the project team specify several specific quantities during the project planning phase, as follows:

- The percentage of samples from the initial phase borings that are to be submitted for fixed-base laboratory analyses and the selection criteria for these samples
- The number of initial phase locations that can be investigated in the adaptive phase
- The maximum number of adaptive phase step out borings that will be used to investigate the selected initial phase locations
- The percentage of samples from the adaptive phase borings that are to be submitted for fixed-base laboratory analyses and the selection criteria for these samples
- The number and selection criteria for soil samples that will be submitted for PCDD and PCDF analysis and PCB congener analyses via EPA 1668B

Final quantifications of these parameters are dependent on data quality objectives (DQOs) as defined in consultation with the project risk assessment team and project financial constraints.

Optimization of HGL Soil Sampling Objective 3: MPI Sample Verification Sampling. The objective of the MPI sample verification sampling appears to be the generation of a leveraged soil data set appropriate for HHRA and ecological risk assessment. The apparent operating assumption is that, if the verification samples collected from a depth of 6 inches closely correlate with the MPI sampling results from 18 inches, the larger MPI data set can be leveraged for risk calculations. However, a discussion of methods or criteria for assessing sufficiency of the correlation are absent from the HGL plan. Given that soil data typically exhibit pronounced short scale variability (as noted previously, large changes in concentration occurring over small distances), the probable conclusion of the sampling event, as structured, will be that the 6-inch depth soil data collected in accordance with the HGL plan differs significantly from the MPI data.

Given that the existing MPI surface soil data set reflects composited soil for the top 18 inches and that any comparison with data representative of the top 6 inches will be confounded by the variability inherent to soil concentration data, the MPI data, while informative, are essentially unusable for risk assessment calculations. Provided that it would be acceptable to EPA Region 3 risk assessment staff, the recommended approach for generating 6-inch-depth soil data for the HHRA and ecological risk assessments is the ICS approach (discussed in Section 4.3.1.2). Generally, the collection of three replicate ICS samples per DU is recommended so that reliability of the sampling methodology can be assessed. Appropriate DU delineation is critical to the ICS approach. DUs should be defined via the SPP process such that risk characterization objectives are achieved with the optimal number of required samples. Final DU size determination should be based on the CSM and will require input and consideration by all stakeholders in the SPP process.

ICS has been successfully used for a variety of constituents of interest including VOCs. After field sampling, VOC increments are typically shipped to the analytical laboratory for compositing, collection of the composite sample and analysis. Guidance on the application of this approach, including recommended sample processing procedures for VOCs, is provided in a document prepared by The Interstate Technology and Regulatory Council (ITRC) (ITRC, 2012). The document may be downloaded from www.itrcweb.org/ism-1/pdfs/ISM-1_021512_Final.pdf).

The mean concentrations are used for comparison to regulatory threshold values and action levels or are used in risk assessment calculations. In contrast, the conventional approach for soil characterization is to collect and analyze discrete soil samples and calculate the appropriate statistics for risk characterization from the analyses results. In comparison to the more conventional sampling approaches involving the collection of discrete samples, results from ICS applications have shown concentration data to be more consistent, less variable and reproducible.

As was discussed for the offsite and hotspot soil characterization tasks, it is recommended that the field team archive the ICS composite samples from selected DUs. The archived DU samples can then be selected for PCDD and PCDF and PCB congener analyses after the ICS sample results are received and evaluated for other constituents. Depending on the conclusions from the preliminary PCDD and PCDF sampling (conducted during utility/MEC/MD clearance as discussed in Section 4.3.1), the appropriate level of ICS sampling archiving (all samples versus a portion of the samples) and numbers of samples to be submitted for PCDD and PCDF and PCB congener analyses can be determined. Specific decisions on the numbers and selection of samples to be archived should be based on the results of the preliminary PCDD and PCDF sampling task.

The optimization team also recommends development of decision logic or decision rules (consistent with results of preliminary PCDD and PCDF sampling conducted as per Section 4.3.1) that can assist field crews in determining appropriate sample numbers and locations that will be analyzed for PCDDs and PCDFs, explosives, hexavalent chromium, grain size and asbestos.

4.3.3 GROUNDWATER INVESTIGATION

This section describes groundwater sampling activities and recommended strategies for optimizing the characterization of Site groundwater. Section 4.3.3.1 summarizes the HGL-planned activities (HGL, 2011). Section 4.3.3.2 provides suggested changes as a result of the optimization review team's site visit, preliminary CSM development and site data/report reviews.

4.3.3.1 HGL Planned Field Activities

The HGL planned investigation of Site groundwater includes the installation of temporary monitoring wells, the installation of follow-up permanent monitoring wells, redevelopment of existing monitoring wells and the collection of groundwater samples. Figure 18 shows the proposed groundwater sampling locations.

Temporary Well Installation—Main Site Area. A total of 24 pre-pack temporary wells designated TW-01 through TW-24 will be installed in areas where Site activities may have resulted in releases of contamination. The locations of the 24 temporary wells are shown on Figure 18. The temporary wells will be used to assess the overall groundwater quality and inform the placement of permanent groundwater monitoring wells.

The temporary wells will be installed using a sonic drill rig to a depth of 8 ft below the top of the water table. Once the desired depth is achieved, a 10-ft-long, 0.010-slotted, 2-inch diameter pre-pack monitoring well will be installed. The well screen will be positioned across the water table with approximately 8 ft of the well screen located below the water table.

Temporary well groundwater samples will be analyzed for TCL VOCs, TCL SVOCs, TCL pesticides and PCBs and TAL metals. In addition, 50 percent of the samples will be analyzed for PCDDs and PCDFs, explosives and hexavalent chromium.

Temporary Well Installation—Site Wetland Area. Four 10-ft-long, 0.010-slotted, 2-inch-diameter temporary pre-pack monitoring wells will be installed in the Site wetlands using either a sonic drill rig or by using a stainless steel hand auger. Samples collected from the wells will be analyzed for TCL VOCs, TCL SVOCs, TCL pesticides and PCBs, TAL metals, explosives, hexavalent chromium, alkalinity, hardness, chloride, sulfide, sulfate, nitrate, nitrite, TOC, total suspended solids (TSS), total dissolved solids (TDS), methane, ethane and ethene.

Installation of Permanent Wells. Based on the results of the temporary well groundwater contamination screening, up to six new groundwater monitoring wells will be installed and developed. Prior to well drilling, a UXO technician will conduct down hole clearances for MEC. A sonic drill rig will be used to drill and install the groundwater monitoring wells.

Groundwater Sampling. All nine existing wells, six new wells and four temporary wells installed in the Site wetlands will be sampled during the groundwater sampling event. Groundwater purging and sampling activities will be conducted via the low-flow sampling method. A bladder pump with a dedicated bladder will be used to pump each well. An in-line water quality meter and separate turbidity meter will be used to collect field water quality parameter data.

Permanent well groundwater samples will be analyzed for TCL VOCs, TCL SVOCs, TCL pesticides and PCBs, TAL metals, hexavalent chromium, alkalinity, hardness, chloride, sulfide, sulfate, nitrate, nitrite, TOC, TSS, TDS, methane, ethane and ethene.

Well Redevelopment. The existing nine site monitoring wells (MW-1R, MW-2, MW-4, MW-5, MW-6, MW-7, MW-8, MW-9 and MW-10) will be redeveloped. The locations of the nine wells are depicted on Figure 18. Wells not located or determined to be compromised will not be redeveloped. If a well is compromised or cannot be located, the EPA Remedial Project Manager (RPM) will be notified. Wells determined to be compromised will be properly abandoned by a Commonwealth of Virginia-licensed well driller.

4.3.3.2 Recommended Optimization Strategies

The groundwater sampling described in the HGL plan is designed to address characterization objectives which include (1) assess groundwater quality in the potential hotspot areas identified from historical air photo analyses (discussed in Section 2), (2) assess groundwater quality in the wetland area between the Site and Paradise Creek, (3) generate site analytical data for an expanded analyte list and (4) expand, as necessary, the Site groundwater monitoring well network with up to six new monitoring wells. Consistent with the adaptive approach defined for soils, the groundwater characterization should also consider employment of an adaptive approach, to the extent possible given the drilling/sampling challenges presented by the ubiquitous fill layer. Also, in addition to the above objectives, as stated previously, a significant Site characterization data gap to be addressed is the development of a more complete understanding of Site groundwater elevations and flow directions.

The groundwater characterization approach defined in the work plan is non-adaptive in that it consists of the installation of a select number of monitoring wells at prescribed locations. Any decision to install follow-up wells must await the receipt of fixed base laboratory analyses results provided within the standard turnaround time for the laboratory.

To increase the flexibility of the groundwater characterization, the following adaptive approach is recommended. The associated field logic is shown on Figure 20. Based on discussions with EPA (Rossi 2012), EPA Region 3 may reduce the final number of temporary wells from 24 to a total of 12. Given that 12 wells will be installed, the recommended approach consists of the installation of an initial subset of these wells (8 are proposed) with the remaining wells (four) installed based on the field data generated from the initial wells.

Given the 24 temporary well locations proposed in the HGL plan and an initial subset of eight wells, the recommended adaptive approach can be implemented as follows. The proposed 24 temporary well locations should first be prioritized based on existing information. A subset should then be selected consisting of the eight locations judged most likely to be impacted by Site operations and to provide information on groundwater flow directions. Consistent with the HGL plan (e.g., co-location of subsurface soil hotspot borings with onsite temporary wells), the eight locations can be defined to coincide with eight of the soil borings specified for hotspot soil assessment (discussed in the previous section). The drilling program may then be structured to first investigate these initial eight locations and then, based on the field analysis results, up to four follow-up wells can be used to step out from the initial locations. The groundwater field analytics can include PCB IA, PAH IA, metals via Lumex (with water attachment) and field parameters plus any supporting data from the field analysis of the soil samples collected during the hotspot subsurface soil investigation. Based in part on an assessment of the preliminary PCDD and PCDF surface soil sampling results obtained in accordance with Section 4.3.1, the project team can determine the number and locations of groundwater samples that should be analyzed for PCDD and PCDF compounds and PCB congeners via EPA Method 1668B.

The above approach requires that the project team address several specific issues during the project planning phase, as follows:

- Prioritization of the HGL-proposed 24 well locations with regard to the relative potential for Site impact
- Determination of the overall number of wells (assumed to be 12) that can be installed given available project resources
- Selection of the initial number of wells to be installed (assumed to be eight)
- Selection of the wells for the collection of samples for the analysis of PCDD and PCDF compounds and analysis of PCB congeners via EPA 1668B

Final quantification of these parameters is dependent on DQOs as defined in consultation with the project risk assessment team and project financial constraints.

Other recommendations for the groundwater characterization include:

- The depth of sample collection within the screened interval of each monitoring well should be included in the routine field documentation for each groundwater sample. This data will be important in general, but critically so if subsequent use of 3-D visualization and analysis technology is ever warranted.

- If temporary monitoring wells are installed, each temporary well should be constructed such that it can be readily converted to a permanent well. The construction of each temporary well should include the installation of filter sand and fine filter sand above the top of the well screen and the installation of a bentonite grout seal. Conversion of a temporary well to permanent status would then only require the addition of the appropriate surface completion.

- The HGL plan calls for the installation of the four temporary wells in the Site wetland area. The apparent objective of these wells is to characterize groundwater quality in the wetland area in close proximity to the shoreline of Paradise Creek. It is recommended that groundwater sampling at these locations be eliminated or considered in combination with the locations specified by HGL for onsite temporary well installation. As discussed in the optimization evaluation of the proposed Paradise sediment characterization, the performance of sediment pore water sampling in Paradise

Creek is recommended to assess the groundwater to surface water pathway. It is expected that the proposed temporary and new wells in combination with the existing monitoring well network will likely sufficiently characterize groundwater quality near the creek shoreline as well as inform sediment and pore water sampling locations adjacent to the Site.

Recommendations regarding the proposed analyte lists include:

- The current temporary well analyte list calls for half of the wells (12) to be analyzed for dioxins and furans. If the results obtained from the preliminary sampling for PCDD and PCDF compounds in the initial field task (utility/MEC/MD clearance discussed in Section 4.3.1) suggest that these compounds are not a significant concern, a further reduced groundwater sampling scope may be considered. Dioxin and furan samples should be biased toward locations with the highest observed soil dioxin/furan concentrations and/or along any suspected potential primary transport pathways.

- To provide data comparable to the Elizabeth River TMDL currently under development and to develop PCB congener concentration data in groundwater for comparison to congener composition data for Paradise Creek pore water/surface water, groundwater samples from monitoring wells installed down gradient from the areas with elevated PCB concentrations may be analyzed to a low method detection level via EPA Method 1668B (EPA, 2008). The PCB congener analysis is beneficial for comparing Site PCB congeners to sediment PCB congeners for fingerprinting purposes. For example, if the Site congener suite of PCBs poorly matches the sediment congener suite, offsite PCB source attribution may be considered.

- The permanent well analyte list includes several constituents (sulfide, nitrite, methane, ethane and ethane) normally used to evaluate natural attenuation of chlorinated ethene compounds. It is suggested that the analysis of these compounds only be performed if elevated concentrations of chlorinated hydrocarbons are detected in the temporary well sampling task.

- The optimization team recommends development of decision logic or decision rules (consistent with results of preliminary PCDD and PCDF sampling conducted as per Section 4.3.1) that can assist field crews in determining appropriate sample numbers and locations that will be analyzed for PCDDs and PCDFs, explosives and hexavalent chromium.

4.3.4 SEDIMENT INVESTIGATION

This section describes soil sampling activities and recommended strategies for optimizing the characterization of Site sediment. Section 4.3.4.1 summarizes the HGL-planned activities (HGL, 2011). Section 4.3.4.2 provides suggested changes as a result of the optimization review team’s site visit, preliminary CSM development and site data/report reviews.

4.3.4.1 HGL Planned Field Activities

Western Drainage and Concrete Channel. Eight sediment samples are planned for collection from four locations along the western drainage and two samples will be collected from one location at the outlet of the drainage. Four sediment samples will be collected from two locations within the concrete-lined drainage channel. The collected sediment samples will be visually inspected, field screened with a PID and lithologically characterized. The samples will be collected from the top 0–6 inches and from the interval from 6 inches to 2 ft below the top. All samples will be analyzed for TCL VOCs, TCL SVOCs, TCL pesticides and PCBs, TAL metals, TOC, grain size, oxidation-reduction potential (ORP) and pH. In addition, 50 percent of the samples will be analyzed for hexavalent chromium, explosives, and PCDD and PCDFs. A field instrument will be utilized to measure the sediment sample's ORP.

Site Wetlands. Eighteen sediment samples designated WLSD-01 through WLSD-18 will be collected from the wetlands bordering Paradise Creek. The locations of the wetland sediment samples are depicted on Figure 21. Sediment samples from the wetlands will be collected from the top 6 inches and from 6 inches to 2 ft below the top of the sediment. A decontaminated stainless steel hand auger will be used for sample collection. The sediment samples will be visually inspected, field screened with a PID and lithologically characterized. The sediment samples will be submitted through the Contract Laboratory Program (CLP) to an EPA-approved laboratory for TCL VOCs, TCL SVOCs, TCL pesticides and PCBs, TAL metals, TOC, grain size and pH analyses. In addition, 50 percent of the samples will be analyzed for hexavalent chromium, explosives and dioxins. A field instrument will be utilized to measure the sediment sample's oxidation-reduction potential ORP.

Paradise Creek. Twelve sediment samples designated PCSD-01 through PCSD-12 will be collected from Paradise Creek. In general, the sediment sample locations will be dependent on areas of deposition bordering the Site (eight locations), as well as upstream locations of the Site (two locations) and downstream locations of the Site (two locations). The locations of the Paradise Creek sediment samples are shown on Figure 22; however, the exact locations will be determined in the field after collecting channel bottom depths and surface water flow measurements in order to assess flow regimes within the creek. Samples will be collected using core samplers, hand augers, or ponar dredges from a depth of 0–6 inches below the top of the sediment. All samples will be analyzed for TCL VOCs, TCL SVOCs, TCL pesticides and PCBs, TAL metals and TOC. Half of the samples will also be analyzed for hexavalent chromium, explosives, PCDDs and PCDFs and grain size.

4.3.4.2 Recommended Optimization Strategies

Opportunities for optimization of the Site drainage and wetlands investigations are discussed first followed by a discussion of optimization strategies for Paradise Creek. The drainages include the western drainage and the northwestern (concrete-lined channel) drainage located along the boundary of the ARREFF property and the northwestern portion of the Site.

Northwestern Drainage. Based on observations made during the February site visit, sample collection from the concrete-lined drainage channel may be hindered by the presence of deep, standing water and limited access, as portions of the channel are covered by concrete or pavement. Prior to sampling, a survey of the accessible portions of the channel is recommended to identify locations of sufficient sediment accumulation for sample collection. Up to three locations are recommended. If standing water is present, a petit Ponar dredge may be necessary to collect samples. To provide data comparable to the Elizabeth River TMDL currently under development and to develop PCB congener concentration data for northwestern drainage sediment, PCB analyses of selected sediment samples can be performed at a low method detection level using EPA Method 1668B. An approach for converting congener concentration data to an equivalent Aroclor concentration given specific assumptions is provided in Narquis et al. (2007). Selected samples should also be analyzed for PCDD and PCDF compounds.

The selection of sediment samples for congener analyses may be based on Aroclor analyses results. It is recommended that all fixed-base laboratory samples be analyzed for PCB Aroclors and a portion of each sample archived. Based on the results of the Aroclor analyses, the most elevated Aroclor samples can be submitted for congener analysis by Method 1668B (a minimum of 3 samples is recommended). Regarding the collection of northwestern drainage sediment samples for PCDD and PCDF analyses, the scope of this sampling may be driven largely by the results of the preliminary PCDD and PCDF sampling in surface soil conducted in accordance with Section 4.3.1.

Western Drainage. To efficiently identify potential localized areas with elevated concentrations of COCs and minimize the need for follow-up sampling rounds in the western drainage and in the site wetlands, an adaptive sampling approach is recommended. Suggested decision logic is shown on Figure 23. An initial field sampling and analysis event that includes the length of the western drainage and Site wetland area would establish the optimal locations for the collection of the eight proposed fixed-base laboratory samples to meet or exceed project DQOs for collaborative sample data. Consistent with the HGL draft WP, two samples should be collected at the outlet of the western drainage to Paradise Creek. Field-based analyses accomplished using XRF and, potentially, IA screening methods for PCBs and PAHs are suggested for the field characterization of the western drainage and wetland area. To provide data comparable to the Elizabeth River TMDL currently under development and to develop PCB congener concentration data for western drainage sediment for comparison to congener composition data for Paradise Creek sediments, PCB analyses of selected sediment samples should be performed at a low method detection level using EPA Method 1668B. Selected samples should also be analyzed for PCDD and PCDF compounds.

As was also indicated for the northwestern drainage, the selection of sediment samples for congener analyses may be based on Aroclor analyses results. It is recommended that all fixed-base laboratory samples be analyzed for PCB Aroclors and a portion of each sample archived. Based on the results of the Aroclor analyses, the most elevated Aroclor samples can be submitted for analysis by Method 1668B (a minimum of 3 samples is recommended). Regarding the collection of western drainage sediment samples for PCDD and PCDF analyses, the scope of this sampling may be driven largely by the results of the preliminary PCDD and PCDF sampling in surface soil conducted in accordance with Section 4.3.1.

Site Wetlands. To optimize the wetlands sediment sampling activity, it is recommended that this sampling be conducted using ICS methodology rather than conducting the sampling at the 18 prescribed locations in the HGL Plan. As discussed in previous sections, ICS provides an effective strategy for estimating the mean concentration of soil constituents within a defined DU. As a result of short scale heterogeneity in sediment, prescribed sampling results are often subject to misinterpretation. DU boundaries and the appropriate number of soil increments will require project team and stakeholder input.

Paradise Creek. The proposed collection of 12 sediment samples from Paradise Creek is intended to address the data gaps summarized in the HGL plan. Specifically, these data gaps include the characterization of background sediment and surface water quality, the characterization of surface water quality, the selection of sample locations based on local flow regime and the assessment of contaminant bioavailability and sediment toxicity. It is suggested that the proposed sampling approach be re-evaluated with respect to ecological risk assessment objectives. Since sediment quality in Paradise Creek is at least partially influenced by conditions offsite, a key objective of the sediment sampling task should be the evaluation of potential impacts of the Site on the benthic environment adjacent to the Site. The recommended approach (consistent with elements of the Triad Approach to sediment quality assessment [EPA, 2002a]) would, therefore, include in addition to sediment sampling, enumeration of the benthic macroinvertebrate community and characterization of sediment pore water. This approach will provide context for interpretation of the Paradise Creek sediment data collected near the Site and help define potential sediment impairment directly attributable to the Site.

In summary, it is suggested that the sediment characterization approach include three components: (1) the collection of sediment samples, (2) the enumeration of macroinvertebrate fauna and (3) the collection of sediment pore water samples. Sediment and sediment pore water are key to determining the overall quality of the benthic environment. Enumeration of macroinvertebrates measures species populations and diversity as a general *in situ* indicator of the quality of the benthic environment. Co-location of enumeration sampling areas with sediment and pore water sampling locations enables the evaluation of spatial variability of benthic quality at multiple locations along the Site's Paradise Creek shoreline. The optimization review team recommends 8 to 10 such sampling points as a means to sufficiently characterize the Site's shoreline using the proposed three component approach. For control purposes, two offsite sampling points, located upstream from the Site would provide baseline conditions for comparison to Site results. The similarity/dissimilarity of benthic enumeration and sediment and pore water quality at the upstream control points would indicate the relative significance of Site contributions to Paradise Creek sediment quality adjacent to the Site.

It is further recommended that a survey of the Paradise Creek channel offshore from the Site be conducted to identify zones of preferential groundwater discharge to surface water. The results of the survey may be useful in identifying potential groundwater contaminant migration pathways. Aerial or camera-based thermal infrared imagery alone or in combination with a survey of temperature and specific conductivity differentials in pore water can be used to identify preferential groundwater discharge zones. Examples of the application of thermal imaging to identify groundwater discharge zones in surface water are provided on the EPA Clu-In site at www.clu-in.org/download/contaminantfocus/sediments/GW-to-SW.pdf. The optimization team is aware of least one other Superfund site in Region 3 where application of infrared imagery is planned to assist the project team in locating and evaluating groundwater discharge zones in surface water bodies. Additional information is available upon request.

Additional sediment characterization concerns include the characterization of PCB concentrations at sufficiently low method detection levels for comparison to the Elizabeth River TMDL under development, the identification of specific PCB congeners for comparison to PCB congener analyses from onsite environmental media samples and the characterization of PCDD and PCDF compounds. Although homologue (MPI, 2008) and congener (Unger et al., 2005) data exist for the sediments, the homologue results are mostly non-detect and are reported at elevated detection levels. In addition, laboratory QC data are unavailable for the congener results. A subset of the sediment samples (approximately 20 percent), therefore, should be analyzed using EPA Method 1668B at a low detection level for PCB congeners in sediment samples for TMDL comparison purposes. In addition, in a limited subset of these samples, analyses of PCB congeners should also be performed to assist in potential "fingerprinting" of Paradise Creek PCB contamination to Site sources. As noted above, an approach for converting congener concentration data to an equivalent Aroclor concentration given specific assumptions is provided in by Narquis et al. (2007). Regarding the collection of Paradise Creek sediment samples for PCDD and PCDF analyses, the scope of this sampling may be driven largely by the results of the preliminary PCDD and PCDF sampling in surface soil conducted in accordance with Section 4.3.1.

4.3.5 SURFACE WATER INVESTIGATION

This section describes soil sampling activities and recommended strategies for optimizing the characterization of Site surface water. Section 4.3.5.1 summarizes the HGL-planned activities (HGL, 2011). Section 4.3.5.2 provides suggested changes as a result of the optimization review team's site visit, preliminary CSM development and site data/report reviews.

4.3.5.1 HGL Planned Field Activities

Western and Northwestern Drainages. The HGL draft sampling plan includes collection of five surface water samples. The samples will be co-located with the five sediment samples planned for Western and Northwestern drainages (Figure 21). The surface water samples will be collected if surface water is present during the field investigation. The samples will be collected utilizing hand dipping techniques if the drainage is accessible and shallow or utilizing a remote sampling devise such as a dipper or discrete water sampler if access to the drainage channel is a health and safety concern and/or the surface water body is deeper than 1 ft. Site drainage surface water samples will be analyzed for TCL VOCs, TCL

SVOCs, TCL pesticides and PCBs and TAL metals. Approximately half of the samples will also be analyzed for PCDDs and PCDFs, hexavalent chromium and explosives.

Site Wetlands. Ten surface water samples designated WLSW-01 through WLSW-10 will be collected from the Site wetlands. Four of the wetland surface water samples will be collected from four of the wetland sediment sample locations. The remaining six surface water wetland samples will be collected from seep locations along the Paradise Creek shoreline during low tide. Surface water samples will only be collected if surface water is present. Hand dipping techniques will be employed if the drainage is accessible and shallow; otherwise, a remote sampling device such as a dipper or discrete water sampler will be utilized. Site wetlands surface water samples will be analyzed for TCL VOCs, TCL SVOCs, TCL pesticides and PCBs and TAL metals. Approximately half of the samples will also be analyzed for PCDDs and PCDFs, hexavalent chromium and explosives.

Paradise Creek. Twelve surface water samples designated PCSW-01 through PCSW-12 will be collected from Paradise Creek. The locations of the surface water samples are shown on Figure 22; however, the exact locations of the samples will be determined in the field and based on observed surface water/groundwater discharges and primary surface water flow paths through Paradise Creek. Paradise Creek surface water samples will be analyzed for TCL VOCs, TCL SVOCs, TCL pesticides and PCBs, TAL metals, alkalinity, hardness, chloride, sulfide, sulfate, nitrite and nitrate. Approximately half of the samples will also be analyzed for PCDDs and PCDFs, hexavalent chromium and explosives.

4.3.5.2 Recommended Optimization Strategies

It is recommended that surface water sample collection efforts be coordinated with the collection of sediment samples and collection locations should coincide with the sediment characterization locations. With regard to sample quantities and placement, the same recommended strategies apply as are provided for sediments (see Section 4.3.4). With regard to surface water sample analyses, the following suggestions are offered:

- As discussed previously, since PCDDs and PCDFs are relatively immobile, sampling of these constituents in surface water should be contingent on the results obtained from the preliminary PCDD and PCDF soil sampling event conducted in accordance with Section 4.3.1.

- EPA Method 1668B should be used for PCB analyses to ensure that results are reported to the lowest possible method detection level. In addition, since an aggregate PCB concentration is necessary for comparison to the RSL, analyses results can be reported as the sum of individual PCB homologue concentrations. As noted previously, an approach for converting congener concentration data to an equivalent Aroclor concentration given specific assumptions is provided in by Narquis et al. (2007).

4.3.6 SEQUENCING OF FIELD ACTIVITIES

Sequencing of field activities is a critical element of any dynamic or adaptive sampling approach as each activity can greatly inform subsequent sampling locations and frequencies. The field investigation will include the identification and mapping of buried utilities at the Site and the collection of soil, groundwater, sediment and surface water data. Following utility identification, the progression of major field tasks is recommended as follows:

- **Preliminary ICS Surface Soil sampling for PCDD and PCDF Compounds.** This sampling is proposed to occur as early as possible during the field effort, preferably during the buried utility delineation task (Section 4.3.1). Results of the sampling will provide the opportunity to optimize selected locations for a subset of sample analyses for PCB congener and PCDD/PCDF analyses as well as inform planned sampling in other media (subsurface soil, groundwater, surface water, sediments)

- **Survey for off-site extraction wells.** A review of municipal and/or state-maintained well permit databases should be performed to identify, to the extent possible, the extraction wells located in the vicinity of the Site. The results of the permit database review should be field verified with specific attention given to identifying the cause of the low groundwater levels observed in the northeastern portion of the Site. This survey will assist in the identification of locations for permanent monitoring well installation.

