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HALEY& ALDRICH

15 July 2014
File No. 28612-302

Atlantic Richfield Company
150 West Warrenville Road
Naperville, IL 60563

Attention: Paul Johnson, P.G.

Subject: Remedial Design Work Plan
Former Anaconda Wire and Cable Company

Hastings-on-Hudson, New York
Site No. #3-60-022

Dear Paul:

The attached Remedial Design Work Plan (RDWP) for OU-1 and OU-2 dated 15 July 2014 has been prepared in accordance with the requirements of the 2013 Amended Order on Consent and DER-10 Technical Guidance for Site Investigation and Remediation (NYSDEC, 2010) for submittal to the New York State Department of Environmental Conservation. The RDWP was modified to incorporate the changes identified in the letter from NYSDEC dated June 16, 2014 upon which approval was contingent.

Sincerely yours,
HALEY & ALDRICH OF NEW YORK

Wayne Hardison

Wayne C. Hardison, P.E.
Program Manager

Enclosures:
NYSDEC letter dated June 16, 2014
Remedial Design Work Plan dated July 15, 2014

New York State Department of Environmental Conservation
Division of Environmental Remediation
Remedial Bureau C, 11th Floor
625 Broadway, Albany, New York 12233-7014
Phone: (518) 402-9662 • **Fax:** (518) 402-9679
Website: www.dec.ny.gov

Joe Martens
Commissioner

June 16, 2014

Mr. Paul G. Johnson, PG
Operations Project Manager
Atlantic Richfield Company
Remediation Management
150 W. Warrenville Road
MC 200 1E
Naperville, Illinois 60563

Dear Mr. Johnson:

Re: Harbor at Hastings Site 360022
Remedial Design Work Plan

The New York State Department of Environmental Conservation (Department) has reviewed your letter dated June 5, 2014 transmiting Atlantic Richfield Company's response to the Department's May 7, 2014 comments on the draft Remedial Design Work Plan. The following modification is requested based on our review:

> Appendix 5 should be modified to clearly identify what sediment coring locations will be sampled in 2014. Suggested modified language for Appendix 5 is enclosed.

The Remedial Design Work Plan is approved contingent upon incorporating the identified changes in the document.

In accordance with the Order on Consent and 6NYCRR 375-1.6(d), please indicate within 15 days whether you will modify the work plan, and submit the modified work plan within 30 days. The modified work plan should be submitted to the parties and in the formats specified in the Order on Consent.

Please contact me if you have any questions or concerns at (518) 402-9662.

Sincerely,

William T. Ports

William T. Ports, P.E.
Project Manager
Remedial Bureau C

Enclosure

ec: A. Peterson ARCO
J. Lucari ARCO
M. Daneker Arnold & Porter
W. Hardison Haley & Aldrich
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HALEY & ALDRICH

15 July 2014
File No. 28612-302

Mr. William T. Ports, P.E.
New York State Department Environmental Conservation
Division of Environmental Remediation
625 Broadway
Albany, New York 12233-7014

Subject: Remedial Design Work Plan
Former Anaconda Wire and Cable Company
One River Street
Hastings-on-Hudson, New York
Site No. #3-60-022

Dear Mr. Ports:

Haley & Aldrich of New York (Haley & Aldrich) is pleased to submit this Remedial Design Work Plan, prepared for the Former Anaconda Wire and Cable Company site located at 1 River Street, Hastings on Hudson, New York.

I, Wayne Hardison certify that I am currently a NYS registered professional engineer and that this Remedial Design Work Plan was prepared in accordance with the applicable statues and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

PROFESSIONAL ENGINEER CERTIFICATION

Signature: ______________________

Name: _Wayne C. Hardison, P.E.______

Title: _Program Manager____________

Lic. State/#: _067080____________________

Date: _15 July 2014____________

Engineer's

Please contact us if you have questions.

Sincerely yours,
HALEY & ALDRICH OF NEW YORK

Wayne C. Hardison, P.E.
Program Manager

c: Atlantic Richfield; Attn.: Mr. Paul Johnson

REMEDIAL DESIGN WORK PLAN
FORMER ANACONDA WIRE AND CABLE COMPANY SITE
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK
NYSDEC SITE #3-60-022

by

Haley & Aldrich of New York
Rochester, New York

for

Atlantic Richfield Company
Naperville, Illinois

File No. 28612
15 July 2014

HALEY & ALDRICH

EXECUTIVE SUMMARY

This Remedial Design Work Plan (RDWP) describes the activities required to prepare a remedial design in accordance with the 2013 Amended Order on Consent. The RDWP has also been prepared in accordance with DER-10 Technical Guidance for Site Investigation and Remediation (NYSDEC, 2010) Section 5.2, Remedial Design. This RDWP is organized into sections as summarized below.

Pre-Design Investigation (PDI)

The tasks for PDI include borings, test pits, utility location, bench tests, delineation of remedial excavation extents, and delineation of remedial dredge extents. Data will also be collected to support updates to the site groundwater model. A determination whether any required pilot tests are required will be made during design and supplemental work plans submitted separately. Appendices are provided which include specific technical details for each activity.

Appendices also include the Quality Assurance Project Plan (QAPP) and Community Air Monitoring Plan (CAMP) for the PDI. The Health & Safety Plan will be developed prior to mobilization in accordance with site-specific requirements.

Remedial Design

The remedial design section provides an overview of the design process. The final details regarding specific drawings and specifications will be developed during the design and submitted as a Final Design. In general, the goal of the design process is to develop documents for construction of the remedy.

This section also discusses specific plans that will be developed as part of the design including the Remedial Action Monitoring Plan (RAMP), Community and Environmental Response Plan (CERP), and the construction phase CAMP.

Permits

This section identifies required permits, exempted permits or other authorizations for the remedial action. This project requires Federal, State and local permits including a Joint Permit Application.

Schedule

This section describes the schedule for the completion of the PDI and design.

Post-Construction Plans

This section identifies the plans and actions currently known to be required following construction. Specific plans, including the Site Management Plan (SMP), will be developed and submitted separately.

Site Figures

The activities conducted as part of the PDI will further refine the understanding of the scope of the remedy. As indicated in DER-10 Section 5.2, scaled site maps which identify areas where remedial actions will be conducted as well as locations, depths, and concentrations of contaminants are provided in Appendix C of this RDWP. The included maps have been previously presented as Figures in two documents: the Revised Feasibility Study (RFS) and the OU-2 ROD.

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1. INTRODUCTION

1.1 Site Location and Description

The Site is located on the eastern bank of the Hudson River within the confines of the Hudson River Valley (Figure 1). The ground surface at the Site is relatively flat with ground surface predominantly ranging from approximately El. 3 to El. 11.

The Site consists of two Operable Units, OU-1 and OU-2. OU-1 is an upland area approximately 2,400 feet long by 500 feet wide. OU-2 is the area that extends westward into the Hudson River approximately 400 feet from the western OU-1 boundary, north into the Old Marina (approximately 300 feet north of the northwestern corner of OU-1), and approximately parallel to the southern property boundary. OU-1 and OU-2 boundaries are described in the Record of Decision (ROD) (NYSDEC, 2012), also see Appendix C Site Figures.

The Hudson River is considered a drowned-river estuary. The river is approximately 4,800 feet wide at the Site with a maximum depth of about 50 feet at midstream. There is no navigation channel specified at the Site's location along the river. Based on historical studies the currents vary from about 2.2 fps on the flood tide (flowing upstream) to about 2.9 fps on the ebb tide (flowing downstream). Depending on wind direction and velocity, wave heights of 3 feet to 5 feet and wakes of passing vessels of 2.5 feet have been observed. During the winter, ice floes may accumulate along the eastern shore of the Hudson River when there is a strong west wind.

1.2 Site History

The on-shore portion of the Site (OU-1) was created by filling the Hudson River between the mid-1800s and the early 1900s with the placement of uncontrolled fill. The western edge of the fill progressively utilized a series of bulkhead walls of various construction types. These bulkhead walls establish the boundaries of OU-1 and some elements of the off-shore portion of the Site (OU-2). Buildings at the Site were supported by piles likely driven to or into the Basal Sand, which is a sand unit located at depths ranging from 10 feet to more than 70 feet below ground surface (bgs). The Site was primarily used as an industrial facility for well over a century. Buildings were added and demolished since the Site's original development.

During World War II, Anaconda Wire and Cable Company (AWC) was awarded contracts from the U.S. Navy (Navy) to manufacture electric cable for shipboard use. The Navy required the insulation of shipboard cable to be heat and flame resistant to avoid fire damage and to withstand heat generated from conducting high electric currents. PCB mixtures were used to make these products for the Navy. The material was used exclusively during the World War II-era and PCB use in the manufacturing of cable was suspended after AWC's contracts with the Navy were fulfilled at the end of the war, as there was no civilian market for these products. After World War II, AWC produced electrical and television cable until it ceased operations in 1975. Atlantic Richfield purchased AWC in 1977, never operated the plant, and then sold the Site in 1978. Since 1978, several owners and tenants subsequently occupied the Site. In 1998, AR's affiliate, ARCO Environmental Remediation Limited (AERL), purchased the Site in order to facilitate environmental investigation and remediation efforts.

As of 2013, Building 52 and the water tower are the only remaining structures on the Site. Building 52 is located in the northeastern corner of the Site. All other buildings have been demolished with only the slabs remaining. All tenants have vacated the Site.

1.3 Remedial Investigation and Feasibility Study Summary

Since 1998, AR and AERL have implemented remedial investigations, Interim Remedial Measures (IRM) and demolition activities as part of the remedial process. NYSDEC issued a Record of Decision (ROD) for the OU-1 portion of the Site in March 2004 (NYSDEC, 2004). In March 2003 the Final Feasibility Study Report (FS) for OU-2 was prepared and submitted by Earth Tech of New York, Inc. (Earth Tech) (Earth Tech, 2003) based on the December 2000 Remedial Investigation Report (RI) for OU-2 (Earth Tech, 2000).

In October 2003, NYSDEC issued the Proposed Remedial Action Plan (PRAP) for OU-2 (NYSDEC, 2003). Subsequent investigations completed by Parsons lead to the necessity for updating the 2003 OU-2 FS. The Supplemental Feasibility Study Report for Operable Unit No. 2 (SFS) was completed and submitted to NYSDEC in April 2006 (Parsons, 2006). In 2009, a Modified Feasibility Study Report (MFS) was prepared and submitted to NYSDEC (Haley & Aldrich, 2009), which incorporated additional new data and analyses with the intent to fully integrate OU-2 and OU-1 remedial activities. In 2011, a Revised Feasibility Study (RFS) was submitted (Haley & Aldrich, 2011) to address proposed amendments to the OU-1 ROD and the integrated remedies for OU-1 and OU-2.

On 30 March 2012 NYSDEC issued an amended ROD for OU-1 and a ROD for OU-2. The Amended Order on Consent was signed 6 November 2013.

1.4 Active Interim Remedial Measures

Two Interim Remedial Measures (IRM) have been undertaken at the Site that are currently active. The active IRMs are LNAPL recovery and DNAPL recovery. LNAPL is recovered periodically from select wells located near the North Boat Slip in the vicinity of the former boiler house. DNAPL is recovered periodically from select wells installed in the Northwest Onshore Area (see Figure 2).

1.5 Project Goals and Objectives

The OU-1 ROD Amendment states that:

The goals selected for this site are:

- *Reduce, control, or eliminate to the extent practicable the contamination present within the soils and fill on site, and thereby eliminate the significant threat posed by the presence of hazardous wastes at the site.*
- *Eliminate the potential for direct human or animal contact with the contaminated soils or groundwater on site.*
- *Eliminate the threat to surface waters and sediments by eliminating surface run-off and subsurface releases of fill from the site.*

- *Eliminate, to the extent practicable, the migration of PCBs, metals and other contaminants into the Hudson River by surface and subsurface erosion of contaminated soils, transport of contaminated groundwater, and migration of PCBs in both elastic material and petroleum phases.*

- *Prevent, to the extent possible, migration of contaminants at the site to groundwater and surface water.*

Further, the remediation goals for the site include attaining to the extent practicable:

- *Provide for attainment of SCGs for groundwater quality at the limits of the site.*

The OU-2 ROD states:

The remedial action objectives for this site are:

Surface Water

RAOs for Public Health Protection

- *Prevent surface water contamination which may result in fish advisories.*

RAOs for Environmental Protection

- *Restore surface water to ambient water quality criteria for the contaminant of concern.*

- *Prevent impacts to biota from ingestion/direct contact with surface water causing toxicity and impacts from bioaccumulation through the marine or aquatic food chain.*

Sediment

RAOs for Public Health Protection

- *Prevent direct contact with contaminated sediments.*

- *Prevent surface water contamination which may result in fish advisories.*

RAOs for Environmental Protection

- *Prevent releases of contaminant(s) from sediments that would result in surface water levels in excess of (ambient water quality criteria).*

- *Prevent impacts to biota from ingestion/direct contact with sediments causing toxicity or impacts from bioaccumulation through the marine or aquatic food chain.*

- *Restore sediments to pre-release/background conditions to the extent feasible.*

1.5.1 Standards, Criteria and Guidance

Table 1 presents a list of SCGs applicable to the Site. The list was derived from the NYSDEC website titled "Index of Standards, Criteria and Guidance (SCGs) for Investigation and Remediation of Inactive Hazardous Waste Disposal Sites." In summary, applicable SCGs for the Site were identified predominantly from the following sources.

- Part 375 – Environmental Remediation Programs. NYSDEC's regulations concerning remedial programs for Inactive Hazardous Waste Disposal Sites.
- Related NYSDEC technical and administrative guidance including DER-10 and Technical and Operational Guidance (TOGS) 1.1.1 Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations.
- Part 700-706 – Water Quality Regulations for Surface Waters and Groundwater.
- NYSDEC Fish, Wildlife and Marine Resource Guide Documents, including Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites (NYSDEC, 1994), NYSDEC Shoreline Protection Guidance (NYSDEC, 2007), and Technical Guidance for Screening of Contaminated Sediments (NYSDEC, 1999).

SCGs will be identified in more detail in the Preliminary Design.

1.6 Selected Remedy

The selected remedy is described in the OU-1 ROD Amendment and the OU-2 ROD. Excerpts are provided below. Appendix C includes figures from the RFS and the OU-2 ROD that describe the remedy. Appendix D includes the OU-1 Record of Decision and the OU-2 Record of Decision which summarize the nature and extent of contamination.

1.6.1 OU-1

The 2012 ROD Amendment resulted from new data that had been obtained. The elements of the OU-1 (on-shore) remedy are as follows:

"The elements of the amended remedy listed below are identified as unchanged, modified or new when compared to the original 2004 ROD:

1. *A remedial design program to verify the components of the conceptual design and provide the details necessary for the construction, operation and maintenance, and monitoring of the remedial program. Green remediation principals and techniques will be implemented to the extent feasible in the design, implementation, and site management of the remedy as per DER-31. The major green remediation components are as follows:*

    - *Considering the environmental impacts of treatment technologies and remedy stewardship over the Longterm;*
    - *Reducing direct and indirect greenhouse gas and other emissions;*
    - *Increasing energy efficiency and minimizing use of non-renewable energy;*
    - *Conserving and efficiently managing resources and materials;*

- *Reducing waste, increasing recycling and increasing reuse of materials which would otherwise be considered a waste;*
- *Maximizing habitat value and creating habitat when possible;*
- *Fostering green and healthy communities and working landscapes which balance ecological, economic and social goals; and*
- *Integrating the remedy with the end use where possible and encouraging green and sustainable redevelopment (modified)*

2. *At the Northwest Corner of the site and along the Northern Shoreline, excavation of surface soil (0- 12 inches) contains greater than 1ppm PCB and subsurface soil containing greater than 10 ppm PCB to a maximum depth of 9 feet. Outside of the Northwest Corner and the Northern Shoreline areas, excavation of surface soil (0-12 inches) containing greater than 1ppm PCB and subsurface soil contains greater than 10 ppm PCB, to a maximum depth of 12 feet. (modified)*

3. *Outfalls and associated pipe bedding from Building 52 that are potential PCB source areas will be excavated, sampled and removed, or decommissioned as approved by the Department. (new)*

4. *Excavation of shallow soils from the southern portion of the site that are identified as "lead hotspots". These correspond to lead levels between 2,160 ppm and 43,200 ppm. (unchanged)*

5. *In conjunction with OU2, installation of a sheet pile wall within the Hudson River to provide containment and allow for the recovery of PCB DNAPL onshore and offshore of the northwest corner of the site. The location and alignment of the proposed sheet pile wall will be verified during the remedial design to minimize filling into the Hudson River. The area behind the sheet pile wall will be filled with soil and/or lightweight aggregate as approved by the Department. The sheet pile wall will include sealed joints, installation of tie-rods, upland anchors, and cathodic protection. The wall system will also include groundwater filtration units to adsorb contaminants that may be present in groundwater discharging to the river. (new)*

6. *The shoreline south of the northwest area will either be a steel bulkhead or construction of a sloped shoreline cover system. The sloped shoreline cover system will be designed and constructed such that no additional fill material will be placed into the Hudson River, and will require the removal of sediment or fill below the current sediment or water elevation for placement of a cover system. The sloped shoreline cover system will be designed with the following layers: an isolation layer of soil or geotextile designed to prevent the migration of contaminated soil particles into the Hudson River; an erosion protection layer; and a habitat/surface substrate layer. The habitat/surface substrate layer will be designed to restore aquatic, intertidal and stream bank habitats while taking into account erosional forces, such as waves and currents. (new)*

7. *Construction and operation of a recovery system for PCB DNAPL, consisting of a series of wells and an active pumping system to remove fluid PCB material as it collects. (new)*

8. *A site cover will be required to allow for restricted residential use of the site. The cover will consist either of the structures such as buildings, pavement, sidewalks comprising the site development or a soil cover in areas where the upper two feet of exposed surface soil will exceed the applicable soil cleanup objectives (SCOs). However, pile-supported structures will not be permitted in any areas where PCB material is potentially present. Where the soil cover is required, it will be a minimum of two feet of soil, meeting the SCOs for cover material as set forth in 6 NYCRR Part 375-6.7(d) for restricted residential use. The soil cover will be placed over a demarcation layer, with the upper six inches of the soil of sufficient quality to maintain a vegetation layer with appropriate natural species. (modified)"*

The ROD also requires development of a Site Management Plan, including institutional controls, which will be implemented after construction.

1.6.2 OU-2

The 2012 ROD describes the elements of the OU-2 (off-shore) remedy as follows:

1. A remedial design program would be implemented to provide the details necessary for the construction, operation, maintenance, and monitoring of the remedial program. Green remediation principals and techniques will be implemented to the extent feasible in the design, implementation, and site management of the remedy as per DER-31. The major green remediation components are as follows:

- *Considering the environmental impacts of treatment technologies and remedy stewardship over the Longterm;*
- *Reducing direct and indirect greenhouse gas and other emissions;*
- *Increasing energy efficiency and minimizing use of non-renewable energy;*
- *Conserving and efficiently managing resources and materials;*
- *Reducing waste, increasing recycling and increasing reuse of materials which would otherwise be considered a waste;*
- *Maximizing habitat value and creating habitat when possible;*
- *Fostering green and healthy communities and working landscapes which balance ecological, economic and social goals; and*
- *Integrating the remedy with the end use where possible and encouraging green and sustainable re-development*

2. Installation of a sheet pile wall within the Hudson River to provide containment and allow for the recovery of liquid PCB DNAPL offshore of the northwest corner of the site. The location and alignment of the northwest extension area (NEA) sheet pile wall will be verified during the remedial design to minimize filling into the Hudson River while enabling effective DNAPL containment and recovery and maintaining stability of *the site. It is estimated that this area of fill will encompass 0.88 acres. The area behind the sheet pile wall will be filled with soil and/or lightweight aggregate as approved by the Department. The sheet pile wall will include sealed joints, installation of tie-rods, upland anchors, and cathodic protection. The wall system will also include groundwater filtration units to adsorb contaminants that may be present in groundwater before discharge to the river.*

3. *Mitigation of fill placed into the Hudson River to replace the aquatic habitat that will be lost as a result of the NEA. Mitigation will involve the creation and/or restoration of river habitat in accordance with a Department-approved plan.*

4. *Development and implementation of a plan for further delineation and recovery of PCB DNAPL from beneath the northwest corner of the site and the NEA.*

5. *Removal of sediment and fill that contains PCB concentrations greater than 1 ppm and/or copper, zinc and lead concentrations above the background concentrations listed in Table 2 of Exhibit A, to a maximum excavation depth of 6 feet within the area where sediment resuspension controls, such as a fixed silt curtain, are feasible. This area generally corresponds to a water depth of 15 feet and a distance from the shoreline into the river of approximately 60 to 80 feet and along approximately 2000 feet of shoreline.*

6. *The specific area where fixed sediment resuspension controls can be feasibly deployed will be evaluated during design based on the water depth and velocity conditions at the site. Alternative designs for fixed resuspension controls will be evaluated to increase the depth of feasible resuspension controls. Designs for mobile resuspension controls will also be evaluated and developed for dredging in deeper water, if necessary.*

7. *Removal of sediment from a targeted area outside the northwest extension area in deeper than 15 feet of water that is defined by PCB concentrations greater than 50 ppm, to a maximum depth of 6 feet. During the design, sampling will be performed to determine whether additional areas of PCBs greater than 50 ppm exist. Based upon an evaluation of the significance of the distribution of contaminants and the feasibility of removal, additional areas of sediment may be targeted for dredging.*

8. *On-site dewatering of dredged and excavated sediments for off-site transportation and disposal or onsite reuse, as appropriate. On-site reuse of sediments will be evaluated during design. Water removed from the sediment will be treated and discharged back to the river in compliance with regulatory requirements.*

9. *Backfill of dredged areas with Department-approved material. Dredged areas within the resuspension controls will be backfilled with clean material to isolate remaining contamination, prevent erosion of cap materials, restore bathymetry, and provide a habitat layer. In nearshore areas which have contamination remaining above background concentrations, isolation capping will be placed following dredging. The isolation cap will consist of a sand isolation layer; armoring layer; and a minimum of a 24 inch habitat layer. The isolation and armoring layer thicknesses and materials of the cap will be established in the remedial design. As part of the design, a river flow and deposition study will be conducted to determine approximate sedimentation rates and the acceptability that up to 12 inches of the habitat layer may fill in by natural*

deposition within a reasonable duration of time after installation of the remainder of the isolation cap. Additional backfill needed to reach bathymetry requirements will be placed between the erosion protection layer and habitat layer. The habitat layer will be designed to restore aquatic habitat. Dredged areas that are outside the near shore area will be backfilled with appropriate river substrate to within 12 inches of the pre-dredge elevation provided that the sedimentation study demonstrates that sufficient deposition will occur within a reasonable time frame. All activities associated with the excavation and restoration of Hudson River sediments will meet the requirements of 6NYCRR Part 608."

The ROD also requires development of a Site Management Plan, including institutional controls, which will be implemented after construction.

2. PRE-DESIGN INVESTIGATION

Numerous prior investigations have collected data that will be used for design of the remedy. Specifically, environmental and geotechnical data from the following recent activities is relevant:

- 50% Design Report for Operable Unit No. 1, Haley & Aldrich of NY (2006)
- Supplemental Northwest Corner Investigation Findings Report", Haley & Aldrich of NY (2008)
- DNAPL IRM Recovery Well Installation", Haley & Aldrich of NY (2010).

However, data gaps remain that must be filled in order to complete the design. These data gaps include definition of excavation extents, definition of dredge extents, geotechnical data at select alignments and supplemental information regarding site features which will impact design and constructability (e.g. riprap, outfalls, former sumps, etc.)

This section describes the activities for collection of additional data required for the design of the remedy. The majority of the activities will be completed upon approval of this work plan, however, some specific activities have been completed under separate work plans.

The OU-2 ROD requires an updated bathymetry survey be completed as part of the baseline sampling for the Site Management Plan. This information is also required for planning the PDI, and was completed in accordance with a work plan approved by NYSDEC (letter dated 10 October 2012); results have been submitted to NYSDEC. Review of the results from the bathymetry survey indicates that none of the anomalies require additional probes or borings. See Appendix C for the bathymetry results submittal.

2.1 Phase 1 PDI Investigation

To better plan the PDI, some activities have been submitted and approved under the OU-1 ROD prior to this RDWP. The Phase 1 PDI Investigation (Phase 1) work plan is attached for reference as Appendix 1 and includes the following tasks.

- Ground Penetrating Radar (GPR) survey will be evaluated.

- Groundwater level data collection through the deployment of data loggers in select existing monitoring wells to support the update of the site-specific groundwater model.

- The Site survey will update site features and investigation locations and be completed in phases by a NYS licensed surveyor.

2.2 OU-1 Supplemental Investigation

Data collection in this section includes various topics or planning related information required for design (see Appendix 2).

2.2.1 Groundwater Levels

Design of the remedy requires collection of groundwater elevations and updating the existing groundwater model. In addition to the 16 data loggers installed in existing wells as part of the

Phase 1 PDI Investigation, seven (7) groundwater monitoring wells will be installed and data loggers deployed therein.

2.2.2 Groundwater Sampling

Baseline groundwater sampling will be completed to monitor shallow groundwater prior to remedial construction to evaluate the long term effectiveness of the remedy.

Baseline groundwater sampling will be completed for three upgradient wells and three Site wells during the PDI (as shown on Figure 2-3 of Appendix 2) and then annually thereafter until the beginning of construction as described below. Groundwater samples will be collected using low flow techniques and analyzed for PCBs, beryllium, copper, lead, and zinc.

The goal of the baseline groundwater sampling program is to sample shallow-screened wells to provide data at both upgradient and down gradient locations across the Site to establish a baseline for groundwater quality; groundwater flow is generally west to east. A description of monitoring wells selected for this program along with a rationale for their selection is provided below with additional information in Appendix 2.

Upgradient Wells include PDMW-16S, PDMW-20S and PDMW-19S and are generally located upgradient of Site wells in areas absent of known impacted soils. Previous groundwater samples ranged from non-detect (ND) to 0.00061 ppm for PCBs and ND to 0.0043 for lead.

Site wells include MW-01A, MW-05 and MW-09 and are generally located down gradient of or proximate to PCB and/or lead soil contamination or suspected sources of contamination. Previous groundwater samples ranged from ND to 0.16 ppm for PCBs and ND to 0.5 ppm for lead.

These well pairs will provide upgradient and down gradient samples in various areas of contamination that will be addressed during implementation of the remedy.

2.2.3 Void Assessment

There are several areas of the Site, especially in areas adjacent to the Hudson River, in which evidence of soil erosion or subsidence beneath the concrete slab (i.e. voids) have been observed. These areas, as shown on Figure 2-2 within Appendix 2, will be assessed by using a hammer drill to access the subsurface and evaluating soil contact with the slab. Results of this evaluation will be used to support the remedial design.

2.2.4 Subsurface Anomalies

Additional investigation will be conducted for various sumps and subsurface anomalies identified previously as well as anomalies identified during the Phase 1 activities as shown on Figure 2-4 within Appendix 2. This work may include a series of slab cores to identify and measure existing sumps or voids beneath existing slabs.

2.2.5 Outfall Investigations and Evaluate Existing Underground Utilities

During prior site activities, storm sewers and other utilities were discovered that are not currently well documented with respect to alignments, outfall locations, etc.

This investigation will use a combination of historical document review, direct visual observation (e.g. opening manholes), and invert surveying. Video observation of major sewer piping and probes and/or test pits may be utilized based on results of visual inspections. Select Building 52 outfalls, as shown on Figure 2-5 within appendix 2, may be investigated using borings or test pits based on results of Appendix 3 investigations. Locations of utilities are shown on Figures 2-6 and 2-7 within Appendix 2.

2.3 OU-1 Excavation Pre-delineation

Excavation is the remedy selected to address onshore soils that exhibit concentrations of PCBs above removal criteria. The basis for excavation locations is historic data collected during the RI, 50% Design, and other Site activities, which are described in the Conceptual Site Model (CSM) (Haley & Aldrich, 2008). This data is not sufficient to delineate the extents of excavation required to meet the remedial action goals in the ROD. Since a significant portion of excavations may extend below the water table and will require shoring or other methods to support the excavation, determining the extents of PCB contamination during construction (i.e. complete initial excavation followed by sampling and analysis to confirm the extents (i.e., verification sampling and analysis)) is not efficient, may not be possible, and increases workers exposure to safety risks. Therefore, a pre-excavation delineation sampling program will be completed to fully define the required horizontal and vertical limits of removal prior to construction.

In general, existing data points that indicate the presence of PCBs that exceed removal criteria will be delineated in accordance with sampling frequency identified in DER-10 guidance. Between 200 and 250 locations ("offsets" from existing data points) will be completed and between 400 and 600 samples collected and held or analyzed during the first round of sampling, which includes resampling existing locations and offsets from existing data points. Additional sampling ("step outs" from first round "offsets") may be required based on results of the initial offsets from existing data points. Below is a summary of the program. Details of the program are described in Appendix 3.

PCBs are present at concentrations that exceed removal criteria beneath Building 52 as identified in the CSM but sampling is not included in this RDWP due to the uncertainty regarding the remedy implementation in this area. If sampling within Building 52 is determined to be required, the RDWP will be amended or a separate workplan submitted.

2.3.1 Spatial Distribution of Samples

The excavation pre-delineation program investigates an existing exceedance through sampling at an offset that satisfies the minimum sampling requirements set forth in DER-10 guidance (i.e. one sample per 30 linear feet of sidewall, one sample per 900 square feet of excavation bottom, and horizon samples where applicable). Offset distances and geometries from existing data points will vary based on subsurface features present in the vicinity of existing data points. Design of excavation pre-delineation sampling will vary depending upon the location of existing borings with respect to subsurface features and other data points. Evaluation of locations that exceed criteria will generally fall into one of three categories as described below.

1. An “isolated” existing data point describes an existing data point location in which no other data or subsurface features, which exhibits the potential to be a source of PCBs, exist in the vicinity. These areas will generally be investigated as a 30 foot by 30 foot investigation unit unless supplemental site or chemical information indicates that reducing the area is appropriate.
2. A “linear feature” is one or more data points with a criteria exceedance that may be associated with a utility or other liquid conveying site feature (e.g. outfalls and associated pipe bedding from Building 52 that are potential PCB source areas). Criteria exceedances associated with these features may be related to the gravel bedding parallel to the feature and result in horizontal distribution of impacts in the direction parallel to the feature more than in the directions perpendicular to the feature. Therefore, the approach for pre-delineating excavation limits will be to position offsets closer in the direction perpendicular to the feature (e.g. 5 feet) and the standard sampling interval (i.e. 30 feet) in the direction parallel to the feature. Presence of supplemental site or chemical information may indicate that reducing the offset distance is appropriate.
3. A “cluster” location refers to an area where multiple existing data points with criteria exceedances exist within close proximity to one another in an area greater than 900 square feet. For this case, the initial geometry of the investigation units is defined based on the existing data and offset samples are placed around the perimeter. Within a “cluster” one data point may serve as a confirmation sample for the side wall of an adjacent area.

2.3.2 Vertical Distribution of Samples

Similar to the horizontal pre-delineation, the vertical (bottom) extents of PCB criteria exceedances within each excavation area will be established through pre-excavation sampling and analysis. Sampling depths intervals will be determined relative to existing grade.

Determination of excavation limits requires sidewall and bottom samples that exhibit concentrations of PCBs below exceedance criteria as follows:

- Bottom samples will be collected as required. Note that the initial excavation depth will be established as the top of the clean sampling interval (e.g. if the existing data point (or resample) indicates the presence of PCBs below criteria at a depth of 8 – 10 feet and above criteria at 6 – 8 feet, then the excavation bottom would be established at 8 feet).
- Bottom of sidewall samples will be collected from borings at the bottom two foot interval of the proposed excavation.
- Horizon samples will be collected, if applicable, at sidewalls (i.e. offsets and step outs) where multiple horizons of exceedances are identified in the existing sample location:

    - At intervals of elevated concentrations which are separated by an interval with significantly lower concentrations.

Vertical sampling intervals will be:

- 0-2 ft for lead hotspots
- Two foot intervals for bottom of excavation samples
- Horizon samples, if applicable, will be collected at the 2 foot interval that corresponds with interval of elevated concentration identified in the existing data point.

Sample interval depths have been identified to define maximum excavation depths as follows:

- 9 feet bgs in the Northern Shoreline Area
- In other areas of the site where PCB impacts above criteria extend below 12 feet, excavation pre-delineation sampling may be proposed to stop at 9 feet. The DEC will be consulted in these specific areas prior to altering the sampling program.

Lead hotspot locations have a pre-determined excavation depth of 2 ft. Therefore, offset borings will only be completed to determine the horizontal distribution of subsurface impacts as specified in the ROD.

If exceedances occur after multiple step-out attempts, alternate methods to delineate PCB criteria exceedances may be reviewed with NYSDEC.

2.4 Extension Alignment Investigation

The selected remedy includes a bulkhead that extends into the Hudson River in the Northwest Offshore Area (See Appendix C) which requires confirmation of the absence of PCB Material as DNAPL or semi-solid phase and obstructions along the alignment of the proposed bulkhead (see Appendix 4). The probes will also confirm the absence of obstructions (e.g. riprap).

In general, the probes will ascertain presence or absence using a barge mounted drill rig. Where possible (along the northern property line) the probes will be advanced from land based equipment. Off-shore probes will be advanced using rotary wash drilling techniques, using a drilling rig mounted on a Shugart barge. Casing will be advanced through the sediment and split spoon samples will also be advanced in front of the casing. Samples will be examined for PCBM as discussed in the preceding section. If no recovery is obtained, observations will be made to evaluate whether PCBM is visibly adhered to the split spoon sampler. The split spoons will be advanced either to the top of the Marine Silt, or until hammer blow counts indicate the potential presence of riprap.

2.4.1 Purpose and Scope

The purpose of the PCBM and riprap probes is to evaluate the presence of both PCBM and obstructions along the alignments of the proposed bulkhead extension wall and deadman. It is important to confirm that semi-solid or liquid PCBM do not exist along the alignment, since it could be dragged down to the Basal Sand aquifer during construction of the wall.

A phased approach of probes is planned in the vicinity of the planned extension wall and deadman, with the actual number and locations of probes to be determined as the work progresses, depending on conditions encountered. The proposed probe procedure utilizes methods that have been successfully employed at the site during previous investigations, which include the adhesion testing performed in 2008 to observe presence of PCBM, and the riprap probes performed in 2010 to initially evaluate the extent and thickness of riprap.

In general, samples will be obtained from the probes and will be evaluated to determine visual evidence of PCBM. A procedure to visually observe PCBM in sediment samples, called adhesion testing, was previously performed at the site in 2008. Samples will be visually inspected, probed with a stainless steel spatula, and logged for PCBM observations and soil stratigraphy. Samples where PCBM is positively identified will be photographically recorded.

2.4.2 Off-shore Probes

Off-shore probes will be advanced using rotary wash drilling techniques, using a drilling rig mounted on a barge. If assumed riprap is encountered, the rollerbit will be inserted into the hole and spun to confirm refusal. Observations will be made of the thickness and likely size of the riprap (as inferred based on drilling action).

Split spoon samples will be obtained from mudline to 5 feet below the top of the Marine Silt (except for the obstruction zones or in locations where roller bit refusal is encountered

The general sequence of the work is anticipated to be as follows:

- Round 1 - Perform probes generally at 30-foot centers. At locations adjacent to an existing positive PCBM observation, the probe spacing will be decreased to 15 feet. For each probe, obtain split-spoon samples at 2-foot intervals to a depth corresponding to 5 feet below the estimated top of the Marine Silt. Perform adhesion testing on each split spoon sample. If obstructions are encountered when pushing the split spoon, the roller bit will be advanced through the obstruction to the extent possible, to obtain information on thickness and size of riprap. If no PCBM is observed in any sample taken from Round 1, and if no significant riprap thickness is encountered, the program will be complete. For locations where PCBM is observed in Round 1 samples, and/or if significant riprap thickness is encountered, continue to Round 2 at those locations.

- Round 2 and 3 – Perform probes 13 feet outboard from previous round in locations where positive PCBM observations are identified, and/or riprap is encountered. Spacing of probes will be determined based on conditions encountered in the previous round. If no PCBM is observed and no riprap is encountered, the program will be complete.

Up to approximately 27 probes are expected to be completed for Round 1. Locations adjacent to the Old Marina are approximate and subject to change based on access restrictions for the drilling barge.

2.4.3 Probes Along North Property Line

The purpose of the probes planned to be drilled adjacent to the north property line is to determine presence or absence of PCBM and riprap, as discussed above, with the added objective of determining whether the wall alignment can be moved south to coincide with the property line along the Old Marina. The current alignment shown in the RFS is north of the property line.

Due to the sloped shoreline and tidal conditions, a drill rig cannot physically be positioned to install vertical borings at the property line. Therefore, the drill rig will be positioned on-shore as near as possible to the property line, and an angled boring will be completed to evaluate conditions at the property line.

Most of the property line probes will be spaced 15 to 30 feet apart.

Probes will also be performed along the Round 2 and/or Round 3 lines, as needed, if the Round 1 probes indicate the presence of PCB Material, or significant obstructions. The actual number of locations will vary based on actual results since the observations may indicate the need to "step-out" from some locations.

2.5 Deepwater Investigation

The goal of this investigation is to examine deepwater areas where PCBs in excess of 50 mg/kg (ppm) (elevated PCB concentrations) are known or suspected to be present in order to gather data for making decisions regarding remedial action (see Appendix 5). This investigation addresses areas in the proximity of existing exceedances and areas between EB-10 and EB-14. Areas previously identified in the ROD to be dredged are pre-delineated in a separate investigation (see Appendix 6). The deepwater investigation sediment sampling, which will be conducted within an area located approximately 300 feet off-shore of the Site (approximately 4 acres), will be used to further understand lateral and vertical PCB contamination, within specific deepwater areas.

The sampling program employs a 160-foot triangulation grid for investigation areas and an 80-foot triangulation grid for refinement of extents of contamination. All tasks will be performed during a single field event to the extent feasible. As currently planned, the sampling vessel will remain on site until all locations are completed. Sampling described in Task 1, Task 2 and some of the Task 3 locations associated with historical locations (EB-10, EB-14, CS-19) will all be completed during the first sampling round (26 locations). After analysis and review with the NYSDEC, additional Task 3 samples may be completed (up to 22 or more locations). Task 4 sampling may also be completed as described herein.

- **Task 1: Resampling - Resample Specific Locations With Elevated PCB Concentrations**
  This task investigates areas in the proximity of specific existing exceedances. Specifically, this task will re-sample areas proximate to three previously sampled deepwater locations where elevated PCB concentrations were detected (EB-10, EB-14, CS-19). Sampling at these locations will be used to 1) confirm the presence of elevated PCB concentrations at each location, 2) confirm the depths of elevated PCB concentration previously detected, and 3) observe physical characteristics at each location.

- **Task 2: Investigation Unit Sampling - Sample the Area Between EB-10 and EB-14**
  This task samples areas between EB-10 and EB-14. Sampling at these locations will be used to 1) identify the presence of elevated PCB concentrations at each location, 2) to identify the depths of elevated PCB concentration if present, 3) determine whether additional sampling (i.e. step-out sampling) is necessary, and 4) observe physical characteristics at each location. Sediment samples will be collected in a 160-foot triangulation grid pattern to divide the investigation area into hexagonal Investigation Units.

- **Task 3: Decision Unit Sampling - Including Step-out Investigation (as needed)**
  Investigation Unit(s) will be divided into smaller hexagonal Decision Units as necessary. Sampling will include locations associated with Task 1 and locations from Task 2 that require additional investigation. Finally, step-out samples will be collected in areas that require additional investigation and would create new Decision Units. This investigation task will

further assess the nature and extent of elevated PCB concentrations emerging from Task 2 and will support decisions regarding the need for remedial action.

- **Task 4: Variability of Sediment Concentrations**
  Variability sampling will be completed at VC-101, VC-102 and VC-103 to assess the variability of the sediment concentrations to better understand if the concentrations are uniform or if exceedances are sporadic. Based on the results from the initial sampling, additional locations may be selected to help assess the contaminant mass distribution in relevant areas. Three additional cores will be added in close proximity to each location being evaluated, with samples collected at corresponding intervals.

2.6 Off-shore Pre-delineation

Appendix 6 describes a program to provide supplementary data for making decisions regarding remedial action. The existing data collected during the RI and other Site activities was sufficient for completion of the feasibility study but additional data is necessary for further delineation of areas for potential remedial action and to pre-delineate the extent of dredging required in the ROD, especially in the areas referred to in the RFS as backwater areas consisting of the South Boat Slip, North Boat Slip and the Old Marina. Investigation will be completed in Nearshore areas, Backwater areas and the Deepwater area adjacent to the Northwest Offshore Area.

Vibracore samples along with ponar grabs for surface samples will be collected from barge or boat-mounted equipment. Re-sampling may also be conducted at some previously sampled locations confirming existing data where elevated PCB and metals concentrations were detected.

Vertical distribution of sample intervals will be used to delineate PCB and metal concentrations in targeted sediment deposits which may require dredging and to document the sediment concentrations that will be left in place after remedial action. An initial 0-0.5 ft. depth interval will be sampled to correspond to previous depths and analyses along with a 0.5-1 ft. interval. One-foot sampling depth intervals will be conducted up to 6 ft. depths to provide more refined PCB and metals contaminant distribution data and residual concentrations as applicable. Deeper two-foot interval samples will be analyzed if needed to document sediment concentrations that will be left in place after remedial action.

Spatial distribution was selected based on the following and considered the presence of existing data. The sampling program employs a sampling grid in order to fill data gaps or address uneven distribution of existing data. Grid spacing is approximately 80 feet and will provide a consistent basis for understanding the distribution of contaminants in the sediment to refine dredge extents and provide a basis for remedial design. Additionally, step-out sampling will be implemented where required to adequately delineate locations where spatial extents are not fully bounded.

2.7 Geotechnical Exploration

Geotechnical conditions and analyses are critical for design of the remedy. Collection of several types of data is described in Appendix 7.

Several phases of geotechnical investigations have been performed at the site in the past, and are shown on Figures 2A and 2B in Appendix C, Existing Geotechnical Explorations. The following is a general summary of the existing geotechnical information:

- 20 borings that terminated in the Marine Silt
- 49 borings that terminated in the Basal Sand (20 in the river, 29 on land)
- 14 borings that terminated in Rock (all on land)
- 10 test pits
- Geotechnical laboratory test data
  - Strength testing (unconsolidated undrained [UU] triaxial, consolidated undrained [CU] triaxial, direct simple shear [DSS], and field vane)
  - Consolidation testing
  - Index testing (Atterberg Limits, organic content, grain size, specific gravity)

Some data gaps have been identified, and new geotechnical explorations are proposed to address the data gaps and provide additional stratigraphy and laboratory testing data in several areas: in the general vicinity of the planned deadman anchor, in the general vicinity of the planned Northwest Extension bulkhead wall, and in the off-shore area between the North Boat Slip and the South Boat Slip. The information will be used for bulkhead and deadman design, excavation support design, design of the sloped shore, and general site geotechnical analysis (e.g., settlement).

Additionally, some test pits are planned at various locations around the site where sheetpile support of excavation (SOE) may be used during remedial construction (i.e., excavation locations that are about 6 feet bgs or greater). The purpose of the test pits is to gather information on soil conditions, excavation effort, existing foundations and potential obstructions that could affect the design and/or construction of the sheetpile SOE walls.

2.8 Bench Testing

Design of the site remedy may include management of saturated soils and sediment, treatment of water during construction and long-term treatment of groundwater as part of a groundwater management system. Prior to remedial design at the Site, a series of bench-scale treatability tests will be performed to identify effective treatment technologies and associated design parameters for the potential full scale system (see Appendix 8). These technologies include:

- Solids Dewatering: Methods and basic design parameters for the dewatering of water-laden excavated soils and dredged sediments;
- Stabilization: Methods and basic design parameters for the solidification of construction materials to be re-used on-site for various purposes;
- Construction Water Treatment: Methods and basic design parameters for the potential treatment of various metals and PCBs in water generated during construction activities (e.g., solids dewatering supernatant and on-shore excavation dewatering); and
- Long-Term Groundwater Treatment: Initial testing of treatment methods for residual groundwater: to screen technology and provide basic design parameters for further testing, if needed.

2.9 Pilot Tests

No pilot tests are currently planned for the Pre-Design Investigation. If pilot testing requirements are identified, a workplan will be submitted separately.

2.10 Field Procedures

Field procedures are provided in Appendix A. Procedures specific to various PDI tasks are referenced within the appendix that describes that task. Some procedures that are common to multiple tasks are summarized below. Subcontractors selected for individual PDI tasks will submit proprietary Standard Operating Procedures that will be reviewed and inserted into Appendix A prior to the commencement of work.

Decontamination

Where applicable, reusable equipment will be decontaminated prior to each use, and following each work day, if they are used, in order to prevent cross-contamination. An onshore area will be designated for decontamination of equipment used in the field investigations.

Investigation Derived Waste Management

All remaining sediment, fluids used for decontamination of sampling equipment, and sample collection disposable wastes (e.g., gloves, paper towels, foil, etc.) will be placed into appropriate containers and staged on-Site for disposal. These Investigation Derived Wastes (IDW) will be disposed in accordance with the project guidelines.

In some areas within the Site it may be acceptable to return exploration soil cuttings and test pit soils to the point of collection. In other areas it may not be practical to return cuttings and soils to their origin, and they will be better handled by collection, followed by characterization and disposal. Prior to returning IDW to the point of collection (e.g. test pits), visual observations will be made to determine the presence of DNAPL, LNAPL, or obvious signs of semi-solid PCBM. In the absence of these observations, IDW will be returned to point of generation. If these types of material are observed, then NYSDEC will be consulted and spoils will be characterized and disposed.

2.11 QAPP

The Quality Assurance Project Plan (QAPP) is bound herein as Appendix A. The QAPP has been developed in accordance with the EPA guidance documents; "EPA Requirements for Quality Assurance Project Plans", EPA QA/R-5, March 2001; "EPA Guidance for Quality Assurance Project Plans"; EPA QA/G-5, February 1998, and the "EPA-New England Quality Assurance Project Plan Guidance”, April 2005.

2.12 PDI Data Summary Report

Following completion of PDI field work and laboratory analyses, a PDI Data Summary Report will be prepared and submitted to NYSDEC. The report will include:

- Site Management (H&S, CAMP results, waste management)
- A description of activities (soil sampling, sediment sampling, probes, geotechnical borings, test pits, bench tests)
- Figures depicting the surveyed location of activities
- Boring logs
- Analytical and geotechnical data tables
- Data validation summary

3. BASELINE MONITORING

Several types of "baseline" data are required for specific monitoring requirements. The main goal for the baseline sampling is to provide a benchmark against which post-construction performance monitoring can be compared in order to assess the performance and effectiveness of the remedy. This section summarizes those requirements and the work plans to comply with those requirements. Note that noise reference data will be collected prior to commencement of construction and the data collection will be described in the RAMP.).

3.1 OU-2 Baseline Sampling and Analysis Plan (BSAP)

The OU-2 ROD requires baseline sampling of OU-2 media and biota as part of the Site Management Plan, which will be submitted following the remedial action. In order to acquire baseline data, sampling is required prior to construction. The OU-2 Baseline Sampling and Analysis Plan has been submitted to NYSDEC under a separate cover.

3.2 Groundwater Sampling

Baseline sampling of site groundwater was requested in a letter from NYSDEC dated 5 April 2013. Existing monitoring wells will be resampled during this PDI to update site groundwater data, as described in Appendix 2.

3.3 PCB Air Monitoring

Baseline sampling or background concentrations of PCBs in air will be collected at the site prior to commencement of construction activities and will be described in detail in the construction phase CAMP under separate cover.

4. REMEDIAL DESIGN

4.1 Technologies

The site remedy technologies consist of excavation, backfill, a bulkhead, site cover, groundwater treatment, potential DNAPL recovery and dredging. None of these technologies are innovative or unproven.

The design will also incorporate the proposed mitigation for the encroachment into the river of the new extension bulkhead. Selection of the mitigation scope will be completed after completion of the preliminary design of the bulkhead and the extent of encroachment; if any, has been defined.

4.2 Design Phases

The design will be prepared in two phases: Preliminary and Final. By taking this approach a Remedial Action Work Plan (RAWP) will not be prepared. The design will be based on data from the PDI as well as other prior investigations.

Preliminary Design

Preliminary Design will include calculations for excavation, backfill, site cover, drainage, shoreline design, bulkhead, corrosion protection, shoring, dredging and groundwater treatment. Preliminary studies will be made to assess sediment resuspension control methods based on water depth and velocity (Remedial Element 6) , transportation methods for materials onto and off the Site, disposal location(s), source(s) of backfill, fill material sources (both upland and river), river hydrodynamics and the site groundwater model.

A specific analysis will be made in consultation with NYSDEC to develop a Mitigation Plan for the encroachment into the river that will result from installation of the new extension bulkhead and the associated encroachment into the Hudson River. The extent of the potential encroachment will be determined during the Preliminary Design. The Mitigation Plan will identify conceptual design information, decision framework, and permitting/approval approach for the construction of a compensatory mitigation project (or projects). The mitigation to replace lost aquatic habitat will be developed and integrated into the overall design.

During preliminary design, scaled drawings will be prepared and will include the following design elements:

- Site General Arrangement
- Bulkhead
- Excavation extent
- Dredging extent
- Rough Grading
- Finish Grading
- Groundwater Treatment
- Utilities
- River Encroachment Mitigation

The Preliminary Design will also include:

- Update to the groundwater model
- Hydrodynamic analysis
- Sea level rise analysis
- Temporary facilities for construction support
- Materials delivery and transport facilities
- Record of permit status and applicable SCGs addressed in the design
- Updated cost estimate
- Updated project schedule
- List of specifications

The remedial design will consider additional factors including:

- Sustainability. The design will evaluate core elements including:

  i. energy requirements;
  ii. air emissions;
  iii. water requirements and associated impacts on water resources;
  iv. impacts on land and ecosystems;
  v. material consumption and waste generation; and
  vi. impacts on long-term stewardship.

- Protection of identified fish and wildlife resources. The remedial design will include appropriate measures for delineating and protecting the identified resource or habitat and for monitoring related impacts during the implementation of the remedial action.

At the conclusion of Preliminary Design, a Preliminary Design Submittal will be prepared for review by NYSDEC and include the draft Remedial Action Monitoring Plan (RAMP) and the Mitigation Plan.

Final Design

Final Design will incorporate any comments resulting from review of the Preliminary Design. Drawings, work plans and technical specifications will be included of sufficient detail suitable to bid the work and for the selected Contractor to execute the work. The Final Design submittal will include a cost estimate and implementation schedule as well as the RAMP, CERP, and CAMP. Final design will also include a proposed schedule for implementation of the compensatory mitigation project. Construction and monitoring of the compensatory mitigation project will be in accordance with the approved Final Design.

At the conclusion of Final Design, a Final Design Submittal will be prepared for review by NYSDEC. The Final Design will be signed and stamped by a NYS PE and include the required certifications.

4.3 Work Plans and Monitoring Plans

As part of the design process, various plans will be prepared to support the remedial action.

4.3.1 Remedial Action Monitoring Plan (RAMP)

The RAMP which details the monitoring needs during construction includes:

- the frequency of sampling or monitoring;
- the specific steps involved;
- an applicable quality assurance/quality control plan; and
- reporting.

A draft RAMP will be submitted with the Preliminary Design and revised for submittal with the Final Design.

4.3.2 Community and Environmental Response Plan (CERP)

The CERP is a concise summary of the controls, monitoring or work practices and how they combine to provide the necessary protection of the community and ecological resources, the details of how these are to be implemented will be included in the technical specifications of the design. In particular, this plan addresses short term impacts and includes:

- a summary of the CAMP (see below);
- identification of any temporary measures to be erected or installed to protect the public on or adjacent to the site from exposure;
- vapor/odor management plans;
- noise and vibration baseline monitoring and mitigation;
- measures to secure the site from trespassers;
- erosion and sediment control measures to comply with the substantive requirements of a storm water management permit;
- waste management measures;
- water management and treatment measures;
- traffic control and site access plans;
- decontamination of trucks and equipment leaving the site; and
- off-site trucking routes and emergency procedures.

4.3.3 Community Air Monitoring Plan (CAMP) - construction phase

The CAMP will address community health and safety, which identifies measures or actions to ensure that the public living and working near the site as well as employees or visitors to any facility located on the site are protected from exposure to site contaminants during intrusive activities and remedial actions. The CAMP will include:

- Requirements identified by the NYSDOH (DER-10 Appendix 1A).
- Baseline sampling for dust and noise
- A fugitive dust/particulate monitoring program (DER-10 Appendix 1B).
- A noise monitoring program

5. PERMITS OR AUTHORIZATIONS

The remedial action will be designed to comply with applicable federal, state and local laws, regulations,requirements, and SCGs applicable to the Site. Permits or other authorizations necessary to implement the remedial program, or for which the permit exemption provision of DER-10, Section 1.10 apply, will be identified in the Preliminary Design and Final Design along with any information necessary for demonstrating compliance with the substantive permit or other authorization requirements.

Permits (or authorizations) currently identified for consideration during the design are:

1. JPA. A Joint Permit Application (JPA) will be made that addresses requirements of USACE, National Marine Fisheries and NYS Department of State. Initial discussions will commence following approval of this RDWP.

2. SPDES or POTW - Construction dewatering effluent will be discharged either to the Hudson River or to the POTW. Once the discharge is determined during Preliminary Design, the appropriate submittals will be initiated.

3. Resources. The substantive technical requirements of applicable resource-related permits (e.g., 6 NYCRR Parts 608, 661, 663) will be identified and appropriate submittals will be initiated.

4. Permit Exemptions. Exemptions from the following permit programs will be reviewed as described in DER-10, Section 5.1(c)(6):

   - Air - Title 5 permits
   - Air - State permits
   - Air - Registrations
   - Ballast Discharge
   - Chemical Control
   - Coastal Erosion Hazard Areas
   - Construction of Hazardous Waste Management Facilities
   - Construction of Solid Waste Management Facilities
   - Dams
   - Excavation and Fill in Navigable Waters (Article 15)
   - Flood Hazard Area Development
   - Freshwater Wetland
   - Hazardous Waste
   - Long Island Wells
   - Mined Land Reclamation
   - Navigation Law - Docks
   - Navigation Law - Floating Objects
   - Navigation Law - Marinas
   - Non-Industrial Waste Transport
   - Operation of Solid Waste Management Facilities
   - Operation of Hazardous Waste Management Facilities
   - State Pollution Discharge Elimination Systems (SPDES)
   - Stream Disturbance

- Tidal Wetlands
- Water Quality Certification
- Water Supply
- Wild, Scenic and Recreational Rivers

5. TSCA. USEPA will be consulted with respect to the Toxic Substances Control Act. Revision to the RDWP may be required based on that consultation.

6. SCHEDULE

The anticipated schedule is:

- Complete Pre-Design Investigation 270 days following approval of the RDWP.
- Submit a Data Summary Report 120 days following completion of the PDI.
- Submit the Preliminary Design 180 days following submittal of the Data Summary Report.

The schedule for Final Design, procurement of contractors and construction will depend on the timing and results of the review process. The schedule will be updated as necessary.

7. POST CONSTRUCTION PLANS

It is anticipated that institutional controls and environmental easements will be required as part of the remedy. Preparation of a draft Site Management Plan (SMP) will be initiated following receipt of comments on the Preliminary Design and completed during the construction phase. The SMP requires approval by NYSDEC before submittal of the final report. The SMP will be prepared in accordance with DER-10 Section 6.2 and include an updated site survey.

The SMP will provide a general description of the site, the controls in-place as well as a description of the nature and extent of the remaining contamination at the site. The SMP will include three separate plans summarized as follows:

i. institutional and engineering control (IEC) plan,
ii. monitoring plan, and
iii. operation and maintenance plan.

8. SITE FIGURES

DER-10 requires a scaled site map identifying all areas where remedial actions will be conducted, which specify, as appropriate or identified at this point in the project, the following:

i. the proposed location of remedial treatment units;
ii. the areas, with volumes if applicable, for each environmental medium to be remediated;
iii. the vertical and horizontal extent of area to be remediated;
iv. the location, depth and concentration of all contaminants in excess of the remedial action objectives;
v. sample locations, depths and parameters for all confirmation and/or documentation samples; and
vi. wetlands, streams or other habitats potentially disturbed by the remedial action.

The activities conducted as part of the PDI will further refine the understanding of the scope of the remedy. As indicated in DER-10 Section 5.2, scaled site maps are provided in this RDWP for investigations that will more completely identify areas where remedial actions will be conducted.

The current understanding of the scope of the remedy is shown in the figures listed below and are bound herein in Appendix C. These maps have been previously presented as Figures in two documents: the RFS and the OU-2 ROD.

SITE FEATURE	FIGURE
Project location	OU-2 ROD Figure 1
Site plan showing names of the geographic areas of the site	OU-2 ROD Figure 2
Selected Remedy – Modified Alternative 6	OU-2 ROD Figure 7
Selected Remedy – Section 8100	RFS Figure 18
Selected Remedy – Section 6780	RFS Figure 21
Selected Remedy – OU-1 Excavation Plan	RFS Figure 32
Location, depth and concentration of contamination in the Northwest On-Shore and Off-Shore Areas	RFS Figures 4, 5, and 6
Location, depth and concentration of contamination in OU-1 outside the Northwest Areas are represented by the designated areas of excavation on RFS Figure 32.	RFS Figure 32
Location, depth and concentration of OU-2 contamination	OU-2 ROD Figures 5 and 6

Proposed pre-delineation samples are described in Appendices 2 and 3 and will be completed in lieu of documentation and confirmation sample locations where applicable as well as further delineate the location, depth and concentration of all contaminants in excess of the remedial action objectives.

Regarding habitat types, the on-shore portion of the site is a closed industrial facility with the surface cover comprised primarily of concrete, asphalt, gravel, and structures. There are no wetlands on the site. The Hudson River habitat will be disturbed during remediation as shown in the figures and described above with mitigation developed during design.

As part of ongoing investigation and design-related activities, an updated map of Hudson River bathymetry has been prepared based on the Hastings Hydrographic Survey Work Plan and is contained in Appendix C.

TABLES

TABLE 1
STANDARDS, CRITERIA, AND GUIDANCE DOCUMENTS (SCGs) APPLICABLE TO REMEDIAL DESIGN
FORMER ANACONDA WIRE AND CABLE COMPANY
HASTING-ON-HUDSON, NEW YORK
NYSDEC SITE NO. 3-60-022

Division of Environmental Remediation SCGs

NYSDEC Remedial Guidance (DER) and Policy (CP) Documents
> CP-43 Groundwater Monitoring Well Decommissioning Policy
> CP-51 Soil Cleanup Guidance Policy
> DER-10 Technical Guidance for Site Investigation and Remediation
> DER-31 Green Remediation
6 NYCRR Part 364 - Waste Transporters
6 NYCRR Part 370 - Hazardous Waste Management System: General
6 NYCRR Part 371 - Identification and Listing of Hazardous Wastes
6 NYCRR Part 372 - Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities
6 NYCRR Subpart 374-1 - Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities
6 NYCRR Part 375 - Environmental Remediation Programs

Division of Water SCGs

Analytical Services Protocols
Technical and Operational Guidance Series (TOGS)
> TOGS 1.1.1 Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations.
6 NYCRR Part 702.15(a), (b), (c), (d), (e) & (f)
6 NYCRR Part 700-706 - NYSDEC Water Quality Regulations for Surface Waters and Groundwater
6 NYCRR Part 750-757 - Implementation of NPDES Program in NYS

Division of Fish and Wildlife and Marine Resources SCGs

Fish, Wildlife and Marine Resource Guide
6 NYCRR Part 182 - Endangered & Threatened Species of Fish & Wildlife
6 NYCRR Part 608 - Use and Protection of Waters
6 NYCRR Part 661 (Cp. 10) - Tidal Wetlands Land Use Regulations

Division of Environmental Permits SCGs

DEC Permits Guidance (DEP)
> Assessing and Mitigating Noise Impacts - Program Policy #DEP-00-1
> Suspending Application Review and Time Frames - Program Policy #DEP-02-1
6 NYCRR Part 621 - Uniform Procedures

Division of Air Resources SCGs

6 NYCRR Part 200 (200.6) - General Provisions
6 NYCRR Part 201 - Permits and Registrations
6 NYCRR Part 211 (211.1) - General Prohibitions
6 NYCRR Part 257 - Air Quality Standards

TABLE 1
STANDARDS, CRITERIA, AND GUIDANCE DOCUMENTS (SCGs) APPLICABLE TO REMEDIAL DESIGN
FORMER ANACONDA WIRE AND CABLE COMPANY
HASTING-ON-HUDSON, NEW YORK
NYSDEC SITE NO. 3-60-022

NYS Department of State SCGs
Consistency Reviews
State Coastal Policies
Part 600 - Department of State, Waterfront Revitalization and Coastal Resources Act

U.S. Environmental Protection Agency SCGs
Laws, Policy and Guidance for Federal Superfund
National Contingency Plan
Waste Cleanup and Risk Assessment

OSHA SCGs
29 CFR Part 1910.120 - Hazardous Waste Operations and Emergency Response

U.S. Army Corp of Engineers SCGs
33 USC 466 Section 404 - Clean Water Act
33 CFR Parts 320 -330 - Regulatory Programs of the Corps of Engineers

United States Miscellaneous SCGs
16 USC 470 - National Historic Preservation Act

Note: This list was derived primarily from the NYSDEC Website titled “Index of Standards, Criteria and Guidance (SCGs) for Investigation and Remediation of Inactive Hazardous Waste Disposal Sites.”

https://hank.haleyaldrich.com/sites/projects/28612/Shared Documents/289 - RDWP/5-7-14 RTC RDWP/Redline RDWP Edits/[RDWP Table 1 SCGs-F.xlsx]Sheet1

APPENDIX A

Quality Assurance Project Plan (QAPP)

ATTACHMENT A
REMEDIAL DESIGN WORK PLAN
QUALITY ASSURANCE PROJECT PLAN

Prepared By:

HALEY & ALDRICH
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200 Town Centre Drive
Rochester, New York 14623

14 October 2013

QUALITY ASSURANCE PROJECT PLAN

APPROVALS

Approved By: ____ Date: ____________________
Remedial Design Contractor – Haley & Aldrich, Inc.

Approved By: ____ Date: ____________________
Quality Assurance (QA) Officer – Haley & Aldrich, Inc.

Approved By: ____ Date: ____________________
Laboratory QA Officer – Pace Analytical, Inc.

Approved By: ____ Date: ____________________
Laboratory QA Officer – Terrasense Geotechnical Laboratories

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Site Location:

Document Title: Remedial Design Work Plan (RDWP)
Quality Assurance Project Plan (QAPP)

Preparer's Name and Affiliation: Denis Conley, Haley & Aldrich of New York

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Preparation Date: 29 April 2013; 14 October 2013 Revision 1

Remedial Design Contractor's Project QA Officer ______________________________
Signature Date

____
Printed Name/Organization

Approval Signature ______________________________
Signature Date

____
Printed Name Organization

Other Approval Signature ______________________________
Signature Date

____
Printed Name Organization

LIST OF ACRONYMS AND SHORT FORMS

Acronym	**Agency/Organization/Definition**
CD	Consent Decree
COC	Contaminants of Concern (COC)
CRADA	Cooperative Research and Development Agreement
DO	Dissolved Oxygen
DQO	Data Quality Objective
DUSR	Data Usability Summary Report
EPA	United States Environmental Protection Agency
FSP	Field Sampling Plan
GAC	Granulated Activated Charcoal
GC/MS	Gas Chromatography/Mass Spectroscopy
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
ICP	Inductively Coupled Plasma
ICS	Interference Check Samples
LCS/LCSD	Laboratory Control Sample/Laboratory Control Sample Duplicate
MD	Matrix Duplicate
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NIST	National Institute of Standards and Technology
NYSDEC	New York State Department of Environmental Conservation
ORP	Oxidation-Reduction Potential
OVA	Organic Vapor Analyzer
PARCCS	Precision, Accuracy, Representativeness, Comparability, Completeness, Sensitivity
PDI	Pre-Design Investigation
PE	Performance Evaluation
PID	Photo-ionization Detector
PPE	Personal Protective Equipment
QA	Quality Assurance
QAO	Quality Assurance Officer
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
QC	Quality Control

LIST OF ACRONYMS AND SHORT FORMS (continued)

Acronym	Agency/Organization/Definition
RAO	Response Action Objectives
RD/RA	Remedial Design/Remedial Action
RDWP	Remedial Design Work Plan
RI	Remedial Investigation
ROD	Record of Decision
RPD	Relative Percent Difference
RPM	Remedial Project Manager
SDG	Sample Delivery Groups (SDG)
SOPs	Standard Operating Procedures
SOW	Statement of Work
SPT	Standard Penetration Test
SRM	Standard Reference Materials
SSO	Site Health and Safety Officer
SVOC	Semi-volatile Organic Compounds
SW-846	"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", EPA SW-846, 3rd Edition with Updates I through III

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been developed in accordance with the EPA guidance documents; "EPA Requirements for Quality Assurance Project Plans", EPA QA/R-5, March 2001; "EPA Guidance for Quality Assurance Project Plans"; EPA QA/G-5, February 1998, and the "Technical Guidance for Site Investigation and Remediation”, (DER-10), NYSDEC, May 2010.

To accomplish the remedial design and implement the remedial design and remedial action (RD/RA) at the Former Anaconda Cable and Wire Co. Site, a series of Pre-Design Investigations (PDI) (see Figure 1.1) will be conducted to collect data to develop the design for appropriate remedial actions to address the site conditions identified during the Remedial Investigation (RI), evaluated during the Feasibility Study (FS) and selected in the Record of Decision (ROD).

The collection of the design data will utilize a variety of intrusive techniques for the sampling and analysis of soils, sediment, and groundwater.

These techniques will include:

- Discreet sampling of soil
- Discreet sampling sediments
- Discreet sampling of groundwater
- Collection of soils and groundwater from existing and new monitoring well locations,
- Collection of surface water processed during pilot/treatability bench testing activities
- Off-site analysis of Contaminants of Concern (COC) and associated parameters in accordance with procedures promulgated by the EPA Office of Solid Waste and Emergency Response in “Test Methods for Evaluating Solid Waste”, SW-846, 1996
- Off-site analysis of sediment and surface soil samples for geotechnical characteristics in accordance with industry accepted procedures

2.0 PROJECT ORGANIZATION

2.1 Project Team Organization

The project team consists of a NYSDEC Remedial Project Manager (RPM), Remedial Design Contractor Project Manager, Quality Assurance Officer (QAO), Laboratory QAO, Data Validation Staff, Site Health and Safety Officer (SSO), and task leaders and field personnel. An additional component of the project team includes the analytical laboratories supporting the RD/RA project; laboratory responsibilities including Laboratory QAO, are described in Section 2.3.

Personnel responsibilities specifically related to QAPP activities are listed below. Resumes for key project personnel are provided in Appendix 4.

2.1.1 Haley & Aldrich - QAO

The Quality Assurance Officer is responsible for overseeing the review of field and laboratory produced data through the following functions:

- Assuring the application and effectiveness of the QAPP by the project staff
- Conducting internal quality checks of the PDI activities
- Providing input to the Project Manager as to corrective actions required resulting from the above-mentioned evaluations

2.1.1.1 Data Validation Staff

The Haley & Aldrich QAO will be assisted by the Data Validation subcontractor staff in the evaluation and validation of field and laboratory generated data. The QAO and Data Validation subcontractor staff will monitor the activities of the contract laboratories to meet the Data Quality Objectives (DQO) for the project. The data validator staff will be professionals independent of the laboratory and familiar with the analytical procedures performed. Resumes of the Data Validation staff are provided in the Attachment 4 of this document.

Data validation will utilize the EPA "National Functional Guidelines for Organic Data Review," US EPA 2008, the "National Functional Guidelines for Inorganic Data Review," revised 7/02, and the EPA Region 2 Data Validation Standard Operating Procedures (SOPs). The validation process will include a review of each validation criterion as prescribed by the guidelines and will be presented in a Data Usability Summary Report (DUSR) for each analytical data package.

2.1.2 Haley & Aldrich SSO

The Haley & Aldrich Site Health and Safety Officer is responsible for production, implementation, and enforcement of the Health and Safety Plan in accordance with safety rules and regulations.

2.2 PDI Organization

A total of seven (7) discrete PDIs are planned in support of the project as described in the RDWP. The Project Manager or the designated Task Leader is responsible for the execution of the respective PDIs. Depending on the task, appropriately experienced personnel will be assigned as field team leaders.

The field team leader is responsible for the overall operation of the field team in the completion of data collection activities in support of the PDI. The field team leader will work with the SSO to conduct the PDI activities in compliance with the Site Health & Safety Plan (HASP). The field team leader will facilitate communication and coordinate efforts between the Project Manager or his designee and the field team members.

Field Team Personnel involved in investigations and operations are responsible for:

- Performance of field activities as detailed in the RDWP and in compliance with the DQOs outlined in this QAPP,
- Taking all reasonable precautions to prevent injury to themselves and to their fellow employees and immediately reporting any accidents and/or unsafe conditions to the SS.

2.3 Laboratory Responsibilities

Several laboratory organizations have been selected to support the PDIs. These laboratory organizations include:

- Pace Analytical Inc. –Schenectady, New York
- Terrasense Geotechnical Laboratories, Totowa, New Jersey

Specific information regarding the sampling and analysis program to support each PDI is provided in the RDWP. A summary of the analytical parameters and the methods of analysis are presented in Table 2.3.1.

The specific responsibilities of laboratory personnel involved in the project related to QAPP activities are as follows:

2.3.1 Laboratory Project Manager

The Laboratory Project Manager will report directly to the Haley & Aldrich QAO and will be responsible for ensuring all resources of the laboratory are available on an as-required basis.

The Laboratory Project Manager will also sign all final laboratory data reports provided from the analysis of the project samples and will provide Case Narrative descriptions of any data quality issues encountered during the analyses conducted by the laboratory.

2.3.2 Laboratory QA Officer

The Laboratory QAO will have responsibility for review and validation of the analytical laboratory data generated as part of the PDI. The QAO will also define appropriate quality assurance (QA) procedures, review documentation, and approve the final laboratory analytical reports.

The Laboratory QAO will conduct internal audits of the laboratory procedures and recommend appropriate corrective actions. The Laboratory QAO reports directly to Laboratory Management and will provide written communications to the Haley & Aldrich QAO for any anomalies or corrective actions implemented that affect the reported results for the project samples.

2.3.3 Sample Custodian

The sample custodian will receive and inspect the incoming sample containers, record the condition of the incoming sample containers and sign COC documentation. The custodian will notify the project manager of any non-conformance identified during sample receipt and inspection and assign a unique identification number to each sample. After log-in, the sample custodian will initiate transfer of the samples to appropriate laboratory sections and monitor access/storage of samples and extracts.

2.4 Special Training/Certification Requirements

Field sampling team members will have received 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) safety training and annual 8-hour refresher courses required by 29 CFR Parts 1910 and 1926. On-site subcontractor personnel involved in invasive activities (e.g., excavation/drilling) will have received equivalent training.

Each subcontractor will be responsible for providing documentation of the compliance with the applicable task specific personnel training requirements.

2.5 Project Organization Structure

The project organizational structure for the project is provided in Figure 2.1.

3.0 PROJECT PLANNING / PROBLEM DEFINITION

The purpose of the RDWP and the project objectives and goals for the implementation of the PDIs to be conducted is presented in the following sections.

3.1 Problem Definition

The RDWP has been prepared in accordance with "DER-10 Technical Guidance for Site Investigation and Remediation" (NYSDEC, 2010), Section 5.2, Remedial Design. The purpose of the RDWP is to describe the activities required to prepare a remedial design in accordance with the Record of Decision (ROD). The selected remedy is described in the OU-1 ROD Amendment and the OU-2 ROD (dated March 2012) and is presented in Section 1.6 of the RDWP. The ROD established several remedial goals for the identified site conditions as follows:

For Operable Unit #1 (OU1):

- *Reduce, control, or eliminate to the extent practicable the contamination present within the soils and fill on site, and thereby eliminate the significant threat posed by the presence of hazardous wastes at the site.*
- *Eliminate the potential for direct human or animal contact with the contaminated soils or groundwater on site.*
- *Eliminate the threat to surface waters and sediments by eliminating surface run-off and subsurface releases of fill from the site.*
- *Eliminate, to the extent practicable, the migration of PCBs, metals and other contaminants into the Hudson River by surface and subsurface erosion of contaminated soils, transport of contaminated groundwater, and migration of PCBs in both elastic material and petroleum phases.*
- *Prevent, to the extent possible, migration of contaminants at the site to groundwater and surface water.*

Further, the remediation goals for the site include attaining to the extent practicable:

- *Provide for attainment of SCGs for groundwater quality at the limits of the site.*

For Operable Unit #2 (OU2):

The remedial action objectives (RAO) include:

Surface Water

RAO for Public Health Protection

- *Prevent surface water contamination which may result in fish advisories.*

RAO for Environmental Protection

- *Restore surface water to ambient water quality criteria for the contaminant of concern.*
- *Prevent impacts to biota from ingestion/direct contact with surface water causing toxicity and impacts from bioaccumulation through the marine or aquatic food chain.*

Sediment

RAO for Public Health Protection

- *Prevent direct contact with contaminated sediments.*
- *Prevent surface water contamination which may result in fish advisories.*

RAO for Environmental Protection

- *Prevent releases of contaminant(s) from sediments that would result in surface water levels in excess of (ambient water quality criteria).*
- *Prevent impacts to biota from ingestion/direct contact with sediments causing toxicity or impacts from bioaccumulation through the marine or aquatic food chain.*
- *Restore sediments to pre-release/background conditions to the extent feasible.*

3.2 Project/Task Description

This QAPP has been prepared to prescribe sampling procedures, sample custody, analytical procedures, data reduction validation and reporting, and personnel requirements to ensure that the data generated as part of the PDIs are of appropriate quality to support the remedial design process.

Detailed descriptions for the implementation of each PDI are presented in Appendices 1 through 7 of the RDWP. Below is a general description of each PDI, focusing on the associated data collection, verification, validation, and management procedures to assure the development of the remedial action to address the project goals and achieve the RAO set forth in the ROD.

3.2.1 RDWP Appendix 1: Phase 1 Investigation

RDWP Appendix 1 – Phase 1 Investigation will include the following data collection elements

- A site survey using ground penetrating radar (GPR) will be completed to identify subsurface structures that could affect the implementation of additional data collection activities.
- Groundwater level data loggers will be deployed within existing monitoring wells to obtain groundwater level data that extends over a longer time period than was performed during the remedial investigation (RI) phase of the project.
- The topographic survey for the site will be updated to assist in planning the remaining PDIs and prepare design documents for construction of the remedial systems. In addition, this survey will verify or update site features and investigation locations.

3.2.2 RDWP Appendix 2: OU-1 Supplemental Investigation

RDWP Appendix 2 – OU-1 Supplemental Investigation will include the following data collection activities:

- The installation of seven (7) additional groundwater monitoring wells for the purpose of establishing a more comprehensive understanding of the static water table throughout OU-1.
- Groundwater level data loggers will be deployed within the new monitoring well network and operating in conjunction with the existing monitoring wells described in PDI-1.
- Collection and laboratory analysis from five (5) existing groundwater samples for the purpose of documenting baseline site groundwater quality.
- The assessment of the presence/absence of void spaces and relative size will be performed in areas beneath the existing site concrete slabs.
- Subsurface anomalies that have been previously identified including locations detected by the GPR survey conducted as part of RDWP Appendix 1 will be further investigated.
- Existing Utility Structures including sumps, storm sewers and outfall locations will be verified to assist in the design process. Data collection activities will include historical records review, direct visual observation and video surveys of the existing sewer piping.

3.2.3 RDWP Appendix 3: OU-1 Excavation Pre-Delineation

The current extent of soil quality data collected during the RI and other Site activities is not sufficient to determine the extent of excavation required to achieve the remedial action criteria in the ROD. A pre-delineation sampling plan is described in RDWP Appendix 3.

Excavation pre-delineation sampling will be performed by acquiring representative soil samples at a frequency that complies with the post-excavation confirmation or documentation sampling requirements prescribed by DER-10. The total number of samples and locations will depend on the comparison of the analytical data to the OU-1 soil excavation criteria. If needed, “step-out” samples may be collected at some locations to complete the delineation. Data collection activities will include sample location determinations, chain of custody documentation, sample analysis and reporting, verification, validation and management.

3.2.4 RDWP Appendix 4: Extension Alignment Investigation

The installation of the extension of the bulkhead into the Hudson River in the Northwest Corner of the Site will require an evaluation of the presence/absence of PCB Material as dense non-aqueous liquid (DNAPL) or semi-solid phase along the proposed alignment.

Based on the orientation of the bulkhead wall, this work will be completed on land and offshore. Probes will be completed offshore into underlying sediments using a barge mounted drill rig. Probes will be completed on shore using roto-sonic technology. The number of locations will be field determined based on the observations obtained. The data collection activities will include visual observation of the probe conditions and the determination of the probe placement along the proposed alignment.

3.2.5 RDWP Appendix 5: Deepwater Investigation

The OU-2 ROD requires the determination of additional “significant and contiguous areas of sediment that exceed 50 parts per million (ppm) total PCBs”. This PDI will include the collection of sediment samples in deep water areas for the analysis of total PCBs to achieve this goal.

The number of locations and samples will be based on the comparison of the analytical data to the 50 ppm total PCB criteria. To achieve delineation, “step-out” samples may be collected at some locations. Data collection activities as part of this PDI will include sample location determinations, chain of custody documentation, sample analysis and reporting, and data verification, validation and management.

3.2.6 RDWP Appendix 6: Off-Shore Pre-delineation

Sediment quality data collected during the RI and other Site activities is not sufficient to pre-delineate the extent of dredging required to achieve the remedial goals set forth in the ROD, especially in the areas referred to as the “Backwater” areas consisting of the South Boat Slip, North Boat Slip and the Old Marina, “Nearshore” areas consisting of the expected silt curtain alignment on the west and the OU-1/OU-2 Boundary on the east, and “deepwater” adjacent to the northwest offshore area.

The number of locations and samples to be collected and submitted for laboratory analysis will be based on the comparison of the analytical data to the ROD criteria. To achieve delineation, “step-out” location samples may be collected. Data collection activities as part of this PDI will include sample location determinations, chain of custody documentation, sample analysis and reporting, verification, validation and management.

3.2.7 RDWP Appendix 7: Geotechnical Explorations

The geotechnical explorations will provide additional stratigraphic information for the underlying soils in several areas of the site including in the general vicinity of the planned deadman anchor, in the general vicinity of the planned Northwest Extension bulkhead wall, in the Old Marina, and in the general off-shore area between the North Boat Slip and the South Boat Slip. The information will be used for bulkhead and deadman design, excavation support design, design of the sloped shore, and general site geotechnical analysis (e.g. settlement).

Several test pits will also be installed at various locations around the site where sheetpile support of excavation (SOE) is planned for "hot spot" excavation locations that are 6 ft bgs or greater). The purpose of the test pits will be to gather information on soil conditions, and potential obstructions that could affect the design and/or construction of the sheet pile SOE walls.

3.3 Project Schedule

The project schedule is provided in the RDWP.

4.0 PROJECT DATA QUALITY OBJECTIVES AND MEASUREMENT PERFORMANCE CRITERIA

4.1 Data Quality Objectives (DQO)

DQO are qualitative and quantitative statements derived from the outputs of each step of the investigative process. The DQO process is a series of planning steps based on the scientific method that is designed to ensure that the type, quantity and quality of environmental data used in decision making are appropriate for the intended application.

The seven (7) steps of the DQO process include:

1. Stating the problem
2. Identifying the decision
3. Identifying inputs to the decision
4. Defining the boundaries of the study
5. Developing a decision rule
6. Specifying limits on decision errors
7. Optimizing the design for obtaining data

The decision rules for the major PDIs activities based on the environmental media and investigation goals are provided below.

RDWP Appendix 3: OU-1 Excavation Pre-Delineation

- The purpose of the OU-1 excavation pre-delineation program is to delineate remedial excavation limits based on exceedance of PCB and lead criteria at existing data points.
- The primary decision rule for the Appendix 3 will be to determine the limits of remedial excavation.

  Additional decisions will include the following:
  - Determine the off-site disposal options for the excavated soils

  The inputs to the decision will include the collection of the following types of data and information:
  - Total PCB concentrations will be measured in soil obtained from soil borings completed at horizontal and vertical locations determined based on requirements set forth in DER-10.
  - Lead concentrations will be measured in soil obtained from soil borings completed at horizontal locations determined based on requirements set forth in DER-10.
  - Copper and zinc concentrations will also be measured in soil obtained from soil borings completed at final perimeter locations (determined by lead concentrations at horizontal locations) for documentation purposes.

The spatial boundaries for RDWP Appendix 3 are defined by existing soil data collected during various site investigation events. The temporal boundary will be limited to the time in which the data collection activities are performed. The practical constraints for RDWP Appendix 3 are inclement weather, site access restrictions and subsurface conditions.

The decision rules used to designate excavation areas include:

- Total PCB concentration exceeding criteria at existing data points
- Total PCB concentration below the remedial goal in subsurface soils samples will designate the extent of the excavation limits
- Lead concentrations below the remedial goal in surface soils samples will designate the extent of the excavation limits
- Whether excavated soils are a characteristic hazardous waste based on Total PCB and lead concentrations.

The limits on decision errors for RDWP Appendix 3 include the following:

Type I decision error (false rejection error):
- Incorrectly conclude that an excavation area is noncompliant with the remedial goal
- Consequences of this type of error would result in excavation and disposal of soil that is below exceedance criteria
- Incorrectly conclude that excavated soils are a characteristic hazardous waste
- Consequences of this type of error are more costly disposal and deposition of soils in an alternate landfill

Type II decision error (false acceptance error):
- Incorrectly conclude that an excavation area is compliant with the remedial goal
- Consequences of this type of error are that less excavation than is required by the ROD would be completed. Soil that exceeds criteria would be left in place.
- Incorrectly conclude that excavated soils are not a characteristic hazardous waste
- Consequences of this type of error are that soils are placed in a landfill which is not properly permitted to accept this type of waste.

Method to Optimize the Design for Obtaining Data will include:

- Employ approved EPA methods for Total PCB and lead analyses to provide appropriate sensitivity, accuracy, and precision for decision making
- Employ appropriate test methods to provide sensitivity, accuracy, and precision to effectively characterize the excavated soils for off-site disposal.

RDWP Appendix 4: Extension Alignment Investigation Plan

- The purpose of the OU-1 extension alignment investigation program is to evaluate the presence of PCBM and obstructions along the alignments of the proposed bulkhead extension wall and deadman
- The primary decision rule for the RDWP Appendix 4 will be to determine the alignment of the bulkhead extension wall and deadman.

The inputs to the decision will include the collection of the following types of data and information:

- Presence of PCBM will be evaluated in soil obtained from soil borings completed along the proposed alignment at horizontal locations determined based the anticipated presence of PCBM. The evaluation of the presence of PCBM in the vertical direction will be completed from ground surface to the top 5 feet of the Marine Silt.

The spatial boundaries for RDWP Appendix 4 are defined by the alignment of the proposed alignments and existing soil data collected during various site investigation events. The temporal boundary will be limited to the time in which the data collection activities are performed. The practical constraints for RDWP Appendix 4 are inclement weather, site access restrictions and subsurface conditions.

The decision rules used to designate excavation areas include:

- Visual observation of PCBM in completed borings
- Presence of obstructions that may inhibit installation of sheet piles

<u>The limits on decision errors for RDWP Appendix 3 include the following:</u>

Type I decision error (false rejection error):
- Incorrectly conclude PCBM and obstructions are present
- Consequences of this type of error would result in selecting alternate alignment locations, resulting in additional excavation and disposal of material

Type II decision error (false acceptance error):
- Incorrectly conclude PCBM is not present
- Consequences of this type of error are that sheet pile may be driven through PCBM, dragging the material into the Basal Sand.
- Incorrectly conclude that obstructions to sheet pile installation are not present
- Consequences of this type of error are increased cost of installation due to refusal of sheet piles due to encountered obstructions during installation.

Method to Optimize the Design for Obtaining Data will include:

- Employ appropriate test methods to provide sensitivity, accuracy, and precision to effectively characterize the alignments.

RDWP Appendix 5: OU-2 Deep Water Investigation

- The purpose of RDWP Appendix 5 is to delineate total PCB concentrations in OU-2 deep water designated areas that are known to exceed criteria.
- The primary decision rule for the RDWP Appendix 5 is to determine the limits of the sediment capping/ removal areas to comply with the remedial goals established by the ROD.

The inputs to the decision will include the collection of the following types of data and information:

- Total PCB concentrations will be measured in sediments obtained from samples completed at horizontal and vertical locations as described in Appendix 5.

The spatial boundaries for RDWP Appendix 5 are defined by existing sediment data collected during various investigation events. The temporal boundary will be limited to the time in which the data collection activities are performed. The practical constraints for RDWP Appendix 5 are inclement weather, site access restrictions and subsurface conditions.

For the decision rules to designate excavation areas include:

- Total PCB concentration exceeding the exceedance criteria
- Total PCB concentration below the exceedance criteria will delineate the extent of the sediment capping/removal

The limits on decision errors for RDWP Appendix 5 include the following:

Type I decision error (false rejection error):
- Incorrectly conclude that deepwater sediments are noncompliant with the remedial goal
- Consequences of this type of error would result in capping/removal sediments that are below exceedance criteria

Type II decision error (false acceptance error):
- Incorrectly conclude that deepwater sediments are compliant with the remedial goal
- Consequences of this type of error are that less capping/removal is required by the ROD would be completed. Sediment that exceeds criteria would be left in place.

Method to Optimize the Design for Obtaining Data will include:

- Employ approved sampling and test methods for Total PCB analysis to provide appropriate sensitivity, accuracy, and precision for decision making

RDWP Appendix 6: OU-2 Off-Shore Delineation

- The purpose of RDWP Appendix 6 is to delineate total PCB concentrations in OU-2 off-shore designated areas referred to as the "Backwater" areas consisting of the South Boat Slip, North Boat Slip and the Old Marina, "Nearshore" areas consisting of the expected silt curtain alignment on the west and the OU-1/OU-2 Boundary on the east, and "deepwater" areas that are known to exceed the remedial goal.
- The primary decision rule for the RDWP Appendix 6 is to determine whether the limits of the sediment capping/ removal areas to comply with the remedial goals established by the ROD.

The inputs to the decision will include the collection of the following types of data and information:

- Total PCB concentrations will be measured in sediments obtained from samples completed at horizontal and vertical locations determined based on requirements described in RDWP Appendix 6.

The spatial boundaries for RDWP Appendix 6 are defined by existing sediment data collected during various investigation events. The temporal boundary will be limited to the time in which the data collection activities are performed. The practical constraints for RDWP Appendix 6 are inclement weather, site access restrictions and subsurface conditions.

For the decision rules to designate capping / removal areas include:

- Total PCB concentration exceeding the exceedance criteria
- Total PCB concentration below the exceedance criteria will delineate the extent of the sediment capping/removal

The limits on decision errors for RDWP Appendix 6 include the following:

Type I decision error (false rejection error):

- Incorrectly conclude that backwater sediments are noncompliant with the remedial goal
- Consequences of this type of error would result in capping/removal sediments that are below exceedance criteria

Type II decision error (false acceptance error):

- Incorrectly conclude that backwater sediments are compliant with the remedial goal
- Consequences of this type of error are that less capping/removal is required by the ROD would be completed. Sediment that exceeds criteria would be left in place.

Method to Optimize the Design for Obtaining Data will include:

- Employ approved sampling and test methods for Total PCB analysis to provide appropriate sensitivity, accuracy, and precision for decision making

4.2 Measurement Performance Criteria

The quality assurance program is designed to produce data of the quality necessary to achieve project objectives and meet or exceed the minimum standard requirements for field and analytical methods.

The quality assurance program will include:

- A mechanism for ongoing control of measurement data and evaluation of data quality

- A measure of data quality in terms of precision, accuracy, representativeness, completeness and comparability

The following is a general discussion of the criteria used to measure the DQO, including field and laboratory analytical data quality. Field data collection and associated quality assurance will be the responsibility of Haley & Aldrich and the subcontractors retained for field explorations activities. Laboratory data quality assurance described herein will be the responsibility of the contracted analytical laboratory(s). A summary of the Data Quality Indicators (DQI) and the associated measurement performance criteria is presented in Table 4.2.

4.2.1 Precision

Precision determines the reproducibility of measurements under a given set of conditions or is a quantitative measure of the variability of a group of measurements compared to their average value. Precision will be stated in terms of Relative Percent Difference (RPD) expressed as a percentage of the mean, and a relative range.

The overall precision of measurement data is a mixture of sampling and analytical factors. Analytical precision is much easier to control and quantify than sampling precision. There are more historical data related to individual method performance and the sample "universe" is limited to the samples received within a laboratory. In contrast, sampling precision is unique to each site.

Precision will be determined by collecting and analyzing field duplicate samples and by creating and analyzing laboratory duplicates from the field samples. The analytical results from the field duplicate samples will provide data on sampling precision.

4.2.1.1 Field Precision Criteria

Precision of the field sample collection procedures will be assessed by data from the analysis of field duplicate samples. RPD will be calculated for detected analytes from investigative and field duplicate samples. Field duplicate samples will be collected at a minimum frequency of 1 per 20 investigative samples. The DQO for field duplicate analysis will be +/- 100% RPD for soil/sediments and +/- 35% for surface/groundwater field duplicates for analytes detected in both the investigative and field duplicate samples at concentrations greater than or equal to 5 times the quantitation limit.

4.2.1.2 Laboratory Precision Criteria

Laboratory precision will be assessed through the calculation of RPD for replicate/duplicate sample analyses performed as Matrix Spike/Matrix Spike Duplicate (MS/MSD) and Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) sample analyses. The equation to be used to determine precision is presented in Section 7.3.

Laboratory duplicate analysis will provide data on laboratory precision. Laboratory duplicate analyses will be performed through the use of MS/MSD for organic parameters and Matrix Duplicate (MD) analyses for inorganic parameters.

4.2.2 Accuracy

Accuracy relates to the bias in a measurement system. Bias is the difference between the average value of observed measurements and the "true" value. Sources of error are the sampling process, field contamination, preservation techniques, sample handling, sample matrix, sample preparation and analytical techniques.

4.2.2.1 Field Accuracy Criteria

Evaluating the results of field equipment rinse and trip blanks will assess sampling accuracy. Field equipment rinse and trip blanks will be collected as appropriate for each sampling effort. Field equipment rinse blanks will be collected by passing ASTM Type II de-ionized water or equivalent over and/or through the respective field equipment utilized during each sampling effort. One rinse blank will be collected for each type of field equipment used. Field rinse blanks will be prepared and analyzed for each target parameter for which environmental media have been collected.

Field equipment blank samples will be collected at a frequency of 1 per 20 field samples collected during a sampling event . Equipment blank samples will not be collected for samples collected using pre-cleaned and/or disposable sampling equipment. Equipment blank samples will be analyzed to evaluate contamination from ambient conditions and/or sample container contamination.

Equipment blank samples should not contain target analytes. The equipment and trip blank sample data will be evaluated using the procedures specified in Section 7.3.

Analyzing calibration check samples will assess accuracy of field measurements, specific conductivity, dissolved oxygen, pH and temperature obtained during groundwater sampling events.

4.2.2.2 Laboratory Accuracy Criteria

Analytical accuracy will be assessed through the use of known Laboratory Control Samples (LCS) and project- specific matrix spike sample analyses.

LCS analyses will be performed with each analytical batch of project samples to determine the accuracy of the analytical system. MS/MSD analyses will be performed with each batch of twenty (20) project samples to assess the accuracy of identifying and quantifying analytes within the sample matrices. Additional sample volume (3X) will be collected at sample locations selected for MS/MSD analyses so quantitation limits can be met.

The accuracy of the organics analyses also will be monitored through the analysis of surrogate compounds. Surrogate compounds are added to each sample, standard, blank and Quality Control (QC) sample prior to sample preparation and analysis. Surrogate compound percent recoveries will provide information on the effect that the sample matrix exhibits on the accuracy of the analyses.

4.2.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents a characteristic of a population, a parameter variation at a sampling point or an environmental condition. Representativeness is a qualitative parameter that is most concerned with the proper design of the sampling program. The representativeness criterion is best satisfied selecting sampling locations properly and ensuring that a sufficient quantity of sample is collected.

Representativeness will be addressed by describing sampling techniques and the rationale used to select sampling locations. Sampling locations may be biased (based on existing data, instrument surveys, observations, etc.) or unbiased (completely random or stratified-random approaches) depending on the situation.

Representativeness will also be assessed by the use of field duplicate samples. By definition, field duplicate samples are collected so that they are equally representative of a given point in space and time. In this way, they provide both precision and representativeness information.

4.2.3.1 Field Representativeness Criteria

Representativeness is dependent upon the proper design of the sampling program. The sampling programs are designed to provide data representative of field conditions. For this investigation, sampling will be biased in some instances and random in some instances. The representativeness criteria for field sampling will be to ensure that the sampling locations are properly established on and off site (as applicable), the correct locations are sampled, and that the approved sampling procedures are followed. Appendix 1 provides a summary of the field Standard Operating Procedures (SOP) that will be used for the project.

4.2.3.2 Laboratory Representativeness Criteria

The representativeness criteria for laboratory data will be to ensure that the proper analytical procedures are used for sample preparation (e.g., homogenizing the sample prior to sub-sampling), sample analysis and that sample holding times are met. Additionally, the accuracy and precision of the laboratory data affect representativeness. The laboratory representativeness criteria will include achieving the accuracy and precision criteria for the sample analyses.

4.2.4 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. Sample data should be comparable with other measurement data for similar samples and sample conditions. This goal is achieved through using standard operating procedures (SOPs) to collect and analyze representative samples and the reporting of analytical results.

The SOPs for the Field Sampling Methods to be implemented during the execution of the RDWP are provided in Appendix 1 and 3 to this plan. A listing of the Laboratory SOPs for the preparation and analysis of the samples collected during the BSAP is provided as Appendix 2. Uncontrolled copies of the Laboratory SOPs are available upon request from the subcontractor laboratories.

4.2.4.1 Field Comparability Criteria

The field SOPs for the various activities to be conducted during this investigation will provide guidelines to generate reproducible results. Comparability of data will be based on the use of Standard Reference Materials (SRM) obtained from either EPA Cooperative Research and Development Agreement (CRADA) suppliers or the National Institute of Standards and Technology (NIST) for instrument initial calibration and continuing calibration verification.

4.2.4.2 Laboratory Comparability Criteria

The reported analytical data will be in standard units of mass of contaminant within a known volume of environmental media.

- Solid Matrices - micrograms (ug) contaminant per kilogram (kg) of media (Dry Weight) or parts per billion (ppb)
- Aqueous Matrices – (Organic parameters) micrograms (μg) per liter (L) of media or parts per billion (ppb)
- Aqueous Matrices - (Inorganic parameters) - milligrams (mg) per liter (L) or parts per million (ppm)
- Ambient Air– milligrams per cubic meter (mg/M^3)

4.2.5 Completeness

Completeness is defined as the percentage of measurements made which are judged to be valid measurements. The completeness goal is essentially the same for all data uses: that a sufficient amount of valid data is generated. The completeness of the data generated will be determined by comparing the amount of valid data, based on independent validation, with the total data set. The completeness goal will be greater than (>) 90%.

4.2.5.1 Field Completeness Criteria

The criteria for field completeness will be that > 90 % of the field measured data are valid. The procedure for determining field data validity is provided in Section 5.8. The equation for calculating completeness is presented in Section 7.3.

4.2.5.2 Laboratory Completeness Criteria

The criteria for laboratory completeness will be that a minimum of 90 % of the laboratory data are determined to be valid (usable) for the intended purpose. Analytical data generated by the laboratory will be validated prior to incorporation into the site database. Validation will be performed by a professional independent of the laboratory, experienced in the analytical procedures performed. Guidance for the data validation will be derived from the "National Functional Guidelines for Organic Data Review", (7/08), and the EPA "National Functional Guidelines for Inorganic Data Review", (7/02). The evaluation of the data completeness will be performed at the conclusion of each sampling and analysis effort. Corrective actions such as revised sample handling procedures will be implemented if problems are noted. The procedure for determining laboratory data validity is provided in Section 5.8. The equation for calculating completeness is presented in Section 7.3.

4.2.6 Sensitivity

Sensitivity is the ability of a method or instrument to detect a parameter to be measured at a level of interest.

4.2.6.1 Field Sensitivity Criteria

The sensitivity of the field instruments selected to measure the pH, temperature, conductivity, ORP, turbidity and DO for this project will be measured by analyzing calibration check solutions, where appropriate, at the lower end of the expected concentration range. The sensitivity of handheld VOC analyzer used to screen samples for VOC (if required) will be less than background readings of ambient air.

Instrument	Parameter	Sensitivity
Water Quality Checker (Horiba U-22 or equivalent)	pH Temperature Conductivity ORP Turbidity Dissolved Oxygen	0-14 0-55°C 0-9.99 S/m ±1999 mV 0-800 NTU 0-19.99 mg/L
PID (MiniRAE Plus or equivalent)	VOCs	0-1999 ppm

4.2.6.2 Laboratory Sensitivity Criteria

The sensitivity requirements for the laboratory analyses presented as method detection limits (MDL) and laboratory reporting limits (RL) are provided in Table 2.3.1.

4.3 Special Training/Certification Requirements

Special training/certification requirements for this project were provided in Section 2.0. Laboratory shall maintain certification through the performance of analytical methodologies prescribed by:

- EPA Contract Laboratory Program Statement of Work (CLP-SOW),
- EPA-500 series methodologies,
- EPA-600 series methodologies,
- EPA "Test Methods for Evaluating Solid Waste" SW-846,
- Standard Methods For The Examination Of Water And Wastewater (APHA/AWWA/WPCF),
- New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP), applicable to the appropriate categories

4.4 Documentation and Records

The documents, records, and reports generated during the project are identified in the following subsections.

4.4.1.1 Field and Laboratory Records

Documents and records generated during the project include sample collection records, QC sample records, field measurement records, laboratory records and data handling records. A brief description of these documents and records are provided below.

Sample collection records that will be used during the sampling activities include field logbooks or standard field forms, soil boring logs, COC records and shipping papers. Field measurements of pH, temperature, conductivity, ORP, turbidity, DO and conductivity will be recorded in bound logbooks or on standard field forms. Calibration data, where applicable, will also be recorded in these logbooks or forms. Field logbooks or standard forms will be used during the project to document the generation of QC samples including equipment blank samples, field duplicate samples and MS/MSD samples.

The laboratory will maintain documentation of trip blank sample preparation, quality records for de-ionized water provided for equipment blank samples, and sample integrity information. Laboratory records that will be maintained for the project include sample receipt documentation, field and laboratory COC documentation, sample container cleanliness certifications, reagent and standard reference material (SRM) certifications, sample preparation records, sample analysis records, including instrument calibration data/raw data, QC data, corrective action reports and final reports.

4.4.1.2 Data Reporting Format

Field data will be recorded in bound logbooks or on standard forms (e.g., soil boring logs). Field data primarily will be from direct-reading meters or field observations. These data will be tabulated and included in project reports or submittals, as appropriate.

The laboratory Project Manager will perform a final review of the laboratory data summary packages and case narratives to determine whether the report meets the project requirements. In addition to the record of the COC, the final laboratory data report format shall consist of the following:

Title Page
- project name and number
- laboratory project or lot number
- signature of the Laboratory QA Officer or his/her designee
- date issued

Table of Contents - laboratory report contents

Case Narrative
- number of samples and respective matrices
- laboratory analysis performed
- any deviations from intended analytical strategy
- definition of data qualifiers used
- QC procedures utilized and references to the acceptance criteria
- condition of samples "as received"
- discussion of whether or not sample holding times were met
- discussion of technical problems or other observations which may have created analytical difficulties
- a discussion of laboratory QC checks which failed to meet project criteria

Analytical Methods Summary - methods of sample preparation and analyses for samples.

Analytical Sample Summary - cross-reference table of laboratory sample to project sample identification numbers.

Shipping and Receiving Documents

- sample container documentation
- sample reception information and original chain of custody record

Chemistry Data Package by Analysis

- Sample Results
  - sample quantitation (reporting) limits (RL), reporting MDL and estimated values between the RL and MDL, provided in an electronic format compatible with EQuIS
  - methods of sample preparation and analyses for samples
  - raw data for sample results (dated chromatograms, parameter specific quantitation reports, mass spectra and instrument printouts)
- QC Summary Data with Current Control Limits
  - MS/MSD recoveries, LCS, method blank results, surrogate recoveries, Gas Chromatography/Mass Spectroscopy GC/MS tuning results, and internal standards (organics)
  - MS recoveries and matrix duplicate relative percent differences, LCS, serial dilutions, method blank results, and reagent blank results and interference check standards (inorganics)
- Standard Data
  - initial calibration data, initial calibration checks, continuing calibration verification/check standards
  - initial and continuing calibration blanks
  - raw data for calibration data (dated chromatograms, parameter specific quantitation reports, mass spectra and instrument printouts)
- Raw QC Data - dated chromatograms, parameter specific quantitation reports, mass spectra and instrument printouts of QC samples.
- Miscellaneous Data
  - instrument run logs
  - sample preparation records
  - instrument conditions

4.4.2 Data Archiving and Retrieval

All records for the PDIs will be maintained consistent with NYSDEC requirements and data results will be provided to the Department in an electronic format compatible with EQuIS.

5.0 DATA GENERATION AND ACQUISITION

The design and implementation of the measurement systems that will be used during the RD/RA project, including sampling and analytical procedures, data handling and documentation are detailed in the following subsections.

5.1 Sampling Process Design

The rationale for the sampling programs is provided in the RDWP.

5.1.1 Sampling Methods

A summary list of the sampling methods and procedures for the collection of soil, sediment, and surface water are provided in Appendix 1: Field Standard Operating Procedures (SOP).

5.1.2 Field Equipment and Sample Container Cleaning Procedures

Cleaning/decontamination procedures for the field sampling and handling equipment are provided in the RDWP. The laboratory will provide sample containers pre-cleaned in accordance with the EPA guidance document entitled "Specifications and Guidance for Contaminant-Free Sample Containers", EPA 540/R-93/051. Example certificates of analysis for each lot of containers to be used during the project will be maintained at the laboratory and available upon request.

5.1.3 Field Equipment Maintenance, Testing, and Inspection Requirements

Field equipment will be inspected and tested prior to being shipped to the field. Prior to use in the field, the equipment will be calibrated, and the performance information will be recorded in the field logbook or daily field form. Any required maintenance will be performed and documented prior to returning the equipment to service. Maintenance logs for field equipment will be kept with the field equipment. Critical spare parts for field equipment and replacement field equipment will be available and can be shipped for overnight delivery, or delivered to the field, if necessary. Alternately, field equipment vendors will provide replacement equipment shipped for overnight delivery as necessary.

5.1.4 Inspection and Acceptance Requirements for Supplies and Sample Containers

Field Task Leaders are responsible for ensuring that the field supplies for the project are acceptable. The field supplies for the sampling activities will include:

- calibration standard solutions for field instrument calibration and calibration checks
- detergent (Alconox) for equipment cleaning
- distilled water for sample collection equipment decontamination
- deionized water for field equipment rinse blank samples
- chemical preservatives for pH adjustment of samples (e.g., nitric acid for metals)
- sample containers to collect the solid and aqueous samples

Field calibration standards (e.g., pH buffers, conductivity solutions) will be traceable to NIST standards. Cleaning detergents (e.g., Alconox) will be laboratory-grade or equivalent. Distilled water will be purchased as needed from a variety of vendors or provided by the laboratory.

Water, chemical preservatives, and sample containers will be provided by the laboratory and will maintain documentation of the purity/cleanliness for these materials. The Laboratory QAO is responsible for ensuring that these materials are acceptable for the project. The acceptability of these materials for use will be evaluated by reviewing lot analysis certificates (deionized water, chemical preservatives, and containers).

5.2 Sample Handling and Custody Requirements

The procedures for sample handling, labeling, shipping, and COC documentation are provided in the subsections that follow. Table 5.2.1 contains sample container, preservation, shipping and packaging requirements.

5.2.1 Sample Handling

The procedures used to collect and label the investigation samples are provided in the FSP. The sample numbering system for the project has been designed to uniquely identify each sample from each sampling program and event.

Example Sample Name: ID-MMDDYY-HHMM

Dashes must separate each code section.

> ID: The first code section represents the sample location's predetermined ID or the four-digit Haley & Aldrich employee ID number of the person that collected the sample (for duplicate or blank samples). For employees with two or three numbers in their employee ID number, zeros will be added in the front so that the section code contains four numbers.
>
> MMDDYY: The second code section represents the six digit date that the sample was collected. One digit days, months, and/or years will be preceded with a zero (ie. 070501). There should be NO slashes, dashes, or periods in the date. The date code should match the sample date recorded on the chain of custody.
>
> HHMM: The third code section represents the time that the sample was collected, in military time. One-digit times will be preceded with a zero (ie. 0101). There should be NO colons, slashes, dashes, or periods in the time. The time code should match the sample time recorded on the chain of custody.

For samples collected as MS/MSD, the ID and date codes will be assigned as described above. The time code will be replaced with the sample code, either MS or MSD.

For samples collected as Field Duplicates, and Field Equipment Blanks, the ID and date codes will be assigned as described above. The time code will be replaced with a sample number (ie. 0001, 0002, 0003), that will be reset for each day of sampling. This will simplify sample naming for the QA/QC samples and avoid identifying the parent sample for blind duplicates. Parent samples will be identified on the Sample Key.

A field code will be written in capital letters in the comments section of the Chain-of-Custody for each sample. The field code will not be part of the sample name. Listed below are appropriate field codes.

N	Field Sample
FD	Field Duplicate (note sample number (i.e. 0001) substituted for time)
TB	Trip Blank (note sample number (i.e. 0001) substituted for time)
EB	Equipment Blank (note sample number (i.e. 0001) substituted for time)
FB	Field Blank (note sample number (i.e. 0001) substituted for time)
MS	Matrix Spike Sample
MSD	Matrix Spike Duplicate Sample

The naming convention described above does not associate samples with the location from which the sample was collected. Therefore, a Sample Identification Key will be used to associate the sample name with the sample location. The Sample Identification Key will be updated upon completion of each sample and will contain additional information regarding the sample (i.e., filtered versus unfiltered, sample matrix, etc.). The information on the Sample Identification Key will exactly match information on sample bottles and the Chain-of-Custody (i.e. date, time, etc.). One Sample Identification Key will be completed for each Chain-of-Custody and will be submitted to the Haley & Aldrich Project Manager.

Information regarding the sample matrix, sampler, date, time, location, depths (if applicable), sample type, parent sample (if applicable) and any other relevant information will be recorded on the Sample Identification Key.

Samples will be placed in shipping coolers containing ice immediately following collection. The samples will be hand-delivered or shipped to the laboratory via an overnight courier service.

The laboratory will group the samples in Sample Delivery Groups (SDG). An SDG is a group of 20 or fewer field samples (including field QC samples) received by the laboratory within 7 calendar days.

5.2.2 Sample Custody

Custody of a sample begins when it is collected by or transferred to an individual and ends when that individual relinquishes or disposes of the sample. A sample is under your custody if:

1. the item is in actual possession of a person
2. the item is in view of the person after being in actual possession of the person
3. the item was in actual possession but is stored to prevent tampering
4. the item is in a designated and identified secure area

5.2.2.1 Field Custody Procedures

The quality of data can be affected by sample collection activities. If the integrity of collected samples is in question, the data, regardless of the analytical quality, will also be in question. Field sampling standard operating procedures will provide for the collection of samples representative of the matrix being investigated.

The following procedures will be used to maintain the integrity of the samples:

- Upon collection, samples are placed in the proper containers. In general, samples collected for organic analysis will be placed in pre-cleaned glass containers, and samples collected for inorganic analysis will be placed in pre-cleaned plastic (polyethylene) bottles
- Samples will be assigned a unique sample number and will be affixed to a sample label. The information to be placed on the sample label includes: the sample ID number, the sample type, the sampler's name, date collected, preservation technique, and analytical parameter and method to be performed. Information on the labels will be completed with indelible ink
- Samples will be properly and appropriately preserved by field personnel in order to minimize loss of the constituent(s) of interest due to physical, chemical or biological mechanisms
- Appropriate volumes will be collected to insure that method or contract required detection limits (or quantification limits) can be successfully obtained and that the required level of QC relative to both precision and accuracy can be completed
- A COC record will be completed during sample collection. The COC records will accompany the samples to the laboratory. The field personnel collecting the samples will be responsible for the custody of the samples until the samples are relinquished to the laboratory. Sample transfer will require the individuals relinquishing and receiving the samples to sign, date and note the time of sample transfer on the COC record.
- Samples will be shipped or delivered in a timely fashion to the contract laboratory so that holding-times and/or analysis times as prescribed by the methodology can be met
- Samples will also be transported in containers (coolers) which will maintain the refrigeration temperature for those parameters for which refrigeration is required.
- Field personnel will keep written records of field activities on applicable preprinted field forms or in a bound field notebook. These records will be written legibly to record field data collection activities. The title page of each logbook will contain the following information:
  - person to whom or task for which the logbook is assigned
  - project number
  - project name
  - the starting date for entries into the logbook
  - the ending date for entries into the logbook

All field measurements obtained and samples collected will be recorded. All logbook entries will be made in ink, signed and dated. If an incorrect logbook entry is made, the incorrect information will be crossed out with a single strike mark, initialed and dated by the person making the correction. The correct information will be entered into the logbook adjacent to the original entry.

Whenever a sample is collected or a measurement is made, a detailed description of the location will be recorded in the logbook or standard field form. All equipment used to obtain field measurements will be recorded in the field logbook or standard field form. In addition, the calibration data for all field measurement equipment will be recorded in the field logbook or on standard field forms.

The equipment used to collect samples, time of sample collection, sample description, volume, number of containers and preservatives added (if applicable) will be recorded in the field logbook or standard field form.

5.2.2.2 Laboratory Custody Procedures

The laboratory custody procedures will be based upon the EPA policies and procedures (EPA-330/9-78-001-R). It will be the responsibility of the laboratory sample custodian to receive all incoming samples. Once received, the custodian will document that each sample is received in good condition, that the associated paperwork, such as COC forms, have been completed and will sign the COC forms. In special cases, the custodian will document from appropriate sub-samples that proper preservation has been achieved. The custodian will also document that sufficient sample volume has been received to complete the analytical program. The sample custodian will then place the samples into secure, limited access storage.

Consistent with the analyses requested on the COC form, analyses by the laboratory analysts will begin in accordance with the appropriate methodologies. Empty sample bottles, when the available volume has been consumed by the analysis, will be returned to secure and limited access storage. The samples will be held at least thirty (30) days after reports have been submitted. Disposal of remaining samples will be completed in compliance with pertinent regulations.

5.2.2.3 Final Project Files Custody Procedures

The final project files will be maintained by Haley & Aldrich and will consist of the following:

1. project plan
2. project log books
3. field data records
4. sample identification documents
5. COC records
6. correspondance
7. references, literature
8. final laboratory reports
9. miscellaneous - photos, maps, drawings, etc.
10. final reports

The final project file materials will be the responsibility of the Haley & Aldrich Project Manager. All records for the RD/RA PDIs will be maintained consistent with the requirements of the CD.

5.3 Analytical Method Requirements

The field and laboratory analytical methods that will be used are detailed in the following subsections.

5.3.1 Field Analytical Methods

Standard Operating Procedures (SOPs) for the field measurements are provided in the RDWP. Field-portable pH/temperature, conductivity, oxidation and reduction potential (ORP), dissolved oxygen

(DO) and turbidity meters will be used to analyze aqueous samples. The data from these analyses will be used to determine the time for the collection of representative samples.

5.3.2 Laboratory Analytical Methods

Soil, surface water, groundwater and sediment samples will be analyzed off site in accordance with the EPA methodology requirements promulgated in:

- Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846 EPA Office of Solid Waste, 3rd Edition and promulgated updates, (1986).

- American Society for Testing and Materials (ASTM) Standards. (Current Revision)

The analytical methodology that will be used for the analysis of soil, sediment, and surface water samples are presented in Table 2.3.1. A summary of the field samples to be collected and associated field and laboratory quality control and quality assurance samples to be analyzed as part of the project is presented in Table 5.3.1

5.4 Quality Control (QC) Requirements

The field and laboratory quality control requirements for the PDI activities are discussed in the following subsections.

5.4.1 Field Quality Control

Field QC requirements include analyzing reference standards for instrument calibration and for routine calibration checks in accordance with the manufacturer's recommendations.

Field QC samples for this project include field blank samples to determine the existence and magnitude of sample contamination resulting from ambient conditions or sampling procedures, field duplicate samples to assess the overall precision of the sampling and analysis events, and trip blank samples to monitor cross-contamination of samples by VOC.

5.4.2 Analytical Quality Control

Analytical QC procedures are documented in the laboratory specific SOP, which addresses the minimum QC requirements. A list of the applicable Laboratory SOPs is provided in Appendix 2 to this plan. The internal QC checks vary for each analytical procedure but in general will include the following QC elements:

1. Standard Reference Materials
2. Instrument Performance Checks – Organics
3. Initial and Continuing Calibration Checks
4. Internal Standard Performance
5. Method Blank Samples
6. Laboratory Control Samples
7. MS/MSD

8. System Monitoring Compounds/Surrogates
9. Inductively Coupled Plasma (ICP) Interference Check Samples (ICS)
10. ICP Serial Dilution
11. ICP and ICP/Mass Spectrometer QC Analyses
12. Reagent Checks

The laboratory data package will include a summary of QC sample data. Any project samples analyzed concurrently with non-conforming QC samples will be re-analyzed by the laboratory, if sufficient sample volume is available.

5.5 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

The use of materials of known purity and quality will be utilized for the analysis of environmental samples. The laboratory will carefully monitor the use of all laboratory materials including solutions, standards and reagents through well-documented procedures.

All solid chemicals and acids/bases used by the laboratory will be reagent grade or better. All gases will be high purity or better. All standard reference materials (SRM) will be obtained from approved vendors of the NIST (formerly National Bureau of Standards), the EPA Environmental Monitoring Support Laboratories or reliable commercial sources.

All materials including standards or standard solutions will be dated upon receipt, and will be identified by material name, lot number, purity or concentration, supplier, receipt/preparation date, recipient/preparer's name, expiration date and all other pertinent information. The procedures used to verify that instruments and equipment are functional and properly maintained are described in the following subsections.

5.5.1 Field Instrument Maintenance

The field equipment for this project includes field-portable Photo-ionization Detector (PID) systems, pH/temperature, specific conductivity, ORP, DO and turbidity meters. Specific preventive maintenance procedures to be followed for field equipment are those recommended by the manufacturer. Field instruments will be checked and calibrated before use.

5.5.2 Laboratory Instrument Maintenance

As part of its QA/QC program, the laboratory will conduct routine preventive maintenance program to minimize the occurrence of instrument failure and other system malfunctions. Designated laboratory employees will regularly perform routine scheduled maintenance and repair of (or coordinate with the instrument manufacturer for the repair of) all instruments. All maintenance that is performed will be documented in the laboratory's maintenance logbooks. All laboratory instruments are maintained in accordance with manufacturer's specifications.

5.6 Calibration Procedures and Frequency

The procedures for maintaining the accuracy for all the instruments and measuring equipment which are used for conducting field tests and laboratory analyses are described in the following subsections. These instruments and equipment will be calibrated in accordance with the manufacturer's specifications before use.

5.6.1 Direct Reading Instruments/Equipment

Instruments and equipment used to measure environmental data will be calibrated in accordance with the manufacturer's specifications.

The field instruments include DO meters, pH meters, turbidity meters, specific conductance meters and PID systems. Field instruments will be used for real-time sample measurement during monitoring well sampling and organics screening for both on-site screening of soil samples and for health and safety air monitoring.

Field instruments will be calibrated prior to use and the calibration will be verified periodically during use. Satisfactory completion of the pre-operation inspection will be noted on the Field Sampling Record, along with the results of the field measurements.

5.6.2 Non-direct Reading Instruments

Calibration procedures for non-direct reading instruments will consist of initial calibration, initial calibration verification and continuing calibration verification. The SOP for each analysis to be performed in the laboratory describes the calibration procedures, the frequency, acceptance criteria and the conditions that will require re-calibration.

5.7 Inspection/Acceptance Criteria for Supplies and Consumables

The procedures that will be used to ensure that supplies and consumables used in the field and laboratory will be available as needed and free of contaminants are detailed in the following subsections.

5.7.1 Field Supplies and Consumables

Supplies and consumables for field measurements and sampling will be obtained from various vendors and include standards for field meter calibration, sample containers, preservatives, detergent and water for equipment decontamination. Additional field supplies and consumables will include pump tubing and Personal Protective Equipment (PPE). Pump tubing will be constructed of pre-cleaned High-Density Polyethylene (HDPE). This material will not introduce contaminants into the samples or interfere with the analyses. All field supplies will be consumed or replaced with sufficient frequency to prevent deterioration or degradation that may interfere with the analyses and PDI activities.

5.7.2 Laboratory Supplies and Consumables

The Laboratory QAO is responsible for the ensuring the acceptability of supplies and consumables. The laboratory SOPs provide details on determining deterioration of reagents and standards, and the corrective actions required if contaminants or deterioration are identified.

5.8 Data Management

The procedures for managing data from generation to final use and storage are detailed in following subsections.

5.8.1 Data Recording

Field data will be recorded in field logbooks or on standard forms and consist of measurements from direct reading instruments or direct measurements. Field staff personnel are responsible for recording field data and the Project Manger or his designee is responsible for identifying and correcting recording errors.

Laboratory data are recorded in a variety of formats. The laboratory SOPs provide the data recording requirements for each preparation and analysis method to be used in support of the PDI activities.

5.8.2 Data Validation

Validation of field data for this project will primarily consist of checking for transcription errors and review of data recorded in field logbooks or on standard forms. Data transcribed from the field logbook or standard forms into summary tables for reporting purposes will be verified for correctness by the QAO or his designee.

The final laboratory reports will be checked for completeness of each data package by qualified Data Validation staff. Completeness checks will be administered on all data to determine whether all required deliverables are present. At a minimum, deliverables will include sample COC forms, analytical results, QC summaries and supporting raw data from instrument printouts. The review will determine whether all required items are present and request copies of missing deliverables.

Validation of the analytical data will be performed by the QAO or his designee based on the evaluation criteria outlined in "EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review", EPA 540/R-99/008, October 1999, and "EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review", EPA 540/R-01-008, July 2002. Data qualification and corrective actions specified in these documents will be used for qualification of the data.

Organic Analysis

1. technical holding times
2. GC/MS instrument performance check
3. initial and continuing calibration
4. internal standard performance
5. method, trip and field blanks
6. system monitoring compounds (surrogate spikes)
7. MS/MSD results

8. LCS
9. field duplicate samples

Inorganic Analysis

1. technical holding times
2. initial calibration
3. initial and continuing calibration verification
4. blanks
5. ICP interference check samples
6. ICP serial dilutions
7. LCS
8. MS and matrix duplicate results
9. field duplicate samples

The data validation staff will generate a data usability summary report (DUSR) for each sample delivery group, utilizing the EPA "National Functional Guidelines for Organic Data Review," US EPA 2008, the "National Functional Guidelines for Inorganic Data Review," revised 7/02 and EPA Region 2 Data Validation SOPs, and supply the findings to the project data management team. The DUSR will include data qualification and corrective actions recommendations for incorporation into the final project database.

Data validation will include two (2) tiers of review based on guidance provided from "Innovative Approaches to Data Validation", US EPA Region III, June 1995. All laboratory data from the analysis of samples collected as part of the project will undergo Tier 1 data review and verification with, 10 percent (%) of the reported results subject to full Tier 2 data validation.

5.8.3 Data Transformation/Data Reduction

Field data reduction procedures will be minimal in scope compared to those implemented in the laboratory setting. Only direct read instrumentation will be employed in the field. The pH, conductivity, temperature, turbidity and VOC readings collected in the field will be generated from direct read instruments following calibration per manufacturer's recommendations. Such data will be written into field logbooks or standard forms immediately after measurements are taken. If errors are made, results will be legibly crossed out, initialed and dated by the field team member, and corrected in a space adjacent to the original entry.

The methods and procedures employed to reduce laboratory data will be in accordance with the applicable chapter of SW-846, Third Edition. All calculations are checked by qualified laboratory personnel at the conclusion of each operating day. If errors are noted, the corrections will be made with the original notations crossed out legibly. Analytical results for soil samples shall be calculated and reported on a dry weight basis.

QC data (e.g., laboratory duplicates, surrogates, MS/MSD will be compared to the method acceptance criteria. Data considered to be acceptable will be entered into the laboratory computer system. Data summaries will be sent to the Laboratory QAO for review. If approved, data will be logged into the project database format. Unacceptable data shall be appropriately qualified in the project report. Case narratives will be prepared which will include information concerning data that fell outside acceptance limits and any other anomalous conditions encountered during sample analysis.

5.8.4 Data Transmittal/Transfer

The Haley & Aldrich QAO or his designee is responsible for verifying the correctness of the field data after the data are transferred to a spreadsheet and/or database format. The chemical analysis data are maintained in a database that is described below.

Laboratory data will be provided as electronic data deliverables (EDD) in a Microsoft Access® and EQuIS compatible format. The laboratory data will be downloaded into the EDD directly from the laboratory information management system (LIMS).

5.9 Data Assessment

Assessment of laboratory data will be performed using the procedures detailed in the laboratory specific SOPs. These assessments included determining the mean, standard deviation, percent difference, RPD and percent recovery for spike sample analyses.

Assessment of QC data for data validation purposes will include determining the mean, standard deviation, percent difference, percent recovery, RPD and percent completeness. The statistical equations to determine percent recovery, RPD and percent completeness are provided in Section 7.3.

5.10 Data Storage and Retrieval

Laboratory data will be stored by Haley & Aldrich in hardcopy format. Electronic instrument data are maintained on magnetic media for the time period required by the ROD. All laboratory records for this project will be maintained consistent with the storage requirements in the ROD.

6.0 ASSESSMENT/OVERSIGHT

The following subsections describe the procedures used to ensure proper implementation of this QAPP and the activities for assessing the effectiveness of the implementation of the project and associated QA/QC activities.

6.1 Assessments and Response Actions

Assessments consisting of internal and external audits may be performed during the project. Internal technical system audits of both field and laboratory procedures will be conducted to verify that sampling and analysis are being performed in accordance with the procedures established in the RDWP and QAPP. External field and laboratory audits may be conducted by NYSDEC.

Internal audits of field activities include the review of sampling and field measurements conducted by the Haley & Aldrich QAO or designee. The audits will verify whether procedures are being followed. Internal field audits will be conducted once during each phase of the sampling and at the conclusion of the project. The audits will include examination of the following:

- Field sampling records, screening results, instrument operating records
- Sample collection
- Handling and packaging in compliance with procedures
- Maintenance of QA procedures
- COC reports

Follow up audits will be conducted to correct deficiencies, if any, and to verify that procedures are maintained throughout the investigation. Corrective action resulting from internal field technical system audits will be implemented immediately if data may be adversely affected due to unapproved or improper use of approved methods. The QAO will identify deficiencies and recommended corrective action to the Project Manager. The Field Task Leaders and field team will perform implementation of corrective actions. Corrective action will be documented in the field logbook and/or the project file. Follow up audits will be performed as necessary to verify that deficiencies have been corrected, and that the QA/QC procedures described in this QAPP are maintained throughout the project.

The laboratory QAO or designee will conduct an internal laboratory technical system audit. The laboratory technical system audit is conducted on an annual basis and includes examining laboratory documentation regarding sample receiving, sample log-in, storage and tracking, COC procedures, sample preparation and analysis, instrument operating records, data handling and management, data tracking and control and data reduction and verification. The laboratory QAO will evaluate the results of the audit and provide a final report to section managers that will include any deficiencies and/or noteworthy observations.

Corrective action resulting from deficiencies identified, if any, during the internal laboratory technical system audit will be implemented immediately. The Project Manager or section leaders, in consultation with the laboratory supervisor and staff, will approve the required corrective action to be implemented by the laboratory staff. The laboratory QAO will ensure implementation and documentation of the corrective action. All problems requiring corrective action and the corrective action taken will be reported to the laboratory Project Manager. Follow up will be performed as necessary to verify that deficiencies have been corrected, and that the QA/QC procedures described in the QAPP are maintained throughout the project.

A review of a data package from samples recently analyzed by the laboratory can include (but not be limited to) the following:

- Comparison of resulting data to the SOP or method
- Verification of initial and continuing calibrations within control limits
- Verification of surrogate recoveries and instrument timing results
- Review of extended quantitation reports for comparisons of library spectra to instrument spectra, where applicable
- Assurance that samples are prepared and analyzed within holding times

6.2 Reports to Management

Quality Assurance (QA) Management Reports will be prepared during the RD/RA. Minimally, these reports will include project status, results of system audits, results of periodic data quality validation and assessment and data use limitations and any significant QA problems identified and corrective actions taken.

The Haley & Aldrich QAO will be responsible within the organizational structure for preparing these reports. The Project Manager will be provided with these reports for distribution with monthly status reports, if appropriate.

The 30% Remedial Design Report will include a section that summarizes the data quality information contained in the periodic QA Management Reports and will provide an overall data quality assessment compared to the DQO outlined in this QAPP.

Table A.1
Methods of Analysis and Reporting Limits

Target Analytes	Methods of Preparation and Analysis	Matrix	Method Detection Limit (ug/Kg)	Laboratory Reporting Limit (ug/Kg)
Total Hardness	EPA 130.2	Ground Water	5 mg/l	25 mg/l
Total Dissolved Solids (TDS)	SM 2540C		0.0015 mg/l	0.005 mg/l
Total Lead (Pb)	EPA 3015A/6010C			5 ug/l
Total PCBs as Aroclors	EPA 3546/8082A		0.1 ug/l	0.05 ug/l
Total Organic Carbon (TOC)	SM 5310B		0.2 mg/l	1.0 mg/l
Total PCBs as Aroclors	EPA 3546/8082A	Soil	5.0 - 15	50
Total Lead (Pb)	EPA 3015A/6010C		132	500
Total Zinc (Zn)			37	500
Total Copper (Cu)			62	500
Total PCBs as Aroclors	EPA 3546/8082A	SED	5.0 - 15	50
Total Lead (Pb)	EPA 3015A/6010C		132	500
Total Copper (Cu)			37	500
Total Zinc (Zn)			62	500
Moisture Content	ASTM D2216	Soil	NA	NA
Grain Size Analysis	ASTM D422			
Atterberg Limits	ASTM D4318			
Organic Content	ASTM D2974			
Specific Gravity	ASTM D854			
One-Dimensional Consolidation	ASTM D4186			
UU Triaxial Test	ASTM D2850			
CU Triaxial test	ASTM D4767			
Total PCBs as Aroclors	EPA TO-10A	Air	0.04 $\mu g/m^3$ *	0.1 $\mu g/m^3$ *

Notes:
ug/kg = micrograms per kilogram or parts per billion (ppb)
µg/m3 = micrograms per cubic meter
PDI = Pre-Design Investigation
SED = Sediment
EPA = Test Methods for Evaluating Solid Waste, SW-846 3rd Edition with updates
ASTM = American Society for Testing and Materials
NA = Not Applicable
* Assumes a minimum run time of 3.5 hours.

TABLE A.2
Data Quality Indicators (DQI)

Parameter	Matrix	Data Quality Indicators	Measurement Performance Criteria	QA Sample Used to Assess Measurement Performance	QC Sample Assessed Error Sampling (S), Analytical (A) or both (S&A)
Total Hardness	Ground Water	Precision	<35% RPD	Field Duplicate/Lab Duplicate	S&A
		Accuracy	75-125% True Value	LCS and MS	A
Total Dissoved Solids (TDS)		Precision	<35% RPD	Field Duplicate/Lab Duplicate	S&A
		Accuracy	75-125% True Value	LCS and MS	A
Lead, Total		Precision	<35% RPD	Field Duplicate/Lab Duplicate	S&A
		Accuracy	75-125% True Value	LCS and MS	A
Total PCBs as Arochlors		Precision	<35% RPD	Field Duplicate	S&A
		Accuracy	50-150% True Value	LCS and MS/MSD	A
Total Organic Carbon		Precision	<35% RPD	Field Duplicate/Lab Duplicate	S&A
		Accuracy	75-125% True Value	LCS and MS/MSD	A
Lead, Total	Soil	Precision	<35% RPD	Field Duplicate/Lab Duplicate	S&A
		Accuracy	75-125% True Value	LCS and MS	A
	SED	Precision	<100% RPD	Field Duplicate/Lab Duplicate	S&A
		Accuracy	75-125% True Value	LCS and MS	A
Zinc, Total	Soil	Precision	<35% RPD	Field Duplicate/Lab Duplicate	S&A
		Accuracy	75-125% True Value	LCS and MS	A
	SED	Precision	<100% RPD	Field Duplicate/Lab Duplicate	S&A
		Accuracy	75-125% True Value	LCS and MS	A
Copper, Total	Soil	Precision	<35% RPD	Field Duplicate/Lab Duplicate	S&A
		Accuracy	75-125% True Value	LCS and MS	A
	SED	Precision	<100% RPD	Field Duplicate/Lab Duplicate	S&A
		Accuracy	75-125% True Value	LCS and MS	A
Total PCBs as Aroclors	Soil	Precision	<35% RPD	Field Duplicate	S&A
		Accuracy	50-150% True Value	LCS and MS/MSD	A
		Precision	<35% RPD	MS/MSD	A
	SED	Precision	<100% RPD	Field Duplicate	S&A
		Accuracy	50-150% True Value	LCS and MS/MSD	A
		Precision	<35% RPD	MS/MSD	A
	Air	Accuracy	60-120% True Value	LCS	A

Notes:
RPD - Replicate Percent Difference
MS/MSD - Matrix Spike Matrix Spike Duplicate
LCS - Laboratory Control Sample

Table A.3

Sample Preservation, Handling and Holding Times

Parameter	Matrix	Sample Volume/Weight[1]	Containers (Number, size & type)	Preservation Requirements	Holding Time[2]
Geotechnical Parameters[3]	Soil	Varies	Polyethylene Container	NA	NA
Total Hardness	Ground Water	100 ml	250 ml HDPE	HNO_3, 4 ± 2ºC	180 days
Total Dissolved Solids (TDS)	Ground Water	100 ml	250 ml HDPE	HNO_3	180 days
Lead (Pb), Total	Ground Water	100 ml	250 ml HDPE	HNO_3	180 days
Total PCBs as Aroclors	Ground Water	1000 ml	2 x 1000 ml amber glass	4 ± 2ºC	180 days extract, 40 days analyze
Total Organic Carbon (TOC)	Ground Water	150 ml	500 ml glass	H_2SO_4	28 days
Lead (Pb), Total	Soil	10 g	4 oz glass jar	4 ± 2ºC	180 days
	SED	2 g			
Copper (Cu), Total	Soil	10 g			
	SED	2 g			
Zinc (Zn), Total	Soil	10 g			
	SED	2 g			
Total PCBs as Aroclors	Soil	10 g	4 oz glass jar w/Teflon lined lid	4 ± 2ºC	180 days extract, 40 days analyze
	SED	10 g			
	Air	1 m^3	1 x PUF Cartridge[4]	4 ± 2ºC	7 days extract, 40 days analyze

Notes:

[1] - Represents amount needed by the laboratory, actual sample volume will be greater.

[2] - Holding time is determined from the time of sample collection to the time of sample preparation and/or analysis.

[3] - Geotechnical Parameters include: Moisture Content; Grain Size; Atterberg Limits; Organic Content; Specific Gravity; UU and CU Triaxial Tests

[4] - Polyurethane Foam

NA = Not Applicable

g = gram

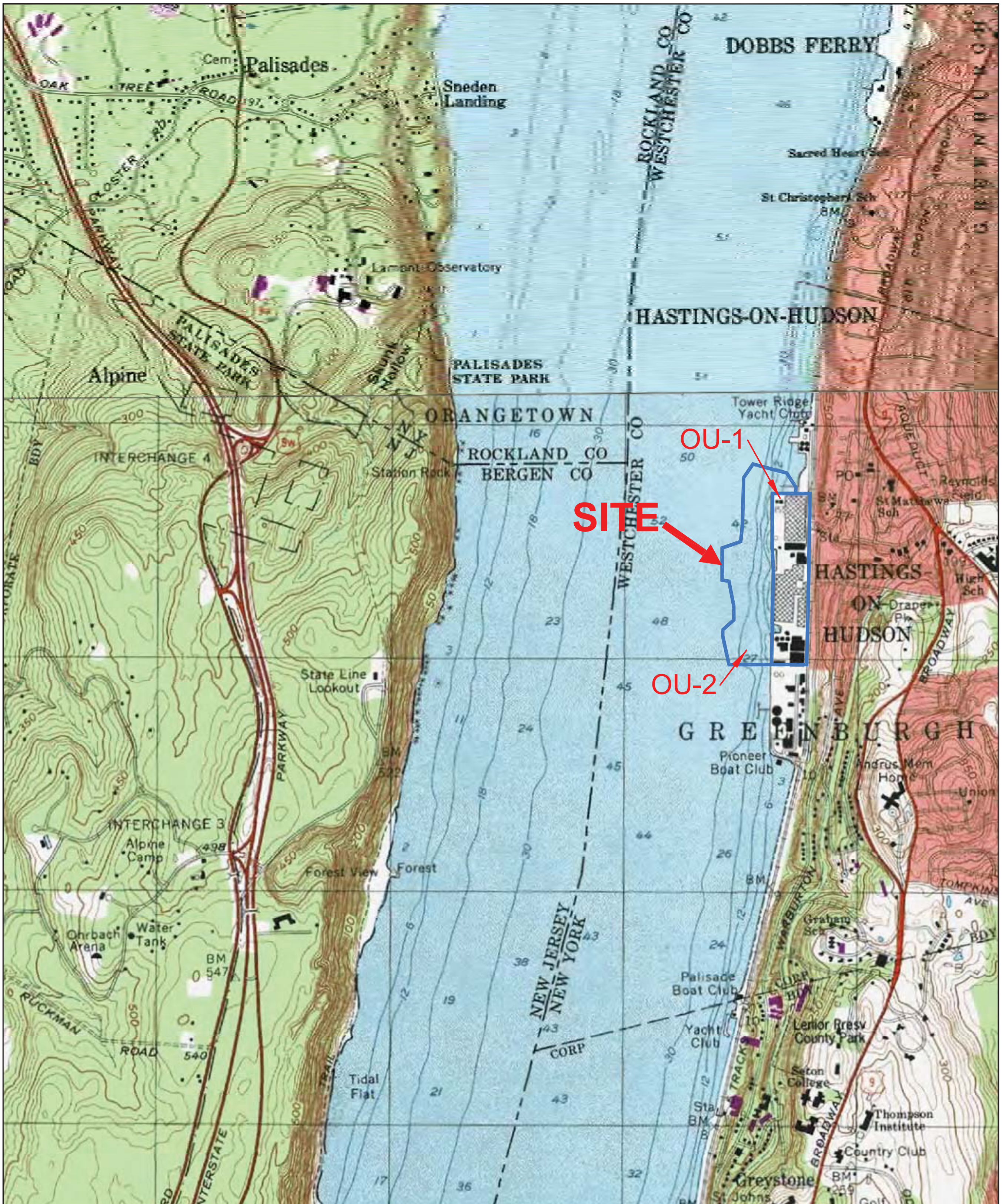
oz = ounce

°C = degrees Celsius

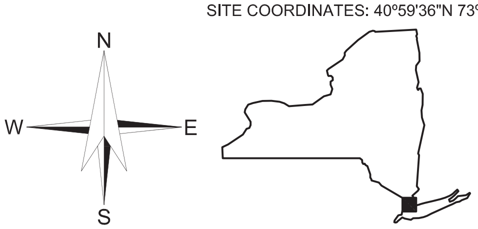
Table A.4
Field and Laboratory Quality Control Sample Summary

Matrix	Parameter	Analytical Method/ SOP Reference	No. of Samples	No. of Field Duplicate Pairs	Organic	Inorganic		No. of Equip. Blanks (Field)	Total No. of Sample Results
					No. of MS/ MSDs	No. of Lab Duplicates	No. of MS		
Ground Water	Total Hardness	**EPA 130.2**	3	1	-	1	1	1	7
	Total Dissolved Solids (TDS)	**SM 2540C**			-				
	Lead, Total	**EPA 3015A/6010C**			-				
	Total PCBs as Aroclors	**EPA 3546/8082A**			1	-	-		6
	Total Organic Carbon (TOC)	**SM 5310B**			1[1]	-	-		6
Soil	Total PCBs as Aroclors	**EPA 3546/8082A; S-NY-O-314-rev.00 & NE_278_00**	507	51	26	NA	NA	26	610
	Lead, Total	**EPA 3015A/6010C; NE_295_00**	16	2	NA	1	1	1	21
	Zinc, Total								
	Copper, Total								
SED	Total PCBs as Aroclors	**EPA 3546/8082A; S-NY-O-314-rev.00 & NE_278_00**	168	17	9	NA	NA	9	203
SED	Lead, Total	**EPA 3015A/6010C; NE_295_00**	160	16	NA	8	8	8	200
	Zinc, Total		135	14		7	7	7	170
	Copper, Total		135	14		7	7	7	170
	Total PCBs as Aroclors	**EPA 3546/8082A; S-NY-O-314-rev.00 & NE_278_00**	304	30	15	NA	NA	16	365
Soil	Geotechnical Parameters	**ASTM D2216; D422; D4318; D2974; D854; D2850; D4767; D4186**	21	2	NA	NA	NA	NA	23
Air	Total PCBs as Aroclors	**EPA 10A**	60	NA	NA	NA	NA	NA	60

Notes:
PDI = Pre-Design Investigation
SED - Surficial Sediment
MS/MSD - Matrix Spike / Matrix Spike Duplicate Sample
MS- Matrix Spike
Geotechnical Parameters include: Moisture Content; Grain Size; Atterberg Limits; Organic Content; Specific Gravity; UU and CU Triaxial Tests
NA = Not Applicable
[1] TOC Analysis will also include Lab Duplicate.



SITE COORDINATES: 40°59'36"N 73°53'9"W



U.S.G.S. QUADRANGLE: HASTINGS-ON-HUDSON, NEW YORK

HALEY & ALDRICH

NYSDEC SITE #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

Site Locus

SCALE: 1:24000
MAY 2011

FIGURE 1.1

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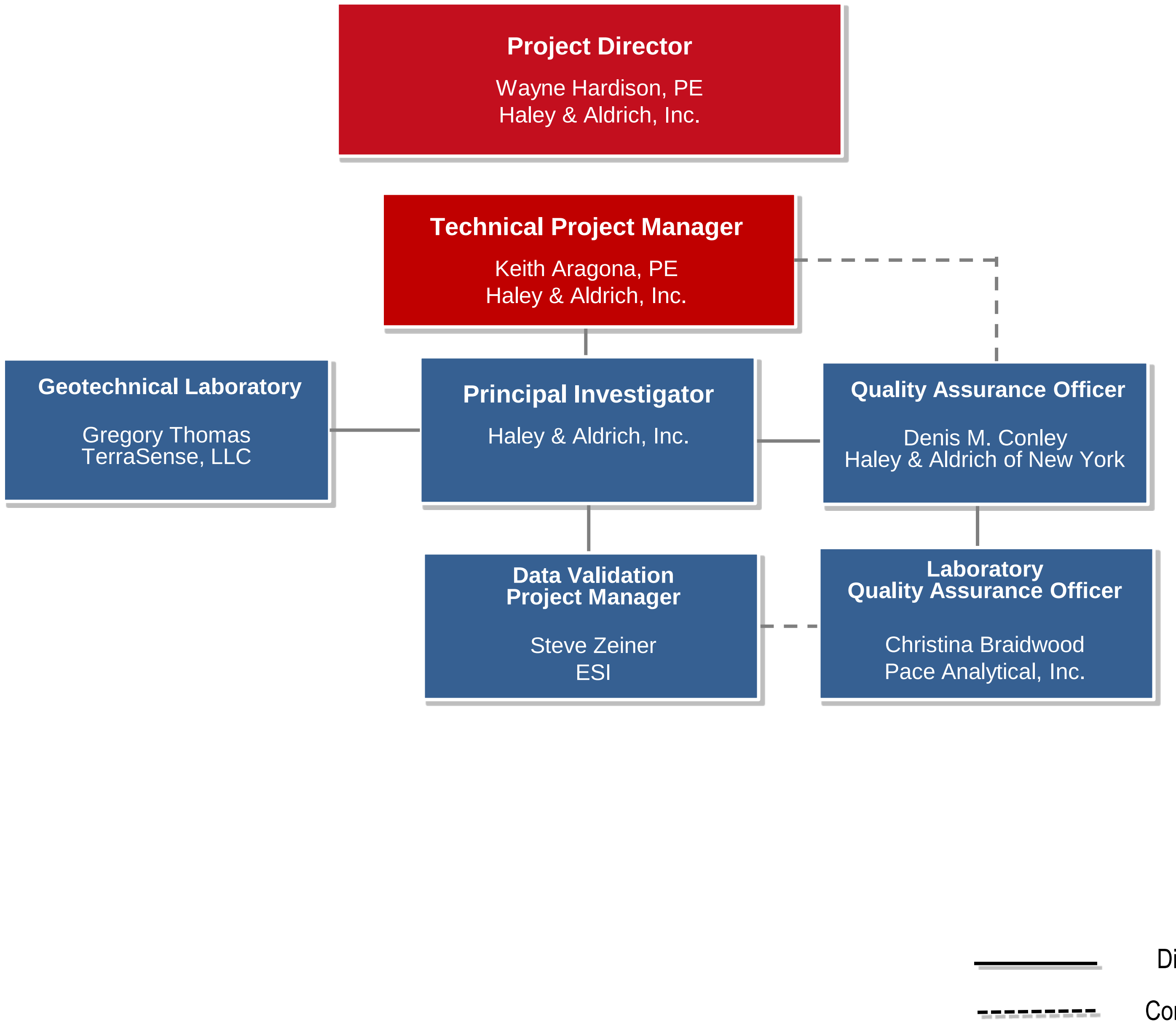
Figure 2.1
Project Organizational Chart



Appendix 1

Haley & Aldrich Standard Operating Procedures

Operating Proceedures

OP1001 – Excavation and Trenching
OP1002 – Drilling Safety
OP1004 – Operation / Calibration of PID Photoionization Detector
OP1008 – Operations Over, Near, or On Water
OP1020 – Work Near Utilities
OP2000 – Monitoring Field Explorations
OP2001 – Identification and Description of Soils Using Visual-Manual Methods
OP2005 – Test Borings, Sampling, Standard Penetration Testing and Borehole Abandonment
OP2007 – Undisturbed Fixed Piston Tube Sampling
OP3001 - Preservation and Shipment of Environmental Samples
OP3003HOH - Subsurface Soil Sampling
OP3004 - Sediment Sampling
OP3012 - Low Stress/Low Flow Groundwater Sample Collection Procedure
OP3026 - Chain of Custody
OP3027 – Decontamination Procedure
OP3029 – Field Data Recording
OP3030 - Field Instruments: Use and Calibration
OP3028 - Investigation Derived Wastes (IDWs)

Note: Operating Proceedures are available upon request.

Appendix 2

Laboratory Standard Operating Procedures

APPENDIX 2

Summary of Laboratory Standard Operating Procedures
Remedial Design Work Plan (RDWP)
Former Anaconda Wire and Cable Site
Hastings on Hudson, New York

Laboratory Analytical Method Reference	Extraction Method Reference	Matrix	Standard Operating Procedure (SOP)[1]
EPA 8082a PCB Aroclors (Low Level)	Solid Phase (SPE) EPA 3535	Groundwater	S-NY-O-314-rev.00
TOC/DOC SM 5310	N/A	Groundwater	NE_128_08
EPA 8082a Solid Phase (SPE) EPA 3535 (Centrifuged/Dissolved PCBs)	Solid Phase (SPE) EPA 3535	Groundwater	S-NY-O-314-rev.00
EPA 8082a PCB Aroclors	Microwave Extraction EPA 3546	Suficial Sediment/Soil	S-NY-O-314-rev.00
EPA 7470A	CVAA	Groundwater	NE_025_11
EPA 6010C	Microwave Digestion EPA 3015A	Suficial Sediment, Soil & Groundwater	NE_295_00
EPA 200.7	Acid Digestion EPA 3050	Groundwater	NE_122_09
EPA TO-10A	N/A	Air	SNY_0_241

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2190 Technology Drive
(518) 346-4592

1. Uncontrolled Copies of Pace Analytical Laboratory SOPs are available upon request.
2. N/A - Not Applicable for this parameter
3. PCB - Polychlorinated Biphenyls
4. TOC/DOC - Total Organic Carbon/Dissolved Organic Carbon
5. EPA - United States Environmental Protection Agency
6. SM - Standard Methods for the Examination of Wastewater and Wastes

Appendix 3

Subcontractor Standard Operating Procedures

Appendix 4

Key Personnel Resumes

WAYNE C. HARDISON, P.E.

Program Manager

Over 37 years of experience in industrial and environmental systems design

Education
University of Tennessee, MSIE, Engineering Management, 1993
University of Tennessee, B.S.E., Mechanical Engineering, Magna Cum Laude, 1978
David Lipscomb College, Nashville, TN 1974

Professional Registration
Professional Engineer:
1990/New York (Reg. No. 067080)
2000/ Nebraska (Reg. No. E-9961)
2000/Michigan (Reg. No. 6201045810
1995/Kentucky (Reg. No. 22982)
Inactive/Tennessee (Reg. No. 00015176)

Professional Societies
Project Management Institute

Mr. Hardison brings over 37 years of engineering experience to our environmental engineering practice. He has a strong background in mechanical (industrial and environmental systems) design, construction administration and project management. Mr. Hardison is responsible for the coordination of multi-discipline and multi-office project assignments for Haley & Aldrich. He has significant project management experience on remedial design/remedial implementation projects, and is recognized for his ability to focus on customer requirements and issues in order to achieve business objectives.

Relevant Project Experience

1 River Street, Atlantic Richfield, Hastings on Hudson, NY. Program manager for remediation of soils and sediments impacted with polychlorinated biphenyl (PCB) and metals at the former Anaconda Wire & Cable site. Project includes coordinating multiple disciplines, design studies, pilot testing, bulkhead design, extensive removal of soils and sediment adjacent to and in the Hudson River, transportation and disposal, water treatment, and other related tasks to comply with the New York State Department of Environmental Conservation Consent Order and a Federal Consent Decree. The project also includes delineating site dense non-aqueous phase liquid (DNAPL), revising the site conceptual model, supplemental investigations, and completing a feasibility study to develop an integrated off-shore and on-shore remedy. The off-shore remedy includes a combination of capping and dredging. Total construction cost is estimated to exceed $100 Million.

Environmental Reserve Review, Confidential Client. Member of team to review and validate the basis for existing corporate environmental reserves exceeding $100 Million. Team leader to complete similar assessment of the portfolio related to operation and maintenance (O&M) including development of common process program, consolidation of individual sites into sub-portfolios, cost-reduction and compliance enhancements.

Confidential Client, Nebraska. Project manager for design/build remediation system consisting of dual-phase extraction system as a chlorinated solvent source measure and a permeable reactive barrier (PRB) wall for off-site migration at an operating industrial facility. Project includes design, development of operating and maintenance plan, on-going operations, refinement of the site conceptual model, reserve planning and development of a closure strategy.

Confidential Client, New Jersey. Third party review of remedial action plan and remedial design for National Priorities List site in Wisconsin. Operable Unit includes estimated 3800 cu yd of PCB-contaminated surficial flood plain soil/sediment and 71,000 cu yd of river sediment. Removal action estimated cost is $30 Million.

Former Manufactured Gas Plant (MGP) Site, Tarrytown, NY. Design manager for remedial action for brownfield site redevelopment with residential and commercial buildings, riverwalk, ferry terminal and municipal facilities. Project included conceptual design, estimating and contracting for >$5 Million design/ build remediation of MGP DNAPL site and diesel fuel light non-aqueous phase

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liquid (LNAPL) along Hudson River for mixed use redevelopment. The project also included development of operating and closure strategy as well as refinement of the site conceptual model. The design process was integrated with the remediation contractor to evaluate alternative approaches, obtain regulatory approval and adapt to field condition discovered by concurrent geotechnical and environmental investigation activities. Final design included an innovative DNAPL barrier, recover trench, slurry wall; sediment removed and impacted soil removed and resulted in millions of dollars of reduced implementation costs.

Confidential Aerospace Manufacturer, Design Quality Control. Technical reviewer for remedial design for various sites including groundwater recovery, excavated soil management and treatment and vapor migration control for redevelopment sites.

Remediation Value Engineering Third Party Review, Confidential Client, New Hampshire. Prepared independent estimate and value engineering proposals for remediation of lead impacted soils on and off site.

Confidential Client, Dayton, OH. Design manager for DNAPL recovery system including construction and startup.

Confidential Client, Parma, OH. Design manager for surface water collection system at oil impacted storage area at an operating facility.

Industrial / Manufacturing Sites, New Jersey. Provided senior technical review, design management, contractor qualification and selection, review of technical proposals. Reviewed and coordinated process selection, equipment selection and procurement for multiphase extraction, metals treatment, thermal oxidizer and related treatment systems for two sites with chlorinated solvents and toluene.

Leachate Treatment, Defiance, OH. Senior technical review for design and construction of treatment system for PCB-impacted groundwater leachate recovery system.

DNAPL Recovery System, Vandalia, OH. Senior technical review for upgrades at deployment of DNAPL recovery system. System is housed in a portable trailer and includes pumping system, DNAPL/water separator and groundwater treatment by regenerable resin.

Brownfield Redevelopment, Detroit, MI. Project manager for focused feasibility study and bench testing for interim measures at a site combining former industrial occupancy and MGP waste. Evaluated measures include bioremediation of dissolved plumes, capture of LNAPL and DNAPL and in-situ stabilization of coal tar impacted soils by deep soil mixing.

Brownfield Redevelopment, Former Landfill, Utica, MI. Project manager for investigation of methane gas and impact on proposed redevelopment. Project included coordination of geotechnical investigation as well as estimates for gas control measures.

Acid Vault Closure, Warren, MI. Project manager for closure of spent acid vault. Project was fast-tracked due to discovery of the vault containing acid and metals during a property transaction and required coordination of multiple parties and contractors.

System Decommissioning, Atlanta, GA. Project manager for turnkey decommissioning of closed remediation site consisting of over 40 wells and associated piping, pumps, vacuum extraction and controls, located interior and exterior of an operating facility.

Former Refinery, Confidential Client. Project design manager for design and implementation of approximately 34-acre geosynthetic cover system, groundwater capture, treatment for benzene, toluene, ethylbenzene and xylenes (BTEX) and inorganics and free-product recovery at the site of a former refinery. Project included review of alternative systems, detailed cost and constructability analysis, coordination of bids and technical review of contractor and vendor bids. Project manager for construction phase engineering support including permitting, value engineering and construction monitoring.

Confidential Client, Connecticut. Senior technical reviewer for multiple-acre methane recovery system for a new facility being constructed over a historical uncontrolled fill over facility included high rise offices, labs and parking structures.

Electric Beam Pilot Study, Orange County, Water District, California. Project engineer for pilot test that successfully demonstrated destruction of chlorinated solvents methyl tert-butyl ether (MTBE) and other contaminants in well water and waste water. Pilot study utilized a mobile truck unit developed by HVEA.

Xerox, Oak Brook, IL. Project manager for implementation of an Illinois Environmental Protection Agency (EPA)-approved Closure Plan. The development of this program included strategic replanning, revisions to the Corrective Measures Study negotiation of risk-based cleanup objectives, budgeting and implementation of targeted excavation areas, *ex situ* treatment, and replacement of 9,000 cubic yards of soils contaminated with chlorinated solvents near and beneath existing structures. Prior to implementing the Closure Plan, Mr. Hardison coordinated design and implementation activities for three 2-PHASE Extraction and associated treatment systems at the site. Programs to remove former underground solvent piping systems were also implemented under critical time requirements for Xerox. Mr. Hardison has served as project manager for all aspects of this project, including post-closure monitoring and Closure Certification submissions to Illinois EPA.

Xerox, Building 801, Henrietta, NY. Project manager for remediation program including feasibility study, remedial design and remedial action. Responsible for program planning with Xerox project manager of annual budgets. Corrective Measures Study assessed technical and economic benefits of excavation, in-situ and ex-situ remediation approaches. Provided design team coordination, construction administration and ongoing remediation optimization for the selected in-situ vacuum extraction system.

Xerox Building 201/206/218, Webster, NY. Project manager for site remediation, including strategic planning, CMS revisions, cost estimate, design and implementation. Project includes migration-control of impacted groundwater in bedrock and remediation of source areas using dual-phase extraction technology and blasted bedrock zones. Contaminants include trichloroethene (TCE), trichloroethane (TCA), and tetrachloroethene (PCE).

Confidential Client, Michigan. Coordinated feasibility studies and corrective measures studies for a portfolio of manufacturing sites, design and implementation of interim remedial measures as turnkey projects, reserve analysis and transaction scenario planning.

Landfill, New York, Leachate Collection System. Project engineer for design of leachate collection and storage system for landfill expansion cells. Design included engineering and specifications for pumps, piping and tanks.

Manufacturing, Confidential Client. Project engineer for feasibility study to evaluate alternatives to reduce solids and control pH in facility discharges. Alternative considered included both source and point-of-compliance measures. Project manager for design estimates, and staged implementation program for selected measures.

Industrial Facility, Confidential Client, Columbus, OH. Project engineer for replacement of process underground storage tanks (USTs). Coordinated design concepts and construction costs with facility engineering including HAZ-OP review. Design included 3 UST's ranging from 12,000 to 10,000 gallons, truck unloading facility, transfer pumps and transfer piping as well as inventory control and monitoring system. Developed detailed design, provided construction technical support and developed startup/O&M procedures to construct and commission tanks during plant operations.

Industrial Facility, Confidential Client, Columbus, OH. Project engineer for evaluation of alternatives for replacement of process USTs. Coordinated design concepts and construction costs with contractor. Design included 12 UST's ranging from 30,000 to 12,000 gallons, truck and railcar unloading facility, transfer pumps and transfer piping as well as inventory control and monitoring system. Developed detailed design, provided construction technical support and developed startup/O&M procedures to construct and commission tanks during plant operations as part of design/build team.

Industrial Facility, Confidential Client, Sanborn, NY. Project engineer for preparation of conceptual design, estimate and design/build request for proposal for an approximately 14-acre site impacted by chlorinated solvents. Provided technical review of bidders, design and third party quality control during construction and startup.

New Hanover County Steam Plant Expansion, Wilmington, NC. Project engineer for preliminary plant layout equipment specification and piping for 250 tons per day municipal solid waste incineration/cogeneration expansion. Equipment included materials handling systems, tanks, water treatment, dust/ fume treatment, pumps and stack.

NASA, Huntsville, AL. Project manager for upgrade of facilities for new research and development use. Work included high pressure gases, clean room, computer rooms and radiation shielding for an environmental effects laboratory.

KEITH M. ARAGONA, P.E.

Senior Project Manager

Education
The University of Michigan, M.S. Mechanical Engineering, 2009
North Carolina State University, M.S. Civil Engineering, 1999
West Virginia University, B.S. Civil/Environmental Engineering, Magna Cum Laude, 1997

Professional Registration
Michigan: Professional Engineer (Reg. No. 6201053743)
1998/North Carolina: Engineer-in-Training

Professional Societies
American Society of Civil Engineers, Member
American Society of Mechanical Engineers, Member
Project Management Institute, Member

Since joining Haley & Aldrich, Mr. Aragona has managed and completed projects involving environmental construction, demolition, soil and groundwater remediation and assessment, groundwater flow modeling, and environmental site assessments. His project experience and responsibilities include managing all aspects of engineering design, bidding, and construction management for a variety of environmental remediation systems and building demolition, operations and maintenance of remediation systems, engineering and construction cost estimating, strategic planning, evaluating remediation alternatives, and contract writing.