- **Comprehensive Site wide ICS Surface Soil Sampling for Risk Assessment.** This soil sampling will be conducted to support site human health and ecological risk determinations. The preliminary ICS surface soil sampling for PCDD and PCDF compounds will be used to calibrate the level of sampling for these constituents that is appropriate for the comprehensive site wide ICS sampling event.

- **Soil sampling to evaluate potential offsite contamination and to characterize hotspots; groundwater characterization through the installation of temporary monitoring wells.** These tasks involve boring construction via sonic methods and will require the services of a licensed drilling subcontractor. Conducting these tasks simultaneously will allow efficient staging of drilling operations to avoid drilling rig idle time. These results will be used to characterize subsurface soil and fill material on site as well as inform placement of permanent wells.

- **Installation of permanent monitoring wells.** This task will require the services of a licensed drilling subcontractor and should be coordinated to coincide with the soil boring and temporary well installation tasks discussed in the previous bullet.

- **Northwestern and western drainage ditch sediment and surface water sampling.** Sampling from the northwestern drainage and adaptive sampling from the western drainage will be conducted. These tasks can be coordinated with the other non-drilling tasks.

- **ICS Wetland Sediment Sampling.** ICS sampling of Site surface soil and ICS sampling of Paradise Creek wetland sediments can be coordinated with the other non-drilling tasks.

- **Paradise Creek groundwater discharge survey.** A survey to identify groundwater seeps and zones of preferential groundwater discharge to Paradise Creek channel offshore from the Site should be conducted prior to performing sediment characterization sampling in the creek.

- **Paradise Creek sediment and surface water sampling.** The sediment and sediment pore water and benthic enumeration sampling can be conducted independent of the other tasks.

5.0 FINDINGS

The observations provided below are the interpretations of the optimization review team based on historical information and data review, a site visit conducted February 22, 2012 and SPP conducted with project technical team members and stakeholders in a meeting prior to the site visit. The observations are not intended to imply a deficiency in any previous characterization work or the draft HGL RI work plan but are offered as observations that provide context for constructive suggestions provided in Sections 4 and 6 of this document. The optimization review team believes the suggestions offered are in the best interest of EPA Region 3 and project stakeholders including the public.

Findings regarding the Site include the following:

- The Site is bordered by active industrial facilities all situated up-slope topographically from the Site. Surface water and sediment runoff from the adjacent upslope portions of the U.S. Navy, Sherwin Williams, ARREFF and the SPS-RDF facility properties drain on to the PIM Site property. Site surface water, soil and sediment therefore, may be impacted by these potential offsite contamination sources. In addition to recognizing the potential for contaminant migration from the PIM site to nearby properties, the recommended sampling also seeks to evaluate the potential for off-site contaminants to be transported to the PIM site via surface water features and topographically up gradient properties.

- During the February site visit, the optimization review team observed continued human use of the Site for various ad hoc purposes that may result in the release of additional contamination and/or expose individuals to known contamination at the Site. A portion of the Site appears to be currently used by a contractor for equipment/material staging and equipment repair. The contents of the buildings present in the northwestern portion of the Site include various personal vehicles, tools, material storage drums and children’s bicycles.

- Extensive portions of the Site are underlain by various types of fill that can attain apparent thicknesses exceeding 10 ft. The fill appears to consist of soil mixed with various forms of rubble (wood, concrete, asphalt, glass) and metal scraps. Fill materials observed across much of the southern portions of the Site can present challenges for not only drilling technologies, but sample collection and homogenization strategies. Proposed standard operating procedures (SOP) should provide clear direction to the project team as to how sample collection and homogenization will address this unique matrix.

- Based on groundwater level data from the previous site investigations, groundwater flows to the northeast and to the southwest from a local high groundwater elevation measured at MW-4 (7.46 ft above msl), located in the central portion of the Site. Southwestward groundwater flow from the mound is toward Paradise Creek at an average rate of 20 ft/year (MPI, 2008). It should be noted that this apparent groundwater mound is visually correlated with historical impoundment and surface features identified in the EPA aerial photography review (HGL 2011) and identified in Figure 2. Lower groundwater elevations in the eastern portion of the Site may partially result from groundwater drainage to City storm drainage ditches and piping that border the northern and eastern boundaries of the Site. The presence of water levels below mean sea level (NAVD88) suggests the existence of offsite groundwater pumping that may influence site groundwater transport. Water and sewer services are readily accessible to the properties bordering Elm Avenue in the Site vicinity. The City of Portsmouth indicates that if such service is available, private wells are not typically used as sources for potable water supply. An inventory of wells in the Site vicinity was not identified in the documents reviewed or performed for this study. It is recommended that the project team develop a groundwater supply well inventory for the PIM Site vicinity.

- Elevated PCB concentrations are present in Site soil. Several areas, particularly in the central and east-central portion of the Site, exceed 1000 x the RSL for Aroclor 1221 and 1232 (540 mg/kg). In the available Site characterization data, PCB analyses of onsite soil and Paradise Creek sediments have been inconsistent in that Aroclors have been analyzed in Site soils while homologues and congeners have been analyzed in Paradise Creek sediments. PCBs expressed as equivalent Aroclor concentrations are required for Region 3 risk evaluations while PCBs expressed as congener concentrations are required for fate and transport considerations. To the extent possible, suggestions provided in this document seek to leverage both types of PCB data to meet DQOs for risk evaluations as well as provide data for fingerprinting and fate/transport evaluations.

- Elevated metals concentrations are present in Site soil. Lead concentrations exceed 800 mg/kg (lead RSL for industrial soil) over broad areas and in isolated areas distributed in the east and central portions of the Site, lead exceeds 8,000 mg/kg. The available monitoring wells installed near and down gradient from the elevated metals areas, however, exhibit relatively low metals concentrations. The contrast between metals concentrations in Site soil and subjacent groundwater suggests that a low capacity exists for soils to leach metals to groundwater.

- A TMDL for PCBs is in development for the Elizabeth River Watershed and is scheduled to be issued in 2014. Evaluation of Site PCB concentrations will require analyses at a method of detection level that is less than the TMDL. The Elizabeth River PCB TMDL could potentially be identified as a future ARAR or influence future PCB analytical technique considerations for the Site.

6.0 RECOMMENDATIONS

The purpose of this review is to evaluate Site conditions and identify opportunities to optimize the planned RI at the Site. Recommendations for specific RI tasks were presented in Section 4.3. This section lists the recommendations that transcend individual tasks and are applicable to the RI in general. Note that while the recommendations provide some details to consider during implementation, they are not meant to replace the HGL plan or other more comprehensive planning documents.

- Access to the Site should be limited to authorized individuals and entities only. Any currently existing unauthorized use of Site buildings or grounds should be curtailed. As a result of structural integrity issues and potential contamination concerns, all use of the Site buildings should also be terminated and each building should be secured such that any future unauthorized entry is prevented.

- Development of a fill isopach map showing the estimated distribution, thickness and general composition of fill at the PIM Site is recommended. Information sources for preparation of the map can include site boring logs, surface mapping and historical aerial photographs.

- In recognition of the hazards posed by MEC/MD, a trained UXO technician should be present during drilling operations. A protocol should be developed by UXO staff for conducting down-hole magnetometer screening incrementally during borehole advancement through the fill layer.

- It is recommended that the RI be structured so that data collection for each environmental media follows an adaptive sampling strategy. Low cost, rapid turnaround field analyses can be more fully employed to identify the priority sampling locations for fixed-base laboratory analyses. An adaptive framework utilizing decision logic or decision rules should drive the selection of sampling locations for fixed-base laboratory soil, groundwater and sediment sample collection.

- It is also recommended that DMAs be conducted for field-based analysis technologies under consideration for deployment in the field investigation. A discussion of DMA design fundamentals and associated case studies are available in the EPA publication: *Demonstrations of Method Applicability under a Triad Approach for Site Assessment and Cleanup—Technology Bulletin, August 2008*, available from www.clu-in.org/download/char/demonstrations_of_methods_applicability.pdf. Additionally, OSRTI is available upon request to provide technical assistance in the design and implementation of a DMA for XRF or any other real time, field screening technology that might be considered by Region 3 for the PIM Site RI.

- It is suggested that temporary well installation and permanent well installation tasks be merged by constructing each temporary well in a manner that will allow it to be finished as a permanent well. Doing this will avoid redundancy between the well installation tasks and reduce the number of attempts to achieve effective monitoring well placement in thick, irregular fill terrain.

- A preliminary, ICS-based soil sampling event (coinciding with the MEC/MD survey) should be considered for sampling the Site areas with the most elevated PCB concentrations for PCDDs and PCDFs. The decision to carry these constituents forward for additional soil investigation and in the investigation of other media can be based on the results of this initial sampling.

- Given that two, fairly extensive sediment sampling events have been conducted in Paradise Creek adjacent to the Site, one that included the analyses of PCB congeners and PAHs and the other that included the analysis of PCB homologues and seven metals, consideration should be given to defining the Paradise Creek sediment characterization task objective to be the estimation of specific impacts to the benthic environment directly attributable to the Site. Toward this end, the RI Team should consider the performance of benthic enumeration, sediment pore water sampling and sediment sampling at several locations both adjacent to and upstream from the Site.

- As a recommended precursor activity to conducting benthic enumeration, pore water sampling and sediment sampling, a groundwater discharge survey of the Paradise Creek channel offshore from the Site should be performed. It is recommended that aforementioned sediment characterization activities include any identified zones of preferential groundwater discharge identified by the survey. Thermal infrared or forward looking infrared imagery (FLIR) alone or in combination with a survey of temperature, specific conductivity differentials and water quality in pore water, and groundwater/surface water head elevations within the stream channel, can be used to identify preferential groundwater discharge zones. In addition, three dimensional visualization analysis of hydrogeologic parameters such as relative hydraulic conductivity and porosity is also a tool that can greatly inform any evaluation of the presence or absence and location of potential groundwater discharge zones in Paradise creek adjacent to the PIM site.

- A review of municipal and/or state-maintained well permit databases should be performed to identify, to the extent possible, the extraction wells located in the vicinity of the Site. The results of the permit database review may help to understand groundwater flow directions and the cause of the low groundwater levels observed in the northeastern portion of the Site.

- Selected soil, groundwater, surface water and sediment samples (onsite drainages and Paradise Creek sediments) should be targeted for low level PCB congener analyses via EPA Method 1668B. The congener analyses will allow comparison of the PCB congeners present in Site soil to those present in Paradise Creek, thus providing an indication of the potential significance of the Site as a contributing source of PCB contamination in Paradise Creek sediment. In addition, Method 1668B will yield Paradise Creek sediment concentration results with detection levels comparable with the upcoming TMDL.

APPENDIX A
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TABLES

Table 1. Soil Sampling Analytical Parameters and Potential Screening Values Reported in HGL (2011) and Recommended Updated Values Where Appropriate
(Shading denotes a value that could not be verified in USEPA-published tables)

Analyte	EPA Residential RSL (mg/kg) June 2011(1)	EPA Residential RSL (mg/kg) April 2012(1)	Region 3 Ecological SSL (mg/kg)(2)
	HGL RI/FS Site Management Plan, 2011	Values Identified during this report	
Aroclor 1016	0.39	0.39	-
Aroclor 1221	0.14	0.14	-
Aroclor 1232	0.14	0.14	-
Aroclor 1242	0.22	0.22	-
Aroclor 1248	0.22	0.22	-
Aroclor 1254	0.11	0.22	-
Aroclor 1260	0.22	0.22	-
Aroclor 1262	0.22 (as PCBs)	-	-
Aroclor 1268	0.22 (as PCBs)	-	-
Total PCBs	-	-	0.1
Arsenic	0.39	0.39	18
Cadmium	7	7	0.36
Chromium	0.29 (as Chromium VI)	0.29 (as Chromium VI)	26
Lead	400(3)	400(3)	11
Mercury	0.78 (methyl mercury)	0.78 (methyl mercury)	0.058
Nickel	150	150	38
Silver	39	39	4.2

Notes:

(1) Noncarcinogenic RSLs based on hazard quotient of 0.1.

(2) The lowest value from the EPA Region 3 Ecological SSLs derived for plant, soil invertebrate, avian, or mammalian receptors; where this value is not available, the lower of the Region 3 BTAG soil screening level for flora or fauna has been used.

(3) EPA recommended value for residential soils (www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm)

PCB = polychlorinated biphenyl

RSL = Regional Screening Level

mg/kg = milligrams per kilogram

Updated April 2012 EPA RSLs are available.

This table was generated in part from December 2011 RI/FS Site Management Plan by HGL

Table 2. Groundwater Sampling Analytical Parameters and Potential Screening Values Reported in HGL (2011) and Recommended Updated Values Where Appropriate

(Shading denotes a value that could not be verified in USEPA-published tables)

Analyte	EPA MCL (µg/L)	EPA MCL (µg/L)	EPA Tap Water RSL (µg/L) June 2011 (1)	EPA Tap Water RSL (µg/L) April 2012 (1)	Region 3 Ecological Freshwater SSL (µg/L) (2)	Region 3 Ecological Freshwater SSL (µg/L) (2)
	HGL RI/FS Site Management Plan, 2011	**Values Identified during this report**	**HGL RI/FS Site Management Plan, 2011**	**Values Identified during this report**	**HGL RI/FS Site Management Plan, 2011**	**Values Identified during this report**
Aroclor 1016	0.5	-	0.26	0.96	0.00074	0.00074
Aroclor 1221	0.5	-	0.0068	0.0043	0.00074	0.00074
Aroclor 1232	0.5	-	0.0068	0.0043	0.00074	0.00074
Aroclor 1242	0.5	-	0.034	0.034	0.00074	0.00074
Aroclor 1248	0.5	-	0.034	0.034	0.00074	0.00074
Aroclor 1254	0.5	-	0.034	0.034	0.00074	0.00074
Aroclor 1260	0.5	-	0.034	0.034	0.00074	0.00074
Aroclor 1262	0.5	-	0.17 (PCBs)	-	-	-
Aroclor 1268	0.5	-	0.17 (PCBs)	-	-	-
Total PCBs	NA	-	-	-	0.00074	0.00074
Arsenic	10	10	0.045	0.045	31 (Arsenic V)	31 (Arsenic V)
Cadmium	5	5	1.8	0.69	2.5 (3)	2.5 (3)
Chromium	100	100	0.043 (Chromium VI)	0.031 (Chromium VI)	110 (Chromium VI) (3)	110 (Chromium VI) (3)
Lead	15	15	-	-	25 (3)	25 (3)
Mercury	2 (mercury compounds)	2 (mercury compounds)	0.37 (methyl mercury)	0.16 (methyl mercury)	0.04 (methyl mercury)	0.04 (methyl mercury)
Nickel	-	-	73	30	52 (3)	520 (3)
Silver	-	-	510	7.1	32 (3)	32 (3)

Notes:

(1) EPA Region 3 Tap Water Noncarcinogenic RBCs based on hazard quotient of 0.1.

(2) Region 3 Freshwater Screening Benchmark multiplied by a dilution factor of 10.

(3) Value corresponds to a hardness = 100 mg/L

MCL = Maximum Contaminant Level

PCB = polychlorinated biphenyl

RSL = Regional Screening Level

µg/L = micrograms per liter

Updated April 2012 EPA Region 3 Tap Water RBCs are available.

This table was generated in part from December 2011 RI/FS Site Management Plan by HGL

Table 3. Surface Water Sampling Analytical Parameters and Potential Screening Values Reported in HGL (2011) and Recommended Updated Values Where Appropriate
(Shading denotes a value that could not be verified in USEPA-published tables)

Analyte	EPA MCL (µg/L)	EPA MCL (µg/L)	EPA Tap Water RSL (µg/L) June 2011 (1)	EPA Tap Water RSL (µg/L) April 2012 (1)	Region 3 Ecological Freshwater SSL (µg/L) (2)	Region 3 Ecological Freshwater SSL (µg/L) (2)
	HGL RI/FS Site Management Plan, 2011	Values Identified during this report	HGL RI/FS Site Management Plan, 2011	Values Identified during this report	HGL RI/FS Site Management Plan, 2011	Values Identified during this report
Aroclor 1016	0.5	-	0.26	0.96	0.000074	0.000074
Aroclor 1221	0.5	-	0.0068	0.0043	0.000074	0.000074
Aroclor 1232	0.5	-	0.0068	0.0043	0.000074	0.000074
Aroclor 1242	0.5	-	0.034	0.034	0.000074	0.000074
Aroclor 1248	0.5	-	0.034	0.034	0.000074	0.000074
Aroclor 1254	0.5	-	0.034	0.034	0.000074	0.000074
Aroclor 1260	0.5	-	0.034	0.034	0.000074	0.000074
Aroclor 1262	0.5	-	0.17 (PCBs)	-	-	-
Aroclor 1268	0.5	-	0.17 (PCBs)	-	-	-
Total PCBs	NA	-	-	-	0.000074	0.000074
Arsenic	10	10	0.045	0.045	3.1 (Arsenic V)	3.1 (Arsenic V)
Cadmium	5	5	1.8	0.69	0.25 (3)	0.25 (3)
Chromium	100	100	0.043 (Chromium VI)	0.031 (Chromium VI)	11 (Chromium VI) (3)	11 (Chromium VI) (3)
Lead	15	15	-	-	2.5 (3)	2.5 (3)
Mercury	2 (mercury compounds)	2 (mercury compounds)	0.37 (methyl mercury)	0.16 (methyl mercury)	0.004 (methyl mercury)	0.004 (methyl mercury)
Nickel	-	-	73	30	5.2 (3)	52 (3)
Silver	-	-	510	7.1	3.2 (3)	3.2 (3)

Notes:

(1) EPA Region 3 Tap Water Noncarcinogenic RBCs based on hazard quotient of 0.1.
(2) Region 3 Freshwater Screening Benchmark
(3) Value corresponds to a hardness = 100 mg/L
MCL = Maximum Contaminant Level
PCB = polychlorinated biphenyl
RSL = Regional Screening Level
µg/L = micrograms per liter
Updated April 2012 EPA Region 3 Tap Water RBCs are available.
This table was generated in part from December 2011 RI/FS Site Management Plan by HGL

Table 4. Sediment Sampling Analytical Parameters and Potential Screening Values Reported in HGL (2011) and Recommended Updated Values Where Appropriate
(Shading denotes a value that could not be verified in USEPA-published tables)

Analyte	EPA Residential RSL (mg/kg) June 2011 (1)	EPA Residential RSL (mg/kg) April 2012 (1)	Region 3 Ecological SLL (mg/kg) (2)
	HGL RI/FS Site Management Plan, 2011	Values Identified during this report	
Aroclor 1016	0.39	0.39	-
Aroclor 1221	0.14	0.14	-
Aroclor 1232	0.14	0.14	-
Aroclor 1242	0.22	0.22	-
Aroclor 1248	0.22	0.22	-
Aroclor 1254	0.11	0.22	-
Aroclor 1260	0.22	0.22	-
Aroclor 1262	0.22 (as PCBs)	-	
Aroclor 1268	0.22 (as PCBs)	-	
Total PCBs	-	-	0.0598
Arsenic	0.39	0.39	9.8
Cadmium	7	7	0.99
Chromium	0.29 (Chromium VI)	0.29 (as Chromium VI)	43.4
Lead	400 (3)	400(3)	35.8
Mercury	0.78 (methyl mercury)	0.78 (methyl mercury)	0.18
Nickel	150	150	22.7
Silver	39	39	1

Notes:

(1) Noncarcinogenic RSLs based on hazard quotient of 0.1.

(2) EPA Region 3 freshwater sediment benchmarks dated August 2006

(3) EPA recommended value for residential soils (www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm)

Updated April 2012 EPA RSLs are available.

This table was generated in part from December 2011 RI/FS Site Management Plan by HGL

Table 5

Summary of Optimization Recommendations for Each of the Field Sampling Tasks Presented in the Hydrogeologic, Inc. (HGL) Work Plan (Plan)

Optimization Report Section and Title	HGL Plan Defined Task	Media Sampled and Numbers of Samples	Analytes for Each Media[1]	Optimization Report Recommendations	Media Sampled and Numbers of Samples	Analytes for Each Media[1]
4.3.1 **Munitions and Explosives of Concern/Munitions Debris (MEC/MD) Avoidance and Utility Clearance**	Prior to remedial investigation (RI) field events, MEC/MD avoidance and utility clearance will be conducted by trained MEC/MD technicians in areas of planned investigative work. The planned strategy for each drilling location (to be supervised by a MEC/MD technician) is to perform visual surveys, advancement of borings to 2 to 6 feet below ground surface (BGS) by hand augering and use of a magnetometer to detect buried metallic or magnetically susceptible objects.	Soil	MEC/MD	A MEC/MD technician should be present during all drilling operations in fill areas and a protocol should be developed for conducting downhole magnetometer screening incrementally during borehole advancement through the fill layer. Initial, pre-intrusive RI activities should focus on the location and mapping of buried utilities with UXO surveying provided to the extent necessary for support of utility clearance. An additional task recommended to be performed in conjunction with the MEC/MD avoidance and utility clearance task is a preliminary screening sampling for polychlorinated dibenzo-p-dioxins/polychlorinated dibenzofurans (PCDD/PCDF) in Site areas where the maximum PCB concentrations are observed in surface and subsurface soil. Using the established grid system for the Site and an ICS sampling approach, it is recommended that a minimum of 8 to 10 grid cells be selected for sampling. The PCB hotspots likely coincide with maximum PCDD/PCDF concentration locations. The objective of the preliminary PCDD/PCDF sampling is calibration of PCDD/PCDF sampling to a level appropriate for the occurrence and concentration levels of these compounds.	Soil - 8-10 ICS samples	PCDD/PCDF
4.3.2 **Soil Investigation**	Assessment of potential offsite contamination will be conducted by installing 23 soil borings offsite using a sonic drill rig for field-based XRF lead screening and sampling for fixed-base laboratory analyses. Sampling will be performed at the following depths: 0 to 6 inches, 6 inches to 2 ft, 3 to 5 ft, and 6 to 8 ft BGS.	Soil - 92 samples	All samples: field X ray fluorescence (XRF) screening 10% of samples: fixed-base laboratory target analyte list (TAL) metals Zero to 0.5 ft and 0.5 to 2 ft samples: fixed-base laboratory target compound list (TCL) PCBs	For the offsite and hotspot soil characterization tasks, a more adaptive approach is recommended. Sampling for these two tasks can be conducted in two phases within a single field event. At the 23 offsite and 31 hotspot (includes the 11 hotspot borings and the 18 temporary wells at which hotspot soil sampling will also be conducted) locations, install soil borings and collect samples at the HGL plan-specified sampling depths. In the first phase, samples from the prescribed depths at each boring are field analyzed and a percentage of the samples are submitted for fixed-base laboratory analysis. A goal of 10 to 20 percent fixed-base laboratory collaborative samples can be maintained by targeting samples where the field XRF results indicate one or more metals are near the remedial screening levels (RSLs). All first phase soil samples are archived for potential future PCDD/PCDF analysis. The field-based analyses results generated from the first phase borings are then used to determine the appropriate locations for the second phase. Specifically, second phase borings will be installed at step-out locations from a subset of the first phase borings (3 to 5). Field analyses of the soil samples collected during the second phase will be used for further (potentially final) characterization. The field team will select for submission for fixed-base laboratory analysis all samples from the final step borings.	Phase I Field analysis: 216 Fixed-based-laboratory: 44 Phase II (assume 3 step out borings at 5 locations) Field analysis: 40 Fixed-base-laboratory: 20	Phase I Field (Offsite): metals by XRF, PAH and PCBs by IA Laboratory (Offsite): 20% for TAL metals and PCBs Field (Hot Spot): metals by XRF, PAH and PCBs by IA Laboratory (Hot Spot): TCL VOCs, TCL SVOCs, TCL pesticide/PCBs, TAL metals, TOC; 50% for explosives, CR VI, grain size, asbestos, PCDD/PCDF (determined based on Section 4.3.1 preliminary sampling) Phase II Field: metals by XRF and PCBs by IA Laboratory: TCL VOCs, TCL SVOCs, TCL pesticide/PCBs, TAL metals, TOC; 50% for explosives, CR VI, grain size, asbestos, PCDD/PCDF (determined based on Section 4.3.1 preliminary sampling)
	Hotspot evaluation will be conducted by installing 11 borings in areas of known potential impacts onsite utilizing a sonic drill. Two borings will be installed offsite on the ARREFF property. In addition, hotspot soil sampling will be conducted in 18 of the temporary monitoring wells installed in accordance with Section 4.3.3. Sampling will be performed at the following depths: 0 to 6 inches, 6 inches to 2 ft, 4 to 6 ft, and 8 to 10 ft BGS.	Soil - 52 samples	All samples: TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, TAL metals, TOC. 50% of samples will be analyzed for dioxins and furans, explosives, chromium VI, grain size and asbestos.			
	Malcolm Pirnie (MPI) confirmatory sampling will be conducted by re-sampling ten percent (55) of the 555 soil borings completed during the 2008 MPI investigation. Sampling will be performed at the following depths: 0 to 6 inches, 6 inches to 2 ft, 4 to 6 ft, and 8 to 10 ft BGS.	Soil - 220 samples	All samples: TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, TAL metals, TOC. 50% of samples will be analyzed for dioxins and furans, explosives, chromium VI, grain size and asbestos.	Recommended approach for generating 6-inch-depth soil data for the HHRA and ecological risk assessments is the ICS approach. This rationale for this recommendation is the generation of appropriate data (0-6 inch depth) for risk assessment purposes and avoidance of the need to statistically compare the MPI data set (0-18 inch depth) with the MPI sample verification sampling data set (0-6 inches). Final DU size determination should be based on the CSM and will require input and consideration by all stakeholders in the SPP process. It is recommended that the field team archive the ICS composite samples from selected DUs. The archived DU samples can then be selected for PCDD/PCDF and PCB congener analyses after the ICS sample results are received and evaluated for other constituents.	Soil - Specific decisions on DU size and number of sample increments requires input from stakeholders; selection of number of samples to be archived for PCDD/PCDF analysis based on Section 4.3.1 preliminary sampling task.	TCL VOCs, TCL SVOCs, TCL pesticide/PCBs, explosives, Cr VI, grain size, asbestos, PCDD/PCDF samples archived for analysis based on Section 4.3.1 preliminary sampling task results