Relevant Project Experience

Petroleum, Former Manufacturing Facility, Hastings-on-Hudson, NY. Engineer responsible for managing and completing multiple high profile projects at the site. All field work has been completed without lost time safety incidents.

Demolition of 10 buildings: Project engineer and project manager responsible for developing construction drawings and specifications for a fast-tracked demolition project. Responsibilities included review of site historical data, site walk, completion of bid drawings and specifications, engineering cost estimate, and recommendations to client for contractor selection. Construction manager for the decommissioning and demolition of 10 buildings of various construction using New York City union labor. Project tasks included managing field staff, air monitoring, erosion control, building decommissioning (including removal of hazardous materials, transformers, biohazards, and other waste materials that required special handling), asbestos abatement, building demolition, waste profiling, construction material segregation, use of barges to receive large construction equipment and field offices, use of barges to remove scrap steel from the site. Challenges that were faced and overcome during execution of field activities include the proximity of the work site to a commuter passenger train platform and tracks (within 30 - 50 feet), obtaining permits to complete work adjacent to the railroad, completing an asbestos abatement using two shifts, geotechnical evaluations to determine the stability of the shoreline during steel staging activities, and weekly site walks by city officials. Approximately 34,000 man hours were used to complete this $5.1M project without a lost time safety incident.

DNAPL remediation feasibility evaluation and pilot test: Engineer responsible for evaluating technologies to remediate a viscous dense non-aqueous phase liquid (DNAPL) containing 40% polychlorinated biphenyls (PCBs) located 35 feet below ground surface that increases in viscosity with the addition of heat. Challenges included the presence of a timber pile field, DNAPL located beneath the Hudson River, and rip rap located on the shoreline. Evaluated technologies included directionally drilled wells, a large diameter caisson with horizontal wells, and a vertical well network (chosen technology). Also responsible for operations of the chosen technology.

DNAPL remediation system: Engineer responsible for designing and implementing the remedial design for removal of DNAPL from the subsurface. Key challenges included determining, while installing recovery wells, the DNAPL is not continuous, resulting in field decisions to place the wells; presence of a previously unknown wooden bulkhead that may be contributing to preventing further migration of DNAPL; and installation of large diameter wells on an angle in order to access DNAPL located off shore.

Evaluation of historic building: Engineer responsible for managing the engineering evaluation and cost benefit analysis of preserving a politically charged building (built in 1908) located on the site. The process included evaluating the roof, columns, and floor to determine remedial effort required to bring the building back into service for several different potential future uses.

Site operations and maintenance: Engineer responsible for evaluating the site on a continual basis to determine health and safety, security, and housekeeping maintenance items that are required to be addressed.

Tier 2 Automotive Parts Supplier, Manufacturing Facility, Flint, MI. Engineer responsible for an interim measure remediation of DNAPL-impacted soils via excavation. Responsibilities included designing the remedial action, managing contractors' bids, completing contract documents (technical specifications), engineering support during construction, reporting, and overall project budget and schedule. Key aspects of the project included dewatering, removing subsurface obstructions, protecting an adjacent roadway during the excavation via sheet pile and anchor shoring, roadway integrity monitoring through daily surveys, ambient air monitoring, excavating DNAPL-impacted soils to 15 feet below ground surface, hazardous waste soils management, installing bioamendment, and excavating backfill and compaction.

Also responsible for an interim measure groundwater extraction system design and installation. Responsibilities included designing the remedial action, managing the remedial design, completing contract documents (technical specifications), managing contractors' bids, negotiating a discharge location with the City, engineering support during construction, reporting, and overall project budget and schedule. Key aspects included installing 9,600 feet of 2-in high density polyethylene (HDPE) groundwater transfer piping containing a 12-in secondary containment pipe laid on grade; groundwater treatment via air stripping; iron sequestering agent injection; exterior treatment enclosure construction; site civil, electrical, and instrumentation; remote monitoring; building security; and extending public utilities to the newly installed building. Responsible for ongoing operations and maintenance of the system.

Tier 2 Automotive Parts Supplier, Manufacturing Facility, Grand Rapids, MI. Engineer responsible for an interim measure storm water retention basin closure via excavation of contaminated sediments and then backfilling. Responsibilities included designing portions of the remedial action, managing portions of the remedial design, completing contract documents (technical specifications), managing contractors' bids, engineering support during construction, reporting, and overall project budget and schedule. Key aspects of the project included dewatering a 1-acre area, adjacent structure integrity monitoring through daily surveys, mixing sediments with a stabilizing agent, removal of contaminated sediments, and backfill and compaction of the basin.

Responsible for an interim measure groundwater extraction system design and installation. Responsibilities included managing the design, managing contractors' bids, completing contract documents (technical specifications), engineering support during construction, reporting, and overall project budget and schedule. Key aspects of the project included pumping well installation, installing utilities and groundwater transfer and discharge piping via directional drilling, designing and constructing a permanent enclosure, motor control panel, and electrical service.

Responsible for completing a post closure care plan for a former hazardous waste storage area and a Corrective Measures proposal for the site. Evaluated several types of remedial technologies in order to choose the most effective and cost-effective technology to complete remedial activities at various areas of interest on site.

Former Manufacturing Facility, Superfund Site, Bronson, MI. Engineer for a remedial investigation to determine the nature and extent of subsurface impacts at a former manufacturing site impacted with DNAPL. Responsibilities included completing the remedial investigation work plan; managing field staff during three phases of investigation; procuring project subcontractors; monitoring the progress and quality of soil, gas, and groundwater sample collection; completing remediation alternatives assessment and associated costs of DNAPL-impacted soil and groundwater on the site; quarterly updates to environmental reserve estimates; preparing and reviewing interim monitoring reports; and providing technical support of project activities.

Engineer responsible for completing a CERCLA feasibility study to evaluate applicable remediation technologies and capital and long-term operating costs.

Telecommunications Facility, Manufacturing Facility, Omaha, NE. Engineer responsible for an interim measure remediation of DNAPL-impacted groundwater slurry wall and permeable reactive barrier (PRB). Responsibilities included designing the remedial action, completing contract documents (technical specifications), managing contractors' bids, and limited oversight during construction. Key aspects of the project included designing the zero valent iron PRB and slurry cutoff wall, installing the soil/bentonite slurry wall to 55 feet below ground surface under slurry, installing the PRB, and installing monitoring wells. Responsible for ongoing groundwater sampling and operations and maintenance of the PRB.

Tier 2 Automotive Parts Supplier, Former Manufacturing Facility, Dayton, OH. Engineer overseeing construction activities required to remove various underground storage tanks (USTs), including five State-regulated USTs and one Resource Conservation and Recovery Act (RCRA) Hazardous Waste UST located in a vault in the basement of a former manufacturing facility, a RCRA Hazardous Waste above ground storage tank, and a RCRA Hazardous Waste Collection Sump. Responsibilities included construction and excavation supervision, compacted fill placement, in-situ density testing, performance analysis, health and safety monitoring and development, and report preparation.

Tier 2 Automotive Parts Supplier, Manufacturing Facility, Fayette, OH. Emergency response to a free product spill at the facility to their storm water sewer system and to a creek located south of the facility. Performed a facility-wide Phase II subsurface investigation to determine the nature and extent of PCB, volatile organic compound (VOC), metals, and semi-VOC impact to the subsurface at the facility, and removed impacted soil and free product from a portion of the facility. Responsibilities included designing and executing a subsurface investigation, remediation design, completing contract documents (technical specifications), managing contractors' bids, managing field staff, engineering support during construction, reporting, and overall project budget and schedule. Key aspects of the project included storm sewer cleaning, excavating impacted soils inside a building and adjacent to its foundation, and reconstructing the facility's chip handling area.

Former Police Barracks, Tier 2 Automotive Parts Suppliers, Various Facilities, Flint, Grand Rapids, and Mount Pleasant, MI. Completed audits to determine the effectiveness and efficiency of existing free product collection and groundwater recovery and treatment systems. Made recommendations for treatment system upgrades and equipment replacement to increase cost efficiencies of the systems, and evaluated and recommended alternative strategies to achieve long-term remediation goals.

Tier 2 Automotive Parts Supplier, Howell, MI. Completed an Integrated Contingency Plan (ICP) for use at the facility and distribution to the Michigan Department of Environmental Quality (MDEQ), fire and police departments, and the Local Emergency Planning Committee. The ICP complies with requirements listed in the RCRA; State of Michigan Hazardous Waste Management Act; Clean Water Act (Spill Prevention Control and Countermeasure [SPCC] Plan); MDEQ Water Division (Pollution Incident Prevention Plan and Spillage of Oil and Polluting Materials); Occupational Safety and Health Administration; Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); Emergency Planning and Community Right-to-Know Act; Toxic Substance Control Act; Clean Air Act; Michigan Clean Air Act; Michigan Environmental Response Act; and Department of Transportation Hazardous Materials Transportation Act.

Steel Processing Center and Various Tier 2 Automotive Parts Suppliers, Multiple Locations in Michigan. Completed SPCC Plans for use at facilities. The SPCC Plans comply with requirements listed in the Clean Water Act (SPCC Plan) and the MDEQ Water Division (Pollution Incident Prevention Plan and Spillage of Oil and Polluting Materials).

Tier 2 Automotive Parts Supplier, Anaheim, CA. Engineer responsible for the design of a soil vapor extraction system. Responsibilities included completing the engineering design for agency approval.

City of Sandusky, Sandusky, OH. Engineer responsible for construction oversight during the installation of a forced water main. Responsibilities included supervising trench excavation and compaction, pipe placement, and report writing.

City of Kent, Kent, OH. Engineer responsible for delineating petroleum-impacted soil during the installation of a storm water sewer. Impacted soil was shipped to a hazardous waste landfill.

NAV-TECH Industries, Cleveland, OH. Performed a test pit program at the site to support an Ohio Voluntary Action Program site closure. The test pit program also supported the determination of whether NAV-TECH was eligible to apply for State, county, and/or city funding to pay for subsequent subsurface investigations and remediation prior to development.

Risk Assessment, Various Clients, Ohio. Risk assessor responsible for developing site-specific cleanup levels for a manufacturing facility and a city property. Site-specific information was used to modify fate and transport models and exposure scenarios to develop cleanup levels.

Groundwater Modeling and Visualization

Confidential Client, Manufacturing Facility, Wheatfield, NY. Completed a groundwater flow model describing groundwater flow in fractured bedrock with four distinct horizontal flow zones. The model predicted groundwater capture and volume of water removed for a migration control system. The purpose of the model was to conceptualize the effectiveness of various groundwater migration control systems.

3-Dimensional Environmental Site Visualization. Engineer responsible for developing quantitative, animated 3-dimensional models for several industrial sites. Modeling included using 3-dimensional geostatistical methods to develop animated presentations showing the relationship among regional geology, hydrogeology, site features, extent of product, and the co-mingling contaminant plumes.

Environmental Site Assessments (ESA)

Performed ESAs for commercial and industrial properties for various types of clients at locations within the United States. ESAs were completed in accordance with standards established by the American Society for Testing and Materials, Environmental Site Assessments, E 1527-00. These studies involved in-depth background research, including reviewing historical and current aerial photographs, evaluating UST registrations, reviewing State and Federal databases, site inspections, and surrounding property usage evaluation.

Research

North Carolina State University, Laboratory Research, Raleigh, NC. Performed a subsurface investigation, and designed and performed laboratory tests to estimate soil, contaminant, and surfactant adsorption and desorption parameters required to remediate a radioactive and DNAPL impacted industrial property located in Ashtabula, Ohio.

DENIS M. CONLEY

Senior Scientist

Over 20 Years of experience in the investigation, and remediation of industrial properties throughout the US and the world.

Education
University of Southern Maine, B.A. Biology, 1982
University of Southern Maine, B.S. Applied Chemistry, 1986

Professional Registration
1989/Certified Bacteriologist, Maine
1991/ Certified Data Validator, New York

Professional Societies
ASTM E50.02 - Vapor Intrusion Task Group, 2006
NYWEA –Seminar Committee, 2002-Present

Special Studies and Courses
OSHA 40 Hr. (29 CFR 1910.120), 1991

8 Hr. Refresher (29 CFR 1910.120), 1992-2008

24-Hour OSHA Supervisor Training (29 CFR 1910.124), 1994

Water Treatment Process Chemistry, University of New Hampshire, 1989

Comprehensive Industrial Hygiene, University of Michigan, 1995

Mr. Conley serves as a Project Manager and Quality Assurance Officer within Haley & Aldrich and sits in our Rochester, NY office. He has more than 20 years of diversified experience in the investigation, evaluation, and implementation of remedial technologies including enhanced bioremediation, multi-phase extraction, and *in situ* thermal remediation. Mr. Conley has managed projects throughout the United States, Great Britain, the Middle East, and South Pacific.

Projects have included hydrogeologic investigations under State-sanctioned Voluntary Cleanup Programs, Federal corrective actions and emergency response orders, and the preparation of Corrective Measure and Feasibility Studies. Mr. Conley has experience in the remediation of surface and subsurface soils and groundwater impacted with chlorinated solvents, herbicides and pesticides, polychlorinated biphenyls (PCBs), dioxins/ furans, and coal tar.

Mr. Conley has served as adjunct faculty with the Rochester Institute of Technology's Department of Chemistry in Rochester, New York conducting courses in environmental chemistry for undergraduate and graduate students.

Relevant Project Experience

Quality Assurance Officer (QAO) Remedial Design/Remedial Action, Federal Superfund Site, Eastern Massachusetts. Responsible of all QA activities to support additional studies for the development of an RD/RA for a federal Superfund site under a Record of Decision issued by USEPA Region 1.

Quality Assurance Officer (QAO) Remedial Investigation/Feasibility Study, Federal Superfund Site, Central Ohio. Prepared Sampling and Analysis Plans (SAP), and Quality Assurance Project Plans (QAPP) with PRP group staff in the execution of an emergency response order under USEPA Region 5 oversight.

Quality Assurance Officer (QAO) Remedial Investigation/Feasibility Study, Federal Superfund Site, Southwestern Michigan. Prepared Sampling and Analysis Plans (SAP), and Quality Assurance Project Plans (QAPP) in the execution of an emergency response order under USEPA Region 5 oversight.

Rocky Mountain Arsenal (RMA) Wildlife Refuge. Denver, Colorado, Prepared work plans and Quality Assurance documents for approval by State and Federal stakeholders including the USEPA, CDOH, ACOE and ATSDR for the remediation of pesticide impacted soils and groundwater in the Central Remediation Area (CRA).

General Motors Corporation, RCRA Facility Investigations, Continental U.S. and Mexico. Prepared Sampling and Analysis Plans (SAP), Quality Assurance Project Plans (QAPP) with GM-Environmental Services staff in the execution of Streamlined Corrective Action orders with USEPA Region 5.

Eastman Kodak Company, Facility Reference Document, Rochester, NY. Developed a site-wide Quality Assurance Project Plan (QAPP) for the Kodak Park facility. The QAPP is utilized as a guidance document for the preparation of work plans conducted at the facility for NYSDEC interim remedial measures (IRM), RCRA Facility Investigations (RFI), and CERCLA Remedial Investigation/Feasibility Studies under USEPA Region 2.

Xerox Corporation, Corrective Measures Study (CMS), Worldwide Manufacturing facility, Webster, NY. Project Manager and primary author of the CMS for a large multi-building manufacturing facility located in upstate New York.

Major Oil Company Refinery Complex, Lake Charles, LA. Installation and operation of a groundwater recovery system for free phase ethylene dichloride (EDC) at an active industrial facility in Lake Charles, Louisiana. The recovery system utilizes carbonaceous and polymeric resins to adsorb EDC for recycling and re-use.

Facility Decontamination and Restoration, Israel Electric Corporation, Ashdod, Israel. Quality Assurance oversight for insurance representatives during the decontamination and restoration of a 200,000-sq-ft electric power generation station following a PCB transformer fire. Decontamination was performed in accordance with procedures promulgated under 40 CFR Part 761 by the USEPA Office of Pollution Prevention and Toxics.

Feasibility Study, State Superfund Site, Western New York. Prepared the final Feasibility Study for a Class 2 Hazardous Waste Site located in Western New York. The site soils and groundwater have been impacted with chlorinated solvents and process materials from an active manufacturing facility.

TSCA National Permit Demonstration, Federal Superfund Site, Missouri Electric Works, Cape Girardeau, MO. Responsible for an equivalency demonstration using the TerraTherm In-Situ Thermal Desorption (ISTD) process for remediation of PCBs from overburden soils. The demonstration findings were used to develop a Nationwide Permit for PCB Treatment from the USEPA Office of Pollution Prevention and Toxics (OPPT).

Soil Remediation, Island of Saipan, Commonwealth Northern Marianas Islands. Applied the patented ISTD technology on the island of Saipan for the treatment of soils impacted with PCBs.

Presentations and Papers

"ASTM E2600 Standard – Assessment of Vapor Intrusion in Real Estate Transactions", Rochester Engineering Society Symposium, Rochester, New York, 2008.

"Observed Attenuation Factors (AF) from Soil Vapor Intrusion Investigations (SVI) at Industrial Facilities in New York State", Midwestern States Risk Assessment Symposium, Indianapolis, IN, 2006.

"Self-Seeding Indigenous Microorganisms for the Treatment of MTBE-impacted Groundwater", presented at the 8th International Symposium for In-Situ and On-Site Bioremediation, Battelle Memorial Institute, 2005.

"Enhanced Bioremediation of 1,1,1-Trichloroethane: Multiple Site Review", presented at the 7th International Symposium for In-Situ and On-Site Bioremediation, Battelle Memorial Institute, 2003.

"Field Demonstration of Thermally Enhanced Multi-phase Extraction," with J. Savarese, S. Gupta, and R. Baker, presented at the 3rd International Conference on the Remediation of Recalcitrant and Chlorinated Compounds, Battelle Memorial Institute, Monterey, CA, 2002.

"Field Scale Implementation of Thermal Well Technology, Naval Facility Centerville Beach, Ferndale, California," presented at the 2nd International Conference on the Remediation of Recalcitrant and Chlorinated Compounds, Battelle Memorial Institute, Monterey, CA, 2000.

"In Situ Thermal Desorption of Refined Petroleum Hydrocarbons from Saturated Soils," with K.S. Hansen, G.L. Stegemeier, presented at Battelle Memorial Institute Conference, Monterey, CA, 2000.

"ISTD Treatability Study at Rocky Mountain Arsenal Hex Pit," with R.S. Baker, J. Galligan, D. Gregory, P. Patton, and S. Hall, proceedings of the 2nd International Conference on the Remediation of Recalcitrant and Chlorinated Compounds, Battelle Memorial Institute, Monterey CA, 2000.

"Application of ISTD Thermal Well Technology - Case Study," presented at the 1st International Environmental Exposition, Interstate Technology Regulatory Cooperation (ITRC) Workgroup, Atlantic City, NJ, 1999.

"*In situ* Thermal Desorption of Coal Tar," with Kirk S. Hansen, H. J. Vinegar, and G. L. Stegemeier, *proceedings from the* 11th International Symposium, Institute of Gas Technology, Orlando, FL, 1998.

"In Situ Thermal Desorption of PCBs," with H. J. Vinegar, G. L Stegemeier, and J.M. Hirsch, et al, *proceedings of the* Superfund XVIII Conference, Washington, DC, 1997.

"Applied Groundwater Treatment using UV Oxidation Technologies," with J.E. Loney, presented at the 28th Mid-Atlantic Industrial and Hazardous Waste Conference, Buffalo, NY, 1996.

"Surfactant Applications in Environmental Restoration," with D.A. Edwards, and M.G. Biekirch, proceedings of the 28th Mid-Atlantic Industrial and Hazardous Waste Conference, Buffalo, NY, 1996.

AMANDA COVER
Quality Assurance Chemist

FIELDS OF COMPETENCE

- Volatile and semivolatile organic data (generated by GC and GC/MS analyses) validation.
- Pesticides and PCB Aroclor data validation.
- Inorganic and wet chemistry data validation.
- Performance Evaluation Studies.

CREDENTIALS

B.S., Environmental Science, Albright College, Reading, Pennsylvania, 2006.

PROFESSIONAL DEVELOPMENT COURSES

Multi-Agency Radiology Laboratory Analytical Protocols Manual; Part 1 Training; "The MARLAP Process", United States Environmental Protection Agency, Region 3 Philadelphia, Pennsylvania, August 2009.

SUMMARY OF EXPERIENCE

Ms. Cover, who joined the Chemistry Quality Assurance Department in 2009, is responsible for analytical data validation to determine environmental data quality and usability. She is also responsible for the evaluation of laboratory data deliverables relative to regulatory and client-specific requirements. Data reviewed are generated by US EPA Contract Laboratory Program (CLP) Protocols and SW-846 Methods.

She was previously employed at an environmental laboratory where she served as an analytical chemist and Health and Safety Officer. In the Wet Chemistry Department, she analyzed samples for hexavalent chromium, sulfide, hardness, alkalinity, and total organic carbon and performed several other analyses. She was also responsible for screening samples for radioactivity prior to laboratory-wide handling of the samples.

Ms. Cover performed research in the environmental science discipline. She assisted with a baseline water-quality study for a restoration project in Reading, Pennsylvania, to evaluate the success of the restoration. In addition, she researched nutrient loadings effects on aquatic organisms and water quality in Angelica Creek and the Schuylkill River.

KEY PROJECT

- Serves as a data verification chemist for a project involving a utility company fly ash spill in Eastern Tennessee. Verifies the consistency of data between electronic and limited hardcopy deliverables from several participating laboratories.
- Performed analytical data validation interpreting volatile organic, semivolatile organic, inorganic, and wet chemistry analyses and prepared technical quality assurance reports.
- Provided data validation services for projects to determine usability and defensibility of data as well as laboratory compliance with project-specific requirements.
- Verified analytical results from electronic data deliverables (EDDs) and database output during validation tasks
- Coordinated and reviewed double-blind performance evaluation studies as part of quality monitoring activities for a corporate laboratory program.
- Performed senior-level review of data validation reports.

PRESENTATION/PAPERS

Cover, A. "Primary Production in Angelica Creek and the Schuylkill River." Undergraduate Science Research Paper, May 2006.

JENNIFER N. GABLE
Senior Quality Assurance Chemist II

FIELDS OF COMPETENCE

- Corporate laboratory program design, execution, and maintenance.
- Quality assurance oversight for environmental investigatory and remedial projects.
- Project management.
- Laboratory auditing.
- Quality assurance project plan preparation.
- Performance evaluation study design, execution, and statistical review.
- Analytical request for proposal preparation and proposal review and evaluation.
- Analytical and environmental chemistry consulting.
- Data validation.

CREDENTIALS

Graduate coursework toward M.S. Chemistry Degree at Villanova University, Pennsylvania.

B.S., Chemistry, Bloomsburg University, Bloomsburg, Pennsylvania, 2002.

SUMMARY OF EXPERIENCE

Ms. Gable has 7 years of analytical quality assurance experience at Environmental Standards. As a Senior Quality Assurance Chemist, she has performed project management duties for several projects of varying size and scope. Ms. Gable serves as the QA Oversight Project Manager for three national Environmental Contract Laboratory Programs and coordinates discrete and ongoing quality monitoring activities including laboratory auditing, performance evaluation studies, and data validation. In addition, Ms. Gable serves as the technical reference point for the laboratory programs. She has assisted several clients in preparing technical requests for proposal for environmental laboratory services and in selecting appropriate laboratories to meet their specific requirements. Ms. Gable has developed quality assurance project plans for several projects encompassing various sample matrices and analytical parameters. In addition, Ms. Gable has assisted in the coordination and implementation of quality assurance programs for projects of varied size and scope. Ms. Gable has conducted numerous on-site audits of environmental laboratories ranging from small wastewater facilities to large, full-service environmental and industrial hygiene laboratories. She is experienced in validation of data to determine analytical data quality and usability. Data reviewed include those for air, soil/sediment, aqueous, and biological tissue samples analyzed in accordance with US EPA Contract Laboratory Protocols (CLP) and SW-846 Methods.

KEY PROJECTS

- Coordinated interdepartmental efforts to develop and implement quality assurance programs for projects of varied size and scope, including investigatory projects involving release of fly ash into terrestrial and aquatic environments.
- Designed and executed an environmental corporate laboratory program encompassing $3 to $4 million in annual analytical expenditures. Responsibilities include preparation of the Technical Specifications Manual and Request for Proposal; review and scoring proposals from eight major national environmental laboratories; and coordination of the laboratory program rollout meeting.
- Serve as Project Manager for national contract laboratory programs. Serves as QA oversight manager and coordinates discrete and ongoing quality monitoring activities including laboratory auditing, performance evaluation studies, and periodic data validation. Also serves as primary contact for the programs' Help Desks.

KEY PROJECTS (Cont.)

- Served as Project Manager for several projects of varying size and scope. Served as a consulting chemist and on-site quality assurance oversight representative. Coordinated the efforts of staff chemists to perform validation of organic and inorganic analytical data and to prepare technical quality assurance reports; communicated with clients regarding validation issues.
- Audited organic, inorganic, wet chemistry, and industrial hygiene parameters at several environmental laboratories to evaluate compliance with laboratory standard operating procedures, good laboratory practice, and client-specific or project-specific requirements.
- Planned and executed single-blind and double-blind performance evaluation studies as part of quality monitoring activities for several corporate laboratory programs and on a project-specific basis.
- Prepared Technical Specifications Manuals for several Environmental Corporate Laboratory Programs.
- Developed laboratory requests for proposal for submission to several laboratories as part of a corporate laboratory program re-bid for a major energy corporation.
- Managed and performed senior-level review for data validation projects.
- Performed analytical data validation interpreting volatiles, semivolatiles, PCBs, inorganics, and wet chemistry analyses and developed technical quality assurance reports for projects of varying size and scope.

PRESENTATION/PAPERS

Rogers, W., R. J. Vitale, J. N. Gable, E. E. Rodgers, J. P. Kraycik, and N. E. Carriker. “Porewater Studies Subsequent to the Kingston Ash Event.” World of Coal Ash Conference, Lexington, KY, April 2013.

Babyak, C., J. Gable, K. C. P. Lee, W. Rogers, R. J. Vitale, N. Carriker. “Multi-laboratory Comparison of Sequential Metals Extractions.” Goldschmidt Conference, Montreal, Quebec, June 2012.

Vitale, R. J., J. Gable, E. Cowan, K. Seramur, W. Rogers, N. Carriker, C. Babyak. “Chemical, Optical and Magnetic Susceptibility Characterization of Coal Fly Ash.” Goldschmidt Conference, Montreal, Quebec, June 2012.

Forman, R. L., R. J. Vitale, J. N. Gable. “Important Factors for Performing Percent Moisture Tests on Biological Matrices.” Sediment Management Work Group (SMWG) Fall Sponsor Forum, Philadelphia, PA, October 2011.

Gable, J. N., R. L. Forman, R. J. Vitale. “Laboratory Selection During Emergency Response Actions – Balancing the Need for Quality Data With the Need for Quick Data.” National Environmental Monitoring Conference (NEMC), Bellevue, WA, August 2011.

Vitale, R. J., R. L. Forman, J. N. Gable, E. E. Rodgers, *et. al.* “Implementation of a Field and Laboratory Quality Oversight Program During the TVA Kingston Fly Ash Recovery Project to Ensure High Quality and Defensible Data.” TVA-Kingston Fly Ash Release Environmental Research Symposium, Harriman, TN, August 2-3, 2011.

PRESENTATION/PAPERS (Cont.)

Rogers, W. J., R J. Vitale, J. N. Gable, E. E. Rodgers, J. Gruzalski, and N. E. Carriker. "Observations of Metals and Metaloids in Sediment Porewater Associated with the Tennessee Valley Authority, Kingston, TN Ash Recovery." TVA-Kingston Fly Ash Release Environmental Research Symposium, Harriman, TN, August 2-3, 2011.

Gable, J. N. "Purchasing Analytical Services: Method Flexibility and the Need to Educate Analytical Buyers." East Tennessee Environmental Conference. Kingsport, TN. March 16-17, 2010.

Carriker, N., R. J. Vitale, R. L. Forman, and J. N. Gable. "Kingston Ash Release - Initial Water and Sediment Monitoring Response and Subsequent Refinements (Poster)." SETAC Annual Meeting, New Orleans, LA, 2009.

Vitale, R.J. and Gable, J. "Laboratory MDL Verification Studies – No Guidance and No Rules for Defining Detection." TCEQ 2008. Austin, TX, April 2008.

Schott (Gable), J. N., S. T. Zeiner, D. R. Blye, and D. J. Lancaster. "Evaluating Calibration Model Reliability." The 20th Annual National Environmental Monitoring Conference, Washington, DC. July 19-23, 2004.

Kristina Harsh
Quality Assurance Chemist

FIELDS OF COMPETENCE

- Volatile and semivolatile organic data (generated by GC and GC/MS analyses) validation.
- Inorganic data validation.
- Laboratory coordination.

CREDENTIALS

B.S., Chemistry, West Virginia University, Morgantown, West Virginia, 2008.

B.S., Forensic and Investigative Science with emphasis in Chemistry, West Virginia University, Morgantown, West Virginia, 2008.

SUMMARY OF EXPERIENCE

Ms. Harsh, who joined the Chemistry Quality Assurance Department in 2010, has 2 years of analytical chemistry laboratory experience. She is responsible for determining environmental data usability and quality though data validation. Guided by regulatory and client-specific requirements, she evaluates laboratory data deliverables. The data reviewed are generated by the US EPA Contract Laboratory Program (CLP) protocols and SW-846 Methods. Ms. Harsh also coordinates the efforts of several laboratories for a major pipeline company, including coordinating the field sampling events, and delivery of bottleware from the laboratories to the field. She ensures that the laboratory provides proper deliverables according to client specifications.

Before joining Environmental Standards, she was employed at a pharmaceutical contract laboratory where she focused on finished product testing. Her responsibilities included HPLC, UV, dissolution, Karl Fischer, osmolality, and physical tests. She also held a laboratory assistant position in which she was responsible for preparing reagents and unknowns for the student organic chemistry laboratories.

KEY PROJECTS

- Performed analytical data validation interpreting organic, inorganic, and general chemistry analyses and prepared technical quality assurance reports.
- Coordinates sampling and delivery of bottleware kits to the field for a large pipeline company. Verifies proper deliverables by the laboratory to the client. Also, provides chemistry communication between the laboratory and the client.

PRESENTATION/PAPERS

"Direct Injection Mass Spectrometric Confirmation of Multiple Drugs in Overdose Cases from Postmortem Blood Using Electrospray Ionization-Tandem Mass Spectrometry and MS^3. "Journal of Analytical Toxicology, Volume 32, Issue 8, Page: 709-714, 2008.

ALYSSA KRESS
Quality Assurance Chemist

FIELDS OF COMPETENCE

- Volatile and semivolatile organic data validation.

CREDENTIALS

B.S., Chemistry, Minor in French, Juniata College, Huntingdon, Pennsylvania, 2011.

SUMMARY OF EXPERIENCE

Ms. Kress joined the Chemistry Quality Assurance Department in 2011. She is responsible for analytical data validation to determine environmental data quality and usability for numerous project sites. Data reviewed include those for State of Alaska Department of Environmental Conservation (ADEC) Methods and SW-846 Methods. In addition, she evaluates laboratory data deliverables to determine compliance with method, regulatory, and client-specific requirements.

Prior to joining Environmental Standards, Ms. Kress was involved in numerous undergraduate chemistry research projects, including the analysis of silver coins using laser-induced breakdown spectroscopy; the analysis of chemical, biological, radiological, nuclear, and explosive materials by laser-induced breakdown spectroscopy; and the base-catalyzed reaction of *o*-phthaldialdehyde with malonic acid. She also has experience working in an industrial setting through a summer internship.

KEY PROJECTS

- Performed analytical data validation interpreting volatile and semivolatile organic compounds and prepared technical quality assurance reports.
- Provided data validation services for various projects to determine usability and defensibility of data as well as laboratory compliance with regulatory and project-specific requirements.

PRESENTATIONS

- Kress, A.M., K.M. Beiswenger, R.R. Hark, A.L. Miller, "A Preliminary Evaluation of Portable and Standoff Laser-Induced Breakdown Spectroscopy (LIBS) Units for the Identification of Hazardous Materials by First Responders." American Chemical Society National Meeting. Moscone Center, San Francisco, CA, March 21 - 25, 2010.
- Kress, A.M, R.R. Hark, "Synthesis of 1-indanone via the base-catalyzed condensation reaction of *o*-phthaldialdehyde with malonic acid." American Chemical Society National Meeting. Moscone Center, San Francisco, CA, March 21 - 25, 2010.
- Kress, A.M., R.R. Hark, L.J. East, J. Gonzalez, "Analysis of Silver Coins by Laser-induced Breakdown Spectroscopy (LIBS)." LIBS 2010. Doubletree Hotel, Memphis, TN, September 12 – 17, 2010.
- Kress, A.M., R.R Hark, L.J East, J. Gonzalez, "Analysis of Silver Coins by Laser-induced Breakdown Spectroscopy (LIBS) and laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS)." American Chemical Society National Meeting. Anaheim Convention Center, Anaheim, CA, March 27 – 31, 2011.

STEVEN J. LENNON
Senior Quality Assurance Chemist I

ENVIRONMENTAL STANDARDS

FIELDS OF COMPETENCE

- Volatile and semivolatile organic data (generated by GC and GC/MS analyses) validation of data.
- Pesticide, herbicide, and PCB data validation.
- Explosives data validation.
- Dioxin data validation.
- Metals data validation.
- Laboratory auditing.
- Air sampling using viable and nonviable collection procedures.
- Surface sampling using tape, swab, and carpet check procedures.
- Indoor air quality investigations for chemical and biological contamination.
- Interpretation of indoor air quality data.
- Microbiological aseptic techniques: clean room protocol; filling of containers with sterile cell culture media; and preparation of liquid media from dry powder components.
- Working knowledge of the following instruments, autosamplers, and data processing software:
  - OI Analytical 4560 and Tekmar purge and trap sample concentrators;
  - Hewlett Packard GC/MS (mass spec. models: 5970-5973);
  - OI Analytical Archon autosampler, OI Analytical 4551 autosampler, Hewlett Packard DMP-16; and
  - RTE-A, Target, Hewlett Packard Chemstation, and Enviroquant.

CREDENTIALS

B.S., Environmental Biology/Marine Biology, Millersville University, Millersville, Pennsylvania, 1994.

Professional Development Course: Microorganisms in Indoor Air-Health Complaints, Sampling Strategies & Interpretation, AIHA Conference, 2002.

Inspection, Testing, and Assessment of Microbial Contaminated Buildings – An Overview, National Asbestos and Environmental Training Institute (Herman Sabath), 2002.

Gas Chromatography and Mass Spectral Training, MDL Systems Inc. (Mark A. Ferry), 1999.

Archon Autosampler Training Course, Professional Technical Services, Ltd. (Scott Wolsing), 1997.

4460A & 4560 Concentrator Training, OI Analytical, 1995.

Basic 49 CFR Training Course, Hazardous Materials.com (Roy S. Marshall), 2003.

CERTIFICATIONS

Certified Residential Mold Inspector – Indoor Environmental Standards Organization, Minneapolis, MN.

PROFESSIONAL AFFILIATIONS

Indoor Environmental Standards Organization (IESO) – Member

American Indoor Air Quality Council (AmIAQ) – Member

SUMMARY OF EXPERIENCE

Mr. Lennon has 14 years of experience in the field of analytical environmental chemistry; this experience includes performing instrumental analyses for volatile organic compounds according to US EPA methodology. Mr. Lennon is currently responsible for performing analytical data validation to determine data quality/usability and compliance with regulatory and client-specific deliverable requirements.

An experienced indoor air quality investigator, Mr. Lennon is responsible for sample collection design, sample collection using a variety of methods visual inspection of buildings, and interpretation of laboratory results.

Prior to joining Environmental Standards, Mr. Lennon was an environmental chemist for a large analytical laboratory. He was responsible for GC/MS analysis of solid and aqueous samples in accordance with US EPA methods (e.g., 8260B, 524.2, and OLM03.2). He was also responsible for instrument preventive maintenance and troubleshooting and maintaining the integrity of the computer systems. He demonstrated competence in various US EPA methods by completing quad studies (show reproducibility). He was also responsible for analyzing the performance evaluation studies for Method 524.2, Rev. 4.0 and performing method detection limit studies.

Mr. Lennon was also previously employed by a small biotechnology company as a production technician. He was responsible for the aseptic filling of bottles and bags with liquid cell culture media. He also facilitated the measuring and formulating of liquid media from dry powder chemical components.

KEY PROJECTS

- Performed analytical data validation for numerous site investigations to determine analytical data outliers and data quality/usability. Data reviewed included those for US EPA CLP protocols, SW-846 Methods, Methods for the Chemical Analysis of Water and Wastes, and US EPA Series 200 and 600 Methods.

- Served as Project Manager for an annual laboratory performance evaluation (PE) study conducted for a major client.

- Served as the primary contact between field sampling personnel and analytical laboratories receiving the samples collected for a site investigation conducted for a major client.
- Currently serves as a Data Validation Task Manager for the numerous site investigations conducted for a major client.

KAITLYN MAKARA
Quality Assurance Chemist

FIELDS OF COMPETENCE

- Volatile, pesticide/polychlorinated biphenyl (PCB), and semivolatile organic data validation.
- Inorganic and wet chemistry data validation.

CREDENTIALS

B.S., Chemistry, Arcadia University, Glenside, Pennsylvania, 2010.

SUMMARY OF EXPERIENCE

Ms. Makara, who joined the Quality Assurance Chemistry Department in 2010, is responsible for analytical data validation to determine environmental data quality and usability for numerous project sites. Data reviewed include those for US EPA Contract Laboratory Program (CLP) protocols and SW-846 Methods. In addition, she evaluates laboratory data deliverables to determine compliance with method, regulatory, and client-specific requirements.

Prior to her employment with Environmental Standards, Ms. Makara was involved in undergraduate chemistry research. Her research included using a genetic algorithm to optimize the potential energy surfaces of hydrogen chloride clusters to find their global minima where the most stable structures occur.

KEY PROJECTS

- Performed analytical data validation interpreting volatile organic, pesticide/PCB, semivolatile organic, inorganic, and wet chemistry analyses and prepared technical quality assurance reports.
- Provided data validation services for various projects to determine data usability and defensibility as well as laboratory compliance with method, regulatory, and project-specific requirements.

AMMIE L. MARTIN
Senior Quality Assurance Chemist

ENVIRONMENTAL® STANDARDS

FIELDS OF COMPETENCE

- Organic data validation.
- Inorganic and wet chemistry data validation.
- Laboratory Auditing.
- Experience in operation, calibration, and maintenance of:
  - GC/ECD
  - GC FID
  - HPLC
  - IC

CREDENTIALS

B.S., Chemistry, Georgia Southern University, Statesboro, Georgia, 1999.

CERTIFICATION

OSHA 29 CFR 1910.120 24-hour HAZWOPER Training. Certification: March 2010, Updated through June 2012.

OSHA 40 CFR 265.16 Hazardous Waste Management Training. Certification: January 2010, Updated through April 2012.

OSHA 40 CFR 172.702 and 172.704 Hazardous Materials Management (DOT) Training. Certification: February 2010, Updated through February 2012.

SUMMARY OF EXPERIENCE

Ms. Martin joined the Chemistry Quality Assurance department in 2012 and is responsible for the verification and validation of analytical data to determine environmental data quality and usability. Data reviewed are generated following US EPA Contract Laboratory Program (CLP) protocols and SW-846 Methods. She evaluates laboratory data deliverables for compliance with regulatory and client-specific requirements.

Prior to this position, Ms. Martin worked as a quality assurance specialist and chemist for a major environmental laboratory in Georgia. She was responsible for managing performance evaluation (PE) studies and performing data method audits and internal quality system audits. In addition, she analyzed and evaluated samples utilizing Dionex® ion chromatograph (IC), Waters® HPLC, and Agilent® GC/FID and GC/ECD instruments for various clients.

KEY PROJECTS

- Performed analytical data validation interpreting volatile, semivolatile, and inorganic analyses and developed technical quality assurance reports for a major petroleum spill project.
- Verified analytical results from electronic data deliverables (EDDs) and database output during validation tasks.
- Performed senior-level review of data validation reports.

KRISTIN L. MAY
Quality Assurance Chemist III

FIELDS OF COMPETENCE

- Inorganic and wet chemistry data validation.
- PCB Aroclor data validation.
- Laboratory coordination.
- Data management.

CREDENTIALS

B.S., West Chester University, West Chester, Pennsylvania, 2001.

SUMMARY OF EXPERIENCE

Ms. May joined the Chemistry Quality Assurance Department in 2009 with over 5 years of environmental laboratory experience. As a Quality Assurance Chemist III, she is responsible for performing analytical data validation to determine environmental data quality and usability. Data reviewed are generated by US EPA Contract Laboratory Program (CLP) protocols and SW-846 Methods. She also acts as a coordinator for a client with its contracted laboratories to help resolve issues and to ensure that data deliverables are reported by the requested turn-around-times. She has also coordinated the efforts of several laboratories for a major pipeline company, including coordinating the field sampling events, delivery of bottleware from the laboratories to the field, delivery of samples from the field to the laboratory, and sample analysis. She ensured that the laboratory performed the analysis and reporting limits according to client specifications.

Ms. May has over 5 years experience as a wet chemistry laboratory technician for various environmental laboratories including an aquatic toxicology laboratory, a contract laboratory, and both small-scale and large-scale water and wastewater treatment plants.

Prior to her laboratory experience, she worked in the field of aquatic biology for the Philadelphia Water Department's Office of Watersheds and the Pennsylvania Department of Environmental Protection. Ms. May participated in creek and river assessments, specializing in aquatic macroinvertebrate collection and identification. She also assisted with habitat assessments, fish population studies, flow monitoring, fluvial geomorphology projects, report writing, and public outreach programs.

KEY PROJECTS

- Acts as the main contact for several laboratories and a major oil company. Tracks samples from time of collection to laboratory receipt and ensures data deliverables are reported by the requested turn-around-times. Also manages sample receipt, handling, analysis, and reporting issues.
- Performs analytical data validation interpreting PCB, inorganic, and general chemistry analyses and prepares technical quality assurance reports.
- Provides data validation services for projects to determine usability and defensibility of data as well as laboratory compliance with project-specific requirements.
- Performs senior-level review of data validation reports.
- Acted as the main contact for several laboratories and a large pipeline company and assisted in scheduling, sampling, and delivery of bottleware kits and of samples from the field. Also, provided chemistry communication between the laboratory and client. Worked with the IT Department to maintain a database, electronic data deliverable (EDD) specifications, and data verification module for the client. Verified proper deliverables from the laboratories to the client. Served as the day-to-day contact for all issues and communication among the laboratories, the client, and Environmental Standards.

ANDREW PIASECKI
Quality Assurance Chemist

FIELDS OF COMPETENCE

- Inorganic, organic, and wet chemistry data validation.

CREDENTIALS

B.S., Chemistry, Ursinus College, Collegeville, Pennsylvania, 2009.

SUMMARY OF EXPERIENCE

Mr. Piasecki, who is a recent graduate of Ursinus College, joined the Chemistry Quality Assurance Department in December 2009. He is responsible for analytical data validation to determine environmental data quality and usability. He is also responsible for the evaluation of laboratory data deliverables relative to regulatory and client-specific requirements. Data reviewed are generated by US EPA Contract Laboratory Program (CLP) Protocols and SW-846 Methods.

Mr. Piasecki researched the attachment of biothiophene to functionalized single-walled carbon nanotubes for the possible production of solar cells. He also investigated the electrical properties of single-walled carbon nanotubes.

KEY PROJECTS

Performed analytical data validation interpreting inorganic, organic, and wet chemistry analyses and prepared technical quality assurance reports for an energy company.

PRESENTATION/PAPER

Piasecki, A. "The Attachment of Bithiophene to Functionalized Single-Walled Carbon Nanotubes." Ursinus College, December, 2008.

Piasecki, A. "TCE in our Community." Ursinus College, February 2009.

ERIN E. RODGERS
Senior Quality Assurance Chemist II

FIELDS OF COMPETENCE

- Data validation.
- Project, task, and data validation management.
- Laboratory coordination.
- Mentoring and training of junior chemists.
- Laboratory auditing.
- Performance Evaluation Studies.
- Evaluation of Target® and EvironQuant® electronic data files.
- Quality assurance oversight for environmental investigatory and remedial projects.
- Various inorganic and general chemistry analyses.

CREDENTIALS

B.S., West Chester University, West Chester, Pennsylvania, 2003.

PROFESSIONAL DEVELOPMENT COURSES

Understanding Project Management Practices, Villanova University, Pennsylvania, 2007.
Communication, Leadership and Motivation, Villanova University, Pennsylvania, 2007.

Multi-Agency Radiology Laboratory Analytical Protocols Manual; Part 1 Training; "The MARLAP Process", United States Environmental Protection Agency, Region 3 Philadelphia, Pennsylvania, August 2009.

SUMMARY OF EXPERIENCE

Ms. Rodgers joined the Chemistry Quality Assurance Department in 2004 with 4 years of environmental laboratory experience. As a Senior Quality Assurance Chemist II, she is responsible for performing analytical data validation to determine both analytical data quality and usability. Data reviewed include those for US EPA Contract Laboratory Program (CLP) protocols and SW-846 methods. In addition, she evaluates laboratory data deliverables to determine compliance with regulatory and client-specific requirements. Ms. Rodgers has performed project, task, and data validation management duties for several ongoing data validation projects and consulting projects. She has performed forensic review of data to confirm or refute results for several clients. She has conducted on-site environmental laboratory audits for several clients.

Ms. Rodgers serves as Data Validation Project Manager for a project involving a utility company fly ash spill in East Tennessee; in this position, she coordinates delivery of data packages from several laboratories and for several matrices; coordinates the efforts of junior chemists; and communicates with the laboratories and client on a weekly basis. Ms. Rodgers is responsible for ensuring the accuracy of all validation reports and verifying that data are reported consistently between the laboratory hardcopy and electronic data deliverable. In addition, she is responsible for tracking project schedules and deadlines and coordinating the efforts of several chemists to deliver validation reports on schedule. Furthermore, she works with the IT Department to maintain the project database. On a monthly basis, Ms. Rodgers travels to the site of the fly ash spill to assist in data management and chemistry consulting tasks with other site personnel.

Ms. Rodgers is the Project Manager for a project that requires the review of laboratory raw data to confirm or refute reported positive ethanol results at various sites in California. She also has coordinated the efforts of several laboratories for a major pipeline company, including coordinating the field sampling events, delivery of bottleware from the laboratories to the field, delivery of samples from the field to the laboratory, and sample analysis. She ensures that the laboratory performs the analysis and reporting limits according to client specifications.

Ms. Rodgers also is responsible for mentoring junior chemists. Her responsibilities include orientation and training on analytical methods, company standard operating procedures (SOPs) and protocols, and validation procedures.

Prior to joining Environmental Standards, Ms. Rodgers was employed at a privately owned environmental laboratory where she was responsible for drinking and waste water testing. She operated various instruments such as a Perkin Elmer ion chromatogram, an atomic adsorption, and a graphite atomic adsorption. Her laboratory experience provided a solid foundation for her responsibilities at Environmental Standards.

KEY PROJECTS

- Serves as Data Validation Project Manager for a project involving a utility company fly ash spill in Eastern Tennessee. Coordinates delivery of data packages from several laboratories and for several matrices; coordinates the validation efforts of several chemists; tracks project schedules and deadlines, and communicates with the laboratories and client on a weekly basis. In addition, she works with the IT Department to maintain the project database.

- Performed analytical data validation interpreting volatile, semivolatile, PCB, inorganic, and wet chemistry analyses and prepared technical quality assurance reports for clients that include a major pipeline company and a global technologies company.

- Performed laboratory audits for several major companies to assess laboratory quality and reliability. The audits evaluated laboratory adherence to good laboratory practices, laboratory quality assurance/quality control (QA/QC) programs, and the analytical methods requested by the clients.

- Assisted senior chemists as Validation Task Manager for several large projects. In addition, served as Project Manager for an ongoing assessment for a major pipeline company to assess total and hexavalent chromium, metals, volatile organic, polynuclear aromatic hydrocarbon, and wet chemistry analyses at several sites. Coordinated the efforts of several chemists to perform validation of organic and inorganic analytical data and to prepare technical quality assurance reports and communicated with clients regarding validation and deliverable issues; verified laboratory compliance with the guidelines set forth by the client in the QAPP.

- Verified analytical results from electronic data deliverables (EDDs) and database output during validation tasks.

- Serves as Project Manager responsible for evaluating laboratory electronic data files using software such as Target® and EvironQuant® to either confirm or refute laboratory-reported positive results for ethanol at several sites in California.

- Responsible for maintaining, cataloging, and archiving all electronic data packages received for a major client so that the data can be easily accessed at a later date.

- Assisted a senior chemist and Principal as Validation Task Manager for a large project for a major client. Communicated with the client, contractor, and various laboratories involved to coordinate receipt of data packages and EDDs. Also communicated with the various laboratories about missing deliverables and reporting issues. Coordinated the efforts of several chemists to perform validation and prepare quality assurance reports of PCB as Aroclors and Congeners, organchorine pesticide compounds, polycyclic aromatic hydrocarbons, and metals data on fish and sediment samples.

KEY PROJECTS (Cont.)

- Serves as Validation Project Manager for an environmental and engineering company. Responsible for coordinating delivery of data packages and EDDs with the client and performing data validation of the polycyclic aromatic hydrocarbon data.

- Acted as the main contact between several laboratories and a large pipeline company and assisted in scheduling, sampling, and delivery of bottleware kits and of samples from the field. Also, provided chemistry communication between the laboratory and client. Worked with the IT Department to establish a database, EDD specification, and data verification module for the client. Verified proper deliverables by the laboratories to the client. Served as the day-to-day contact for all issues and communication among the laboratories, the client, and Environmental Standards.

- Served as Project Manager for a small consulting project that involved determining the reliability of results performed by two different methods.

- Coordinated several double-blind performance evaluation studies for clients and participated in subsequent discussions to evaluate the laboratory-reported results. Assisted one client in coordinating a second performance evaluation study to confirm the results of the initial study.

- Assisted a client with a forensic evaluation of data to determine if data could be supported or refuted in advance of litigation.

- Assisted a client in setting up a procedure to investigate the potential cause of PAH contamination at its site. Coordinated with the laboratory and client to certify the collection bottleware, collection equipment, and laboratory extraction equipment. Once the samples had been collected and data reported, evaluated the data to provide feedback to the client on the potential causes of the contamination.

- Serves as the Project Manager verifying and reprocessing laboratory data files using Target and EnvironQuant software for a benzene, toluene, ethylbenzene, and xylenes (BTEX) project.

- Coordinated a double-blind PT evaluation that involved six laboratories and various consultants. Evaluated laboratory-reported results and assessed laboratory corrective actions.

PUBLICATIONS/PRESENTATIONS

Vitale, R. J., E. E. Rodgers, R. L. Forman. "A Novel Approach to Verifying Detection Limits." TCEQ Environmental Conference & Trade Fair, Austin, TX, April/May 2013.

Rogers, W., R. J. Vitale, J. N. Gable, E. E. Rodgers, J. P. Kraycik, and N. E. Carriker. "Porewater Studies Subsequent to the Kingston Ash Event." World of Coal Ash Conference, Lexington, KY, April 2013.

Rodgers, E. E., R. L. Forman, R. J. Vitale, W. J. Rogers, N. E. Carriker. "A Different Approach to Detection Limits." (Poster). SETAC North America 33rd Annual Meeting, Long Beach, CA, November 2012.

Vitale, R. J., R. L. Forman, J. N. Gable, E. E. Rodgers, *et. al.* "Implementation of a Field and Laboratory Quality Oversight Program During the TVA Kingston Fly Ash Recovery Project to Ensure High Quality and Defensible Data." TVA-Kingston Fly Ash Release Environmental Research Symposium, Harriman, TN, August 2-3, 2011.

Rogers, W. J., R J. Vitale, J. N. Gable, E. E. Rodgers, J. Gruzalski, and N. E. Carriker. "Observations of Metals and Metaloids in Sediment Porewater Associated with the Tennessee Valley Authority, Kingston, TN Ash Recovery." TVA-Kingston Fly Ash Release Environmental Research Symposium, Harriman, TN, August 2-3, 2011.

MATTHEW S. THOMAS
Senior Quality Assurance Chemist

FIELDS OF COMPETENCE

- Volatile and semivolatile organic data (generated by GC, GC/MS, and HPLC analysis) validation.
- Inorganic and general chemistry data validation.
- Pesticide and PCB data validation.
- Dioxin and furan data validation.
- Data validation and quality assurance oversight project management.

CREDENTIALS

B.S., Chemistry, Davis and Elkins College, Elkins, West Virginia, 1991.

B.S., Mathematics, Davis and Elkins College, Elkins, West Virginia, 1991.

SUMMARY OF EXPERIENCE

Mr. Thomas, who has 6 years of analytical quality assurance experience, is responsible for performing data validation for numerous site investigations to determine analytical data quality and usability and for managing various data validation efforts. Data reviewed include those for US EPA Contract Laboratory Program (CLP) protocols and SW-846 methods. He also is responsible for ensuring that data deliverables are compliant with regulatory and client-specific requirements.

Prior to this position, Mr. Thomas worked as a method development chemist for a major laboratory in Pennsylvania. He was responsible for developing analytical methods for various pharmaceutical products.

KEY PROJECTS

- Performed analytical data validation interpreting volatile, semivolatile, and inorganic analyses and developed technical quality assurance reports for a major petroleum spill project.
- Performed analytical data validation interpreting volatile and inorganic analyses and prepared data usability assessment reports for a coal fly ash remediation project.
- Verified analytical results from electronic data deliverables (EDDs) and database output during validation tasks.
- Performed analytical data validation interpreting volatile, semivolatile, and HRGC/HRMS PCB congener and dioxin/furan data for long-term site remediation project.

ROCK J. VITALE, CEAC
Technical Director of Chemistry/Principal

FIELDS OF COMPETENCE

- Analytical and environmental chemistry.
- Analytical method development and specification design.
- Corporate laboratory program design, execution, and maintenance.
- Laboratory auditing.
- Litigation support and analytical data dispute resolution.
- Method validation study design and execution.
- Forensic environmental chemistry (release fingerprinting).
- Performance evaluation study, design, and execution.
- Quality assurance oversight of large, complex (sediment) characterization projects.
- Rigorous third-party data validation for RI/FS, RFIs/CMS, Permit B, delisting studies, and CAA stack tests/trial burns.
- Representation of industry at regulatory meetings.
- Project-specific request for proposal preparation.
- Preparation or third-party review of Quality Assurance Project Plans.
- Sampling and analytical design - air, soils/sediments, surface/groundwater, and biota.
- Technical liaison among laboratories, industries, and consultants.
- Theoretical and practical knowledge of all facets of quantitative analysis for organic and inorganic pollutants by published methodologies.

CREDENTIALS

B.S., Environmental Science and Biology, Marist College, New York, 1981.

Additional Undergraduate Chemistry credits to satisfy B.S. Chemistry, Villanova University, Pennsylvania and Rider College, New Jersey, 1982-1985.

Villanova University, Pennsylvania. Chemistry Graduate Course Work.

CERTIFICATIONS AND AWARDS

Fellow - American Institute of Chemists (FAIC) - American Institute of Chemists, Alexandria, Virginia.
Certified Professional Chemist (CPC) - American Institute of Chemists, Alexandria, Virginia.
Certified Environmental Analytical Chemist (CEAC) - National Registry of Certified Chemists (NRCC), Washington, DC - Registrant #2510.
Chartered Fellow Chemist (FRACI CChem) - The Royal Australian Chemical Institute, Inc. - Registrant # 31900.

Environmental Standards named one of the Top Ten Method Developers in the April 1995 issue of *Environmental Laboratory.*

Environmental Standards awarded the Chrysler Corporation’s Vendor Excellence Award for designing and implementing the Chrysler Corporation Environmental Laboratory Program, April 1996.

Environmental Standards awarded the Columbia Gas Transmission Corporation 1997 Consultant of the Year Award for performing quality assurance oversight for the 19,000-mile pipeline environmental investigation.

BOARD OF DIRECTORS/ADVISORY BOARD AND EXPERT PANEL APPOINTMENTS

Editorial Board of The Chemist, A journal of The American Institute of Chemists, (May 2012 to present)
Officer, Members-at-Large, American Society of Testing and Materials (ASTM), Committee E36 – Conformity Assessment (Term January 2006-December 2007).
US EPA Office of Inspector General-Expert Panel-Evaluation of Drinking Water Laboratory Procedures-Selected Panelist (2005).
American Institute of Chemists – Board Member (1997-2003, 2007 - present).
Appointed Federal Advisory Committee Board Member – Environmental Laboratory Advisory Board (ELAB) (2004 - 2010).
Invited Expert-TCEQ PCB Advisory Group (2005).
Standard Methods for the Evaluation of Water and Wastewater – Chairman of the Joint Technical Group (JTG) - Section 3500-Cr (2002-present).
Society of Applied Spectroscopy – Delegate (2000-2002).
National Water Quality Monitoring Council Methods and Data Comparability Board – Board Member (September 2001-present).
National Registry for Certified Chemists – Board Member (July 2001-December 2009).
Environmental Testing & Analysis – Advisory Board Member (1998-2001).
Environmental Standards, Inc. CEO and Chairman of the Board (1987-present).

PROFESSIONAL AFFILIATIONS

American Chemical Society - Member # 00971942
American Industrial Hygiene Association (AIHA) - Elected Member - #158051
American Institute of Chemists - Fellow
Editor - *The Chemist,* 1995-2003
The Royal Society of Chemistry - Member #335273
The Royal Australian Chemical Institute, Inc. - Fellow 31900
American Water Works Association - Member
American Society of Testing and Materials - Member (Subcommittees E36.10-E36.50 and 50.02) - #000115510
American Society of Quality Control - Member (Symposium Co-Chair 1995)
International Society of Environmental Forensics - Member
Society of Toxicology and Chemistry (SETAC) - Member - #180963
United States EPA SW-846 Inorganics Workgroup - Invited SW-846 Workgroup Member and OSWER/WTQA Symposium Committee, 1996–2001

SUMMARY OF EXPERIENCE

Mr. Vitale has 29 years of analytical quality assurance experience. Specifically, he has 6 years of analytical experience performing analyses for organic and inorganic contaminants in a variety of media by instrumental and classical methods, including research and development of analytical methodologies. As a Principal of Environmental Standards, Mr. Vitale oversees a staff of approximately 35 quality assurance chemists and is responsible for the direction of the technical and managerial aspects of the Valley Forge, Pennsylvania, operations. Mr. Vitale is a recognized expert in the following fields: organic and inorganic data validation (including specialty analyses); laboratory auditing; preparation or third-party review of quality assurance project plans (QAPjPs) for remedial investigations/feasibility studies (RIs/FSs); Resource Conservation and Recovery Act (RCRA) Facility Investigations/Corrective Action Program (RFI/CAP) and remedial actions; design of specialty analyses to accommodate project-specific data quality objectives (DQOs); design of quality assurance programs; and agency negotiations.

Prior to co-founding Environmental Standards, Mr. Vitale was the Quality Assurance Manager for a large environmental consulting firm with 26 offices nationwide. He designed and implemented a quality assurance and data validation program for all RI/FSs, site inspections, and RCRA closures. His responsibilities also included the preparation of QAPjPs for Superfund/RCRA studies in all US EPA Regions, as well as a number of state-led projects. He also trained and managed a staff of five data reviewers. Mr. Vitale served as technical liaison among potentially responsible parties (PRPs), laboratories, and/or state and federal agencies.

Prior to the QA Manager position, Mr. Vitale served as a quality assurance chemist with a primary US EPA Superfund contractor for US EPA Region III for 3 years. He provided quality assurance reviews for over 300 US EPA site inspections, based upon rigorous examination of gas chromatography (GC), GC/mass spectroscopy (GC/MS) (high and low resolution), graphite furnace atomic absorption (GFAA), and inductively coupled plasma (ICP) data. He co-authored and provided peer-review comments on numerous documents on the subject of data validation for both state and federal agencies.

KEY PROJECTS

- Provided response-wide quality assurance oversight of environmental sampling and the analytical efforts in the Gulf of Mexico for the Mississippi Canyon 252 Deepwater Horizon oil release. Responsibilities included the preparation of a comprehensive QAPjP; laboratory audits; field sampling audits of the collection of air, oil, biota, surface water, waste and sediment samples; validation and verification of associated analytical project data; and on-site chemistry consulting. Provided immediate support at the Gulf Coast Incident Command in Houma, Louisiana, following the release, and then transitioned to the Gulf Coast Restoration Organization in New Orleans, Louisiana.

- Provided project management and quality assurance oversight for the Tennessee Valley Authority (TVA) Kingston Fossil Plant Fly Ash Release cleanup project – the largest fly ash release to a river system in the United States. Responsibilities included the preparation of a comprehensive QAPjP; laboratory selection and on-going audits; critical real-time data validation of associated analytical project data; meeting attendance; and on-site chemistry consulting.

- Provided quality assurance oversight of environmental sampling and data management for a major natural gas exploration and production company in the Marcellus Shale region. Responsibilities included the preparation of a field sampling plan and QAPjP; validation and verification of associated analytical project data; and chemistry consulting.

- Performed data validation for more than 500 multi-media RIs/FSs, RCRA RFIs, and remedial actions and routine monitoring projects on data generated by more than 350 laboratories on projects throughout the United States.

- Prepared QAPjPs, which included formulation of DQOs, for more than 75 privately funded RIs/FSs, RFIs, and remedial actions (*e.g.*, drum removals) for submission to federal and state regulatory agencies. Also, performed third-party review and comment on QAPjPs prepared by other entities for a significant number of RIs/RSs and RFIs prior to submission of the documents to the lead regulatory agency.

- At the request of Fortune 500 companies, engineering companies, and in some instances, the audited laboratories, conducted comprehensive laboratory audits of over 200 laboratories (domestic and international) in the areas of organics analyses, inorganic analyses, classical parameters, and specialty analyses. Provided critical comments, recommendations, and performance evaluation (PE) reports.

- Designed, executed, and maintained corporate laboratory programs for a number of Fortune 500 companies. Corporate programs included performing a needs assessment for facilities, execution of round-robin blind PE studies, laboratory audits of candidate laboratories, preparation of detailed technical and cost specifications/requests for proposal (RFPs), evaluation of laboratories' proposals, assistance in contract and logistics execution, and maintenance of corporate laboratory contract programs.

KEY PROJECTS (Cont.)

- Designed analytical specifications and DQOs, including modifications to analytical methods and oversight of project laboratories performing method validation, for a significant number of projects. Key projects included design of analytical methods to achieve part-per-trillion level detection limits for 1,2,3-trichloropropane in river water by GC/MS and design of an analytical method to achieve part-per-trillion level detection limits for Mirex, Photomirex, and Kepone in air, water, soil, and biota using isotope dilution techniques and chemical ionization (CI) GC/MS. Furthermore, conceived of, designed, and provided complete oversight for a 4-month method evaluation study (MES) for the development of an alkaline digestion method for the analysis for hexavalent chromium in soil samples. The complete MES report was submitted to the SW-846 workgroup for inclusion in the methods manual. The inclusion of promulgated Method 3060A in the third update of SW-846 is credited to Mr. Vitale.

- Prepared a significant number of comprehensive RFPs for analytical services for a wide variety of large short-term and long-term environmental investigations. Evaluated laboratory proposals, provided recommendations for award, and participated in contract negotiations.

- Acted as sole-source quality assurance oversight consultant in the areas of general consultation, analytical problem troubleshooting, and dispute resolution/arbitration for a number of Fortune 500 companies. Attended frequent meetings and negotiations with federal and state agencies on behalf of clients and provided training seminars to corporate environmental groups on the subjects of quality assurance and analytical chemistry.

- Provided complete quality assurance oversight for three sampling consultants and five project laboratories for the performance of sampling and analysis for more than 60 individual chromite ore processing residue contaminated sites in the state of New Jersey. Oversight included scheduling analyses, ordering bottleware, performing field and laboratory audits, sample tracking, database input and maintenance, laboratory invoice approval, data validation, and attending monthly meetings with the state.

- Provided complete quality assurance oversight for two project laboratories for the analysis of organic vapors collected from vapor wells installed in Long Island, New York, around a major gasoline importer. Approximately 120 samples per month were collected using Tenax/ambersorb cartridges and were analyzed by thermal desorption GC/MS for a variety of gasoline-related components. Oversight included summarizing preliminary data received (via fax) from the project laboratories and, subsequently, disseminating the information to the project team, performing field and laboratory audits, sample tracking, database input and maintenance, laboratory invoice approval, and data validation.

- Provided complete quality assurance oversight for 2-year environmental impact studies performed at a publicly owned treatment works (POTW) in New York State. Oversight included preparing the sampling consultant RFP, assisting in the selection process, reviewing the Work Plans and QAPjPs, performing field and laboratory audits, validating all project analytical data, and attending monthly meetings with the steering committees.

- Provided complete quality assurance oversight for a 19,000-mile gas transmission pipeline investigation. Oversight included assisting in the laboratory selection process, reviewing the QAPjP, performing field and laboratory audits, validating data, initiating blind PE samples, and attending meetings.

- Trained, supervised, and managed a substantial staff of quality assurance personnel. In addition, conducted numerous training seminars on environmental quality assurance throughout the United States.

KEY PROJECTS (Cont.)

- Provided complete quality assurance oversight on a large sediment investigation on the lower Hudson River. Oversight included laboratory selection, QAPjP preparation, conducting field and laboratory audits, data validation, data management (including data visualization by EVS), and meeting attendance.
- Provided project management and quality assurance oversight for the remediation efforts related to a 100-million gallon fly ash release by an international utility company. Responsibilities included the preparation of a comprehensive field sampling plan and QAPjP; the quality assurance of all field data including air, ash, biota; monitoring well, residential well, surface water, and sediment samples; preparation of data statistics and report for the public and various agencies; oversight of surface water and residential well sampling efforts; and validation of 10% of the analytical project data.
- Contributing author of the 1986 prototype of "Functional Guidelines for Organic Data Validation With Modifications for Use Within US EPA Region III."

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Vitale, R. J., S. T. Zeiner, and E. T. Lahr. "Perchlorate Utilization of Ion Chromatography and Liquid Chromatography on Characterization Project." The 21st Annual National Environmental Monitoring Conference (NEMC). Wyndham City Center, Washington, DC, July 25-27, 2005.

Vitale, R. J., D. R. Blye, R. L. Forman, and D. J. Lancaster. "Method Detection Limits: A Data User's Perspective." The 21st Annual National Environmental Monitoring Conference (NEMC), Wyndham City Center, Washington, DC, July 25-27, 2005.

Vitale, R. J. and K. R. Clay. "An Evaluation of Analyte Isolation and Analytical Finish Methods for Cr(VI) in Solids." The 21st Annual National Environmental Monitoring Conference (NEMC). Wyndham City Center, Washington, DC, July 25-27, 2005.

Vitale, R. J. "Approaches To Designing A Low-Level Method." Texas Commission of Environmental Quality (TCEQ) Conference. Austin, TX, May 2-4, 2005.

Vitale, R. J. and R. L. Forman. "Obtaining Legally Defensible Analytical Chemistry Laboratory Data." 2004 Annual Environmental Laws and Regulations Conference. Harrisburg, PA, April 13, 2004.

Blye, D. R., R. J. Vitale, and R. L. Forman. "Forensic Electronic File Review." The 19th Annual International Conference on Contaminated Soils, Sediments, and Water. Amherst, MA, October 20-23, 2003.

Vitale, R. J. and D. J. Lancaster. "Whole Effluent Toxicity Laboratory Testing: Lessons Learned from Auditing Method Compliance, Technique, and Documentation." BP Soil and Groundwater Center of Expertise Annual Meeting. BP Westlake Park Complex, Houston, TX, September 30 - October 2, 2002.

Vitale, R. J., R. L. Forman, and G. L. Kirkpatrick. "Data Quality Audits." Auditing in a Changing World - The Auditing Round Table. Hyatt Regency, Atlanta, GA, September 17-20, 2002.

Vitale, R. J. "Laboratory System Auditing." Third Annual US ACE Program Analytical Compliance, Analytical Program Compliance Data Quality Objectives. The Galt House Hotel, Louisville, KY, June 18, 2002.

Vitale, R. J. Moderator and Session Chair. "Metals: Sampling and Analysis." The National Water Quality Monitoring Council (NWQMC) National Monitoring Conference 2002. Madison, WI, May 19-23, 2002.

Vitale, R. J., M. R. Green, and R. L. Forman. "Commercial Environmental Laboratory On Site Audits - Observations and Recommendations for Enhancing Method Requirements," under the session Principles of Environmental Sampling and Analysis – Two Decades Later. The American Chemical Society (ACS) 224th National Meeting. Boston, MA, August 18-22, 2002.

PRESENTATIONS (Cont.)

Forman, R. L. and R. J. Vitale. "Performance Evaluation Studies – What Can They Tell You?" under the session Principles of Environmental Sampling and Analysis – Two Decades Later. The American Chemical Society (ACS) 224th National Meeting. Boston, MA, August 18-22, 2002.

Roberts, T. M., R. J. Vitale, M. A. Michell. "Assessment of the Effects of Active Sites in Discrete Sampling, Purge, and Trap Concentrators on Oxygenated Compounds." The 17th Annual Waste Testing and Quality Assurance Symposium. Arlington, VA, August 13-16, 2001.

Zeiner, S. T., D. J. Lancaster, and R. J. Vitale. "Negative Effects of the 'Grand Mean' Calibration Approach on Generated Internal Surrogate Compounds Recovery Limits." The 17th Annual Waste Testing and Quality Assurance Symposium. Arlington, VA, August 13-16, 2001.

Vitale, R. J. "Certification and Environmental Chemistry," under the session The Professional Chemist and Certification, The American Chemical Society (ACS) 221st National Meeting. San Diego, CA, April 2-5, 2001.

Forman, R. L. and R. J. Vitale. "Concrete Chips as a Test Medium for a Performance Evaluation Study." PittCon 2001. New Orleans, LA, March 7-9, 2001.

Vitale, R. J. "Data Validation and Detecting Laboratory Fraud," Analytical Program Compliance – Future Directions for a Quality Analytical Program, First Annual Meeting Louisville District US ACE, Louisville, KY, November 9, 2000.

Forman, R. L., R. J. Vitale, and D. P. Callaghan. "Data Comparability of Volatile Soil Samples Collected in Pennsylvania by 'Traditional' and EnCore® Sampling Techniques." The 16th Annual International Conference on Contaminated Soils, Sediments, and Water. Amherst, MA, October 16-19, 2000.

Blye, D. R. and R. J. Vitale. "Trivalizing Environmental Data Validation." The 76th Annual American Institute of Chemists National Meeting. Alexandria, VA, June 1-3, 2000.

Vitale, R. J. and R. L. Forman. "Soil Field Duplicates Versus Laboratory Duplicates for Mercury on a Large Multi-State Pipeline Investigation." The 14th Annual Conference on Contaminated Soils. Amherst, MA, October 25-28, 1999.

Wibby, C. and R. J. Vitale. "Standard Reference Materials: Challenges and Applicability in Implementing PBMS." ASQEED, Best Practices for the Energy Industry. San Antonio, TX, October 3-6, 1999.

Head, J. G., R. J. Vitale, M. Cohen, and K. J. Robbins. "Comparison of Field Duplicate, Laboratory Duplicate, and Matrix Spikes for Mercury in a Large Multi-State Pipeline Investigation." The 15th Annual Waste Testing and Quality Assurance Symposium. Arlington, VA, July 18-22, 1999.

Dupes, L. J. and R. J. Vitale. "Reactive Sulfide Analysis: A Case Study in Auditing Waste Characterization Methodologies." The 15th Annual Waste Testing and Quality Assurance Symposium. Arlington, VA, July 18-22, 1999.

Forman, R. L. and R. J. Vitale. "Lessons Learned From Performance Evaluation Studies." The 15th Annual Waste Testing and Quality Assurance Symposium. Arlington, VA, July 18-22, 1999.

Vitale, R. J. and F. J. Carlin, Jr. "The Use of Sulfuric Acid Cleanup Techniques To Minimize Matrix Interferences for the Analysis for Toxaphene in Soils and Sediments." The 15th Annual Waste Testing and Quality Assurance Symposium. Arlington, VA, July 18-22, 1999.

Forman, R. L., R. J. Vitale, C. Wibby, and J. Lowery. "Evaluating Environmental Laboratory Performance Using Multi-Phase Reference Materials." PittCon '99. Orlando, FL, March 7-12, 1999.

PRESENTATIONS (Cont.)

Vitale, R. J., K. Robbins, D. P. Callaghan, and J. Head. "Comparison of Soil Field Duplicate Versus Laboratory Duplicate Results for Mercury on a Large Multi-State Pipeline Investigation." PittCon '99. Orlando, FL, March 7-12, 1999.

Vitale, R. J., R. L. Forman and L. J. Dupes. "Comparison of Volatile Organic Compound Results Between Method 5030 and Method 5035 on a Large Multi-State Hydrocarbon Investigation." The 14th Annual Waste Testing and Quality Assurance Symposium. Arlington, VA, July 13-15, 1998.

Dupes, L. J., R. J. Vitale and D. J. Weaver. "Ignitability Performance Evaluation Study - Are Your Wastes Being Correctly Characterized?" The 14th Annual Waste Testing and Quality Assurance Symposium. Arlington, VA, July 13-15, 1998.

Forman, R. L., R. J. Vitale, D. C. Nuber, and D. P. Callaghan. "A Case Study: Effective Assessment of Data Usability During a Multi-Year Air Study." 91st Annual Air and Waste Management Association Meeting. San Diego, CA, June 14-18, 1998.

Vitale, R. J. and R. L. Forman. "A Comparison Of Single-Blind Versus Double-Blind Performance Evaluation Sample Results From Commercial Environmental Laboratories." The 75th Annual American Institute of Chemists National Meeting. Philadelphia, PA, May 28-30, 1998.

Vitale, R. J. and D. R. Blye. "Laboratory Audit Conformance Requirements for Chemical Standards In Environmental Analysis." PittCon '98. New Orleans, LA, March 1-5, 1998.

Vitale, R. J. "Balancing Regulatory Compliance with Technical Validity." Soil Sampling for Volatile Organics Seminar, O'Hare International Holiday Inn, Chicago, IL, December 10, 1997.

Mussoline, G. R. and R. J. Vitale. "A Statistical Analysis of an Analytical Holding Time for Hexavalent Chromium." SUPERFUND XVIII. Washington, DC, December 2-4, 1997.

Blye, D. R. and R. J. Vitale. "General Electric Waste and Wastewater Sampling and Analytical Issues Workshop." General Electric Company. Toronto, Canada, September 19, 1997.

Lancaster, D. J. and R. J. Vitale. "An Evaluation of Methods for Quantifying Polychlorinated Biphenyls in Environmental Samples." The American Institute of Chemists 74th National Meeting. Las Vegas, NV, September 4-6, 1997.

Vitale, R. J. "Balancing Regulatory Compliance with Technical Validity." Soil Sampling for Volatile Organics Seminar, Philadelphia Airport Hilton. Philadelphia, PA, August 14, 1997.

Vitale, R. J., G. R. Mussoline, and K. A. Rinehimer. "Environmental Monitoring of Chromium in Air, Soil, and Water." Chromium Symposium-1996. Arlington, VA, April 23-24, 1996.

Vitale, R. J., G. R. Mussoline, J. C. Petura, and B. R. James. "US EPA Proposed Cr(VI) Analytical Method: A Reliable Analytical Method for Extracting and Quantifying Cr(VI) in Soils." The Sixth West Coast Conference on Contaminated Soils and Groundwater. Newport Beach, CA, March 11-14, 1996.

Vitale, R. J. and L. J. Dupes. "Case Study: A Laboratory Performance Evaluation Study - An Important Part of the Lab Selection Process." US EPA Region II and New York Water Environment Associates Symposium - Current Topics in Environmental Management: Air, Hazardous Waste, Water, Wastewater and Groundwater at the IBM Corporation. Yorktown Heights, NY, November 2, 1995.

Mussoline, G. R., K. A. Rinehimer, and R. J. Vitale. "Chromium Speciation Analysis in Soils/Sediments - Zero Percent Matrix Spike Recoveries May Not Equal Unreliable Data." 10th Annual Conference on Contaminated Soils. Amherst, MA, October 23-26, 1995.

PRESENTATIONS (Cont.)

Vitale, R. J. and D. R. Blye. “Selecting an Environmental Laboratory.” Environmental Laboratories: Testing the Waters, Water Environment Federation. Cincinnati, OH, August 13-16, 1995.

Grega, K. K. and R. J. Vitale. “QA/QC Considerations for Radiological Monitoring.” Beneficial Reuse ‘95 Third Annual Conference on Recycle and Reuse of Radioactive Scrap Metal. Knoxville, TN, July 31 - August 3, 1995.

Vitale, R. J., G. Mussoline, and W. Boehler. “Interlaboratory Comparison of Quality Control Results from a Long-Term Vapor Well Monitoring Investigation Using a Hybrid EPA Method T01/T02 Methodology.” US EPA 11th Annual Waste Testing and Quality Assurance Symposium. Washington, DC, July 23-28, 1995.

Blye, D. R. and R. J. Vitale. “Data Quality - Assessment of Data Usability Versus Analytical Method Compliance.” US EPA 11th Annual Waste Testing and Quality Assurance Symposium. Washington, DC, July 23-28, 1995.

Vitale, R. J. and D. R. Blye. “Environmental Data Quality Assurance Seminar.” Phillips Petroleum Corporation. Bartlesville, OK, May 24, 1995.

Vitale, R. J. and D. R. Blye. “Environmental Data Quality Assurance Seminar.” Ford Motor Co. Dearborn, MI, May 18, 1995.

Vitale, R. J. “Assessing Data Quality for Risk Assessment Through Data Validation.” Second Symposium on Superfund Risk Assessment in Soil Contamination Studies. Phoenix, AZ, January 26-27, 1995.

Vitale, R.J. and D. R. Blye. “Environmental Data Quality Assurance Seminar.” Exxon Biomedical Services, Inc. East Millstone, NJ, January 24-25, 1995.