4.3.3 **Groundwater Investigation**	24 pre-pack temporary wells will be installed via sonic methods in areas where Site activities may have resulted in releases of contamination (based on the analysis of historical aerial photographs and observed conditions). The wells will be installed with 10-ft long well screens with the base of the screen positioned at a depth of 8 ft below the water table. Groundwater samples will be collected.	Groundwater - 24 samples	All samples: TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, and TAL metals. 50% of the samples will be analyzed for PCDDs/ PCDFs, explosives, and chromium VI.	The number of temporary wells is likely reduced to 12 from the 24 indicated by the HGL Plan (issued in December 2011), as per discussions with Region 3. An adaptive approach is recommended in which 8 wells will be installed initially and the remaining 4 will be installed based on field data generated from the initial wells. The eight initial locations can coincide with the hotspot soil assessment borings. During installation of the 8 initial wells, field groundwater analyses including PCB immunoassay (IA), PAH IA, metals via Lumex, and field parameters. Based on the results of the groundwater data obtained in real time, step-out, follow-up locations for the 4 remaining wells will be selected. As determined from the preliminary PCDD/PCDF surface soil sampling results obtained in Section 4.3.1, the project team can determine the number and locations of groundwater samples that should be analyzed for PCDD/PCDF compounds and PCB congeners via EPA Method 1668B.	Groundwater: 12 field analyzed samples (including 8 during initial temporary well installation and 4 during the installation of follow-up temporary wells)	Field analyses: PCB IA, PAH IA, metals via Lumex (with water attachment), and field parameters Laboratory: Based on sampling level determined from the initial PCDD/PCDF sampling performed as per Section 4.3.1, submit appropriate number of samples for PCDD/PCDF analyses is based on preliminary surface soil sampling results.
	4 pre-pack temporary wells will be installed in the Site wetlands and groundwater samples will be collected.	Groundwater - 4 samples	All samples : TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, TAL metals, explosives, hexavalent chromium, alkalinity, hardness, chloride, sulfide, sulfate, nitrate, nitrite, TOC, TSS, TDS, methane, ethane, and ethene.	Considering that the sediment pore water sampling recommended for Paradise Creek may provide more useful data regarding the impact of site groundwater on surface water. In addition, the existing wells and the proposed onsite temporary wells will likely sufficiently characterize groundwater quality near the creek shoreline. It is recommended, therefore, that groundwater sampling at the four temporary wells planned for the wetland area be eliminated or considered in combination with the locations specified by HGL for onsite temporary well installation.	Sampling recommended for elimination	Sampling recommended for elimination
	Installation of up to 6 new permanent groundwater monitoring wells - well locations to be based on temporary well sampling results.	Groundwater to be sampled in accordance with the site-wide groundwater sampling task described at part of Section 4.3.3.	N/A	It is recommended that this task be eliminated by requiring that all temporary wells be installed in a manor such that they could be completed as permanent wells. The decision to complete a temporary well as permanent would be based on real time field sampling results obtained during temporary well drilling. Accordingly, duplication of drilling tasks can be avoided.	N/A	N/A
	All Site wells will be sampled in a Site-wide groundwater sampling task. All nine existing wells plus the six new wells and four temporary wells installed in the Site wetlands will be sampled during a site-wide groundwater sampling event.	Groundwater - 19 samples	TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, TAL metals, chromium VI, alkalinity, hardness, chloride, sulfide, sulfate, nitrate, nitrite, TOC, TSS, TDS, methane, ethane, and ethene.	Recommendations for the list of analytes for the site wide groundwater sampling event including the 6 new wells and the 9 existing wells are as follows. For permanent well sampling, it is suggested that the analysis of sulfide, nitrite, methane, ethane, and ethane only be performed if elevated concentrations of chlorinated hydrocarbons are detected in the temporary well sampling task. To provide data comparable to the Elizabeth River TMDL currently under development, and to develop PCB congener concentration data in groundwater for comparison to congener composition data for Paradise Creek pore water/surface water, groundwater samples from monitoring wells installed down gradient from the areas with elevated PCB concentrations may be analyzed to a low method detection level via EPA Method 1668B.	Groundwater - 19 samples analyzed via fixed-base laboratory	Analyte list as indicated in the HGL Plan with the following exception: eliminate analysis for sulfide, sulfate, nitrate, nitrite, methane, ethane, and ethene unless VOCs are detected in the temporary wells. Also, add PCB Congener analyses for selected wells in PCB hotspot areas for comparison to Paradise Creek sediment sampling results for PCB congeners.
	The existing nine site monitoring wells (MW-1R, MW-2, MW-4, MW-5, MW-6, MW-7, MW-8, MW-9, and MW-10) will be redeveloped.	Groundwater	No field analytical or fixed-base laboratory sampling will be conducted.	No changes recommended to this task.	N/A	N/A
	Northwestern Drainage (referred to in the HGL Plan as "Concrete Channel") Four sediment samples are planned for collection from 2 locations within the concrete-lined Northwest Drainage ditch. The samples will be collected from 0 - 6 inches and from the interval 6 inches to 2 feet BGS.	Sediment - 4 samples via fixed-base laboratory	All samples: TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, TAL metals, TOC, and grain size; field pH and field ORP. 50% of samples will be analyzed for chromium VI, explosives, and PCDD/PCDFs.	Prior to sampling, a survey of the accessible portions of the channel is recommended to identify locations of sufficient sediment accumulation for sample collection. Up to three areas should be sampled. If standing water is present, a petit Ponar dredge may be necessary to collect samples. To provide data comparable to the Elizabeth River total maximum daily load (TMDL) currently under development and to develop PCB congener concentration data for northwestern drainage sediment, PCB analyses of selected sediment samples can be performed at a low method detection level using EPA Method 1668B. It is recommended that all fixed-base laboratory samples be analyzed for PCB Aroclors and a portion of each sample archived. Based on the results of the Aroclor analyses, the three most elevated Aroclor samples can be submitted for analysis by EPA Method 1668B	Sediment - up to 3 samples	Analyte list as indicated in the HGL Plan with the addition of the following: Based on Aroclor analyses results in archived samples, submit samples for PCB Congener analyses via EPA Method 1668B; also, analyze for PCDD/PCDF in accordance with findings of preliminary PCDD/PCDF sampling conducted via Task 4.3.1.

Table 5
Summary of Optimization Recommendations for Each of the Field Sampling Tasks Presented in the Hydrogeologic, Inc. (HGL) Work Plan (Plan)
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4.3.4 **Sediment Investigation**	Western Drainage Ditch Eight sediment samples are planned for collection from 4 locations within the Western Drainage ditch. In addition, 2 samples will be collected at the outlet of the ditch to Paradise Creek. The samples will be collected from 0 - 6 inches and from the interval 6 inches to 2 feet BGS.	Sediment - 10 samples via fixed-base laboratory	All samples: TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, TAL metals, TOC, and grain size; field pH and ORP. 50% of samples will be analyzed for chromium VI, and explosives.	An adaptive approach for sampling the Western Drainage is recommended. Sampling should include the entire length of the Western Drainage and would provide data for the establishment of optimal locations for the 8 proposed fixed-base laboratory samples. Consistent with the HGL WP, 2 samples should be collected at the ditch outlet to Paradise Creek. During the initial sampling, field-based analyses accomplished using XRF and, potentially, IA screening methods for PCBs and PAHs are suggested. To provide data comparable to the Elizabeth River TMDL currently under development and to develop PCB congener concentration data for western drainage sediment for comparison to congener composition data for Paradise Creek sediments, PCB analyses of selected sediment samples should be performed at a low method detection level using EPA Method 1668B. Selected samples should also be analyzed for PCDD/PCDF compounds. It is recommended that all fixed-base laboratory samples be analyzed for PCB Aroclors and a portion of each sample archived. Based on the results of the Aroclor analyses, the three most elevated Aroclor samples can be submitted for analysis by Method 1668B. Regarding the collection of Western Drainage sediment samples for PCDD/PCDF analyses, the scope of this sampling may be driven largely by the results of the preliminary PCDD/PCDF sampling in surface soil.	Sediment - Field: adaptively defined sampling over length of drainage Laboratory: 10 samples	Field: metals via XRF; PCBs and PAHs via IA Laboratory: Analyte list as indicated in the HGL Plan with the addition of the following: Based on Aroclor analyses results in archived samples, submit samples for PCB Congener analyses via EPA Method 1668B; also, analyze for PCDD/PCDF in accordance with findings of preliminary PCDD/PCDF sampling conducted via Task 4.3.1.
	Site Wetlands Eighteen sediment samples will be collected at pre-defined locations. Using a hand auger, the samples will be collected from 0 - 6 inches and from the interval 6 inches to 2 feet BGS.	Sediment - 18 samples via fixed-base laboratory	All samples: TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, TAL metals, TOC, and grain size; field pH and ORP. 50% of samples will be analyzed for chromium VI, explosives, and PCDD/PCDF.	As a result of anticipated short scale heterogeneity in the wetland sediment, It is recommended that sediments in the wetland area be characterized using ICS methodology. ICS is, therefore, recommended rather than conducting the sampling at the 18 prescribed locations as envisioned in the HGL Plan. DU boundaries and the appropriate number of soil increments will require project team and stakeholder input.	Sediment - Specific decisions on DU size and number of sample increments requires input from stakeholders; selection of number of samples to be archived for PCDD/PCDF analysis based on Section 4.3.1 preliminary sampling task.	Laboratory: Analyte list as indicated in the HGL Plan with the addition of the following: Based on Aroclor analyses results in archived samples, submit samples for PCB Congener analyses via EPA Method 1668B; also, analyze for PCDD/PCDF in accordance with findings of preliminary PCDD/PCDF sampling conducted via Task 4.3.1.
	Paradise Creek Twelve sediment samples will be collected at locations determined in the field. The sampling points will be located upstream (2 locations), bordering the site (8 locations), and downstream (2 locations). The samples will be collected from the top 6 inches of sediment.	Sediment - 12 samples via fixed-base laboratory	All samples: TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, TAL metals, and TOC. 50% of samples will also be analyzed for chromium VI, explosives, PCDDs/PCDFs, and grain size.	It is suggested that the proposed sampling approach be re-evaluated with respect to ecological risk assessment objectives. It is recommended that evaluation of the relative impact of the site on Paradise Creek sediment be established as the characterization objective. Accordingly, it is suggested that the following sediment characterization sampling be conducted immediately offshore from the site and at locations offsite (within Paradise Creek/Elizabeth River but hydraulically isolated from site): (1) the collection of sediment samples, (2) the enumeration of macroinvertebrate fauna, and (3) the collection of sediment pore water samples. Statistical comparison of the near site and off site sampling results will provide an indication of site impacts on the creek. It is recommended that a survey of the Paradise Creek channel offshore from the Site be conducted to identify zones of preferential groundwater discharge to surface water. The results of this sampling will help guide the selection of the sediment characterization locations. For the Elizabeth River TMDL under development, a subset of the sediment samples (approximately 20 percent), should be analyzed using EPA Method 1668B at a low detection level for PCB congeners in sediment samples for TMDL comparison purposes.	Sediment and sediment pore water - 8 to 10 locations with analysis via fixed-base laboratory Benthic enumeration at each of the above locations	Laboratory: Analyte list as indicated in the HGL Plan with the addition of the following: Based on Aroclor analyses results in archived samples, submit samples for PCB Congener analyses via EPA Method 1668B; also, analyze for PCDD/PCDF in accordance with findings of preliminary PCDD/PCDF sampling conducted via Task 4.3.1.
4.3.5 **Surface Water Investigation**	Western and Northwestern Drainage surface water samples will be collected at the sediment sampling locations defined for these two drainages.	Surface Water - 5 samples	All samples: TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, and TAL metals. 50% of the samples will also be analyzed for PCDDs/PCDFs, chromium VI, and explosives.	It is recommended that surface water sample collection efforts be coordinated with the collection of sediment samples and collection locations should coincide with the sediment characterization locations. With regard to sample quantities and placement, surface water sampling should be coordinated with the sediment sampling strategies discussed above for the Northwest Drainage, the Western Drainage, and Paradise Creek. Sampling for PCDDs and PCDFs should be contingent on the results obtained from the preliminary PCDD/PCDF sampling event discussed in Section 4.3.1. EPA Method 1668B should be used for PCB analyses to ensure that results are reported to the lowest possible method detection level. In	Surface Water - up to 3 samples	Laboratory: Analyte list as indicated in the HGL Plan with the addition of the following: Based on Aroclor analyses results in archived samples, submit samples for PCB Congener analyses via EPA Method 1668B; also, analyze for PCDD/PCDF in
	Surface water sampling in the Site wetlands bordering Paradise Creek: collect 4 samples co-located with wetland sediment sample locations and 6 samples from seep locations along the Paradise Creek shoreline.	Surface Water - 10 samples	All samples: TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, and TAL metals. 50% of the samples will also be analyzed for PCDDs/PCDFs, chromium VI, and explosives.		One sample per ICS DU	

Table 5
Summary of Optimization Recommendations for Each of the Field Sampling Tasks Presented in the Hydrogeologic, Inc. (HGL) Work Plan (Plan)
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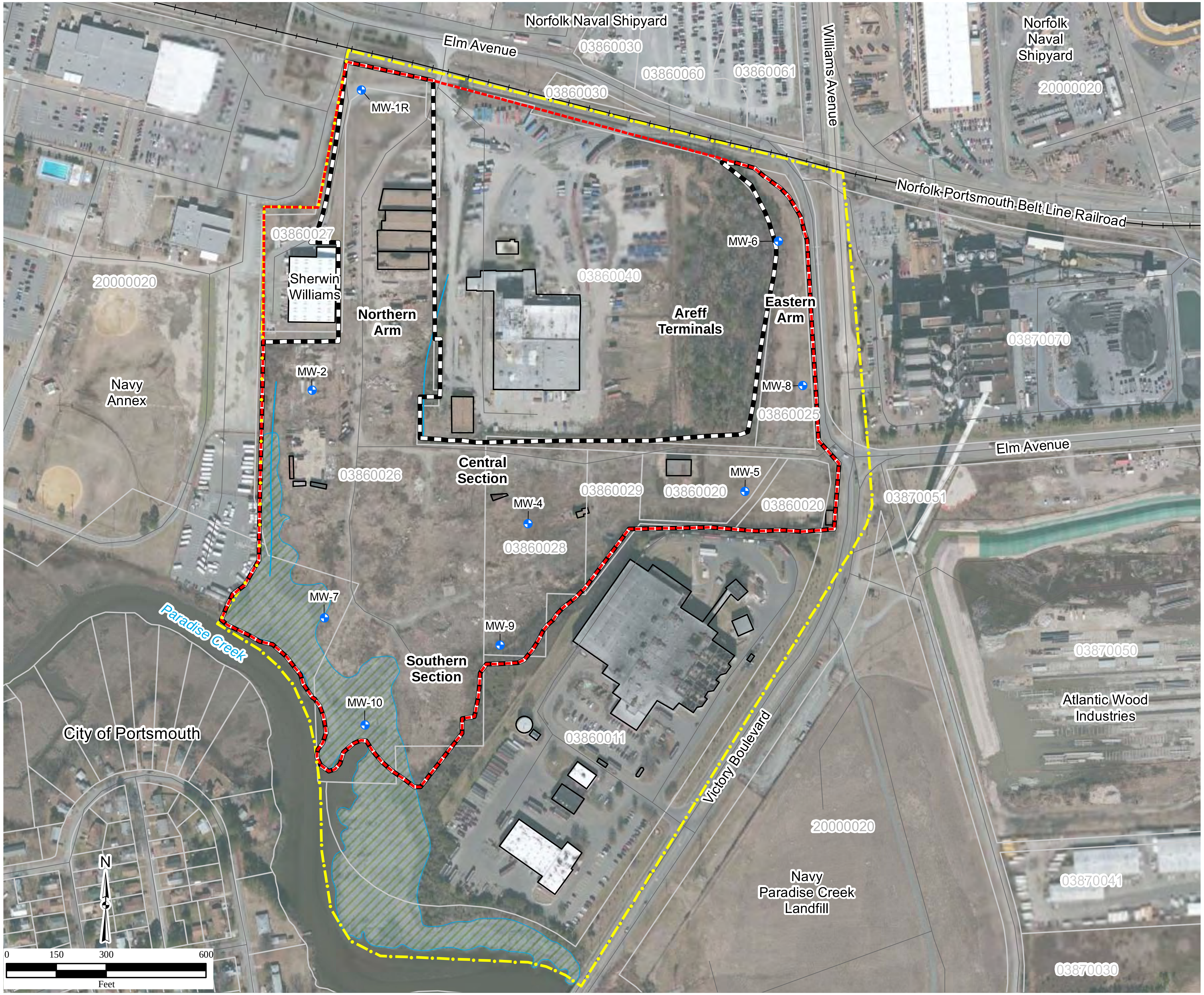
	Paradise Creek surface water samples: collected at locations that will be determined in the field based on observed surface water/groundwater discharges and surface water flow paths.	Surface Water - 12 samples	All samples: TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, and TAL metals, alkalinity, hardness, chloride, sulfide, sulfate, nitrite, and nitrate. 50% of the samples will also be analyzed for PCDDs/PCDFs, chromium VI, and explosives.	addition, since an aggregate PCB concentration is necessary for comparison to the RSL, analyses results can be reported as the sum of individual PCB homologue concentrations.	Surface Water - up to 10 samples	also, analyze for PCDD/PCDF in accordance with findings of preliminary PCDD/PCDF sampling conducted via Task 4.3.1.

1. Definition of chemical analyte acronyms
PCDD\PCDF: polychlorinated dibenzo-p-dioxins/polychlorinated dibenzofurans
VOC: volatile organic compound
SVOC: semi-volatile organic compound
TCL: target compound list
TAL: target analyte list
PCB: polychlorinated biphenyl
PAH: polycyclic aromatic hydrocarbon
TOC: total organic carbon
TSS: total suspended solids
TDS: total dissolved solids
ORP: oxidation/reduction potential

FIGURES



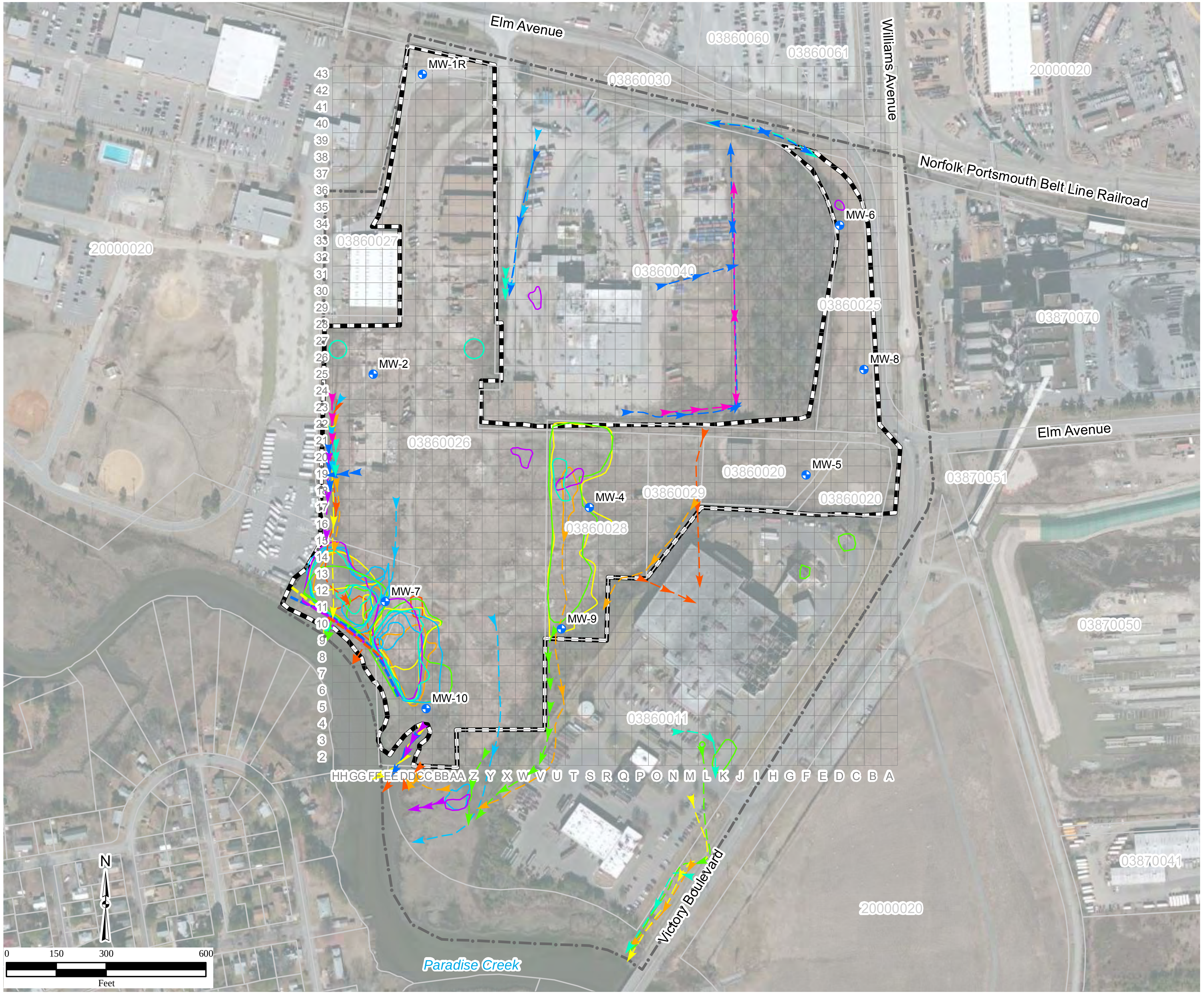
HGL—Site Management Plan, RI/FS,
Peck Iron and Metal—City of Portsmouth, VA

Figure 1
Peck Iron and Metal Site Layout

Legend

- ● Monitoring Well
- — Drainage
- — Road
- ┼┼ Railroad
- ☐ Building
- ☐ Parcel
- 03860028 Tax Parcel #
- ▭ Peck Iron and Metal Site
- ▭ Peck Iron and Metal Remediation Investigation Area
- ▭ Environmental Photographic Interpretation Center Study Area
- ▨ Wetland

\\gst-srv-01\hglgis\Peck_MSIW\SMP_RIFS
(2-02)Site_Layout.mxd
11/2/2011 PD
Source: HGL, Malcolm Pirnie, EPA
ArcGIS Online Bing Maps Aerial



HGL—Site Management Plan, RI/FS,
Peck Iron and Metal—City of Portsmouth, VA

Figure 2
1937 to 2009
Impoundments and Drainages

Legend

● Monitoring Well
MW-4 Well Identification
☐ Malcolm Pirnie 50 foot x 50 foot Sample Grid
AA Grid Column or Row Identification
☐ Parcel
03860028 Tax Parcel #
Peck Iron and Metal Site
Environmental Photographic Interpretation Center Study Area

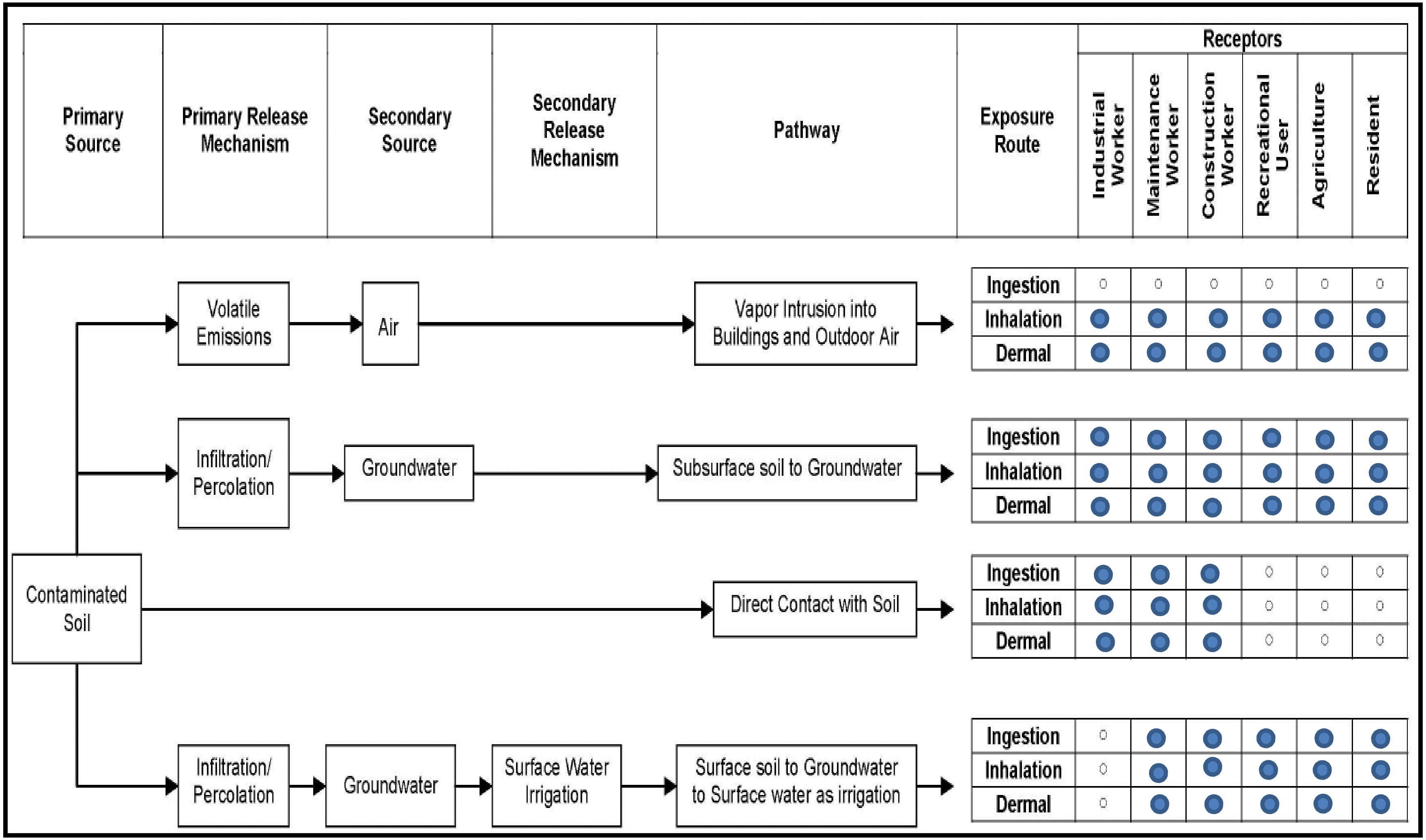
Historical Liquid and Drainage features (by shape):

Drainage Channel
Drainage Channel, Indeterminate Flow
Breach
Berm / Dike
☐ Liquid / Impoundment

Last Known Year Feature Applies (by color):

1937
1947
1954
1958
1963
1970
1980
1990
1998
2009

\\gst-srv-01\hglgis\Peck_MSIW\SMP_RIFS
(2-06)Impoundments.mxd
11/16/2011 CNL
Source: HGL, Malcolm Pirnie, EPA
ArcGIS Online Bing Maps Aerial



Pathway	Exposure Route	Receptors					
		Industrial Worker	Maintenance Worker	Construction Worker	Recreational User	Agriculture	Resident
Vapor Intrusion into Buildings and Outdoor Air	Ingestion	○	○	○	○	○	○
	Inhalation	●	●	●	●	●	●
	Dermal	●	●	●	●	●	●
Subsurface soil to Groundwater	Ingestion	●	●	●	●	●	●
	Inhalation	●	●	●	●	●	●
	Dermal	●	●	●	●	●	●
Direct Contact with Soil	Ingestion	●	●	●	○	○	○
	Inhalation	●	●	●	○	○	○
	Dermal	●	●	●	○	○	○
Surface soil to Groundwater to Surface water as irrigation	Ingestion	○	●	●	●	●	●
	Inhalation	○	●	●	●	●	●
	Dermal	○	●	●	●	●	●

Figure 3. Generic Pathway Receptor-Network Diagram for Human Health Risk Assessment

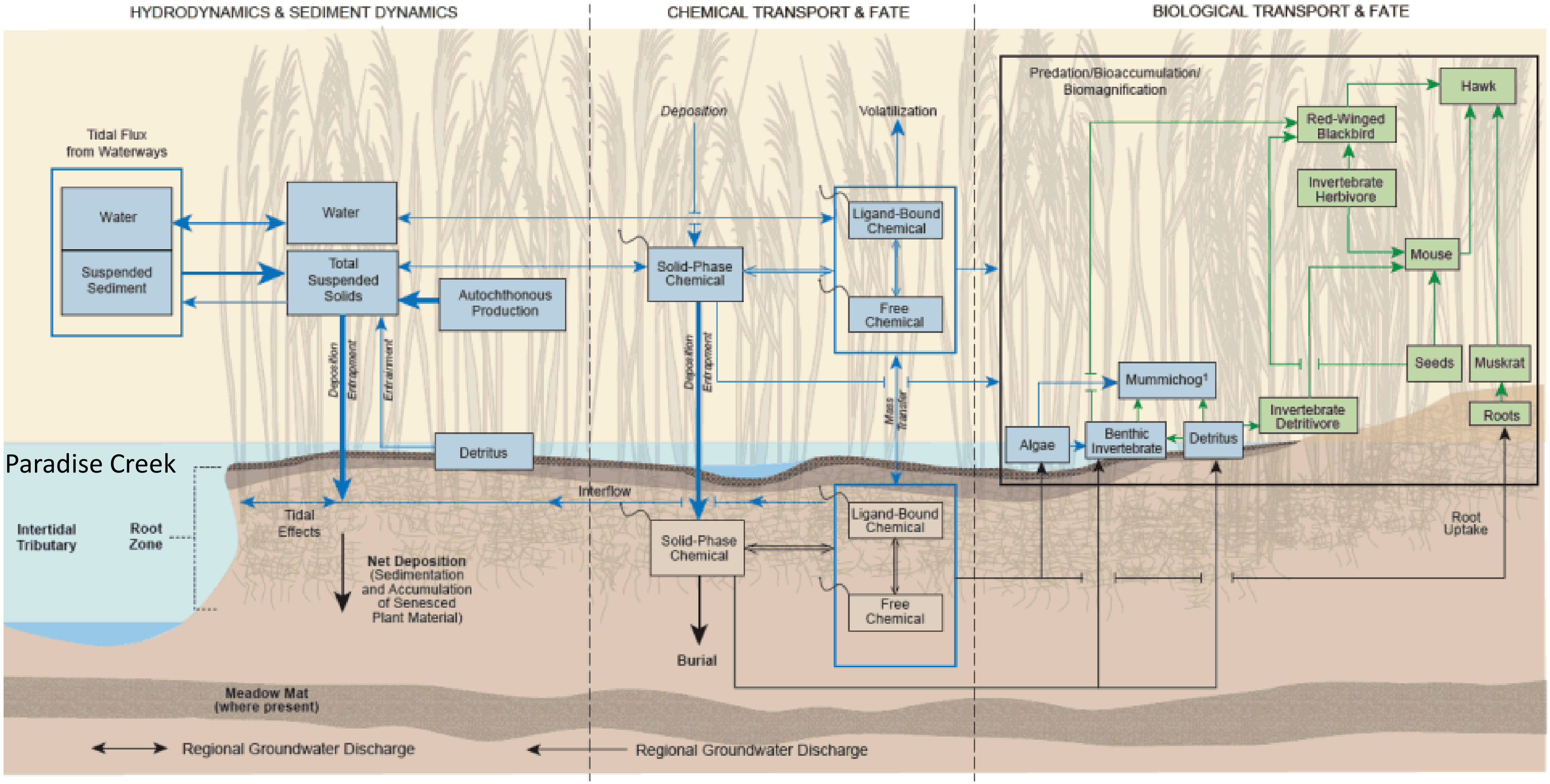


Figure 4. Schematic Representation of Potential Ecological Exposure Pathways for the PIM Site

(Modified from Geosyntec Consultants)

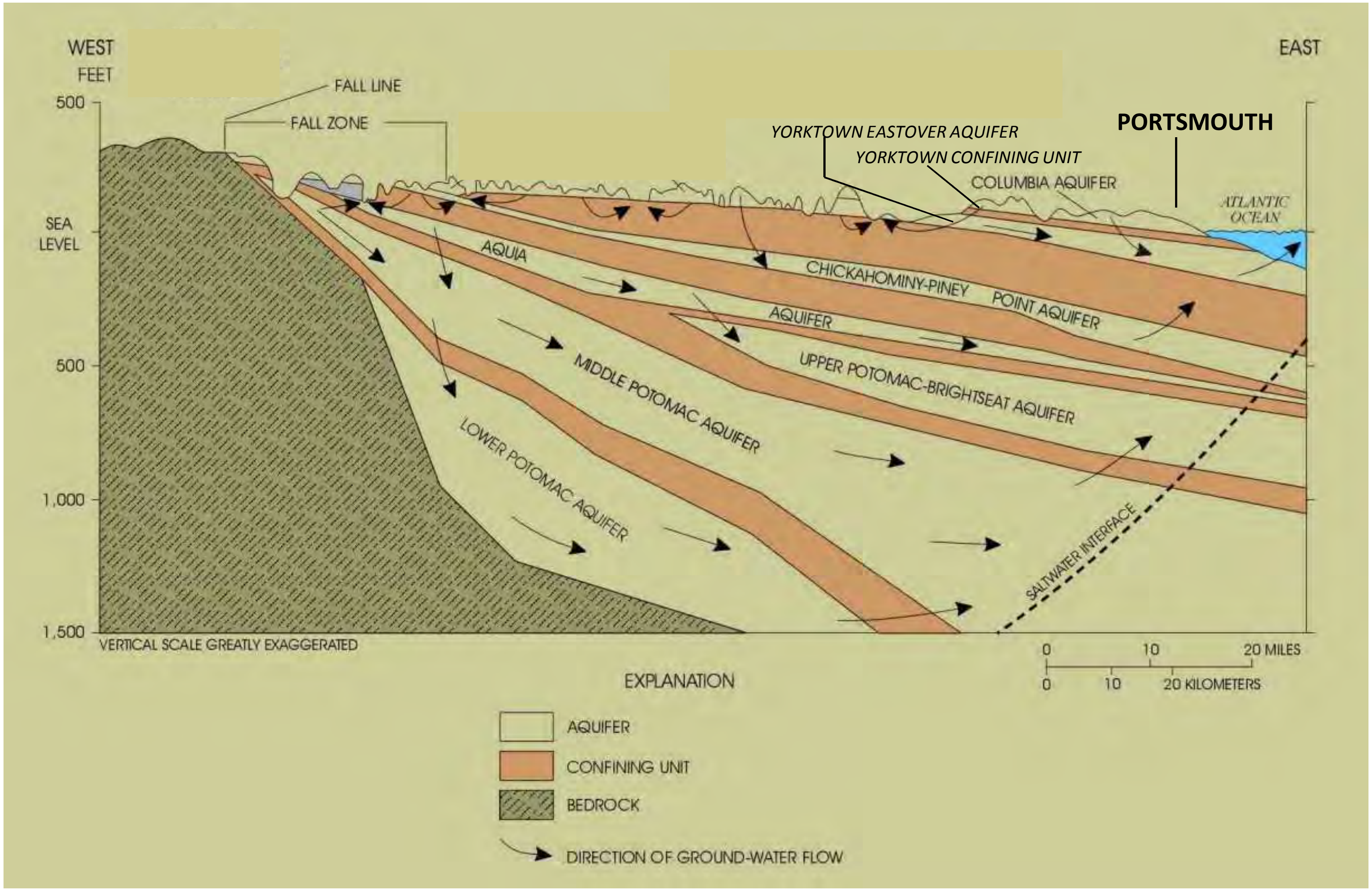
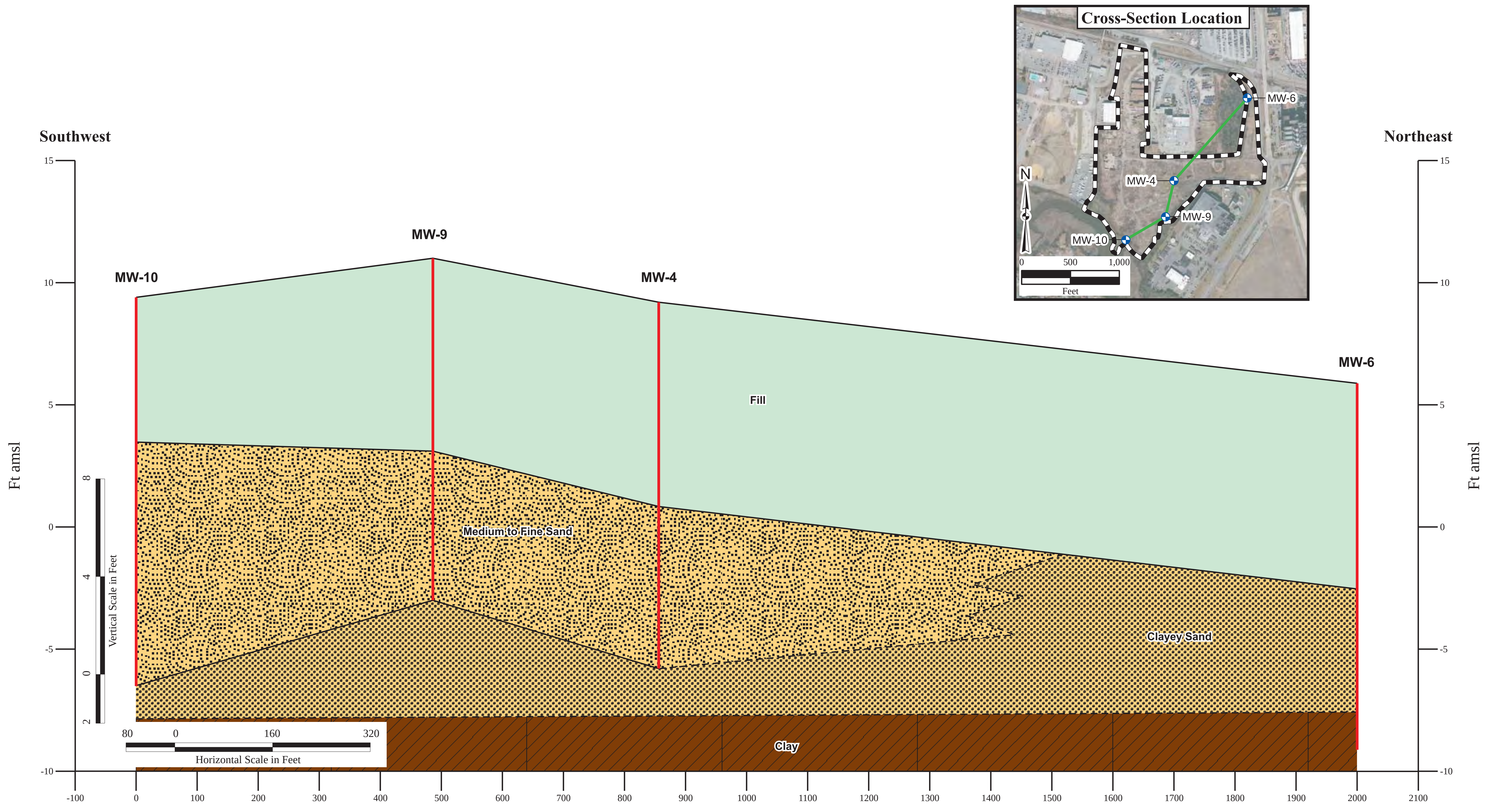


Figure 5. Representative Hydrogeologic Cross-Section for the Atlantic Coastal Plain in Virginia
(Modified from Harsh and Laczniak (1990) (fide McFarland, 1998)



\\gst-srv-01\hglgis\Peck_MSIW\SMP_RIFS
Geologic_Cross_Section.cdr
11/16/2011 CNL
Source: HGL, Malcolm Pirnie

Legend

Boring
MW-10 Boring / Well Identification
Lithology Boundary (dashed where inferred)

🟩 Fill
▦ Clayey Sand
▒ Sand
▨ Clay

Notes:
Vertical Datum is NGVD 1988.

ft amsl = feet above mean sea level

Inset Features:
● Monitoring Well
Geologic Cross Section
Peck Iron and Metal Site

Figure 6
Geologic Cross Section

Figure 7
October 2008 Groundwater Potentiometric Surface

Legend

●	Monitoring Well
MW-9 6.37	Monitoring Well Identification 2008 Groundwater Elevation (ft amsl)
—4—	2008 Groundwater Elevation Contour (ft amsl) (dashed where inferred, 1 ft contour interval)
▭	Peck Iron and Metal Site

Notes:
Water levels measured on July 24, 2008.
MW-6 and MW-8 were not screened in the water table aquifer.
Vertical datum is NGVD 1988.

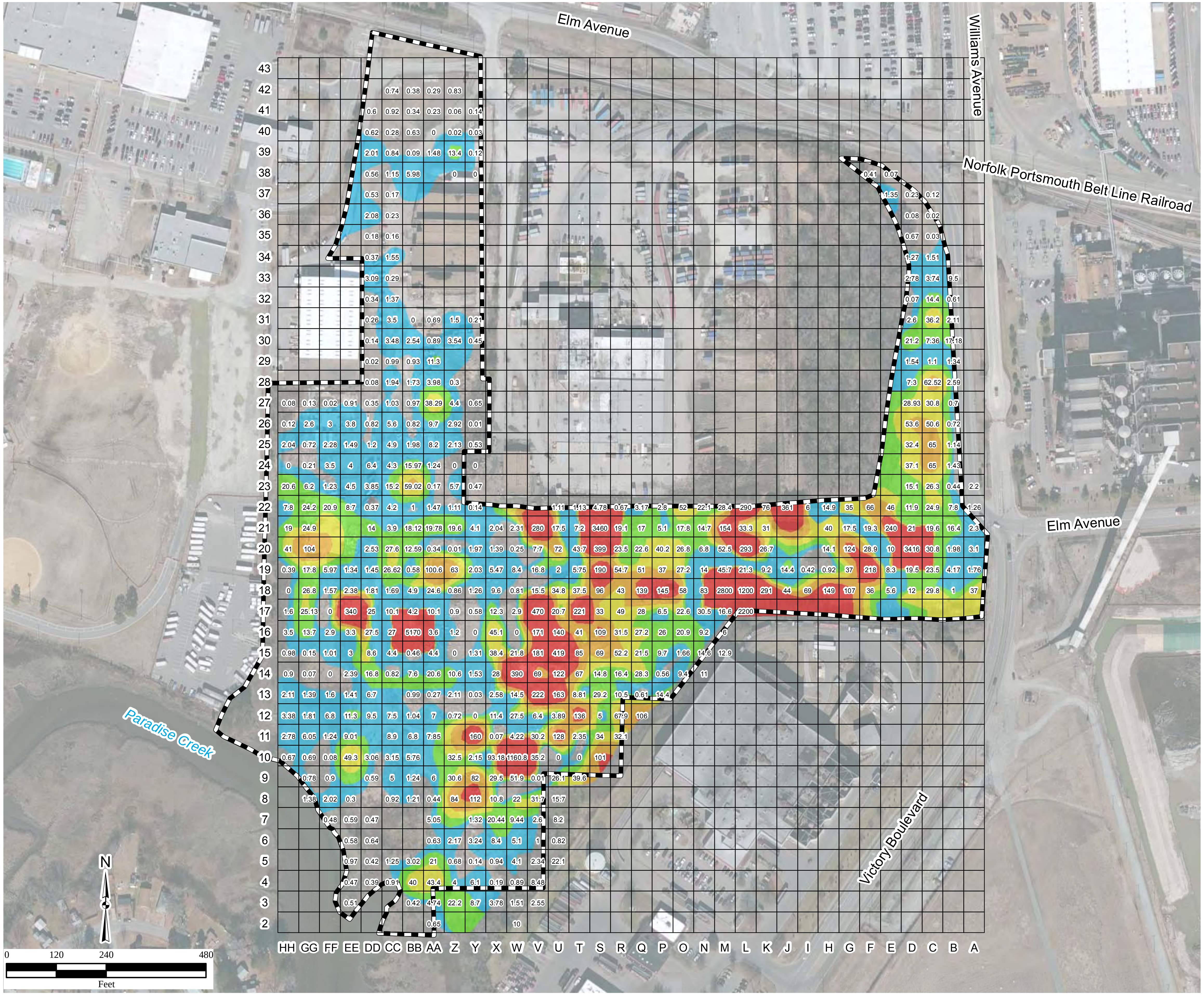
ft amsl = feet above mean sea level

\\gst-srv-01\hglgis\Peck_MSIW\SMP_RIFS
(2-09)pot_2008-10.mxd
11/16/2011 CNL
Source: HGL, Malcolm Pirnie
ArcGIS Online Bing Maps Aerial

HGL—Site Management Plan, RI/FS,
Peck Iron and Metal—City of Portsmouth, VA

Figure 8

PCB Concentrations in Soils
(0 to 18 inches bgs)



Legend

3.17	Malcolm Pirnie 50 foot x 50 foot Sample Grid and PCB Concentration (mg/kg)
AA	Grid Column or Row Identification
▭	Peck Iron and Metal Site

PCB Concentration (mg/kg):

🟦	>1.0–10
🟩	>10–25
🟨	>25–50
🟧	>50–100
🟥	>100

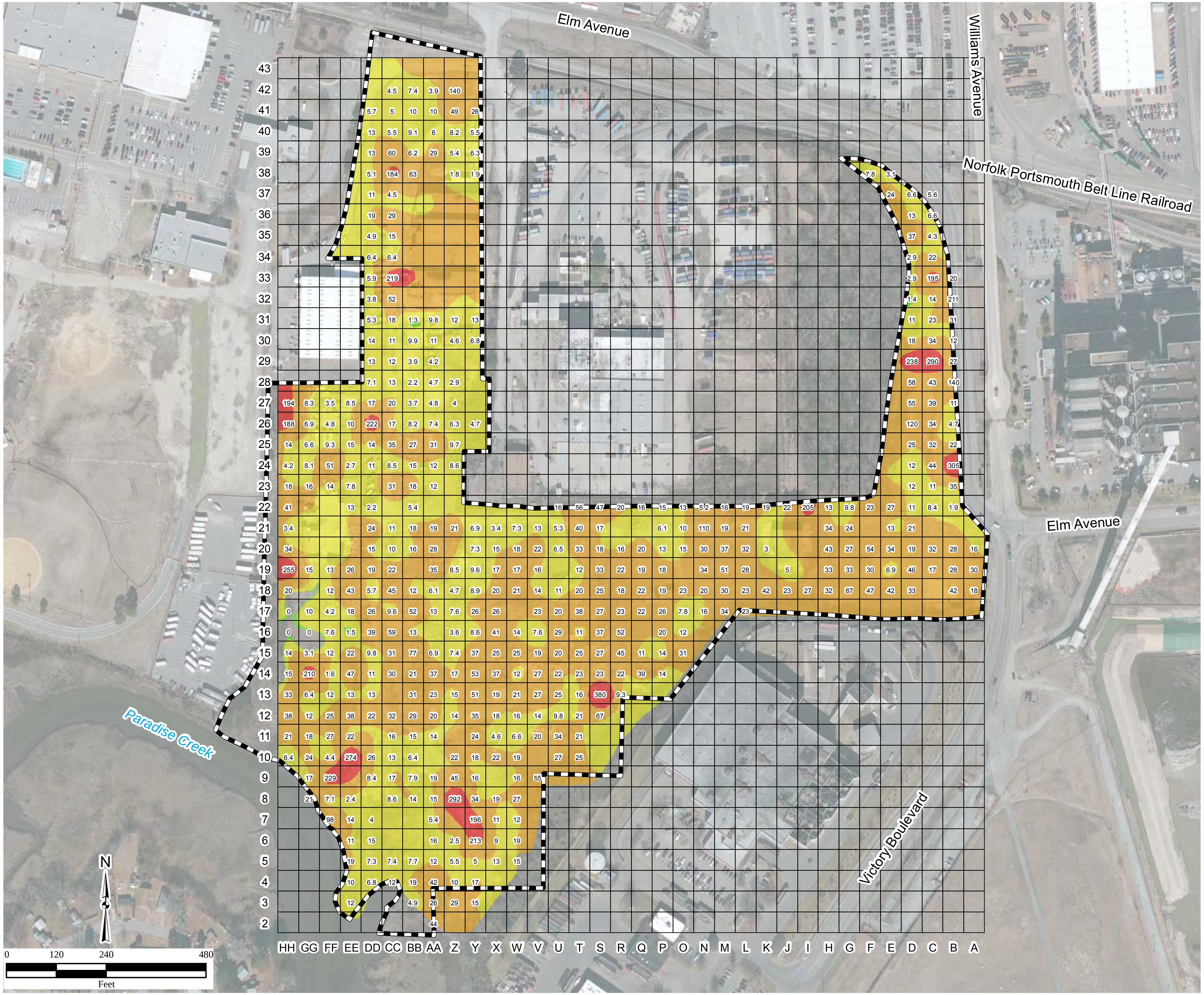
Notes:
bgs=below ground surface
mg/kg=milligrams per kilogram
PCB=polychlorinated biphenyl

\\gst-srv-01\hglgis\Peck_MSIW\SMP_RIFS
(2-10)PCB_Surf.mxd
11/16/2011 CNL
Source: HGL, Malcolm Pirnie
ArcGIS Online Bing Maps Aerial

HGL HydroGeoLogic, Inc.

HGL—Site Management Plan, RI/FS,
Peck Iron and Metal—City of Portsmouth, VA

Figure 9
Arsenic Concentrations in Soils (0 to 18 inches bgs)



Legend

16	Malcolm Pirnie 50 foot x 50 foot Sample Grid and PCB Concentration (mg/kg)
AA	Grid Column or Row Identification
▨	Peck Iron and Metal Site

Arsenic Concentration (mg/kg):

🟩	>0.39–1.6
🟨	>1.6–16
🟧	>16–160
🟥	>160

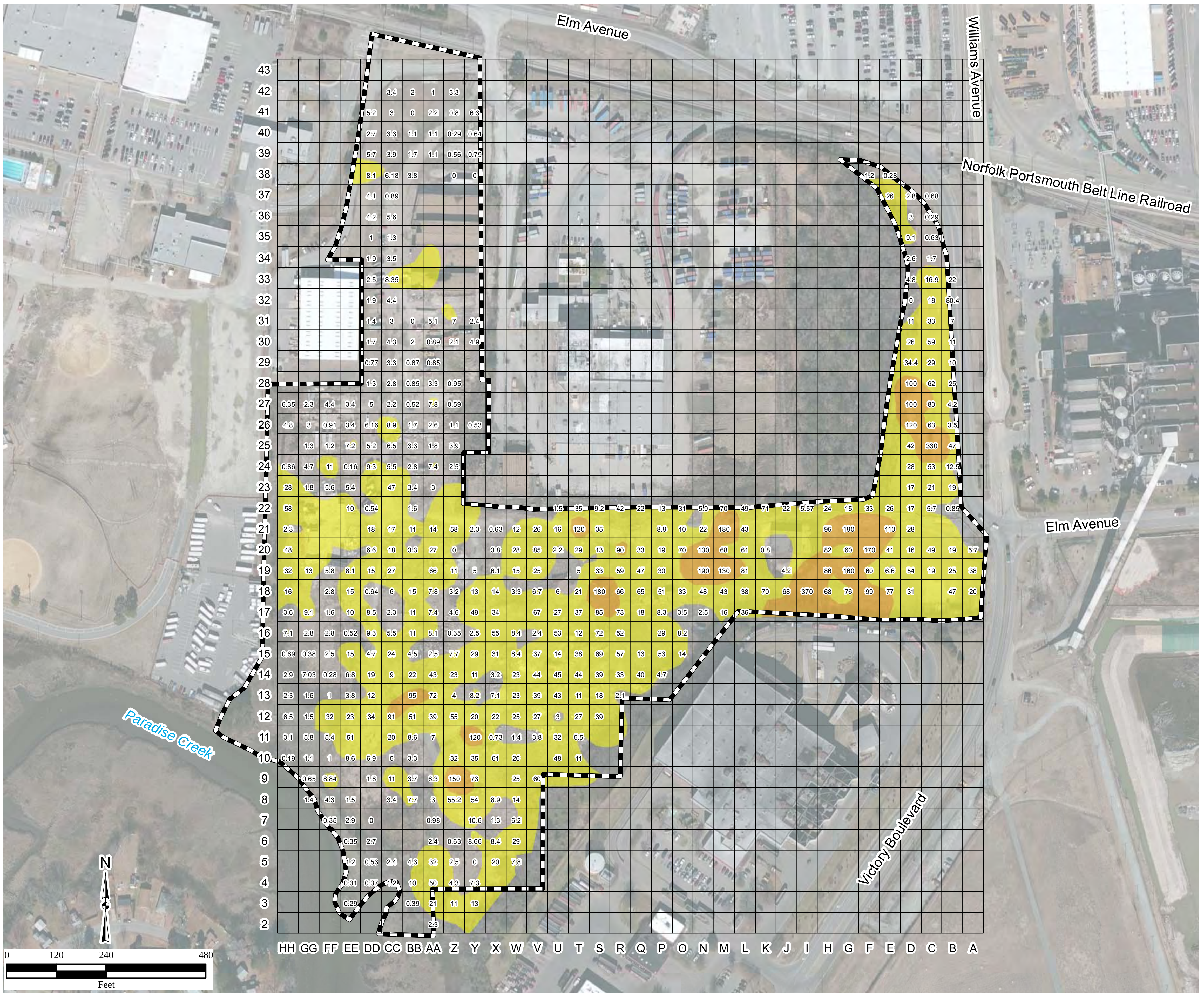
Notes:
0.39 ppm=Residential June 2011 RSL (CR = 10^{-6})
1.6 ppm=Industrial June 2011 RSL (CR = 10^{-6})
16 ppm=10x Industrial June 2011 RSL
160 ppm=100x Industrial June 2011 RSL

bgs=below ground surface
mg/kg=milligrams per kilogram
CR=cancer risk
RSL=regional screening level

\\gst-srv-01\hglgis\Peck_MSIW\SMP_RIFS\(2-12)As_Surf.mxd
11/16/2011 CNL
Source: HGL, Malcolm Pirnie
ArcGIS Online Bing Maps Aerial

HGL HydroGeoLogic, Inc

Figure 10
Cadmium Concentrations in Soils (0 to 18 inches bgs)



Legend

22	Malcolm Pirnie 50 foot x 50 foot Sample Grid and PCB Concentration (mg/kg)
AA	Grid Column or Row Identification
▨	Peck Iron and Metal Site

Cadmium Concentration (mg/kg):