Vitale, R. J. “Cost Savings and Enhanced Data Quality Through Thoughtful Project Planning.” US EPA Region II RCRA Outreach Seminar on Quality Assurance in Environmental Decision-Making at the IBM Corporation. Yorktown Heights, NY, November 2, 1994.

Vitale, R. J. “How to Audit Environmental Laboratories.” Workshop on Generating Scientifically Valid and Legally Defensible Data, US EPA Office of Compliance Personnel. Crystal City, VA, July 15, 1994.

Vitale, R. J., B. James, G. Mussoline, and J. Petura. “Hexavalent Chromium Methods for Soils; Results of Extraction Comparison Research and Multi-Laboratory Holding Time Study.” US EPA 10th Annual Waste Testing and Quality Assurance Symposium. Arlington, VA, July 11-14, 1994.

Vitale, R. J. “Do Low Matrix Spike Recoveries Equal Bad Data: A Case Study of Hexavalent Chromium in Soil.” Conference on Quality Assurance in Environmental Monitoring and Workshop on Generating Scientifically Valid and Legally Defensible Data. Alfred, NY, May 18, 1994.

Vitale, R. J. “Regaining Control of Your Environmental Investigation Through Auditing Your Environmental Laboratory.” Conference on Quality Assurance in Environmental Monitoring and Workshop on Generating Scientifically Valid and Legally Defensible Data. Alfred, NY, May 18, 1994.

Vitale, R. J. “Procedures for Auditing Laboratories.” Quality Assurance in Environmental Monitoring. Syracuse, NY, March 7, 1994.

Vitale, R. J., G. R. Mussoline, B. R. James, and J. C. Petura. “Innovative Quality Control Approach to Quantifying Hexavalent Chromium in Soils.” PittCon ‘94. Chicago, IL, February 27 - March 4, 1994.

Vitale, R. J., G. R. Mussoline, B. R. James, and J. C. Petura. “Interpretation of Ancillary Parameters and Matrix Spike Recovery Data for Hexavalent Chromium Determination In Soils.” SUPERFUND XIV. Washington, DC, November 30 - December 2, 1993.

Vitale, R. J. “Auditing Your Environmental Laboratory.” Sampling, Analyzing and Validating Your Environmental Data Seminar. Philadelphia, PA, November 8-9, 1993.

PRESENTATIONS (Cont.)

Vitale, R. J. "Procedures for Auditing Laboratories." Conference on Quality Assurance in Environmental Monitoring. Yorktown Heights, NY, October 21, 1993.

Vitale, R. J. "A Method Evaluation Study for the Analysis for Hexavalent Chromium in Solid Samples Using a Modified Alkaline Digestion Procedure and Colorimetric Determination." US EPA Ninth Annual Waste Testing and Quality Assurance Symposium. Crystal City, VA, July 12-16, 1993.

Vitale, R. J. and D. R. Blye. "Environmental Data Quality Seminar." Amoco Oil Co. Chicago, IL, May 13, 1993.

Miller, M., R. J. Vitale, and R. Beach. "Data Management Systems in Performance Measurements - Techniques in Overall Data Quality Assessment." 20th Annual Conference on National Energy and Environmental Quality, American Society of Quality Control (ASQC), 1993.

Vitale, R. J. "Data Validation." Quality Assurance in Environmental Monitoring Conference, NYS DEC. Albany, NY, November 18, 1992.

Vitale, R. J. "Data Validation." Quality Assurance in Environmental Monitoring Conference, New York Water Pollution Control Association, Inc. and Westchester Community College. Yorktown Heights, NY, November 19, 1992.

Vitale, R. J. "QAPP Design for Sampling and Analysis of Hexavalent Chromium in Various Media." Hexavalent Chromium Analytical Methods Workshop. Arlington, VA, October 15, 1992.

Vitale, R. J. "Laboratory Audits." Merck & Co., Inc. 1991 Environmental Conference. Montreal, Canada, June 26, 1991.

Vitale, R. J. "Cost-Effective Site Investigations." Controlling the Costs of Site Remediation Seminar, Environmental Resources Management-New England, Inc. Boston, MA, June 20, 1989.

CONFERENCE MODERATOR/CHAIR

Vitale, R. J. Session Chair. "Innovative Planning and Quality Oversight for the Characterization of Complex Sediment Investigations." SETAC North America 27th Annual Meeting. Montreal, Canada, November 3-9, 2006.

Vitale, R. J. Session Chair. "Metals: Sampling and Analysis." The National Water Quality Monitoring Council (NWQMC) National Monitoring Conference 2002. Madison, WI, May 19-23, 2002.

Vitale, R. J. Moderator and Session Chair, "Technical Issues in Chemistry." The 76th Annual American Institute of Chemists National Meeting. Alexandria, VA, June 1-3, 2000.

Vitale, R. J. Moderator and Session Chair, "PBMS Laboratory Auditing and Accreditation." The 15th Annual Waste Testing and Quality Assurance Symposium. Arlington, VA, July 18-22, 1999.

Vitale, R. J. Moderator and Conference Co-Chair, Technical Issues in Chemistry. The 75th Annual American Institute of Chemists National Meeting. Philadelphia, PA, May 28-30, 1998.

Vitale, R. J. Moderator and Conference Co-Chair, "Technical Issues in Chemistry." The New Alchemist, The American Institute of Chemists 74th National Meeting, Las Vegas, NV, September 4-6, 1997.

Vitale, R. J. Moderator, Quality Assurance Workshop, "Environmental Laboratories: Moving Toward the 21st Century," Water Environment Federation (WEF). Philadelphia, PA, August 3-6, 1997.

Vitale, R. J. Moderator and Conference Co-Chair, International Standards, 39th Annual Quality Symposium, "Navigating the Quality Process," Philadelphia Section of the American Society of Quality Control. Philadelphia, PA, November 14, 1995.

THOMAS H. WEINMANN
Senior Quality Assurance Chemist II

FIELDS OF COMPETENCE

- Volatile and semivolatile organic data (generated by GC, GC/MS, and HPLC analysis) validation.
- Inorganic and wet chemistry data validation.
- Pesticide and PCB data validation.
- Radiochemistry data validation.
- Dioxin and furan data validation.
- HRGC/HRMS data validation.
- Data validation and quality assurance oversight project management.

CREDENTIALS

B.S., Chemistry, West Chester University, West Chester, Pennsylvania, 1999.

B.S., Computer Science, Shippensburg University, Shippensburg, Pennsylvania, 1993.

SUMMARY OF EXPERIENCE

Mr. Weinmann, who has 12 years of analytical quality assurance experience, is responsible for performing data validation for numerous site investigations to determine analytical data quality and usability and for managing various data validation efforts. Data reviewed include those for US EPA Contract Laboratory Program (CLP) protocols and SW-846 methods. He also is responsible for ensuring that data deliverables are compliant with regulatory and client-specific requirements.

Prior to this position, Mr. Weinmann worked as a software developer for a major employer services firm. He was responsible for developing Windows-based Human Resource Information Systems that included employee data and benefits administration and payroll processing functionality.

While studying chemistry at West Chester University, Mr. Weinmann assisted in research in the field of graphite intercalation. He prepared a diolefin diphosphine cobalt complex using vacuum line techniques that proved to be an effective alkali metal carrier for ambient temperature intercalation reactions.

KEY PROJECTS

- Manages the ongoing data validation and quality assurance oversight efforts for several industrials required to periodically monitor PCB discharge levels in support of Pollutant Minimization Plans.
- Assists with the inorganic and radiochemistry data validation efforts associated with the characterization, remediation, and monitoring activities at a legacy mine site.
- Managed the data validation and quality assurance oversight efforts for a remedial investigation on a portion of the Hackensack River in New Jersey. Responsibilities included assisting in the procurement of laboratory analytical services; coordination of sampling and analytical work; validation of organic, inorganic, wet chemistry, and radiochemistry data; and preparation of the required data deliverables.
- Assisted in the preparation of a Quality Assurance Project Plan for the environmental activities related to a facility remediation program to ensure data quality by detailing specific methods and procedures.
- Managed the data validation and quality assurance oversight efforts for a coalition of Delaware River Estuary point-source dischargers tasked with providing analytical data to a regulatory agency as part of a PCB TMDL study. Responsibilities included assisting in the procurement of laboratory analytical services, coordination of the sampling and analytical work, validation of HRGC/HRMS PCB congener data, and preparation of the data deliverables required by the agency.
- Managed quick turn-around data validation efforts to determine the impact of a petroleum spill on the surrounding soil and groundwater. The laboratory data for nearly 800 samples analyzed for volatile organic compounds were validated and presented to the client within 2 weeks.

KEY PROJECTS (Cont.)

- Performed analytical data validation interpreting volatile, semivolatile, PCB, and inorganic analyses and developed technical quality assurance reports for a major gas pipeline project.

- Performed analytical data validation interpreting volatile, semivolatile, and inorganic analyses and prepared data usability assessment reports for a petroleum refinery site investigation.

- Verified analytical results from electronic data deliverables (EDDs) and database output during validation tasks.

- Performed analytical data validation interpreting volatile, semivolatile, and inorganic analyses on groundwater and residential well samples and prepared technical quality assurance reports for a manufacturing plant site investigation.

- Performed analytical data validation interpreting historical semivolatile and inorganic data that had been reprocessed due to laboratory error and prepared technical quality assurance reports for a manufacturing plant site investigation.

- Managed the analytical data validation efforts to confirm the presence of PCB and inorganic analytes identified in a prior phase of the investigation in surface water and sediment samples from a canal adjacent to a parcel of land under consideration for real estate transactions.

- Performed analytical data validation interpreting semivolatile and inorganic analyses on performance evaluation samples submitted to several laboratories and prepared comparative reports for a quarterly monitoring program.

- Managed the data validation and efforts for a multiphase study conducted on a portion of the Upper Columbia River in Washington. Responsibilities included validation of sediment, surface water, and fish tissue analytical data and preparation of the required data deliverables.

ENVIRONMENTAL®
STANDARDS

GARY P. YAKUB
Senior Quality Assurance Chemist I

FIELDS OF COMPETENCE

- Analytical Quality Assurance
- Laboratory Compliance Audits
- Environmental Data Validation
- Environmental Laboratory Accreditation
- Continuing Education Training
- Project Management
- Environmental Organic Analyses Methods
- Environmental Inorganic Analyses Methods
- Environmental Wet Chemistry Analyses Methods
- Environmental Microbiology Analyses Methods
- Environmental Radiochemistry Analyses Methods
- Wastewater Process Control
- Wastewater Microbiology

CREDENTIALS

BS Biology, Indiana University of Pennsylvania, Indiana, Pennsylvania, 1984.

BS Chemistry, Duquesne University, Pittsburgh, Pennsylvania, 1986.

CERTIFICATIONS

Certified to provide Water/Wastewater Operator Continuing Education Training in the following states: Maine, New Hampshire, Vermont, Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Ohio, Virginia, and West Virginia.

SUMMARY OF EXPERIENCE

Mr. Yakub has over 25 years of experience in the environmental field, working first as a laboratory analyst, next as the laboratory's Quality Assurance Officer, and now as an environmental consultant specializing in corporate environmental liability issues.

As an analyst, Mr. Yakub has performed all phases of environmental analyses, including wet chemistry, metals digestion and analyses, mercury digestion and analyses by cold-vapor atomic absorption, volatile organic analyses by purge and trap/GC-MS, semi-volatile organic analyses by extraction /GC-MS, Pesticide and PCB analyses by extraction/GC-ECD, and various microbiological analyses, including membrane filtration, multiple tube fermentation, defined substrate utilization analyses, HPC, microscopic evaluation, Cryptosporidium/Giardia analyses, and wastewater activated sludge diagnostic evaluation.

As Quality Control Officer, Mr. Yakub developed and instituted a complete Quality Assurance/Quality Control Program for the laboratory, including documentation, sample and data handling procedures, chain-of-custody, internal auditing, a performance evaluation program, ethics/data integrity, and data validation.

As an environmental consultant serving the environmental community, Mr. Yakub currently provides laboratory accreditation assistance, laboratory compliance audits, environmental data validation, document preparation and review, and other services to the client. As an auditor, Mr. Yakub has audited over 80 commercial, municipal, and industrial laboratories for compliance with federal and state guidelines, compliance with published methods, and compliance with client technical specifications.

KEY PROJECTS

- Developed and implemented a Total Quality Assurance Program for a large municipal wastewater treatment plant in Pennsylvania.

KEY PROJECTS (Cont.)

- Provided water and wastewater operator continuing education contact hours through seminars, conferences, and special education classes throughout 13 states in the northeastern United States.
- Assisted several large commercial laboratories to meet Environmental Laboratory Accreditation requirements for multiple state jurisdictions.
- Performed compliance audits for laboratories seeking to meet state Environmental Laboratory Accreditation programs.
- Performed laboratory compliance audits for industrial clients to ensure that their contract laboratories meet client requirements for organic and inorganic environmental analyses.
- Assisted an industrial client in the development of laboratory program criteria and the evaluation and selection of contract laboratories that met the criteria.
- Provided Ethics and Data Integrity Education classes to municipal wastewater treatment personnel to meet state requirements.
- Performed a detailed water usage study, suggested system maintenance and usage parameters to reduce the amount of potable water used at a major beef processing/packaging company that resulted in the savings of millions of gallons of potable water.
- Performed environmental data validation of PCB Aroclor, PCB congener, metals, and wet chemistry data for a major PCB environmental cleanup effort in EPA Region II.
- Performed environmental data validation of metals and wet chemistry data for a major fly ash release cleanup in EPA Region IV.
- Performed environmental data validation of metals and organic explosives data for a RCRA site cleanup in EPA Region V (including Ohio EPA Tier I and Tier II Validation protocols).
- Performed environmental data validation of high resolution GC/MS, organics, pesticides, metals, and wet chemistry data on surface water, beach sediments, and fish tissue samples for a major cleanup effort in EPA Region X.
- Performed environmental data validation of polychlorinated dioxins, furans, and polybrominated diphenyl ethers by High Resolution GC/MS for an environmental cleanup effort in EPA Region 4.
- Performed environmental data validation of gasoline and diesel range organics, PAHs, biomarkers, dispersant markers, and wet chemistry data associated with the cleanup of a major oil spill in the Gulf of Mexico.
- Performed environmental data validation of polychlorinated dioxins and furans by High Resolution GC/MS associated with the remediation of a wood-preservative Superfund site in EPA Region IV.
- Performed environmental data validation of Appendix IX Volatiles and Semi-Volatiles, Organic Tentatively Identified Compounds (TICs), Appendix IX Metals and Mercury, Perchlorate, Nitroaromatics and Nitroamines associated with the RCRA cleanup of a former commercial explosives manufacturing site in EPA Region III.
- Performed environmental data validation associated with groundwater monitoring for the environmental remediation of an industrial brownfield site in EPA Region III impacted by arsenic and benzo(a)pyrene.

KEY PROJECTS (Cont.)

- Performed environmental data validation of Appendix IX Volatiles and Semi-Volatiles, Organic Tentatively Identified Compounds (TICs), Appendix IX Metals and Mercury, Formaldehyde, Herbicides, and Pesticides associated with the RCRA Facility Investigation of a chemical manufacturing site in EPA Region III.

- Developed a Laboratory Technical Specifications Manual for a large tobacco corporation to ensure the compliance and uniformity of the laboratory services provided to the client.

- Investigated selenium analysis issues and developed a laboratory protocol for the analysis of low-level selenium in a high-chloride matrix for a major West Virginia coal company.

- Performed audits of major laboratories to assess their analytical capabilities with respect to state-required analyses in support of a major chemical company's exploration and production of natural gas in the Marcellus Shale formation.

- Performed audits of laboratories to assess capabilities and compliance with method requirements in support of coal mining operations and environmental compliance for a major coal energy production company.

PRESENTATIONS

Yakub, G. P. "Laboratory Ethics: An Auditor's Perspective." National Environmental Monitoring Conference (NEMC), San Antonio, TX, August 2013.

STEPHEN T. ZEINER, CEAC
Senior Technical Chemist

FIELDS OF COMPETENCE

- Analytical and environmental chemistry.
- Analytical method specification design and third-party evaluation.
- Corporate laboratory program design, execution, and maintenance.
- Laboratory auditing.
- Performance evaluation study design and execution.
- Project-specific analytical/sampling request for proposal preparation.
- Project-specific quality assurance oversight.
- Purge and trap/GC instrumentation repair and troubleshooting.
- Quality Assurance Project Plan preparation and evaluation.
- Rigorous third-party data validation for RI/FS, RFIs/CMS, Permit B, delisting studies, and CAA stack tests.
- Technical liaison among laboratories, industries, and consultants.
- Theoretical and practical knowledge of all facets of quantitative analysis for organic and inorganic pollutants by published methodologies.
- Air, surface, and bulk sampling using viable and nonviable collection procedures for fungal and other biological analytes.
- Air, surface, and bulk sampling using active and passive sample collection procedures for chemical analytes.
- Indoor air quality investigation/design and execution for chemical and biological contamination and assessment of indoor environments.

CREDENTIALS

B.S., Chemistry, Shippensburg University, Pennsylvania, 1988.

Shippensburg University, Pennsylvania. Graduate Analytical Chemistry Course Work.

CERTIFICATIONS

Certified Environmental Analytical Chemist (CEAC) – National Registry of Certified Chemists (NRCC), Washington, DC.

PROFESSIONAL DEVELOPMENT COURSES

"Certified Level 1 and II Mold Inspector Training." Indoor Environmental Standards Organization. Stevensville, MD. October 26-27, 2002.

"Indoor Air Quality PDC." Philadelphia Section of American Industrial Hygiene Association." Wayne, PA. March 25, 2003.

"Advances in Environmental Mold Issues in Pennsylvania." Lorman Education Services. Lansdale, PA. November 7, 2003.

"Indoor Air Quality From Different Perspectives." Philadelphia Section of American Industrial Hygiene Association. Plymouth Meeting, PA. April 1, 2004.

"Special Topics in Industrial Ventilation for Practicing EHRS Professionals." Philadelphia Section of American Industrial Hygiene Association. Plymouth Meeting, PA. March 14, 2005.

"Indoor Mold in Construction, Health, and Legal Issues." Cook College Continuing Professional Education. New Brunswick, NJ. June 21, 2005.

IAQA Philadelphia Chapter Workshop." Indoor Air Quality Association Philadelphia Chapter. Villanova, PA. December 11, 2009.

"Mold, Allergens, Sampling, and Data Interpretation." Environmental Microbiology Laboratory. Philadelphia, PA. December 12, 2006.

"IAQ/IH Sampling Workshop." EMSL Analytical, Inc. Plymouth Meeting, PA. May 15, 2008.

PROFESSIONAL AFFILIATIONS

American Institute of Chemists – Member
American Industrial Hygiene Association - Philadelphia Section – Member

SUMMARY OF EXPERIENCE

Mr. Zeiner has 22 years of analytical and quality assurance experience. Specifically, he has 2 years of analytical experience performing analyses for organic contaminants in a variety of media by instrumental methods, including research and development of analytical methodologies. As a Senior Technical Chemist, Mr. Zeiner has 20 years of experience in the following fields: indoor air quality (IAQ) investigation design/execution and litigation support; organic, inorganic, radiological, and general chemistry data validation (including specialty analyses such as dioxin/furan data); laboratory audits/evaluations; third-party review and production of Quality Assurance Project Plans (QAPjPs) for remedial investigations/feasibility studies (RIs/FSs); Resource Conservation and Recovery Act (RCRA) Facility Investigation/corrective action plans (RFI/CAP) and remedial actions; design of specialty analytical data package deliverables to accommodate project-specific data quality objectives (DQOs); third-party review and critique of laboratory-prepared analytical methods; specification of quality assurance/quality control (QA/QC) parameters for investigative sampling events; third-party review and critique of laboratory standard operating procedures (SOPs); management of several chemists on large data validation and corporate contract laboratory programs; project cost tracking; review of project invoices; production and evaluation of cost proposals; design of corporate contract laboratory programs; sample collection design; sample collection using a variety of methods; inspection of buildings and interpretation of laboratory results.

Prior to employment at Environmental Standards, Mr. Zeiner was a chemist for a large independent analytical laboratory. He was responsible for performing volatile organic analyses by SW-846 and US EPA 500 and 600 Series Methods using purge and trap gas chromatography (GC) with photoionization (PID), flame ionization (FID), and electrolyte conductivity (ELCD) detectors. His responsibilities included writing laboratory-specific modifications of SW-846 and US EPA methods, writing and updating SOPs, designing and implementing a comprehensive repair and preventive maintenance program, and training 16 chemists in the repair and performance of preventive maintenance procedures for purge and trap/GCs. In addition, he researched and developed a laboratory method for the application of purge and trap/GC techniques for separation and detection of non-halogenated/non-aromatic volatile organic compounds.

KEY PROJECTS

- Served as part of the emergency response team for an oil spill in the Gulf of Mexico. Served as Data Validation Task Manager and provided technical support for the Quality Assurance oversight efforts. The project included thousands of samples collected and analyzed for a wide variety of analytes. The project team coordinated with multiple laboratories, consultants, and governmental agencies to facilitate the collection, submission, analysis, and reporting of the analytical data. The data collected were utilized for forensic analysis of the data and for risk assessments. The data validation effort included both Stage 2A and Stage 4 validation efforts.

- Performed an in-depth on site audit of the Quality Assurance/Quality Control system at the Umatilla Chemical Agent Disposal Facility in Umatilla, Oregon. This audit required an understanding of the acceptable exposure limits and analytical challenge program required by the U.S. Army Chemical Management Agency for Near Real Time Automatic Continuous Air Monitoring Systems (ACAMS) and Depot Area Air Monitoring Systems (DAAMS) historical and confirmatory analyses. The audit required an understanding of appropriate Conditions of Operations, the Laboratory Analysis Monitoring Plan, the Laboratory Quality Control Plan, and the Standard Operating Procedures for the Analytical Laboratory Department and the Air Monitoring Department.

KEY PROJECTS (Cont.)

- Performed analytical data validation for numerous site investigations to determine analytical data outliers and data quality/usability. Data were reviewed according to US EPA Contract Laboratory Program (CLP) protocols, SW-846 Methods, Methods for the Chemical Analysis of Water and Wastes, and the US EPA Series 200, 500, and 600 Methods.

- Conducted on-site audits of numerous environmental analytical laboratory facilities. The on-site audits included evaluations of the laboratory's sample log-in and receipt procedures, organization, sample preparation methods, analytical expertise and method compliance, QA/QC procedures, logbook documentation procedures, data package preparation procedures, and results reporting and review procedures. Co-authored detailed audit reports that included descriptions of the laboratory procedures and recommendations for improvements.

- Designed and conducted an IAQ sample collection at a 200,000-square foot elementary school in support of a Pennsylvania Act 2 cleanup of a large #2 fuel oil release. The multi-round sampling events included the collection of air samples using Summa® cannisters for collection of volatile compounds and XAD-2 resin tubes for collection of semivolatile compounds. The results of the air samples were utilized to reopen the school and monitor for any vapor intrusion.

- Provided IAQ and mold consulting support in conjunction with the renovation of a hotel with three towers and nine stories per tower. The IAQ consulting support included inspections of the building; development of the fungal remediation scope-of-work; communication support for workers and owners; design of remediation goals and sample collection points; collection of air samples for mold spores; and collection of surface samples for mold spores. The reports were utilized to assess post-remediation completeness and were presented to the subcontractors and other interested parties as documentation of activities and completion of the fungal remediation.

- Conducted peer review of the Second Edition of the Standard and Reference Guide for Professional Mold Remediation S520 (published by the Institute of Inspection, Cleaning and Restoration Certification Standard [IICRS]).

- Conducted mold investigation for 12,000-square foot building as part of a post-remediation evaluation and in response to continued employee complaints. The investigation included visual inspection of the building and collection of air samples. The report was presented to the employees to document that the mold remediation had been effective.

- Designed and conducted an IAQ investigation of a single-story 20,000-square foot office building in response to complaints by a Fortune 500 Company's employees. The IAQ investigation included visual inspection of the building, interview of management and staff, and collection of air samples for mold spores and dust. The report was presented to the employees to document the conditions in the building.

- Designed and conducted a mold investigation that included four buildings of various sizes in response to a flood event. The mold investigation included visual inspection of the buildings and collection of air samples for mold spores. The report was utilized to assist in the preparation of cleanup plans as well as an assessment of continued building use.

- Designed and conducted a mold investigation of a 5,000-square foot home and litigation support in defense of our client. The mold investigation included review of prior inspection sampling reports, visual inspection of the home, and collection of viable air and surface samples. The report was utilized to generate an expert report in support of our client's claims.

- Served as Analytical Data Quality Manager and client contact for a Fortune 500 industrial client. As part of a corporate laboratory program integrated with data management, duties included on-site training, assistance to address project analytical problems, analytical laboratory recommendations, audit coordination, performance evaluation sample study coordination, invoice review, and development and maintenance of program documents.

KEY PROJECTS (Cont.)

- Served as part of the environmental chemistry team to support defense litigation for a site whose main analyte of concern was technical chlordane. Responsibilities included evaluation of historical data, validation of current data, and production of expert reports. The evaluation of technical chlordane included research into the production and production specifications of technical chlordane.

- Provided IAQ and mold consulting support for owner of a two-story 200,000-square foot building. The IAQ consulting support included review of previous IAQ report, collection of air samples for mold spores, collection of surface samples for e.coli and fecal coliform, inspections of the building, and participation in meetings with tenant representatives. The reports were utilized to assess post-remediation completeness and were presented to the tenant as documentation of activities.

- Served as a Project Manager and provided quality assurance support to a Fortune 500 industrial client for a US EPA Region IV site investigation. Served as contact point for analytical performance and data quality issues, managed chemists performing data usability assessment on aqueous samples, and facilitated database modification.

- Served as data validation Project Manager for US EPA Region II and NYS DEC site investigations. Duties included data log-in and tracking, assisting in technical data validation problems, reviewing quality assurance reports, tracking budgets for data package review, and providing technical assistance to clients.

- Designed and conducted IAQ sample collection at a 3,000-square foot two-story residence in support of a Pennsylvania Act 2 cleanup of a #2 fuel oil release. The multi-round sample events included the collection of air samples using Summa® canisters for collection of volatile compounds and XAD-2 resin tubes for collection of semivolatile compounds. Provided consulting support for client in dealing with the resident. The reports were utilized to assess the condition of the IAQ, monitor for vapor intrusion, and document the effectiveness of the subslab remediation system.

- Served as Project Manager for the development of a corporate contract laboratory program that included a Laboratory Users/Corporate Quality Assurance Guide. Developed a written survey to collect project information from approximately 80 client sites. Designed a client-specific Request for Proposal (RFP). Additionally, laboratory audits were performed on the short-listed laboratories, and the laboratory proposals were evaluated and ranked.

- Served as a Project Manager and provided quality assurance support to a Fortune 500 industrial client for a Texas RFI. Served as contact point for analytical performance and data quality issues, managed chemists performing data usability assessment on solid and aqueous samples, and facilitated database modification.

- Served as a Project Manager and provided technical support for a major Alaskan oil pipeline company for all remediation and monitoring activities conducted by the company. Served as a contact point for validation requests and managed chemists performing data validation on solid, aqueous, and waste sample data.

- Served as a Project Manager and provided technical support to a Fortune 100 industrial client for a US EPA Region II RI/FS. Served as contact point for technical questions regarding data quality issues and managed chemists performing data validation on solid and aqueous sample data.

- Served as Project Manager for a preliminary NYS DEC site investigation for Aroclor characterization. Responsibilities included the preparation of a Request for Quotation (RFQ), review and evaluation of proposals, preparation of data package deliverables that were required for the project-specific analytical protocol, and performance of a laboratory audit of the selected project laboratory.

- Served as part of the peer-review team for the US EPA Region I volatile organic, semivolatile organic, and pesticide/PCB data validation guidelines.

KEY PROJECTS (Cont.)

- Served as an on-site technical consultant to three laboratories. Duties included the review of data package deliverables prior to issuance and the review of analytical data for accuracy and adherence to volatile organic, semivolatile organic, and inorganic method protocols.

- Served as data validation Project Manager and provided quality assurance support for a Metals Parts Furnace Halogenated Wastes and Carbon Micronization System with Deactivation Furnace System Performance Tests portions of a trial burn. Validated liquid, solid, and air samples that were analyzed for particulate matter, hydrochloric acid, chloride, hydrofluoric acid, trace metals, total organics, polychlorinated dibenzo-p-dioxins/polychlorinated dibenzofurans, volatile and semivolatile products of incomplete combustion, and PCB congeners. Assisted the client and project laboratory to establish the requirements for a fully documented data package. Provided interface among Environmental Standards, the client, and project laboratory for resolution of technical issues.

- Served as part of a project team for the review and comparison of US EPA stack testing methodologies and European stack testing methodologies for polychlorinated dibenzodioxin/polychlorinated dibenzofuran.

- Provided data validation services for an RFI at a major aircraft corporation. Reviewed PCDD/PCDF, volatile, semivolatile, and pesticide/PCB compounds for several data package delivery groups. Prepared reports and performed secondary review of reports and data tables for several additional packages.

- Developed an RFQ that included the analytical specifications and QA/QC procedures necessary for laboratories to perform work and to accurately bid work under the client's environmental contract laboratory program. The laboratories were also requested to provide additional technical information for review by Environmental Standards.

- Co-authored and managed the development of an Environmental Contract Laboratory Program – Analytical Services and Quality Assurance Guidance Manual, which included information useful both to the client's staff for project planning and to the laboratory's staff for sample analysis and data package generation. Topics in the manual included analytical methods, data package specifications, communication schemes, DQO options, QA/QC procedures, corrective actions, and electronic deliverable specifications.

- Served as part of a team that audited and evaluated several laboratories' sample log-in and receipt procedures, organization, sample preparation methods, analytical expertise and method compliance, QA/QC procedures, documentation procedures, data packaging procedures, and results reporting methods. Co-authored detailed audit reports that included descriptions of the laboratories' procedures. A ranking report based on the technical aspects evaluated during the audits was provided to the client.

- Served as part of a team that provided data management for a major gas pipeline company spanning nine states in the eastern United States.

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APPENDIX B

PDI Community Air Monitoring Plan (CAMP)

PDI COMMUNITY AIR MONITORING PLAN
REMEDIAL DESIGN WORK PLAN
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

by

Haley & Aldrich of New York, Inc.
Rochester, New York

for

Atlantic Richfield Company

File No. 28612
September 2013

HALEY & ALDRICH

TABLE OF CONTENTS

1. INTRODUCTION

This Pre-Design Investigation (PDI) Community Air Monitoring Plan (CAMP) describes the perimeter air monitoring to be conducted during remedial design activities at the former Anaconda Wire and Cable Plant site in the Village of Hastings-on-Hudson, New York. Perimeter air monitoring will be conducted during all ground intrusion activities. Monitoring activities are designed to meet the project objectives defined in Section 2.0 of this CAMP and will conform to the NYSDOH Generic Community Air Monitoring Plan (NYSDOH, June 2000) and Occupational Safety and health Administration (OSHA) regulations promulgated under 29 CFR 1910.120.

During the implementation of this CAMP, steps will be taken that will prevent and reduce fugitive dust emissions and to ensure proper precautions are taken to protect human health to the surrounding community during remedial design activities at the site. This CAMP includes Polychlorinated Biphenyls (PCBs), Volatile Organic Carbon (VOCs) and particulate air monitoring to assess if fugitive particulates are leaving the site during ground disturbance activities. The details of the dust control and air-monitoring program are described in the following sections of this CAMP.

1.1 Project Objectives

There are four primary objectives of this CAMP. These overall project objectives are to:

- Help protect human health and the environment;
- Use real-time monitoring results in conjunction with worker health and safety programs;
- Evaluate the effectiveness of, and need for, additional dust suppression controls; and
- Document air quality during site activities.

The specific air monitoring and data quality objectives are outlined below.

1.2 Community Air Monitoring Program Overview

Monitoring under this CAMP should be completed as outlined below.

- The first phase of sampling will establish baseline or background concentrations at the site prior to ground disturbance activities. Baseline conditions will be determined utilizing real-time and laboratory data that will be collected at least 2 days before the start of work.
- The second phase of sampling will be conducted during ground disturbance tasks to document ambient air conditions at the site perimeter and to compare these conditions to the established action level criteria for the site. This will include real-time air sample collection for the documentation of general and transient conditions assessment during ground intrusion activities.

Particulate data will be collected from two locations on the site perimeter, one upwind and one downwind, of the ground disturbance activities. PCB collection will occur downwind of the ground disturbance activities. The location of the two air monitoring locations may change from day to day depending on site activities and meteorological conditions. This monitoring will be conducted utilizing direct reading aerosol (particulate) and continuous flow monitoring devices. In addition to the field screening indicator measurements or observations, meteorological parameters consisting of wind speed, wind direction, sigma theta, temperature and relative humidity will be monitored.

On-site air quality action levels are summarized in the table below:

	Particulate Matter	PCBs (per Aroclor)	VOCs
PDI Activity	During ground disturbance activities	During ground disturbance activities	During ground disturbance activities except for concrete coring
Action Level	100 $\mu g/m^3$ greater than background	0.11 $\mu g/m^3$	5 ppm greater than background
Response	Implement suppression techniques	Implement suppression techniques	Take samples more often, implement engineering controls
Stop Work Limit	150 μg/m3 greater than background for 15 minute average with suppression techniques in place or visible fugitive dust leaving the site	Not Applicable	25 ppm at the perimeter of the work area
Sampling Period	15 minute average	8 hrs	15 minute interval
Sampling Method	Data RAM	EPA Method TO-10A using Sorbent, Polyurethane Foam	PID or 5 gas meter
Location	Upwind & Downwind	North and South end of B52 for north test pits & downwind for south test pits	Workzone (downwind)

2. AIR QUALITY CONTAMINANTS OF CONCERN

PDI activities associated with remedial investigation of the Site have the potential to generate chemical risk to the health of nearby off-site receptors through inhalation exposures to the contaminants of concern (COC) in the air-borne particulates.

2.1 Polychlorinated Biphenyl's (PCBs)

Polychlorinated biphenyl's (PCBs) are a group of manufactured organic chemicals that contain 209 individual chlorinated chemicals (known as congeners). PCBs are either oily liquids or solids and are colorless to light yellow in color. They have no known smell or taste. There are no known natural sources of PCBs. Some commercial PCB mixtures are known in the United States by their industrial trade name, Aroclor.

PCBs do not burn easily and are good insulating material. They have been used widely as coolants and lubricants in transformers, capacitors, and other electrical equipment. The manufacture of PCBs stopped in the United States in 1977 because of evidence that they build up in the environment and cause harmful effects. Products containing PCBs are old fluorescent lighting fixtures, electrical appliances containing PCB capacitors, old microscope oil, and hydraulic fluids. OSHA limits the concentration of PCBs in workroom air to 1 mg/m3 for PCBs with 42% Cl and 0.5 mg/m3 for PCBs with 54% Cl.

3. PERIMETER AIR MONITORING

The perimeter air monitoring system is intended to produce sufficient information for controlling the potential risk from fugitive emissions on an on-going basis. The sampling program is designed to provide real-time air monitoring so that acceptable risks for acute and subchronic exposures are not exceeded. Perimeter monitoring for particulate matter (fugitive dust) will comply with NYSDOH CAMP requirements found in DER-10.

3.1 Field Screening Methods

Data for the particulate instrument will be collected at two locations, one upwind and one downwind of the ground disturbance activities.

An aerosol meter will be used to provide screening results for particulate matter. This direct reading instrument (the DataRAM, or equivalent) has a measurement range from 0.001 to 400 mg/m3, and provides appropriate sensitivity for site applications.

These direct reading instruments will be calibrated on a daily basis and maintained in accordance with the manufacturer's specifications. All real-time monitoring data will be logged. Data records will be referenced to Site location, time and date of reading, and the initials of the field technician. The monitoring information will be downloaded and reviewed with the documentation package to ensure the airborne levels at the Site perimeter are less than the established Site action levels.

Ambient air at the upwind and downwind locations will be measured on a continuous basis and reported as 15-minute averages. If ambient air concentrations at the downwind site is 100 μg/m3 above background (as measured at the upwind site) for a 15-minute period, or if airborne dust is observed leaving the work site, dust suppression activities will be employed. Work activities will be continued during dust suppression provided that the downwind levels do not exceed 150 μg/m3 above background and provided that no visible dust is migrating from the work site.

If after implementation of dust suppression techniques, downwind levels are greater than 150 μg/m3 above the upwind level, work will cease and a re-evaluation of activities initiated. Work will resume provided that dust suppression measures and other controls are successful in reducing the downwind concentration to less than 150 μg/m3 of the upwind level for 15 minutes and in preventing visible dust from migrating beyond the work site.

Meteorological parameters consisting of wind speed, wind direction, temperature and relative humidity will be monitored continuously onsite and reported as 15-minute averages.

3.2 Constituent Specific Monitoring

A full characterization of air quality requires the performance of additional constituent-specific sampling to verify that the Site action levels and engineering controls are protective of human health.

3.2.1 Sampling Location and Frequency

Perimeter monitoring will include two locations, one upwind and one downwind of the construction activities. Both upwind and downwind wind directions will be pre-established each day by collection of actual site-specific meteorological data at a representative location on site. Perimeter monitors will be placed as close to the property line as feasible, such that other sources of fugitive dust between the sampler and the property line are minimized. Upwind and downwind locations will be monitored simultaneously. Samples will be collected during the active working period on the site for each day that activities are conducted, generally during the hours of 7 AM to 5 PM. Pumps will be installed at air monitoring stations established at two locations. The pumps pull ambient air through analytical detector tubes at a constant flow rate. The devices, approximately 4 to 6 feet above ground, will be deployed at the beginning of each day prior to any ground disturbance activities taking place. The continuous sampling devices will be removed at the end of the workday, and the samples sent off site for laboratory preservation and analysis. All samples collected will be sent to the laboratory at the end of each day of monitoring.

The locations of monitoring devices should generally remain the same throughout the program, but may be modified during activities due to the location, nature and intensity of site activity. Modifications of monitoring locations shall be documented.

3.2.2 Constituents of Interest

PCBs:

Constituents of Interest	**Action Level**	**Base Detection Limit***	**Sampling Method**	**Media**	**Sampling Period**
PCBs	0.11 $\mu g/m^3$	0.1 $\mu g/m^3$	EPA Method TO-10A	Sorbent, Polyurethane Foam	8 hrs

*Actual detection limit would be 0.04 $\mu g/m^3$ based on a run time of 8 hrs at 5 l/min.

The meteorological data will be evaluated and used to select the sample location for the down wind sample for each day of monitoring. Depending on wind direction relative to Building 52 and location of ground disturbance, one additional location will be added to measure air flows that are diverted around the structure.

At the conclusion of each sampling day or event, the sample pumps will be removed from their monitoring locations, the sampling tubes will be removed from the inlet tubing, the individual cartridge will be labeled with the monitoring location identification number, date, and total monitoring time, and then be refrigerated or placed into an approved shipping container. Chain-of custody forms will be completed and shipped with the samples to the analytical laboratory. When completing the chain-of-custody forms, the sampling technician will identify the specific analytes to be analyzed.

Sampling during soil borings will be completed daily for at least the first 3 days and the frequency may be adjusted based on type of ground disturbance, sample results and discussions with the DEC and DOH (e.g. once every 3 to 5 days). Sample turn-around time will initially be prioritized and adjusted based on type of ground disturbance, sample results and discussions with the DEC and DOH.

Reporting of sampling events will include meteorological data, and the presence of potential sources of the COI.

Pace Laboratories will be used for all sample analysis.

Volatile Organic Carbon (VOCs):

VOC monitoring will be done in the work zone or other downwind location as required, details of which are documented in the Haley & Aldrich Site Specific Health and Safety Plan (HASP) for onsite workers.

3.3 Equipment

3.3.1 SKC Leland Legacy Sample Pumps

PCBs air samples will be collected using SKC Leland Legacy Sample Pumps (SKCs) or equivalent. SKCs will operate at a flow rate of approximately 5 l/min for the collection air samples. PCBs will be sampled using a 20-mm x 7.6 cm polyurethane foam (PUF) cylinder, fitted under slight compression inside a glass cartridge.

<u>Operation</u>

After individual calibration of each pump/cartridge combination, samples will be placed at selected locations, at heights generally 4 to 6 feet above ground surface. Pumps will be checked during the day, to verify proper operation.

At the end of the day, the total accumulated time as registered on the pump run time clock will be compared with the times calculated from the recorded start/end times. If consistent, the time noted on the pump will be used to calculate the total volume sampled by the pump according to:

Total minutes (min) x flow rate (l/min) = total volume (l)

<u>Calibration</u>

Each pump cartridge combination will be individually calibrated using a SKC calibrator. Pumps will be calibrated at the beginning and end of each day and the arithmetic mean of the two measurements will be used to calculate the flow rate and, from that, the total volume.

3.3.2 The DataRAM (pDR-1000AN)

Real time monitoring of particulates will be conducted using a DataRAM or equivalent device. The DataRAM monitor provides essentially real time analyses of particle matter less than 10μm in diameter using internally mounted precision spaced pulsed laser beams for quantification. Air enters the sampling cavity by diffusion and by the passing of ambient air over and around the instrument. Output is in mg/m^3 with a detection limit of 1μg/m^3 declared by the manufacturer.

3.3.3 Meteorological Station

Meteorological data will be recorded using a Weather Monitor II from Davis Instruments or equivalent device. Pertinent parameters with respect to the CAMP will be recorded and primarily include wind direction and high maximum wind speed.

3.4 Documentation

The instruments will be calibrated at the beginning of each workday and the time of day and name of field personnel will be recorded. In addition, weather conditions at the site will be recorded each day. Measurements will be documented for each reading at all designated monitoring locations.

The following information will be recorded for each instrument reading:

- Date and time of reading;
- Reading location;
- Concentration reading; and
- Ground disturbance activities

3.4.1 Sample Custody

For each sample that is collected, an entry will be made on a chain-of-custody form. The information to be recorded includes the sampling date and time, sample identification number, matrix type, requested analyses and methods, preservatives, and the sampler's name. Sampling team members will maintain custody of the samples until they are relinquished to laboratory personnel or a professional courier service. The chain-of-custody form will accompany the samples from the time of collection until received by the laboratory. Each party in possession of the samples (except the professional courier service) will sign the chain-of-custody form signifying receipt. The chain-of-custody form will be placed in a plastic bag and shipped with samples packaged with ice. A copy of the original completed form will be provided by the laboratory along with the report of results. Upon receipt, the laboratory will inspect the condition of the sample containers and report the information on chain-of-custody or similar form.

3.5 Quality Assurance/Quality Control (QA/QC)

The quality assurance and quality control (QA/QC) procedures proposed for this program are described in this section. The QA/QC procedures associated with the air quality measurements program are designed to evaluate and ensure the accuracy and precision of monitoring methods.

3.5.1 Particulate Monitors

The DataRAM will be used to continuously monitor particulate emissions at the upwind and down-wind (or work area) locations. At a minimum, the DataRAMs will be field checked daily using zero calibration air. At the beginning of each workday, when site intrusive activities take place, a calibration check will be performed on each unit at the measurement location. Two calibration points will be checked to determine instrument performance. A zero (or particulate-free) test sample, using the appropriate particulate filter supplied by the manufacturer for this purpose, will be placed over the sample inlet. The data output for the MIE DataRAM will be observed and the response recorded in the field logbook. An upscale calibration point will also be check by activating the "on-board" calibration feature. This procedure activates a light-emitting diode to simulate one upscale particulate concentration value. The results will be recorded in the field logbook and maintained on-site throughout the duration of site activities. Instrument calibration procedures will be conducted according to the manufacturer's recommendations.

If the field technician determines that the instrument has a problem, the unit will be repaired or replaced, whichever takes less time. During the latter part of the workday each air quality measurement device will be QA/QC checked. If a system fails the QA/QC procedure and cannot be quickly corrected, the site manager will be immediately notified. The site technician will then take immediate measures to remedy the situation.

3.5.2 Meteorological Measurement System

The on-site meteorological system will continuously measure and report the parameters listed in Section 1.2 of this plan. QA/QC and calibration procedures will follow the manufacturer's recommendation for meteorological systems. A calibration of each parameter will be conducted on-site at the time of installation of the meteorological tower system and at the end of the program. The calibration results will be noted in the on-site field logbook and provided in the project report.

4. DATA SUMMARIES

4.1 Data Summaries

Daily data summaries will be prepared to document the field screening results for the day. The summaries will include the locations monitored, hourly measured results, the date and time of the reading, location-specific observations, weather conditions, site activities related to air quality, and the daily maximum value and daily average value for each day. Monitoring results will be summarized as they become available and results will be maintained on site.

5. CORRECTIVE ACTIONS

Based upon perimeter particulate monitoring data described in the previous sections and/or visual observation, the need for dust suppression procedures will be determined by the Site Health and Safety Officer. The documents, which will serve as guidance for the implementation of dust control procedures, are the AQMD Rule 403, the NYSDOH CAMP (NYSDOH, June 2000) and DER-10. The work area will be conducted in a manner that reduces the potential to generate dust and particulates from being generated. Based on the guidance from these documents the following techniques may be employed to mitigate the generation and migration of fugitive dust during remediation activities:

1. Reduce the pace of, or cease, dust producing activity until the problem is corrected.

2. Notify the area supervisor of dust conditions and implement dust suppression procedures.

3. Remove accumulated dirt and soil from problematic areas, and/or cover, enclose, or isolate dust generating areas/surfaces to shield them from the wind.

4. Increase frequency, volume, and/or coverage of water misting, sprays, and foggers to prevent soil and dirt from drying.

5. Provide additional dust suppression systems and any required operating personnel during the task duration.

6. Modify operating procedures and methods to eliminate problematic conditions.

7. Increase level of worker awareness and instruct them on implementation of any new or modified operating procedures.

8. Report and document all procedural modifications and results.

9. Perform routine audits of dust suppression methods and work areas for dust sources.

If, after implementation of dust suppression techniques, downwind particulate levels are greater than 150 μg/m3 above the upwind level and visible dust is noted, work will be suspended until appropriate corrective measures are identified and implemented to remedy the situation.

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1. Air Quality Management District (AQMD). 2001. Rules and Regulations. http://www.aqmd.gov/rules/rulesreg.html.
2. Haley & Aldrich, Inc., 2001. Hammond Air Monitoring Plan, Hammond Indiana.
3. ENSR Corp and Haley & Aldrich of New York, 2005. Community Air Monitoring Workplan for Predesign Field Investigation Services, Operable Unit 1, Former Anaconda Wire and Cable Plant Site, Hastings On Hudson, New York.
4. Haley & Aldrich, Inc., 2008. Air Monitoring Work Plan for Remediation of Area of Interest, Old Fort Wayne Former MGP Site, Fort Wayne, Indiana.
5. Haley & Aldrich of New York, Inc., 2009. Air Monitoring Plan, Decommissioning and demolition of Buildings 51, 51A, 72, 72A, 22, 22A, 22B, 22C, 57, 17, and remnants of 15. Atlantic Richfield Company, Hastings on Hudson, New York.
6. New York State Department of Health Generic Community Air Monitoring Plan.
7. DER-10 / Technical Guidance for Site Investigation and Remediation (DER-10), New York State Department of Environmental Conservation. Office of Remediation and Materials Management. May, 2010.

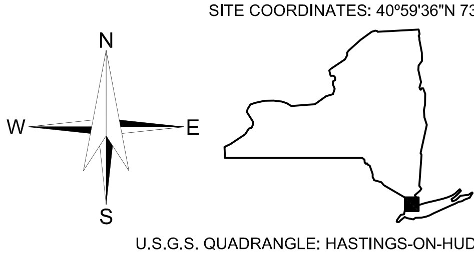
APPENDIX C

Site Figures

Appendix C Figures from OU-2 ROD

March 2012, Record of Decision, Harbor at Hastings, Operable Unit No. 02: Hudson River Sediments, State Superfund Project, Hastings-on-Hudson, Westchester County, Site No. 360022, NYSDEC

SITE COORDINATES: 40°59'36"N 73°53'9"W



U.S.G.S. QUADRANGLE: HASTINGS-ON-HUDSON, NEW YORK

HALEY & ALDRICH

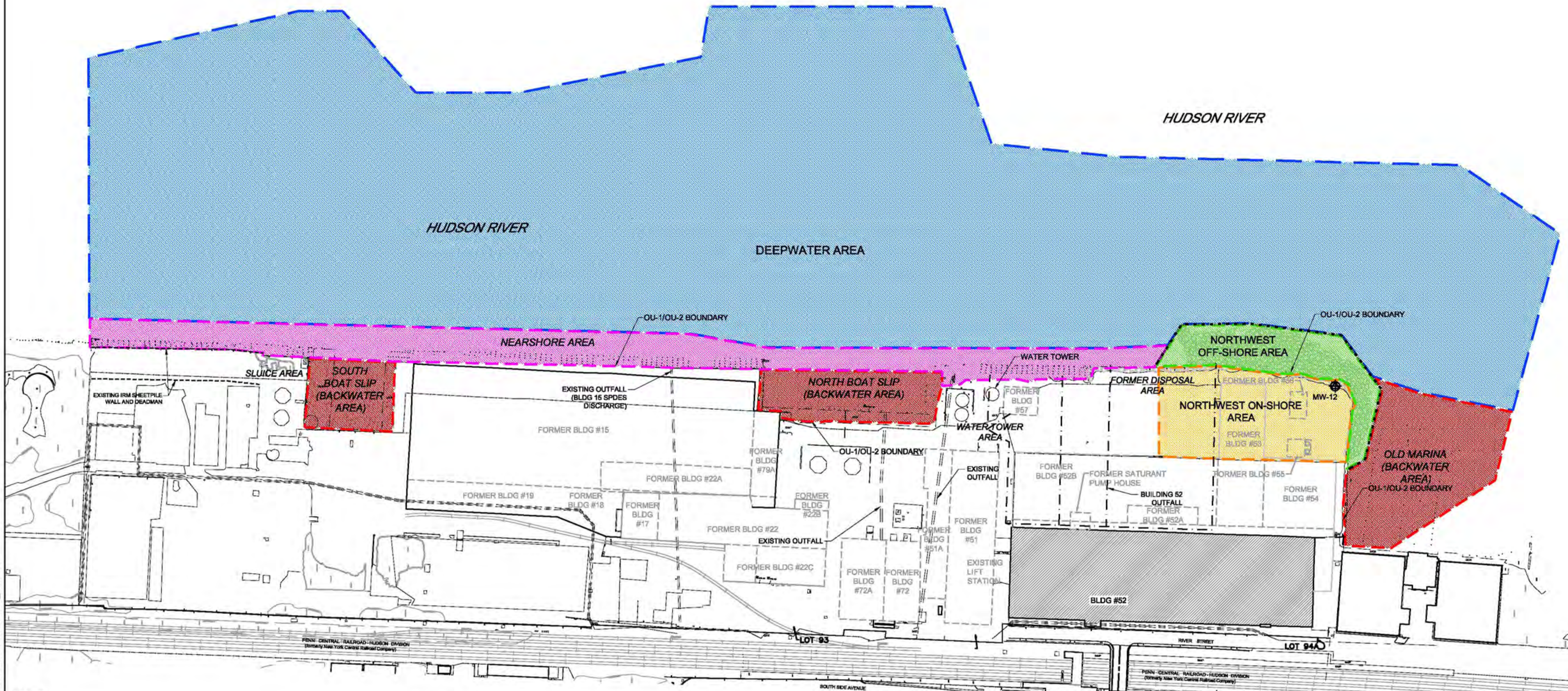
NYSDEC SITE #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

Site Locus

SCALE: 1:24000
MAY 2011

FIGURE 1

G:\PROJECTS\28612\250 - RFI\CAD\PLAN VIEWS & SECTIONS\28612-LOCUS_D1.DWG



LEGEND:

- RAIL ROAD
- EXISTING STRUCTURES
- RIP-RAP
- BUILDING 52 OUTFALLS
- EXISTING OFFSITE OUTFALLS
- MONITORING WELL
- DEEPWATER AREA
- NEARSHORE AREA
- NORTHWEST OFF-SHORE AREA
- NORTHWEST ON-SHORE AREA
- BACKWATER AREA

NOTES:

1. BASE PLAN PROVIDED BY BOSWELL ENGINEERING DRAWING NO. 04-209-MW (01/27/2006).
2. OTHER SITE FEATURES BASED ON VARIOUS HISTORICAL DOCUMENTS.
3. NUMEROUS MONITORING WELLS ARE LOCATED ON SITE. HOWEVER, ONLY MW-12 IS SHOWN AS IT IS THE FIRST LOCATION WHERE LIQUID PCB MATERIAL WAS OBSERVED.
4. MEAN HIGH AND MEAN LOW WATER ARE EL. +2.2 AND EL. -2.0, BASED ON HISTORICAL SITE REPORTS.
4. THE OU-2/OU-1 BOUNDARY IS LOCATED AT THE MHW.

0 200 400
SCALE IN FEET

HALEY & ALDRICH

NYSDEC SITE #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

Site Features

SCALE: AS SHOWN
MAY 2011

FIGURE 2

G:\PROJECTS\28612\250 - RFS\CAD\PLAN VIEWS & SECTIONS\28612-OU-2 SITE PLAN_D2.DWG

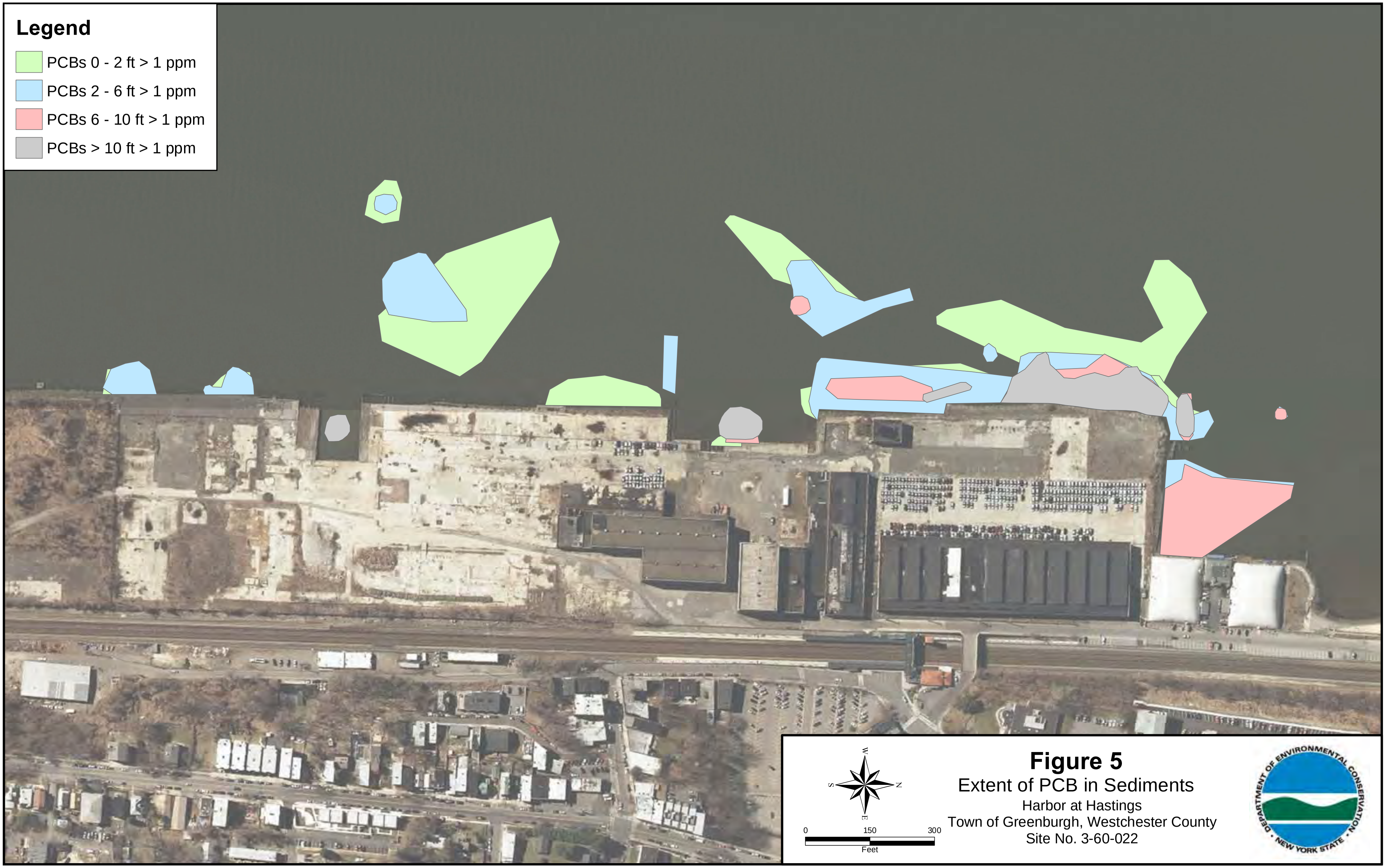


Figure 5

Extent of PCB in Sediments

Harbor at Hastings

Town of Greenburgh, Westchester County

Site No. 3-60-022

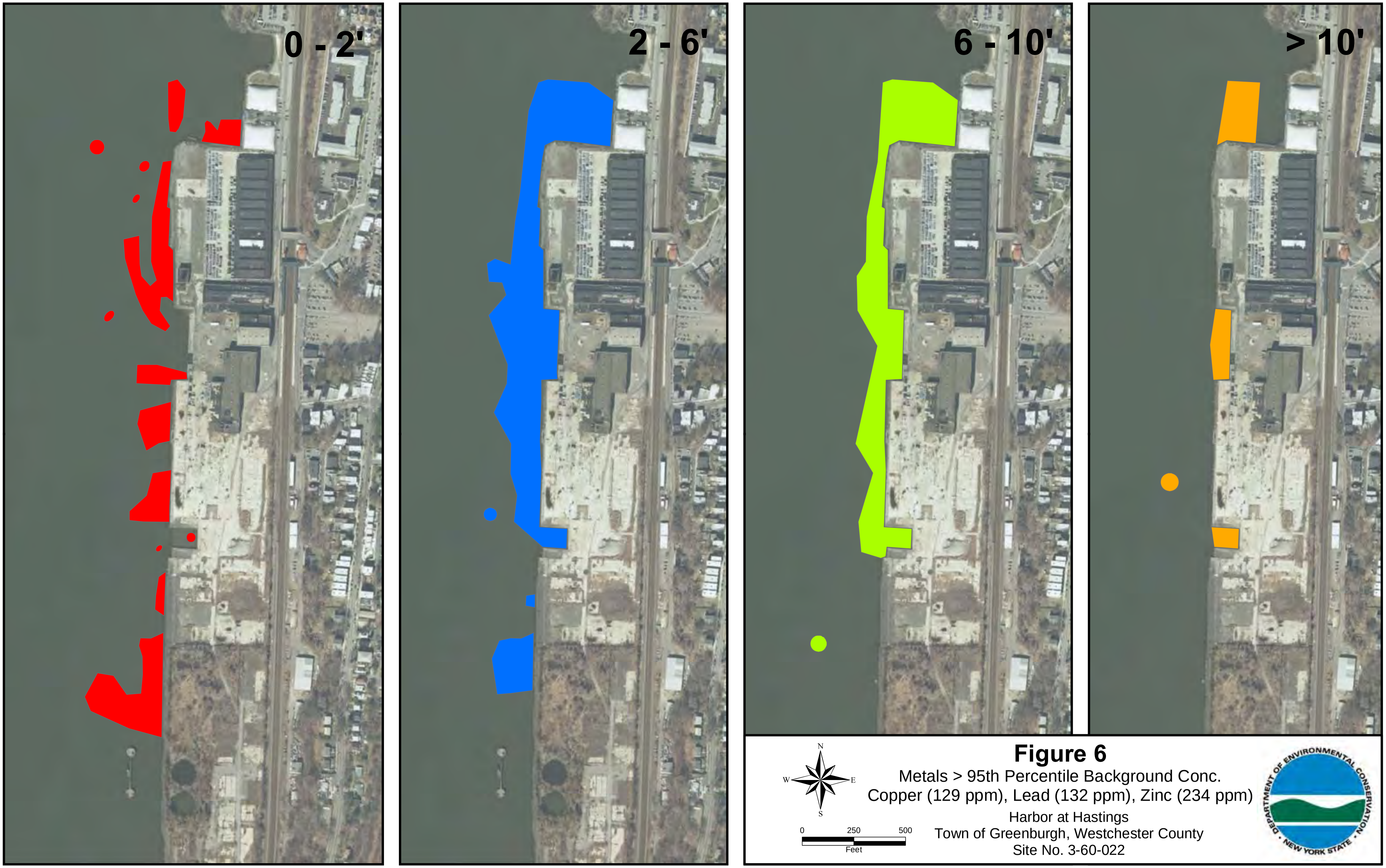
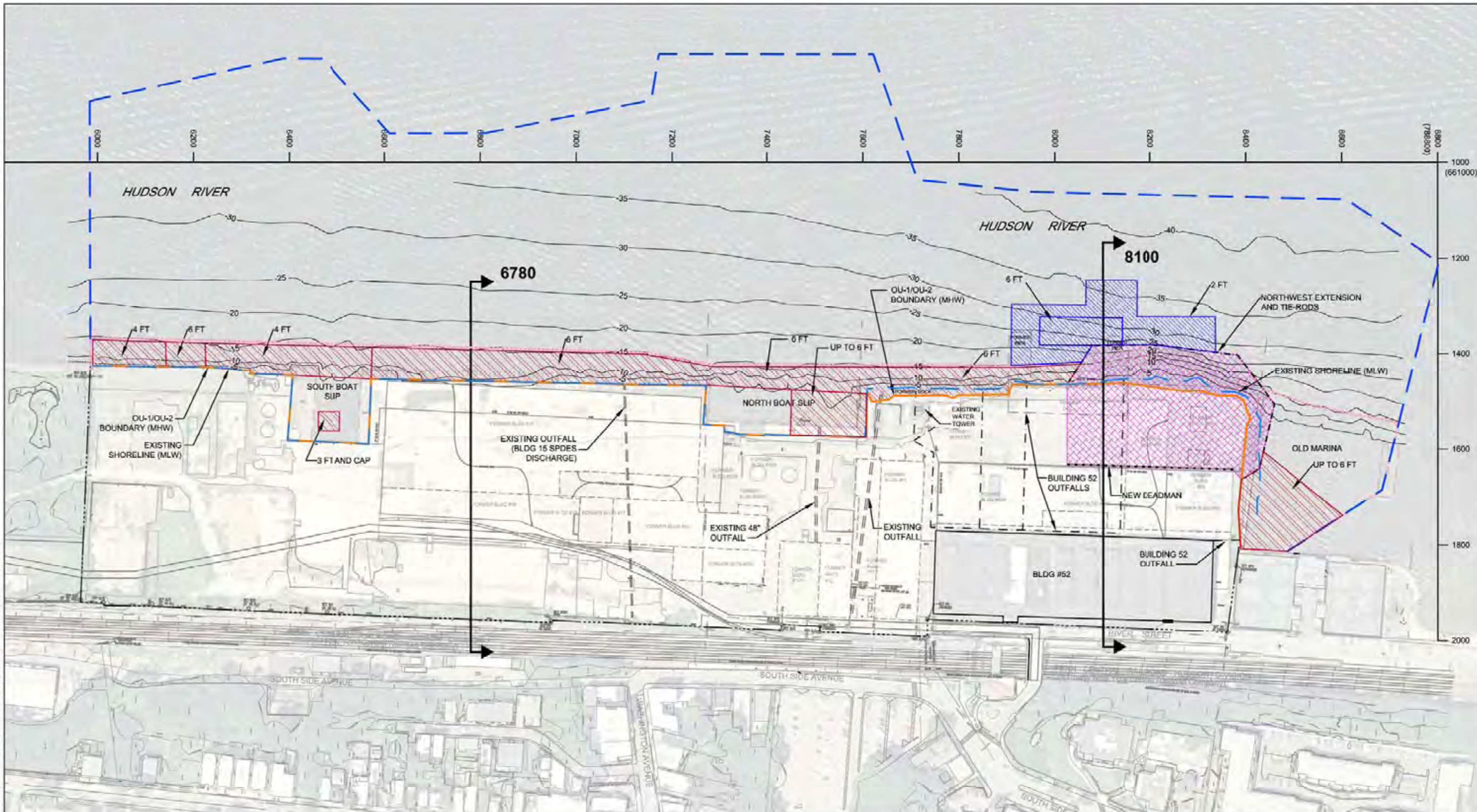


Figure 6

Metals > 95th Percentile Background Conc.
Copper (129 ppm), Lead (132 ppm), Zinc (234 ppm)

Harbor at Hastings
Town of Greenburgh, Westchester County
Site No. 3-60-022



LEGEND:

- PROPERTY LINE
- RAIL ROAD
- FENCE
- RIP-RAP
- EXISTING OFFSITE OUTFALLS
- EXISTING SHORELINE (MLW)
- OU-1/OU-2 BOUNDARY (MHW)
- SILT CURTAIN
- OU-2 SECTION LINES
- NORTHWEST EXTENSION
- NEARSHORE AND BACKWATER DREDGE AREA
- DEEPWATER DREDGE AREA
- BULKHEAD WALL
- OU-2 LIMITS

NOTES:

1. BASE PLAN PROVIDED BY BOSWELL ENGINEERING DRAWING NO. 04-209-MW (01/27/2005).
2. OTHER SITE FEATURES BASED ON VARIOUS HISTORICAL DOCUMENTS.
3. EXISTING 5 FT BATHYMETRY BASED ON DATA FROM ALPINE OCEAN SEISMIC SURVEY (1997).
4. ELEVATION CONTOURS ARE BASED ON NAVD 88 DATUM.
5. BACKGROUND ORTHOIMAGERY FROM NAIP, 2010.
6. DREDGE DEPTHS ARE SHOWN AS MAXIMUM DEPTHS. ACTUAL DREDGE MAY BE CONSTRAINED BY CONSTRUCTIBLE LIMITS, AS SHOWN ON THE SECTIONS.
7. OU-1 REMEDIAL ACTIVITIES ARE SHOWN ON FIGURES 28 AND 30.
8. MEAN HIGH AND MEAN LOW WATER ARE EL. +2.2 AND EL. -2.0, BASED ON HISTORICAL SITE REPORTS.

0 200 400
SCALE IN FEET

HALEY & ALDRICH

NYSDEC SITE #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

PLAN VIEW
MODIFIED ALTERNATIVE 6

SCALE: AS SHOWN
FEBRUARY 2012

FIGURE 7

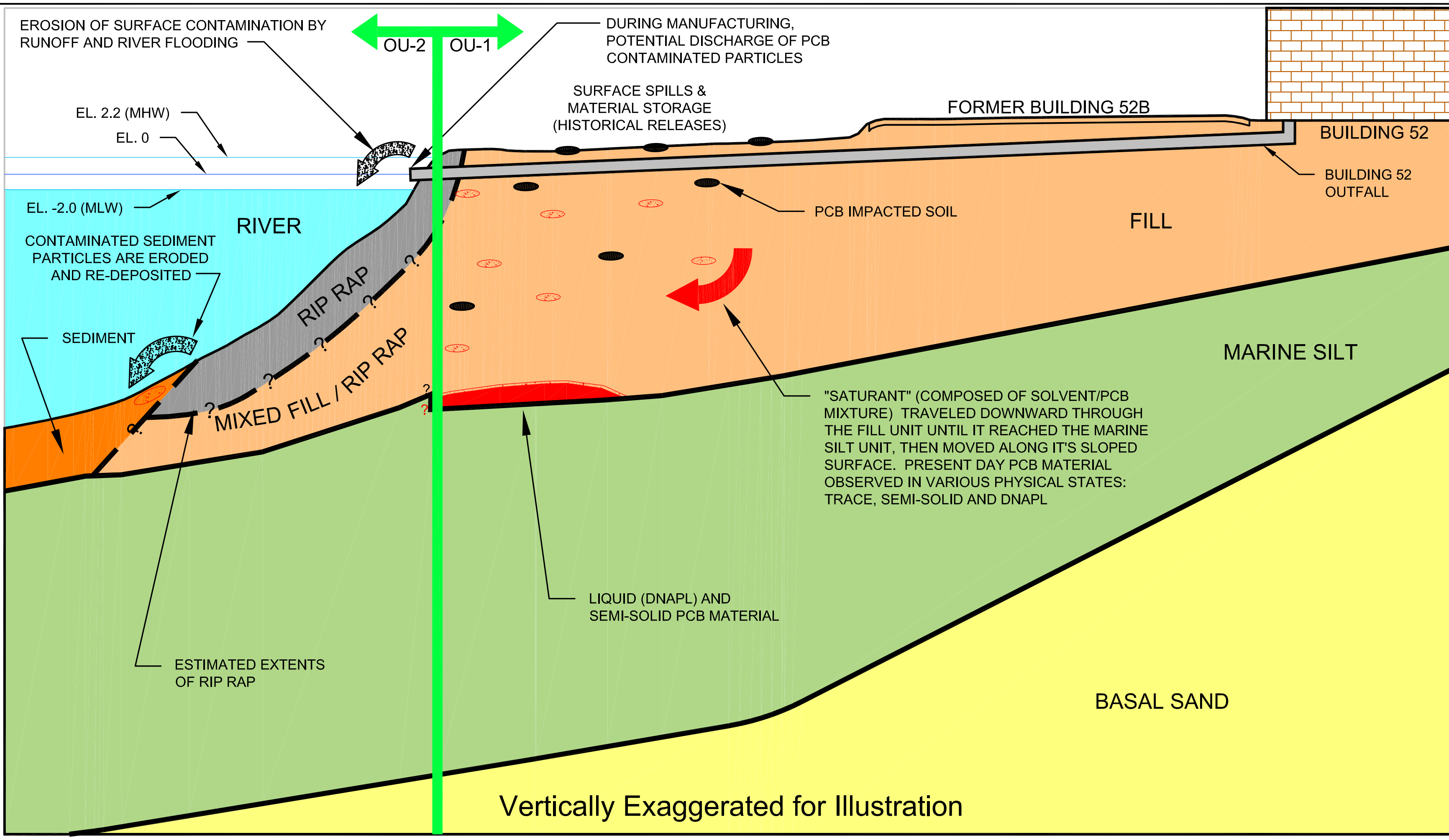
G:\PROJECTS\26512\265 - FINAL RFS\CAD\MODIFIED ALTERNATIVE 6\26512-265-PRAP MODIFIED ALT 6.DWG

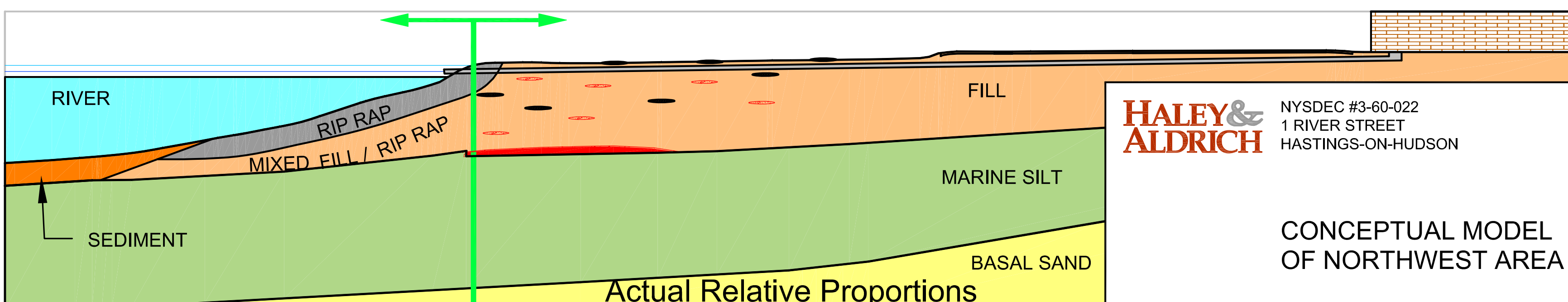
Appendix C Figures from RFS

October 2011, Revised Feasibility Study, Former Anaconda Wire and Cable Company Site, Hastings-on-Hudson, NY, NYSDEC Site # 3-60-022, Haley & Aldrich of New York.

Figure 4.	Conceptual Model of Northwest Area
Figure 5.	DNAPL Extents
Figure 6.	PCB Material Locations
Figure 18.	Alternatives 5, 6, 7, 8: Section 8100
Figure 21.	Alternatives 3, 6: Section 6780
Figure 32.	OU-1 Excavation Plan

G:\PROJECTS\28612\250 - RFS\CAD\PLAN VIEWS & SECTIONS\28612-CSM NW AREA FIG-4_D2.DWG





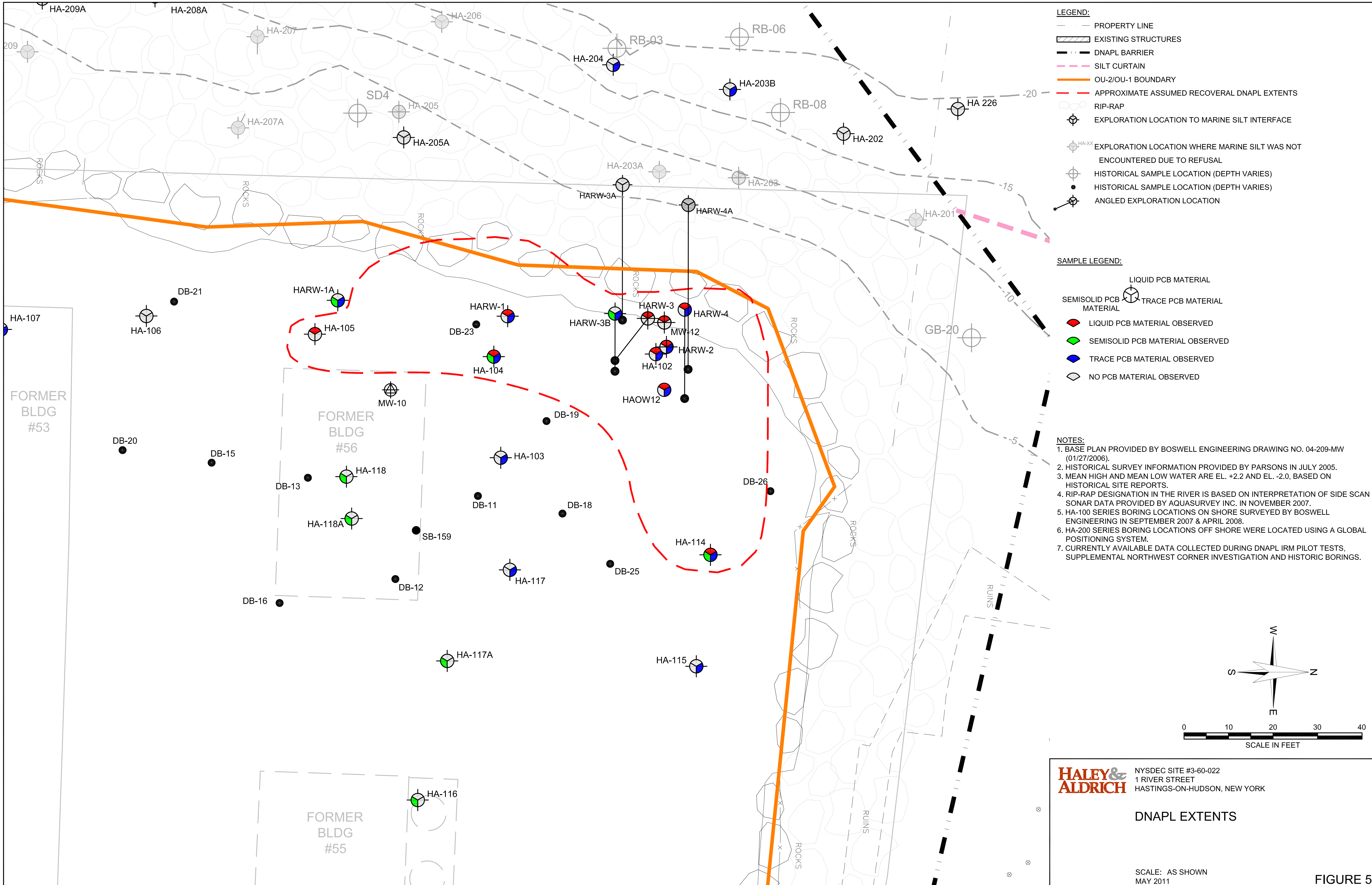
HALEY & ALDRICH

NYSDEC #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON

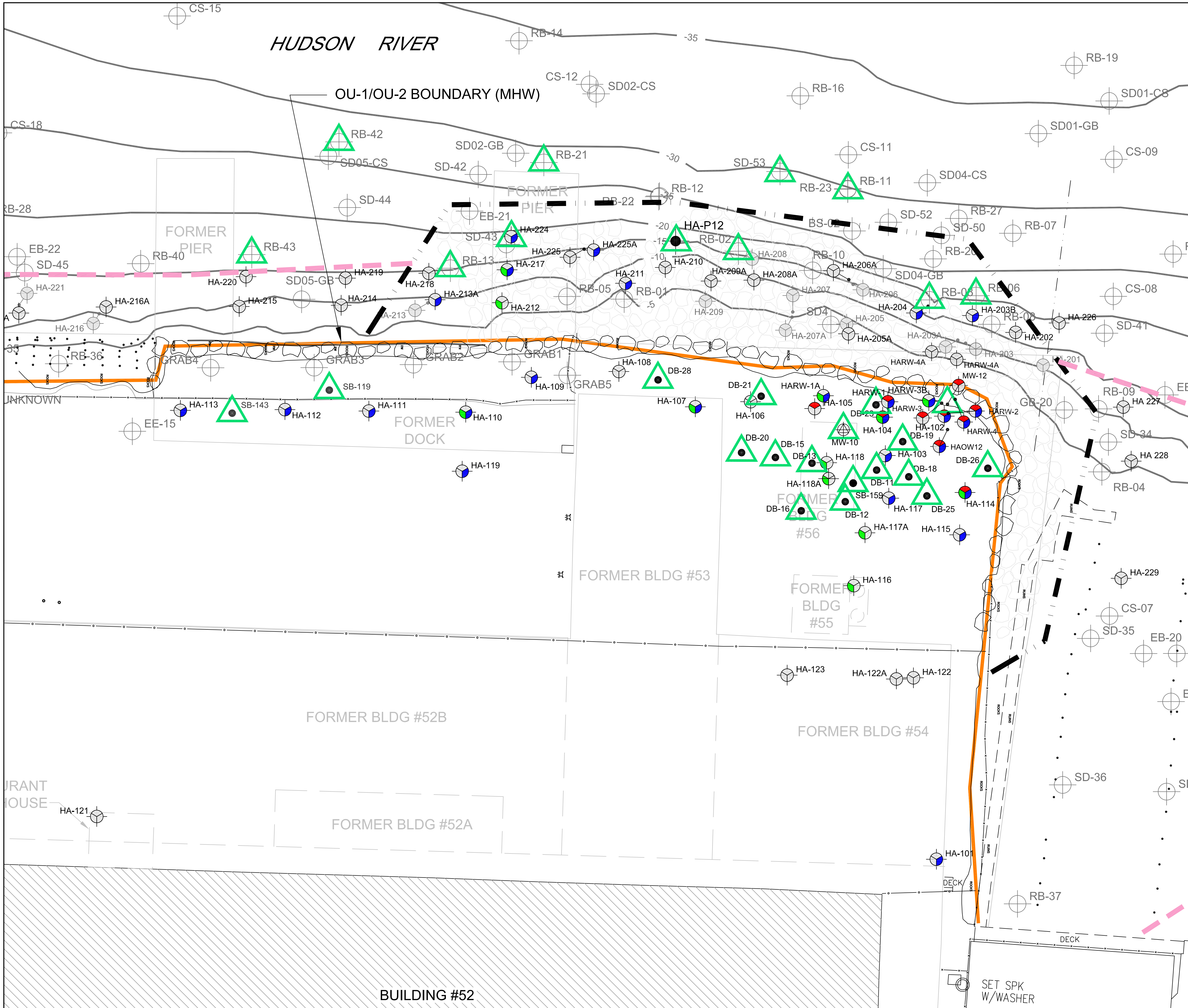
CONCEPTUAL MODEL OF NORTHWEST AREA

SCALE: NOT TO SCALE
SEPTEMBER 2011

FIGURE 4



G:\PROJECTS\28612\250 - RFS\CAD\PLAN VIEWS & SECTIONS\28612-PCB MATERIAL EXTENTS.DWG



LEGEND:

- EXISTING STRUCTURES
- PROPOSED DNAPL BARRIER
- PROPOSED TEMPORARY SILT CURTAIN
- OU-2/OU-1 BOUNDARY (MHW)
- RIP-RAP
- EXPLORATION LOCATION TO MARINE SILT INTERFACE
- LEADER INDICATING ACTUAL EXPLORATION LOCATION
- EXPLORATION LOCATION WHERE MARINE SILT WAS NOT ENCOUNTERED DUE TO REFUSAL
- HISTORICAL SAMPLE LOCATION (DEPTH VARIES)
- HISTORICAL SAMPLE LOCATION (DEPTH VARIES)
- RIP-RAP INVESTIGATION PROBE

SAMPLE LEGEND:

LIQUID PCB MATERIAL
SEMISOLID PCB MATERIAL
TRACE PCB MATERIAL

- LIQUID PCB MATERIAL OBSERVED
- SEMISOLID PCB MATERIAL OBSERVED
- TRACE PCB MATERIAL OBSERVED
- NO PCB MATERIAL OBSERVED
- INFERRED PCB MATERIAL LOCATION

NOTES:

1. BASE PLAN PROVIDED BY BOSWELL ENGINEERING DRAWING NO. 04-209-MW (01/27/2006).
2. HISTORICAL SURVEY INFORMATION PROVIDED BY PARSONS IN JULY 2005.
3. MEAN HIGH AND MEAN LOW WATER ARE EL. +2.2 AND EL. -2.0, BASED ON HISTORICAL SITE REPORTS.
4. RIP-RAP DESIGNATION IN THE RIVER IS BASED ON INTERPRETATION OF SIDE SCAN SONAR DATA PROVIDED BY AQUASURVEY INC. IN NOVEMBER 2007.
5. HA-100 SERIES BORING LOCATIONS ON SHORE SURVEYED BY BOSWELL ENGINEERING IN SEPTEMBER 2007 & APRIL 2008.
6. HA-200 SERIES BORING LOCATIONS OFF SHORE WERE LOCATED USING A GLOBAL POSITIONING SYSTEM.
7. CURRENTLY AVAILABLE DATA COLLECTED DURING DNAPL IRM PILOT TESTS, SUPPLEMENTAL NORTHWEST CORNER INVESTIGATION AND HISTORIC BORINGS.