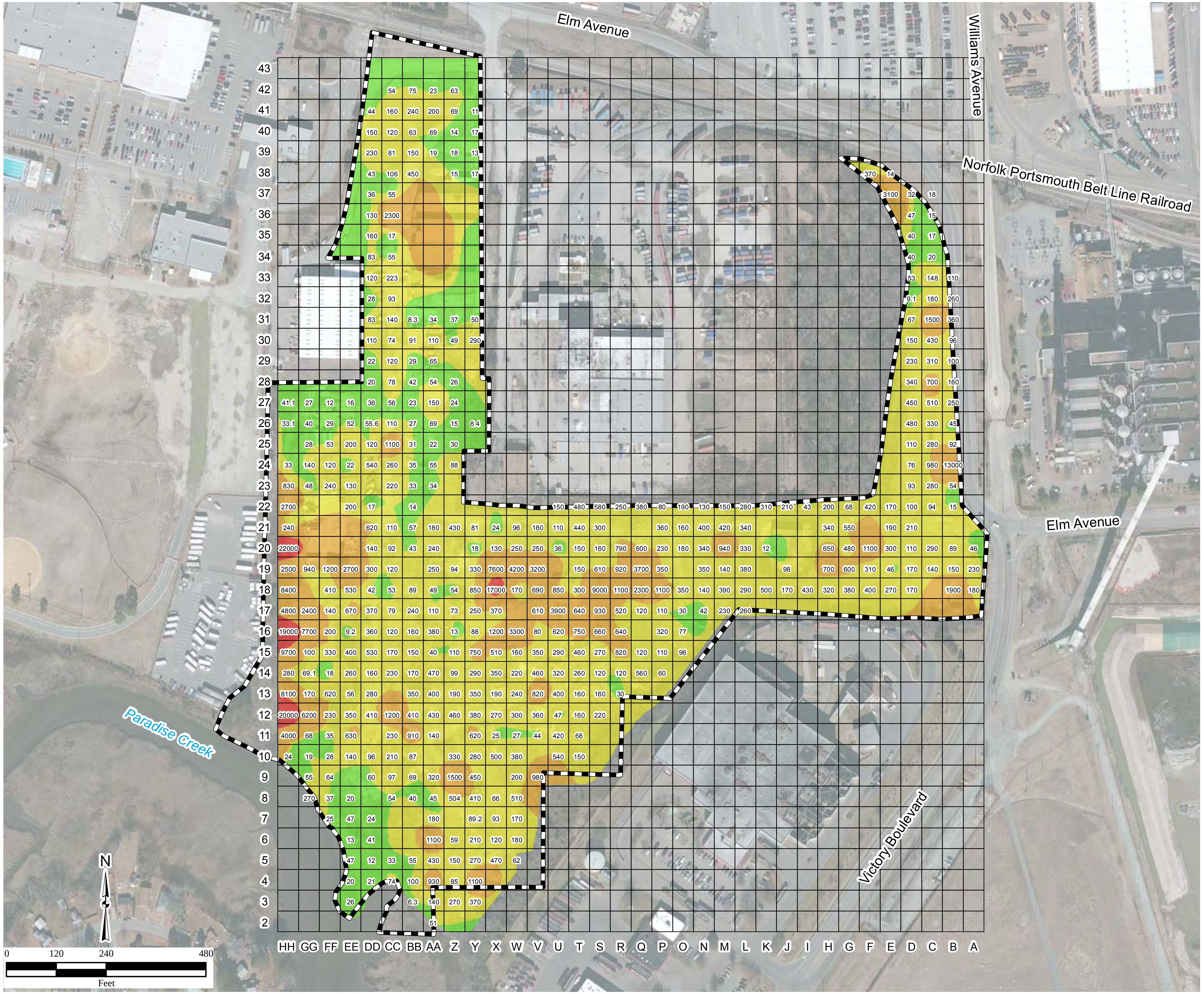
🟨	>7–80
🟧	>80

Notes:
7 ppm=Residential June 2011 RSL (adjusted for HI=0.1)
80 ppm=Industrial June 2011 RSL (adjusted for HI=0.1)

bgs=below ground surface
mg/kg=milligrams per kilogram
HI=hazard index
RSL=regional screening level

\\gst-srv-01\hglgis\Peck_MSIW\SMP_RIFS
(2-14)Cd_Surf.mxd
11/16/2011 CNL
Source: HGL, Malcolm Pirnie
ArcGIS Online Bing Maps Aerial

HGL HydroGeoLogic, Inc



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Peck Iron and Metal—City of Portsmouth, VA

Figure 11
Chromium Concentrations in Soils (0 to 18 inches bgs)

Legend

380	Malcolm Pirnie 50 foot x 50 foot Sample Grid and PCB Concentration (mg/kg)
AA	Grid Column or Row Identification
▭	Peck Iron and Metal Site

Chromium Concentration (mg/kg):

🟦	>0.29–5.6
🟩	>5.6–56
🟨	>56–560
🟧	>560–12,000
🟥	>12,000

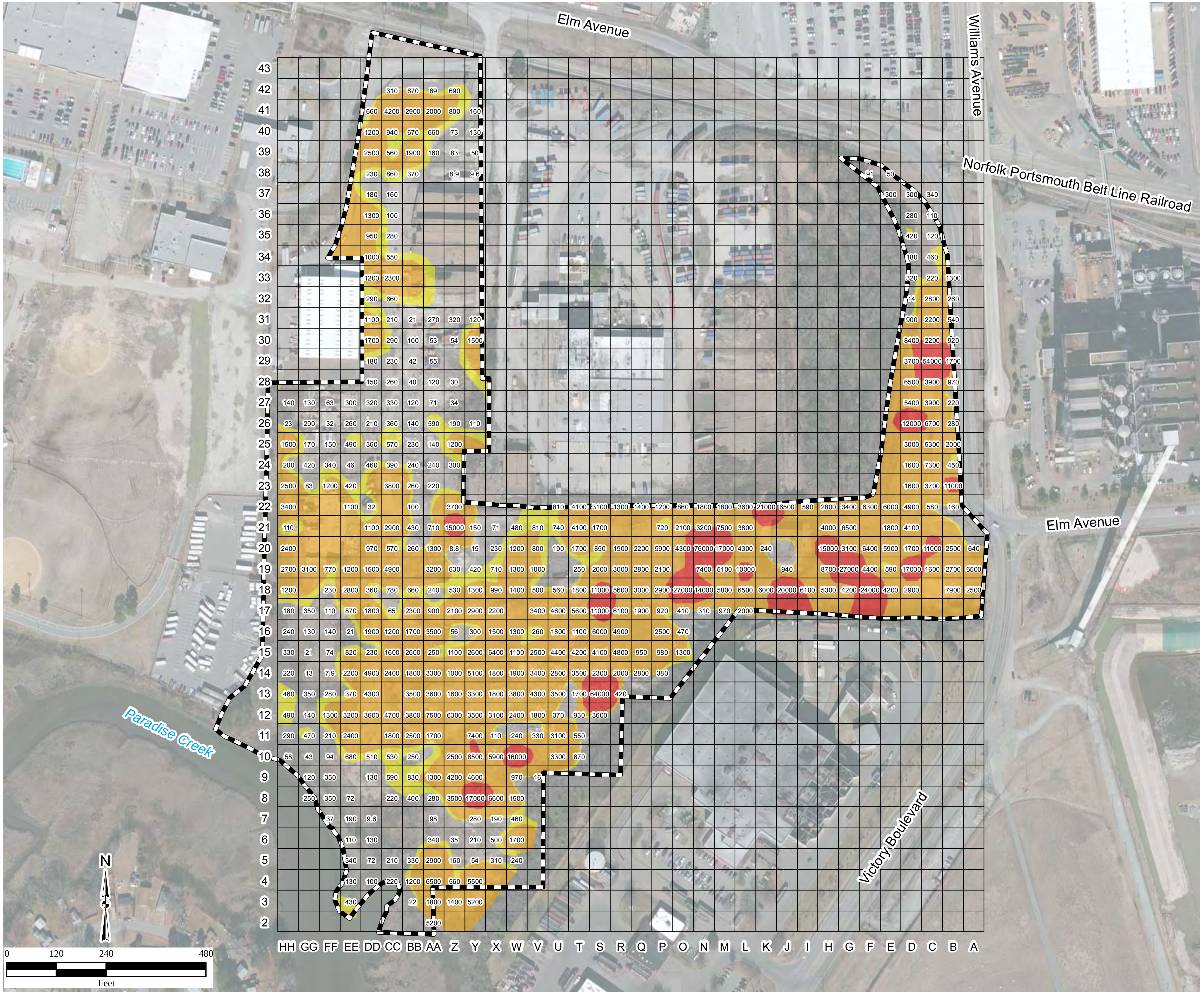
Notes:
0.29 ppm=Hexavalent Chromium Residential June 2011 RSL
5.6 ppm=Hexavalent Chromium Industrial June 2011 RSL (CR = 10^{-6})
56 ppm=10x Hexavalent Chromium Industrial June 2011 RSL
560 ppm=100x Hexavalent Chromium Industrial June 2011 RSL
12,000 ppm=Trivalent Chromium Residential June 2011 RSL (adjusted for HI=0.1)

bgs=below ground surface
mg/kg=milligrams per kilogram
CR=cancer risk
HI=hazard index
RSL=regional screening level

\\gst-srv-01\hglgis\Peck_MSIW\SMP_RIFS
(2-16)Cr_Surf.mxd
11/16/2011 CNL
Source: HGL, Malcolm Pirnie
ArcGIS Online Bing Maps Aerial

HGL—Site Management Plan, RI/FS,
Peck Iron and Metal—City of Portsmouth, VA

Figure 12
Lead Concentrations in Soils (0 to 18 inches bgs)



Legend

1400	Malcolm Pirnie 50 foot x 50 foot Sample Grid and PCB Concentration (mg/kg)
AA	Grid Column or Row Identification
▭	Peck Iron and Metal Site

Lead Concentration (mg/kg):

🟨	>400–800
🟧	>800–8,000
🟥	>8,000

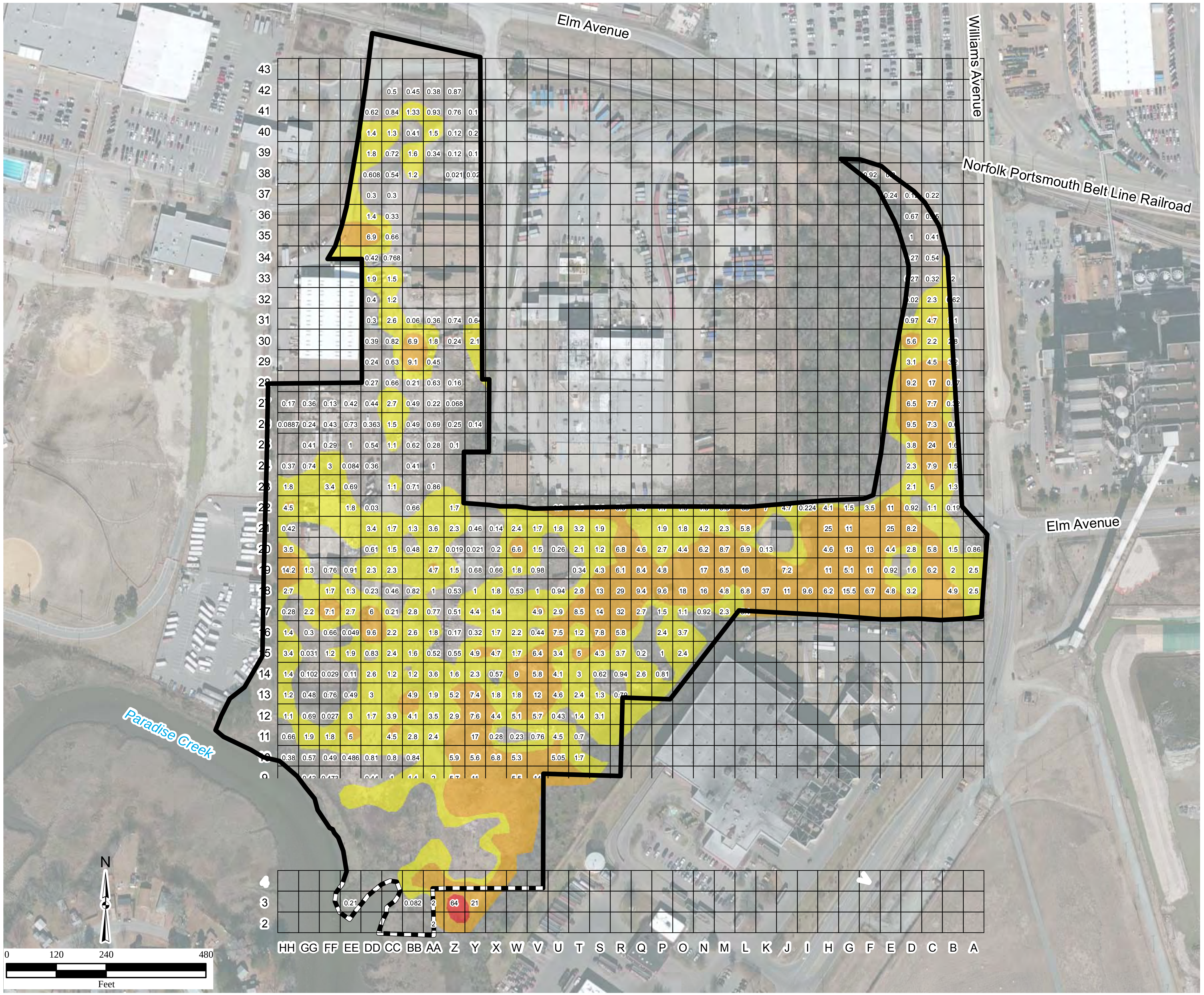
Notes:
400 ppm=Lead Residential June 2011 RSL
800 ppm=Lead Industrial June 2011 RSL
8,000 ppm=10x Lead Industrial June 2011 RSL

bgs=below ground surface
mg/kg=milligrams per kilogram
RSL=regional screening level

\\gst-srv-01\hglgis\Peck_MSIW\SMP_RIFS
(2-18)Pb_Surf.mxd
11/16/2011 CNL
Source: HGL, Malcolm Pirnie
ArcGIS Online Bing Maps Aerial

Figure 13

Mercury Concentrations in Soils (0 to 18 inches bgs)



Legend

2.4	Malcolm Pirnie 50 foot x 50 foot Sample Grid and PCB Concentration (mg/kg)
AA	Grid Column or Row Identification
▭	Peck Iron and Metal Site

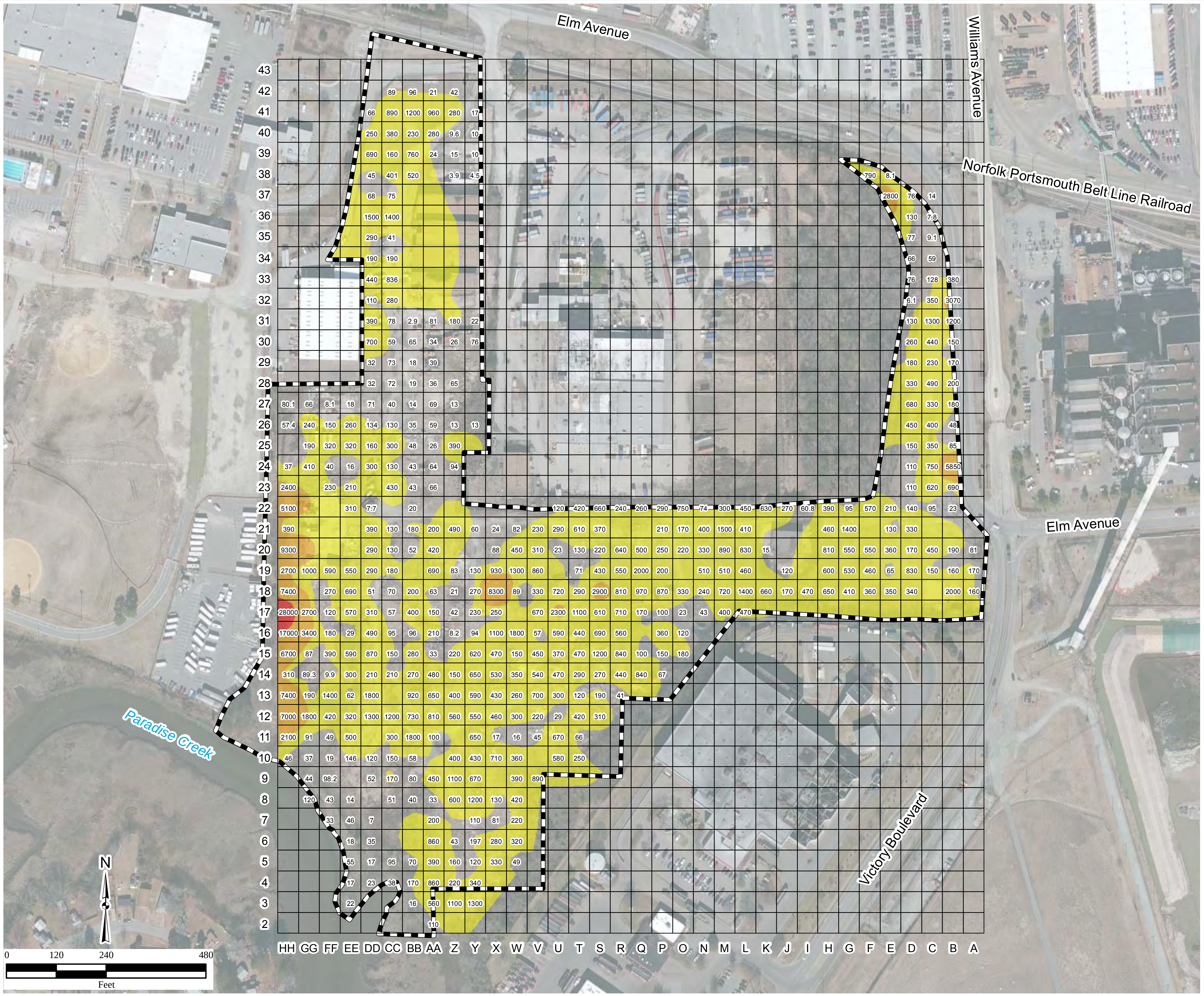
Mercury Concentration (mg/kg):

🟨	>1.0–4.3
🟧	>4.3–43
🟥	>43

Notes:
1.0 ppm=Elemental Mercury Residential June 2011 RSL
(adjusted HI=0.1)
4.3 ppm=Elemental Mercury Industrial June 2011 RSL
(adjusted HI=0.1)
43 ppm=10x Elemental Mercury Industrial June 2011 RSL
(adjusted HI=0.1)

bgs=below ground surface
mg/kg=milligrams per kilogram
HI=hazard index
RSL=regional screening level

\\gst-srv-01\hglgis\Peck_MSIW\SMP_RIFS
(2-20)Hg_Surf.mxd
11/16/2011 CNL
Source: HGL, Malcolm Pirnie
ArcGIS Online Bing Maps Aerial



HGL—Site Management Plan, RI/FS,
Peck Iron and Metal—City of Portsmouth, VA

Figure 14

Nickel Concentrations in Soils
(0 to 18 inches bgs)

Legend

260	Malcolm Pirnie 50 foot x 50 foot Sample Grid and PCB Concentration (mg/kg)
AA	Grid Column or Row Identification
▭	Peck Iron and Metal Site

Nickel Concentration (mg/kg):

- 🟨 >150–2,000
- 🟧 >2,000–20,000
- 🟥 >20,000

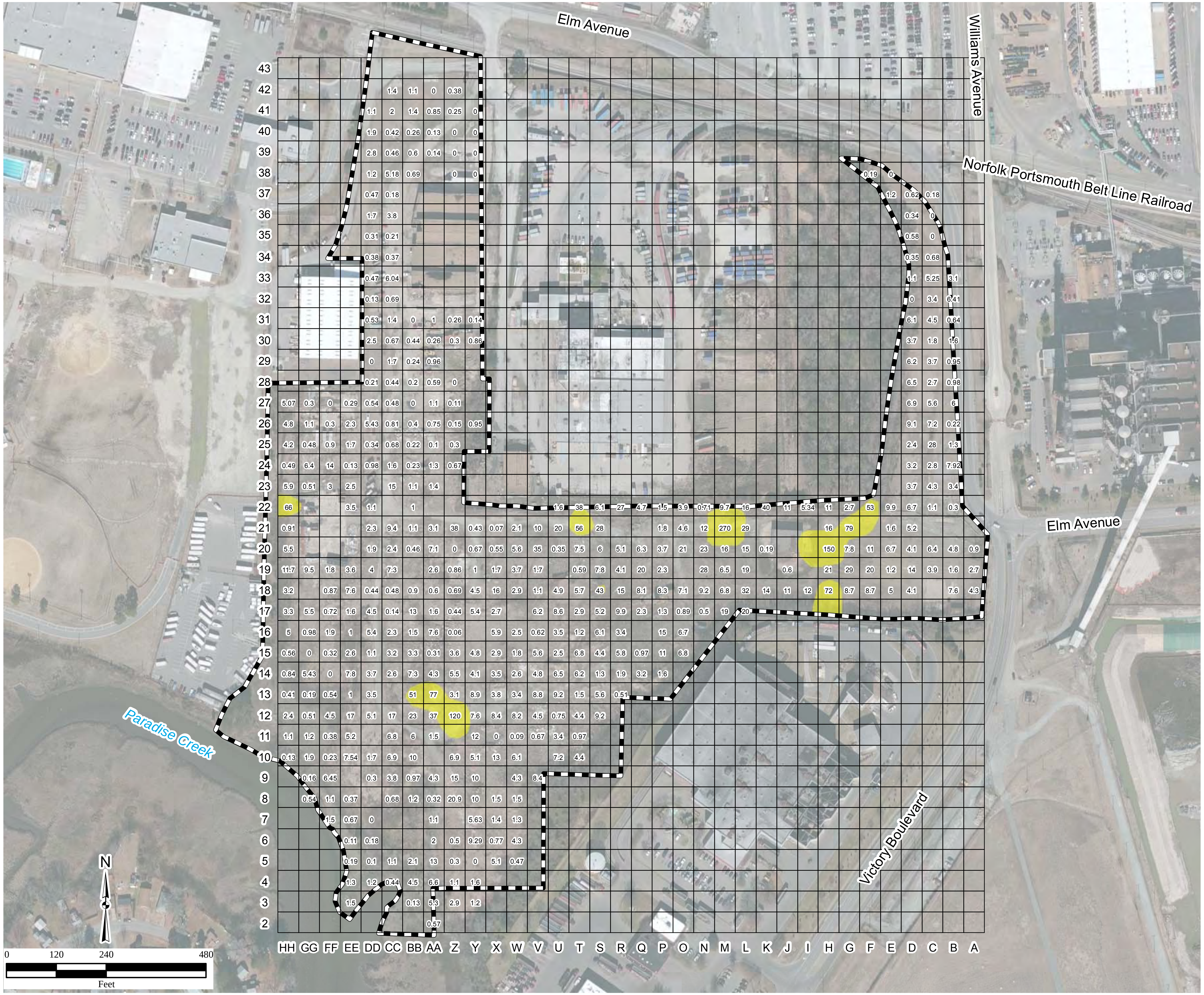
Notes:
150 ppm=Nickel Residential June 2011 RSL (adjusted HI=0.1)
2,000 ppm=Nickel Industrial June 2011 RSL (adjusted HI = 0.1)
20,000 ppm=10x Nickel Industrial June 2011 RSL (adjusted HI=0.1)

bgs=below ground surface
mg/kg=milligrams per kilogram
HI=hazard index
RSL=regional screening level

\\gst-srv-01\hglgis\Peck_MSIW\SMP_RIFS
(2-22)Ni_Surf.mxd
11/16/2011 CNL
Source: HGL, Malcolm Pirnie
ArcGIS Online Bing Maps Aerial

HGL HydroGeoLogic, Inc

Figure 15
Silver Concentrations in Soils (0 to 18 inches bgs)



	HH	GG	FF	EE	DD	CC	BB	AA	Z	Y	X	W	V	U	T	S	R	Q	P	O	N	M	L	K	J	I	H	G	F	E	D	C	B	A
43																																		
42						1.4	1.1	0	0.38																									
41					1.1	2	1.4	0.85	0.25	0																								
40					1.9	0.42	0.26	0.13	0	0																								
39					2.8	0.46	0.6	0.14	0	0																								
38					1.2	5.18	0.69		0	0																			0.19	0				
37					0.47	0.18																								1.2	0.62	0.18		
36					1.7	3.8																									0.34	0		
35					0.31	0.21																									0.58	0		
34					0.38	0.37																									0.35	0.68		
33					0.47	6.04																									1.1	5.25	3.1	
32					0.13	0.69																									0	3.4	6.41	
31					0.53	1.4	0	1	0.26	0.14																					6.1	4.5	0.64	
30					2.5	0.67	0.44	0.26	0.3	0.86																					3.7	1.8	1.6	
29					0	1.7	0.24	0.96																							6.2	3.7	0.95	
28					0.21	0.44	0.2	0.59	0																						6.5	2.7	0.98	
27	5.07	0.3	0	0.29	0.54	0.48	0	1.1	0.11																						6.9	5.6	6	
26	4.8	1.1	0.3	2.3	5.43	0.81	0.4	0.75	0.15	0.95																					9.1	7.2	0.22	
25	4.2	0.48	0.9	1.7	0.34	0.68	0.22	0.1	0.3																						2.4	28	1.3	
24	0.49	6.4	14	0.13	0.98	1.6	0.23	1.3	0.67																						3.2	2.8	7.92	
23	5.9	0.51	3	2.5		15	1.1	1.4																							3.7	4.3	3.4	
22	66			3.5	1.1		1							1.6	38	6.1	27	4.7	1.5	3.9	0.71	9.7	16	40	11	5.34	11	2.7	53	9.9	6.7	1.1	0.3	
21	0.91				2.3	9.4	1.1	3.1	38	0.43	0.07	2.1	10	20	56	28			1.8	4.6	12	270	29				16	79		1.6	5.2			
20	5.5				1.9	2.4	0.46	7.1	0	0.67	0.55	5.6	35	0.35	7.5	6	5.1	6.3	3.7	21	23	16	15	0.19			150	7.8	11	6.7	4.1	6.4	4.8	0.9
19	11.7	9.5	1.8	3.6	4	7.3		2.6	0.86	1	1.7	3.7	1.7		0.59	7.8	4.1	20	2.3		28	6.5	19		0.6		21	29	20	1.2	14	3.9	1.6	2.7
18	3.2		0.87	7.6	0.44	0.48	0.9	0.6	0.69	4.5	16	2.9	1.1	4.9	5.7	43	15	8.1	8.3	7.1	9.2	6.8	32	14	11	12	72	8.7	8.7	5	4.1		7.6	4.3
17	3.3	5.5	0.72	1.6	4.5	0.14	13	1.6	0.44	5.4	2.7		6.2	8.6	2.9	5.2	9.9	2.3	1.3	0.89	0.5	19	20											
16	5	0.98	1.9	1	5.4	2.3	1.5	7.6	0.06		5.9	2.5	0.62	3.5	1.2	6.1	3.4		15	6.7														
15	0.56	0	0.32	2.6	1.1	3.2	3.3	0.31	3.6	4.8	2.9	1.8	5.6	2.5	6.8	4.4	5.8	0.97	11	6.8														
14	0.84	5.43	0	7.8	3.7	2.6	7.3	4.3	5.5	4.1	3.5	2.6	4.8	6.5	6.2	1.3	1.9	3.2	1.6															
13	0.41	0.19	0.54	1	3.5		51	77	3.1	8.9	3.8	3.4	8.8	9.2	1.5	5.6	0.51																	
12	2.4	0.51	4.5	17	5.1	17	23	37	120	7.6	8.4	8.2	4.5	0.75	4.4	9.2																		
11	1.1	1.2	0.38	5.2		6.8	6	1.5		12	0	0.09	0.67	3.4	0.97																			
10	0.13	1.9	0.23	7.54	1.7	6.9	10		6.9	5.1	13	6.1		7.2	4.4																			
9		0.16	6.45		0.3	3.8	0.97	4.3	15	10		4.3	8.4																					
8		0.54	1.1	0.37		0.68	1.2	0.32	20.9	10	1.5	1.5																						
7			1.5	0.67	0			1.1		5.63	1.4	1.3																						
6				0.11	0.18			2	0.5	9.29	0.77	4.3																						
5				0.19	0.1	1.1	2.1	13	0.3	0	5.1	0.47																						
4				1.3	1.2	0.44	4.5	6.6	1.1	1.6																								
3				1.5			0.13	5.3	2.9	1.2																								
2								0.57																										

Legend

4.7	Malcolm Pirnie 50 foot x 50 foot Sample Grid and PCB Concentration (mg/kg)
AA	Grid Column or Row Identification
▭	Peck Iron and Metal Site

Silver Concentration (mg/kg):

🟨 >39

Notes:
39 ppm=Silver Residential June 2011 RSL (adjusted HI=0.1)

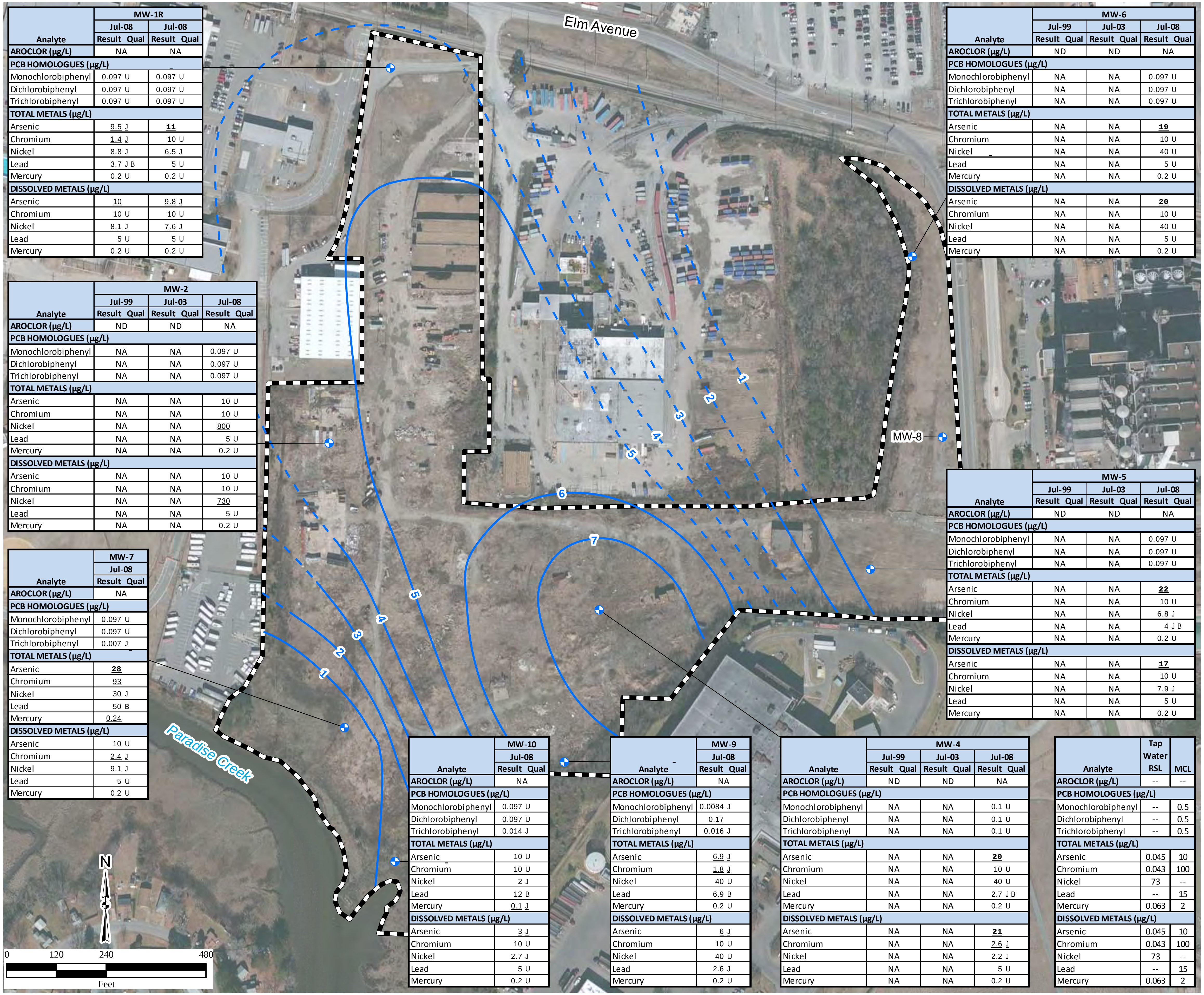
bgs=below ground surface
mg/kg=milligrams per kilogram
HI=hazard index
RSL=regional screening level

\\gst-srv-01\hglgis\Peck_MSIW\SMP_RIFS
(2-24)Ag_Surf.mxd
11/16/2011 CNL
Source: HGL, Malcolm Pirnie
ArcGIS Online Bing Maps Aerial

HGL HydroGeoLogic, Inc

HGL—Site Management Plan, RI/FS,
Peck Iron and Metal—City of Portsmouth, VA

Figure 16
Groundwater Contaminant Concentrations



Analyte	MW-1R	
	Jul-08	Jul-08
	Result Qual	Result Qual
AROCLOR (µg/L)	NA	NA
PCB HOMOLOGUES (µg/L)		
Monochlorobiphenyl	0.097 U	0.097 U
Dichlorobiphenyl	0.097 U	0.097 U
Trichlorobiphenyl	0.097 U	0.097 U
TOTAL METALS (µg/L)		
Arsenic	9.5 J	**11**
Chromium	1.4 J	10 U
Nickel	8.8 J	6.5 J
Lead	3.7 J B	5 U
Mercury	0.2 U	0.2 U
DISSOLVED METALS (µg/L)		
Arsenic	10	9.8 J
Chromium	10 U	10 U
Nickel	8.1 J	7.6 J
Lead	5 U	5 U
Mercury	0.2 U	0.2 U

Analyte	MW-2		
	Jul-99	Jul-03	Jul-08
	Result Qual	Result Qual	Result Qual
AROCLOR (µg/L)	ND	ND	NA
PCB HOMOLOGUES (µg/L)			
Monochlorobiphenyl	NA	NA	0.097 U
Dichlorobiphenyl	NA	NA	0.097 U
Trichlorobiphenyl	NA	NA	0.097 U
TOTAL METALS (µg/L)			
Arsenic	NA	NA	10 U
Chromium	NA	NA	10 U
Nickel	NA	NA	800
Lead	NA	NA	5 U
Mercury	NA	NA	0.2 U
DISSOLVED METALS (µg/L)			
Arsenic	NA	NA	10 U
Chromium	NA	NA	10 U
Nickel	NA	NA	730
Lead	NA	NA	5 U
Mercury	NA	NA	0.2 U

Analyte	MW-7
	Jul-08
	Result Qual
AROCLOR (µg/L)	NA
PCB HOMOLOGUES (µg/L)	
Monochlorobiphenyl	0.097 U
Dichlorobiphenyl	0.097 U
Trichlorobiphenyl	0.007 J
TOTAL METALS (µg/L)	
Arsenic	**28**
Chromium	93
Nickel	30 J
Lead	50 B
Mercury	0.24
DISSOLVED METALS (µg/L)	
Arsenic	10 U
Chromium	2.4 J
Nickel	9.1 J
Lead	5 U
Mercury	0.2 U

Analyte	MW-10
	Jul-08
	Result Qual
AROCLOR (µg/L)	NA
PCB HOMOLOGUES (µg/L)	
Monochlorobiphenyl	0.097 U
Dichlorobiphenyl	0.097 U
Trichlorobiphenyl	0.014 J
TOTAL METALS (µg/L)	
Arsenic	10 U
Chromium	10 U
Nickel	2 J
Lead	12 B
Mercury	0.1 J
DISSOLVED METALS (µg/L)	
Arsenic	3 J
Chromium	10 U
Nickel	2.7 J
Lead	5 U
Mercury	0.2 U

Analyte	MW-9
	Jul-08
	Result Qual
AROCLOR (µg/L)	NA
PCB HOMOLOGUES (µg/L)	
Monochlorobiphenyl	0.0084 J
Dichlorobiphenyl	0.17
Trichlorobiphenyl	0.016 J
TOTAL METALS (µg/L)	
Arsenic	6.9 J
Chromium	1.8 J
Nickel	40 U
Lead	6.9 B
Mercury	0.2 U
DISSOLVED METALS (µg/L)	
Arsenic	6 J
Chromium	10 U
Nickel	40 U
Lead	2.6 J
Mercury	0.2 U

Analyte	MW-4		
	Jul-99	Jul-03	Jul-08
	Result Qual	Result Qual	Result Qual
AROCLOR (µg/L)	ND	ND	NA
PCB HOMOLOGUES (µg/L)			
Monochlorobiphenyl	NA	NA	0.1 U
Dichlorobiphenyl	NA	NA	0.1 U
Trichlorobiphenyl	NA	NA	0.1 U
TOTAL METALS (µg/L)			
Arsenic	NA	NA	**20**
Chromium	NA	NA	10 U
Nickel	NA	NA	40 U
Lead	NA	NA	2.7 J B
Mercury	NA	NA	0.2 U
DISSOLVED METALS (µg/L)			
Arsenic	NA	NA	**21**
Chromium	NA	NA	2.6 J
Nickel	NA	NA	2.2 J
Lead	NA	NA	5 U
Mercury	NA	NA	0.2 U

Analyte	Tap Water RSL	MCL
AROCLOR (µg/L)	--	--
PCB HOMOLOGUES (µg/L)		
Monochlorobiphenyl	--	0.5
Dichlorobiphenyl	--	0.5
Trichlorobiphenyl	--	0.5
TOTAL METALS (µg/L)		
Arsenic	0.045	10
Chromium	0.043	100
Nickel	73	--
Lead	--	15
Mercury	0.063	2
DISSOLVED METALS (µg/L)		
Arsenic	0.045	10
Chromium	0.043	100
Nickel	73	--
Lead	--	15
Mercury	0.063	2

Analyte	MW-6		
	Jul-99	Jul-03	Jul-08
	Result Qual	Result Qual	Result Qual
AROCLOR (µg/L)	ND	ND	NA
PCB HOMOLOGUES (µg/L)			
Monochlorobiphenyl	NA	NA	0.097 U
Dichlorobiphenyl	NA	NA	0.097 U
Trichlorobiphenyl	NA	NA	0.097 U
TOTAL METALS (µg/L)			
Arsenic	NA	NA	**19**
Chromium	NA	NA	10 U
Nickel	NA	NA	40 U
Lead	NA	NA	5 U
Mercury	NA	NA	0.2 U
DISSOLVED METALS (µg/L)			
Arsenic	NA	NA	**20**
Chromium	NA	NA	10 U
Nickel	NA	NA	40 U
Lead	NA	NA	5 U
Mercury	NA	NA	0.2 U

Analyte	MW-5		
	Jul-99	Jul-03	Jul-08
	Result Qual	Result Qual	Result Qual
AROCLOR (µg/L)	ND	ND	NA
PCB HOMOLOGUES (µg/L)			
Monochlorobiphenyl	NA	NA	0.097 U
Dichlorobiphenyl	NA	NA	0.097 U
Trichlorobiphenyl	NA	NA	0.097 U
TOTAL METALS (µg/L)			
Arsenic	NA	NA	**22**
Chromium	NA	NA	10 U
Nickel	NA	NA	6.8 J
Lead	NA	NA	4 J B
Mercury	NA	NA	0.2 U
DISSOLVED METALS (µg/L)			
Arsenic	NA	NA	**17**
Chromium	NA	NA	10 U
Nickel	NA	NA	7.9 J
Lead	NA	NA	5 U
Mercury	NA	NA	0.2 U

Legend

●	Monitoring Well
MW-8	Well Identification
—4—	2008 Groundwater Elevation Contour (ft amsl) (dashed where inferred, 1 ft contour interval)
▨	Peck Iron and Metal Site

Notes:
Bolded value: Analyte concentration exceeds EPA MCL
Underlined value: Analyte concentration exceeds EPA Tap water RSL (adjusted)
--=not applicable
µg/L=micrograms per liter
B= positive detection, representative of laboratory blank contamination
CR=cancer risk
HI=hazard index
J=positive detection, considered an estimate
MCL=Maximum Contaminant Level
NA=not analyzed
ND=not detected
Qual=qualifier
RSL=Regional Screening Level (June 2011 value; adjusted for CR=10^{-6}, HI=0.1)
U=not detected

\\gst-srv-01\hglgis\Peck_MSIW\SMP_RIFS
(2-26)GW_Contaminants.mxd
11/16/2011 CNL
Source: HGL, Malcolm Pirnie
ArcGIS Online Bing Maps Aerial

HGL
HydroGeoLogic, Inc

HGL—Site Management Plan, RI/FS,
Peck Iron and Metal—City of Portsmouth, VA

Figure 17
PCB Homologue Detections Paradise Creek Sediment Samples

Analyte	SD-4-0 Result Qual
PCB Homologues (µg/kg)	
Heptachlorobiphenyl	35 J
Hexachlorobiphenyl	40 J

Analyte	SD-5-0 Result Qual
PCB Homologues (µg/kg)	
Heptachlorobiphenyl	290 U
Hexachlorobiphenyl	75 J

Analyte	SD-32-0 Result Qual
PCB Homologues (µg/kg)	
Heptachlorobiphenyl	790 U
Hexachlorobiphenyl	140 J

Analyte	EPA Residential RSLs (x10)
Heptachlorobiphenyl	1100
Hexachlorobiphenyl	1100

Legend

▲	Sediment Sample
SD-1	Sample Location Identification
▬	Peck Iron and Metal Site Boundary
☐	Malcolm Pirnie Sediment Sample Grid

Notes:
µg/L=micrograms per liter
EPA=U.S. Environmental Protection Agency
HI=hazard index
J=positive detection, considered an estimate
PCB=polychlorinated biphenyl
Qual=qualilfier
RSL=Regional Screening Level (June 2011 value, residential soil x10; adjusted for HI=0.1)
U=not detected

\\gst-srv-01\hglgis\Peck_MSIW\SMP_RIFS\(2-27)Sediment_Tags.mxd
11/10/2011 CNL
Source: HGL, Malcolm Pirnie
ArcGIS Online Bing Maps Aerial

HGL HydroGeoLogic, Inc

Figure 18
Site Soil and Groundwater Sample Locations

Legend

⊕ Monitoring Well

⊕ Prepack Well

⊕ Soil Sampled Prepack Well

● Hotspot Soil Boring

⊙ XRF Soil Boring

● Malcolm Pirnie Verification Boring

MW-1R Well or Sample Location Identification

☐ Malcolm Pirnie 50 foot x 50 foot Sample Grid

AA Grid Column or Row Identification

▭ MEC Visual Inspection Area

▭ Peck Iron and Metal Site

▭ Peck Iron and Metal Remedial Investigation Area

Notes:
MEC=munitions and explosives of concern
XRF=x-ray fluorescence

\\gst-srv-01\hglgis\Peck_MSIW\SMP_RIFS
(3-01)Sample_Locs.mxd
11/21/2011 CNL
Source: HGL, Malcolm Pirnie, EPA
ArcGIS Online Bing Maps Aerial

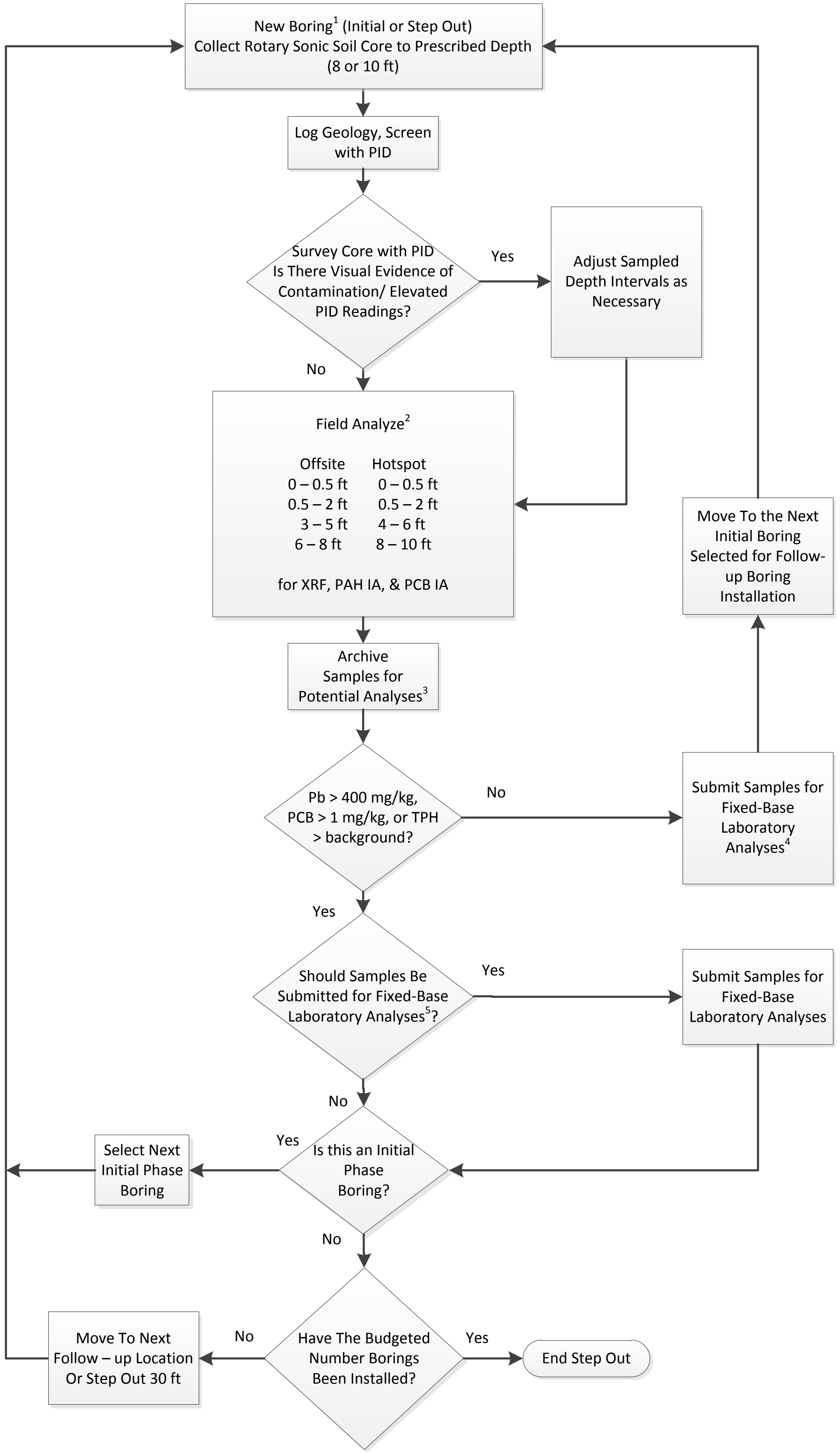


Figure 19. Optimization Team-Proposed Soil Investigation Decision Logic (Offsite Contamination and Hot Spot Assessment)

Figure 19 Footnotes

1. New boring to be installed could be one of the 31 offsite borings (Offsite Soil Characterization Task), 23 hotspot borings (Hotspot Soil Characterization Task), or follow-up step out borings for either of these tasks.

2. Entire soil core will be initially field screened with a PID in preparation of collecting a field sample from the portion of each prescribed sample interval exhibits the highest VOC concentration. The prescribed intervals are adjusted as necessary to reflect field characterization objectives. Each sample is field-analyzed using XRF, PAH IA, and PCB IA. Note that XRF cannot differentiate between the different oxidation states of a given species (i.e., Cr^{+3} vs. Cr^{+6}).

3. Based on the results of the preliminary sampling for PCDD/PCDF compounds in the initial field task (utility/MEC/MD clearance discussed in Section 4.3.1), an appropriate number of the archived samples will be selected for PCDD/PCDF analyses in a fixed base laboratory.

4. Soil samples from initial borings and step out borings for which all field analyses results are below field detection levels will be submitted for fixed-base laboratory analyses.

5. The percentage of samples and selection criteria for initial phase samples that are to be submitted for fixed-base laboratory analyses will be determined by the project team based on data quality objectives and project financial constraints.

Figure 19 (Continued). Optimization Team-Proposed Soil Investigation Decision Logic (Offsite Contamination and Hot Spot Assessment)

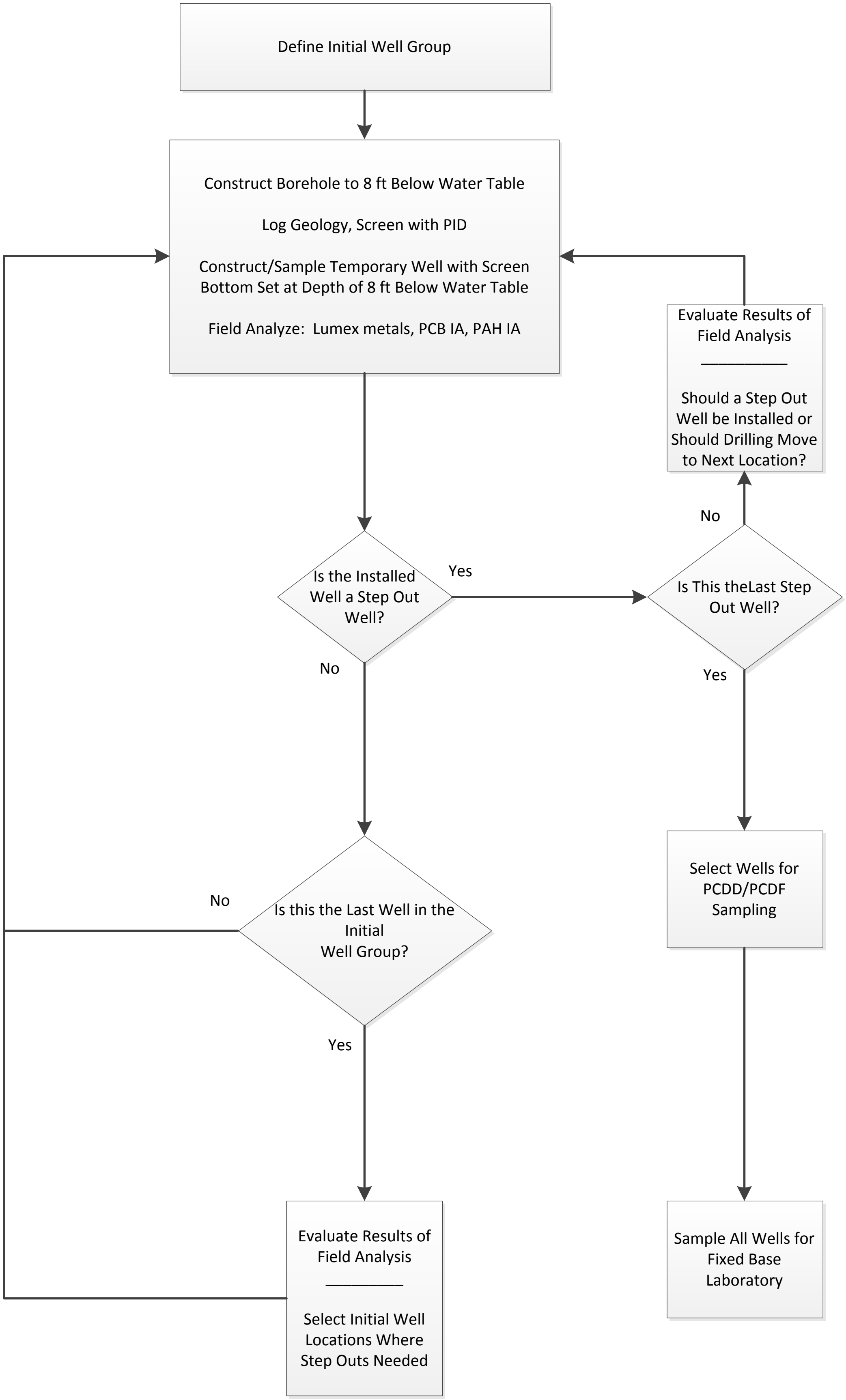
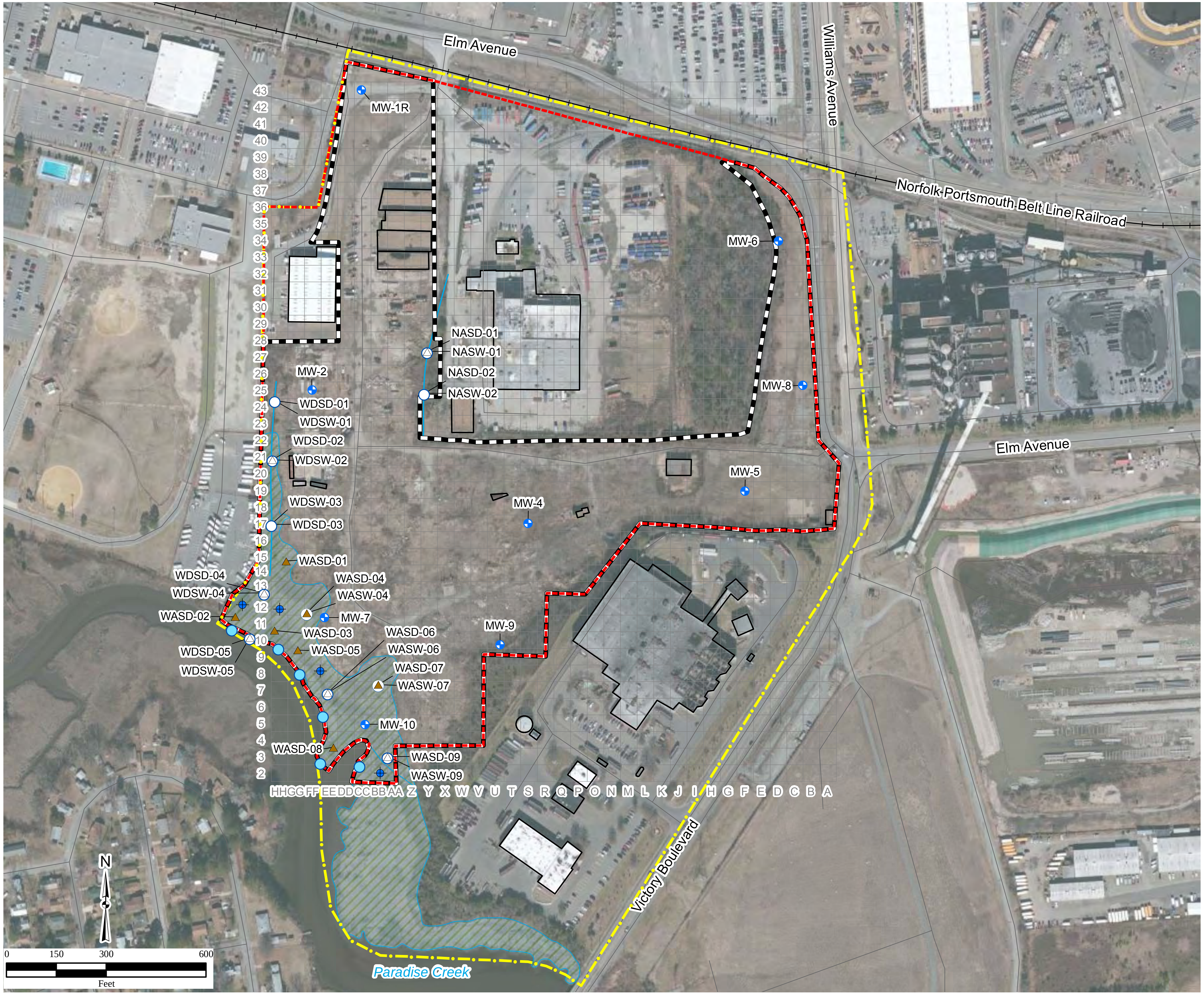


Figure 20. Optimization Team-Proposed Groundwater Investigation Decision Logic



HGL—Site Management Plan, RI/FS,
Peck Iron and Metal—City of Portsmouth, VA

Figure 21
Site Drainage and Wetland Sample Locations

Legend

- ◉ Monitoring Well
- ▲ Sediment Sample
- ○ Surface Water Sample
- ● Surface Water Seep Sample
- ⊕ Wetland Pre-Pack Well
- MW-1R Well or Sample Identification
- □ Malcolm Pirnie 50 foot x 50 foot Sample Grid
- AA Grid Column or Row Identification
- — Drainage
- — Road
- ┼ Railroad
- □ Building
- ▭ Peck Iron and Metal Site
- ▭ Peck Iron and Metal Remediation Investigation Area
- ▭ Environmental Photographic Interpretation Center Study Area
- ▨ Wetland

Note:
Actual locations of surface water seep samples to be determined in field.