HALEY & ALDRICH

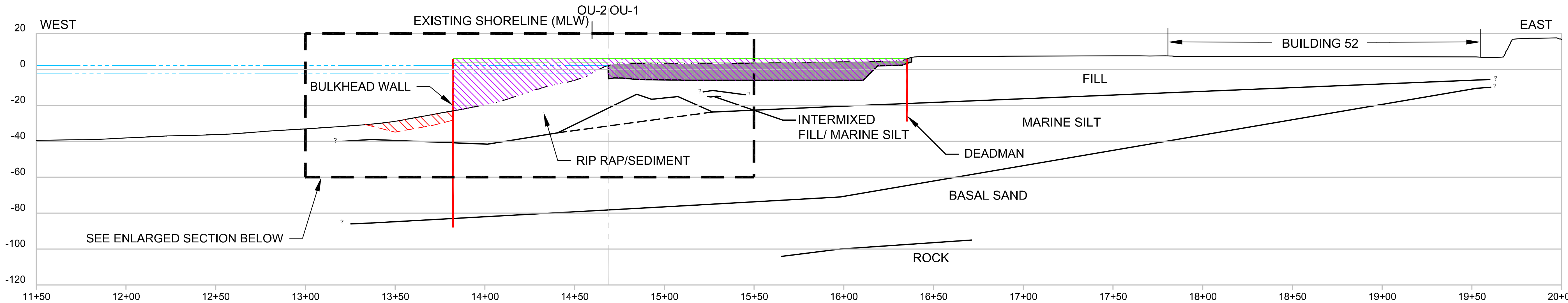
NYSDEC SITE #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

PCB MATERIAL LOCATIONS

SCALE: AS SHOWN
MAY 2011

FIGURE 6

G:\PROJECTS\28612\250 - RFS\CAD\PLAN VIEWS & SECTIONS\28612-PCB MATERIAL EXTENTS.DWG

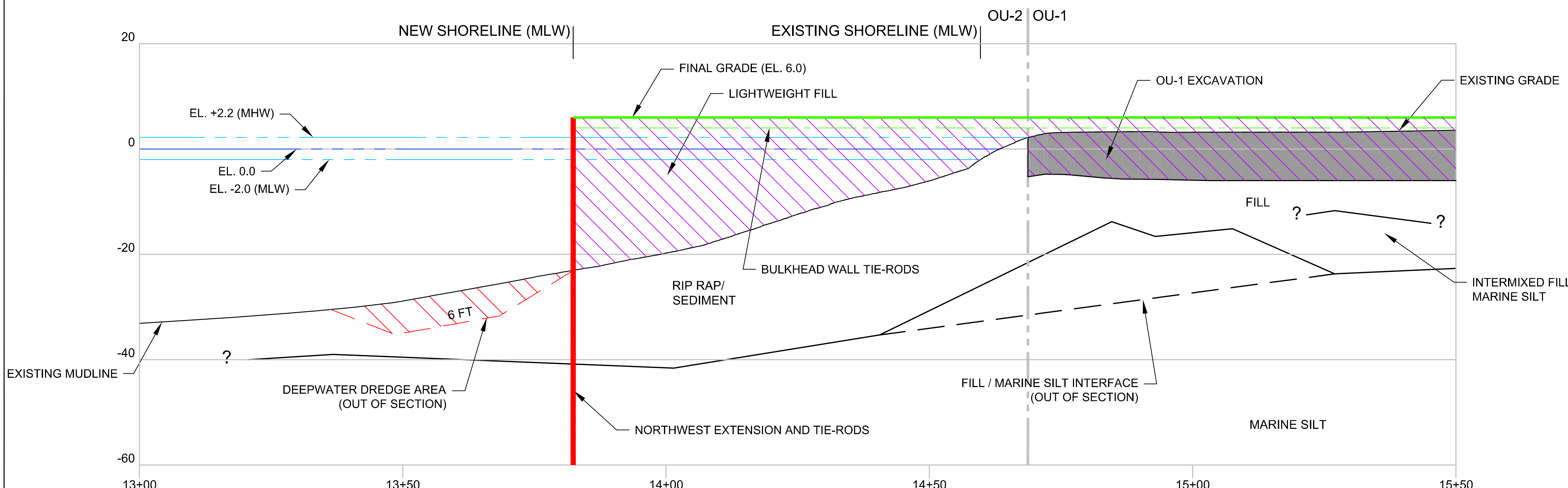


HORIZ. 0 60 120

VERT. 0 60 120

SCALE IN FEET

SECTION 8100 - FULL SECTION



HORIZ. 0 20 40

VERT. 0 20 40

SCALE IN FEET

SECTION 8100 - NORTHWEST EXTENSION

SEE FIGURE 16 FOR LEGEND AND NOTES

G:\PROJECTS\28612\250 - RFS\CAD\PLAN VIEWS & SECTIONS\28612-250-RFS SECTIONS-ALTERNATIVES_D7.DWG

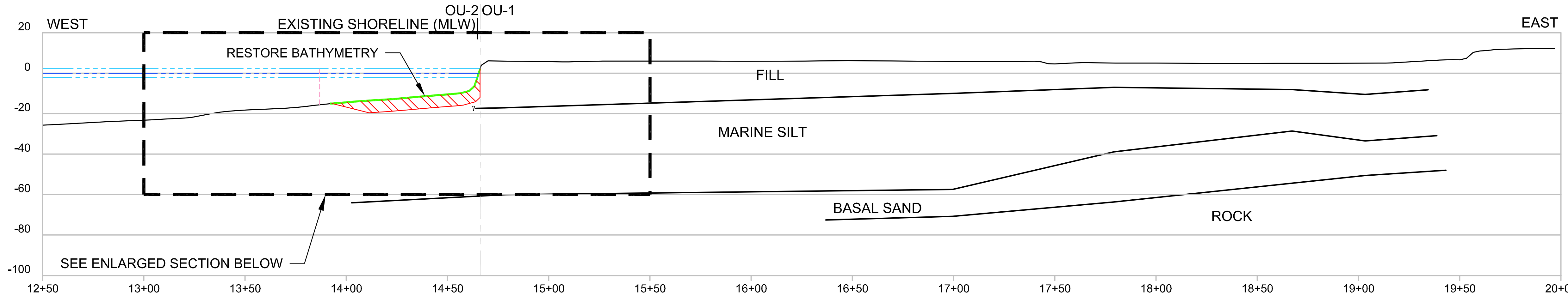
HALEY & ALDRICH

NYSDEC SITE #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

ALTERNATIVES 5, 6, 7, 8
SECTION 8100

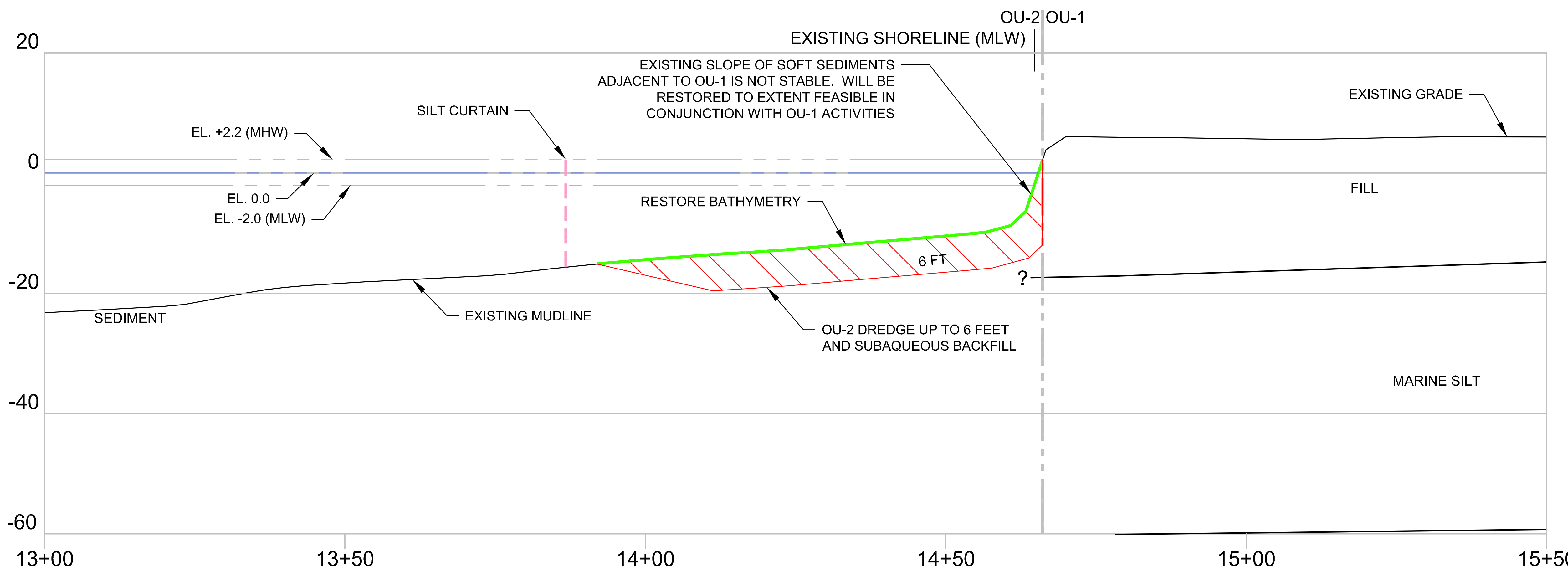
SCALE: AS SHOWN
MAY 2011

FIGURE 18



HORIZ. 0 60 120
VERT. 0 60 120
SCALE IN FEET

SECTION 6780 - FULL SECTION



HORIZ. 0 20 40
VERT. 0 20 40
SCALE IN FEET

SECTION 6780 - NEARSHORE DREDGE (6 FT) AND BACKFILL

SEE FIGURE 16 FOR LEGEND AND NOTES

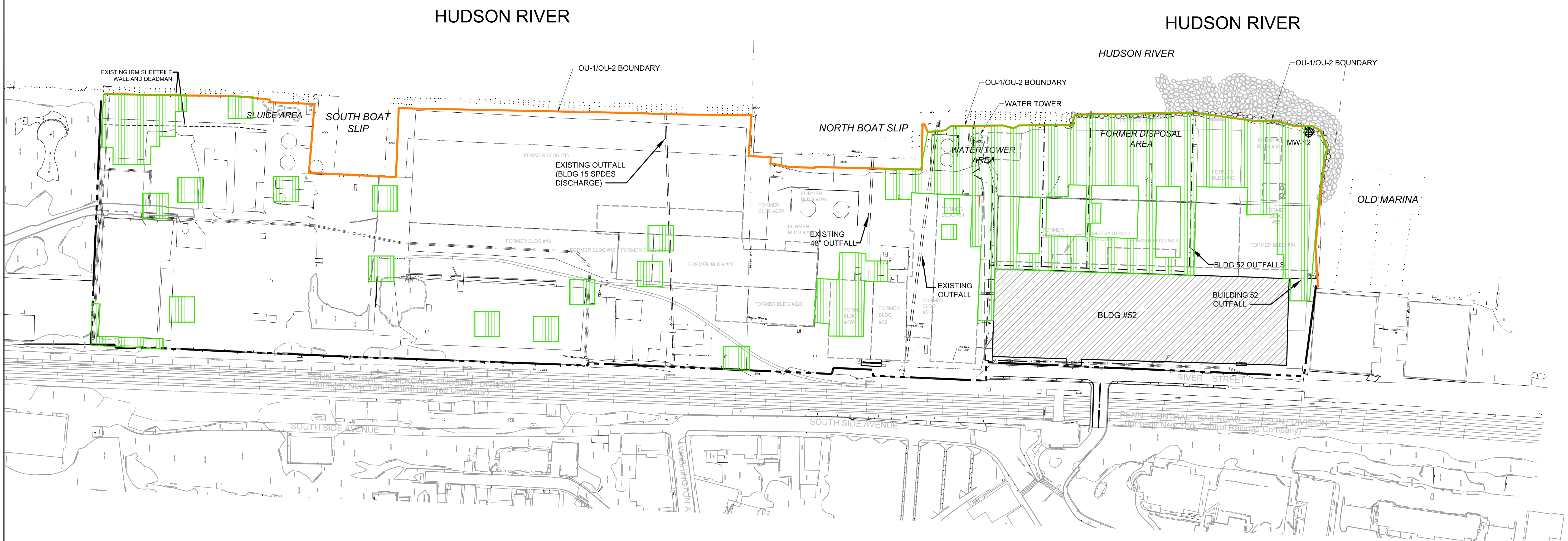
HALEY & ALDRICH

NYSDEC SITE #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

ALTERNATIVES 3, 6
SECTION 6780

SCALE: AS SHOWN
MAY 2011

FIGURE 21



LEGEND:

- PROPERTY LINE
- RAIL ROAD
- EXISTING STRUCTURES
- RIP-RAP
- OU-1/OU-2 BOUNDARY
- BUILDING 52 OUTFALLS
- EXISTING OFFSITE OUTFALLS
- MONITORING WELL
- OU-1 EXCAVATION AREA (DEPTH VARIES)

NOTES:

1. BASE PLAN PROVIDED BY BOSWELL ENGINEERING DRAWING NO. 04-209-MW (01/27/2006).
2. OTHER SITE FEATURES BASED ON VARIOUS HISTORICAL DOCUMENTS.
3. NUMEROUS MONITORING WELLS ARE LOCATED ON SITE. HOWEVER, ONLY MW-12 IS SHOWN AS IT IS THE FIRST LOCATION WHERE LIQUID PCB MATERIAL WAS OBSERVED.
4. MEAN HIGH AND MEAN LOW WATER ARE EL. +2.2 AND EL. -2.0, BASED ON HISTORICAL SITE REPORTS.
5. OU-1/OU-2 BOUNDARY IS MHW.
6. APPROXIMATE EXCAVATION AREAS BASED ON CURRENT DATA. AREAS MAY VARY DURING REMEDIAL DESIGN. EXCAVATION DEPTHS UP TO 9 FT BGS.

HALEY & ALDRICH

NYSDEC SITE #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

OU-1 EXCAVATION PLAN

SCALE: AS SHOWN
OCTOBER 2011

FIGURE 32

G:\PROJECTS\28612\250 - RFS\CAD\PLAN VIEWS & SECTIONS\28612-250-RFS OU-1 EXCAVATION_D1.DWG

Appendix C Updated Hudson River Bathymetry Map

Plot Date: March 14, 2013

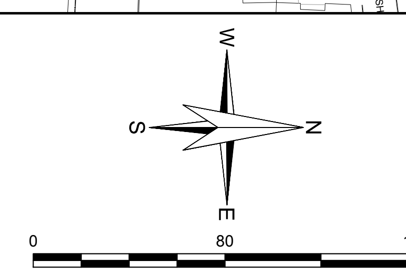
Drawing Name: G:\28612_HASTINGS\286\CAD\28612-286_002.DWG Drawing Layout: SITE PLAN (1)
Operator Name: LUCIDO, SAM

LEGEND

- PROPERTY LINE
- RAIL ROAD
- EXISTING STRUCTURES
- EXTENT OF HYDROGRAPHIC SURVEY
- -25 BATHYMETRIC CONTOUR

NOTES

1. PROPERTY BOUNDARY INFORMATION PROVIDED BY WENDEL COMPANIES, DRAWING XVE-HUDSON-TOPO.DWG, PROJECT NO. 438504, DATED SEPTEMBER 21, 2012.
2. GRID SYSTEM IS THE NEW YORK STATE PLANE COORDINATE SYSTEM, EAST ZONE, NAD 83, U.S. SURVEY FEET.
3. SHORELINE AND ONSHORE FEATURES ARE APPROXIMATE AND ARE BASED ON DIGITAL ORTHOPHOTO QUADRANGLES FLOWN IN 2009 AND OBTAINED FROM THE NEW YORK STATE GIS CLEARINGHOUSE (NYGIS).
4. THE CONTOUR INFORMATION PRESENTED ON THIS DRAWING REPRESENTS THE RESULTS OF A SURVEY PERFORMED BY OCEAN SURVEYS, INC. ON 10-16 DECEMBER 2012 AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS EXISTING AT THAT TIME.



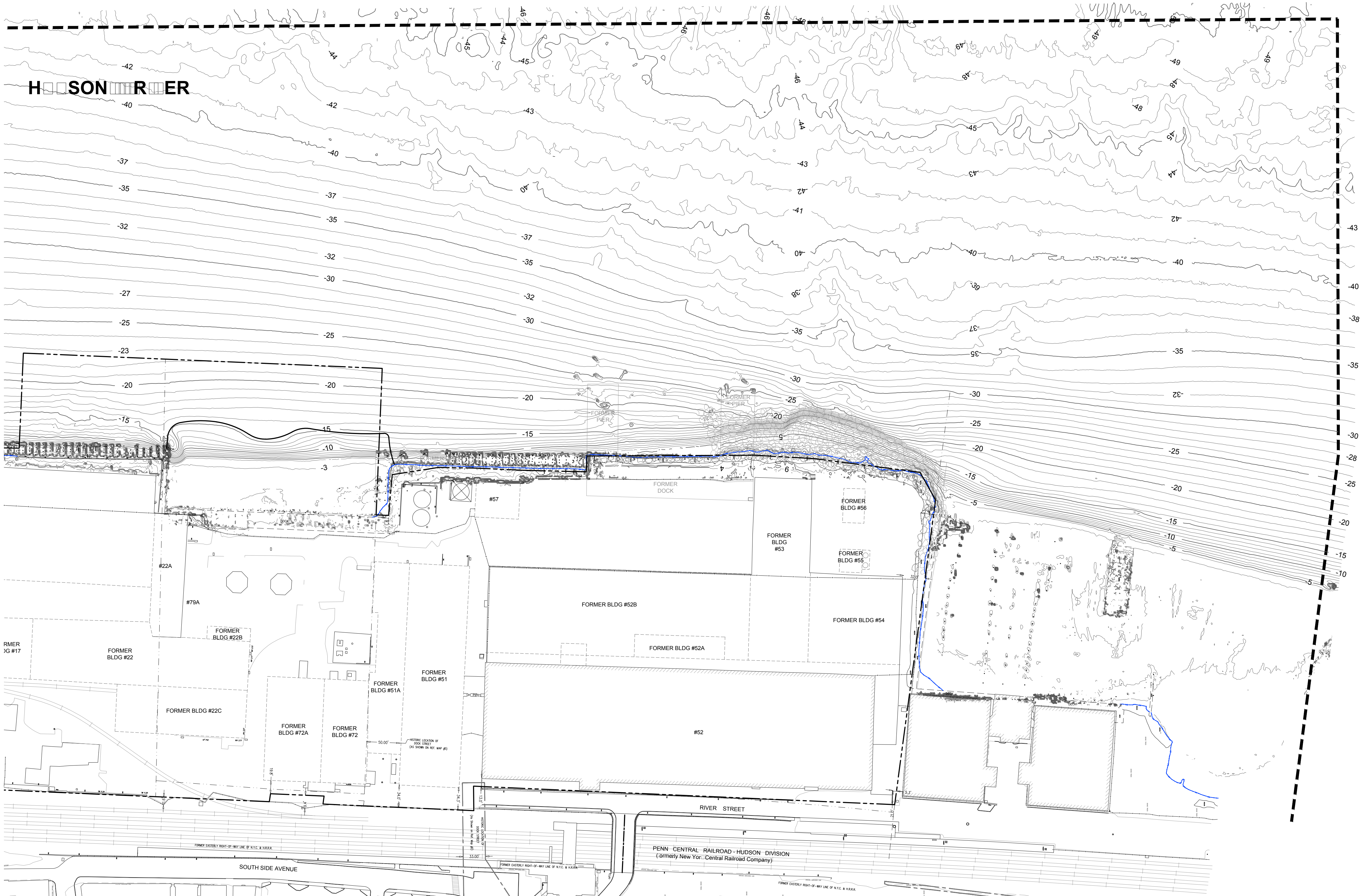
HALEY & ALDRICH

HYDROGRAPHIC SURVEY
NYSDEC SITE #3-60-022
HASTINGS-ON-HUDSON, NEW YORK

BATHYMETRIC CONTOUR PLAN (SHEET 1 OF 2)

SCALE: AS SHOWN
MARCH 2013

FIGURE 1A



LEGEND

- PROPERTY LINE
- RAIL ROAD
- EXISTING STRUCTURES
- EXTENT OF HYDROGRAPHIC SURVEY
- -25 BATHYMETRIC CONTOUR

NOTES

1. PROPERTY BOUNDARY INFORMATION PROVIDED BY WENDEL COMPANIES, DRAWING XVE-HUDSON-TOPO.DWG, PROJECT NO. 438504, DATED SEPTEMBER 21, 2012.
2. GRID SYSTEM IS THE NEW YORK STATE PLANE COORDINATE SYSTEM, EAST ZONE, NAD 83, U.S. SURVEY FEET.
3. SHORELINE AND ONSHORE FEATURES ARE APPROXIMATE AND ARE BASED ON DIGITAL ORTHOPHOTO QUADRANGLES FLOWN IN 2009 AND OBTAINED FROM THE NEW YORK STATE GIS CLEARINGHOUSE (NYGIS).
4. THE CONTOUR INFORMATION PRESENTED ON THIS DRAWING REPRESENTS THE RESULTS OF A SURVEY PERFORMED BY OCEAN SURVEYS, INC. ON 10-16 DECEMBER 2012 AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS EXISTING AT THAT TIME.

W S N E

0 80 160
SCALE IN FEET

HALEY & ALDRICH

HYDROGRAPHIC SURVEY
NYSDEC SITE #3-60-022
HASTINGS-ON-HUDSON, NEW YORK

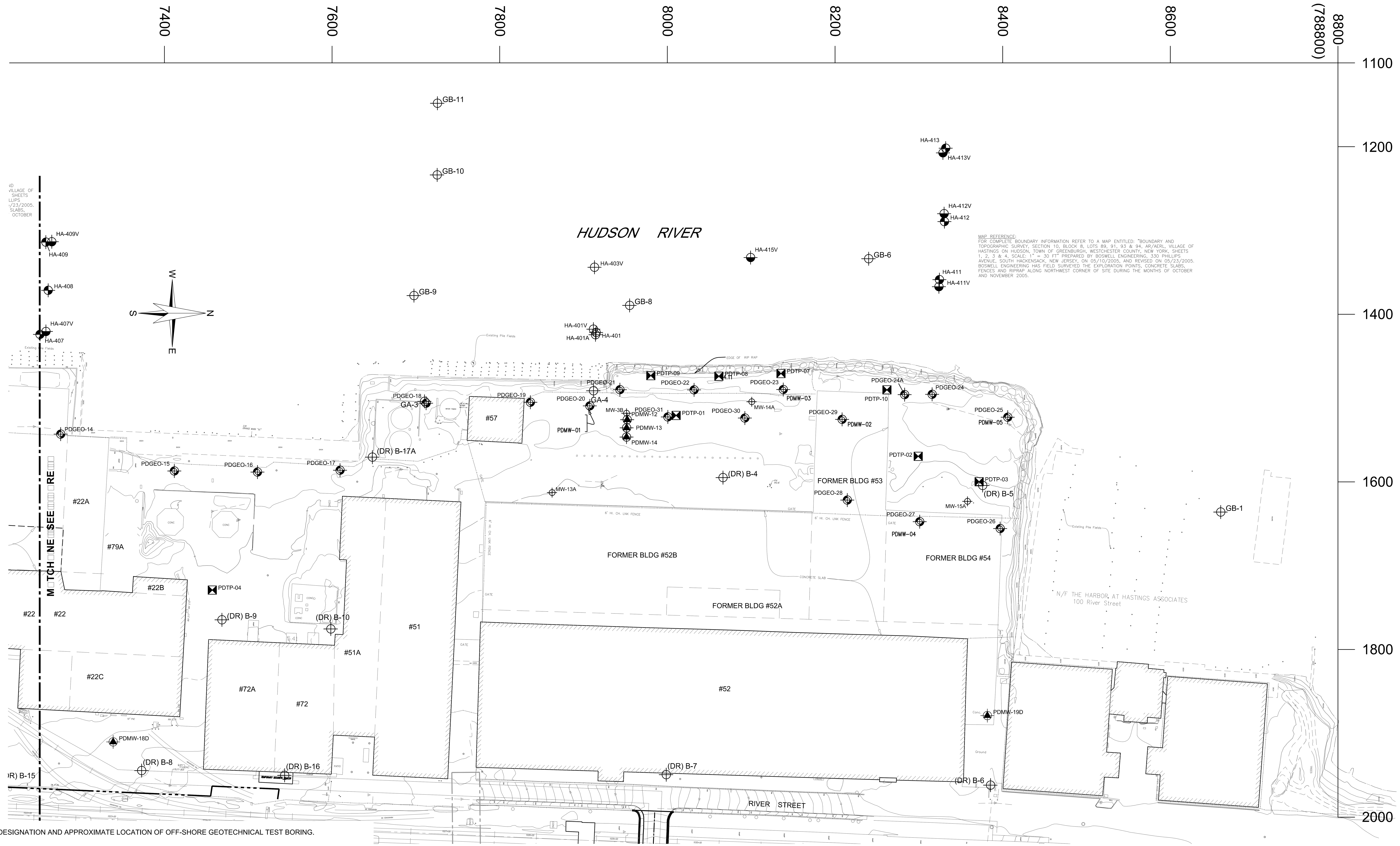
BATHYMETRIC CONTOUR PLAN
(SHEET 2 of 2)

SCALE: AS SHOWN
MARCH 2013

FIGURE 1B

Drawing Name: G:\28612_HASTINGS\286\CAD\28612-286_002.DWG
Operator Name: LUCIDO, SAM
Drawing Layout: SITE PLAN (2)
Plot Date: March 14, 2013

Appendix C Existing Geotechnical Explorations



LEGEND:

HA-411 — DESIGNATION AND APPROXIMATE LOCATION OF OFF-SHORE GEOTECHNICAL TEST BORING.

HA-411V — DESIGNATION AND APPROXIMATE LOCATION OF FIELD VANE TEST.

HA-501A — DESIGNATION AND APPROXIMATE LOCATION OF ON-SHORE GEOTECHNICAL TEST BORING FOR CROSSHOLE SEISMIC TEST.

PDGEO-25 — DESIGNATION AND APPROXIMATE LOCATION OF GEOTECHNICAL BORING DRILLED DURING PRE-DESIGN INVESTIGATION.

PDMW-14 — DESIGNATION AND APPROXIMATE LOCATION OF MONITORING WELL INSTALLED DURING PRE-DESIGN INVESTIGATION.

PDTP-03 — DESIGNATION AND APPROXIMATE LOCATION OF GEOTECHNICAL TEST PIT EXCAVATED DURING PRE-DESIGN INVESTIGATION.

(DR) B-4 — DESIGNATION AND APPROXIMATE LOCATION OF HISTORICAL BORING DRILLED PRIOR TO PRE-DESIGN INVESTIGATION. THE (DR) DESIGNATION WAS ADDED TO LABELS FOR BORINGS DRILLED BY DOLPH ROTFELD, TO DISTINGUISH THEM FROM OTHER B-SERIES BORINGS AT THE SITE.

NOTES:

1. TECHNICAL MONITORING OF HA-SERIES BORINGS WAS PERFORMED BY HALEY & ALDRICH
2. AS-DRILLED LOCATIONS AND GROUND SURFACE ELEVATIONS FOR THE HA-SERIES ON-SHORE BORINGS WERE DETERMINED IN THE FIELD BY SURVEY. AS-DRILLED LOCATIONS OF THE HA-SERIES OFF-SHORE BORINGS WERE DETERMINED BY GPS, AND MUDLINE ELEVATIONS WERE DETERMINED USING TIDE BOARDS INSTALLED ALONG THE SHORELINE.

DRAFT

0 60 120 180 240
SCALE IN FEET

HALEY & ALDRICH

NYSDEC SITE #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

PLAN SHOWING EXISITNG GEOTECHNICAL EXPLORATIONS

SCALE: AS SHOWN
FEBRUARY 2014

FIGURE 2B

28612-116 D093 (D092)
G:\28612\231 - GEOTECH DATA REPORT\CAD\28612-319-D098-SITEGEO PRESENTATION.DWG

G:\28612\231 - GEOTECH DATA REPORT\CAD\28612-319-D098-SITEGEO PRESENTATION.DWG

LEGEND:

HA-411	DESIGNATION AND APPROXIMATE LOCATION OF OFF-SHORE GEOTECHNICAL TEST BORING.
HA-411V	DESIGNATION AND APPROXIMATE LOCATION OF FIELD VANE TEST.
HA-501A	DESIGNATION AND APPROXIMATE LOCATION OF ON-SHORE GEOTECHNICAL TEST BORING FOR CROSSHOLE SEISMIC TEST.
PDGEO-25	DESIGNATION AND APPROXIMATE LOCATION OF GEOTECHNICAL BORING DRILLED DURING PRE-DESIGN INVESTIGATION.
PDMW-14	DESIGNATION AND APPROXIMATE LOCATION OF MONITORING WELL INSTALLED DURING PRE-DESIGN INVESTIGATION.
PDTP-03	DESIGNATION AND APPROXIMATE LOCATION OF GEOTECHNICAL TEST PIT EXCAVATED DURING PRE-DESIGN INVESTIGATION.
(DR) B-4	DESIGNATION AND APPROXIMATE LOCATION OF HISTORICAL BORING DRILLED PRIOR TO PRE-DESIGN INVESTIGATION. THE (DR) DESIGNATION WAS ADDED TO LABELS FOR BORINGS DRILLED BY DOLPH ROTFELD, TO DISTINGUISH THEM FROM OTHER B-SERIES BORINGS AT THE SITE.

NOTES:

1. TECHNICAL MONITORING OF HA-SERIES BORINGS WAS PERFORMED BY HALEY ALDRICH
2. AS-DRILLED LOCATIONS AND GROUND SURFACE ELEVATIONS FOR THE HA-SERIES ON-SHORE BORINGS WERE DETERMINED IN THE FIELD BY SURVEY. AS-DRILLED LOCATIONS OF THE HA-SERIES OFF-SHORE BORINGS WERE DETERMINED BY GPS, AND MUDLINE ELEVATIONS WERE DETERMINED USING TIDE BOARDS INSTALLED ALONG THE SHORELINE.

DRAFT

0 60 120 180 240

SCALE IN FEET

HALEY & ALDRICH

NYSDEC SITE #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

PLAN SHOWING EXISTING GEOTECHNICAL EXPLORATIONS

SCALE: AS SHOWN
FEBRUARY 2014

FIGURE 2A

APPENDIX D

OU-1 Record of Decision Amendment and OU-2 Record of Decision

RECORD OF DECISION AMENDMENT

Harbor at Hastings
Operable Unit Number 01: On-Site Contamination
State Superfund Project
Hastings-on-Hudson, Westchester County
Site No. 360022
March 2012

Prepared by
Division of Environmental Remediation
New York State Department of Environmental Conservation

DECLARATION STATEMENT - RECORD OF DECISION AMENDMENT

Harbor at Hastings
Operable Unit Number: 01: On-Site Contamination
State Superfund Project
Hastings-on-Hudson, Westchester County
Site No. 360022
March 2012

Statement of Purpose and Basis

This Record of Decision Amendment presents the selected remedy for Operable Unit Number 1 of the Harbor at Hastings site, a Class 2 inactive hazardous waste disposal site. The remedial program was chosen in accordance with the New York State Environmental Conservation Law and Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York (6 NYCRR) Part 375, and is not inconsistent with the National Oil and Hazardous Substances Pollution Contingency Plan of March 8, 1990 (40CFR300), as amended.

This decision is based on the Administrative Record of the New York State Department of Environmental Conservation (the Department) for Operable Unit Number: 01 of the Harbor at Hastings site and the public's input to the proposed remedy presented by the Department. A listing of the documents included as a part of the Administrative Record is included in Appendix B of the ROD Amendment.

Description of Selected Remedy

The elements of the amended remedy listed below are identified as unchanged, modified or new when compared to the original 2004 ROD:

1. A remedial design program to verify the components of the conceptual design and provide the details necessary for the construction, operation and maintenance, and monitoring of the remedial program. Green remediation principals and techniques will be implemented to the extent feasible in the design, implementation, and site management of the remedy as per DER-31. The major green remediation components are as follows:

- Considering the environmental impacts of treatment technologies and remedy stewardship over the long term;
- Reducing direct and indirect greenhouse gas and other emissions;
- Increasing energy efficiency and minimizing use of non-renewable energy;
- Conserving and efficiently managing resources and materials;
- Reducing waste, increasing recycling and increasing reuse of materials which would

otherwise be considered a waste;

- Maximizing habitat value and creating habitat when possible;
- Fostering green and healthy communities and working landscapes which balance ecological, economic and social goals; and
- Integrating the remedy with the end use where possible and encouraging green and sustainable re-development (modified)

2. At the Northwest Corner of the site and along the Northern Shoreline, excavation of surface soil (0-12 inches) containing greater than 1ppm PCB and subsurface soil containing greater than 10 ppm PCB to a maximum depth of 9 feet. Outside of the Northwest Corner and the Northern Shoreline areas, excavation of surface soil (0-12 inches) containing greater than 1ppm PCB and subsurface soil containing greater than 10 ppm PCB, to a maximum depth of 12 feet. (modified)

3. Outfalls and associated pipe bedding from Building 52 that are potential PCB source areas will be excavated, sampled and removed, or decommissioned as approved by the Department. (new)

4. Excavation of shallow soils from the southern portion of the site that are identified as "lead hotspots". These correspond to lead levels between 2,160 ppm and 43,200 ppm. (unchanged)

5. In conjunction with OU2, installation of a sheet pile wall within the Hudson River to provide containment and allow for the recovery of PCB DNAPL onshore and offshore of the northwest corner of the site. The location and alignment of the proposed sheet pile wall will be verified during the remedial design to minimize filling into the Hudson River. The area behind the sheet pile wall will be filled with soil and/or lightweight aggregate as approved by the Department. The sheet pile wall will include sealed joints, installation of tie-rods, upland anchors, and cathodic protection. The wall system will also include groundwater filtration units to adsorb contaminants that may be present in groundwater discharging to the river. (new)

6. The shoreline south of the northwest area, will either be a steel bulkhead or construction of a sloped shoreline cover system. The sloped shoreline cover system will be designed and constructed such that no additional fill material will be placed into the Hudson River, and will require the removal of sediment or fill below the current sediment or water elevation for placement of a cover system. The sloped shoreline cover system will be designed with the following layers: an isolation layer of soil or geotextile designed to prevent the migration of contaminated soil particles into the Hudson River; an erosion protection layer; and a habitat/surface substrate layer. The habitat/surface substrate layer will be designed to restore aquatic, intertidal and stream bank habitats while taking into account erosional forces, such as waves and currents. (new)

7. Construction and operation of a recovery system for PCB DNAPL, consisting of a series of wells and an active pumping system to remove fluid PCB material as it collects. (new)

8. A site cover will be required to allow for restricted residential use of the site. The cover will consist either of the structures such as buildings, pavement, sidewalks comprising the site development or a soil cover in areas where the upper two feet of exposed surface soil will exceed the applicable soil cleanup objectives (SCOs). However, pile-supported structures will not be permitted in any areas where PCB material is potentially present. Where the soil cover is required, it will be a minimum of two feet of soil, meeting the SCOs for cover material as set forth in 6 NYCRR Part 375-6.7(d) for restricted residential use. The soil cover will be placed over a demarcation layer, with the upper six inches of the soil of sufficient quality to maintain a vegetation layer with appropriate natural species. (modified)

9. Imposition of an institutional control in the form of an environmental easement for the controlled property, that will:

a. require the remedial party or site owner to complete and submit to the Department a periodic certification of institutional and engineering controls in accordance with Part 375-1.8(h)(3);

b. allow the use and development of the controlled property for restricted-residential, uses as defined by Part 375-1.8(g) which are consistent with the remedial elements, although land use is subject to local zoning laws;

c. restrict the use of groundwater and/or surface water as a source of potable or process water, without necessary water quality treatment as determined by the Department, NYSDOH or Westchester County DOH;

d. prohibit agriculture or vegetable gardens on the controlled property with the exception of community gardens with the approval of the Department; and

e. require compliance with the Department approved Site Management Plan. (new)

10. A Site Management Plan will be required, which includes the following:

a. an Institutional and Engineering Control Plan that identifies all use restrictions and engineering controls for the site and details the steps and media-specific requirements necessary to ensure the following institutional and/or engineering controls remain in place and effective:

Institutional Controls: The Environmental Easement discussed in Paragraph 9 above.

Engineering Controls: The soil cover discussed in Paragraph 8; groundwater treatment system; and PCB DNAPL recovery system.

This plan includes, but may not be limited to:

i. an Excavation and Sediment Management Plan which details the provisions for management of future excavations in areas of remaining contamination;

ii. descriptions of the provisions of the environmental easement including any land use, groundwater and/or surface water use restrictions, which include a prohibition on pile supported structures over areas with PCB material;

iii. provisions for the management and inspection of the identified engineering controls;

iv. maintaining site access controls and Department notification; and

v. the steps necessary for the periodic reviews and certification of the institutional and engineering controls.

b. a Monitoring Plan to assess the performance and effectiveness of the remedy. The plan includes, but may not be limited to:

i. monitoring groundwater quality and elevation to assess the performance and effectiveness of the remedy;

ii. soil cover system inspection and maintenance as necessary to ensure its function is not impaired by erosion or activities at the site;

iii. shore protection system (sheet pile and sloped areas) will be periodically monitored for erosion, corrosion, damage or deterioration; shoreline elevation; and

iv. a schedule of monitoring and frequency of submittals to the Department;

c. an Operation and Maintenance Plan to ensure continued operation, maintenance, monitoring, inspection, and reporting of for any mechanical or physical components of the remedy. The plan includes, but is not limited to:

i. compliance monitoring of treatment systems to ensure proper O&M as well as providing the data for any necessary permit or permit equivalent reporting;

ii. maintaining site access controls and Department notification; and

iii. providing the Department access to the site and O&M records (modified)

New York State Department of Health Acceptance

The New York State Department of Health (NYSDOH) concurs that the remedy for this site is protective of human health.

Declaration

The selected remedy is protective of human health and the environment, complies with State and Federal requirements that are legally applicable or relevant and appropriate to the remedial action to the extent practicable, and is cost effective. This remedy utilizes permanent solutions and alternative treatment or resource recovery technologies, to the maximum extent practicable, and satisfies the preference for remedies that reduce toxicity, mobility, or volume as a principal element.

March 30,2012

Date

Robert W. Schick, P.E., Acting Director
Division of Environmental Remediation

RECORD OF DECISION AMENDMENT
HARBOR AT HASTINGS SITE
OPERABLE UNIT 1 – ON-SITE CONTAMINATION

Village of Hastings on Hudson / Westchester County / Site No. 360022 March 2012

Prepared by the New York State Department of Environmental Conservation
Division of Environmental Remediation

SECTION 1: PURPOSE AND SUMMARY OF THE RECORD OF DECISION AMENDMENT

The New York State Department of Environmental Conservation (the Department), in consultation with the New York State Department of Health (NYSDOH), is selecting an amendment to the Record of Decision (ROD) for the above referenced site. The disposal of hazardous wastes at the site has resulted in threats to public health and the environment that would be addressed by the modification to the remedy identified by this ROD Amendment. The disposal of hazardous wastes at this site, as more fully described in the original ROD and Section 6 of this document, has contaminated various environmental media. The selected amendment is intended to attain the remedial action objectives identified for this site for the protection of public health and the environment. This amendment identifies the new information which has lead to this selected amendment and discusses the reasons for the preferred remedy.

The Department has issued this document in accordance with the requirements of New York State Environmental Conservation Law and Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York; (6 NYCRR) Part 375. This document is a summary of the information that can be found in the site-related reports and documents in the document repository identified below.

On March 18, 2004, the New York State Department of Environmental Conservation (Department) signed a ROD which selected a remedy to cleanup the Harbor at Hastings Site Operable Unit No. 1 (OU1), the on-site soils area. The ROD outlined a set of remedial actions for the site that included partial excavation, containment, groundwater management, and installation of a soil cover. Following the issuance of the ROD, design investigations for OU1 were completed by Atlantic Richfield Company to resolve investigation uncertainties and provide a basis for the remedial design.

The remedial design for OU1 identified constructability issues with the design of the proposed remedy and the need to integrate the OU1 and OU2 (off-site impacts to the Hudson River) remedies. The issues and concerns are related to the alignment of the sheeting at the existing shoreline, the geotechnical stability of the shoreline, and significant new information regarding the presence and extent of dense non-aqueous phase liquid (DNAPL) beneath the Northwest Corner of the site. In addition, the Department issued shoreline protection guidance in 2007 which identified a preference for approaches other than the installation of vertical sheet pile bulkheads, where feasible and appropriate.

The Department is amending the ROD for OU1 of the Harbor at Hastings Site. The selected changes include:

- Modifying the alignment of the sheet pile wall offshore of the northwest corner of the site to extend into the Hudson River in conjunction with the selected OU2 remedy, to provide containment and enable the recovery of PCB DNAPL;

- Allowing installation of either a sheet pile wall or construction of a sloped shoreline cover system along the shoreline in areas that do not require containment of PCB DNAPL;

- Containing the remaining on-site contamination in the Northwest Area using a shoreline barrier in conjunction with a groundwater control and treatment system, a soil cover system, and monitoring to address groundwater and storm water management;

- Elimination of a slurry wall from the Northwest Corner containment area;

- Construction and operation of a recovery system for PCB DNAPL; and

- Excavating and sampling outfalls and associated pipe bedding from Building 52.

In addition, while the criteria for excavation of PCB-contaminated soils have not changed, the new information collected during the design of the original remedy indicates that the extent of the excavation area is significantly increased.

SECTION 2: CITIZEN PARTICIPATION

The Department seeks input from the community on all remedies. A public comment period was held between January 10 and March 12, 2012, during which the public was encouraged to submit comment on the proposed remedy. All comments on the remedy received during the comment period were considered by the Department in selecting a remedy for the site. Site-related reports and documents were made available for review by the public at the following document repositories:

Hastings Public Library
7 Maple Avenue
Hastings-on-Hudson, NY 10706
Mon - Wed: 9:30 - 8:30, Thur: 9:30 - 6:00,
Sat: 9:30 - 5:00, Sun 1:00 - 5:00
Phone: (914) 478-3307

NYSDEC Region 3 Office
21 South Putt Corners Road
New Paltz, NY 12561-1696
Attention: Michael Knipfing
Monday – Friday: 8:30 – 4:30
Phone: (845) 256-3154

Village Clerk
Municipal Offices
7 Maple Avenue
Hastings on Hudson, NY 10706
Mon - Fri: 8:30 - 4:00
Phone:(914)478-3400

A public meeting was also conducted. At the meeting, the findings of the remedial investigation (RI) and the feasibility study (FS) were presented along with a summary of the proposed remedy. After the presentation, a question-and-answer period was held, during which verbal or written comments were accepted on the proposed remedy.

Comments on the remedy received during the comment period are summarized and addressed in the responsiveness summary section of the ROD.

Receive Site Citizen Participation Information By Email

Please note that the Department's Division of Environmental Remediation (DER) is "going paperless" relative to citizen participation information. The ultimate goal is to distribute citizen participation information about contaminated sites electronically by way of county email listservs. Information will be distributed for all sites that are being investigated and cleaned up in a particular county under the State Superfund Program, Environmental Restoration Program, Brownfield Cleanup Program, Voluntary Cleanup Program, and Resource Conservation and Recovery Act Program. We encourage the public to sign up for one or more county listservs at http://www.dec.ny.gov/chemical/61092.html

SECTION 3: SITE DESCRIPTION AND HISTORY

Location: The site is located on approximately 28 acres along the Hastings-on-Hudson waterfront, separated from the village commercial district by railroad tracks. The site is bounded on the north and west by the Hudson River and to the south by the Tappan Terminal site. A former marina borders the site to the north.

Site Features: Most of the site is covered by pavement or concrete building slabs. One building remains at the site (Building 52). The shoreline consists of areas of loosely-placed rip rap and concrete rubble in the north and decaying wooden bulkheads, docks and piers in the central area. Two former boat slips are present along the waterfront, both of which have filled in to a shallow depth with naturally-deposited sediment. The shoreline south of the South Boat Slip consists of modern steel sheeting.

Current Zoning and Uses: The site is zoned general industrial, and is the subject of planning studies by the Village of Hastings-on-Hudson. Several temporary trailers are in use for security and remedial activities.

Historic Uses: The site is the former Anaconda Wire and Cable Company, which ceased operations in 1974. Wire manufacturing operations during a portion of the operating period caused the release of PCBs and metals to site soil, groundwater and sediments. A site investigation was performed in 1986-87 in connection with a potential real estate development. This investigation led to the discovery of high levels of PCBs beneath the northwest corner of the site.

Operable Units: The site is divided into two operable units. An operable unit represents a portion of a remedial program for a site that for technical or administrative reasons can be addressed separately to investigate, eliminate or mitigate a release, threat of release or exposure pathway resulting from the site contamination. Operable Unit 1 (OU1) is the on-site soils area west of the railroad tracks. OU2 is the off-site impacts to the Hudson River.

Site Geology and Hydrogeology: The landmass of the property was constructed by placement of fill material into the Hudson River until the early 1900s. This fill material is approximately 10-20 feet thick along the railroad tracks, and 20-40 feet thick along the river. Beneath the fill layer lies the Marine Silt, which is a structurally weak clayey silt material that is approximately 40 feet thick along the shoreline. Beneath the Marine Silt lies the Basal Sand unit, a very dense sand and gravel material, into which all structural piles for site buildings were placed. Groundwater is approximately 2 to 8 feet below ground surface in the fill material, and is influenced by tidal variation. Groundwater in the Basal Sand unit is confined by the Marine Silt unit and is present in an artesian condition. The shoreline shows signs of historical erosion due to storm events and wave action. Low-lying parts of the site have been flooded during larger storms.

Operable Unit (OU) Number 01 is the subject of this document.

A Record of Decision was issued previously for OU 01 in March 2004.

A site location map is attached as Figure 1.

SECTION 4: <u>LAND USE AND PHYSICAL SETTING</u>

The Department may consider the current, intended, and reasonably anticipated future land use of the site and its surroundings when evaluating a remedy for soil remediation. For this site, alternatives (or an alternative) that restrict(s) the use of the site to restricted residential use as described in Part 375-1.8(g) are/is being evaluated in addition to an alternative which would allow for restricted use of the site.

SECTION 5: <u>ENFORCEMENT STATUS</u>

Potentially Responsible Parties (PRPs) are those who may be legally liable for contamination at a site. This may include past or present owners and operators, waste generators, and haulers.

The Department and ARCO entered into Consent Orders in 1995 and March 2005. These Orders obligate ARCO to implement a RI/FS and RD/RA for OU1.

SECTION 6: <u>SITE CONTAMINATION</u>

6.1: <u>Summary of the Remedial Investigation</u>

A Remedial Investigation (RI) has been conducted. The purpose of the RI was to define the nature and extent of any contamination resulting from previous activities at the site. The field activities and findings of the investigation are described in the RI Report.

The following general activities are conducted during an RI:

- Research of historical information,
- Geophysical survey to determine the lateral extent of wastes,
- Test pits, soil borings, and monitoring well installations,
- Sampling of waste, surface and subsurface soils, groundwater, and soil vapor,

- Sampling of surface water and sediment,
- Ecological and Human Health Exposure Assessments.

6.1.1: Standards, Criteria, and Guidance (SCGs)

The remedy must conform to promulgated standards and criteria that are directly applicable or that are relevant and appropriate. The selection of a remedy must also take into consideration guidance, as appropriate. Standards, Criteria and Guidance are hereafter called SCGs.

To determine whether the contaminants identified in various media are present at levels of concern, the data from the RI were compared to media-specific SCGs. The Department has developed SCGs for groundwater, surface water, sediments, and soil. The NYSDOH has developed SCGs for drinking water and soil vapor intrusion. The tables found in the March 2004 ROD for OU1, which is included as Exhibit A, list the applicable SCGs in the footnotes. For a full listing of all SCGs see: http://www.dec.ny.gov/regulations/61794.html

6.1.2: RI Information

The analytical data collected on this site includes data for:

- groundwater
- surface water
- soil
- sediment
- surface soil

The data have identified contaminants of concern. A "contaminant of concern" is a hazardous waste that is sufficiently present in frequency and concentration in the environment to require evaluation for remedial action. Not all contaminants identified on the property are contaminants of concern. The nature and extent of contamination and environmental media requiring action are summarized in March 2004 ROD for OU1 which is included as Exhibit A. Additionally, the RI Report contains a full discussion of the data. The contaminant(s) of concern identified for this Operable Unit at this site is/are:

polychlorinated biphenyls (PCB)
copper
beryllium
lead
zinc

As illustrated in the original 2004 ROD for OU1 of this site, the contaminant(s) of concern exceed the applicable SCGs for:

soil
groundwater

Since the issuance of the Feasibility Study (FS) and ROD, significant new information about the site has been obtained. The most significant finding is the presence of separate phase PCB material, including liquid PCB Material or DNAPL, beneath Northwest Corner of the site, and along the alignment of the sheet pile wall specified in the original 2004 OU1 ROD. The extent of separate phase PCB is shown in Figure 3.

6.3: <u>Summary of Human Exposure Pathways</u>

This human exposure assessment identifies ways in which people may be exposed to site-related contaminants. Chemicals can enter the body through three major pathways (breathing, touching or swallowing). This is referred to as *exposure.*

For OU-1: The site is completely fenced, which restricts public access. Some contaminated soils remain at the site below concrete and/or clean fill; therefore, people will not come in contact with contaminated soil unless they dig below the surface materials. Contaminated groundwater at the site is not used for drinking or other purposes as the site is served by a public water supply that obtains water from a different source not affected by this contamination. For OU-2: People using the river for recreational purposes such as swimming and boating may come into direct contact with site related contaminants. The river is not a source of potable water in this area. People may come in contact with contaminants present in shallow sediment while entering and exiting the river. Fish in the river are likely to contain the same contaminants that are present in surface water and sediment; therefore, people who consume fish from the river are likely to be consuming these contaminants as well. For specific advisories on fish consumption in this area please refer to NYSDOH's Health Advise on Eating Sportfish and Game. http://www.health.ny.gov/environmental/outdoors/fish/health_advisories/docs/advisory_booklet_2011.pdf

6.4: <u>Summary of Environmental Assessment</u>

This section summarizes the assessment of existing and potential future environmental impacts presented by the site. Environmental impacts may include existing and potential future exposure pathways to fish and wildlife receptors, wetlands, groundwater resources, and surface water.

The Fish and Wildlife Resources Impact Analysis (FWRIA) for OU 01, which is included in the RI report, presents a detailed discussion of the existing and potential impacts from the site to fish and wildlife receptors.

The primary contaminants of concern for the site are PCBs (Aroclors 1260 and 1262) and metals, including copper, lead, and zinc from historic wire manufacturing operations. For OU1, soil and groundwater beneath the site are contaminated with PCBs and metals, including beryllium, above standards, criteria and guidance values. For OU2, PCBs and metals have also contaminated Hudson River surface water and sediments, and site-related PCBs have been detected in resident fish.

The site presents a significant environmental threat due to ongoing releases from contaminated soils and/or sediments to groundwater, surface water and the Hudson River ecosystem. Metals in sediment pose a toxicity threat to benthic organisms, and PCBs in sediment pose a toxicity and bioaccumulation threat to fish and wildlife.

SECTION 7: <u>SUMMARY OF ORIGINAL REMEDY AND ROD AMENDMENT</u>

7.1 Original Remedy

In the March 2004 ROD for OU1 the NYSDEC selected partial excavation, long-term containment, and deed restrictions. The components of the original remedy were as follows:

- Excavation and off-site disposal of PCB-contaminated soil to a maximum depth of 9 feet in the Northwest Corner and along the Northern Shoreline of the site;
- Containment of remaining deep contamination in the Northwest Corner and Northern Shoreline areas using a slurry wall, sealed sheet pile bulkhead, and an impermeable cap;
- Outside of the Northwest Corner and Northern Shoreline containment areas, excavation, to a maximum depth of 12 feet, of all PCB-contaminated soil. For the few areas where PCB contamination exceeds 12 feet, soil would either be excavated by alternative methods, or contained within a watertight sheet pile structure and capped;
- Excavation of lead "hot spots" in shallow soils, corresponding to lead levels between 2,160 ppm and 43,200 ppm;
- Installation of a watertight steel sheet pile bulkhead along the site shoreline;
- Installation of a 2-foot thick barrier system, consisting of a demarcation layer and soil cover over areas not covered by an impermeable cap;
- Institutional controls to prevent exposure to contaminated soils and groundwater beneath the site, and to preserve the integrity of the cover system and containment cells;
- Annual certification that the institutional controls are in place and effective; and
- Long term monitoring.

7.2 New Information

Since the issuance of the FS and ROD, significant new information about the site has been obtained. The most significant finding is the presence of liquid PCB material beneath the Northwest Corner of the site in close proximity to the Hudson River, and along the alignment of the sheet pile wall specified in the original 2004 OU1 ROD. Sheet piles cannot be driven through this material without dragging down or creating a conduit for migration of PCBs into the underlying aquifer. In addition, environmental and geotechnical investigations conducted for OU2 led to a better understanding of the relationship between the OU2 alternatives under consideration and the remedy for OU1. Geotechnical evaluations conducted for OU2 determined that the full extent of contamination beneath the river could not be removed without de-stabilizing the Northwest Corner shoreline and causing a collapse. Because PCB DNAPL was also found beneath the Northwest Corner in close proximity to the river in this area, the original alignment of the sheet pile wall would not have fully contained this PCB Material. Also, pilot tests conducted on both vertical and angled wells have determined that recovery of PCB DNAPL is feasible. An evaluation of groundwater treatment technologies has determined that the low level of PCBs dissolved in groundwater can be feasibly removed by a system of adsorptive panels or canisters installed in the containment wall. With new options for removing PCB DNAPL and treating dissolved contamination, certain elements of the fully-enclosed containment system, the upgradient slurry wall and impermeable membrane, are no longer needed. Therefore, based on the new information submitted, and the need to integrate the proposed remedy for OU2, the Department is amending the ROD for Operable Unit No. 1 at the Harbor at Hastings Site.

7.3 Selected Changes

The selected changes include:

- The alignment of the sheet pile wall, which previously would have followed the existing shoreline, will extend into the Hudson River to provide containment and allow for the recovery of PCB DNAPL located beneath the sediment in this area. The containment element for the northwest on-site contamination (formerly identified as the Northwest Corner and Northern Shoreline Area) will be modified to include recovery of DNAPL; containment of DNAPL by a sheet pile wall with sealed joints installed along the new shoreline alignment; and treatment of groundwater to remove PCBs.

- The proposed change to the shoreline protection component of the remedy is the installation of either a steel bulkhead or an engineered slope along the shoreline in areas which do not require containment of separate phase PCB material. This change allows the flexibility of using the engineered slope instead of the steel bulkhead in areas that do not require PCB containment. In addition to protecting the shoreline, the engineered slope will be designed to prevent the migration of contaminated soil particles into the Hudson River.

- Construction and operation of a recovery system for PCB DNAPL, consisting of a series of vertical and angled wells and an active pumping system to remove fluid PCB material as it collects.

- The outfalls and associated pipe bedding from Building 52 will be excavated, sampled and removed or decommissioned as approved by the Department.

SECTION 8: <u>EVALUATION OF PROPOSED CHANGES</u>

8.1 Remedial Goals

Goals for the cleanup of the site were established in the original ROD. The goals selected for this site are:

- Reduce, control, or eliminate to the extent practicable the contamination present within the soils and fill on site, and thereby eliminate the significant threat posed by the presence of hazardous wastes at the site.

- Eliminate the potential for direct human or animal contact with the contaminated soils or groundwater on site.

- Eliminate the threat to surface waters and sediments by eliminating surface run-off and subsurface releases of fill from the site.

- Eliminate, to the extent practicable, the migration of PCBs, metals and other contaminants into the Hudson River by surface and subsurface erosion of contaminated soils, transport of contaminated groundwater, and migration of PCBs in both elastic material and petroleum phases.

- Prevent, to the extent possible, migration of contaminants at the site to groundwater and surface water.

Further, the remediation goals for the site include attaining to the extent practicable:

- Provide for attainment of SCGs for groundwater quality at the limits of the site.

8.2 Evaluation Criteria

The criteria used to compare the remedial alternatives are defined in the regulation that directs the remediation of inactive hazardous waste sites in New York State (6 NYCRR Part 375). For each criterion, a brief description is provided. A detailed discussion of the evaluation criteria and comparative analysis is contained in the original Feasibility Study.

The first two evaluation criteria are called threshold criteria and must be satisfied in order for an alternative to be considered for selection.

1. Protection of Human Health and the Environment. This criterion is an overall evaluation of each alternative's ability to protect public health and the environment.

The selected ROD amendment remedy will be more protective of human health and the environment when compared to the original remedy. The revised sheet pile wall alignment in the Northwest Corner provides better overall protection of human health and the environment than the original alignment by more effectively containing PCB DNAPL; enhancing PCB DNAPL recovery options; and preventing PCB contaminated groundwater from entering the Hudson River. It provides better containment of the PCB source area when compared to the original remedy based on the new information regarding the nature and extent of PCB DNAPL. Groundwater treatment will be equally protective of the environment and will be monitored.

2. Compliance with New York State Standards, Criteria, and Guidance (SCGs). Compliance with SCGs addresses whether a remedy will meet environmental laws, regulations, and other standards and criteria. In addition, this criterion includes the consideration of guidance which the Department has determined to be applicable on a case-specific basis.

The most important SCGs of concern are the ambient groundwater and surface water standards (6NYCRR Parts 700-705) and the 6NYCRR Part 375 Soil Cleanup Objectives (SCOs) for PCBs. The installation of the sheet pile wall creates a barrier to the groundwater flow to the river and allows collection and treatment of groundwater and DNAPL in the northwest extension area of the site. The engineered sloped shoreline will also prevent the discharge of particles in the historic fill to the Hudson River, which will be equivalent to the original remedy in the areas of the site where separate phase PCB material is not a concern. The provision for an engineered sloped shoreline is also consistent with recent Department shoreline protection guidance, issued in 2007, which identifies a hierarchy of approaches to be used for shore line stabilizations, with preference given to biotechnical approaches over vertical sheet pile bulkheads, where feasible and appropriate. The removal of the former outfalls and pipe bedding from Building 52 will remove additional PCB source areas which may contribute to exceedances of the ambient groundwater standards. The proposed amendment will fully contain the PCB DNAPL which provides the best option for source control of the PCB DNAPL.

The revised sheet pile alignment will need to address the SCGs found in 6NYCRR Part 608 and Environmental Conservation Law Article 15 due to the proposed filling into the Hudson River. This requirement will address the associated filling of approximately 0.88 acres of the Hudson River. Mitigation will be necessary for placement of fill in any river areas which raises the existing sediment grade. The filling activities will be mitigated through the creation of new wetlands areas or improvement of degraded wetlands.

The next five "primary balancing criteria" are used to compare the positive and negative aspects of each of the remedial strategies.

3. Short-term Effectiveness. The potential short-term adverse impacts of the remedial action upon the community, the workers, and the environment during the construction and/or implementation are evaluated. The length of time needed to achieve the remedial objectives is also estimated and compared against the other alternatives.

The short-term impacts of vehicle traffic, contaminated material excavation and handling, and soil backfill will represent noise, dust and emission concerns which will need to be controlled with health and safety plans and engineering controls. The proposed changes represent a decrease in short term impacts due to the generation of less noise and disturbance to the community and the river due to a reduced length of sheet pile wall installation. The short term impacts due to the excavation volume, potential odors, truck traffic and project duration will be equivalent to the original remedy. However, routine procedures will be used to monitor and mitigate odor and dust resulting from the construction activities.

4. Long-term Effectiveness and Permanence. This criterion evaluates the long-term effectiveness of the remedial alternatives after implementation. If wastes or treated residuals remain on-site after the selected remedy has been implemented, the following items are evaluated: 1) the magnitude of the remaining risks, 2) the adequacy of the engineering and/or institutional controls intended to limit the risk, and 3) the reliability of these controls.

The revised sheet pile wall alignment will provide a higher degree of long-term effectiveness than the original location which would have passed through the PCB DNAPL and PCB material. The PCB DNAPL in the Northwest Corner Area will be contained, collected from the new land area created within the Hudson River, and properly disposed off-site.

Both the original remedy and the selected change will require monitoring of the groundwater. The risk associated with the potential release of contaminated groundwater under the selected alternative will be equivalent to the original remedy.

The time needed to achieve compliance with groundwater SCGs across the site is expected to be equivalent for the amended remedy due to the depth of excavation of PCB contaminated soil.

5. Reduction of Toxicity, Mobility or Volume. Preference is given to alternatives that permanently and significantly reduce the toxicity, mobility or volume of the wastes at the site.

The selected amendment will create a barrier and remove PCB DNAPL for off-site disposal, which will provide a permanent reduction in volume. Similarly, PCBs dissolved in groundwater will be removed by a passive recovery system, avoiding the potential for discharge into the river. By comparison, the remedy selected in the 2004 ROD would have relied more heavily on containment, and may not have reduced the volume through treatment. New information indicates, the original remedy may have increased the potential mobility of PCB DNAPL contamination by driving the sheets through the DNAPL along the shoreline which could have created a pathway into uncontaminated zones. The selected amendment will reduce the mobility of this contamination by creating a barrier beyond the known limits of contamination, and allowing further delineation and recovery in the Northwest Extension Area. The amended remedy will therefore provide a greater reduction in mobility of PCBs than the original remedy.

6. Implementability. The technical feasibility and administrative feasibility of implementing each alternative are evaluated. Technical feasibility includes the difficulties associated with the construction of the remedy and the ability to monitor its effectiveness. For administrative feasibility, the availability of the necessary personnel and materials is evaluated along with potential difficulties in obtaining specific operating approvals, access for construction, institutional controls, and so forth.

The selected amendment and original remedy pose different implementability challenges at this site. The selected modification of the sheet pile wall alignment is more technically implementable in comparison to the original remedy because it will avoid the known area of PCB DNAPL and will not result in the potential destabilization of the shoreline during pre-clearing of the rip-rap at the shoreline. The modified alignment will also avoid creating or causing a pathway for PCB migration of the newly identified PCB DNAPL in the subsurface along the wall alignment into deeper uncontaminated zones. Administratively, the construction of the sheet pile wall further out into the Hudson River may be more difficult because it will require permits and approval from the United States Army Corps of Engineers and approval of a wetlands mitigation plan. Installation of groundwater treatment at the shoreline instead of construction of a slurry wall and impermeable cover is more readily implementable.

7. Cost-Effectiveness. Capital costs and annual operation, maintenance, and monitoring costs are estimated for each alternative and compared on a present worth basis. Although cost-effectiveness is the last balancing criterion evaluated, where two or more alternatives have met the requirements of the other criteria, it can be used as the basis for the final decision.

The estimated present worth cost to carry out the amended remedy is $163,000,000, including annual costs for 30 years. The estimated present worth to complete the original remedy was $63,000,000 including annual costs for 30 years. The cost to construct the amended remedy is estimated to be $155,000,000 and the estimated average annual cost is $271,000 per year for 30 years.

The costs are significantly different between the original remedy and amended remedy because the new information obtained during the 50 percent design and subsequent work has been used to update the cost estimate from the original Feasibility Study. The major changes in cost include updated pricing, additional scope items identified during the 50 percent design process, an allowance for work associated with Building 52, a modified approach to shore stabilization, the DNAPL extraction system and the relocation of existing utilities.

Shore stabilization was included in the original OU-1 remedy cost; however, the costs for the new sheet pile wall which extends into the Hudson River (estimated to be approximately $36,000,000) are now included in the OU-2 cost estimate and therefore not included in the OU-1 amended remedy estimate.

This final criterion is considered a modifying criterion and is considered after evaluating those above. It is focused upon after public comments on the proposed ROD amendment have been received.

8. Community Acceptance. Concerns of the community regarding the proposed changes have been evaluated. A responsiveness summary was prepared that presents the public comments received and the manner in which the Department addressed the concerns raised.

SECTION 9: SUMMARY OF ROD AMENDMENT

The Department has amended the Record of Decision (ROD) for the Harbor at Hastings Site OU1.
The estimated present worth cost to carry out the amended OU1 remedy is $163,000,000. The estimated present worth to complete the original remedy was $63,000,000. The cost to construct the amended remedy is estimated to be $155,000,000 and the estimated average annual cost for 30 years is $271,000.

The elements of the amended remedy listed below are identified as unchanged, modified or new when compared to the original 2004 ROD:

1. A remedial design program to verify the components of the conceptual design and provide the details necessary for the construction, operation and maintenance, and monitoring of the remedial program. Green remediation principals and techniques will be implemented to the extent feasible in the design, implementation, and site management of the remedy as per DER-31. The major green remediation components are as follows:

   - Considering the environmental impacts of treatment technologies and remedy stewardship over the long term;
   - Reducing direct and indirect greenhouse gas and other emissions;
   - Increasing energy efficiency and minimizing use of non-renewable energy;
   - Conserving and efficiently managing resources and materials;
   - Reducing waste, increasing recycling and increasing reuse of materials which would otherwise be considered a waste;
   - Maximizing habitat value and creating habitat when possible;
   - Fostering green and healthy communities and working landscapes which balance ecological, economic and social goals; and
   - Integrating the remedy with the end use where possible and encouraging green and sustainable re-development (modified)

2. At the Northwest Corner of the site and along the Northern Shoreline, excavation of surface soil (0-

12 inches) containing greater than 1ppm PCB and subsurface soil containing greater than 10 ppm PCB to a maximum depth of 9 feet. Outside of the Northwest Corner and the Northern Shoreline areas, excavation of surface soil (0-12 inches) containing greater than 1ppm PCB and subsurface soil containing greater than 10 ppm PCB, to a maximum depth of 12 feet. (modified)

3. Outfalls and associated pipe bedding from Building 52 that are potential PCB source areas will be excavated, sampled and removed, or decommissioned as approved by the Department. (new)

4. Excavation of shallow soils from the southern portion of the site that are identified as "lead hotspots". These correspond to lead levels between 2,160 ppm and 43,200 ppm. (unchanged)

5. In conjunction with OU2, installation of a sheet pile wall within the Hudson River to provide containment and allow for the recovery of PCB DNAPL onshore and offshore of the northwest corner of the site. The location and alignment of the proposed sheet pile wall will be verified during the remedial design to minimize filling into the Hudson River. The area behind the sheet pile wall will be filled with soil and/or lightweight aggregate as approved by the Department. The sheet pile wall will include sealed joints, installation of tie-rods, upland anchors, and cathodic protection. The wall system will also include groundwater filtration units to adsorb contaminants that may be present in groundwater discharging to the river. (new)

6. The shoreline south of the northwest area, will either be a steel bulkhead or construction of a sloped shoreline cover system. The sloped shoreline cover system will be designed and constructed such that no additional fill material will be placed into the Hudson River, and will require the removal of sediment or fill below the current sediment or water elevation for placement of a cover system. The sloped shoreline cover system will be designed with the following layers: an isolation layer of soil or geotextile designed to prevent the migration of contaminated soil particles into the Hudson River; an erosion protection layer; and a habitat/surface substrate layer. The habitat/surface substrate layer will be designed to restore aquatic, intertidal and stream bank habitats while taking into account erosional forces, such as waves and currents. (new)

7. Construction and operation of a recovery system for PCB DNAPL, consisting of a series of wells and an active pumping system to remove fluid PCB material as it collects. (new)

8. A site cover will be required to allow for restricted residential use of the site. The cover will consist either of the structures such as buildings, pavement, sidewalks comprising the site development or a soil cover in areas where the upper two feet of exposed surface soil will exceed the applicable soil cleanup objectives (SCOs). However, pile-supported structures will not be permitted in any areas where PCB material is potentially present. Where the soil cover is required, it will be a minimum of two feet of soil, meeting the SCOs for cover material as set forth in 6 NYCRR Part 375-6.7(d) for restricted residential use. The soil cover will be placed over a demarcation layer, with the upper six inches of the soil of sufficient quality to maintain a vegetation layer with appropriate natural species. (modified)

9. Imposition of an institutional control in the form of an environmental easement for the controlled property, that will:

a. require the remedial party or site owner to complete and submit to the Department a periodic certification of institutional and engineering controls in accordance with Part 375-1.8(h)(3);

b. allow the use and development of the controlled property for restricted-residential, uses as defined by Part 375-1.8(g) which are consistent with the remedial elements, although land use is subject to local zoning laws;

c. restrict the use of groundwater and/or surface water as a source of potable or process water, without necessary water quality treatment as determined by the Department, NYSDOH or Westchester County DOH;

d. prohibit agriculture or vegetable gardens on the controlled property with the exception of community gardens with the approval of the Department; and

e. require compliance with the Department approved Site Management Plan. (new)

10. A Site Management Plan will be required, which includes the following:

a. an Institutional and Engineering Control Plan that identifies all use restrictions and engineering controls for the site and details the steps and media-specific requirements necessary to ensure the following institutional and/or engineering controls remain in place and effective:

Institutional Controls: The Environmental Easement discussed in Paragraph 9 above.

Engineering Controls: The soil cover discussed in Paragraph 8; groundwater treatment system; and PCB DNAPL recovery system.