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(3-02)Wetland_Samples.mxd
11/18/2011 CNL
Source: HGL, Malcolm Pirnie, EPA
ArcGIS Online Bing Maps Aerial

Figure 22
Paradise Creek Sample Locations

Legend

▲	Sediment Sample
○	Surface Water Sample
PCSD-1	Well or Sample Identification
▨	Peck Iron and Metal Site

Note:
Actual locations will be determined in field and based upon identified flow patterns within Paradise Creek.

\\gst-srv-01\hglgis\Peck_MSIW\SMP_RIFS
(3-03)Paradise_Samples.mxd
11/9/2011 CNL
Source: HGL, Malcolm Pirnie, EPA
ArcGIS Online Bing Maps Aerial

HGL
HydroGeoLogic, Inc

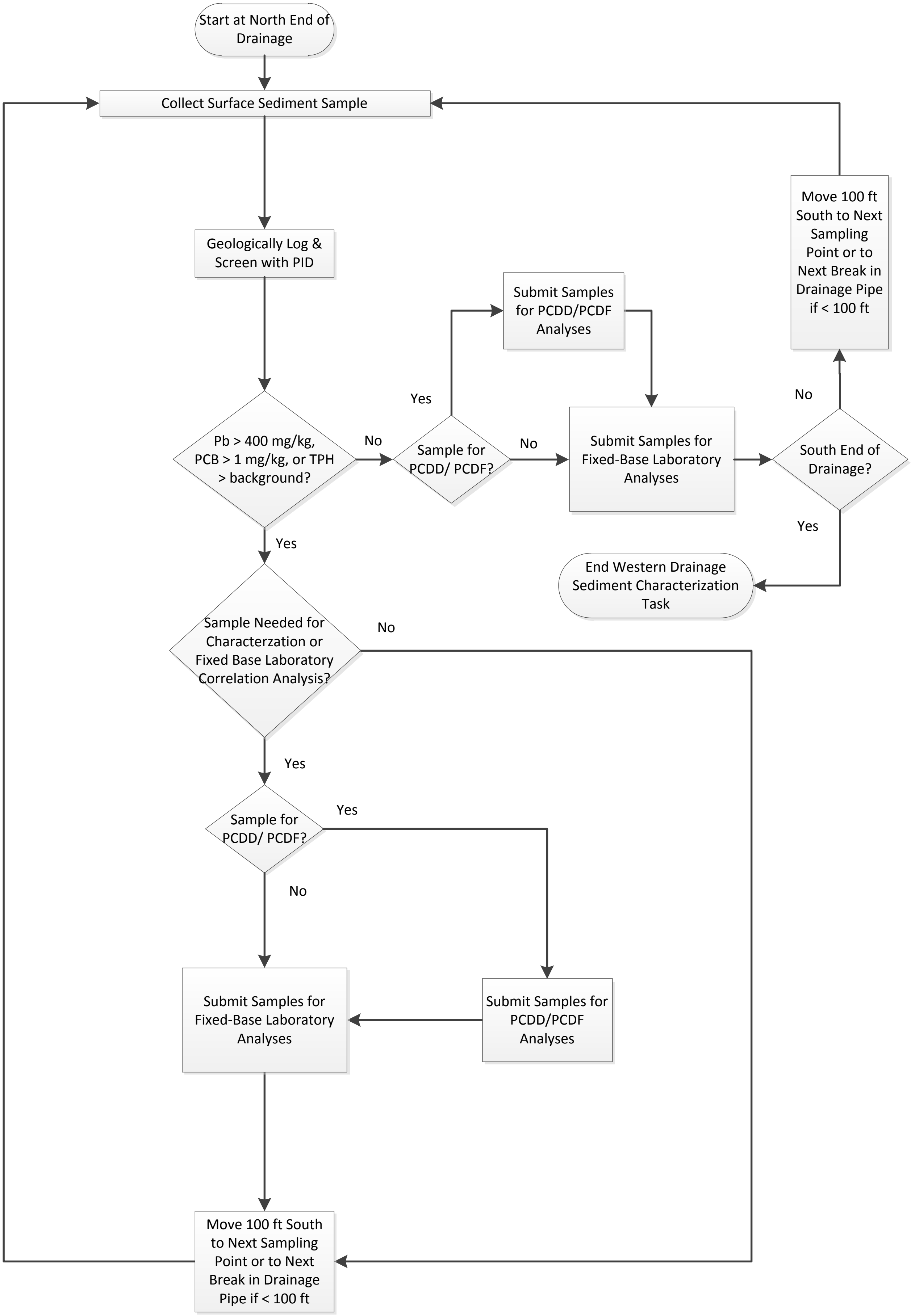


Figure 23. Optimization Team-Proposed Sediment Investigation Decision Logic (Western Drainage)

ATTACHMENT A
TRIP LOG MEMORANDUM FOR FEBRUARY 22, 2012 SITE VISIT

TETRA TECH

MEMORANDUM

Date: **March 30, 2012**

To: **Steve Dyment, US EPA OSRTI**

From: **Mark Shupe, Senior Hydrogeologist, Tetra Tech EMI**

Subject: **DRAFT – Trip Log: Peck Iron Optimization Review Site Visit, Portsmouth, Virginia, February 22, 2012**

The purpose of this memorandum is to document the Wednesday, February 22, 2012 site visit conducted at the Peck Iron and Metal Site (the Site) in Portsmouth, Virginia. The site visit was conducted as part of a remedial investigation (RI) optimization review.

Site visit attendees included representatives from the U.S. Environmental Protection Agency Region 3 (Region 3), the U.S. Environmental Protection Agency Office of Superfund Remediation & Technology Innovation (OSRTI), Virginia Department of Environmental Quality (VDEQ), Hydrogeologic, Inc. (HGL), and Tetra Tech EM Inc. (Tetra Tech); optimization support contractor to OSRTI. The attendees and their contact information are provided in the following table.

Attendee	Affiliation	Phone
Debra Rossi	Region 3	215-814-3228
Bill Hagel	Region 3	215-814-2380
Bruce Pluta	Region 3	215-814-2380
Jeff Tuttle	Region 3	215-814-3236
Ryan Bower	Region 3	215-814-3389
Stephen Dyment	OSRTI	703-402-1857
Durwood Willis	VDEQ	804-698-4192
Kevin Green	VDEQ	804-698-4236
Kyle Newman	VDEQ	804-698-4452
Michelle Hollis	VDEQ	804-698-4014
Brett Brodersen	HGL	703-736-4526
Mark Shupe	Tetra Tech	703-390-0653

The site visit consisted of an initial orientation meeting followed by a site walk of the Peck Iron property. The meeting was held from 9:30 to approximately 11:30 at the US Army Corps of Engineers (USACE) field office at the Atlantic Wood Treating Superfund Site located across Elm Avenue from the Site. Steve Dyment and Mark Shupe facilitated the discussion in accordance with a prepared agenda (Attachment 1). Major topics included:

- General description of current conditions,
- Review of key previous investigations,
- Description of the preliminary conceptual site model (PCSM) and associated data gaps,
- Questions developed from the document review, and
- Summary of potential strategies for conducting the remedial investigation (RI).

The meeting discussions resulted in a list of action items (Attachment 2).

The site walk began at approximately 12:00 noon and was completed by 2:00 PM. The weather was sunny and calm with temperatures in the 60s (Fahrenheit). The site walk began at the entrance gate and proceeded from the group of Site buildings near the gate southward along the western boundary to the southwestern corner of the Site in the vicinity of a recently-constructed wetland adjacent to Paradise Creek. The walk then paralleled Paradise Creek to the eastern boundary and then northward to the center of the main Site area. The eastern portion of the Site was visited, followed by a walk back to the building area and completion at the entrance gate.

An annotated photograph log, available as a Microsoft PowerPoint file, has been uploaded to the EPA Environmental Science Connector (ESC) web site (https://ssoprod.epa.gov/sso/jsp/oblogin.jsp) [Note: Access to the ESC requires EPA authorization. For access support, contact Steve Dyment.]

Notable observations from the site walk included:

- A block of masonry-on-slab buildings is located near the entrance gate. The buildings (approximately six in number) are in poor condition and, because of missing doors and portions of walls, are apparently opportunistically used for multiple purposes by unidentified individuals. An unidentified party is using the building nearest the entrance gate for antique vehicle storage. Within the three adjacent buildings were respectively observed a work bench and storage area, a hydraulic equipment servicing area, and a drum storage area. Labeling on a group of drums in the observed drum storage area indicated that the drums contained powdered magnesium. The drums were staged on a wooden pallet, appeared generally in good condition, and were partially covered by plastic sheeting.

- A storm grate and catchment basin was observed adjacent to the northeastern corner of the northernmost building. Visual assessment identified that two pipes discharged into the catchment basin, both of which appeared to originate within the northernmost building.

- A contractor is using an area to the south and west of the building area for material and equipment staging. It is also likely that some of the observed activities (e.g., hydraulic equipment servicing, work bench activities) in the buildings are attributable to this contractor.

- A Sherwin Williams facility occupies the parcel bordering the western Site boundary. Standing water was observed in a swale adjacent to the Sherwin Williams building. A 1-foot diameter drainage pipe trending approximately north-south on the Site appears to originate on the Sherwin Williams property. The pipe is approximately parallel to the western drainage ditch, observed to be mostly a shallow swale marked by high phragmites. A thin strip of land exists between the western drainage ditch and the chain-link fence located at the Site boundary.

- At various locations, patches of barren soil and areas with stressed vegetation were evident. In addition, areas of standing surface water were present throughout the Site. The observed standing water was likely related to the winter storm that struck the area the previous weekend.

- High phragmites were observed in the Elizabeth River Keepers-constructed wetland located at the southwest corner of the site. Although obscured by high vegetation, the remains of a silt fence were observed that possibly demarcated the wetland boundary.

- A residential area borders the opposite side of Paradise Creek to the south of the Site.

- In conducting initial sampling that coincided with the Site visit, Bruce Pluta with the Region 3 Biological Technical Assistance Group (BTAG) trapped a minnow from Paradise Creek at he Site's southern boundary.

- Much of the southeastern portion of the Site is underlain by apparent building demolition debris. Large blocks of concrete, asphalt, wood and other materials daylight to ground surface in this area.

- A north-south-trending wooded berm separates much of the Site's central area from the Southeastern Public Service Authority Refuse Derived Fuel facility (incinerator) to the east. As marked by high phragmites, a drainage swale parallels, and is located at the toe of, the berm. Standing water was observed in this swale.

- The remains of two former metal processing facilities were observed in the northern central portion of the Site. A large electrical transformer was located adjacent to the easternmost facility.

- Three one-story, cinderblock on-slab buildings are located in eastern portion of the Site. The largest of these may have served as a maintenance building. A possible vent pipe for an underground storage tank (UST) was observed at the southwest corner of this building. The interior of the building was flooded by several inches of water. The two other buildings are located on the eastern boundary of the site adjacent to Elm Avenue. One of the buildings apparently was a restroom/change room facility; the other building was possibly an office.

- An eastern drainage ditch is referenced in the HGL RI work plan for the Site. As clarified by Brett Brodersen (HGL), the eastern drainage ditch is actually located between the block of masonry buildings near the main entrance gate and the Areff facility that borders the Site to the east. The ditch is a north-south-trending, open cement tough that originates on the Areff property and is apparently northward flowing. The southern portion of the ditch is open. The northern portion located behind the block of masonry buildings is covered by a concrete driveway.

With the attendees' return to the main gate, the site walk was completed. The conclusion of the site walk marked the end of the site visit.

cc:
Debra Rossi, Region 3
Bill Hagel, Region 3
Bruce Pluta, Region 3
Jeff Tuttle, Region 3
Ryan Bower, Region 3
Stephen Dyment, OSRTI
Durwood Willis, VDEQ
Kevin Green, VDEQ
Kyle Newman, VDEQ
Michelle Hollis, VDEQ
Brett Brodersen, HGL

Site Log Attachment 1:
Draft Meeting Agenda

Draft Meeting Agenda
Peck Iron & Metal RI Optimization Review
Site Visit (February 22, 2012)

I. Site Visit Objectives

- Introduction of Team Members
- Summary of Data Review Effort
- Summarize Preliminary Conceptual Site Model (PCSM) and Associated Data Gaps / Uncertainties
- Address Outstanding Review Team Questions
- Discuss Potential Investigation Strategies
- Summary and Action Items

II. Site Description

a. Site History

- The site consists of a 33 acre former scrap metal recycling facility which received materials from Federal and State governments, as well as commercial, industrial, and private sources.
- Period of operation: late 1945 to 1999.

b. Adjacent Land Use

- Bounded by industrial/commercial properties and Paradise Creek (tidal tributary to the Southern Branch of the Elizabeth River)

III. Key Previous Investigations

- Hatcher-Sayer, Inc., 1999
- Draper Aden Associates, 2003a
- Draper Aden Associates, 2003b
- Draper Aden Associates, 2005: Sheets A-1 and B
- Unger, M.A., Vadas, G.G., Harvey, E., and Reiger, J., 2005
- Malcolm Pirnie, Inc., 2008: Extent of Contamination Study Report
- Hydrogeologic, Inc., 2011: Site Management Plan RI/FS Peck Iron & Metal

IV. Preliminary CSM

a. Topography and Surface Water Drainage

- Ground surface elevations generally range from sea level to 10 feet msl
- Two north-to-south trending surface water drainage ditches
- Paradise Creek and associated wetlands are located along the site's southern boundary

b. Geology/Hydrogeology

- Characterization limited to upper 15 to 20 feet. Site lithology consists of from 1.5 to 12 feet of silty clay fill underlain by sand or clayey sand and locally by clay. In some areas the fill consists of scrap metal and/or rubble.
- Groundwater is encountered at depths ranging from 8 to 12 feet bgs.
- Shallow groundwater flow is to the south toward Paradise Creek and to the north toward the intersection of Elm and Williams avenues; a groundwater mound is present in the central portion of the site.

c. Constituents of Potential Concern

- Soil
  - Extensive areas with elevated concentrations of PCB and selected metals (lead and other metals).
  - Elevated TPH-DRO
- Groundwater
  - PCBs detected down-gradient of maximum concentration area in soils
  - Arsenic, nickel, lead, and mercury exceeded screening levels
  - Seven VOC compounds exceeded screening levels (benzene, chlorobenzene, 1,4-dichlorobenzene, MTBE, TCE, 1,3,5-trimethylbenzene, vinyl chloride)
- Sediment
  - PCBs detected
  - Seven metals exceed screening levels (As, Cd, Cr, Pb, Hg, Ni, Ag)

d. Potential Contaminant Migration Pathways

- Erosion and surface water transport of contaminated soil
- Leaching of soil constituents to groundwater
- Discharge of contaminated groundwater to surface water
- Fugitive dust generation from contaminated soil

V. Currently Identified Data Gaps /Uncertainties

a. Soil

- Data are only available for a limited list of analytes;
- Lack of data for adjoining properties where potential contaminant releases may have occurred.
- Soil horizons characterized in previous investigations may not be appropriate for risk assessment purposes.
- Potential hotspots exist that have not been characterized.

b. Groundwater

- No data available in areas of potential hotspots in soil
- Limited analyte list used for previous investigation sampling.

c. Surface Water/Sediment (On/Off-Site)

- Limited or no data available;sampling needed for TAL/TCL

VI. Questions

- What is the current plan for site re-use?
- Are leaching analyses data available for site soils?
- Does a fill thickness/fill type (i.e., soil fill versus rubble) map exist for the site?
- Would a benthic macro-invertebrate community evaluation be appropriate for Paradise Creek?

VII. Potential Strategies for Conducting the RI/FS

- Leverage existing site data to the maximum extent possible
- Use adaptive sampling approaches with associated field decision logic diagrams
- Use field analytical methods for both organic and inorganic constituents

VIII. Summary and Action Items

Site Log Attachment 2:
Draft Optimization Team Action Item List for Peck Iron & Metal Site

DRAFT Optimization Team Action Item List for Peck Iron & Metal Site 3/30/12

No.	Action Item	Responsible Party	Status
1	Prepare site visit trip report (including list of attendees and contact information)	Tetra Tech	Completed
2	Contact Elizabeth River Consortium • Identify stakeholders • Any information on historic dredge spoil disposal – locations on site	Tetra Tech	Contacting on 3-30-12
3	Provide VDEQ with Oregon contact (Bryn Thoms) regarding the ongoing Black Butte Mercury Mine optimization	OSRTI	To Be Completed
4	Upload site visit photograph log to EPA's Environmental Science Connector (ESC)	Tetra Tech	Completed
5	Determine the approach/assumptions/calculations/modeling performed by VDEQ to establish the TMDLs for a surface water body like Paradise Creek	Tetra Tech	In progress
6	Obtain flow/tidal information for Paradise Creek	Tetra Tech	Initiating on 3-30-12
7	Approach site owner to assess availability of as-built drawings for buildings, structures, buried utilities	Region 3	To Be Completed
8	Obtain from the City of Portsmouth maps showing locations of City sewers and water mains in the area	Tetra Tech	City contacted, direct contact provided
9	Assess TSCA status • Determine status of any remaining site TSCA requirements (How was 2,500 sample request resolved?) • What is TSCA's role moving forward?	Region 3	TB Completed
10	Determine if the City of Portsmouth imposes restrictions on the installation of wells for water supply purposes	Tetra Tech	Contacting on 3-30-12
11	Evaluate the charrette approach for reuse design options and potential input to the appropriate remedial cleanup levels that should be used for the RI	Region 3	To Be Completed
12	Contact Matt Mellon at Region 3 to discuss the following: • How will EPA preserve macro data (e.g. well construction information, boring logs, etc.) from the RI? • What format does Region 3 require for EQuiS?	OSRTI	To Be Completed
13	How should a yet-to-be-defined TMDL be considered with regard to defining site ARARs? What precedents exist for sites wherein a site remedial approach has been selected (and possibly completed) and the state has re-opened the site because of a TMDL issuance? How has Region 3 handled this situation?	OSRTI	In progress

ATTACHMENT B
PHOTOGRAPHIC LOG FOR FEBRUARY 22, 2012 SITE VISIT

View of front gate from inside the Peck Iron property. Facing north toward Elm Avenue.

View of the main (largest) structure on the Peck Iron property. Looking south/southeast near entry driveway and access gate. Building is decaying and contains a series of bays used for various storage and auto restoration activities

Car storage in the northern most bay of the main (largest) structure on the Peck Iron property. Looking east/southeast, notice roof collapse and other structural issues.

North side of main building on Peck Iron property. Looking west.

Main structure at Peck Iron property. Northeast corner of building facing South. Vat or sump containing liquid identified at the northeast corner of building.

Close up #1 of vat/sump identified at the northeast corner of the main building on the Peck Iron property. Sump was 2-3’ deep with ~ 1.5’ of standing water and had 2 pipes emanating from the building emptying into this structure.

Close up #2 of vat/sump identified at the northeast corner of the main building on the Peck Iron property. Sump was 2-3’ deep with ~ 1.5’ of standing water and had 2 pipes emanating from the building emptying into this structure.

Middle bay of main building on Peck Iron property. Notice drum storage area and staining of concrete areas.

Middle bay of main building on Peck Iron property. Close up of drum storage area.

Middle bay of main building on Peck Iron property. Close up of 1 of the drums (powdered magnesium) contained in the storage area.

Southern most bay of main building on Peck Iron property. Structural building issues, construction/demolition debris, paint cans and other materials are visible.

South side of main building on Peck Iron property, facing north/northwest. Demolition debris, excavation equipment and other metals debris are located south of the building.

View from the southeast corner of the main building on Peck Iron property, facing south. Standing water, excavation equipment, demolition debris piles and other metals debris are located south of the building. Also note the presence of the concrete structure on the left that is associated with the surface water feature of the adjacent Areff property.

View from south of the main building on Peck Iron property, facing north. Standing water, excavation/trucking equipment, demolition debris piles and other metals debris are located south of the building. On the left side of the photo in the distance to the North you can see the fence bordering the railroad tracks and Elm Avenue property entrance as well as buildings on the north side of Elm Avenue.

View from southwest of the main building on Peck Iron property, facing north. The Sherwin Williams facility is the light blue structure to the north. An additional area of excavation/trucking equipment storage/maintenance and metals debris extend south of the Sherwin Williams facility along the western property boundary. A pipe appears to extend from the Sherwin Williams property/facility and discharges surface water in the foreground.

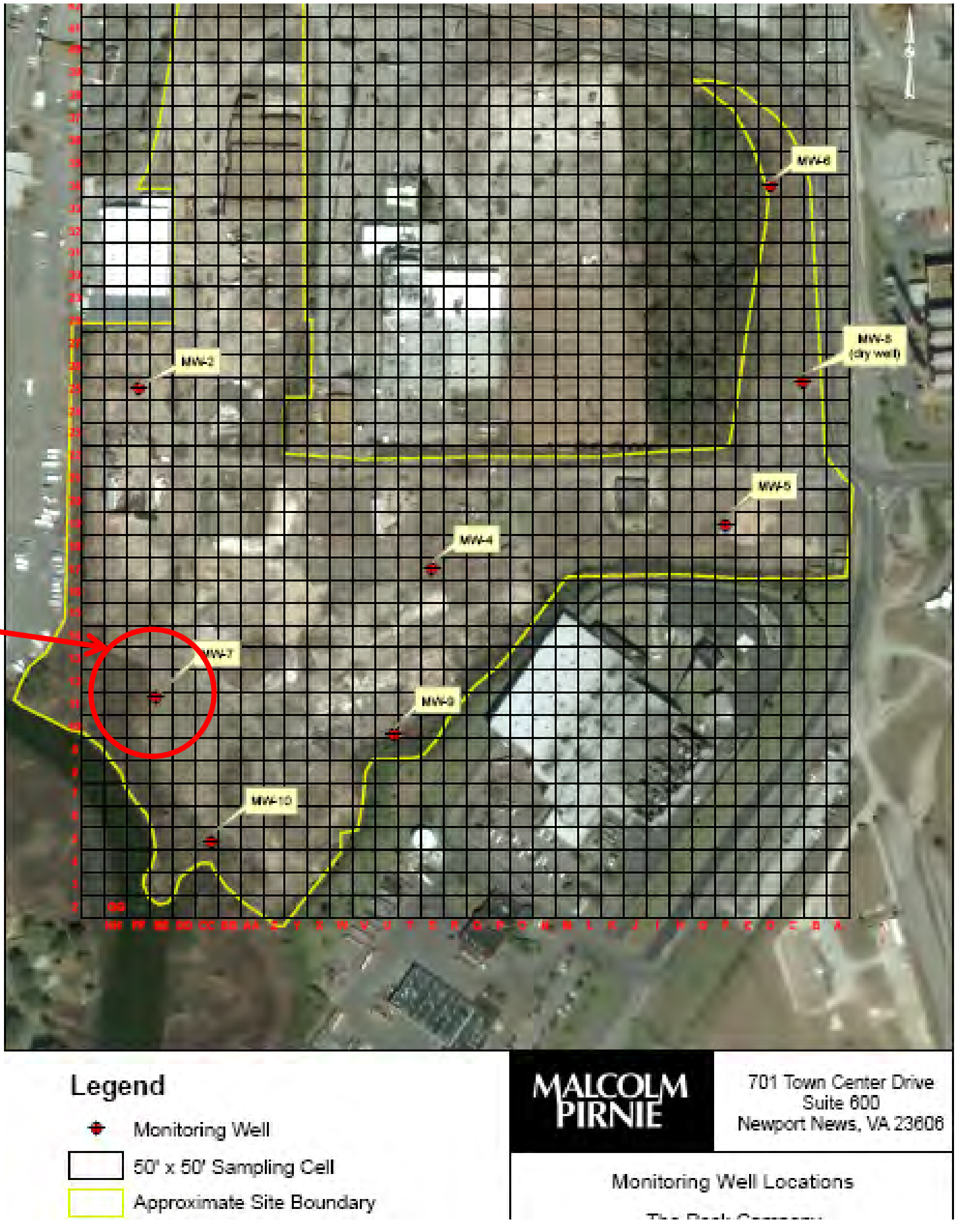
Close up of the pipe extending from the Sherwin Williams facility to the north and discharging surface water to the Peck Iron property near the excavation/trucking equipment storage/maintenance and metals debris south of the Sherwin Williams facility along the western property boundary.

Western drainage feature extending from the Sherwin Williams facility north of the property along the western property boundary to Paradise Creek in the south.

View of the western drainage feature looking north towards the Sherwin Williams facility. Notice the heavy vegetation and phragmites associated with this feature. The site is bordered by another industrial facility (possibly Navy property) to the west. A review of existing data indicates that historical sampling on the western most portions of the property along this feature may be limited.

Series of pictures showing the 18”-24” pipe extending along much of the western drainage feature. The pipe is discontinuous and contains a series of junction boxes, connects and breaks along northern sections of the pipe.

Series of pictures showing the 18”-24” pipe extending along much of the western drainage feature.   Facing south from the middle of the property the pipe appears more competent and may extend all the way to an outfall in Paradise Creek which can be seen in the distance.

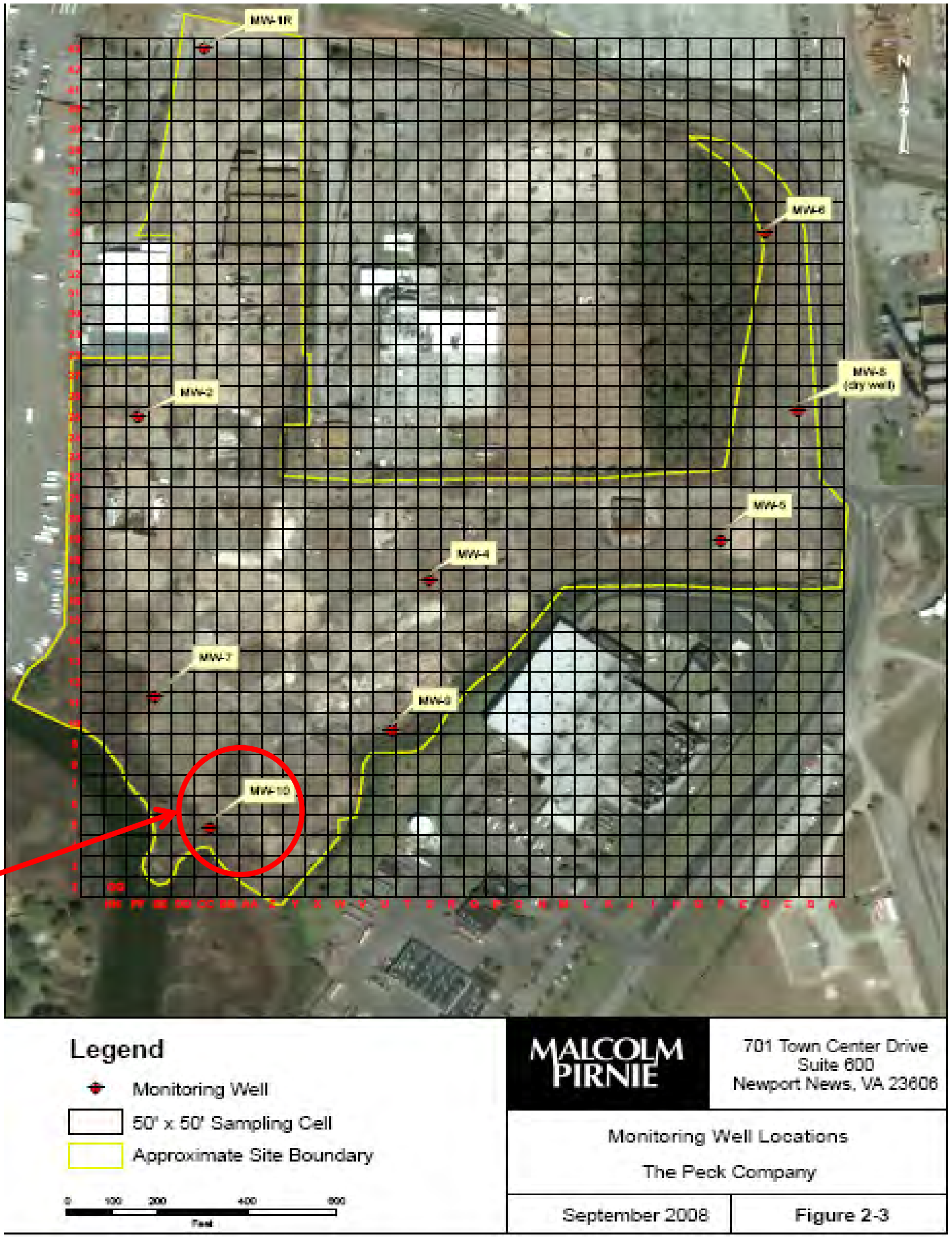


Monitoring well believed to be MW-7 identified in the adjacent site map. View is facing south towards Paradise Creek. Monitoring wells located were 2 inch diameter and stick up mounted but they were locked so we could not confirm the well identity.