This plan includes, but may not be limited to:

i. an Excavation and Sediment Management Plan which details the provisions for management of future excavations in areas of remaining contamination;

ii. descriptions of the provisions of the environmental easement including any land use, groundwater and/or surface water use restrictions, which include a prohibition on pile supported structures over areas with PCB material;

iii. provisions for the management and inspection of the identified engineering controls;

iv. maintaining site access controls and Department notification; and

v. the steps necessary for the periodic reviews and certification of the institutional and engineering controls.

b. a Monitoring Plan to assess the performance and effectiveness of the remedy. The plan includes, but may not be limited to:

i. monitoring groundwater quality and elevation to assess the performance and effectiveness of the remedy;

ii. soil cover system inspection and maintenance as necessary to ensure its function is not impaired by erosion or activities at the site;

iii. shore protection system (sheet pile and sloped areas) will be periodically monitored for erosion, corrosion, damage or deterioration; shoreline elevation; and

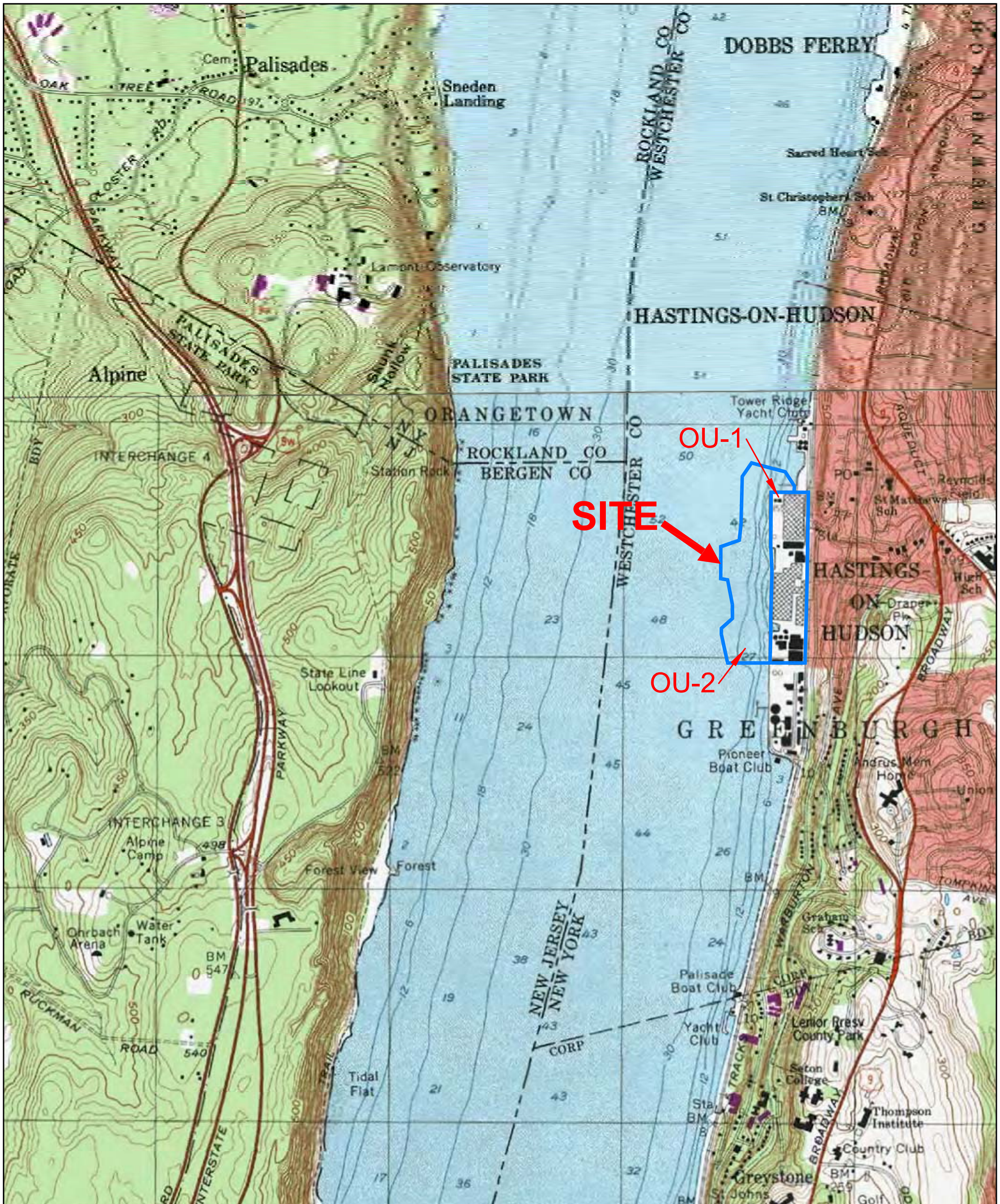
iv. a schedule of monitoring and frequency of submittals to the Department;

c. an Operation and Maintenance Plan to ensure continued operation, maintenance, monitoring, inspection, and reporting of for any mechanical or physical components of the remedy. The plan includes, but is not limited to:

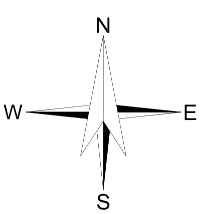
i. compliance monitoring of treatment systems to ensure proper O&M as well as providing the data for any necessary permit or permit equivalent reporting;

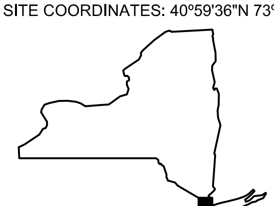
ii. maintaining site access controls and Department notification; and

iii. providing the Department access to the site and O&M records (modified)



SITE COORDINATES: 40º59'36"N 73º53'9"W





U.S.G.S. QUADRANGLE: HASTINGS-ON-HUDSON, NEW YORK

HALEY & ALDRICH

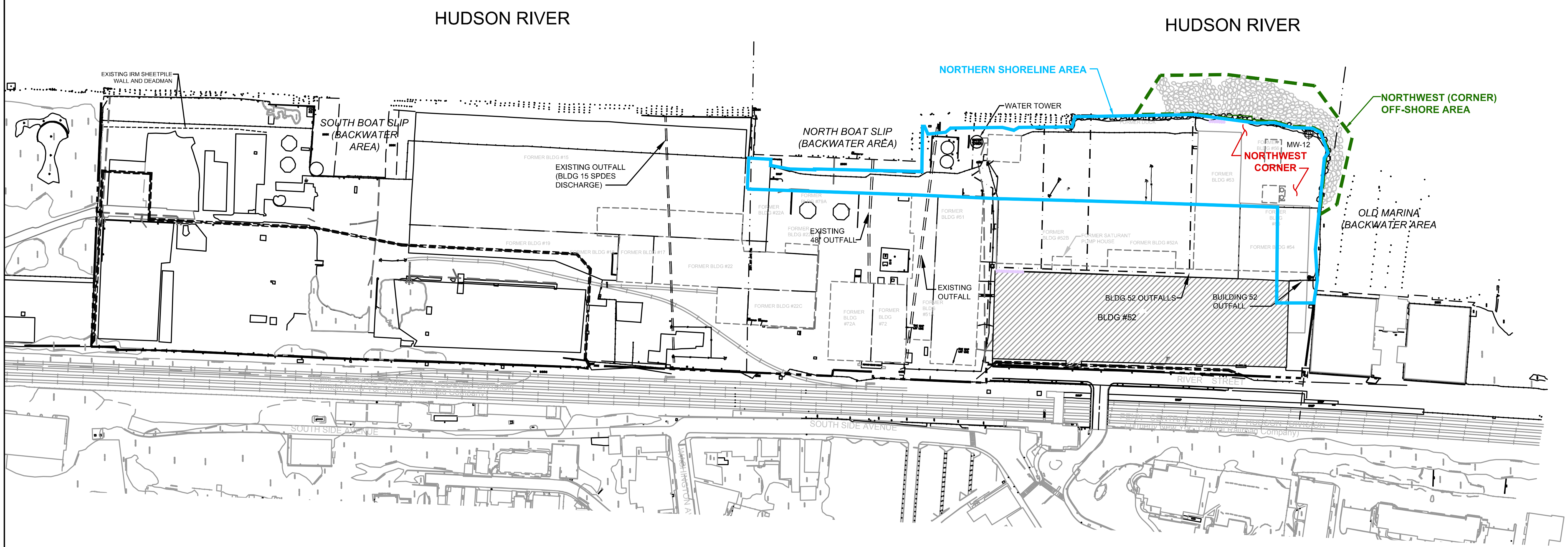
NYSDEC SITE #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

Site Location

SCALE: 1:24000
MAY 2011

FIGURE 1

G:\PROJECTS\28612\250 - RFS\CAD\PLAN VIEWS & SECTIONS\28612-LOCUS_D1.DWG



LEGEND:
- PROPERTY LINE
- RAIL ROAD
- EXISTING STRUCTURES
- RIP-RAP
- BUILDING 52 OUTFALLS
- EXISTING OFFSITE OUTFALLS
- MONITORING WELL
- NORTHERN SHORELINE AREA
- NORTHWEST (CORNER) OFF-SHORE AREA

NOTES:
1. BASE PLAN PROVIDED BY BOSWELL ENGINEERING DRAWING NO. 04-209-MW (01/27/2006).
2. OTHER SITE FEATURES BASED ON VARIOUS HISTORICAL DOCUMENTS.
3. NUMEROUS MONITORING WELLS ARE LOCATED ON SITE. HOWEVER, ONLY MW-12 IS SHOWN AS IT IS THE FIRST LOCATION WHERE LIQUID PCB MATERIAL WAS OBSERVED.
4. MEAN HIGH AND MEAN LOW WATER ARE EL. +2.2 AND EL. -2.0, BASED ON HISTORICAL SITE REPORTS.

HALEY & ALDRICH

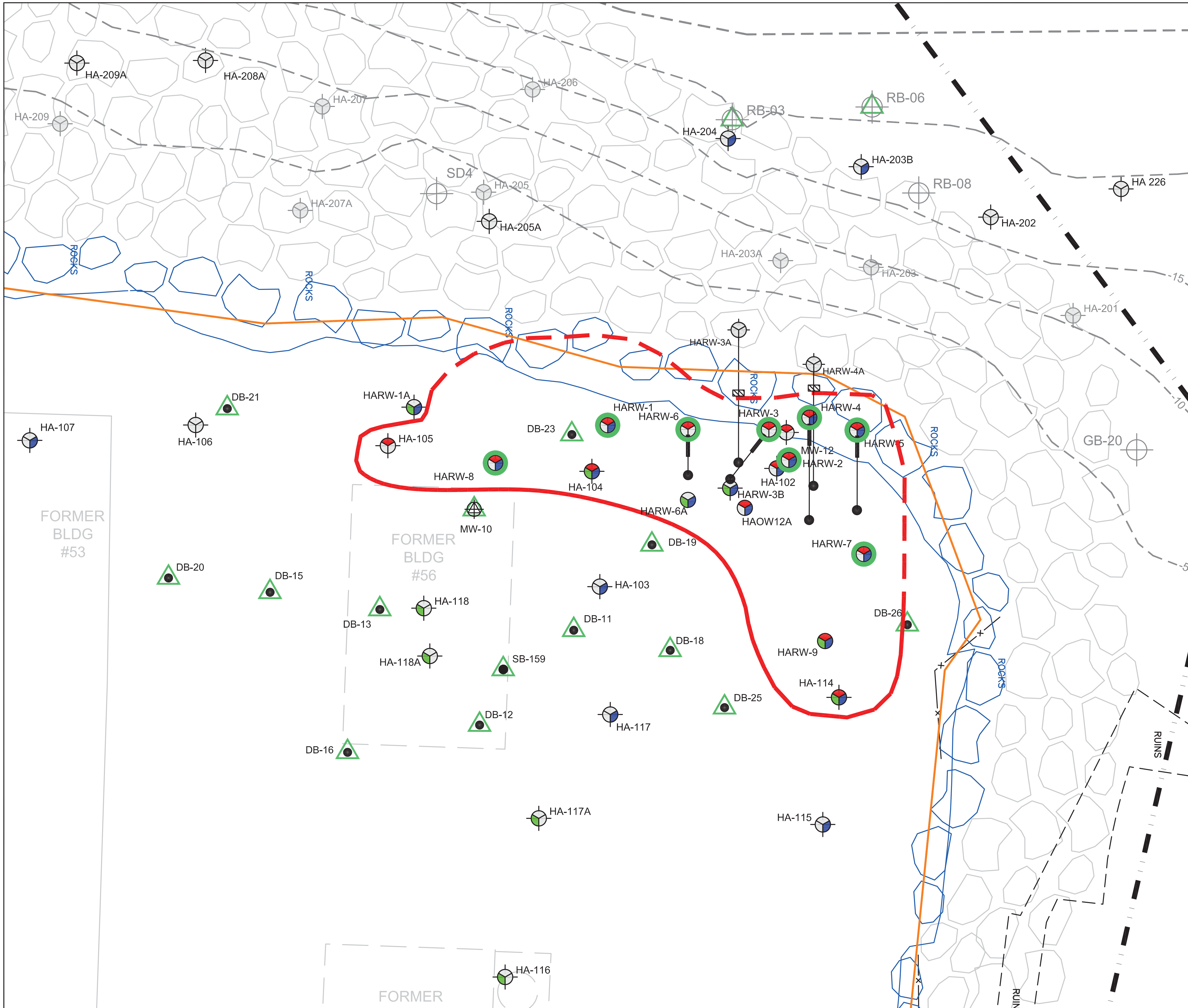
NYSDEC SITE #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

OU-1 SITE FEATURES

SCALE: AS SHOWN
FEBRUARY 2012

FIGURE 2

G:\PROJECTS\28612\265 - FINAL RFS\CAD\FINAL PLAN VIEWS AND SECTIONS\28612-250-RFS OU-1 EXCAVATION_D2.DWG



LEGEND:

- EXISTING STRUCTURES
- DNAPL BARRIER
- OU-2/OU-1 BOUNDARY
- APPROXIMATE ASSUMED RECOVERAL DNAPL EXTENTS
- INVESTIGATED RECOVERABLE DNAPL EXTENTS
- RIP-RAP
- POTENTIAL FORMER WOODEN BULKHEAD
- EXPLORATION LOCATION TO MARINE SILT INTERFACE
- EXPLORATION LOCATION WHERE MARINE SILT WAS NOT ENCOUNTERED DUE TO REFUSAL
- MONITORING WELL LOCATION
- HISTORICAL SAMPLE LOCATION (DEPTH VARIES)
- HISTORICAL SAMPLE LOCATION (DEPTH VARIES)
- ANGLED EXPLORATION LOCATION
- ANGLED WELL LOCATION WITH SCREENED INTERVAL

SAMPLE LEGEND:

- LIQUID PCB MATERIAL
- SEMISOLID PCB MATERIAL
- TRACE PCB MATERIAL
- LIQUID PCB MATERIAL OBSERVED
- SEMISOLID PCB MATERIAL OBSERVED
- TRACE PCB MATERIAL OBSERVED
- NO PCB MATERIAL OBSERVED
- INFERRED POTENTIAL PCB MATERIAL LOCATION
- RECOVERY WELL

NOTES:
1. BASE PLAN PROVIDED BY BOSWELL ENGINEERING DRAWING NO. 04-209-MW (01/27/2006).
2. HISTORICAL SURVEY INFORMATION PROVIDED BY PARSONS IN JULY 2005.
3. MEAN HIGH AND MEAN LOW WATER ARE EL. +2.2 AND EL. -2.0, BASED ON HISTORICAL SITE REPORTS.
4. RIP-RAP DESIGNATION IN THE RIVER IS BASED ON INTERPRETATION OF SIDE SCAN SONAR DATA PROVIDED BY AQUASURVEY INC. IN NOVEMBER 2007.
5. HA-100 SERIES BORING LOCATIONS ON SHORE SURVEYED BY BOSWELL ENGINEERING IN SEPTEMBER 2007 & APRIL 2008.
6. HA-200 SERIES BORING LOCATIONS OFF SHORE WERE LOCATED USING A GLOBAL POSITIONING SYSTEM.
7. CURRENTLY AVAILABLE DATA COLLECTED DURING DNAPL IRM PILOT TESTS, SUPPLEMENTAL NORTHWEST CORNER INVESTIGATION AND HISTORIC BORINGS.

N S E W

0 10 20 30 40
SCALE IN FEET

HALEY & ALDRICH

NYSDEC SITE #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

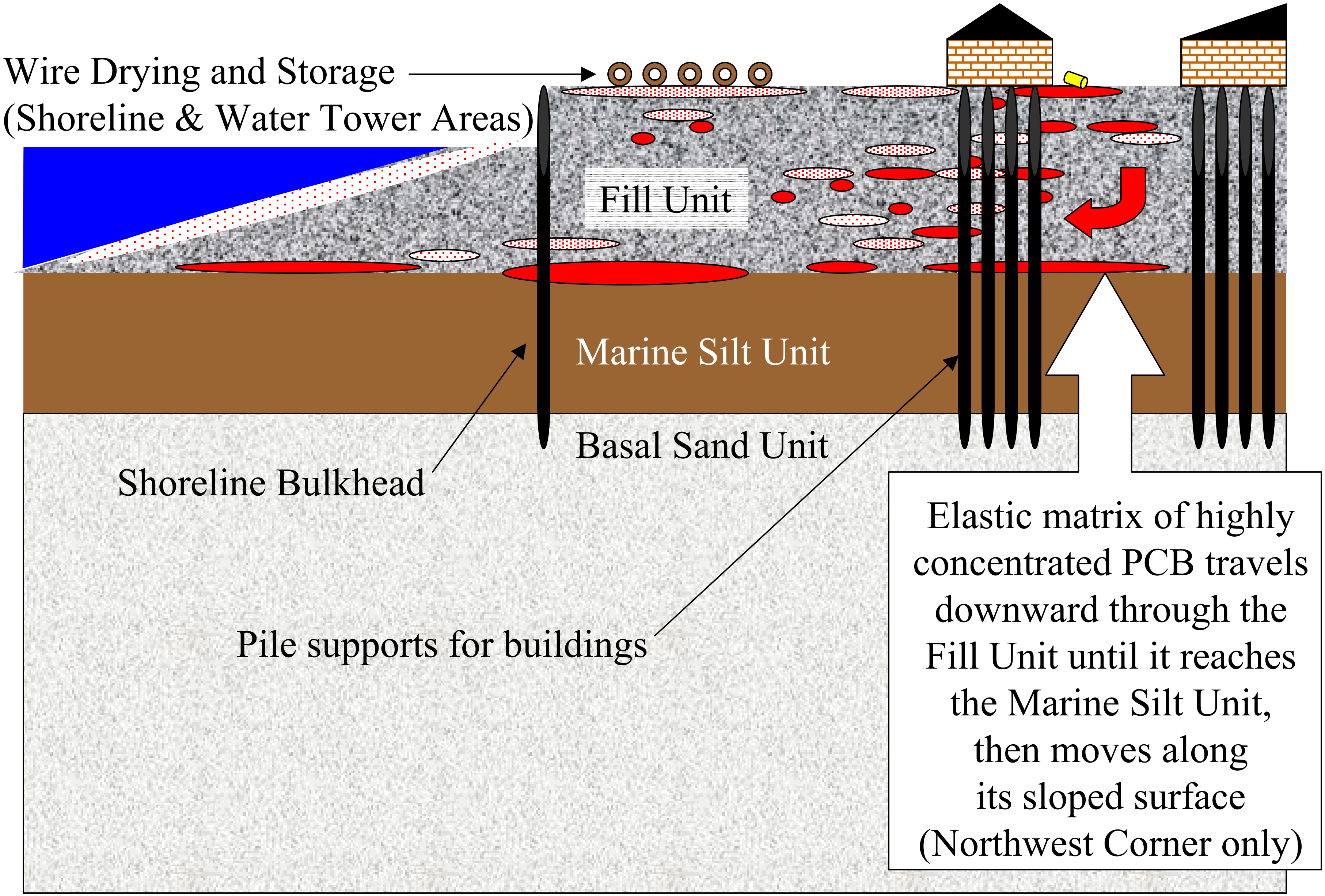
PCB MATERIAL LOCATIONS AND DNAPL EXTENTS IN THE NORTHWEST CORNER

SCALE: AS SHOWN
SEPTEMBER 2011

FIGURE 3

G:\PROJECTS\28612\250 - RFS\COMMUNICATIONS\2011-09-29 DEC FIGURE\28612-PCB MATERIAL EXTENTS_DF.DWG

Figure 4: Conceptual Model of PCB Migration



RECORD OF DECISION

Harbor at Hastings
Operable Unit Number 02: Hudson River Sediments
State Superfund Project
Hastings-on-Hudson, Westchester County
Site No. 360022
March 2012

Prepared by
Division of Environmental Remediation
New York State Department of Environmental Conservation

DECLARATION STATEMENT - RECORD OF DECISION

Harbor at Hastings
Operable Unit Number: 02
State Superfund Project
Hastings-on-Hudson, Westchester County
Site No. 360022
March 2012

Statement of Purpose and Basis

This document presents the remedy for Operable Unit Number: 02: Hudson River Sediments of the Harbor at Hastings site, a Class 2 inactive hazardous waste disposal site. The remedial program was chosen in accordance with the New York State Environmental Conservation Law and Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York (6 NYCRR) Part 375, and is not inconsistent with the National Oil and Hazardous Substances Pollution Contingency Plan of March 8, 1990 (40CFR300), as amended.

This decision is based on the Administrative Record of the New York State Department of Environmental Conservation (the Department) for Operable Unit Number: 02 of the Harbor at Hastings site and the public's input to the proposed remedy presented by the Department. A listing of the documents included as a part of the Administrative Record is included in Appendix B of the ROD.

Description of Selected Remedy

The elements of the selected remedy are as follows:

1. A remedial design program would be implemented to provide the details necessary for the construction, operation, maintenance, and monitoring of the remedial program. Green remediation principals and techniques will be implemented to the extent feasible in the design, implementation, and site management of the remedy as per DER-31. The major green remediation components are as follows:

- Considering the environmental impacts of treatment technologies and remedy stewardship over the long term;
- Reducing direct and indirect greenhouse gas and other emissions;
- Increasing energy efficiency and minimizing use of non-renewable energy;
- Conserving and efficiently managing resources and materials;
- Reducing waste, increasing recycling and increasing reuse of materials which would otherwise be considered a waste;
- Maximizing habitat value and creating habitat when possible;

- Fostering green and healthy communities and working landscapes which balance ecological, economic and social goals; and
- Integrating the remedy with the end use where possible and encouraging green and sustainable re-development

2. Installation of a sheet pile wall within the Hudson River to provide containment and allow for the recovery of liquid PCB DNAPL offshore of the northwest corner of the site. The location and alignment of the northwest extension area (NEA) sheet pile wall will be verified during the remedial design to minimize filling into the Hudson River while enabling effective DNAPL containment and recovery and maintaining stability of the site. It is estimated that this area of fill will encompass 0.88 acres. The area behind the sheet pile wall will be filled with soil and/or lightweight aggregate as approved by the Department. The sheet pile wall will include sealed joints, installation of tie-rods, upland anchors, and cathodic protection. The wall system will also include groundwater filtration units to adsorb contaminants that may be present in groundwater before discharge to the river.

3. Mitigation of fill placed into the Hudson River to replace the aquatic habitat that will be lost as a result of the NEA. Mitigation will involve the creation and/or restoration of river habitat in accordance with a Department-approved plan.

4. Development and implementation of a plan for further delineation and recovery of PCB DNAPL from beneath the northwest corner of the site and the NEA.

5. Removal of sediment and fill that contains PCB concentrations greater than 1 ppm and/or copper, zinc and lead concentrations above the background concentrations listed in Table 2 of Exhibit A, to a maximum excavation depth of 6 feet within the area where sediment resuspension controls, such as a fixed silt curtain, are feasible. This area generally corresponds to a water depth of 15 feet and a distance from the shoreline into the river of approximately 60 to 80 feet and along approximately 2000 feet of shoreline.

6. The specific area where fixed sediment resuspension controls can be feasibly deployed will be evaluated during design based on the water depth and velocity conditions at the site. Alternative designs for fixed resuspension controls will be evaluated to increase the depth of feasible resuspension controls. Designs for mobile resuspension controls will also be evaluated and developed for dredging in deeper water, if necessary.

7. Removal of sediment from a targeted area outside the northwest extension area in deeper than 15 feet of water that is defined by PCB concentrations greater than 50 ppm, to a maximum depth of 6 feet. During the design, sampling will be performed to determine whether additional areas of PCBs greater than 50 ppm exist. Based upon an evaluation of the significance of the distribution of contaminants and the feasibility of removal, additional areas of sediment may be targeted for dredging.

8. On-site dewatering of dredged and excavated sediments for off-site transportation and disposal or onsite reuse, as appropriate. On-site reuse of sediments will be evaluated during

design. Water removed from the sediment will be treated and discharged back to the river in compliance with regulatory requirements.

9. Backfill of dredged areas with Department-approved material. Dredged areas within the resuspension controls will be backfilled with clean material to isolate remaining contamination, prevent erosion of cap materials, restore bathymetry, and provide a habitat layer. In nearshore areas which have contamination remaining above background concentrations, isolation capping will be placed following dredging. The isolation cap will consist of a sand isolation layer; armoring layer; and a minimum of a 24 inch habitat layer. The isolation and armoring layer thicknesses and materials of the cap will be established in the remedial design. As part of the design, a river flow and deposition study will be conducted to determine approximate sedimentation rates and the acceptability that up to 12 inches of the habitat layer may fill in by natural deposition within a reasonable duration of time after installation of the remainder of the isolation cap. Additional backfill needed to reach bathymetry requirements will be placed between the erosion protection layer and habitat layer. The habitat layer will be designed to restore aquatic habitat. Dredged areas that are outside the near shore area will be backfilled with appropriate river substrate to within 12 inches of the pre-dredge elevation provided that the sedimentation study demonstrates that sufficient deposition will occur within a reasonable time frame. All activities associated with the excavation and restoration of Hudson River sediments will meet the requirements of 6NYCRR Part 608.

10. Imposition of an institutional control in the form of an environmental easement for the NEA which will be included with the environmental easement for OU1 that will:

a. require the remedial party or site owner to complete and submit to the Department a periodic certification of institutional and engineering controls in accordance with Part 375-1.8 (h)(3);

b. allow the use and development of the controlled property for restricted residential uses as defined by Part 375-1.8(g), consistent with the OU1 ROD, as amended,, although land use is subject to local zoning laws;

c. restrict the use of groundwater and/or surface water as a source of potable or process water, without necessary water quality treatment as determined by the Department, NYSDOH or Westchester County DOH;

d. prohibit agriculture or vegetable gardens on the controlled property; and

e. require compliance with the Department approved Site Management Plan.

11. A Site Management Plan is required, which includes the following:

a. an Institutional and Engineering Control Plan that identifies all use restrictions and engineering controls for the site and details the steps and media-specific requirements necessary to ensure the following institutional and/or engineering controls remain in place and effective:

Institutional Controls: The Environmental Easement discussed in Paragraph 10 above.
Engineering Controls: The sediment containment system and cover discussed in Paragraphs 2 and 9.

This plan includes, but may not be limited to:

i. Excavation and Sediment Management Plan which details the provisions for management of future excavations in areas of remaining contamination and includes a prohibition on the construction of pile-supported structures within the Northwest Extension Area;

ii. descriptions of the provisions of the environmental easement including any land use, groundwater, and surface water use restrictions;

iii. provisions for the management and inspection of the identified engineering controls;

iv. maintaining site access controls and Department notification; and

v. the steps necessary for the periodic reviews and certification of the institutional and engineering controls.

b. a monitoring plan to assess the performance and effectiveness of the remedy. The plan will be designed to measure PCB and metals concentrations and evaluate the long-term contaminant trends in the affected media (biota, sediment, water). One goal of the monitoring program will be to determine if the remedy is successful in reducing the local contribution to PCB tissue concentrations in biota. This program will monitor the performance and effectiveness of the remedy in achieving the remedial goals established for the project and will be a component of the monitoring and maintenance of the site. The plan includes, but may not be limited to:

i. baseline sampling of biota; surficial sediment sampling; biota sampling in the vicinity of the site and at reference locations; porewater and surface water sampling in the vicinity of the site and at reference locations; shoreline and nearshore bathymetry; and habitat characterization;

ii. long-term sampling of biota; surficial sediment sampling; biota sampling in the vicinity of the site and at reference locations; porewater and surface water sampling in the vicinity of the site and at reference locations; shoreline and nearshore bathymetry; and restoration success to assess the performance and effectiveness of the remedy; and

iii. a schedule of monitoring and frequency of submittals to the Department.

c. an Operation and Maintenance Plan to ensure continued operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical components of the remedy. The plan includes, but is not limited to:

i. compliance monitoring of treatment systems to ensure proper O&M as well as providing the data for any necessary permit or permit equivalent reporting;

ii. providing the Department with required notifications and access to the site and O&M records.

New York State Department of Health Acceptance

The New York State Department of Health (NYSDOH) concurs that the remedy for this site is protective of human health.

Declaration

The selected remedy is protective of human health and the environment, complies with State and Federal requirements that are legally applicable or relevant and appropriate to the remedial action to the extent practicable, and is cost effective. This remedy utilizes permanent solutions and alternative treatment or resource recovery technologies, to the maximum extent practicable, and satisfies the preference for remedies that reduce toxicity, mobility, or volume as a principal element.

March 30, 2012

Date

Robert W. Schick, P.E., Acting Director
Division of Environmental Remediation

RECORD OF DECISION

Harbor at Hastings
Hastings-on-Hudson, Westchester County
Site No. 360022
March 2012

SECTION 1: SUMMARY AND PURPOSE

The New York State Department of Environmental Conservation (the Department), in consultation with the New York State Department of Health (NYSDOH), has selected a remedy for the above referenced site. The disposal of hazardous wastes at the site has resulted in threats to public health and the environment that would be addressed by the remedy. The disposal or release of hazardous wastes at this site, as more fully described in this document, has contaminated various environmental media. The remedy is intended to attain the remedial action objectives identified for this site for the protection of public health and the environment. This Record of Decision (ROD) identifies the selected remedy, summarizes the other alternatives considered, and discusses the reasons for selecting the remedy.

The New York State Inactive Hazardous Waste Disposal Site Remedial Program (also known as the State Superfund Program) is an enforcement program, the mission of which is to identify and characterize suspected inactive hazardous waste disposal sites and to investigate and remediate those sites found to pose a significant threat to public health and environment.

The Department has issued this document in accordance with the requirements of New York State Environmental Conservation Law and 6 NYCRR Part 375. This document is a summary of the information that can be found in the site-related reports and documents.

SECTION 2: CITIZEN PARTICIPATION

The Department seeks input from the community on all remedies. A public comment period was held, during which the public was encouraged to submit comment on the proposed remedy. All comments on the remedy received during the comment period were considered by the Department in selecting a remedy for the site. Site-related reports and documents were made available for review by the public at the following document repositories:

Hastings Public Library
Attn: Susan Feir
7 Maple Avenue
Hastings-on-Hudson, NY 10706
Phone: 914-478-3307

NYSDEC Region 3
Attn: Call for Appointment

21 South Putt Corners Road Phone: 845-256-3154
New Paltz, NY 12561
Village Clerk
Municipal Offices
7 Maple Avenue
Hastings on Hudson, NY 10706
Mon - Fri: 8:30 - 4:00
Phone (914) 478-3400

A public meeting was also conducted. At the meeting, the findings of the remedial investigation (RI) and the feasibility study (FS) were presented along with a summary of the proposed remedy. After the presentation, a question-and-answer period was held, during which verbal or written comments were accepted on the proposed remedy.

Comments on the remedy received during the comment period are summarized and addressed in the responsiveness summary section of the ROD.

Receive Site Citizen Participation Information By Email

Please note that the Department's Division of Environmental Remediation (DER) is "going paperless" relative to citizen participation information. The ultimate goal is to distribute citizen participation information about contaminated sites electronically by way of county email listservs. Information will be distributed for all sites that are being investigated and cleaned up in a particular county under the State Superfund Program, Environmental Restoration Program, Brownfield Cleanup Program, Voluntary Cleanup Program, and Resource Conservation and Recovery Act Program. We encourage the public to sign up for one or more county listservs at http://www.dec.ny.gov/chemical/61092.html

SECTION 3: SITE DESCRIPTION AND HISTORY

Location: The site is located on approximately 28 acres along the Hastings-on-Hudson waterfront, separated from the village commercial district by railroad tracks. The site is bounded on the north and west by the Hudson River and to the south by the Tappan Terminal site. A former marina borders the site to the north.

Site Features: Most of the site is covered by pavement or concrete building slabs. One building remains at the site (Building 52). The shoreline consists of areas of loosely-placed rip rap and concrete rubble in the north and decaying wooden bulkheads, docks and piers in the central area. Two former boat slips are present along the waterfront, both of which have filled in to a shallow depth with naturally-deposited sediment. The shoreline south of the South Boat Slip consists of modern steel sheeting.

Current Zoning and Uses: The site is zoned general industrial, and is the subject of planning studies by the Village of Hastings-on-Hudson. Several temporary trailers are in use for security and remedial activities.

Historic Uses: The site is the former Anaconda Wire and Cable Company, which ceased operations in 1974. Wire manufacturing operations during a portion of the operating period caused the release of PCBs and metals to site soil, groundwater and sediments. A site investigation was performed in 1986-87 in connection with a potential real estate development. This investigation led to the discovery of high levels of PCBs beneath the northwest corner of the site.

Operable Units: The site is divided into two operable units. An operable unit represents a portion of a remedial program for a site that for technical or administrative reasons can be addressed separately to investigate, eliminate or mitigate a release, threat of release or exposure pathway resulting from the site contamination. Operable Unit 1 (OU1) is the on-site soils area west of the railroad tracks. OU2 is the off-site impacts to the Hudson River.

Site Geology and Hydrogeology: The landmass of the property was constructed by placement of fill material into the Hudson River until the early 1900s. This fill material is approximately 10-20 feet thick along the railroad tracks, and 20-40 feet thick along the river. Beneath the fill layer lies the Marine Silt, which is a structurally weak clayey silt material that is approximately 40 feet thick along the shoreline. Beneath the Marine Silt lies the Basal Sand unit, a very dense sand and gravel material, into which all structural piles for site buildings were placed. Groundwater is approximately 2 to 8 feet below ground surface in the fill material, and is influenced by tidal variation. Groundwater in the Basal Sand unit is confined by the Marine Silt unit and is present in an artesian condition. The shoreline shows signs of historical erosion due to storm events and wave action. Low-lying parts of the site have been flooded during larger storms.

Operable Unit (OU) Number 02 is the subject of this document.

A Record of Decision was issued previously for OU 01.

A site location map is attached as Figure 1.

SECTION 4: LAND USE AND PHYSICAL SETTING

The Department may consider the current, intended, and reasonably anticipated future land use of the site and its surroundings when evaluating a remedy for soil remediation. For this site, alternatives (or an alternative) that restrict(s) the use of the site to restricted-residential use (which allows for commercial use and industrial use) as described in Part 375-1.8(g) were/was evaluated in addition to an alternative which would allow for unrestricted use of the site.

A comparison of the results of the RI to the appropriate standards, criteria and guidance values (SCGs) for the identified land use and the unrestricted use SCGs for the site contaminants is included in the Tables for the media being evaluated in Exhibit A.

SECTION 5: ENFORCEMENT STATUS

Potentially Responsible Parties (PRPs) are those who may be legally liable for contamination at a site. This may include past or present owners and operators, waste generators, and haulers.

The PRPs for the site, documented to date, include:

Atlantic Richfield Company (ARCO)

The Department and ARCO entered into Consent Orders in 1995 and March 2005. These Orders obligate ARCO to implement a RI/FS and RD/RA for OU1.

The PRPs for the site declined to implement the remedial investigation and feasibility study portion of the remedial program for OU2 when first requested by the Department. Since 2003 the PRPs have voluntarily performed additional investigations and submitted work plans and reports which include a feasibility study to advance the remedial program. After the remedy is selected, the PRPs will again be contacted to execute an order on consent for the OU2 remedial program. If an agreement cannot be reached with the PRPs, the Department will evaluate the site for further action under the State Superfund. The PRPs are subject to legal actions by the state for recovery of all response costs the state has incurred.

SECTION 6: SITE CONTAMINATION

6.1: Summary of the Remedial Investigation

A Remedial Investigation (RI) has been conducted. The purpose of the RI was to define the nature and extent of any contamination resulting from previous activities at the site. The field activities and findings of the investigation are described in the RI Report.

The following general activities are conducted during an RI:

- Research of historical information,
- Geophysical survey to determine the lateral extent of wastes,
- Test pits, soil borings, and monitoring well installations,
- Sampling of waste, surface and subsurface soils, groundwater, and soil vapor,
- Sampling of surface water and sediment,
- Ecological and Human Health Exposure Assessments.

The analytical data collected on this site includes data for:

- groundwater
- surface water

- soil
- sediment

6.1.1: Standards, Criteria, and Guidance (SCGs)

The remedy must conform to promulgated standards and criteria that are directly applicable or that are relevant and appropriate. The selection of a remedy must also take into consideration guidance, as appropriate. Standards, Criteria and Guidance are hereafter called SCGs.

To determine whether the contaminants identified in various media are present at levels of concern, the data from the RI were compared to media-specific SCGs. The Department has developed SCGs for groundwater, surface water, sediments, and soil. The NYSDOH has developed SCGs for drinking water and soil vapor intrusion. The tables found in Exhibit A list the applicable SCGs in the footnotes. For a full listing of all SCGs see: http://www.dec.ny.gov/regulations/61794.html

6.1.2: RI Results

The data have identified contaminants of concern. A "contaminant of concern" is a hazardous waste that is sufficiently present in frequency and concentration in the environment to require evaluation for remedial action. Not all contaminants identified on the property are contaminants of concern. The nature and extent of contamination and environmental media requiring action are summarized in Exhibit A. Additionally, the RI Report contains a full discussion of the data. The contaminant(s) of concern identified for this Operable Unit at this site is/are:

Polychlorinated Biphenyls (PCB)	Lead
Copper	Zinc

As illustrated in Exhibit A, the contaminant(s) of concern exceed the applicable SCGs for:

- surface water
- sediment

6.2: Interim Remedial Measures

An interim remedial measure (IRM) is conducted at a site when a source of contamination or exposure pathway can be effectively addressed before issuance of the Record of Decision.

There were no IRMs performed at this site during the RI.

6.3: Summary of Environmental Assessment

This section summarizes the assessment of existing and potential future environmental impacts presented by the site. Environmental impacts may include existing and potential future exposure pathways to fish and wildlife receptors, wetlands, groundwater resources, and surface water.

The Fish and Wildlife Resources Impact Analysis (FWRIA) for OU 02, which is included in the RI report, presents a detailed discussion of the existing and potential impacts from the site to fish and wildlife receptors.

The primary contaminants of concern for the site are PCBs (Aroclors 1260 and 1262) and metals, including copper, lead and zinc from historic wire manufacturing operations. For OU1, soil and groundwater beneath the site are contaminated with PCBs and metals, including beryllium, above standards, criteria and guidance values. For OU2, PCBs and metals have also contaminated Hudson River surface water and sediments, and site-related PCBs have been detected in resident fish.

The site presents a significant environmental threat due to ongoing releases from contaminated soils and/or sediments to groundwater, surface water and the Hudson River ecosystem. Metals in sediment pose a toxicity threat to benthic organisms, and PCBs in sediment pose a toxicity and bioaccumulation threat to fish and wildlife.

6.4: Summary of Human Exposure Pathways

This human exposure assessment identifies ways in which people may be exposed to site-related contaminants. Chemicals can enter the body through three major pathways (breathing, touching or swallowing). This is referred to as *exposure.*

For OU-1: The site is completely fenced, which restricts public access. Some contaminated soils remain at the site below concrete and/or clean fill, therefore, people will not come in contact with contaminated soil unless they dig below the surface materials. Contaminated groundwater at the site is not used for drinking or other purposes as the site is served by a public water supply that obtains water from a different source not affected by this contamination. For OU-2: People using the river for recreational purposes such as swimming and boating may come into direct contact with site related contaminants. The river is not a source of potable water in this area. People may come in contact with contaminants present in shallow sediment while entering and exiting the river. Fish in the river are likely to contain the same contaminants that are present in surface water and sediment; therefore, people who consume fish from the river are likely to be consuming these contaminants as well. For specific advisories on fish consumption in this area please refer to NYSDOH's Health Advise on Eating Sportfish and Game. http://www.health.ny.gov/environmental/outdoors/fish/health_advisories/docs/advisory_booklet_2011.pdf

6.5: Summary of the Remediation Objectives

The objectives for the remedial program have been established through the remedy selection process stated in 6 NYCRR Part 375. The goal for the remedial program is to restore the site to pre-disposal conditions to the extent feasible. At a minimum, the remedy shall eliminate or mitigate all significant threats to public health and the environment presented by the contamination identified at the site through the proper application of scientific and engineering principles.

The remedial action objectives for this site are:

<u>Surface Water</u>

RAOs for Public Health Protection

- Prevent surface water contamination which may result in fish advisories.

RAOs for Environmental Protection

- Restore surface water to ambient water quality criteria for the contaminant of concern.
- Prevent impacts to biota from ingestion/direct contact with surface water causing toxicity and impacts from bioaccumulation through the marine or aquatic food chain.

<u>Sediment</u>

RAOs for Public Health Protection

- Prevent direct contact with contaminated sediments.
- Prevent surface water contamination which may result in fish advisories.

RAOs for Environmental Protection

- Prevent releases of contaminant(s) from sediments that would result in surface water levels in excess of (ambient water quality criteria).
- Prevent impacts to biota from ingestion/direct contact with sediments causing toxicity or impacts from bioaccumulation through the marine or aquatic food chain.
- Restore sediments to pre-release/background conditions to the extent feasible.

SECTION 7: SUMMARY OF THE SELECTED REMEDY

To be selected the remedy must be protective of human health and the environment, be cost-effective, comply with other statutory requirements, and utilize permanent solutions, alternative technologies or resource recovery technologies to the maximum extent practicable. The remedy must also attain the remedial action objectives identified for the site, which are presented in Section 6.5. Potential remedial alternatives for the Site were identified, screened and evaluated in the feasibility study (FS) report.

A summary of the remedial alternatives that were considered for this site is presented in Exhibit B. Cost information is presented in the form of present worth, which represents the amount of money invested in the current year that would be sufficient to cover all present and future costs associated with the alternative. This enables the costs of remedial alternatives to be compared on a common basis. As a convention, a time frame of 30 years is used to evaluate present worth costs for alternatives with an indefinite duration. This does not imply that operation, maintenance, or monitoring would cease after 30 years if remediation goals are not achieved. A summary of the Remedial Alternatives Costs is included as Exhibit C.

The basis for the Department's remedy is set forth at Exhibit D.

The selected remedy is referred to as the Nearshore Dredge to 6 feet, Limited Deepwater Dredge and Northwest Extension remedy.

The estimated present worth cost to implement the remedy is $105,000,000. The cost to construct the remedy is estimated to be $95,200,000 and the estimated average annual cost is $454,000.

The elements of the selected remedy are as follows:

1. A remedial design program would be implemented to provide the details necessary for the construction, operation, maintenance, and monitoring of the remedial program. Green remediation principals and techniques will be implemented to the extent feasible in the design, implementation, and site management of the remedy as per DER-31. The major green remediation components are as follows:

- Considering the environmental impacts of treatment technologies and remedy stewardship over the long term;
- Reducing direct and indirect greenhouse gas and other emissions;
- Increasing energy efficiency and minimizing use of non-renewable energy;
- Conserving and efficiently managing resources and materials;
- Reducing waste, increasing recycling and increasing reuse of materials which would otherwise be considered a waste;
- Maximizing habitat value and creating habitat when possible;
- Fostering green and healthy communities and working landscapes which balance ecological, economic and social goals; and
- Integrating the remedy with the end use where possible and encouraging green and sustainable re-development

2. Installation of a sheet pile wall within the Hudson River to provide containment and allow for the recovery of liquid PCB DNAPL offshore of the northwest corner of the site. The location and alignment of the northwest extension area (NEA) sheet pile wall will be verified during the remedial design to minimize filling into the Hudson River while enabling effective DNAPL containment and recovery and maintaining stability of the site. It is estimated that this area of fill will encompass 0.88 acres. The area behind the sheet pile wall will be filled with soil and/or lightweight aggregate as approved by the Department. The sheet pile wall will include sealed joints, installation of tie-rods, upland anchors, and cathodic protection. The wall system will also include groundwater filtration units to adsorb contaminants that may be present in groundwater before discharge to the river.

3. Mitigation of fill placed into the Hudson River to replace the aquatic habitat that will be lost as a result of the NEA. Mitigation will involve the creation and/or restoration of river habitat in accordance with a Department-approved plan.

4. Development and implementation of a plan for further delineation and recovery of PCB DNAPL from beneath the northwest corner of the site and the NEA.

5. Removal of sediment and fill that contains PCB concentrations greater than 1 ppm and/or copper, zinc and lead concentrations above the background concentrations listed in Table 2 of Exhibit A, to a maximum excavation depth of 6 feet within the area where sediment resuspension controls, such as a fixed silt curtain, are feasible. This area generally corresponds to a water depth of 15 feet and a distance from the shoreline into the river of approximately 60 to 80 feet and along approximately 2000 feet of shoreline.

6. The specific area where fixed sediment resuspension controls can be feasibly deployed will be evaluated during design based on the water depth and velocity conditions at the site. Alternative designs for fixed resuspension controls will be evaluated to increase the depth of feasible resuspension controls. Designs for mobile resuspension controls will also be evaluated and developed for dredging in deeper water, if necessary.

7. Removal of sediment from a targeted area outside the northwest extension area in deeper than 15 feet of water that is defined by PCB concentrations greater than 50 ppm, to a maximum depth of 6 feet. During the design, sampling will be performed to determine whether additional areas of PCBs greater than 50 ppm exist. Based upon an evaluation of the significance of the distribution of contaminants and the feasibility of removal, additional areas of sediment may be targeted for dredging.

8. On-site dewatering of dredged and excavated sediments for off-site transportation and disposal or onsite reuse, as appropriate. On-site reuse of sediments will be evaluated during design. Water removed from the sediment will be treated and discharged back to the river in compliance with regulatory requirements.

9. Backfill of dredged areas with Department-approved material. Dredged areas within the resuspension controls will be backfilled with clean material to isolate remaining contamination, prevent erosion of cap materials, restore bathymetry, and provide a habitat layer. In nearshore areas which have contamination remaining above background concentrations, isolation capping will be placed following dredging. The isolation cap will consist of a sand isolation layer; armoring layer; and a minimum of a 24 inch habitat layer. The isolation and armoring layer thicknesses and materials of the cap will be established in the remedial design. As part of the design, a river flow and deposition study will be conducted to determine approximate sedimentation rates and the acceptability that up to 12 inches of the habitat layer may fill in by natural deposition within a reasonable duration of time after installation of the remainder of the isolation cap. Additional backfill needed to reach bathymetry requirements will be placed between the erosion protection layer and habitat layer. The habitat layer will be designed to restore aquatic habitat. Dredged areas that are outside the near shore area will be backfilled with

appropriate river substrate to within 12 inches of the pre-dredge elevation provided that the sedimentation study demonstrates that sufficient deposition will occur within a reasonable time frame. All activities associated with the excavation and restoration of Hudson River sediments will meet the requirements of 6NYCRR Part 608.

10. Imposition of an institutional control in the form of an environmental easement for the NEA which will be included with the environmental easement for OU1 that will:

a. require the remedial party or site owner to complete and submit to the Department a periodic certification of institutional and engineering controls in accordance with Part 375-1.8 (h)(3);

b. allow the use and development of the controlled property for restricted residential uses as defined by Part 375-1.8(g), consistent with the OU1 ROD, as amended,, although land use is subject to local zoning laws;

c. restrict the use of groundwater and/or surface water as a source of potable or process water, without necessary water quality treatment as determined by the Department, NYSDOH or Westchester County DOH;

d. prohibit agriculture or vegetable gardens on the controlled property; and

e. require compliance with the Department approved Site Management Plan.

11. A Site Management Plan is required, which includes the following:

a. an Institutional and Engineering Control Plan that identifies all use restrictions and engineering controls for the site and details the steps and media-specific requirements necessary to ensure the following institutional and/or engineering controls remain in place and effective:
Institutional Controls: The Environmental Easement discussed in Paragraph 10 above.
Engineering Controls: The sediment containment system and cover discussed in Paragraphs 2 and 9.

This plan includes, but may not be limited to:

i. Excavation and Sediment Management Plan which details the provisions for management of future excavations in areas of remaining contamination and includes a prohibition on the construction of pile-supported structures within the Northwest Extension Area;

ii. descriptions of the provisions of the environmental easement including any land use, groundwater, and surface water use restrictions;

iii. provisions for the management and inspection of the identified engineering controls;

iv. maintaining site access controls and Department notification; and

v. the steps necessary for the periodic reviews and certification of the institutional and engineering controls.

b. a monitoring plan to assess the performance and effectiveness of the remedy. The plan will be designed to measure PCB and metals concentrations and evaluate the long-term contaminant trends in the affected media (biota, sediment, water). One goal of the monitoring program will be to determine if the remedy is successful in reducing the local contribution to PCB tissue concentrations in biota. This program will monitor the performance and effectiveness of the remedy in achieving the remedial goals established for the project and will be a component of the monitoring and maintenance of the site. The plan includes, but may not be limited to:

i. baseline sampling of biota; surficial sediment sampling; biota sampling in the vicinity of the site and at reference locations; porewater and surface water sampling in the vicinity of the site and at reference locations; shoreline and nearshore bathymetry; and habitat characterization;

ii. long-term sampling of biota; surficial sediment sampling; biota sampling in the vicinity of the site and at reference locations; porewater and surface water sampling in the vicinity of the site and at reference locations; shoreline and nearshore bathymetry; and restoration success to assess the performance and effectiveness of the remedy; and

iii. a schedule of monitoring and frequency of submittals to the Department.

c. an Operation and Maintenance Plan to ensure continued operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical components of the remedy. The plan includes, but is not limited to:

i. compliance monitoring of treatment systems to ensure proper O&M as well as providing the data for any necessary permit or permit equivalent reporting;

ii. providing the Department with required notifications and access to the site and O&M records.

Exhibit A

Nature and Extent of Contamination

This section describes the findings of the Remedial Investigation for all environmental media that were evaluated. As described in Section 6.1, samples were collected from various environmental media to characterize the nature and extent of contamination.

For each medium, a table summarizes the findings of the investigation. The tables present the range of contamination found at the site in the media and compares the data with the applicable SCGs for the site. The contaminants are arranged into two categories: pesticides/ polychlorinated biphenyls (PCBs), and inorganics (metals and cyanide). For comparison purposes, the SCGs are provided for each medium.

The former manufacturing operations within OU 1 caused the release of PCBs and metals to site soil, groundwater and sediments at the Harbor at Hastings Site. The nature and extent of contamination found in OU 1 is important to understanding the contamination found in the sediments of OU 2. The areas of concern include the Northwest Corner On-Shore Area, Building 52 outfalls, Building 15 Outfall, and Sluice Area have been identified as areas which have caused the release and discharge of contaminants from portions of OU 1 to the OU 2 sediments. These areas are shown on Figure 2.

The OU 2 portion of the site is divided into different areas which has been useful to define the nature and extent of contamination and evaluate alternatives. These areas are described below and are labeled on Figure 2.

<u>Near Shore Area</u>: The area of sediments along the shore defined by the feasible limit of resuspension controls on the west and the existing bulkhead between OU1/OU2 boundary on the east. This area is generally within 60 to 80 feet from the shoreline. This area does not include the Backwater Area or the Northwest Corner Off-Shore Area.

<u>Backwater Areas</u>: These sediment areas include the Old Marina, North Boat Slip, and South Boat Slip and are areas with lower river velocities and have been identified with increased sediment deposition.

<u>Deepwater Area</u>: Sediment areas beyond the feasible deployment of resuspension controls. The furthest extent of contamination is approximately 400 feet west of the OU 1 shoreline and 300 feet north, and adjacent to the OU1 southern boundary.

<u>Northwest Corner Off-Shore Area</u>: The area of rip rap that is offshore of the Northwest Corner On-Shore Area of OU1. This area extends approximately 100 feet from the shoreline and represents an area of approximately 0.88 acres.

<u>The Northwest Corner On-Shore Area</u>: The area of OU1 where PCB DNAPL has been found and current PCB DNAPL recovery is occurring.

Waste/Source Areas

As described in the RI and Feasibility Study reports, waste/source materials were identified at the site and are impacting sediment.

Wastes are defined in 6 NYCRR Part 375-1.2 (aw) and include solid, industrial and/or hazardous wastes. Source Areas are defined in 6 NYCRR Part 375 (au). Source areas are areas of concern at a site were substantial quantities of contaminants are found which can migrate and release significant levels of contaminants to another environmental medium. Wastes and Source areas were identified at the site in sediment areas in close proximity to outfalls and manufacturing buildings.

The highest levels of PCB in sediments at the site were found in the Northwest Corner Off- Shore Area and were associated with separate phase PCB material that varies in consistency from a fluid dense non-aqueous phase liquid (DNAPL) to an elastic material that resembles rubber cement. This PCB material is the Aroclor wire insulating mixture that was formulated in the Northwest Corner On-Shore Area of the property in Building 56. This material apparently migrated through the soil beneath the property in its fluid form and was also discharged into the Hudson River through outfalls; by runoff; and eroded surface soil from areas where wire reels were dried or stored on the site.

The PCB Material has been classified in three different physical states, the variation in the physical state of the material represents weathering changes since the material was released:

> Liquid PCB (LPCB) Material or Dense Non-aqueous Phase Liquid was observed to be amber in color, is less viscous than the Semi-Solid or Trace PCB Material and is highly to moderately mobile, readily flowing into monitoring wells when it is encountered.
>
> Semi-Solid PCB (SSPCB) Material was generally observed to be more viscous than Liquid PCB Material and appeared grayish-brown in color. Based on visual observations, SSPCB has a sticky, string-like consistency. Although not as fluid or capable of migration, large deposits of semi-solid PCBM have been identified.
>
> Trace PCB (TPCB) Material, when observed, consists of small quantities of TPCB Material intermingled with the soil and was more difficult to visually observe. Like the Semi-Solid PCB Material, the Trace PCB Material had a string-like consistency (small strings and hair-like filaments) and appeared grayer in color.

Samples containing PCB Material were found in sediments adjacent to the northwest corner of the property, as indicated on Figure 3. Samples outside this area generally contained lower levels of PCBs, indicating that the contamination is sorbed onto the sediment particles. The precise locations in the subsurface and boundaries between the different forms of PCB material is not currently known, due to the limitations to perform investigation borings to the targeted depth in the area of rip rap immediately off-shore of the site.

With limited exceptions, the depth of PCB migration in both OU1 and OU2 is controlled by the marine silt layer, which is present between 30 and 42 feet beneath the site. The surface of the marine silt, which generally tilts towards the Hudson River, is also characterized by troughs and ridges. These features may be directing the migration of the Liquid PCB Material beneath the site, creating preferential pathways and depressions where the material may pool.

Investigations beginning in 2006 and continuing into 2011 identified locations at which Liquid PCB Material is present beneath the Northwest Corner On-Shore Area shoreline in both monitoring wells and DNAPL recovery wells. Soil and sediment sampling has generally identified the PCB nature and distribution in the shoreline and sediment area. The location where PCB DNAPL was identified in monitoring and recovery wells is shown on Figure 3.

The waste/source areas identified will be addressed in the remedy selection process.

Surface Water

Surface water samples were collected during the RI from upstream and on-site locations in the Hudson River. The samples were collected to assess the surface water conditions on and off-site. The results indicate that polychlorinated biphenyls (PCBs) and lead in surface water at the site exceed the Department's Surface Water Quality Standards. Levels of PCB in Hudson River surface water were higher than the 0.001 parts per trillion (ppt) standard in all of the 5 samples taken. The highest level, 62.4 ppt, was found in the North Boat Slip area of the site. Elevated levels were also found in samples taken offshore of Dobbs Ferry, the background location (57.0 ppt), in the former marina area (52.7 ppt), and offshore of the northwest corner (46.6 ppt). The sample taken offshore of Dobbs Ferry was significantly more turbid than the others, and elevated levels seen there may have resulted from suspended material in the sample. A much lower level (18.0 ppt) was found in the south boat slip.

The PCB analysis for these samples was congener-specific, so an evaluation of Aroclor patterns was not performed. However, the highest degree of chlorination, which is consistent with the higher numbered Aroclors (eg. Aroclor 1260) found at the site, was found in the sample collected from the old marina. The lowest degree of chlorination was found in the sample collected from Dobbs Ferry, the upstream location. These results suggest that the site is a source of dissolved PCBs in the Hudson River.

Table 1 - Surface Water

Detected Constituents	Concentration Range Detected (ppb)[a]	SCG[b] (ppb) or (ppt)	Frequency Exceeding SCG
Metals			
Lead	6.3 to 23.1 ppb	8.0 ppb	2 of 4
Pesticides/PCBs			
PCBs, total	18.0 to 57.0 ppt	0.001 ppt	4 of 4

a - ppb: parts per billion, which is equivalent to micrograms per liter, ug/L, in water.
b-SCG: Ambient Water Quality Standards and Guidance Values (TOGs 1.1.1) and 6 NYCRR Part 703: Surface Water and Groundwater Quality Standards.

The primary surface water contaminants are polychlorinated biphenyls (PCBs) and lead associated with historical manufacturing and disposal at the site. The primary surface water contamination is found where high levels of PCBs were found in soils and sediments near the Northwest Corner Off-Shore Area.

Based on the findings of the Remedial Investigation, the presence of PCB in soils and sediment has resulted in the contamination of surface water. The site contaminants that are considered to be the primary contaminants of concern in surface water which will be addressed by the remedy selection process are PCBs and lead.

Sediments

Sediment samples were collected during the RI and during additional investigations from the Hudson River and at locations upstream, adjacent and downstream of the site along the Hudson River. The samples were collected to assess the potential for impacts to river sediment from the site related contaminants. The results indicate that sediment in the Hudson River exceed the Department's sediment SCGs for PCBs, copper, lead, mercury, nickel, silver and zinc. The following is a summary of the SCGs and patterns of detection for these metals and PCBs.

The highest PCB concentrations in shallow and deeper sediment were found offshore of the northwest corner of the property. The samples included PCB material identified as semisolid PCB material. Movement of PCB Material as DNAPL through the fill in OU-1 has historically occurred vertically and, to a limited extent, horizontally along the interface with the Marine Silt. It appears that there has been some historical movement of DNAPL along the Marine Silt interface near the boundary between OU-1 and OU-2. However, there are also other transport mechanisms by which PCBs were likely deposited in OU-2. For example, PCB Material was likely associated with the outfalls of pipes associated with Building 52 and other manufacturing operations on OU-1. In addition, historic activities such as the mixing of PCB manufacturing ingredients along the Northwest Corner may have resulted in the overland transport of PCBs to the River, and other historic activities along the old dock and pier structures may also have resulted in PCB deposition in river sediments. Finally, prior to the installation of the IRM in the northwest corner, PCB contaminated soils may have washed or eroded from the upland surface soils. It appears that the PCB Material moved through the more permeable fill unit and into the sediments. A conceptual model of PCB migration showing the PCB migration pathways is shown in Figure 4.

Screening Criteria for PCBs

For PCBs and other organic contaminants, the "Technical Guidance for Screening Contaminated Sediments" lists four screening values that correspond to different levels of protection. The values for these criteria were calculated using the site-specific values of organic carbon content, as directed by the guidance, and are listed in Table 3.

Remediation Goals That Account for Background Contamination

Because sediments in the lower Hudson River are widely contaminated with low levels of PCBs that exceed some of these screening criteria, background levels were factored into the development of site-specific remediation goals. Background levels of PCBs in the 10 samples taken upstream and across the river from the site ranged from non-detectable to 7.0 ppm. The sediment containing the 7.0 ppm value was re-sampled and determined to contain 1.2 ppm PCB based on re-sampling. As a result, the Feasibility Study considered 1 ppm as a remedial goal based on background conditions. It should be noted that where background concentrations that exceed risk-based criteria for toxicity and/or bioaccumulation are used as remediation goals, some ecological risk is anticipated to remain in the unremediated sediments.

Screening Criteria for Metals

New York State sediment criteria for metals are based on their toxicity to sediment-dwelling (benthic) organisms. For each metal, the following criteria were considered. Specific values are listed in Table 2.

The following effects-based values are based on observed toxicity from field studies, as reported in the literature:

Effects Range - Low (ER-L) - The level of sediment contamination that can be tolerated by most benthic organisms, but still causes toxicity to a few species.

Effects Range - Median (ER-M) - The level at which significant harm to benthic aquatic life is anticipated.

Remediation Goals That Account for Background Contamination

Because sediments in the lower Hudson River are widely contaminated with some metals that exceed effects-based levels, background levels were factored into the development of site-specific remediation goals. The site-derived background concentrations were determined based on a combined sediment data set from the 2003 Feasibility Study and "Hudson River Estuary Sediments – Metals" (NYSDEC 2009). The 90^{th} and 95^{th} percentile values of the background data set were used to determine the range of site-specific background concentrations of metals.

Copper concentrations exceeded the effects range median (ER-M) of 270 ppm in shallow sediment at three locations: offshore of the sluice discharge area, offshore of the Building 15 SPDES discharge pipe, and in the northwest area over the Fill Unit. The extent of copper concentrations in the deeper sediments was greater in comparison to the shallow sediments.

Lead concentrations also exceeded the ER-M of 218 ppm in sluice area, the northwest area over the Fill Unit, and a location off-shore. The detection of high concentrations of lead were similar to copper, but at a lesser distance from shore.

The range of mercury contamination in shallow sediments (0.018 to1.4 ppm) is similar to background levels (0.41 to 2.5). The pattern of mercury contamination shows that levels are higher near shore and near the former marina, which are both sediment deposition areas. Because mercury levels are consistent with background, and there is no pattern of mercury contamination near OU 1 source areas, mercury appears to be caused by regional or upstream contaminant sources.

Nickel exceeded the ER-M of 52 ppm in both the shallow and deeper sediments at the same locations, off-shore of the sluice and water tower areas.

Silver exceeded the ER-M of 3.7 ppm in two locations of the northwest area of the site for the shallow sediments and broad areas offshore of the south boat slip, north boat slip, and old marina for the deeper sediments. Silver was not identified as a contaminant of concern on the OU 1 property, and the pattern of silver contamination is not consistent with the presence of the on-site source areas.

Zinc exceeded the ER-M of 410 ppm offshore of the sluice area and the water tower area for the shallow sediments. The deeper sediments exceeded the ER-M offshore of the sluice, Building 15 discharge pipe, and offshore of the water tower area.

The highest concentrations of metals in sediments are found in the offshore of the sluice area, Building 15 discharge pipe, and water tower area. The concentrations of metals found in these areas are much lower past approximately 100 feet of the shoreline. The deeper sediments within 100 feet of shore, up to 6 feet, generally have higher concentrations than the shallow sediments (0- 2 feet).

Figure 5 and 6 present the areas identified with PCB and metals sediment contamination from the site.

Table 2 - Sediment

Detected Constituents	Concentration Range Detected (ppm)[a]	SCG[b] (ppm)	Frequency Exceeding SCG	Site Derived Value [c] (ppm)	Frequency Exceeding Site Derived Value
Metals					
Arsenic	1.5 – 44.4	ER-L 8.2	330 of 543		
		ER-M 70	0 of 543		
Cadmium	ND – 87.3	ER-L 1.2	376 of 574		
		ER-M 9.6	181 of 574		
Copper	ND -4301	ER-L 34	393 of 546	104 to 129	219 of 546
		ER-M 270	92 of 546		190 of 546
Lead	ND- 2,700	ER-L 46.7	359 of 523	110 to 132	153 of 523
		ER-M 218	15 of 523		105 of 523
Mercury	ND – 4.0	ER-L 0.15	360 of 492		
		ER-M 0.71	284 of 492		
Nickel	ND- 1,390	ER-L 20.9	391 of 523		
		ER-M 51.6	8 of 523		
Silver	ND -11.9	ER-L 1.0	284 of 523		
		ER-M 3.7	65 of 523		
Zinc	ND- 6,450	ER-L 150	278 of 523	203 to 234	153 of 523
		ER-M 410	35 of 523		111 of 523
PCBs					
	ND-5,200	See Table 3		1	314 of 1014

a - ppm: parts per million, which is equivalent to milligrams per kilogram, mg/kg, in sediment;
b - SCG: The Department's "Technical Guidance for Screening Contaminated Sediments."
c – Site Derived Value: Background range for metals (copper, lead and zinc) is the 90th to 95th percentile values of the metals background data set.
ER-L = Effects Range – Low and ER-M = Effects Range – Median. A sediment is considered contaminated if either of these criteria is exceeded. If the ER-M criteria are exceeded, the sediment is severely impacted. If only the ER-L is impacted, the impact is considered moderate.

Table 3 PCB Screening Criteria for Alternate Levels of Protection

LEVEL OF PROTECTION	PCB SCREENING CRITERION	FREQUENCY OF EXCEEDANCE IN SURFACE SEDIMENT (0-6")	FREQUENCY OF EXCEEDANCE IN SUBSURFACE SEDIMENT (>6")
Human Health Bioaccumulation	0.019 ppb[a]	85/153	380/863
Wildlife Bioaccumulation	34.2 ppb	85/153	380/863
Benthic Aquatic Life Chronic Toxicity	1.010 ppm	46/153	271/863
Benthic Aquatic Acute Toxicity	335 ppm[a]	0/153	21/863

These are site-specific values calculated based on the average measured organic carbon content of the sediment of 2.43%.

a - ppb: parts per billion, which is equivalent to micrograms per kilogram, ug/kg, in sediment;
a - ppm: parts per million, which is equivalent to milligrams per kilogram, mg/kg, in sediment;

Based on the findings of the Remedial Investigation, the presence of PCBs, copper, lead, mercury, nickel, silver and zinc have resulted in the contamination of sediment. The site contaminants that are considered to be the primary contaminants of concern which will drive the remediation of sediment to be addressed by the remedy selection process are PCBs, copper, zinc and lead.

Exhibit B

Description of Remedial Alternatives

Site Specific Conditions Limiting the Development of Alternatives

Geotechnical instability associated with the northwest corner is a critical factor in the development of the alternatives. Global stability refers to the ability of a slope or retaining wall to resist a rotational or sliding failure that would cause destabilization. A slope or retaining wall failure in the northwest corner would release contaminated soil into the Hudson River and cause damage to the site. It is generally recognized that the global stability factor of safety of 1.5 is the minimum allowable for design of a slope or retaining wall. The global stability factor of safety for the existing condition in the northwest corner is approximately 1.0, indicating that the slope is marginally stable. Removal of existing rip rap from along this portion of the shoreline, even temporarily, would reduce the resistance to rotational failure (the "buttressing effect"), and increase the potential for contaminant release.

Because the contamination in the Northwest Corner Off-Shore Area cannot be fully removed, the following two remedial approaches are used in the alternatives to address the unique site conditions in the Northwest Corner Off-Shore Area.

Northwest Sloped Cap: This is a subaqueous cap which provides chemical and physical isolation of contamination from the environment. The cap would be placed in layers after sufficient dredging to allow the cap's final grade to approximate the existing bathymetry.

Northwest Extension Area:

This remedial approach involves the Northwest Corner Off-Shore Area of the site which is distinguished by the presence of rip rap and PCB Material that will be contained by a proposed sealed sheet pile wall. The sheet pile wall will contain PCB Material and prevent further release into the environment, and will be filled with lightweight fill to an elevation that rises to meet the OU 1 grade. To meet the requirements of Article 15 and 6 NYCRR Part 608, the sheet pile wall alignment will be placed to minimize filling of the Hudson River while still meeting the remedial goals. The alignment is anticipated to be along the toe of the rip-rap slope. Fill behind the wall will be minimized to reach the minimal necessary elevation for remedial actions. The location of the sheet pile wall was also chosen to avoid drag down of the PCB Material (liquid or semi-solid) or creation of vertical flow pathways along sheet piles into underlying uncontaminated layers. Due to the potential presence of PCB Material throughout this area, pile-supported structures will not be permitted on the Northwest Extension. This remedial approach will require aquatic habitat mitigation for placing fill into the Hudson River.

The following alternatives were considered based on the remedial action objectives (see Section 6.5) to address the contaminated media identified at the site as described in Exhibit A:

Alternative 1: No Action

The No Action Alternative is evaluated as a procedural requirement and as a basis for comparison. This alternative leaves the site in its present condition and does not provide any additional protection to public health and the environment.

Alternative 2: Near Shore Cap and Northwest Sloped Cap

Alternative 2 includes installation of a 3-foot subaqueous cap in the near shore area with associated sediment dredging to maintain the existing bathymetry; targeted dredging and placement of a subaqueous cap or backfill in backwater and deepwater areas, as appropriate; dredging and installation of a sloped subaqueous cap in the northwest area; institutional controls and monitoring. The overall thickness of the subaqueous cap in near shore areas may allow for up to 12 inches to be deposited naturally through sedimentation. Disposal options for removed sediments include a combination of off-site disposal and potential on-site re-use in OU-1. The details and limitations for the on-site reuse will be developed during the remedial design. This alternative includes an institutional control, in the form of a site management plan, necessary to protect the sediment cap, protect public health, and monitor the environment due to contamination remaining at the site.

Present Worth: $74,400,000
Capital Cost: $65,800,000
Annual Costs: $394,000

Alternative 3: Near Shore Dredge (up to 6-feet) and Backfill and Northwest Sloped Cap

Alternative 3 includes dredging up to 6 feet in near shore areas where sediments exceed the site-specific cleanup goals listed in Table 2; placing subaqueous cap or backfill in near shore areas to restore dredged areas to existing grades, which may allow for natural deposition; targeted dredging and placement of a subaqueous cap or backfill in backwater and deepwater areas, as appropriate; dredging and installation of a sloped subaqueous cap in the Northwest Corner Off-Shore area; institutional controls; and monitoring. Disposal options for removed sediments include a combination of off-site disposal and potential on-site reuse in OU-1. The details and limitations for the on-site reuse will be developed during the remedial design. This alternative includes institutional controls, in the form of a site management plan, necessary to protect the sediment cap, to protect public health, and to monitor the environment due to contamination remaining at the site.

Present Worth: $77,900,000
Capital Cost: $69,400,000
Annual Costs: $394,000

Alternative 4: Near Shore Dredge (up to 10-feet) and Backfill and Northwest Sloped Cap

Alternative 4 includes dredging up to 10 feet in near shore areas where sediments exceed the site specific clean-up goals listed in Table 2; placing subaqueous cap or backfill in near shore areas to restore dredged areas to existing grades, which may allow for natural deposition; targeted dredging and placement of a subaqueous cap or backfill in backwater and deepwater areas, as appropriate; dredging and installation of a sloped subaqueous cap in the Northwest Corner Off-Shore area; institutional controls; and monitoring. Disposal options for removed sediments include a combination of off-site disposal and potential on-site reuse in OU-1. The details and limitations for the on-site reuse will be developed during the remedial design. This alternative includes institutional controls, in the form of a site management plan, necessary to protect the sediment cap, to protect public health, and to monitor the environment due to contamination remaining at the site.

Present Worth: $78,600,000
Capital Cost: $70,100,000
Annual Costs: $394,000

Alternative 5: Near Shore Cap with Dredge (for cap) and Northwest Extension

Alternative 5 includes installation of a 3-foot subaqueous cap in the near shore area with associated dredging to maintain the existing bathymetry; placing subaqueous cap or backfill in near shore areas to restore dredged areas to existing grades, which may allow for natural deposition ; targeted dredging in backwater and deepwater areas; extension of the Northwest Corner On-Shore Area to create an above-grade containment area; institutional controls for contaminated sediments; and long term monitoring. The Northwest Corner of the site property would be extended by installing a sealed sheet pile wall at a feasible location beyond the limits of Liquid PCB Material and backfilling it with clean material, while minimizing fill placed in the river. Disposal options for removed sediments include a combination of off-site disposal and potential on-site reuse in OU-1. The details and limitations for the on-site reuse will be developed during the remedial design. A mitigation plan would be developed and implemented to mitigate the habitat impacts associated with installation of the bulkhead wall and placement of fill into the river. This alternative includes institutional controls, in the form of a site management plan, necessary to protect public health and to monitor the environment due to contamination remaining at the site.

Present Worth: $89,000,000
Capital Cost: $79,100,000
Annual Costs:.. $454,000

Alternative 6: Near Shore Dredge (up to 6-feet) and Backfill and Northwest Extension

Alternative 6 includes dredging up to 6 feet in near shore areas where sediments exceed the site specific clean-up goals listed in Table 2; placing subaqueous cap or backfill in near shore areas to restore dredged areas to existing grades, which may allow for natural deposition; placing a subaqueous cap in backwater and deepwater areas; targeted dredging in backwater and deepwater areas; extension of the Northwest Corner as described in Alternative 5; institutional controls for contaminated sediments; and monitoring. Disposal options for removed sediments include a combination of off-site disposal and potential on-site reuse in OU-1. The details and limitations for the on-site reuse will be developed during the remedial design. A mitigation plan will be developed and implemented to mitigate the habitat impacts associated with the installation of the bulkhead wall and placement of fill into the river. This alternative includes institutional controls, in the form of a site management plan, necessary to protect public health and to monitor the environment due to contamination remaining at the site.

This alternative has been modified from the alternative developed in the FS to include additional dredging in deepwater, old marina, and north boat slip areas, as shown on Figure 7. The FS evaluated dredging in the near shore area limiting the area to be dredged to a maximum water depth of 15 feet, which represents the limit of commercially-available silt curtains. The location and types of sediment resuspension controls in greater than 15 feet of water may include other innovative and customized approaches to extend areas of dredging to approximately 100 feet from shore, or approximately 20 feet of water for targeted areas. This approach would dredge sediments in targeted areas which contain the most highly impacted sediment for PCB and metals and therefore represents a greater sediment volume than the original Alternative 6. Targeted dredging is defined for deepwater areas where resuspension controls cannot be feasibly used due to water depth and current velocities. The areas were preliminarily identified as those containing PCB contaminated sediments with greater than 50 ppm.

Present Worth: $92,600,000
Capital Cost: $82,700,000
Annual Costs:.. $454,000

Modified Alternative 6 Costs

Present Worth: $105,000,000
Capital Cost: $95,200,000
Annual Costs:.. $454,000

Alternative 7: Near Shore Dredge (up to 10-feet) and Backfill, Northwest Extension

Alternative 7 includes dredging up to 10 feet where sediments exceed the site specific cleanup goals listed in Table 2; placing subaqueous backfill in near shore areas to restore dredged areas to existing grades, which may allow for natural deposition; placing subaqueous cap in backwater and deepwater areas; targeted dredging in backwater and deepwater areas; installing a bulkhead wall (steel sheeting) beyond PCB dense non-aqueous phase liquid (DNAPL) in the Northwest Corner Area; institutional controls for contaminated sediments; and monitoring. Disposal options for removed sediments include a combination of off-site disposal and potential on-site re-use in OU-1. The details and limitations for the on-site re-use will be developed during the remedial design. Mitigation of habitat impacts due the installation of the bulkhead wall and placing fill in the river. This alternative includes institutional controls, in the form of a site management plan, necessary to protect public health and the environment from any contamination remaining at the site.

Present Worth: $93,300,000
Capital Cost: $83,400,000
Annual Costs:.. $454,000

Alternative 8: Near Shore/Backwater Dredge to Feasible Limits and Backfill, Limited Deepwater Dredging, Northwest Extension

This alternative would include dredging to the deepest feasible depth where sediments exceed the site specific clean-up goals listed in Table 2 in near shore and backwater areas; limited dredging in deepwater areas; placing subaqueous backfill in near shore, backwater, and deepwater areas, which may allow for natural deposition; installing a bulkhead wall (steel sheeting) beyond PCB dense non-aqueous phase liquid (DNAPL) in the Northwest Corner Area; institutional controls for contaminated sediments; and monitoring. The feasible dredging depth is defined as dredging all sediments that exceed site-specific clean-up levels to constructable limits. Disposal options for removed sediments include a combination of off-site disposal and potential on-site re-use in OU-1. The details and limitations for the on-site re-use will be developed during the remedial design. Mitigation of habitat impacts due the installation of the bulkhead wall and placing fill in the river. This alternative includes institutional controls, in the form of a site management plan, necessary to protect public health and the environment from any contamination remaining at the site.

Present Worth: $185,000,000
Capital Cost: $179,000,000
Annual Costs:.. $272,000

Alternative 9: Dredge to Feasible Limits in All OU-2 Areas and Backfill, Northwest Sloped Cap

This alternative would include dredging to feasible limits where sediments exceed the site specific clean-up goals listed in Table 2; placing subaqueous backfill in near shore, backwater and deepwater areas, which may allow for natural deposition; monitoring. The feasible limit to dredging in the Northwest Corner Off-Shore Area is based on driving steel sheeting along the toe of the rip rap to control DNAPL migration and removing all sediments that exceed site-specific cleanup levels to constructable limits. Sediment remaining in the Northwest Corner Off-Shore Area would be capped with a subaqueous cap. Disposal options for removed sediments include a combination of off-site disposal and potential on-site re-use in OU-1. The details and limitations for the on-site reuse will be developed during the remedial design. This alternative includes institutional controls, in the form of a site management plan, necessary to protect public health and the environment from any contamination identified at the site. The remedy will not rely on institutional or engineering controls to prevent future exposure. There is no Site Management, no restrictions, and no periodic review.

Present Worth: $245,000,000
Capital Cost: $242,000,000
Annual Costs:... $174,000

Exhibit C
Remedial Alternative Costs

Remedial Alternative	Capital Cost[1] ($)	Annual Costs ($)	Total Present Worth[1] ($)
1. No Action	0	0	0
2. Near Shore Cap and Northwest Sloped Cap	$65,800,000	$394,000	$74,400,000
3. Near Shore Dredge (up to 6-feet) and Backfill and Northwest Sloped Cap	$69,400,000	$394,000	$77,900,000
4. Nearshore Dredge (up to 10-feet) and Backfill and Northwest Sloped Cap	$70,100,000	$394,000	$78,600,000
5. Nearshore Cap with Dredge (for cap) and Northwest Extension	$79,100,000	$454,000	$89,000,000
6. Nearshore Dredge (up to 6-feet) and Backfill and Northwest Extension	$82,700,000 ($95,200,000)[2]	$454,000	$92,600,000 ($105,000,000)[2]
7. Nearshore Dredge (up to 10-feet) and Backfill, Northwest Extension	$83,400,000	$454,000	$93,300,000
8. Nearshore/Backwater Dredge to Feasible Limits and Backfill, Limited Deepwater Dredging, Northwest Extension	$179,000,000	$272,000	$185,000,000
9. Dredge to Feasible Limits in All OU-2 Areas and Backfill, Northwest Sloped Cap	$242,000,000	$174,000	$245,000,000

1 Capital Cost and Annual Costs include a 30% contingency in calculating Total Present Worth

2 Modified Alternative 6 includes additional dredging in the following areas and increases the costs presented in Feasibility Study as follows:

Old Marina	6,000 $yards^3$ with an estimated cost of $600/ $yards^3$= $3,600,000
North Boat Slip	3,500 $yards^3$ with an estimated cost of $600/ $yards^3$= $2,100,000
Deepwater Areas for >50 ppm PCBs	4,700 $yards^3$ with an estimated cost of $1,200/ $yards^3$= $5,640,000

Exhibit D

SUMMARY OF THE SELECTED REMEDY

The Department has selected modified Alternative 6, Near Shore Dredge (up to 6 feet) and Backfill and Northwest Extension as the remedy for this site. The elements of this remedy are described in Section 7. The selected remedy is depicted in Figure 7.

Basis for Selection

The selected remedy is based on the results of the RI and the evaluation of alternatives. The criteria to which potential remedial alternatives are compared are defined in 6 NYCRR Part 375.

The modified Alternative 6 was selected because, as described below, it satisfies the threshold criteria and provides the best balance of the balancing criteria described below. It achieves the remediation goals for the site by removing sediment containing greater than 1 ppm PCB and metals exceeding background from the near shore and backwater areas, where the potential for public health and environmental exposures are most likely. Dredging to a depth of 6 feet removes sediment that has the potential to be scoured and migrate, and thus represents an exposure pathway for human and environmental receptors. In deepwater areas, where dredging activities cannot be fully contained, the selected remedy removes PCBs in targeted areas at a higher threshold of 50 ppm up to a depth of 6 feet, thereby removing the highest levels of PCBs from the Hudson River environment. Targeting deepwater areas with PCBs above 50 ppm reduces the time needed to complete dredging activities when compared to deepwater areas above 1 ppm. While this action does not eliminate ecological exposures, it does limit the potential for construction-related impacts associated with disturbance to the river bottom and migration of suspended sediments. The majority of targeted PCB dredging areas identified in the deepwater are within the top two feet. Therefore, the targeted dredging will remove sediments which have the highest levels of PCBs and the greatest potential to migrate and be an on-going source to the environment.

In the Northwest Corner Off-Shore Area, where the full depth of sediment contamination cannot be feasibly excavated without destabilizing the shoreline, the selected containment of the area using sealed sheet piles provides the greatest degree of long term effectiveness by containing the material with the highest levels of PCBs. This extension also enables the more effective removal of Liquid PCB Material from the source area beneath the Northwest Corner On-Shore and Northwest Corner Off-Shore areas by creating a land platform to support additional investigation and removal activities. The sheet piles will be driven along an alignment that is known to be free of liquid or semi-solid PCBs, ensuring that drag down or migration of PCBs into the clean Basal Sand aquifer will not occur. Groundwater passing through the Northwest Corner On-Shore Area will be treated before entering the Hudson River, providing a higher degree of environmental protection and reliability than alternatives that rely on capping the Northwest Corner Off-Shore Area sediments in place. While creation of this filled area in the river results in greater impacts than the capping alternative in terms of loss of habitat, the need to eliminate environmental exposure to the PCBs in this area has been deemed to outweigh the loss of habitat. A mitigation plan will be developed and implemented to mitigate the habitat impacts associated with the installation of the bulkhead wall and placement of fill into the river.

Overall, Alternative 6 is an effective remedy which removes and isolates significant portions of the contamination from the environment that has the potential for exposure to the greatest feasible degree. The remaining known PCB material within the NEA is contained by a structure that provides the highest degree of environmental protection and reliability, and the greatest opportunity for removal of the most mobile material. This alternative creates the conditions necessary for the restoration of surface water and sediment to the extent practicable when it is integrated with the remedy for OU1.

The first two evaluation criteria are termed "threshold criteria" and must be satisfied in order for an alternative to be considered for selection.

1 Protection of Human Health and the Environment. This criterion is an overall evaluation of each alternative's ability to protect public health and the environment.

Alternative 1, the No Action Alternative would not be protective of human health or the environment since it would not achieve remediation goals described in Section 6.5.

Alternatives 2 through 4 provide increasing protection for human health and the environment by removing sediment which exceeds cleanup levels for PCBs and metals. These three alternatives are comparable to Alternatives 5 through 7 because of the same depth of sediment removal outside of the Northwest Corner Off-Shore Area. Alternatives 2 through 4 and 5 through 7 involve the same increasing depths of sediment removal of up to 3, 6 and 10 feet, respectively. The removal of 3 feet of contaminated sediment would leave a greater amount of contaminated sediment than the removal of 6 feet of sediment. The removal of contaminated sediment to a depth of 6 feet provides greater overall protection by reducing the potential for sediment resuspension due to human activities or an extreme erosion event. Because sediment between 6 and 10 feet is not expected to migrate or become exposed, the removal of up to 10 feet of sediment would not provide a substantial increase in environmental protection in comparison to removing 6 feet of sediment. Alternative 6 provides the best balance in the level of protection for the Near Shore sediment because the highest levels of contamination will be removed.

For Alternatives 5 through 8, the installation of the sheet pile wall around the Northwest Extension is more protective of human health and the environment in comparison to the capping evaluated for the Northwest Corner Off-Shore Area in Alternatives 2 through 4 and 9. The sheet pile wall provides better overall protection of public health and the environment than the capping alternatives by more effectively containing PCB DNAPL; enhancing PCB DNAPL recovery options; and preventing PCB contaminated groundwater from entering the Hudson River. By minimizing the further release of PCBs to the Hudson River, the sheet pile wall will prevent site-related contributions to exceedances of surface water standards that contribute to the current PCB contamination in fish tissues in the vicinity of the site. However, installation of the sheet pile and creation of the filled area in the river does result in greater habitat impacts than the capping alternative, which will require mitigation.

Alternative 9 includes an area of extensive deepwater dredging which provides the highest degree of protection for human health and the environment because it would remove a greater extent of contamination that could potentially cause impacts at its current location. However, the substantially increased cost of this alternative ($140 million) is not justified, especially considering the increased short-term risks to the environment due to extensive dredging without turbidity control which could mobilize contaminated sediment to other areas.

2. Compliance with New York State Standards, Criteria, and Guidance (SCGs). Compliance with SCGs addresses whether a remedy will meet environmental laws, regulations, and other standards and criteria. In addition, this criterion includes the consideration of guidance which the Department has determined to be applicable on a case-specific basis.

The primary chemical specific SCGs for the site are the surface water quality standards and sediment screening guidance values. The No Action Alternative would not meet these criteria because groundwater discharging into the

Hudson River would continue to materially contribute to the contravention of the PCB surface water standard. The PCB and metals concentrations found in sediments also exceed the guidance values for screening contaminated sediments and as well as site-specific background sediment concentrations. Therefore, Alternative 1 is rejected as a potential candidate for a remedy for OU 2 because it would not meet the threshold criteria of protecting public health and the environment and would not achieve the SCGs for surface water and sediment.

Alternatives 2 through 4 and 9 would not be as effective in complying with the PCB surface water standard in the Northwest Corner Off-Shore Area, as compared to Alternatives 5 through 8. The capping alternatives (Alternatives 2, 3, 4, and 9) would continue to allow the flow of groundwater through highly contaminated sediment and fill with subsequent discharge into the Hudson River. The resulting desorption of PCBs from sediment into the water column, which currently contributes to the contravention of PCB surface water standards, would continue. Because Alternative 9 removes greater depths of sediment in the different areas, it complies with the SCG for the sediment source to the greatest extent for the alternatives which involve capping the Northwest Off-Shore Area. Alternatives 5 through 8 are more effective at complying with the surface water standard through the installation of a sealed sheet pile wall to contain PCB in the Northwest Extension and treat the groundwater contamination. Groundwater will pass through gates in the wall and will be treated to remove PCBs before it passes into the river. These alternatives will therefore provide a higher degree of surface water protection than Alternatives 2 through 4 and 9. Because Alternative 8 removes greater depths of sediments, it complies with the SCG for the sediment to the greatest extent for the alternatives that involve construction of the Northwest Extension.

Alternatives 2 and 5, which remove 3 feet of sediment, would leave behind a greater mass of PCB and metals which exceed the sediment background and screening guidance concentrations. Alternatives 3 and 6, which remove up to 6 feet of sediment, would address the PCB and metals which exceed the sediment background and screening guidance concentrations to a greater degree than Alternatives 2 and 5. Alternative 4 and 7, which remove up to 10 feet of sediment, would address the PCB and metals which exceed the sediment background and screening guidance concentrations to a greater degree than Alternative to 3 and 6.

In addition, the alternatives will need to meet the substantive requirements of the applicable location-specific SCGs found in 6NYCRR Part 608 Use and Protection of Waters and Environmental Conservation Law Article 15 due to the dredging and filling in the Hudson River. These requirements apply most significantly to Alternatives 5 through 8 because of the construction of the Northwest Extension and associated filling of approximately 0.88 acres of the Hudson River. The allowance for filling the River is based on the findings of the stability analysis and the engineering determination that it is not feasible to address the PCBs in the northwest corner of the site without the Northwest Extension. The NEA extension will be designed to minimize the filling of the Hudson River; however, creation or restoration of river habitat will be required to mitigate for the placement of fill in the river.

The next six "primary balancing criteria" are used to compare the positive and negative aspects of each of the remedial strategies.

3. Short-term Effectiveness. The potential short-term adverse impacts of the remedial action upon the community, the workers, and the environment during the construction and/or implementation are evaluated. The length of time needed to achieve the remedial objectives is also estimated and compared against the other alternatives.

The short-term impacts to the community, workers, and environment for Alternatives 2 through 4 and 5 through 8 generally increase, and are proportional, to the additional material handling activities (dredging, capping and containment work) performed. These impacts include noise, air emissions, resuspension of contaminated sediment from dredging and truck traffic. Alternatives 8 and 9 would have the greatest short-term impacts due to the greater area dredged and volume of sediment handled. The short term impacts from noise, air emissions, and resuspension would be controlled by monitoring and mitigation measures to protect human health and the environment and will be identified in the remedial design. Alternative 2 would have fewer short term impacts than Alternatives 3 and 4 for the dredging and capping alternatives. Alternatives 5 would have fewer short term impacts than alternatives 6 and 7 for the dredging, capping and containment alternatives.

The FS evaluated dredging in the near shore area limiting the area to be dredged to a maximum water depth of 15 feet, which represents the limit of commercially-available silt curtains. The location and types of sediment resuspension controls in greater than 15 feet of water may include other innovative and customized approaches to extend the area of dredging to approximately 100 feet from shore, or approximately 20 feet of water. The additional targeted dredging to approximately 100 feet from shore has the potential to increase the short term environmental impacts, but will increase long term effectiveness and overall environmental protection, provided the short term impacts can be controlled with the alternative approaches.

Short term environmental impacts with PCB resuspension for the dredging and capping Alternatives 2 through 4 and 9 will be greater than Alternatives 5 through 8 in the Northwest Corner Off-Shore Area. These short term impacts are greater because they involve dredging high levels of PCB sediment in the Northwest Corner Off-shore Area to install the cap as compared to containing the same area with the sealed sheet pile.

The short term environmental impacts of dredging in Deepwater Areas were also evaluated because complete resuspension control will not be feasible due to the water depths and velocities. Partial resuspension controls are available in the form of mobile containment systems that are suspended from dredging barges. These provide limited reductions in particle migration from the dredge, but are limited to the upper portion of the water column. The short term impacts for dredging PCB contaminated sediment in limited targeted Deepwater Areas (greater than 50 ppm PCB) in Alternatives 2 thorough 8 will provide long-term benefits by removing concentrated areas of PCBs, particularly in shallow sediments that are most vulnerable to migration and exposure.

4. Long-term Effectiveness and Permanence. This criterion evaluates the long-term effectiveness of the remedial alternatives after implementation. If wastes or treated residuals remain on-site after the selected remedy has been implemented, the following items are evaluated: 1) the magnitude of the remaining risks, 2) the adequacy of the engineering and/or institutional controls intended to limit the risk, and 3) the reliability of these controls.

Alternatives 2 through 4 would provide long-term effectiveness and permanence in increasing order by providing greater removal and capping of increased quantities of sediment. The capped or backfilled sediment layer represents a source of risk that is proportional to the remaining sediment contamination and its respective depth below the sediment surface. Of these alternatives, Alternative 2 will have the least long-term effectiveness and Alternative 4 will have the greatest for the capping alternatives. A monitoring and maintenance program will insure the reliability, but there are potential challenges to maintaining a cap at this location. There is the potential need to repair or replace portions of the cap if it is damaged or if contaminant breakthrough would occur, particularly for the PCB DNAPL beneath the Northwest Corner Off-Shore Area for Alternatives 2 through 4. Contaminant breakthrough is less likely where greater quantities of contaminated sediment are removed and there is a greater thickness of the cap or backfill materials placed over the remaining contaminated sediment. Additionally, the Department has concerns for the long-term stability of the northwest corner that are not addressed under Alternatives 2 through 4.

Alternatives 5 through 8 provide greater long-term effectiveness and permanence in increasing order of the alternative by the containment of PCB DNAPL in the Northwest Extension and dredging of sediments to greater depths. There is an increase in the long-term reliability for the alternatives which remove greater quantities of contaminated sediment. The remaining source of risk from the sediments is directly proportional to the remaining sediment contamination and the respective depth below the sediment surface. Alternative 5 will have the greatest potential for long-term risk and alternative 8 will have the least potential. The sealed sheet pile wall in the Northwest Extension provides the greatest degree of long term effectiveness for containment of the highest levels of PCBs without compromising the geotechnical stability of this area. The extension area also enables the greatest removal of Liquid PCB Material from the source area beneath the Northwest Corner Off-Shore Area by creating a land platform to support delineation and removal activities. The sealed sheet pile wall in the Northwest Extension is considered to be more effective and permanent to control both Liquid PCB Material migration and dissolved groundwater contamination as compared to the sloped shoreline and capping approach in Alternative 9. Monitoring of habitat and biota will be required to ensure the long-term effectiveness of the remedy. However, installation of the sheet pile and creation of the filled area in the river does result in additional ecological impacts because of the loss of habitat.

The removal of up to 6 feet of PCB and metals contaminated sediment in Alternative 6 is more permanent and effective in the long-term due to the removal of greater quantities of PCB and metals contaminated sediments than Alternatives 5. This significantly and permanently reduces the potential for migration of site-related contaminants through erosion, resuspension and re-distribution of sediments, including, but not limited to those mobilized during extreme events or human activities.

Alternative 9 includes extensive deepwater dredging area which will increase short-term impacts due to dredging without turbidity control and migration of contaminated sediment to other areas, however, the long-term impacts will be reduced by removal of the greater volume of contaminated sediment.

5. Reduction of Toxicity, Mobility or Volume. Preference is given to alternatives that permanently and significantly reduce the toxicity, mobility or volume of the wastes at the site.

The alternatives under consideration reduce the mobility of contamination by removing metal and PCB-contaminated sediments from the river system and placing them in secure upland areas and/or landfills. Alternatives that remove greater quantities of sediment provide a greater reduction in potential mobility. However, because the potential for sediment scour at depths greater than 6 feet is less than for surficial sediments, there is little additional reduction in mobility provided by Alternatives 4 and 7 as compared to Alternatives 3 and 6. The toxicity, mobility and volume of wastes at the site are reduced to the degree that Liquid PCB Material is removed from the Northwest Corner Off-Shore Area and destroyed off-site. As a result Alternatives 5 through 8, which include the Northwest Extension and a greater opportunity to remove Liquid PCB Material, would reduce the toxicity, mobility and volume of the PCB DNAPL to a greater degree than Alternatives 2 through 4 and 9. For PCBs that cannot be removed using recovery wells, the sealed sheet pile wall of the Northwest Extension (Alternatives 5 through 8) also provides a greater reduction in mobility than capping the Northwest Corner Off-Shore Area (Alternatives 2 through 4 and 9).

6. Implementability. The technical and administrative feasibility of implementing each alternative are evaluated. Technical feasibility includes the difficulties associated with the construction of the remedy and the ability to monitor its effectiveness. For administrative feasibility, the availability of the necessary personnel and materials is evaluated along with potential difficulties in obtaining specific operating approvals, access for construction, institutional controls, and so forth.

Dredging sediment for all alternatives poses implementation challenges related to water depths and flow dynamics, resuspension control and monitoring, and debris management. Proven technologies such as energy and turbidity barriers, real-time turbidity monitors and a variety of dredging equipment are available to address these challenges. The OU 1 site property provides a large staging area for managing the sediments. The location of the site on a major navigable waterway and adjacent to a rail line greatly expands opportunities for dredged material transport. The major construction differences between alternatives involves the installation a sloped shoreline (Alternatives 2, 3, 4, and 9) versus a sheet pile wall (Alternatives 5, 6, 7, and 8) in the Northwest Corner Off-Shore Area; the depth for dredging sediments; and deepwater dredging. Both groups of alternatives are implementable and acceptable from a geotechnical perspective by using readily available, materials, equipment, and construction practices.

Alternatives 5 through 8 are more challenging to construct because they require the off-shore construction of a large bulkhead wall requiring heavy king pile construction; associated tie-rods and deadman system; and a corrosion protection system. The tie-rod and deadman system will need to be designed to accommodate settlement. Both groups of alternatives will require monitoring and maintenance to add fill for areas that experience settlement. For Alternatives 2, 3, 4, and 9 in Northwest Sloped Cap will require additional construction of erosion protection for wave, ice and potential scouring events to protect the capped areas. The maintenance of the sheet pile wall for repairs and cathodic protection is more specialized in comparison to the sloped shoreline.

Dredging contaminated sediments at deeper depths will require the same monitoring as for the shallower depths of dredging. Sediment resuspension controls will be used during dredging which are designed for the appropriate water depth and velocity conditions at the site. Dredging in the deepwater areas will be performed with limited resuspension controls in targeted areas, which may require site-specific evaluations to implement. Alternative 9, which requires extensive dredging in the Deepwater Areas is the most difficult alternative to implement.

The ability to monitor the effectiveness of the alternatives is more difficult for the Northwest Sloped Cap shoreline in Alternatives 2, 3, 4 and 9. The monitoring will need to determine if PCB breakthrough of the cap over the sloped shoreline area is occurring.

Both groups of alternatives will require a permit from the United States Army Corps of Engineers for construction within the in the navigable waters of the Hudson River. The administrative implementability is more challenging for Alternatives 5, 6, 7, and 8 than for Alternatives 2, 3, 4 and 9 due to the construction of the Northwest Extension into the Hudson River. Permitting and approvals will be required from local and federal agencies for all alternatives that involve fill being placed into the Hudson River and the installation of the sheetpile wall.

7. Cost-Effectiveness. Capital costs and annual operation, maintenance, and monitoring costs are estimated for each alternative and compared on a present worth basis. Although cost-effectiveness is the last balancing criterion evaluated, where two or more alternatives have met the requirements of the other criteria, it can be used as the basis for the final decision.

The no action alternative would be the least expensive to implement since there would be no cost associated with its implementation.

The costs associated with the alternatives for this site are substantial, and range from $74.4 to $245 million due to the size and complex nature of the site conditions. Alternatives 2 through 9 involve increasing present worth costs which vary with the extent of dredging, capping, backfilling, creating the Northwest Extension, and monitoring. These costs increase with the volume of material dredged and disposed. In general, Alternatives 2 through 4 have a lower present worth cost ($74.4 to $78.6 million) in comparison to Alternatives 5 through 7 ($89 to $93 million). The major reason for the increase in cost between the two sets of alternatives involves the higher cost to construct the Northwest Extension as compared to the installation of the Northwest Sloped Cap. However the extension of land is cost effective because the sealed sheet piles provides a greater degree of long term effectiveness for containment of the highest levels of PCBs. This extension also enables the greatest removal of Liquid PCB Material from the source area beneath the Northwest Corner On-Shore Area by creating a land platform to support delineation, monitoring and removal activities.

Table 4 provides a summary of the total costs of Alternatives 2 through 9 with several measures of cost-effectiveness. The costs increase proportionally for dredging PCB and metals contaminated sediments at greater depths. The present worth cost for Alternative 3 is $3.5 million greater than Alternative 2 due to the additional sediment dredging depth (6 feet versus 3 feet) and material handling. Alternative 3 removes roughly the same amount of PCBs as Alternative 2 (2,610 pounds versus 2,590 pounds), but more than twice the amount of copper (19,440 pounds versus 8,240 pounds). The increased present worth cost for Alternative 4 is $0.7 million over Alternative 3 and removes the same amount of PCB and slightly more copper.

Of the alternatives that include the Northwest Extension, the present worth cost of Alternative 6 is $16 million greater than Alternative 5 for the additional sediment dredging depth and material handling. Alternative 6 removes roughly the same amount of PCB as Alternative 5 (610 pounds versus 590 pounds), but more than twice the amount of copper (18,240 pounds versus 7,040 pounds). The increased present worth cost for Alternative 7 is $4.3 million and represents removal of the same amount of PCB as Alternative 6 and a slight increase (1,000 pounds) in the amount of copper contaminated sediment. These estimates represent dredging to a maximum water depth of 15 feet. Other temporary containment approaches may extend the area of dredging to approximately 100 feet from shore and would similarly increase the estimated volume of sediment in each alternative.

The total present worth costs for Alternative 8 and Alternative 9 are $185 and $245 million, respectively. While these alternatives provide for greater sediment dredging and disposal, they are not considered cost effective due to the substantial increase in capital costs relative to the additional environmental benefit.

Table 4: Cost Effectiveness Measures of Alternatives 2 through 9

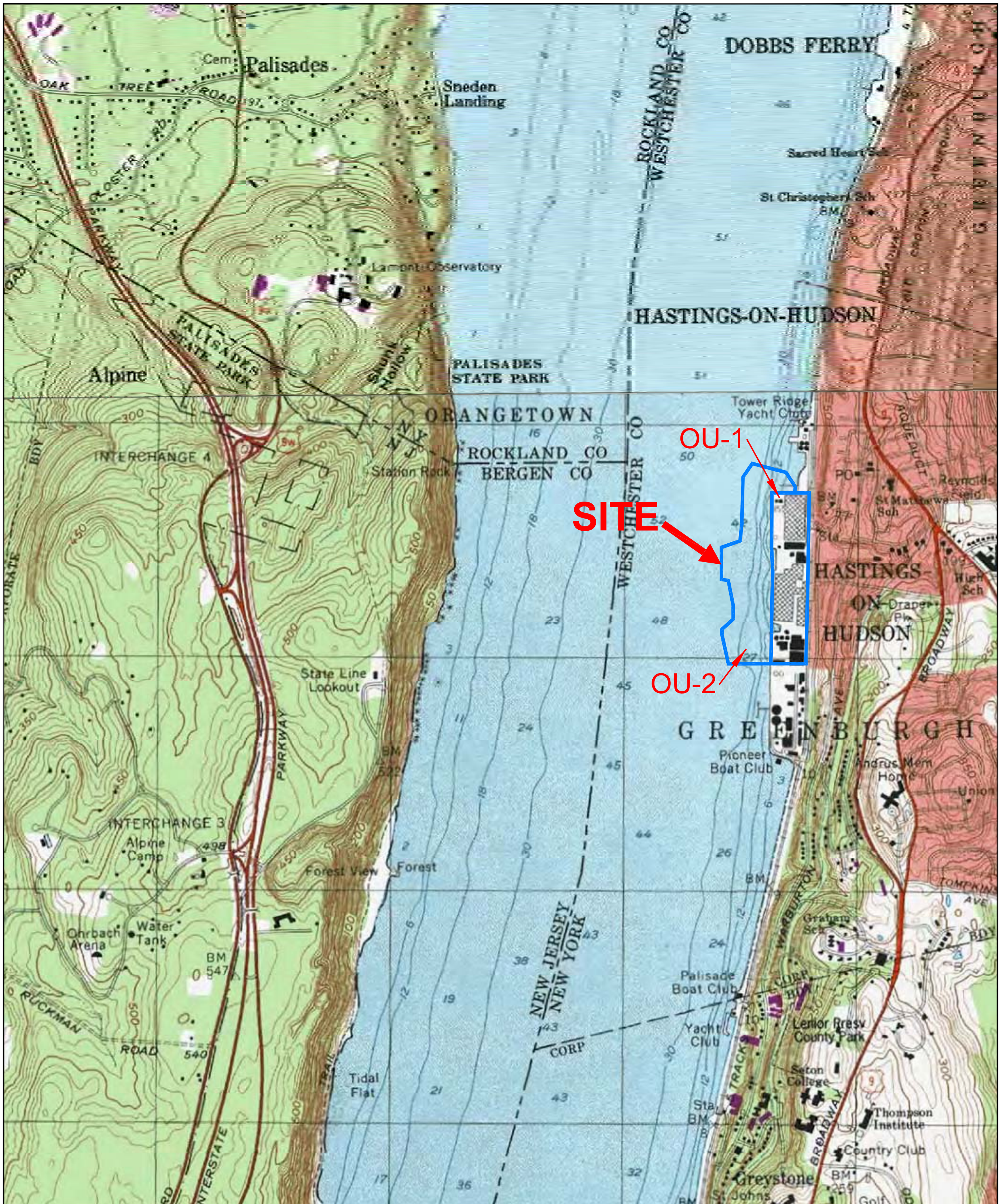
Alternative	Depth of Sediment Removal and volume[2]	Estimated PCB mass removal (contained) and percentage	Estimated Copper mass removal and percentage	Estimated Lead mass removal and percentage	Cost
2	3 feet 15,800 yd^3	2,590 lbs 25%	8,240 lbs 11%	10,100 lbs 45%	$74, 400,000
3	Up to 6 feet 22,400 yd^3	2,610 lbs 25%	19,440 lbs 27%	12,800 lbs 48%	$77,900,000
4	Up to 10 feet 23,300 yd^3	2,610 lbs 25%	20,440 lbs 29%	14,300 lbs 64%	$78,600,000
5[1]	3 feet 12,900 yd^3	590 lbs 6%	7,040 lbs 10%	8,600 lbs 39%	$89,000,000
6[1]	Up to 6 feet 19,500 yd^3	610 lbs 6%	18,240 lbs 25%	11,200 lbs 50%	$92,600,000 ($105,000,000)
7[1]	Up to 10 feet 20,800 yd^3	610 lbs 6%	19,240 lbs 27%	12,700 lbs 57%	$93,000,000
8[1] (NWE)	Greatest extent practicable nearshore and backwater areas 98,700 yd^3	3,000 lbs 29%	41,020 lbs 57%	19,400 lbs 87%	$185,000,000
9 (NW Slope)	Greatest extent practicable 168,300 yd^3	10,460 lbs 100%	71,500 lbs 100%	22,200 lbs 100%	$245,000,000

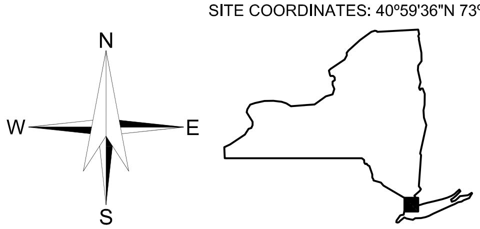
[1] Alternatives which include the Northwest Extension will contain approximately 2,000 pounds of PCBs within the sheetpile wall
[2] The estimated volume of sediment removed assumed dredging to a maximum water depth of 15 feet. Targeted dredging in deepwater areas would increase the estimated volume of sediment in each alternative.

The final criterion, Community Acceptance, is considered a "modifying criterion" and is taken into account after evaluating those above. It is evaluated after public comments on the Proposed Remedial Action Plan have been received.

8. Community Acceptance. Concerns of the community regarding the investigation, the evaluation of alternatives, and the PRAP are evaluated. A responsiveness summary has been prepared that describes public comments received and the manner in which the Department will address the concerns raised.

Alternative 6 has been selected because, as described above, it satisfies the threshold criteria and provides the best balance of the balancing criterion.





SITE COORDINATES: 40º59'36"N 73º53'9"W

U.S.G.S. QUADRANGLE: HASTINGS-ON-HUDSON, NEW YORK

HALEY & ALDRICH

NYSDEC SITE #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

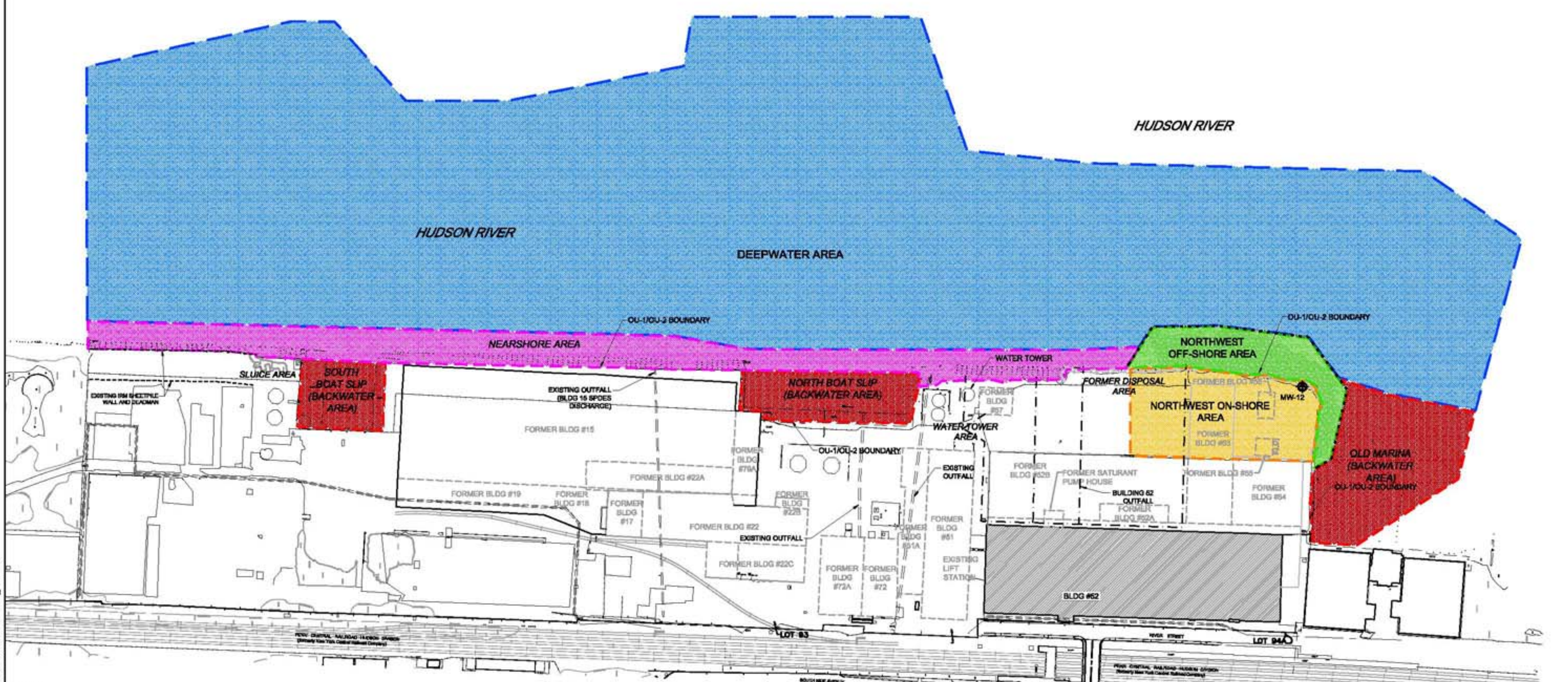
Site Location

PROJECT LOCUS

SCALE: 1:24000
MAY 2011

FIGURE 1

G:\PROJECTS\28612\250 - RFI\CAD\PLAN VIEWS & SECTIONS\28612-LOCUS_D1.DWG



LEGEND:

- RAIL ROAD
- EXISTING STRUCTURES
- RIP-RAP
- BUILDING 52 OUTFALLS
- EXISTING OFFSITE OUTFALLS
- MONITORING WELL
- DEEPWATER AREA
- NEARSHORE AREA
- NORTHWEST OFF-SHORE AREA
- NORTHWEST ON-SHORE AREA
- BACKWATER AREA

NOTES:

1. BASE PLAN PROVIDED BY BOSWELL ENGINEERING DRAWING NO. 04-209-MW (01/27/2006).
2. OTHER SITE FEATURES BASED ON VARIOUS HISTORICAL DOCUMENTS.
3. NUMEROUS MONITORING WELLS ARE LOCATED ON SITE. HOWEVER, ONLY MW-12 IS SHOWN AS IT IS THE FIRST LOCATION WHERE LIQUID PCB MATERIAL WAS OBSERVED.
4. MEAN HIGH AND MEAN LOW WATER ARE EL. +2.2 AND EL. -2.0, BASED ON HISTORICAL SITE REPORTS.
4. THE OU-2/OU-1 BOUNDARY IS LOCATED AT THE MHW.

0 200 400
SCALE IN FEET

HALEY & ALDRICH

NYSDEC SITE #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

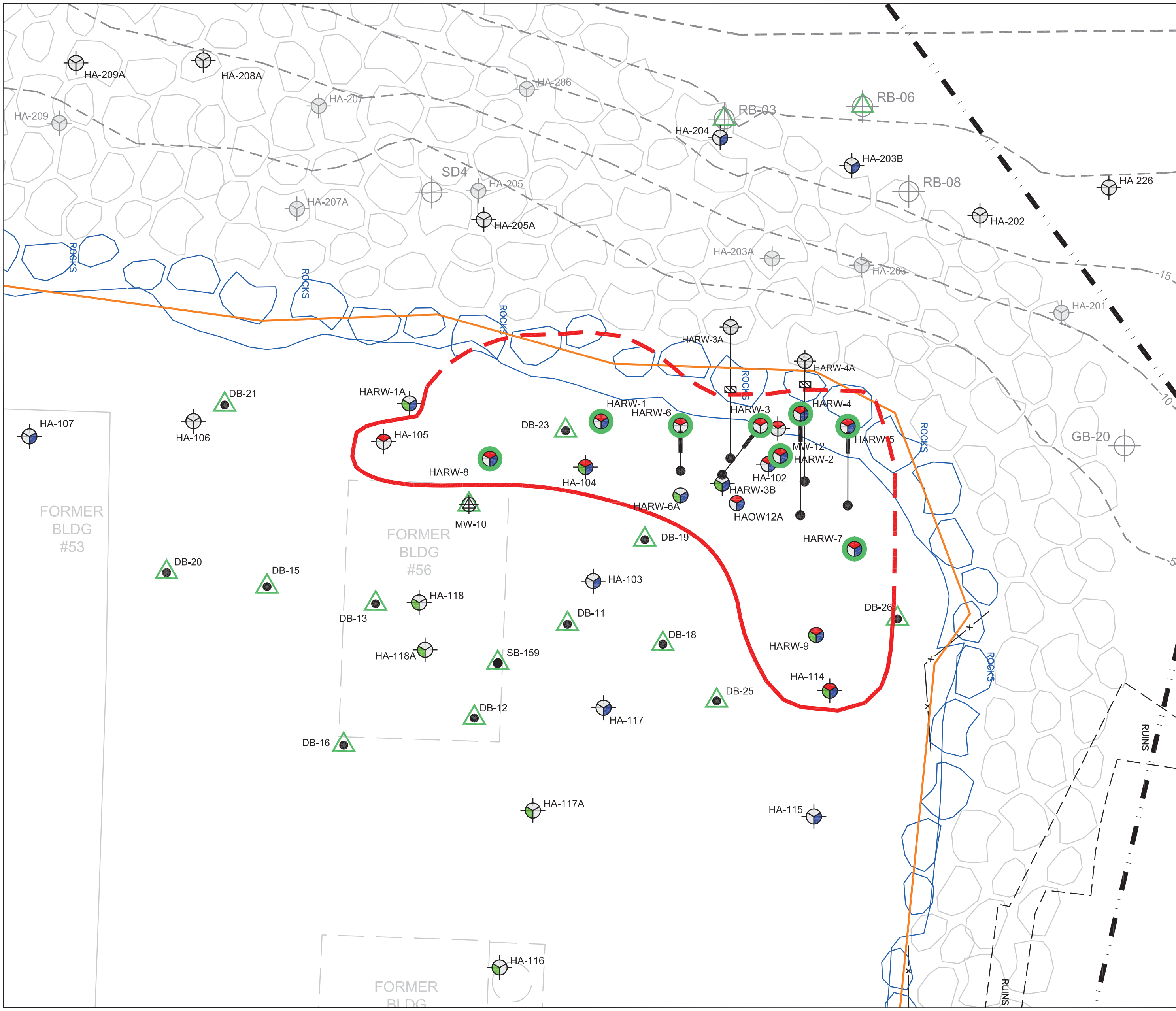
Site Features

OU-2 SITE PLAN WITH AREA DESCRIPTIONS

SCALE: AS SHOWN
MAY 2011

FIGURE 2

G:\PROJECTS\28612\250 - RFS\CAD\PLAN VIEWS & SECTIONS\28612-OU-2 SITE PLAN_D2.DWG



LEGEND:

- EXISTING STRUCTURES
- DNAPL BARRIER
- OU-2/OU-1 BOUNDARY
- APPROXIMATE ASSUMED RECOVERAL DNAPL EXTENTS
- INVESTIGATED RECOVERABLE DNAPL EXTENTS
- RIP-RAP
- POTENTIAL FORMER WOODEN BULKHEAD
- EXPLORATION LOCATION TO MARINE SILT INTERFACE
- EXPLORATION LOCATION WHERE MARINE SILT WAS NOT ENCOUNTERED DUE TO REFUSAL
- MONITORING WELL LOCATION
- HISTORICAL SAMPLE LOCATION (DEPTH VARIES)
- HISTORICAL SAMPLE LOCATION (DEPTH VARIES)
- ANGLED EXPLORATION LOCATION
- ANGLED WELL LOCATION WITH SCREENED INTERVAL

SAMPLE LEGEND:

LIQUID PCB MATERIAL
SEMISOLID PCB MATERIAL
TRACE PCB MATERIAL

- LIQUID PCB MATERIAL OBSERVED
- SEMISOLID PCB MATERIAL OBSERVED
- TRACE PCB MATERIAL OBSERVED
- NO PCB MATERIAL OBSERVED
- INFERRED POTENTIAL PCB MATERIAL LOCATION
- RECOVERY WELL

NOTES:

1. BASE PLAN PROVIDED BY BOSWELL ENGINEERING DRAWING NO. 04-209-MW (01/27/2006).
2. HISTORICAL SURVEY INFORMATION PROVIDED BY PARSONS IN JULY 2005.
3. MEAN HIGH AND MEAN LOW WATER ARE EL. +2.2 AND EL. -2.0, BASED ON HISTORICAL SITE REPORTS.
4. RIP-RAP DESIGNATION IN THE RIVER IS BASED ON INTERPRETATION OF SIDE SCAN SONAR DATA PROVIDED BY AQUASURVEY INC. IN NOVEMBER 2007.
5. HA-100 SERIES BORING LOCATIONS ON SHORE SURVEYED BY BOSWELL ENGINEERING IN SEPTEMBER 2007 & APRIL 2008.
6. HA-200 SERIES BORING LOCATIONS OFF SHORE WERE LOCATED USING A GLOBAL POSITIONING SYSTEM.
7. CURRENTLY AVAILABLE DATA COLLECTED DURING DNAPL IRM PILOT TESTS, SUPPLEMENTAL NORTHWEST CORNER INVESTIGATION AND HISTORIC BORINGS.

0 10 20 30 40
SCALE IN FEET

HALEY & ALDRICH

NYSDEC SITE #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

PCB MATERIAL LOCATIONS AND DNAPL EXTENTS IN THE NORTHWEST CORNER

SCALE: AS SHOWN
SEPTEMBER 2011

FIGURE 3

G:\PROJECTS\28612\250 - RFS\COMMUNICATIONS\2011-09-29 DEC FIGURE\28612-PCB MATERIAL EXTENTS_DF.DWG

Figure 3: Conceptual Model of PCB Migration

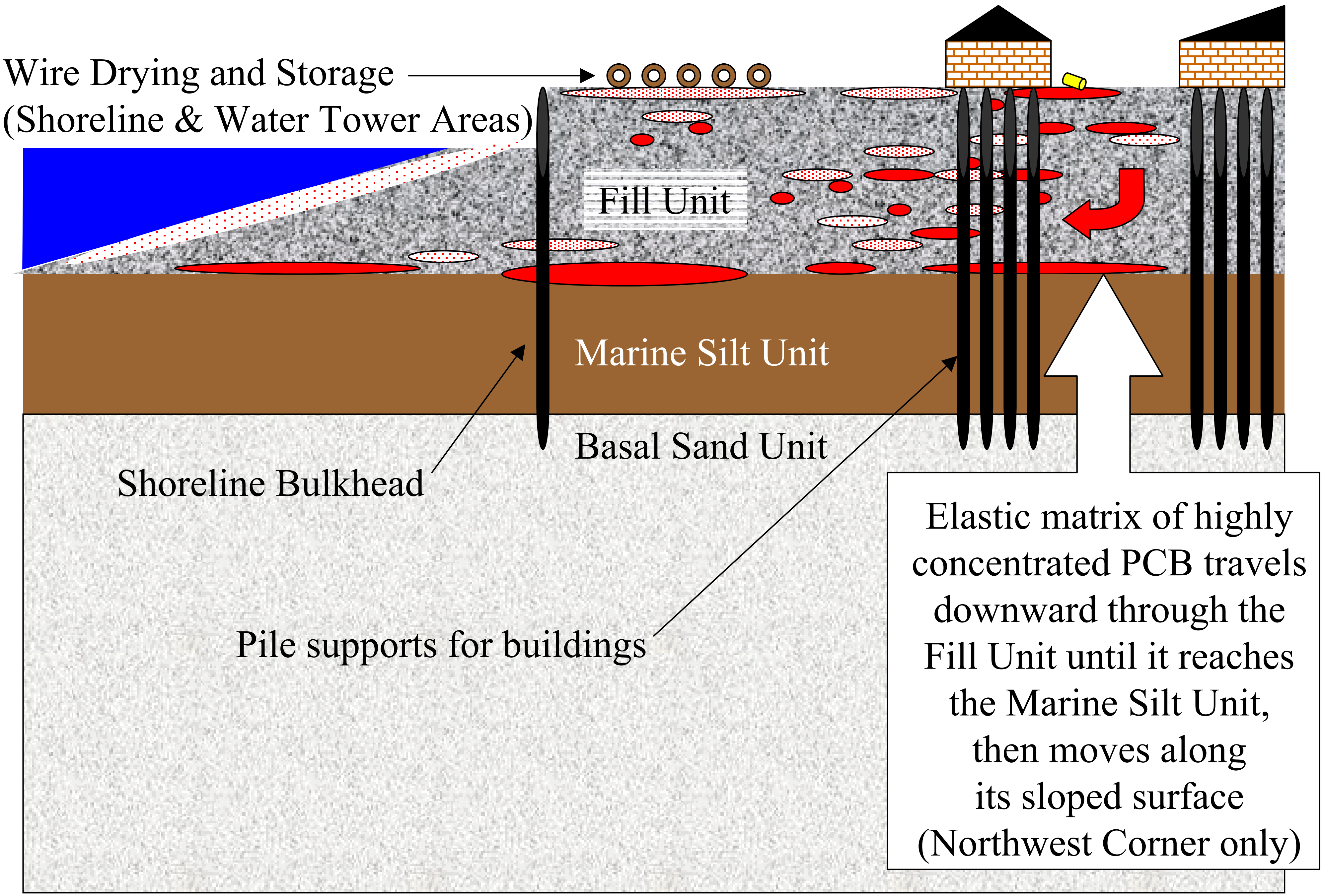


Figure 5
Extent of PCB in Sediments
Harbor at Hastings
Town of Greenburgh, Westchester County
Site No. 3-60-022

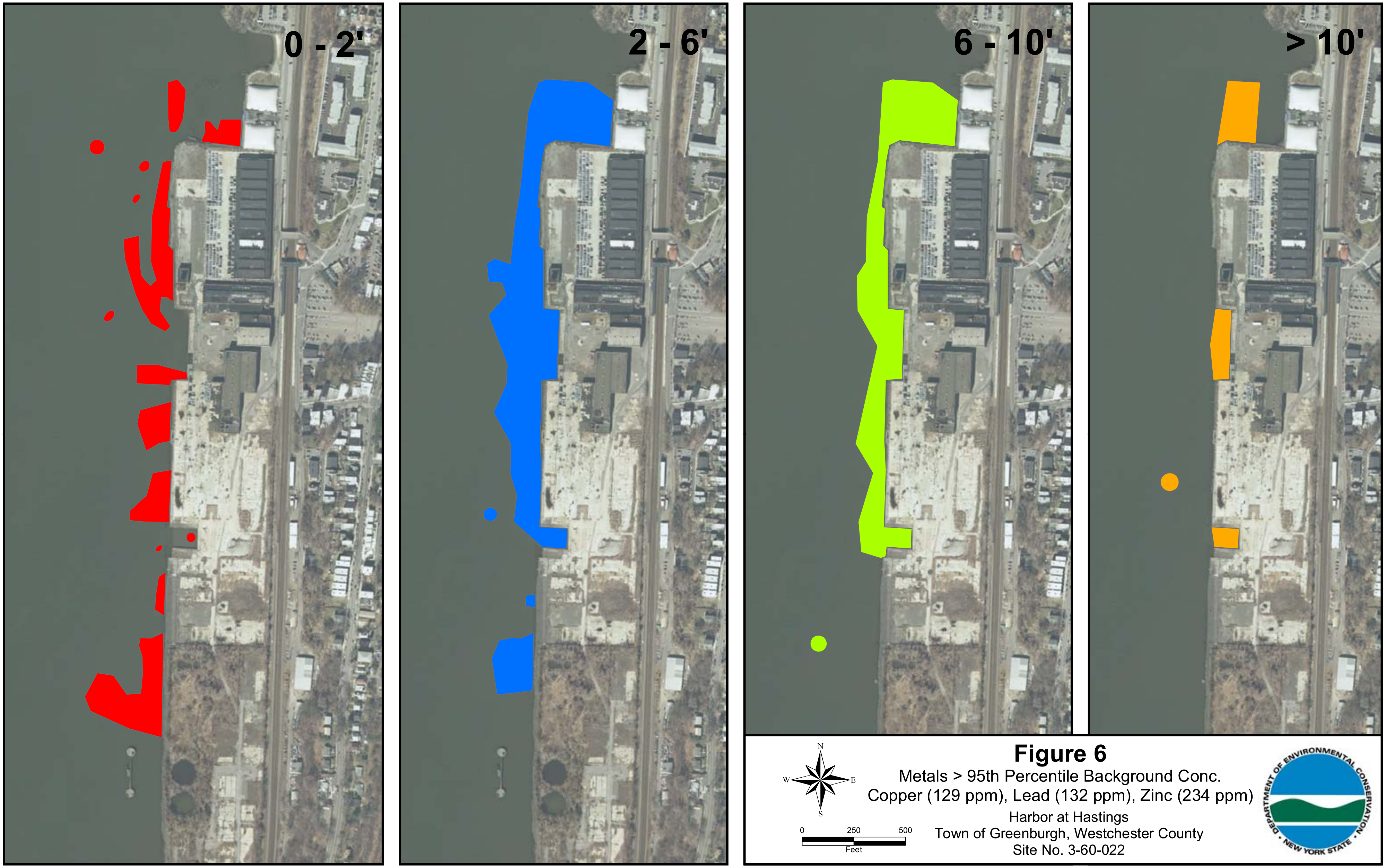
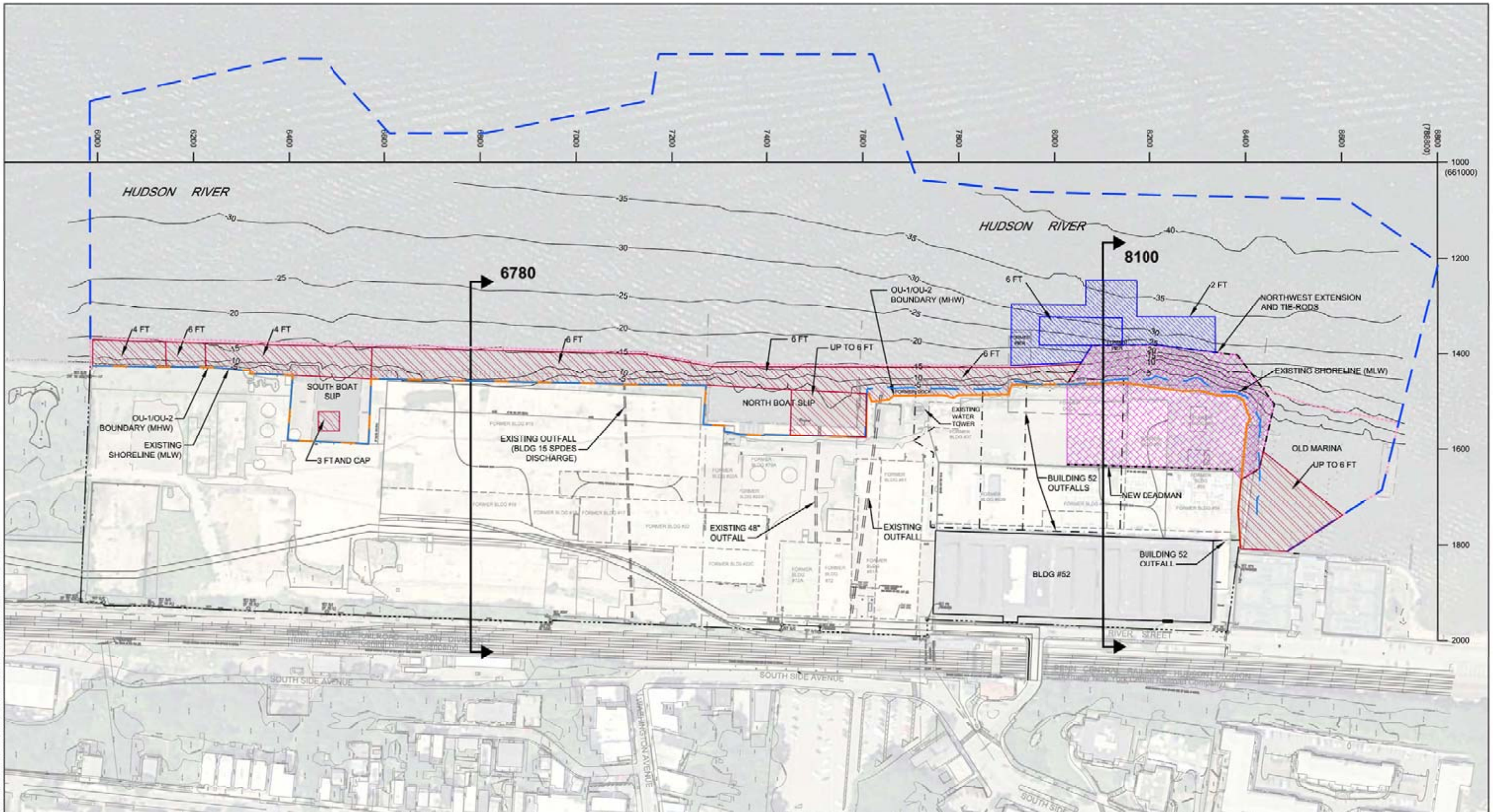


Figure 6

Metals > 95th Percentile Background Conc.
Copper (129 ppm), Lead (132 ppm), Zinc (234 ppm)

Harbor at Hastings
Town of Greenburgh, Westchester County
Site No. 3-60-022



LEGEND:

- PROPERTY LINE
- RAIL ROAD
- FENCE
- RIP-RAP
- EXISTING OFFSITE OUTFALLS
- EXISTING SHORELINE (MLW)
- OU-1/OU-2 BOUNDARY (MHW)
- SILT CURTAIN
- OU-2 SECTION LINES
- NORTHWEST EXTENSION
- NEARSHORE AND BACKWATER DREDGE AREA
- DEEPWATER DREDGE ARIA
- BULKHEAD WALL
- OU-2 LIMITS

NOTES:

1. BASE PLAN PROVIDED BY BOSWELL ENGINEERING DRAWING NO. 04-209-MW (01/27/2006).
2. OTHER SITE FEATURES BASED ON VARIOUS HISTORICAL DOCUMENTS.
3. EXISTING 5 FT BATHYMETRY BASED ON DATA FROM ALPINE OCEAN SEISMIC SURVEY (1997).
4. ELEVATION CONTOURS ARE BASED ON NAVD 88 DATUM.
5. BACKGROUND ORTHOIMAGERY FROM NAIP, 2010.
6. DREDGE DEPTHS ARE SHOWN AS MAXIMUM DEPTHS. ACTUAL DREDGE MAY BE CONSTRAINED BY CONSTRUCTIBLE LIMITS, AS SHOWN ON THE SECTIONS.
7. OU-1 REMEDIAL ACTIVITIES ARE SHOWN ON FIGURES 28 AND 30.
8. MEAN HIGH AND MEAN LOW WATER ARE EL. +2.2 AND EL. -2.0, BASED ON HISTORICAL SITE REPORTS.

0 200 400
SCALE IN FEET

HALEY & ALDRICH

NYSDEC SITE #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

PLAN VIEW
MODIFIED ALTERNATIVE 6

SCALE: AS SHOWN
FEBRUARY 2012

FIGURE 7

G:\PROJECTS\28612\265 - FINAL RFS\CAD\MODIFIED ALTERNATIVE 6\28612-265-FRAP MODIFIED ALT 6.DWG

APPENDIX A

Responsiveness Summary

RESPONSIVENESS SUMMARY

Harbor at Hastings
Operable Units No. 1 and 2
State Superfund Project
Village of Hastings on Hudson, Westchester County, New York
Site No. 360022

The Proposed Remedial Action Plan (PRAP) for the Harbor at Hastings site, was prepared by the New York State Department of Environmental Conservation (the Department) in consultation with the New York State Department of Health (NYSDOH) and was issued to the document repositories on January 2012. The PRAP outlined the remedial measure proposed for the contaminated soil, sediment, surface water, groundwater at the Harbor at Hastings site.

The release of the PRAP was announced by sending a notice to the public contact list, informing the public of the opportunity to comment on the proposed remedy.

A public meeting was held on January 26, 2012, which included a presentation of the remedial investigation and feasibility study (RI/FS) for the Harbor at Hastings as well as a discussion of the proposed remedy. The meeting provided an opportunity for citizens to discuss their concerns, ask questions and comment on the proposed remedy. These comments have become part of the Administrative Record for this site. The public comment period was to have ended on February 10, 2012, however it was extended to March 12, 2012, at the request of the public.

This responsiveness summary responds to all questions and comments raised during the public comment period. The following are the comments received, with the Department's responses:

COMMENT 1: Justification of the 1ppm PCB cleanup goal for soils should be provided through risk assessment modeling.

RESPONSE 1: The 1 ppm soil cleanup objective (SCO) is set forth in 6 NYCRR 375-6.8, and this SCO is protective for residential and ecological resources as well as the future intended use of the site for restricted-residential. The 1 ppm SCO was adopted from EPA and was based on risk management considerations for high occupancy scenarios as described in section 6 of the Development of Soil Cleanup Objectives Technical Support Document, September 2006, which may be found at http://www.dec.ny.gov/chemical/34189.html

COMMENT 2: What are the health hazards of the proposed sediment processing operation?

RESPONSE 2: The NYSDEC and NYSDOH pay close attention to the quality of life for the surrounding community during all parts of the remedial work at a site, including the sediment processing portion of the cleanup. All concerns will be addressed whether it is noise, odor or dust migration in a manner that will monitor and minimize any release or potential for exposure. See response number 11 for CAMP details. Monitoring and other appropriate engineering controls will be in place to assure no hazards result from this or any other operations required to implement the selected remedy.

COMMENT 3: Will BP/ARCO reimburse the State for its costs?

RESPONSE 3: Yes, reimbursement of New York State costs is expected as part of the consent order negotiated with BP/ARCO, the responsible party.

COMMENT 4: Has soil beneath Building 52 been sampled to determine if contamination is beneath it?

RESPONSE 4: Yes the soil beneath Building 52 was sampled and characterized to determine the levels of contaminants below the building.

COMMENT 5: How much semi-solid PCBs are present beneath the river?

RESPONSE 5: The presence of semi-solid PCB has been identified in the areas shown on Figure 3 of the ROD. The full extent and amount of semi-solid PCBs present beneath the river has been difficult to estimate due to the difficulty in installing borings and sampling the area immediately offshore of the Northwest Corner. This area was not extensively sampled because the equipment needed to penetrate the rip rap could not access areas of shallow water under current conditions.

COMMENT 6: Is it safe to use Kinnally Cove for recreational wading in the water and sediments due to potential contamination?

RESPONSE 6: Yes, Kinnally Cove may be used for recreational wading in the water with respect to the contamination associated with the site. Sediments in Kinnally Cove were sampled for PCBs by the Department in 2001, the range of concentrations detected were 0.088 and 1.5 ppm of total PCBs.

COMMENT 7: Will the proposed Northwest extension include cathodic protection of the steel sheeting?

RESPONSE 7: Yes the Northwest extension will include cathodic protection of the steel sheeting.

COMMENT 8: There is concern for sea level rise greater than predicted by the USACE. The remedy needs to add additional rip rap and foundation to accommodate the potential rise in sea level.

RESPONSE 8: The remedial design will include design considerations which take into account estimated sea level changes. Shore protection will be designed to prevent erosion of the shore due to the action of wind, waves and other forces to prevent damage to on-shore development or potential exposure and subsequent transport of contaminated soils.

COMMENT 9: We support the proposed restricted residential use of the site.

RESPONSE 9: Comment noted.

COMMENT 10: What is the scientific basis for the two-foot cover system for restricted residential use of the site?

RESPONSE 10: The basis for the 2 foot cover system is 6NYCRR Part 375, and the associated 2006 Technical Support Document, which may be found at http://www.dec.ny.gov/chemical/34189.html

COMMENT 11: When the CAMP is developed, we are concerned for using the standard particulate action level as a proxy for airborne PCBs. Before construction begins, the community needs a presentation of how the action level for PCBs is developed as part of the CAMP.

RESPONSE 11: In the remedial design phase a site specific Community Air Monitoring Plan (CAMP) will be developed which will specify the action levels for dust, volatile organic compounds and PCBs. Before implementation of the remedy a public meeting will be held and will explain in further detail how the CAMP will be protective of the community.

COMMENT 12: The green remediation elements of the PRAP are too vague. More specific requirements should be stated to minimize construction impacts to Village. These include requirements for barge and/or train transport of contaminated and clean soil, filtered diesel emissions, use of ultra low sulfur diesel fuels and Tier 3 diesel emission standards.

RESPONSE 12: The green remediation elements presented are there to acknowledge the DEC's commitment to green remediation, specific green remediation elements will be identified in the remedial design. The goal will be to minimize construction impacts to the Village to the extent feasible while implementing the remedy.

COMMENT 13: Will the two foot soil cover be able to be breached to construct building foundations?

RESPONSE 13: In areas where building will be permitted, the two foot soil cover may be disturbed provided the requirements included in the approved Site Management Plan are followed.

COMMENT 14: The annual cost of the two-foot cover system is underestimated because it does not include the additional cost for implementing the Site Management Plan during development.

RESPONSE 14: The annual cost does not factor in the costs for development, since these are beyond the scope of this ROD.

COMMENT 15: Who is responsible for the annual costs that are presented in the PRAP?

RESPONSE 15: ARCO will be responsible for the annual operation and maintenance costs.

COMMENT 16: What are potential health effects of other metals in the sediment, such as nickel, mercury and arsenic?

RESPONSE 16: In order to have health effects from metals present in the sediment there first has to be direct contact with these contaminants. Presented below are potential health effects if exposure occurred and at high concentrations.

Nickel: The most common reaction is a skin rash at the site of contact. The skin rash may also occur at a site away from the site of contact. Less frequently, some people who are sensitive to nickel have asthma attacks following exposure to nickel. Some sensitized people react when they consume food or water containing nickel or breathe dust containing it.

Mercury: Exposure to high levels of metallic, inorganic, or organic mercury can permanently damage the brain, kidneys, and developing fetus. Short-term exposure to high levels of metallic mercury vapors may cause effects including lung damage, nausea, vomiting, diarrhea, increases in blood pressure or heart rate, skin rashes, and eye irritation.

Arsenic: Breathing high levels of inorganic arsenic can give you a sore throat or irritated lungs. Ingesting very high levels of arsenic can result in death. Exposure to lower levels can cause nausea and vomiting, decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a sensation of "pins and needles" in hands and feet.

Additional information on these metals can be found on the Agency for Toxic Substances and Disease Registry's website.
http://www.atsdr.cdc.gov/substances/index.asp

COMMENT 17: Will there be any stipulated penalties in the Order on Consent to ensure compliance with the schedule for implementing the remedy?

RESPONSE 17: Stipulated penalties will be subject to negotiations between ARCO and the Department concerning the OU2 Order on Consent. Note that Environmental

Conservation Law also provides for penalties for non-compliance with the terms and conditions of orders on consent.

COMMENT 18: When will the remedial work start and end?

RESPONSE 18: The remedial work will begin after an Order on Consent that includes the OU2 remedy is signed and the remedial design is completed. The public will be notified at important milestones. The Department anticipates the project will take approximately 5 years to complete.

COMMENT 19: What are likely impacts upstream and downstream of the dredging project? We are concerned about this project harming the ongoing efforts to establish oyster beds just upstream of the site.

RESPONSE 19: The impacts upstream and downstream from implementing the remedy are expected to be minimal as a result of the controls that will be in place. This is based on the nature of the contamination and knowledge gained at other sediment remedial projects. The majority of the dredging will be performed using silt curtains which will minimize resuspension from dredging. Monitoring will be performed to identify acceptable requirements to protect water quality in upstream and downstream locations. It is also our understanding of the proposal that the oyster beds are not intended for human consumption.

COMMENT 20: The Department and/or ARCO should use additional outreach such as social media methods to keep residents apprised of the remedial progress and address concerns for airborne exposures during construction. Information should be disseminated in layman's terms using hubs in the Village such as coffee shops, the train platform, etc. as posting locations.

RESPONSE 20: The Department has successfully used websites which provide weekly updates, construction status and daily monitoring, and will work with the PRP explore and implement a website or additional outreach to keep the community informed during the remedial design and construction.

COMMENT 21: Is the proposed 2-foot cover consistent with the five foot cover that is required by the Village and Riverkeeper's Federal Consent Decree with ARCO?

RESPONSE 21: The proposed 2-foot cover is consistent with the Village and Riverkeeper's Federal Consent Decree with ARCO.

COMMENT 22: The Department should request and review ARCO's proposed lighting plan as part of the remedial design.

RESPONSE 22: The need for extensive construction lighting will depend on the nature and schedule of the work to be performed. Decisions concerning work hours and the need for supplemental lighting to safely conduct the work will be made in consultation with the Village of Hastings-on-Hudson.

COMMENT 23: What is included in the proposed restricted residential use? Why are single family homes not permitted?

RESPONSE 23: Restricted residential use is the land use category when there is to be common ownership or a single owner/managing entity for the site. Therefore apartment buildings, condominiums and recreational uses would be allowed that are managed by a single entity pursuant to a site management plan (SMP). It prohibits single family housing because managing and restricting the use of property would be more difficult, and could result in a greater possibility for individual owners and hired contractors to take actions not in conformance with the SMP. Furthermore, agriculture or vegetable gardens on the controlled property would be prohibited with the exception of community gardens with the approval of the Department.

COMMENT 24: Where will additional sampling be conducted in pre-design? Not just in the Northwest Area.

RESPONSE 24: Additional sediment sampling will be performed to identify depths of sediment contamination that will be removed in both nearshore and deepwater areas. Baseline monitoring will also be performed for the long-term monitoring plan to determine the pre-remedial conditions. The baseline monitoring plan will include sampling at background locations to determine ambient contaminant levels that are unrelated to the Harbor at Hastings site.

COMMENT 25: Will the liquid PCB removal operation affect the ability to use the northwest corner and northwest extension area?

RESPONSE 25: The remedial design will seek to minimize the impact of PCB recovery operations on the future use of the northwest extension area.

COMMENT 26: Can some of the shoreline be used for deep water dock access?

RESPONSE 26: The future use of portions of the shoreline for deep water dock access would need to be identified during the remedial design to assure the design takes this into account.

COMMENT 27: Does the PRAP provide for financial assurance to ensure long term monitoring and maintenance of the remedy?

RESPONSE 27: The PRAP and Record of Decision do not include financial assurance to ensure the long term monitoring and maintenance of the remedy. However, the Department has regulatory authority to require financial assurance, and could consider this option during the negotiation of the Order on Consent.

COMMENT 28: What information and experience from the Upper Hudson remediation will be utilized in the design and implementation of this remedy?

RESPONSE 28: While representing a different set of site specific conditions, the applicable information and experience from the Upper Hudson, will be used extensively to design and implement this remedy. Experience concerning the types and frequency of monitoring, community interaction issues, debris removal, air monitoring, dredge techniques, and silt controls will be used in developing the remedial design.

COMMENT 29: Where will the PCBs be taken after they are removed from the site?

RESPONSE 29: The dewatered PCB sediment will be taken to a facility which is permitted to accept PCB waste of the type and concentration removed.

COMMENT 30: Barge and rail transport of both clean and contaminated soils and sediments should be evaluated during the remedial design.

RESPONSE 30: The modes of transport for both clean and contaminated soils and dewatered sediment will be evaluated in the remedial design.

COMMENT 31: Is there a plan for diverting and/or protecting river traffic during the dredging operation?

RESPONSE 31: The appropriate navigational warnings will need to be reviewed and approved for conformance with US Coast Guard requirements before they are deployed.

COMMENT 32: Discuss the significance of the "drag-down" concept.

RESPONSE 32: The "drag down" refers to the potential for the liquid and semisolid PCB material to adhere to the steel sheet piles as they are driven through these materials into deeper into uncontaminated zones. The concern is that PCBs would be carried down into an uncontaminated area during the driving of the piles or flow as a dense non-aqueous phase liquid (DNAPL) through a newly-created migration pathway.

COMMENT 33: Are the proposed new wells in the northwest extension area just to monitor PCBs?

RESPONSE 33: The remedy anticipates installing new wells to both monitor and recover the PCB DNAPL, if present. The details of the additional work will be identified in the remedial design and site management plan.

COMMENT 34: How much of the PCBs have you removed so far in terms of the total amount there?

RESPONSE 34: The amount of PCB DNAPL present was not estimated due to the difficulty in obtaining samples from the immediate offshore area. As a result, the proportion of PCBs removed has not been calculated, but to date approximately 500 gallons of PCB DNAPL have been collected and disposed off-site.

COMMENT 35: Were samples for metals treated with acid to allow for metals speciation?

RESPONSE 35: Yes, samples for metals analysis were acidified, and therefore the results represent total metals in the sample. However, metal speciation was not performed.

COMMENT 36: Were single or duplicate assays performed?

RESPONSE 36: Most samples were single analysis. However, a certain number of samples were analyzed as duplicates, in accordance with generally-accepted practice for conducting environmental investigations.

COMMENT 37: Do you have to do more investigation to determine whether the new bulkhead will go into the liquid PCB pool?

RESPONSE 37: More investigation will be performed during remedial design to determine the final alignment of the sheet pile wall. Previous probing work identified a proposed location which is shown on Figure 7. The major factor concerning the alignment is the presence of the rip rap which will need to be avoided or moved during installation.

COMMENT 38: How long will the monitoring wells be there?

RESPONSE 38: The monitoring wells will remain in place as long as they are needed to monitor contamination in the groundwater.

COMMENT 39: Are you getting pure PCBs out of the recovery wells now?

RESPONSE 39: The material being removed from the wells contains approximately 30-40 % PCB.

COMMENT 40: As to backfilling the site, it is underwater at times. The Army Corps of Engineers (ACOE) guidelines you are following need to be enhanced.

RESPONSE 40: The remedial design will evaluate design considerations which take into account estimated sea level changes. Shore protection will be designed to prevent erosion of the shore due the action of wind, waves and other forces to prevent damage to on-shore development or potential exposure and subsequent transport of contaminated soils. These design elements will also be part of the review by the ACOE as part of their permitting process.

COMMENT 41: What action levels will be used in the CAMP? How can you justify 1ppm for baseline? How, during a limited public comment period, can the public determine whether the 1ppm is sufficiently protective?

RESPONSE 41: The 1 ppm action level is the soil cleanup objective for soil. The Community Air Monitoring Plan (CAMP) still needs to be developed, and it will define the site specific action level for airborne PCBs. The Department has used a 100 ng/m^3 action level for PCBs on recent PCB removal projects. However, the site-specific action level will be developed and documented in the CAMP during the remedial design phase.

COMMENT 42: Has contamination from the upper Hudson River dredging released contamination to the lower Hudson River down to this location, will it?

RESPONSE 42: In 2009 and 2011, the General Electric Company under the oversight of the US Environmental Protection Agency dredged PCB contaminated sediment from stretches of the Upper Hudson River as part of the Hudson River PCB Superfund Site. During dredging, Hudson River water quality was monitored daily at several locations downstream of operations in the Upper Hudson (north of Troy) and samples were collected monthly in the Lower Hudson River at Albany and Poughkeepsie. Water quality was also monitored in the Upper Hudson during the off-season when no dredging was underway. Most relevant based on proximity to the Harbor at Hastings Site are the PCB levels measured in water samples collected from Poughkeepsie; these sample results indicate that PCB levels in river water at Poughkeepsie during dredging are consistent with levels measured before dredge operations began. Water quality will continue to be closely monitored as dredge operations continue.

Jacques Padawer, Ph.D. submitted a letter via email dated February 1, 2012, which included the following comments:

COMMENT 43: Does the DEC have chromatographic and elemental profiles of these three (or more) PCB species in the Arco property? This is critical, should be available, and should be disclosed.

RESPONSE 43: Chromatograms may be found in several documents, including the January 2005 "Field Work Summary Report for Fall 2004" Appendix C, and the November 2009 "Report on Supplemental Northwest Corner Investigation Findings". These documents are available for public review in the repositories.

COMMENT 44: Low chlorination PCBs (“liquid?”) of relatively higher vapor pressure are known to be sequestered by the liver, bind to DNA, and induce liver carcinomas. What modified precaution(s) does the DEC propose to use to monitor the new threats?

RESPONSE 44: In order to have health effects from these PCBs there first has to be exposure to them. In the remedial design phase a site specific Community Air Monitoring Plan (CAMP) will be developed which will specify the action levels for these PCBs. Before implementation of the remedy a public meeting will be held and will explain in further detail how the CAMP will be protective of the community.

Jeremiah Quinlan a Trustee with the Village of Hastings-on-Hudson submitted a letter dated February 29, 2012 which included the following comments:

COMMENT 45: Evaluate and, as appropriate, remediate sanitary/process sewers on site

RESPONSE 45: The process sewers and floor drains from Building 52 are identified for removal. Other sanitary and process sewers will be further identified during the remedial design and will be evaluated for remediation as appropriate.

COMMENT 46: Evaluate the use of the adjacent railroad thoroughly and use it to the extent reasonable.

RESPONSE 46: See Response 30.

COMMENT 47: Disposal of on-site sediments: Strict standards are needed to avoid future issues. Clean and sandy sediments will have less future risk of being a future contamination issue and will have fewer compaction/settlement issues.

RESPONSE 47: The remedial design will identify the parameters for reusing sediment on-site. The reuse of sediments on-site has the benefit of reducing transportation related impacts for both contaminated material and backfill.

COMMENT 48: Where a sloped shoreline will be employed, heavy armoring will provide better protection during storms.

RESPONSE 48: The type of armoring will be identified in the remedial design and the protection during storm events will be evaluated as a factor in identifying the proper size of the material.

COMMENT 49: Concerns on how will the IRM wells be protected from the public in the northwest corner that will be a public park.

RESPONSE 49: The recovery wells in the Northwest Extension Area will be protected from the public in anticipation that the area may be used for public access. This area may need to be temporarily closed during operation and maintenance activities. The remedial design will identify approaches, such as flush mounting the wells; dedicated vaults; or other engineering controls to protect the public while allowing the operation of the wells for their intended purpose.

Eileen Bedell, the property owner of the Hudson Valley Health & Tennis Club, submitted a letter dated March 9, 2012 which included the following comments:

COMMENT 50: I would like the plan to show my property lines reflected on all drawings. My deed includes both shallow and deep water riparian rights. In fact, all of the "Old Marina" is owned by Hudson Valley Health & Tennis Club, although I have no objection to the use of "Old Marina" on your diagrams.

RESPONSE 50: The property lines will be shown on the future drawings and plans in the remedial design. The Department acknowledges the ownership and potential future use of the marina and the need to gain access.

COMMENT 51: I would like the plan to be modified to take into consideration my future plans for reopening the marina. This includes depth, configuration and access issues.

RESPONSE 51: The sediment removal areas are based on the contamination identified in the remedial investigation phases. The approved plans for potential re-use of the marina will be factored into the remedial design with the objective of reducing the footprint of the Northwest Extension Area and minimizing backfill in the marina area. The backfill requirements will be evaluated and adjusted for the future and reasonably anticipated use of the sediment removal area of the marina. However, any additional or future dredging for the marina project must obtain approvals through the regular permitting process, including ECL Article 15 or 6NYCRR Part 608. As noted earlier, additional investigations will be needed before the final sheet pile wall alignment is determined.

COMMENT 52: The metals and PCB contamination plan is inconsistent with the data ARCO has provided me. In addition, test sampling was often restricted by the logistics of sample extraction.

RESPONSE 52: The extent of metals and PCB contamination is identified in the Feasibility Study, Appendix C. The sediment results are presented based on the depth below the sediment/water interface, and are consistent with previous reports. The Department agrees that data gaps exist in the marina area due to the inability to physically access certain locations. For this reason additional sediment sampling will be performed during the design phase and the obstructions are removed.

COMMENT 53: I would like the plan to clarify how future zoning changes for the ARCO property apply or do not apply to my property.

RESPONSE 53: The easement placed on the ARCO property pursuant to the ROD will not apply to the Hudson Valley Health & Tennis Club property. Concerns related to future zoning issues should be directed to the Village of Hastings-on-Hudson.

COMMENT 54: I would like clarification as to whether piles and pile-supported structures will be permitted in the marina.

RESPONSE 54: Restrictions on the installation of piles and pile-supported structures outside of Northwest Extension Area (NEA) are not planned. The installation of piles will not be restricted in the marina area provided that PCB DNAPL is not present. The remedial design will determine the precise boundaries of the NEA.

COMMENT 55: I have no need for backfilling of the marina post dredging. In addition I welcome reuse of the silt as landfill on the OU1 site.

RESPONSE 55: The comment is noted. See Response 51.

COMMENT 56: As you are aware from our discussions, I am opposed to the plan as drafted, particularly based on #2 and #3 above (*as referenced in the letter*). Without modification, I would be unwilling to grant access for executing the work.

RESPONSE 56: The Department acknowledges the plans for re-use of the marina. Additional work will be performed during the remedial design to minimize or eliminate the sheet pile wall on your property, to the extent it can be while still meeting the ROD objectives, to allow implementation of both the remedy and the proposed marina.

Daniel E. Estrin and Justin M. Davidson from Riverkeeper submitted a letter dated March 12, 2012 which included the following comments:

COMMENT 57: Riverkeeper is particularly concerned with the PRAP's general lack of clarity regarding the cleanup procedures that will be followed. In the interest of providing an open and transparent dialogue around the Department's efforts to remediate the site, we want to ensure that the public is well informed as to the particular processes that will be employed during the long-awaited cleanup of the Site.

RESPONSE 57: The cleanup procedures will be identified in the remedial design. The Department shares Riverkeeper's concern that the public should remain well informed during the remedial design and implementation of the remedy. Additional outreach activities will be scheduled at appropriate milestones in the project.

COMMENT 58: The PRAP is unclear as to where additional delineation sampling and study will be conducted. Before dredging and removal activities commence in the deepwater portion of the site, additional delineation sampling must be conducted in order to entirely understand and characterize the full extent of contamination. In particular, paragraph 6 of the proposed remedy provides, "the specific area where fixed sediment resuspension controls can be feasibly deployed will be evaluated during design based on the water depth and velocity conditions. Alternative designs for fixed resuspension controls will be evaluated to increase the depth of feasible resuspension controls." Paragraph 7 of the proposed remedy – which deals with "removal of sediment from a targeted area outside the northwest extension area in deeper than 15 feet of water" – explains that "during design, sampling will be performed to determine whether additional areas of PCBs greater than 50 ppm exist. Based upon an evaluation of the significance of the distribution of contaminants and the feasibility of removal, additional areas of sediment may be targeted for dredging." Taken in conjunction, these two statements suggest that the PRAP fails to define with reasonable specificity the areas where these additional sampling efforts will take place. Particularly, it is not clear whether this sampling will be confined to the immediate vicinity of the northwest extension area, or whether it will appropriately extend downriver to other areas where earlier incomplete and insufficient sampling indicates the possible presence of PCB concentrations.

RESPONSE 58: Additional sampling will be performed in both the near shore and deepwater areas where data gaps exist to provide a precise delineation of sediment to be removed. Such additional sampling is not confined to the immediate vicinity of the Northwest Area.

COMMENT 59: Definition of the areas to be sampled and the associated extent of the potential dredging are essential elements of efforts to evaluate the potential for resuspension and contaminant dispersion and the need for and type of resuspension controls. Recent experience in the upper Hudson near Fort Edward, New York indicates that the combination of equipment selection and dredging protocols can substantially reduce downstream dispersion and in many cases have the potential to eliminate the need for fixed controls such as silt curtains. This potential should be carefully evaluated with full consideration of complications associated with water depths in excess of 15 feet and/or energetic river and/or tidal flows after specification of the area and associated contaminant mass to be dredged. It does not appear to Riverkeeper that such an evaluation has been conducted to date.

RESPONSE 59: The Department has determined that resuspension controls will be used where feasible to reduce and minimize the dispersion of contaminants and will require that the extent of contamination, and the associated extent of the potential dredging, be determined during the design in order to design the controls necessary to address resuspension and contaminant dispersion. The recent experience in the upper Hudson River has provided information that can be applied to the remedial design of this dredging project. However this experience has limitations since the river velocities in the upper Hudson River are less than the current velocities near Hastings-on-Hudson. Also the sediment matrix at this site is also much finer than in the upper Hudson. These site-specific factors will be evaluated in the remedial design to choose the appropriate resuspension controls. The Department contacted a silt curtain manufacturer and a remedial contractor to independently verify the limitations for resuspension controls based on the site specific conditions in selecting the remedy.

COMMENT 60: During the Public Meeting on January 26, 2012, held in the Village of Hastings-on-Hudson, DEC Staff (Mr. George Heitzman) explained that during design, additional delineation sampling will be conducted "throughout." However, it is still unclear where precisely this additional sampling will be conducted, and a thorough explanation should be described in the Record of Decision ("ROD") for OU-2. DEC Staff further explained that additional sampling will be conducted only in areas where previous sampling results indicated "contiguous or concentrated" concentrations over 50 ppm of PCB, rather than "one hit" concentrations above 50 ppm. Earlier sampling that was conducted in portions of the deepwater site outside the northwest extension area was incomplete and unable to accurately define the full extent of contamination, so it would be erroneous to base future sampling efforts on what was conducted previously. Extensive additional delineation sampling should be conducted throughout the entire deepwater portion of the site to best understand precisely where these contiguous or concentrated zones exist and to allow accurate definition of the mass of PCB in each zone.

RESPONSE 60: The previous sampling provided sufficient information to allow the selection of remedy, but the remedy calls for additional sediment sampling in the deepwater areas to further delineate the areas to be dredged to meet the cleanup goals for PCBs. Post-ROD delineation sampling is routinely conducted at remediation sites to more precisely determine removal limits. The Department also agrees that additional sampling is needed to identify whether, and where, contiguous or concentrated zones may exist to allow accurate definition of the sediment to be dredged.

COMMENT 61: Because of the ambiguity surrounding the additional delineation sampling, Riverkeeper requests that an Additional Delineation Sampling Workplan be developed to describe with specificity the locations, actions, and timing of the additional delineation sampling to be conducted. In light of the lack of detail in the PRAP concerning additional in-river sampling to be conducted, we believe this Workplan should be publicly noticed and made available for public comment.

RESPONSE 61: The Department will require the development of a Sediment Delineation Sampling Work Plan as an element of the design and it will be publicly noticed and made available for public review.

COMMENT 62: The proposed action level of 50 ppm for the OU-2 deepwater area is premature, and a more stringent action level threshold below 50 ppm is necessary to protect the benthic community. The PRAP indicates that dredging of sediment in the deepwater portion of OU-2 will be conducted in areas defined by PCB concentrations greater than 50 ppm to six feet below the existing bottom. However, the PRAP completely fails to explain the technical rationale for the proposed 50 ppm action level. According to the DER-10, a PRAP must summarize the "alternatives considered and discuss the reasons for proposing the remedy," which has not been done here with respect to this proposed action level. During the Public Meeting on January 26, 2012, DEC Staff stated that a 50 ppm action level "struck the right balance," given the practical concerns and difficulties with dredging in deeper water. While Riverkeeper understands these concerns, this narrative answer can not suffice as a cogent technical basis to support 50 ppm as the appropriate action level. A satisfactory technical explanation must be made so the public can be informed and properly analyze the bases for selecting an action level that is relatively high.

In addition, on choosing a 50 ppm action level, the PRAP only states that "Targeting deepwater areas with PCBs above 50 ppm reduces the time needed to complete dredging activities when compared to deepwater areas above 1 ppm." However, when asked at the Public Meeting about whether NYSDEC calculated or estimated exactly how much longer dredging would take under a more stringent action level, DEC Staff (Mr. William Ports) responded that DEC had not calculated the time. The PRAP should not conclude without technical backup that choosing a higher action level of 50 ppm will reduce the amount of time needed for dredging when the Department has not calculated or estimated any such temporal differences.