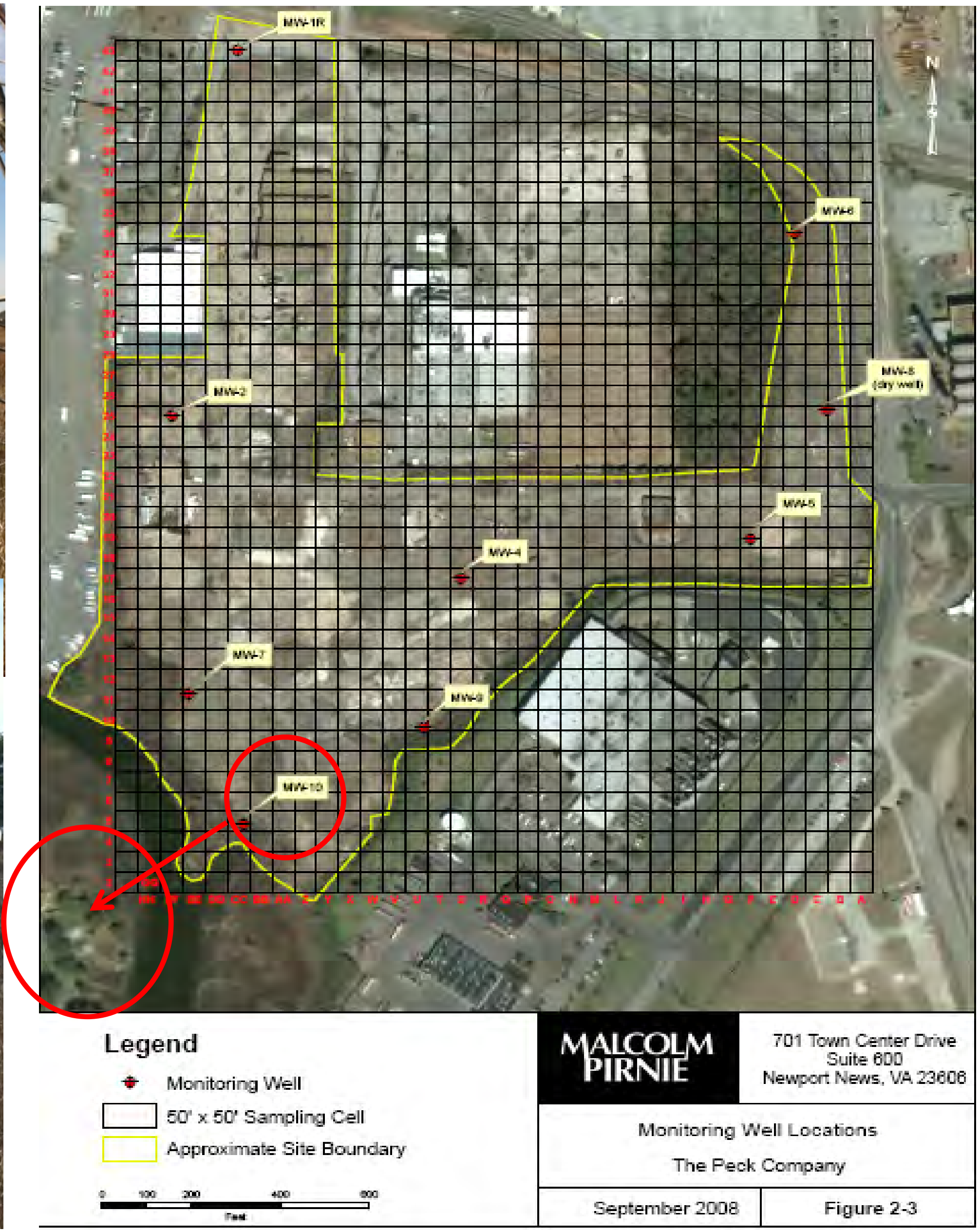
Located southeast of the monitoring well believed to be MW-7 identified in the previous slide, facing southwest. Bruce Pluta (R3 BTAG) and Jeff Tuttle (R3 Risk assessor) can be seen collecting a minnow trap from Paradise creek. There is approximately 100 feet of mud and wetlands before reaching the creek channel.

Series of photos displaying the minnow/chub species collected in the minnow trap shown in the previous slide. According to Mr. Pluta and Mr. Tuttle, the likely home range of this species is less than 100 feet indicating that the species may be both representative of the Paradise Creek food chain and has likely lived its entire existence along the Creek/Peck Iron property boundary.

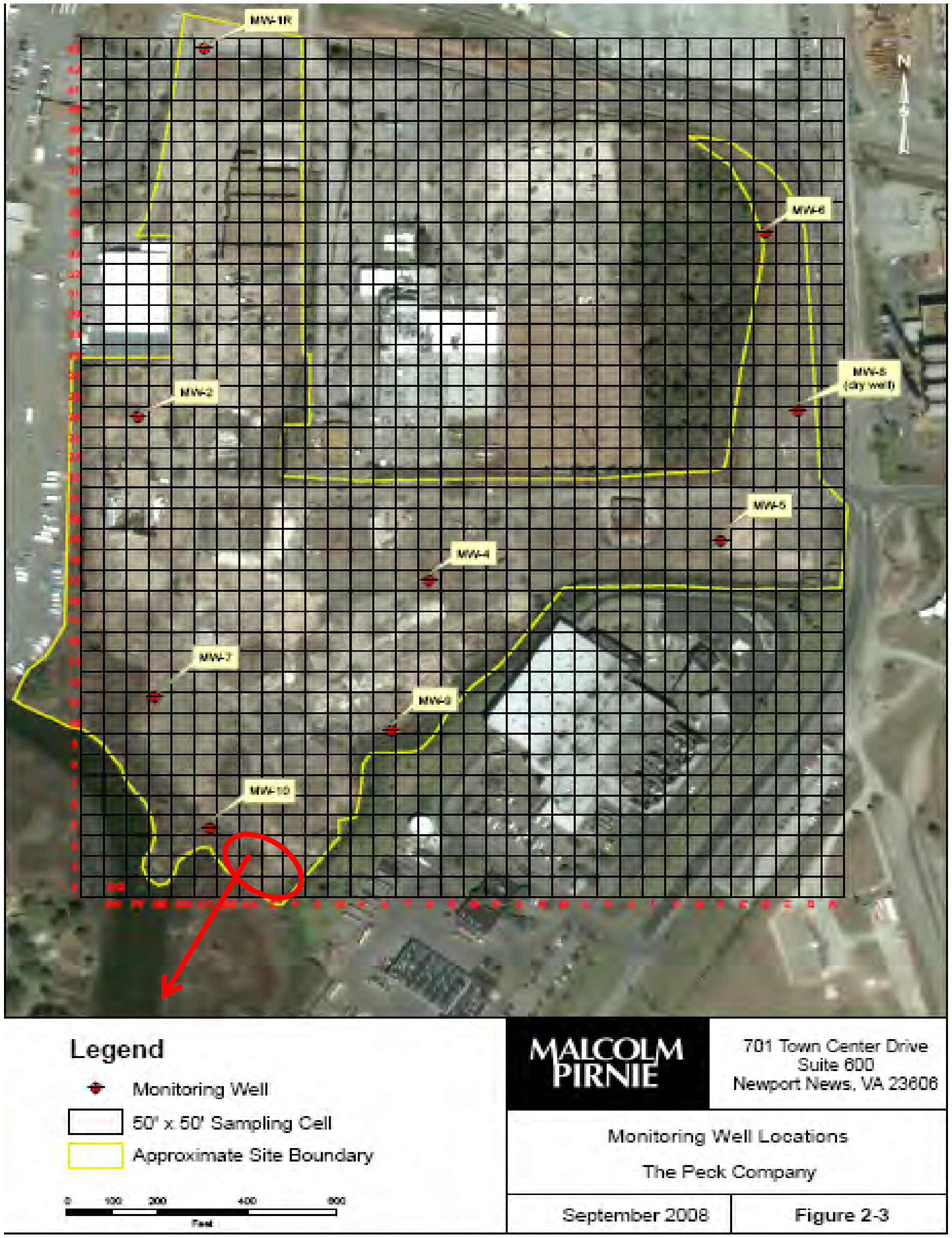
Brett Broderson (HGL) in search of nearby monitoring wells along the southern edge of the property. The Paradise Creek channel is clearly visible in background. There is approximately 100 feet of mud and wetlands before reaching the creek channel.



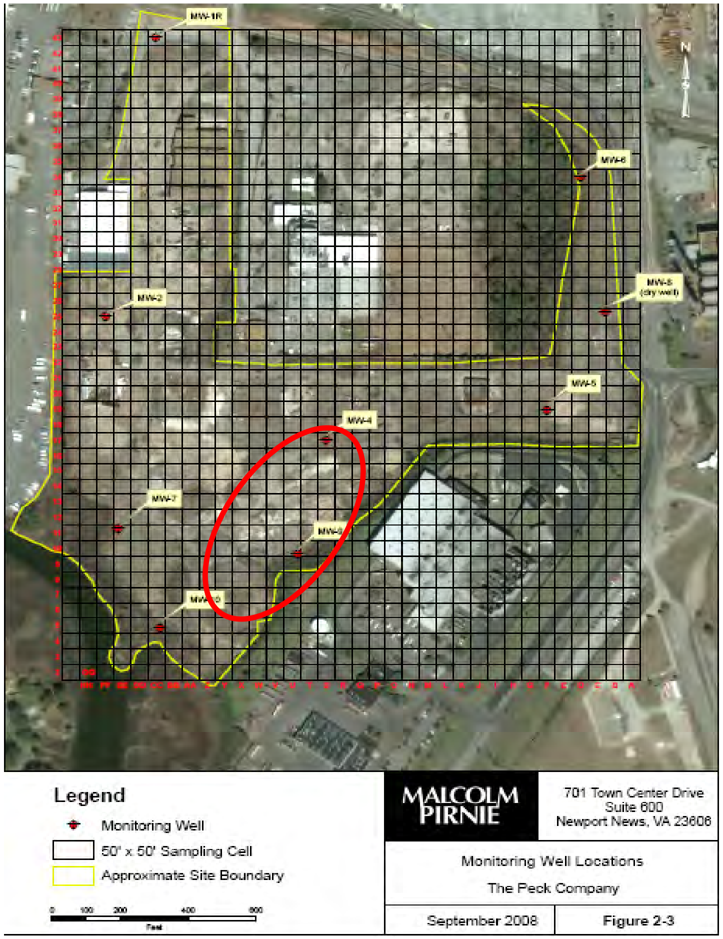
Monitoring well believed to be MW-10 identified in the adjacent site map. View is facing south towards Paradise Creek which can be seen in the background. Monitoring wells located were 2 inch diameter and stick up mounted but they were locked so we could not confirm the well identity.



View from monitoring well believed to be MW-10 identified in the adjacent site map. View is facing southwest towards Paradise Creek. The structures and tall pine trees shown in the map are visible in the distance of these photos.



Interface between demolition debris/fill material and the mud/marsh of Paradise Creek, facing south/southeast. This is the most southern portion of the property and the section of the Creek that runs north/south can be seen in the distance.

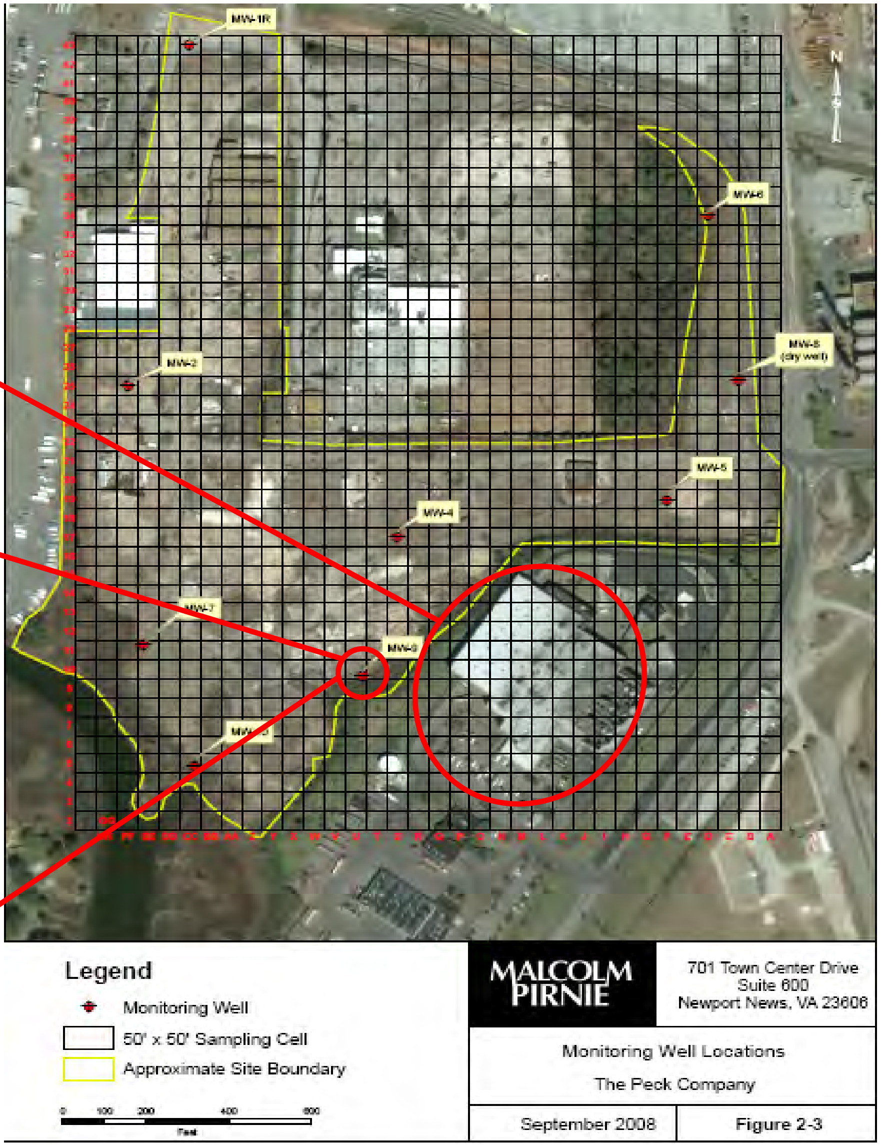


Arref Facility

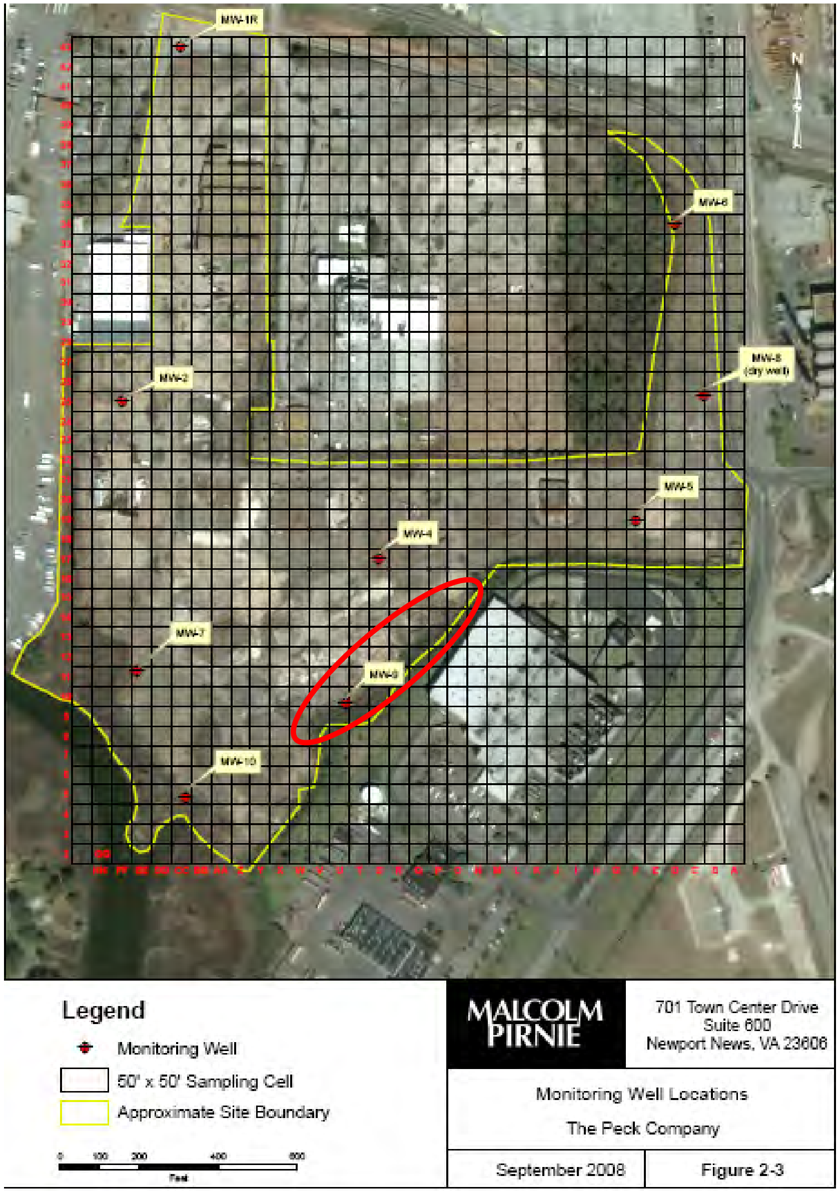
Southeastern Public Service Authority Refuse Derived Fuel facility (incinerator)

Series of pictures showing demolition debris and conduits (some deeper than 6') to the subsurface. In addition to standing water, debris piles, and potential subsurface conduits, the approximate area shown in the adjacent map contained some of the most expansive and (potentially deepest) fill and construction/demolition debris identified during the site visit. The bottom photo shows a view of the debris facing north from the area north of MW-10.

Metals recycling/crushing facility shown in later slides



Series of pictures showing demolition debris field. A monitoring well believed to be MW-9 is identified in the photos. In the distance of the bottom photo you can see the small green building believed to be a metals recycling/crushing facility.



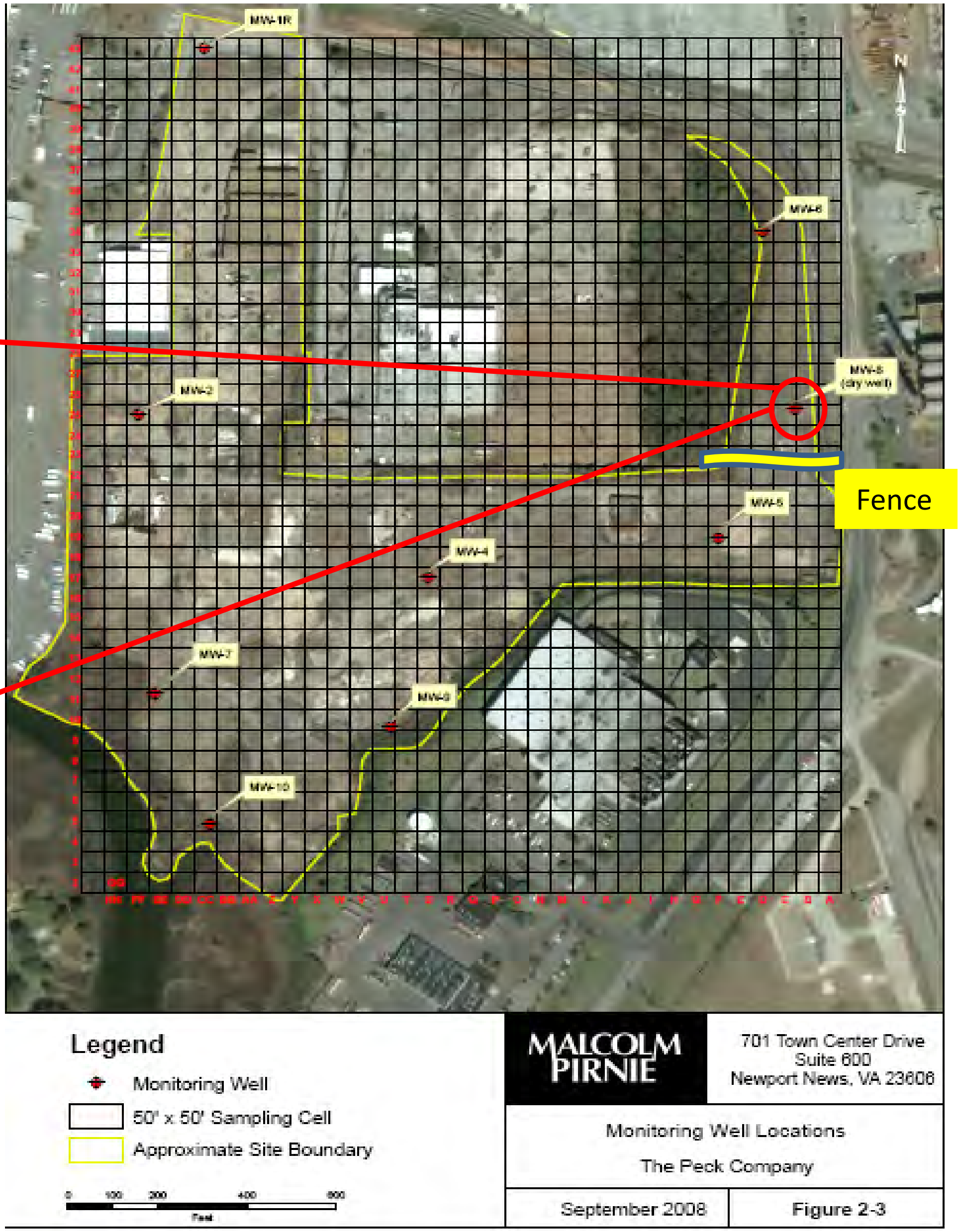
Series of photos showing surface water features, debris, and the wooded berm along the eastern property boundary. In some cases surface water appeared more prevalent (perhaps not solely due to a winter storm several days before the site visit), due to the presence of phragmites.

Series of photos taken near the metals recycling/crusher facility facing northeast towards the Southeastern Public Service Authority Refuse Derived Fuel facility (incinerator). Standing water in this area is believed to be due to a winter storm that struck the area several days before the site visit.

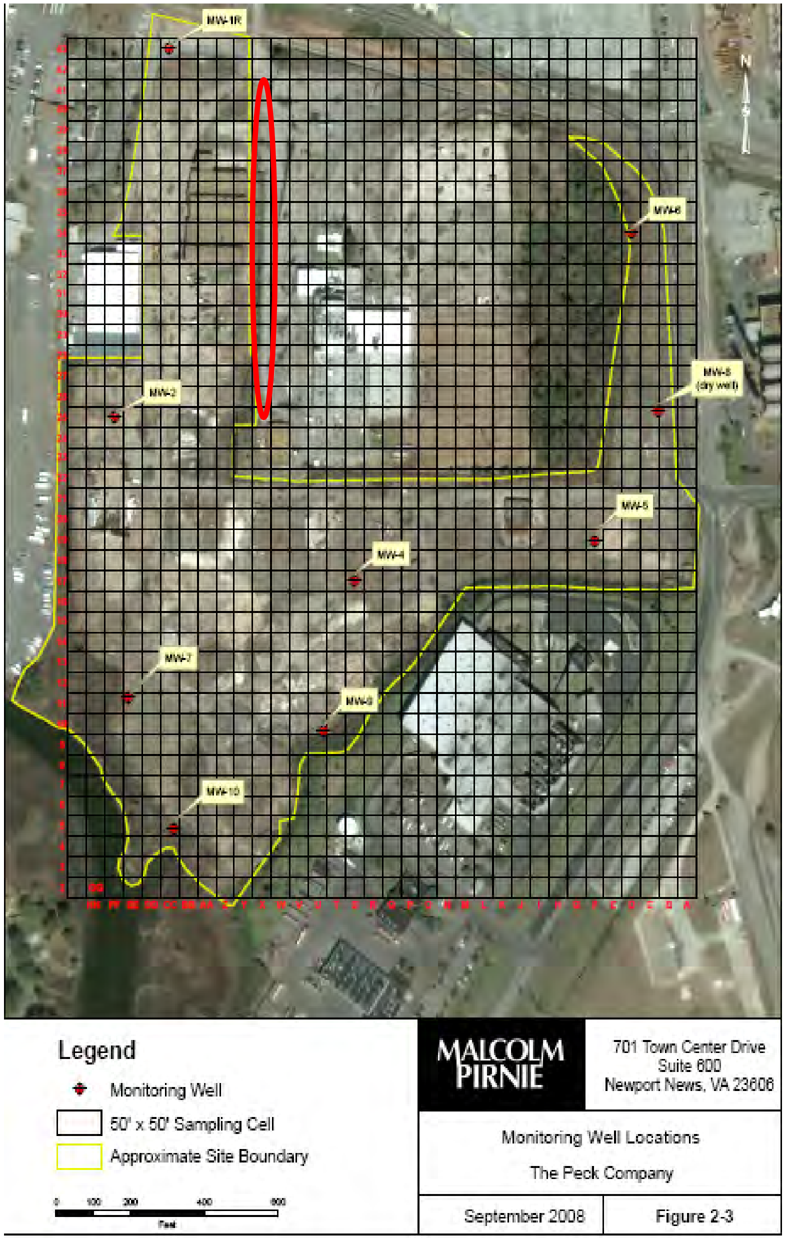
Series of photos taken near the metals recycling/crusher facility. The photo on the left shows the operation facility and infrastructure for a claw/crusher as well as metals and other debris on a concrete pad in the foreground. Behind the facility is a white building, believed to be a maintenance shop shown in subsequent slides. Some of the highest historical hits of PCBs are located near this facility. Photos on the left show a transformer likely used in powering the facility located on east side (back) of the control facility and crushing pad.

Close up inside the sump

Maintenance facility located just northeast of the metals recycling/crusher facility. The building and surrounding area was under several inches of standing water. In the foreground of the photo on the upper left is the sump/piping possibly associated with a UST.



View looking north from the fence line north of maintenance facility. A monitoring well believed to be MW-8 is identified.



Series of photos of the concrete surface drainage feature located along the property boundary with the Arref facility.