The matter of remedial criteria warrants careful elaboration in the ROD for OU-2. Under the NYCRR, the goal of any remedial program for a specific site is to "restore the site to pre-disposal conditions, to the extent feasible. At a minimum, the remedy selected shall eliminate or mitigate all significant threats to the public health and to the environment presented by contaminants disposed at the site through the proper application of scientific and engineering principles." These words are echoed verbatim in the PRAP as two of its stated goals. The selection of the higher threshold of 50 ppm, without sufficient technical support and explanation supporting that action level, does not appear consistent with this legal mandate and the PRAP's stated goals.

While Riverkeeper understands that this higher threshold selection may be based on concerns that dredging will facilitate dispersion and ultimately increase contaminant bio-availability beyond current levels, such concerns must be based on hard data with particular emphasis on the mass of contaminant to be addressed by dredging. In the presence of a small mass – *i.e.*, a discrete area containing less than several pounds of PCBs where that mass is subject to continuing deposition and minimal erosion – the higher threshold of 50 ppm *may* be justified. However, for larger masses, lower thresholds are recommended with 10 ppm being the highest consistent with values used in other sites in the Hudson River and New England when dealing with significant masses of PCB. Because the data available in the PRAP and Revised Feasibility Study (RFS) do not provide sufficient information to properly assess the mass of PCB concentrations throughout the extent of the Site, the public is unable to determine whether the contamination presents "significant" threats to the public health and environment. As a result, the specification of the threshold is at the very least, premature. The present protocols specified in the PRAP do not appear to be sufficient to provide the necessary level of specificity, and the current approach based on sparse sampling and assumptions of costs should be reconsidered. The ROD for OU-2 must provide the basis for quantitative evaluation of the extent of contamination allowing subsequent evaluation and definition of the threshold criteria.

RESPONSE 62: As discussed in the Basis for Selection section of the ROD, the 50 ppm action level for deepwater sediments balances the potential for construction-related impacts associated with disturbance to the river bottom and migration of suspended sediments with the removal of sediments which have the highest levels of PCBs and the greatest potential to migrate and be an on-going source to the environment. The deepwater sediments present a number of concerns which were factored into the decision to remediate sediments in the site specific deepwater areas. These include environmental consequences of resuspending contaminated sediments without resuspension controls in these areas, the potential for remaining contaminated sediments to be disturbed in the future, the proximity of contamination to the sediment surface, and the concentration of contaminants. The Department evaluated the degree and extent of contamination for different action levels based on currently available information. The additional delineation sampling data from the deepwater areas to be collected during the remedial design will be further evaluated and the following factors will be considered in determining the final deepwater dredge area: 1) depth of PCB contamination, 2) type of environment (erosional or depositional), 3) contiguous areas of contamination, 4) thickness of clean sediment above the PCB contamination, 5) duration of dredging and associated potential for migration of resuspended sediments, and 6) the area weighted surface concentration of PCBs.

The time to remove the sediments in the deepwater areas was estimated for different action levels and is presented in the table below. These estimates are based on standard production rates and do not account for certain site-specific factors. The estimated volume of deepwater sediments that contain greater than 50 ppm PCBs is approximately 5000 cubic yards. The size of the mechanical dredge was assumed to be 5 cubic yards, with a production rate of 80 cubic yards per hour. Time estimates were prepared for both an 8-hour dredge day, and a 4-hour dredge day. The latter estimate reflects an attempt to limit deepwater dredging to the slack period during each daylight portion of the tidal cycle to minimize the migration of fines from the dredge area.

Deepwater PCB Remedial Goal	Estimated Volume of Sediment yd^3	Estimated Time in hours of Dredging	Estimated Days (8 hrs/day)	Estimated Days (4 hrs/day)
50 ppm	5000	64	8	16
10 ppm	20,000	250	31	62
1 ppm	53,000	662	83	166

The Department notes that comparison to action levels for unspecified sites in the upper Hudson River and New England site (presumably the Housatonic River) may not be valid due to the site-specific conditions encountered at this site. Sediments in the deepwater portion of the Harbor at Hastings site are significantly finer, comprising approximately 90% fines passing the #200 sieve, as compared to around 40% fines for the upper Hudson River project. Combined with the greater water depth and current velocity, the potential for uncontrolled dispersion during dredging is much greater at this site. The Department also notes that the Housatonic River project was performed by diverting the river and dredging in a dewatered condition, which provides a high degree of migration control, but is not a feasible approach at this site. As a result, the site-specific action levels that resulted from the balancing of criteria for those sites are not comparable to the Harbor at Hastings site.

To the extent feasible the site will be restored in a manner that will be protective of both the environment and public health. The remedy described in this ROD acknowledges the added difficulties of attaining pre-disposal conditions in an environment that contains levels of PCBs that are above standards in upstream locations not affected by the site. However, through implementation of engineering and institutional controls selected in the remedy, significant threats to public health and the environment will be mitigated.

COMMENT 63: As the Department is aware, on September 8, 2011, Riverkeeper submitted to NYSDEC a position statement for proposed PCB and removal criteria for the offshore areas of the Hastings site prepared by our technical consultant, Dr. W. Frank Bohlen, PhD. *See* Exhibit 3. In that statement, Riverkeeper suggested that sampling should be conducted at sites with PCB concentrations of 10 ppm at the surface (0-6 inches) or 50 ppm on the vertical between 0.5 and 3.0 feet below the sediment-water interface, unless the site was surrounded by a minimum of four (4) other cores spaced around the acre surface centered on the high concentration site. Supplementary sampling should consist of four (4) sediment cores each to six (6) feet below the sediment-water interface with each taken at the midpoint (or some reasoned alternative) of the perimeter boundaries of a one acre square centered on the high concentration site. Each core should to be sectioned and analyzed to determine PCB concentrations over the vertical for the 0-6 inches, 0.5-3.0 feet, and 3.0-6.0 feet segments. These data will be compiled with concentrations on the 0-3 feet interval used for computation of the area weighted average (AWA) concentrations. The data detailing concentrations in the 3-6 feet layer would be retained for informational purposes.

RESPONSE 63: This approach will be considered in the development of the Sediment Delineation Sampling Work Plan during the remedial design.

COMMENT 64: Department Staff apparently propose to reject Riverkeeper's position statement as a reasonable way to proceed with additional sampling and PCB remediation in the Deepwater areas. Riverkeeper continues to believe that a more stringent action level below 50 ppm is necessary to protect the benthic community, and in turn, human health and safety. Dr. Bohlen advises that a lower threshold concentration of 10 ppm for the first six inches of sediment would greatly reduce the potential for the bio-accumulation of PCBs by the local marine biological community. *See* Exhibit 3. Dr. Bohlen's specification of the 10 ppm threshold is based on distributions of higher concentrations of PCBs residing below that level as shown in the May 2011 data set in the Revised Feasibility Study. If additional sampling shows that these distributions are very localized or that the deeper sediments contain lower concentrations, then leaving them in place *may* be justified. However, that conclusion cannot be made until a more substantive and robust discussion of the issue supported by data is presented.

RESPONSE 64: The Department has not rejected Riverkeeper's approach to additional sampling and remediation in deepwater areas. The Department will consult with the interested stakeholders after the additional sampling data is obtained.

COMMENT 65: First among the nine factors used in selecting a remedy for a site is the "Overall protectiveness of the public health and the environment." Indeed, the PRAP recognizes that "[t]o be selected, the remedy must be *protective of human health and the* environment, be cost-effective, comply with other statutory requirements, and utilize permanent solutions, alternative technologies or resource recovery technologies to the maximum extent practicable." In order to meet the PRAP's stated goal to "eliminate or mitigate all significant threats to public health and the environment presented by the contamination identified at the site," Riverkeeper believes that DEC *must* consider and adequately study the feasibility of dredging in deepwater areas with a 10 ppm action level for the first six inches below surface ground. This includes additional sampling and study required to properly assess the mass of PCB concentrations. In fact, as DEC Staff explained in the January 26, 2012 Public Meeting, one of the key lessons learned from the GE Site remediation is to "fully characterize" the contamination. As per DEC's own guidance and experience, therefore, DEC is obligated to fully investigate the extent of contamination, which requires more than a superficial examination and testing of potentially contaminated areas.

RESPONSE 65: See Response 62 above. The Department and NYSDOH believe the selected remedy is protective of human health and the environment because it is unlikely for recreational users of the river to be exposed to site-related contaminants through the incidental ingestion of contaminated surface water and direct contact with contaminated sediments in the deepwater area, the primary human exposure pathway is through the consumption of contaminated fish tissue. One goal of the monitoring program will be to determine if the remedy is successful in reducing the local contribution to PCB tissue concentrations in biota. This program will monitor the performance and effectiveness of the remedy in achieving the remedial goals established for the project and will be a component of the monitoring and maintenance of the site. For specific advisories on fish consumption in this area please refer to NYSDOH's annual Health Advise on Eating Sportfish and Game.
http://www.health.ny.gov/environmental/outdoors/fish/health_advisories/docs/advisory_booklet_2011.pdf

COMMENT 66: The ROD for OU-2 should describe the equipment or technology to be used for the in-water dredging activities. In discussing the proposed elements of the cleanup of the OU-2 portion of the site, the PRAP does not describe what types of technology or equipment will be used during the dredging activities. Section 375-1.8(a)(4) of the NYCRR provides that "Remedy selection at a site may consider the use of innovative technologies which are demonstrated to be feasible to meet the remediation requirements." The upriver dredging operations at the GE site provided for several technical advancements in dredging and re-suspension technologies. Even though the PRAP represents the initial stages of the design effort, it would be important to see the use of advanced technologies evaluated in the ROD and implemented at the Hastings site.

RESPONSE 66: In general there are two types of dredging technologies which are applicable to the Harbor at Hastings site. These include mechanical and hydraulic dredging equipment, both types of dredges will be evaluated during the design. Debris removal will be performed before sediment dredging begins.

COMMENT 67: The DEC should consider effects of flooding and sea level rise in its site design. The PRAP makes no mention of potential effects on OU-1 and OU-2 due to flooding of the adjoining upland portions of the site. Although some accommodation has been made in the preliminary OU-1 designs for expected long-term sea-level rise (accepting the Army Corps of Engineers' two-foot fill layer recommendation), there is also the matter of direct rainfall, storm surge and/or high river stage effects on OU-1 to consider. Over the past several years this area of the Hudson River has experienced several extreme storm events resulting in standing water on the site. In fact, as several local Hastings-on-Hudson residents attested to at the January 26, 2012 Public Meeting, the area around the Site has experienced several major flood events over the past several years, indicating a possible change in climate conditions and storm patterns that should be accounted for in DEC's evaluation and design. Depending on source, volume, and velocity, such waters have the potential to overwhelm proposed containment/treatment facilities and destabilize portions of the shoreline and/or groundcover. The displacement of any contaminants from these areas may in turn affect portions of the adjoining offshore. The ROD for OU-1 and OU-2 should include efforts to demonstrate the adequacy of proposed designs to effectively armor the site and minimize sensitivity to storm impacts.

RESPONSE 67: The Department shares the concerns expressed regarding the potential influence of climate change and rising sea level on the long-term effectiveness of the remedy to contain contamination during large storm events. The remedial design will consider future storm events and rising sea level that are likely to result in more intense storms, higher water events, and greater erosive forces on the site than have been documented in the past.

Eric Larson with ARCO submitted a letter dated March 9, 2012 which included the following comments:

COMMENT 68: We anticipate that remediation (both in OU-1 and in OU-2) may need to be coordinated with anticipated site redevelopment. While future uses of the site have not been resolved, we understand that Atlantic Richfield supports the concept of beneficial reuse of this site and anticipates working closely with the Village and other stakeholders in this regard. We would request that the ROD allow for some flexibility in design so that remediation does not unnecessarily impede redevelopment efforts while still maintaining environmental effectiveness.

RESPONSE 68: The Department agrees with this comment and will implement additional discussions to address issues and concerns with the Village and stakeholders while the remedial design proceeds. However, implementation of the remedy will not be delayed due to development-related issues.

COMMENT 69: Targeted Deepwater Dredging: In the October 2003 PRAP for OU-2, consistent with the scope of the RI work and data developed as part of the administrative record, NYSDEC did not propose to conduct any dredging in the deepwater area. Instead, the 2003 PRAP proposed a long term monitoring program for the deepwater area. Since that time, and consistent with the RI scope, there has been only limited additional analysis of the issues surrounding deepwater dredging as proposed in the current OU-2 PRAP. Silt curtains and other resuspension controls are unlikely to be feasible in this environment, nor are they likely to serve as effective barriers to the transport of resuspended sediments at these depths and flows. Therefore, any targeted dredging must balance the negative environmental consequences of resuspending contaminated sediment with the environmental benefits of conducting this dredging. These considerations weigh in favor of conducting limited targeted dredging for shallow (0-2 feet) hot spots (50 ppm or greater) in areas of scour that show a contiguous and concentrated pattern of sediment contamination. Consideration should be given to an alternative deepwater cleanup level at or below the 335 ppm Level of Protection screening criterion included in Table 3 of the PRAP.

We suggest that deepwater dredging of sediments deeper than about 2 feet, particularly in areas that do not appear to be subject to scour, does not provide an environmental benefit that outweighs the potential negative consequences associated with resuspension and transport of contaminated sediments. The deepwater areas identified in the PRAP on Figure 7 are generally consistent with this remediation approach and we do not believe additional dredging in other areas is warranted based on a review of the existing data and the multiple lines of evidence that suggest a consistently depositional environment. The current geometric weighted average concentration of PCBs in surface sediments is approximately 1.3 ppm for all areas outside the proposed deepwater dredge extents.

In this regard, we asked two reviewers, Dr. Michael Palermo and Dr. Victor Magar to review the proposed remedy with respect to the targeted deepwater dredging and we have attached their comments as well.

RESPONSE 69: The areas of targeted dredging in the deepwater areas will be further refined in the remedial design. The Department recognizes that standard silt curtains will not be effective in this environment. However, the Department does not want to predicate the means and methods of minimizing or reducing sediment resuspension in the deepwater areas. The dredging in the deepwater areas must balance the distribution of contaminants and the feasibility of removal. Therefore when additional sediment data is available from the deepwater areas the following factors will be considered: 1) depth of PCB contamination, 2) type of environment (erosional or depositional), 3) contiguous areas of contamination, 4) thickness of clean sediment above the PCB contamination, and 5) the duration of dredging required and associated potential for migration of resuspended sediments, and 6) the area weighted surface concentration of PCBs.. The Department rejects using the PCB cleanup level of 335 ppm in the deepwater areas because it would protect the environment based only on acute toxicity to benthic organisms, and it is feasible to achieve a higher level of protection. The Department believes that the 50 ppm cleanup in targeted areas provides the best balance of the selection criteria given site specific conditions at the site.

COMMENT 70: Metals: Nearshore, Old Marina, North Boat Slip

The OU-2 PRAP proposes dredging sediments to depths of up to 6 feet below the current sediment surface in the nearshore area, Old Marina, and North Boat Slip. There appear to be several rationales for this dredging including: (a) removal of sediments exceeding the PCB remediation criteria; (b) removal of sediments exceeding the PRAP's selected metals criteria; and (c) the provision of sufficient depth to install backfill or a cap to isolate remaining contamination and/or protect against scour or erosion.

The metals remediation criteria selected in the PRAP do not reflect metals toxicity and are not indicative of ecological risk. Indeed, site related investigations into metals toxicity have demonstrated the absence of toxicity at levels much higher than the criteria established in the PRAP. Thus, this approach is not consistent with EPA policy and guidance regarding the evaluation of sediment toxicity and the selection of sediment remedies. For this reason, we do not support the metals criteria set forth in the PRAP. We asked Dr. Kenneth Jenkins to review the PRAP with respect to metals criteria, ecological risk, and evidence of site-related toxicity. We have attached his comments in that regard.

Although metals concentrations in sediments do not justify nearshore dredging up to 6 feet in depth as a general approach, we recognize that site-specific evidence suggests that there may be some benthic toxicity associated with copper concentrations in excess of 982 ug/l, in nearshore sediments if they were to become exposed to biota through inadequate separation. In these targeted areas, near two outfalls along the southern portion of the site, metals concentrations in sediment may support dredging sufficient to protect against scour and provide physical separation from biota.

In addition, as a practical matter, there may be other reasons why some of the proposed nearshore dredging may be appropriate for the ROD. For example, much of this dredging will also remove sediments contaminated with PCBs. For areas without PCB contamination, considerations of site-specific scour potential and the need to improve site-specific aquatic habitat depth could also support portions of the proposed dredging. For this reason, we would urge that the ROD provide for dredging of up to 6 feet in depth while allowing some flexibility in remedial design to determine whether certain nearshore areas could be dredged to less than 6 feet in depth.

While returning sediments to pre-existing conditions to the extent feasible is an RAO, there may be little to no ecological benefit from the removal of metals above the remediation criteria set in the PRAP. As a result, short and long term impacts should be the primary consideration for the feasibility of additional dredging, and the ROD should provide some flexibility to reduce nearshore dredging depths during remedial design to minimize short and long term adverse impacts of dredging, particularly in areas where PCB contamination is absent while accounting for aquatic habitat depth, the integration of a sloped shoreline between OU-1 and OU-2, and other localized factors as may be appropriate.

RESPONSE 70: The metals remediation criteria in the PRAP are based on background concentrations of metals in the sediment. The use of a background concentration as a basis for cleanup concentrations is not based on toxicity but on the occurrence and concentration of the metals in the surrounding area. Toxicity testing conducted on the site was not sufficiently robust to develop a site-specific toxicity threshold. The dredging depth was established to allow for the feasible removal of contaminated sediments and the restoration of the river bed following the remediation. Actual dredge depth will be determined during design based on sampling that indicates the actual depth at which the sediments exceed the cleanup criteria. If other feasibility concerns arise during design, consideration will be given to adjusting dredging appropriately.

COMMENT 71: Capping and Backfilling in the Nearshore Area

The PRAP also proposes the use of backfill and/or capping materials in the nearshore area to protect against scour or erosion, to return the area to pre-dredge depths, and to provide isolation from remaining contamination. Regardless of whether the material is backfill or a cap, 6 feet of fill is not necessary to protect human health and the environment from any contamination that may remain. The analysis presented in the RFS indicated that 3 feet was sufficient. The need for anything more than engineered controls that provide physical separation or isolation is unnecessary. A cover of 6 feet far exceeds any cover necessary to provide separation or isolation of remaining contamination. It is also far more than necessary to provide a substrate for biological activity that would be protected from contact with site-related contaminants. We asked Dr. Danny Reible to review this issue, and we have attached his comments.

Further, in some cases, the requirement for up to 6 feet of backfill may impede the coordination of redevelopment and remediation. The ROD should provide flexibility for backfill/capping in the nearshore areas with between 2 and 6 feet of material and should allow both the full extent of the cap/backfill and the type and nature of soils, sands, or gravels to be used will be determined in remedial design.

RESPONSE 71: Flexibility regarding backfill is provided for in the ROD. Other than the isolation capping layer, the specific substrate for backfill is not specified. Additionally, the remedy allows for a river flow and deposition study to consider allowing natural in-filling following dredging. As noted in the ROD the purpose of the backfill is to "isolate remaining contamination, prevent erosion of cap materials, restore bathymetry, and provide a habitat layer". Depending on dredging depth and location, replacement of riverbed materials with significantly less than what is removed during dredging would not meet all of these goals. See also Response 51.

COMMENT 72: Certain technical challenges have been deferred to design. Perhaps the most significant is whether resuspension/transport controls might be effective in deeper water to allow the expansion of the nearshore dredging area. We have conducted an initial investigation as part of the studies previously submitted to NYSDEC, which shows that the current limits established in the RFS and PRAP for the implementation of resuspension/transport controls are accurate. Our investigation indicates that there is no demonstrated feasible technology that would allow us to significantly expand the proposed dredging limits without creating a substantial risk of contaminant resuspension and transport. In fact, the limits proposed are at the outer edge of silt curtain effectiveness. Thus, consideration of any expansion of the nearshore area in the design phase is unwarranted. There is no compelling reason to treat this technical issue any differently than other technical issues where future improvements during the design process are always possible and are taken into account if and when they are identified.

In this regard, we asked Dr. Palermo to review this issue, and we have attached his comments as well.

RESPONSE 72: The comment is noted.

COMMENT 73: Long Term Monitoring of the Remedy

The RAOs selected in the PRAP are generic and not site-specific. This presents various potential issues including long term monitoring to evaluate the success of the remedy. In particular, the Hudson River (and particularly the lower Hudson) is a highly urbanized watershed that has been home to industry for over 150 years. As a result, the Hudson River has substantial, system-wide contamination that is not related to the Hastings site, including PCB and metals contamination. We note that concentrations of PCBs in Hudson River reference sediments upstream of the Site range from 1 ppm to 2.1 ppm in a background sample within the 0-2 foot interval. As a result, even with successful remediation, site sediments will eventually "equilibrate" with urbanized background concentrations of PCBs, metals, and other pollutants, making the generic RAOs difficult to achieve. The presence of this background industrial contamination must therefore be taken into account in the design and implementation of a long term monitoring plan. Metrics like PCB concentrations in fish tissue, for example, which are more likely to reflect Hudson River conditions in general rather than site specific conditions, are not suitable for inclusion in a long term monitoring program.

We have attached the comments of Dr. Magar on this issue.

RESPONSE 73: The Department has used monitoring to discern different PCB source conditions in urban watersheds. These include PCB congener analysis; analysis of recently deposited surface sediment concentration; analysis of the source of the metals; and other techniques that have been used on other sediment remediation sites. The Department acknowledges that there are other sources of contamination that are unrelated the Harbor at Hastings site. The long-term monitoring plan described in the PRAP is expected to include the consideration of other industrial inputs in the river mainly through the use of baseline and reference sampling during monitoring. Previous data on the site indicated a local effect of increased PCBs in eels associated with the site. Since PCBs will remain in the river and the remedy will depend on engineering controls to prevent continued release of PCBs long-term monitoring of organisms in the river, including fish, is necessary to demonstrate the effectiveness of the remedy to decrease the site-specific influences on the local fish and therefore, must be retained as a component of the monitoring plan.

COMMENT 74: An expected schedule for the combined remedy in OU-1 and OU-2, exclusive of the regulatory process leading up to initiation of design, is included in the RFS. Note that the PRAP has added investigation and scope to the alternative recommended in the RFS.

RESPONSE 74: The Department understands and recognizes the added investigation and scope to the remedy will take additional time.

COMMENT 75: A transportation study regarding the handling of materials being brought into the site and leaving the site is specifically indicated in the RFS and will be part of the design process. The RFS assumptions provide a basis for comparison but do not limit the outcome of the transportation study.

RESPONSE 75: The comment is noted

COMMENT 76: Current Zoning and Uses. Portions of the site are no longer leased to other parties.

RESPONSE 76: The comment is noted and the ROD has been revised to reflect this.

COMMENT 77: Historical Uses. Wire manufacturing duration was much longer than the duration that manufacturing involving PCBs. PCBs were used in the manufacture of wire and cable only during the World War II period.

RESPONSE 77: The comment is noted and the ROD has been revised to clarify that PCBs were only used during a portion of the operation period.

COMMENT 78: Operable Units. This section describes “the site” as two operable units, however, in other sections OU-1 is described as “on site” while OU-2 is described as “off-site”. The use of the word “site” in two different contexts is confusing. Note that there are some references to “on-site” within the document that specifically refer to OU-2. Also note that when the term “off-site” is used to reference OU-2 portions of the project the term should not reflect the status of ownership of said area.

RESPONSE 78: The Department acknowledges this comment.

COMMENT 79: Atlantic Richfield Company has in fact been participating in the site investigation and the remedy evaluation process for many years and voluntarily developed the feasibility study for OU-2.

RESPONSE 79: The comment is noted the ROD was revised to reflect ARCO's voluntary efforts in developing the remedy for the site.

COMMENT 80: Paragraph 6.3. It should be noted that specific fish advisories in the area of the site are primarily due to regional contamination issues and would remain in effect regardless of any remedial actions taken at this site.

RESPONSE 80: The Department acknowledges that certain contaminants in the fish tissue of certain species are attributable to regional contamination issues. However it is not clear whether for certain species, the fish advisory would remain regardless of remedial actions taken at the site.

COMMENT 81: Paragraph 6.4. Paragraph 6.1.2 states the contaminants of concern (COCs) as PCBs, copper, lead and zinc. Paragraph 6.4 re-states theses as the “primary” COCs for the site (previously defined as OU-1) and then describes a different list of COCs related to OU-1. Clarifying the terminology would assist understanding.

RESPONSE 81: As stated in Exhibit A, primary contaminants of concern are those that drive the remedy. The COCs for OU1 and OU2 are slightly different because beryllium was found in OU1 soils but was not found in OU2.

COMMENT 82: Paragraph 6.4. “Metals in sediment pose a toxicity threat to benthic organisms,” Multiple investigations previously conducted indicate that toxicity levels are significantly higher background. We have attached Dr. Jenkins' comments on this issue.

RESPONSE 82: The metals remediation criteria in the PRAP are based on background concentrations of metals in the sediment. The use of a background concentration as a basis for cleanup concentrations is not based on toxicity but on the occurrence and concentration of the metals in the surrounding area. Toxicity testing conducted on the site was determined to be not sufficiently robust to develop a site-specific toxicity threshold.

COMMENT 83: Paragraph 6.5. The RAOs assigned in the PRAP are generic and not Site-Specific. Due to the regional contamination issues, achievement of the specific objectives listed, especially for surface water, are not controlled by the site conditions. We have attached Dr. Magar's comments on this issue.

RESPONSE 83: The comment is noted. However, the surface water contributions from the site will be controlled by the remedy. Baseline and long term monitoring will be implemented to determine the effectiveness of the remedy.

COMMENT 84: Paragraph 1. The reference to the "FS" is presumed to be to the 2011 Revised Feasibility Study (RFS).

RESPONSE 84: The comment is correct.

COMMENT 85: Element 2. The Dense Non-Aqueous Phase Liquid (DNAPL) observed in OU-1 consists of approximately 30-40% PCBs dissolved in a solvent. The DNAPL occupies the void space within the existing fill otherwise occupied by water. The Revised Feasibility Study (2011) used the term "DNAPL" or Liquid PCB Material. Liquid PCBs were not used in the manufacturing process and have not been observed in OU-1 or OU-2. During the World War II era, PCBs were delivered to the site in the form of powder and then mixed with a solvent on site before application in the manufacturing process as a viscous cable coating for certain shipboard cables made for the United States Navy. This war time use of PCBs is the only known manufacturing use of PCBs in cable production at the site.

RESPONSE 85: The comment is noted and the ROD was revised to eliminate references to "liquid PCBs" in favor of "Liquid PCB Material".

COMMENT 86: Element 5. Text variations within the PRAP resulted in inconsistencies with respect to the proposed dredge in the Nearshore and Backwater areas. NYSDEC has prescribed specific areas of potential/anticipated additional dredging in the Old Marina and North Boat Slip that would be in addition to those described in Alternative 6 as shown on the PRAP Figure 7. This additional dredge scope is consistent with the description of the modified Alternative 6 found in exhibit B which states that "This alternative has been modified from the alternative developed in the FS to include additional dredging in deepwater, old marina, and north boat slip areas, as shown on Figure 7." And goes on to explain that "This approach would dredge sediments in targeted areas which contain the most highly impacted sediment for PCB and metals and therefore presents a greater sediment volume than the original Alternative 6." To be consistent with the Exhibit B description and Figure 7, along with the associated volume and cost estimate presented in the PRAP, the description of the proposed remedy in this section should include a more precise description of the dredging limits required to satisfy the remedial goals. For example: "Removal of Nearshore and targeted Backwater sediment and fill..."

An updated figure titled Plan View Modified Alternative 6 (attached) shows the dredge extents proposed for Alternative 6 along with the additional areas delineated in Figure 7 of the PRAP. This would represent the anticipated dredge extents for the modified alternative 6 that was recommended in the PRAP.

RESPONSE 86: The removal of sediment from the Backwater areas falls under the existing remedy component for sediment removal where silt curtains may be feasibly installed in less than 15 feet of water. The additional dredging scope was explicitly added to the alternative description in Exhibit B to clearly distinguish the PRAP alternative from the similar alternative developed in the FS.

COMMENT 87: Element 6. The requirement for evaluation of alternative resuspension control designs is open ended. In order to maintain a reasonable project schedule, the extent of the evaluation should be limited to the current standard or proven practice for similar settings at the time the evaluation is conducted. As noted in the introduction of these comments, no feasible alternatives or proven technologies that would be appropriate for the existing river conditions were identified in the RFS process based on our contact with a supplier of mobile silt curtains. We have attached Dr. Palermo's comments on this issue.

RESPONSE 87: The Department agrees that a limited evaluation will be performed regarding alternative resuspension control designs in the deepwater areas. This will include current standard or proven applications in similar settings.

COMMENT 88: Element 7. We do not believe that additional sampling is required in the deepwater area because the data collected to date indicates a high degree of heterogeneity with average concentrations near background. The average surface sediment concentration of PCBs is 1.3 ppm outside of the currently proposed deepwater dredge areas which suggests that contamination is neither contiguous nor concentrated and that the distribution of the relatively few exceedances of 50 ppm are not significant or that dredging would be warranted in light of the negative short and long term impacts associated with dredging in these water depths. If additional sampling is included in the ROD, it should be limited to delineating areas as shown on Figure 7 of the PRAP and where existing data indicates the potential need for targeted dredging. We have attached Dr. Magar's comments on this issue.

RESPONSE 88: The Department will require additional sediment sampling to determine the distribution of PCB sediments in the deepwater areas to delineate areas to be dredged. This comment is also addressed in Responses 24, 58, 60, 61, 62 and 69.

COMMENT 89: Element 9. Not all elements of an "isolation" cap as defined by the PRAP are necessary at all locations where remaining contamination is above background concentrations. The ROD should allow for the selection of backfill material and capping components to accommodate design for factors including erosion protection requirements (i.e. riprap) and residual contamination as well as provide flexibility for equivalent methods for chemical isolation and habitat creation. For example, areas subject to high erosion forces would require riprap or other appropriate erosion protection at the surface and would not allow for the placement and retention of a 24 inch habitat layer of fine grained silt. Additionally, the migration of divalent metals (including copper) from pore water is improbable and would not require a sand isolation layer in addition to the backfill. We have attached Dr. Reible's comments on this issue. Note that: It is known that this reach of the river has levels of total organic carbon (TOC) with a range of 2.2 – 3.2% (Llansó and Southerland, 2006). This range is considerably elevated compared to other sediment samples obtained from the Hudson (Llansó, R.J. and Southerland, M., 2006). In estuarine/marine systems, copper (Seligman and Zirino, 1998; 2002; Rivera-Duarte, 2006) and other metals (Di Toro et al., 2005;) are known to bind strongly to organic carbon and will be retained even under fairly rigorous extraction procedures (Daminouka and Katsiri, 2009). The likelihood of metals, particularly copper, desorbing from organic ligands in OU-2 sediment is therefore negligible. Previous studies that measured the capacity of naturally occurring sulfides (S-2) to bind divalent metals in both sediment grabs and cores showed that the vast majority of samples had concentrations of S-2 that were greatly in excess of the amount of metals that could be simultaneously extracted with acid (and therefore not bioavailable). Based on equilibrium partitioning sediment benchmarks derived for the protection of benthic organisms to metal mixtures, these levels of sulfides will afford considerable excess binding capacity of any freely dissolved divalent metals in pore water. In addition to this, the placement of backfill would inhibit overlying oxygen in the water column from diffusing into the naturally occurring sediment and therefore encourage anaerobic conditions which, in turn, will stimulate the generation of S-2. The latter would bind to divalent metals, rendering them immobile. Remedial design will consider backfill material and composition for factors including erosion protection requirements (i.e. riprap) and residual contamination concentrations. The ROD should provide flexible language similar the language in the OU-1 ROD

Amendment "The habitat/surface substrate layer will be designed to restore …"

RESPONSE 89: The PRAP identified isolation capping material, but did not specify the specific substrate that should be used for the site backfill. The substrates to be used for restoration will be determined during design and the substrates can vary depending on location in the River.

COMMENT 90: Element 11.a. It is presumed that the phrase "remain in place" with respect to the sediment containment system does not include the habitat layer but rather is intended to ensure that the erosion protection and isolation layers remain in place and are effective.

RESPONSE 90: The comment is correct and is intended for the erosion protection and isolation layers to remain in place. In addition, the habitat layer will be designed to remain in place.

COMMENT 91: Element 11.a.i. The term Northwest Area is introduced in this paragraph and is not defined or shown on the figures. For the purposes of OU-2, it is presumed that this restriction applies to the Northwest Extension Area ("NEA") as defined in the PRAP. Restrictions on the currently existing land in OU-1 are addressed in the OU-1 Proposed ROD Modification.

RESPONSE 91: This element was revised in the ROD to read "Northwest Extension Area", which is located in Operable Unit 2.

COMMENT 92: Element 11.b. After remediation is complete, surface sediments and biota will continue to be affected over time by regional Hudson River contamination that is not associated with the Site, including regional PCB contamination. As a result, it is probable that neither (a) future monitoring of the presence and concentrations of contaminants in surficial sediment nor (b) future monitoring of fish and other migratory species tissue concentrations, or other biologic metrics will provide reliable indicators of the performance of the site remedy. Because these types of monitoring metrics cannot reliably distinguish between local site-related issues and regional contamination, any monitoring program should focus on other parameters, such as bathymetric analysis, to provide information about performance of the remedy. The ROD should provide for sufficient flexibility in the design of a long term monitoring program to allow for these issues to be evaluated during remedial design.
For example, one approach to be considered is evaluating restoration of remediated areas by monitoring for re-colonization by native invertebrate communities. Re-colonization should be weighted more heavily as a monitoring metric than biotic tissue concentrations because of known and ongoing PCB flux from upstream sources and ongoing remediation. Similarly, if re-colonization occurs, benthic macroinvertebrate body burdens should be considered as a more reliable line of evidence for potential site-

related contributions of PCB to biota than would tissue concentrations of other aquatic species. However, benthic macroinvertebrate data would need to be evaluated in the context of sediment and porewater vertical profiles and any protocol for such evaluation must take into account the potential for post-remediation contamination of surficial sediments through deposition from regional non-site related sources.
Fish tissue PCB concentrations should not be considered for monitoring remedy effectiveness because of the conditions throughout the river.
Surface water quality compliance is difficult to measure at the SCG (0.001 parts per trillion). Surface water measurements are potentially confounded by inclusion of suspended particles, which may emanate from multiple sources, including sources unrelated to the site. An apparent absence of migration of site contaminants through porewater to surface water should preclude the need for monitoring biotic tissue, recognizing that the potential tissue concentrations to be influenced by other in-river sources. We have attached Dr. Magar's comments on this issue.

RESPONSE 92: The Department disagrees with the comment regarding the ability of the long term monitoring to be able to distinguish between the site specific PCB sources and those unrelated to the site. Fish tissue samples have been analyzed previously in areas adjacent to the site and have shown site specific influences from the site. The results are reported in the Department's report *1999 As A Special Spatial Year For PCBs in Hudson River Fish*, May 2002.

COMMENT 93: Element 11.b.i and 11.b.ii. The specific baseline and long-term sampling requirements should be developed during design and should consider methods that would provide reliable conclusions that consider regional contamination impacts. We have attached Dr. Magar's comments on this issue.

RESPONSE 93: The Department agrees with the comment that baseline and long-term monitoring should consider methods that would provide reliable conclusions that consider regional contamination impacts.

COMMENT 94: Element 11.c.ii. Regarding "maintaining site access controls", there are no site access controls currently in place for OU-2. A perimeter fence exists in OU-1 along the shore but will be removed as part of the OU-1 remedy implementation.

RESPONSE 94: The comment is noted and the ROD has been revised to reflect this understanding.

COMMENT 95: Page 2. Note that OU-2 samples containing PCB Material have only observed Semi-Solid or Trace PCB Material. No DNAPL has been observed in sediment samples.

RESPONSE 95: The Department does not disagree with the comment that no liquid PCB material have been observed in sediment samples, however the investigation of sediments beneath the rip rap slope has been limited by the inability to obtain samples.

COMMENT 96: Page 3. Surface Water data as summarized on page 3 and in Table 1 requires additional analysis since the conclusions presented are not consistent with other data. Specifically: PCBs; We do not agree with the PRAP's conclusion regarding Surface Water that the degree of chlorination "…results suggest that the Site is the source of PCB contamination in the Hudson River." Any conclusions regarding the source of PCBs within a regional water system like the Hudson River, where there are multiple sources, must be carefully analyzed based on the weight of evidence. For example, while PCBs may be present in samples taken from different locations, sampling results may show differing congener patters, differing degrees of chlorination, or different weathering patterns each of which must be accounted for in attempting to correlate any result to a particular "source." Once in the environment the composition of PCBs changes over time due to various physicochemical properties and biological processes: vapor pressure, solubility, octanol-water partitioning, adsorption, and biodegradation. As the number of chlorine atoms increases, both vapor pressure and water solubility decrease, while adsorption and the octanol-water partitioning coefficient increase. Dechlorination of PCBs occurs primarily through aerobic and anaerobic microbial degradation. Aerobic bacteria preferentially dechlorinate less-chlorinated PCBs resulting in an increase in the degree of chlorination residual over time (i.e., within decades a less chlorinated Aroclor will look more like a more chlorinated Aroclor). Anaerobic bacteria preferentially dechlorinate more highly chlorinated PCBs, mainly by replacement of meta and para positioned chlorine atoms with hydrogen atoms, resulting in predominately ortho substituted mono- through tetra-chlorobiphenyls (i.e., a more chlorinated Aroclor will look more like a less chlorinated Aroclor over time). Additionally, less-chlorinated PCB congeners are less persistent in the environment due to volatilization and solubility; more-chlorinated PCBs are more persistent in the environment due to adsorption. Therefore, over time, under common sediment conditions, an initial release of a less chlorinated Aroclor will often subsequently "weather" in the environment such that sediment samples will present as a more chlorinated Aroclor in laboratory analyses. In summary, the composition of an original PCB mixture released to the environment can be expected to change due to a combination of the processes mentioned above. Therefore, any attempt to determine the source of the PCBs or Aroclors identified in an environmental sample must be approached with caution. Furthermore, Hudson River PCB concentrations show that surface water sample concentrations sampled at the Site are consistent with background concentrations based on all sample locations from 1975 through 2007, summarized in the Injury Determination Report Hudson River Surface Water Resources, Hudson River Natural Resource Damage

Assessment. In addition, surface water PCB concentrations show significantly higher PCB concentrations at upstream sampling locations. Site concentrations show Site levels are consistent with sampling locations immediately upstream and immediately downstream. Therefore, Site surface water PCB concentrations are at, and in most cases below, background PCB levels which suggests that the Site is not a significant contributor of PCBs to the Hudson River. Also note that Site PCB data reports the concentrations of PCBs as Aroclors, whereas the recent NYSDEC results reports the concentrations of PCBs as congeners. During performance studies conducted by EPA for the development of EPA Method 8082, the concentrations determined as Aroclors were larger than those obtained using the congener method, which suggests that Site PCB concentrations reported as Aroclors may be biased high. It should also be considered that, based on initial hydraulic calculations, the pore water volume exiting the site is a small fraction of the surface water and would not be capable of significantly changing the surface water concentrations from background or impacting surface water to the levels indicated in the samples presented within the PRAP. It is unclear if adequate precautions were taken to acquire samples at a location where interference from bottom sediments were eliminated to avoid samples results that were biased high.

RESPONSE 96: The comment is noted.

COMMENT 97: Lead; We do not agree with the conclusion that "The primary surface water contaminants are…lead associated with historical manufacturing and disposal at the site." Based on Gibbs (1994), total suspended sediment concentrations 1 meter above the river bottom increased from approximately 10 mg/kg at the ocean (Varrazano Narrows Bridge, ~45-50 km downstream) to 140 mg/kg in the middle of Haverstraw Bay (~25 km upstream). This work also demonstrated that suspended sediments have metal concentrations much higher (2 to 3 orders of magnitude) than bottom sediments. Site, total and dissolved, lead porewater concentrations as shown in Appendix C of the Field Work Summary Report for Fall 2004 Atlantic Richfield Supplemental Offshore Investigation Former Anaconda Plant Site Operable Unit No. 2 report were reviewed. For the 18 samples collected, all dissolved lead concentrations ranged from non-detect (<0.24 ug/L) to 1.9 µg/L, well below the SCG lead value of 8 µg/L. The total pore water lead concentration averaged 4.7 µg/L and ranged from 0.5 µg/L to 13.2 µg/L; only one sample, which measured 13.2 µg/L lead and was collected in one area south of the south boat slip, exceeded the SCG lead value of 8 µg/L. Given the low Site pore water lead concentrations and the study performed by Gibbs, demonstrating an increase in suspended sediments concentration and associated metals concentration further upstream, one can conclude that the Site is not a significant contributor of lead to the Hudson River.

RESPONSE 97: The Department has a different interpretation of the article by Gibbs. The suspended sediment concentrations measured in the water column for lead will be different from the lead concentration measured in the sediment next to the site. The Department maintains that the lead concentrations found in the sediments near the site are primarily from Harbor at Hastings source areas in OU1, which were identified and found to be related to the former manufacturing and direct discharges into the Hudson River.

COMMENT 98: Page 4. Movement of PCB Material as DNAPL through the fill in OU-1 has historically occurred vertically and, to a limited extent, horizontally along the interface with the Marine Silt. It appears that there has been some historical movement of DNAPL along the Marine Silt interface near the boundary between OU-1 and OU-2. However, there are also other transport mechanisms by which PCBs were likely deposited in OU-2. For example, PCB Material was likely associated with the outfalls of pipes associated with Building 52 and other manufacturing operations on OU-1. In addition, historic activities such as the mixing of PCB manufacturing ingredients along the Northwest Corner may have resulted in the overland transport of PCBs to the River, and other historic activities along the old dock and pier structures may also have resulted in PCB deposition in river sediments. Finally, prior to the installation of the IRM in the northwest corner, PCB contaminated soils may have washed or eroded from the upland surface soils.

RESPONSE 98: The comment is noted and the ROD has been revised accordingly.

COMMENT 99: Page 4, “Screening Criteria for Metals”. As noted in the RFS, the ER-L and ER-M values do not account for site-specific conditions. These values are typically used to initially identify contaminated sediment. As stated in the 1999 NYSDEC Technical Guidance for Screening Contaminated Sediments, “Once a sediment has been identified as contaminated, a site-specific evaluation procedure must be employed to quantify the level of risk, establish remediation goals, and determine the appropriate risk management actions. The site-specific evaluation might include for example: additional chemical testing; sediment toxicity testing; or sediment bioaccumulation tests”. If criteria are exceeded then sediment contamination is quantified, evaluated with respect to exposure to biota and the significance of exceedances are described in terms of the predicted effects. The guidance also states that “If sediment concentrations of a compound are less than all of the sediment criteria for that substance, aquatic resources can be considered to be not at risk (from that compound).” Given this procedure for evaluating sediments, if the sediment is not considered or shown to be a risk, then remedial action is not necessary. A discussion of previous studies and standard practices is provided hereafter as it pertains to toxicity evaluation of metals in sediment.
The biogeochemistry of sediments influences environmental risk for metals contaminants more than for any other category of environmental contaminants. The PRAP includes provisions for remedial goals based on

background, or ambient concentrations of metals in sediments. Based on empirical evidence and relevant site characteristics, metals in OU-2 sediments are expected to pose no risk to human health or the environment at concentrations much greater than background or ambient concentrations. The proper evaluation of environmental risks caused by sediment contamination typically requires the evaluation of three lines-of-evidence: bulk sediment chemistry, sediment toxicity, and the native benthic invertebrate community. These three lines of evidence (LOEs) (often referred to as a Sediment Quality Triad or SQT) are then evaluated relative to a background or 'reference' area(s), to make an overall conclusion (i.e. a 'weight-of-evidence' or WOE) about risks that contaminated sediments pose to ecological receptors.

Accordingly, remedial goals should consider actual risks to human health and the environment associated with sediment, acknowledging that background conditions may constrain the levels to which cleanup can be sustained. Because of the many factors governing the potential toxicity of metals in sediments, sediment quality values (SQVs) are particularly suspect for metals, and therefore inadequate for basing remedial action decisions without supporting lines of evidence. If toxicity and benthic community results were to reflect an absence of chemical affect on the sediment habitat, metals concentrations exceeding SQVs should not be given greater weight than the other biological lines of evidence. Studies within OU-2 (e.g., Llansó and Southerland, 2006; BB&L, 2006) have identified conditions that indicate a reduction in both the surface sediment concentrations and potential risks of divalent metals (and also PCBs) in the biologically active sediment zone, including:

Deposition of sediments at background concentrations: the OU-2 reach adjacent to the site is "depositional," accumulating suspended sediment from upstream sources (~1 inch/year based on the RI). Ongoing deposition has resulted in levels of constituents of potential concern (CPOCs) that are near background conditions.

Elevated TOC: levels of total organic carbon are greater than most Hudson River reaches (recent data suggests an average of 2.96%), which aids in binding contaminants in sediments, reducing bioavailability to invertebrates and fish; and

Strongly reducing conditions in sediment and a marked excess of acid-volatile (AVS): both contribute to limit or eliminate metals bioavailability - no benthic toxicity is predicted for this type of sediment per the USEPA metals mixtures guidance and should be taken into consideration at this site.

It should also be noted that non-chemical stressors at OU-2 likely affect the benthic community more than site-related COPCs. The degraded conditions at 'reference' locations support this conclusion (e.g., at Greystone.) Also note that the native benthic communities are similar at locations upstream and downstream of OU-2.

It is important that metrics that consider the above lines of evidence be included as a component of remedy selection activities. We have attached Dr. Jenkin's comments on this issue.

RESPONSE 99: This statement is not an accurate summary of the sediment criteria. The criteria indicate a need for analysis of potential toxicity is necessary if the criteria are exceeded. A lack of appropriate investigation cannot be used as a basis to assume the lack of risk from exceedance of the criteria. Toxicity and AVS/SEM testing at this site were not sufficiently robust to determine a site-specific toxicity threshold. Therefore, there has been no demonstration that site-specific factors are ameliorating the expected effects associated with metals concentrations above the sediment criteria.

COMMENT 100: Page 4 "Background Contamination" We note that Site Specific Background Values attributed to our site are similar to background values identified in the TAPPAN ZEE HUDSON RIVER CROSSING PROJECT Draft Environmental Impact Statement. The 95th Percentile concentrations for the 313 samples analyzed for the Tappan Zee Bridge were similar to the background samples selected for OU-2. This data shows that the concentrations upriver of OU-2 were much higher than background in some locations:
Copper 1,550 ppm
Lead 604 ppm
Zinc 399 ppm
PCBs 1.2 ppm

RESPONSE 100: The comment is noted. The Department also notes that the cited values are the maximum values of the Tappan Zee DEIS data set, and may have been taken from a distinct source area that does not represent the potential for remediated sediments to be recontaminated.

COMMENT 101: Table 1. The text indicates the maximum detection was 62.4 ppt, the table indicates 57.0 ppt.

RESPONSE 101: The correction was made in the ROD.

COMMENT 102: Table 2 footnotes, last sentence. "If only the ER-L is impacted …" should read " If only the ER-L is exceeded …"

RESPONSE 102: The correction was made in the ROD.

COMMENT 103: Table 3. Note that a site-specific organic carbon content of 2.96% was measured in more recent investigations which would raise the site-specific screening criteria applicable to this project.

RESPONSE 103: The Department used the organic carbon content value of 2.43% which represents all the reported values including the more recent investigations.

COMMENT 104: Northwest Extension Area. The term "sealed sheet pile wall" is presumed to mean a sheet pile wall with sealed joints as described in the RFS.

RESPONSE 104: Yes.

COMMENT 105: Alternative 6. Clarification. The text refers to "site-specific cleanup goals" in Table 2. Based on Figure 2 it appears that the 95th percentile value in the column labeled "Site Derived Value" in Table 2 is the reference. The ROD should explicitly state the Site-specific Cleanup Levels. The values stated by NYSDEC during the Public Meeting were as follows:
Copper 129 ppm
Lead 132 ppm
Zinc 234 ppm

RESPONSE 105: Footnote c of Table 2 indicates that the site-derived cleanup values are the range of the 90^{th} to 95^{th} percentile values of the background data set.

COMMENT 106: The reference in the first paragraph to Section 7.2 is presumed to be a reference to Section 7 of the PRAP.

RESPONSE 106: The correction is noted and incorporated into the ROD.

COMMENT 107: Basis for Selection, 2nd paragraph, 5th line. Regarding the statement that "Dredging to a depth of 6 feet removes sediment that has the potential to be scoured and migrate." The preceding sentence implies this statement is applicable to both nearshore and backwater areas. In the backwater areas, the natural deposition cited in other sections does not indicate that scour is likely to a depth of 6 feet. Preliminary estimates do not indicate that scour in the nearshore would reach 6 feet and wherever dredging and backfill occurs the backfill will be designed for the river conditions, therefore, dredge to 6 feet is not required to eliminate the potential for scour of contaminated sediment. We have attached Dr. Reible's comments on this issue.

RESPONSE 107: The comment is noted and the ROD is modified to include additional language to justify the removal of sediments to 6 feet. The decision to select the 6 feet is based on the removal of sediment to pre-release conditions to the extent feasible, consistent with the remainder of the site.

COMMENT 108: Criteria 1. The correct increased cost for Alternative 9 is $140 million.

RESPONSE 108: The correction was made in the ROD

COMMENT 109: Figure A. The areas identified as Northwest Off-shore and On-shore Area are presumed to be the Northwest Corner Off-shore and On-shore Areas.

RESPONSE 109: The correction was made in the ROD

COMMENT 110: Note that Atlantic Richfield Company has not declined to implement a remedial program as stated.

RESPONSE 110: The OU1 ROD Amendment is modified to reflect that ARCO has agreed to implement the OU1 remedial program. The OU2 ROD was revised to state that the PRPs for the site declined to implement the remedial investigation and feasibility study portion of the remedial program for OU2 when first requested by the Department. Since 2003 the PRPs have voluntarily performed additional investigations and submitted work plans and reports which include a feasibility study to advance the remedial program.

COMMENT 111: Paragraph 6.1.2. The DNAPL is a PCB mixture, not liquid PCBs. Only Semi-Solid and Trace PCB Material has been observed in sediment. The potential presence of DNAPL (i.e. Liquid PCB Material) beneath the rip-rap has been assumed by NYSDEC but has not yet been confirmed.

RESPONSE111: The comment is correct concerning the Department's expectation of the presence of Liquid PCB Material beneath the rip-rap based on the finding of this material in close proximity to the shoreline. Further delineation will be performed in this area to verify this expectation.

COMMENT 112: Paragraph 6.4. It should be noted that beryllium in groundwater was only slightly exceeded in one out of twenty samples and was non-detect in 20 pore water samples collected during the 2005 OU-2 sampling event. Existing conditions do not suggest the need to include beryllium in long term monitoring plans.

RESPONSE 112: The Department believes that beryllium should be included as a baseline monitoring parameter in the long term monitoring plan. If it is not detected, the monitoring plan may be revised to omit it.

COMMENT 113: Paragraph 6.4. It should be noted that PCBs in groundwater are limited by the extremely low solubility of site-specific Aroclors that are associated with the DNAPL and the mobility of local concentrations is restricted by other site factors including organic content of the soil.

RESPONSE 113: The statements in the comment are accurate, however, PCBs have been detected in unfiltered groundwater samples at the site which exceed the Department's ambient groundwater standards. The selected remedy is intended to prevent contaminated groundwater from leaving the site, and monitoring will be performed to identify PCB concentrations in groundwater.

COMMENT 114: Paragraph 7.2. As previously noted, the presence of Liquid PCB Material off-shore has not been confirmed. Semi-Solid PCB Material has been observed but "PCB DNAPL" has not been "found beneath the river".

RESPONSE 114: See Response #111

COMMENT 115: Paragraph 7.3. Since the westward extent of the DNAPL is unconfirmed, we believe that once the area is accessible during construction, delineation should precede installation of recovery wells.

RESPONSE 115: The Department agrees that delineation of PCB/ DNAPL will precede installation of recovery wells.

COMMENT 116: Paragraph 7.3. The sentence "The containment element for the Northwest On-Site Contamination (formerly identified as the Northwest Corner and Northern Shoreline Area)..." uses an undefined Northwest On-site Contamination term. It is presumed that this statement should be as follows "The containment element for the northwest on-site contamination (formerly identified within the Northwest Corner and Northern Shoreline Area)..."

RESPONSE 116: The comment is correct and the change will be incorporated into the ROD Amendment.

COMMENT 117: Element 2. Note that one of the "additional scope" items referred to in Section 8, Paragraph 7 is an expansion of the extent of excavation (and therefore the areas) in the Northwest Corner and Northern Shoreline areas (see Figure 2 comment below).

RESPONSE 117: The Department acknowledges this increased scope based on the additional information gathered during the pre-design investigations. Although the excavation criteria have not changed, the increased extent will be noted in the ROD Amendment.

COMMENT 118: Element 5. The term "sealed sheet pile wall" is presumed to mean a sheet pile wall with sealed joints as described in the RFS.

RESPONSE 118: Agreed.

COMMENT 119: Element 6. We propose the ROD incorporate the flexibility to accommodate constructability limitations, e.g. "eliminate to the extent practicable any additional fill material…"

RESPONSE 119: The Department agrees with the concept of maintaining flexibility to accommodate constructability limitations during remedial design. There will likely be modifications to the remedial design which were not anticipated at the issuance of the Record of Decision. These will be documented and addressed on a case by case basis and the Department will follow its guidance and policy regarding such modifications.

COMMENT 120: Element 7. Operation of recovery systems should be continued only as long as recoverable DNAPL is observed.

RESPONSE 120: The shutdown criteria for recovery of DNAPL will be identified in the Site Management Plan. Recoverable DNAPL will be defined and provisions will be included which identify periodic monitoring to determine if the shutdown criteria is acceptable or additional recovery is necessary.

COMMENT 121: Element 10.bi. Groundwater quality and elevation monitoring does not provide data regarding the remedy performance and should not be required for such purposes. The compliance monitoring in Paragraph 10.c.i would provide the required data.

RESPONSE 121: The Department disagrees with the comment. Groundwater quality and elevation monitoring will be needed to evaluate the remedy performance and evaluate any corrective measures needed should they arise in the future. The Department is willing to evaluate and reduce the frequency based on the results obtained.

COMMENT 122: Element 10.b. Consideration should be given to regional contamination when establishing long term monitoring and criteria for groundwater discharged from the Northwest Extension Area. Groundwater treatment may not be necessary based on the extremely low solubility of site-specific Aroclors that are associated with the DNAPL and their concentrations relative to background surface water contamination.

RESPONSE 122: The PCB groundwater results will be evaluated and used to determine appropriate treatment of groundwater. The PCB groundwater results from the site indicate that levels exceed New York State Ambient Groundwater Standards.

COMMENT 123: Element 10.b.iv is presumed to be part of the previous bullet.

RESPONSE 123: The correction was made in the ROD

COMMENT 124: Figure 2. An updated version of Figure 2 that has been updated for the new data and uses the nomenclature in the text of the proposed modification is attached.

RESPONSE 124: The revised figure will be included.

APPENDIX B

Administrative Record

Administrative Record

Harbor at Hastings
Operable Unit No. 2
State Superfund Project
Village of Hastings on Hudson, Westchester County, New York
Site No. 360022

1. Proposed Remedial Action Plan for the Harbor at Hastings site, Operable Unit No. 2, dated October 2003, prepared by the Department

2. Proposed Remedial Action Plan for the Harbor at Hastings site, Operable Unit No. 2, dated January 2012, prepared by the Department

3. Referral Memorandum dated August 16, 1999 for Harbor at Hastings site, Operable Unit No. 2.

4. RI/FS Work Plan, Work Assignment No. D003821-15

5. Remedial Investigation Report, Harbor at Hastings (OU#2), Site 3-60-022, Earth Tech, December 2000

6. Mariniello Cove Sediment Sample Results, NYSDEC November 11, 2001

7. Final Feasibility Study Report, Harbor at Hastings (OU#2), Site 3-60-022, March 2003

8. Public Meeting Transcript for Remedial Actions Proposed for the Harbor at Hastings Site, Operable units #1 and #2, November 19, 2003

9. Supplemental Feasibility Study Report for Operable Unit No. 2, Parsons, April 2006

10. Revised Feasibility Study OU2, Former Anaconda Wire and Cable Company Site, NYSDEC Site # 3-60-22, Haley & Aldrich, October 31, 2012

11. Letter dated March 22, 2005 from Dave Kalet of ARCO regarding, Request to Initiate Technical Dialogue and for Additional DEC Information

12. Letter dated May 10, 2005 from Dave Kalet of ARCO regarding Additional AVS/SEM Information

13. Letter dated June 8, 2005 from George Heitzman of NYSDEC to Dave Kalet regarding Equilibrium Partitioning Sediment Benchmarks

14. Letter dated August 4, 2005 from Dave Kalet of ARCO regarding Use of Equilibrium Partitioning Sediment Benchmarks Methodology

15. Letter dated September 26, 2005 from George Heitzman of NYSDEC to Joseph Sontchi regarding Equilibrium Partitioning Sediment Benchmark

16. Letter dated October 14, 2005 from Dave Kalet of ARCO regarding Application of Equilibrium Partitioning Sediment Benchmarks Methodology to OU-2

17. Letter dated March 12, 2009 from William Ports of NYSDEC to Dave Kalet regarding Equilibrium Partitioning Sediment Benchmark

18. Letter dated February 1, 2012 from Jacques Padawer, Ph. D

19. Letter dated February 29, 2012 from Jeremiah Quinlan, Village of Hastings-on-Hudson Trustee

20. Letter dated March 9, 2012 from Eric Larson of Atlantic Richfield Corporation, including attachments

21. Letter dated March 9, 2012 Ms. Eileen Bedell, owner of the Hudson Valley Health & Tennis Club, including attachment

22. Letter dated March 12, 2012 from Daniel E. Estrin and Justin Davidson of the Pace Environmental Litigation Clinic, Inc. representing Riverkeeper, Inc., including Exhibits

APPENDIX 1

Phase 1 PDI Investigation Plan

Haley & Aldrich of New York
200 Town Centre Drive
Suite 2
Rochester, NY 14623

Tel: 585.359.9000
Fax: 585.359.4650
HaleyAldrich.com

MEMORANDUM

7 March 2013
File No. 28612-293

TO: Atlantic Richfield
Paul Johnson, P.G.

CC: Haley & Aldrich of New York
Wayne C. Hardison, P.E.

FROM: Haley & Aldrich of New York
Keith M. Aragona, P.E.

SUBJECT: PDI Phase 1 Work Plan Memorandum

This Pre-Design Investigation (PDI) Phase 1 Work Plan (Phase 1 WP) Memorandum describes a portion of the work that will be performed to support the PDI and remedial design. These activities will be completed at the Former Anaconda Wire & Cable Company site (Site), NYSDEC Site # 3-60-022, located on the east shore of the Hudson River at 1 River Street, Hastings-on-Hudson, New York (Figure 1). This Phase 1 WP was prepared on behalf of Atlantic Richfield (AR).

PHASE 1 OVERVIEW

Specific objectives of the Phase 1 work attempt to:

- Locate subsurface features using Ground Penetrating Radar
- Locate site feature and update topographic survey, and
- Install groundwater level data loggers in select monitoring wells.

Collected data will be used to:

- Plan subsequent pre-design data collection efforts,
- Support the design phase of engineering, and
- Support of the groundwater model

SCOPE OF WORK

Activities that will be performed are described below.

A. Ground Penetrating Radar

A ground penetrating radar (GPR) survey of the Site will be completed to the extent practicable. This information will be used as a screening tool in order to identify subsurface features (such as basements, sumps, and large voids) that may require further delineation during PDI activities. GPR results will also be evaluated in an attempt to assess concrete slab thickness, the potential presence of shoreline voids, and other subsurface features and structures.

The effectiveness of GPR at the site will depend upon on the subsurface conditions including slab thickness, quantity of rebar present in concrete slabs, composition of fill material, and brackish water due to the presence of the Hudson River. Therefore, in order to confirm the effectiveness of a GPR survey, the first step in the field program will be to evaluate GPR in several areas prior to finalizing the site wide program. Any areas of the site which are not conducive to GPR will be excluded from the program. Additionally, grid spacing within identified GPR survey areas will vary based on screening results. GPR coverage and appropriate grid spacing will be determined in the field based on screening results.

B. Upland Survey

A better understanding of topography is required in order to complete the final design. To develop the design, the existing topography map of the Site will be updated. Additionally, subsurface features identified by the GPR survey and historical maps will also be located. The survey work will be performed by Wendel Duchscherer, a licensed NYS surveyor, under an agreement with Haley & Aldrich of New York on behalf of ARCO.

C. Groundwater Level Data Logger Installation

Groundwater level data loggers (pressure transducers) will be installed at viable locations (approximately 15 locations) within the existing monitoring well network (as shown in Figure 1). During the PDI, new monitoring wells may be installed in order to further evaluate current hydrogeologic conditions in order to support updating the groundwater model. If new wells are required, installation will be described in a subsequent work plan. Data logger deployment locations were chosen to monitor hydraulic gradient and tidal influence in the Fill and Basal Sand hydrostratigraphic units as shown on Figure 1.

Prior to installation of the data loggers, the wells will be located and evaluated to determine usability. If a well is not suitable for use, an alternate location may be chosen during subsequent phases of work. Data will be downloaded from the data loggers at least every two months for a minimum of six months.

Pressure transducers will be capable of recording approximately 40,000 data points. Data recording frequency will be determined during the groundwater model planning process. Groundwater levels will be measured manually at each location immediately following deployment of the transducer and during each download event. Barometric pressure will be monitored at one location on Site in order to make the proper correction to groundwater level data.

QUALITY ASSURANCE PROCEDURES

All data will be collected with sufficient quality in order to be relied upon to support the remedial design.

A. Ground Penetrating Radar

Noggin SmartCart 1,000, 500, and 250 MHz GPR units or equivalent will be utilized to conduct the GPR survey. Multiple frequency devices will be used in order to maximize the investigation depth and resolution. The penetration depth increases and resolution decreases with decreasing frequency and vice versa.

B. Survey Control

Survey grade global positioning system (GPS) along with conventional survey methods will be used in the vicinity of the project area. The following project control information as will be used for field data collection and mapping.

Horizontal Datum: North American Datum of 1983 (NAD83), New York State Plane, eastern zone coordinate system, U.S. Survey Foot using the existing site control:

PID: KU1618
NAD 83(1996): Lat. 40° 56’ 27.40174”
Long. 73° 57’ 26.68224”
S.P.C. NY E: 768,147.13 ft.
642,016.48 ft.

Vertical Datum: North American Vertical Datum of 1988 (NAVD88), U.S. Survey Foot using the existing site control:

PID: KU1793
ELEV. (NAVD88): 65.77 ft.

C. Groundwater Level Data Logger Installation

Groundwater levels will be measured on a continuous basis at each monitoring location using In Situ Inc. Rugged Troll 200 pressure transducers or equivalent. Transducers employed at the Site are factory-calibrated within the past year and will be confirmed in the field for proper function prior to deployment. Downloaded raw data will be archived prior to manipulation and then exported to a spreadsheet. Corrections for variations in barometric pressure will be performed using data collected from the onsite barologger. Reference point groundwater elevations will be manually measured at each monitoring well location following activation of the transducers and during each data download in order to confirm monitor pressure transducer readings. Pressure data will be converted to groundwater level data if required based on field verification and measurements) and then to groundwater elevations (if required) for use in the groundwater model.

HEALTH & SAFETY

Health and safety requirements applicable to all persons entering the site or involved in field activities are described in the Site-specific Health Safety Security and Environmental Plan (HSSEP), these documents will be available for use on Site prior to the commencement of work.

SCHEDULE

This work is planned to begin in April and is anticipated to be 2 to 3 weeks in duration.

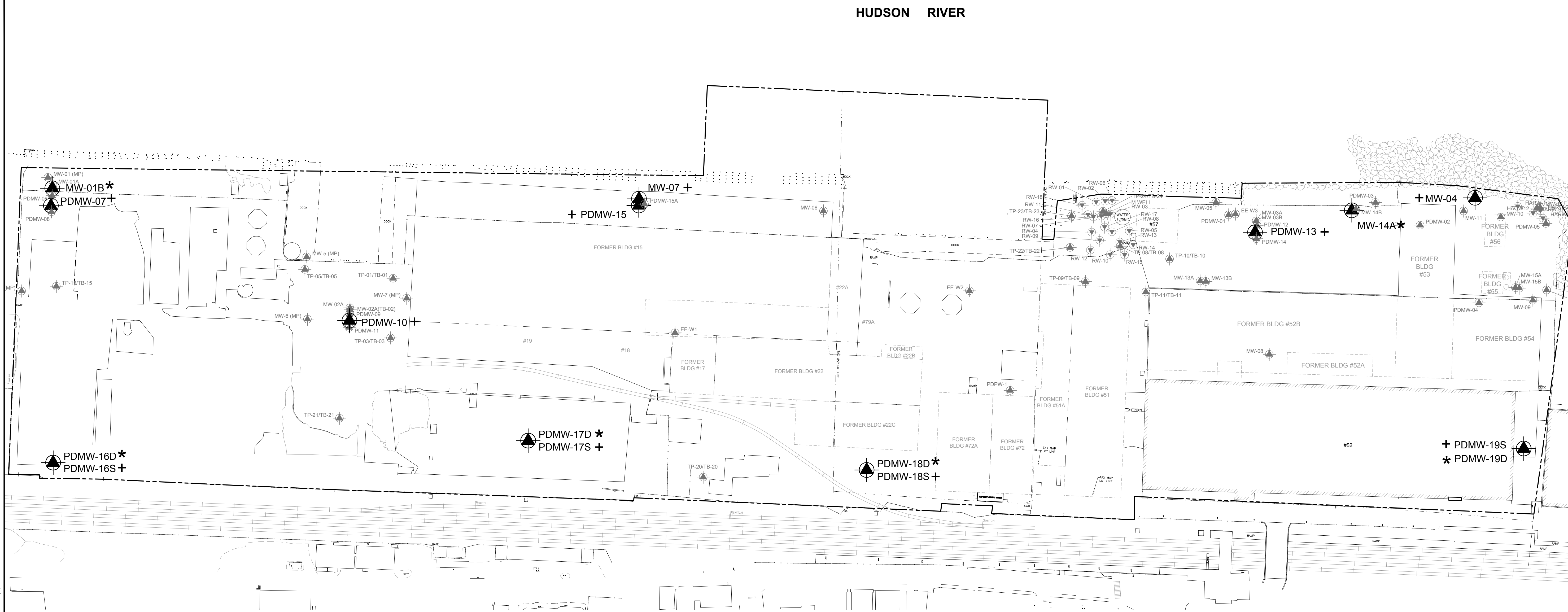
DELIVERABLES

Results of the GPR survey indicating suspected subsurface features and utilities and an updated topographic map of the site will be provided to the NYSDEC upon completion of validation, review, and interpretation of the data. Other data will be incorporated in to the remedial design as applicable.

FIGURES

Figure 1 – Pressure Transducer Installation Program

FIGURES



LEGEND

- PROPERTY LINE
- RAIL ROAD
- EXISTING STRUCTURES
- FORMER STRUCTURES
- FENCE
- RETAINING WALL
- MONITORING WELL
- RECOVERY WELL
- MONITORING WELL (PART OF DATA LOGGER INSTALLATION PLAN)
- \+ WELL SCREEN LOCATED IN FILL UNIT
- * WELL SCREEN LOCATED IN BASAL SAND UNIT

NOTES

1. BASE PLAN PROVIDED BY BOSWELL ENGINEERING DRAWING NO. 04-209-MW (01/27/2006).
2. HISTORICAL SURVEY INFORMATION PROVIDED BY PARSONS IN JULY 2005.
3. PROPERTY BOUNDARY INFORMATION PROVIDED BY WENDEL COMPANIES, DRAWING XVE-HUDSON-TOPO.DWG, PROJECT NO. 438504, DATED SEPTEMBER 21, 2012.
4. RIP-RAP DESIGNATION IN THE RIVER IS BASED ON INTERPRETATION OF SIDE SCAN SONAR DATA PROVIDED BY AQUASURVEY INC. IN NOVEMBER 2007.

W S N E

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SCALE IN FEET

HALEY & ALDRICH

IRM DNAPL EXTRACTION SYSTEM EXPANSION
NYSDEC SITE #3-60-022
HASTINGS-ON-HUDSON, NEW YORK

DATA LOGGER INSTALLATION PLAN

SCALE: AS SHOWN
MARCH 2013

FIGURE 1

Drawing Name: G:\28612_HASTINGS\293\CAD\28612-293-002.DWG
Operator Name: LUCIDO, SAM
Drawing Layout: DATA LOGGER PLAN (1)
Plot Date: March 7, 2013

New York State Department of Environmental Conservation
Division of Environmental Remediation
Remedial Bureau C, 11th Floor
625 Broadway, Albany, New York 12233-7014
Phone: (518) 402-9662 • **Fax:** (518) 402-9679
Website: www.dec.ny.gov

Joe Martens
Commissioner

April 1, 2013

Mr. Paul G. Johnson, PG
Operations Project Manager
Atlantic Richfield Company
Remediation Management
150 W. Warrenville Road
MC 200 1E
Naperville, Illinois 60563

Dear Mr. Johnson:

Re: Harbor at Hastings Site 360022
Pre-Design Investigation Phase 1 Work Plan

The New York State Department of Environmental Conservation (Department) has reviewed the Pre-Design Investigation Phase 1 Work Plan dated March 7, 2013. The work involves locating subsurface features using Ground Penetrating Radar, updating the topographic survey, and installing groundwater data loggers to monitor groundwater levels. The Work Plan is approved with the following modifications listed below.

1. Submit a proposed grid for the ground penetrating radar before the proposed start date.

2. The installation of the groundwater data loggers should include an additional location in the area of the water tower. This location would monitor the groundwater level within the fill unit.

Pursuant to the existing Order on Consent for the project, please notify the NYSDEC at least seven calendar days in advance of any work to be conducted under the work plan.

Please contact me if you have any questions or concerns at (518) 402-9662.

Sincerely,

William T. Ports, P.E.
Project Manager
Remedial Bureau C

ec: J. Nealon DOH
F. Navatril DOH
N. Walz DOH
C. Gosier DEC
R. Quail DEC

Haley & Aldrich of New York
200 Town Centre Drive
Suite 2
Rochester, NY 14623

Tel: 585.359.9000
Fax: 585.359.4650
HaleyAldrich.com

HALEY & ALDRICH

MEMORANDUM

12 April 2013
File No. 28612-293

TO: Atlantic Richfield
Paul Johnson, P.G.

C: Haley & Aldrich of New York
Wayne C. Hardison, P.E.

FROM: Haley & Aldrich of New York
Keith M. Aragona, P.E.

SUBJECT: Hastings on Hudson PDI Phase 1 Work Plan Memorandum

As requested in the NYSDEC letter dated 1 April 2013 approving the Pre-Design Investigation Phase 1 Work Plan, attached are the following:

1. Table 1 and Figure 2R describing the ground penetrating radar (GPR) work scope. The proposed GPR work will entail evaluating specific areas of the site which require additional information to adequately complete the remedial design. Historical drawings are currently being reviewed in order to identify additional subsurface features that may require additional investigation.

2. Figure 1R showing the revised pressure transducer installation program including an additional data logger installed in RW-3 in the Water Tower area. As indicated in the Phase 1 Work Plan, each monitoring well in the data logger installation plan will be located and inspected to determine suitability prior to installation. If monitoring wells are not suitable for data logger installation, an alternate location will be proposed.

Attachments
Table 1 – GPR Survey Scope
Figure 1R – Revised Pressure Transducer Installation Program
Figure 2R – GPR Survey

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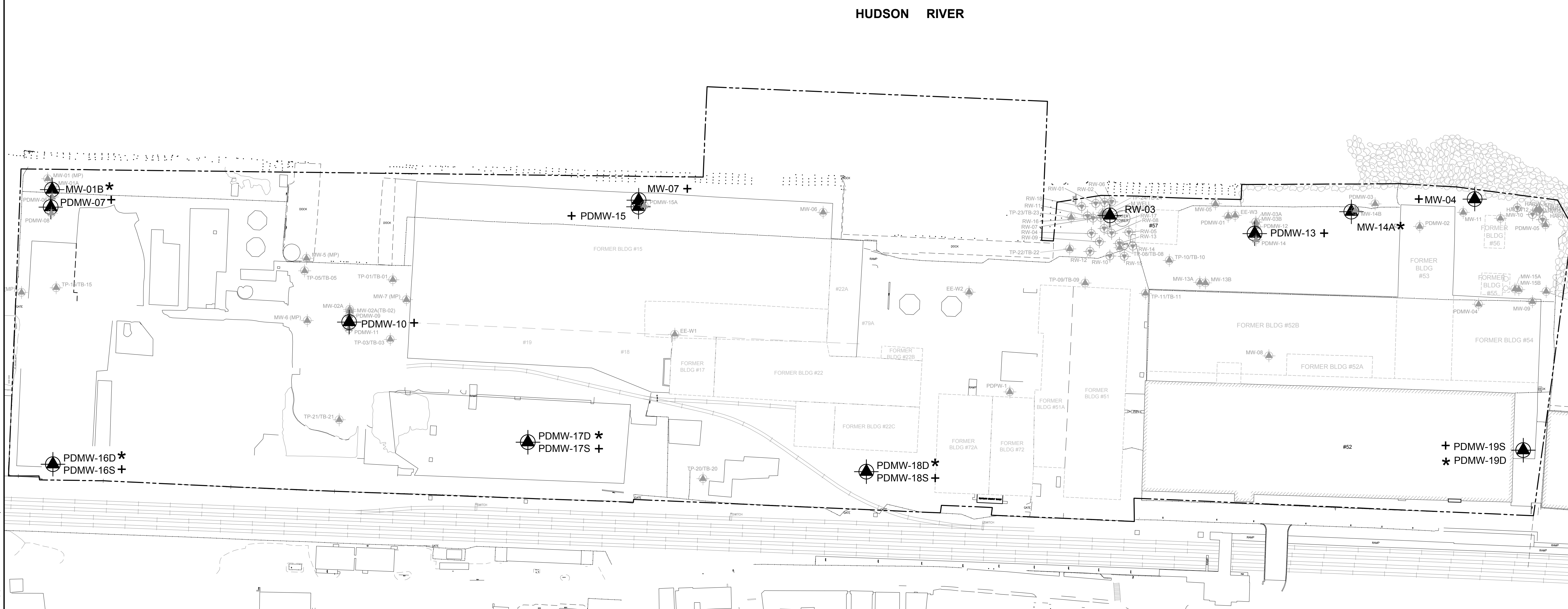
TABLE 1
GPR SURVEY WORK SCOPE
ATLANTIC RICHFIELD
1 River Street
Hastings-on-Hudson, NY

Location on Figure 2R	AREA	Primary Objective (see notes below)	GPR Confirmation Test Locations	Approx. Length (ft)	Primary Objective (see notes below)	Full Scale Scope (if required)	Approx. Length (ft)
1	Building 15	V	* Complete 3 transects east-west; located where voids are known to extend inland	500	V, T	* Complete 25 transects east-west on 25 ft on center from the north side of the south boat split to the south side of the north boat slip; * Complete 2 transects north-south from the north side of the south boat split to the south side of the north boat slip.	6,900
2	Building 51 area	V, T	Complete 2, 140 foot long transects east-west from the shoreline in tank area inland	300	C, V	NONE	0
3	North Boat Slip Shoreline	V, T	* Complete 34, 80 +/- ft long east-west transects on 10 foot centers from west end of boat slip to the east * Complete 2 transects north-south from the south side of the north boat split to the north side of the north boat slip.	3,600	V, T	NONE	0
4	South Boat Slip Shoreline	V, T	Complete 37 transects transects north-south and east west (see Figure 2) 10 ft on center from west end of boat slip toward the east	2,800		NONE	0
5	Old Marina Shoreline		NONE	0	V, C	Complete 2 transects east-west from the east end of the northwest corner to the eastern property boundary.	900
6	Shore Area West of Building 52	C	Complete 1 transect north-south from the north end of the northwest corner to south of the water tower	700	C	Complete 2 transects north-south 80 foot on center from the north end of the northwest corner to south of the water tower	1,400
7	Building 52B Area	T, C	Complete 1 transect north-south from the north end of former Building 52B to the south.	600	T, C, V	Complete approximately 116 transects east-west 5 feet on center from the north end of former Building 52B to the south	16,000
8	Balance of Site		NONE	0	T, C, V	Complete 11 north-south transects 40 ft on center extending from the southern property boundary to the south end of Building 52.	15,300
9	Subsurface features at where high concentrations observed		NONE	0	C	Complete 22 transects north-south 5 ft on center	300
10 thru 14, 20	Subsurface features at 7 specific locations where high concentrations observed		NONE	0	C, V	Complete approximately 78 transects 2.5 ft on center within approximate 1,000 sf areas established in the field, see Fig. 2	2,340
15	South 48 inch outfall	C	Complete 9 transects north-south 2.5 feet on center at 3 locations in areas that the locations of the pipe is known	90	C	Complete 30 transects north-south 2.5 feet on center at 10 locations along the suspected pipe alignment. Focus effort at east end because the alignment there is unknown, particularly with respect to location this pipe crossed the railroad and enters the site.	300
16	North 18-inch outfall		NONE	0	C	Complete 30 transects north-south 2.5 feet on center at 10 locations along the suspected pipe alignment.	300
17	18-inch outfall		NONE	0	C	Complete 30 transects north-south 2.5 feet on center at 10 locations along the suspected pipe alignment.	300
18	IRM Wall Area		NONE	0	C	Complete 1 transect north-south from the north end of the IRM wall to the southern property boundary	400
19	Known vault	V, C	Complete 13 transects east-west 2.5 feet on center in area of known vault	400		NONE	0
			TOTAL	8,990			44,440

Notes: V =voids
T=thickness of concrete slabs
C=location of underground conduits (pipes)



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Drawing Layout: DATA LOGGER PLAN (1)
Plot Date: April 12, 2013
Operator Name: ARAGONA, KEITH

LEGEND

- PROPERTY LINE
- RAIL ROAD
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- FORMER STRUCTURES
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W S N E

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SCALE IN FEET

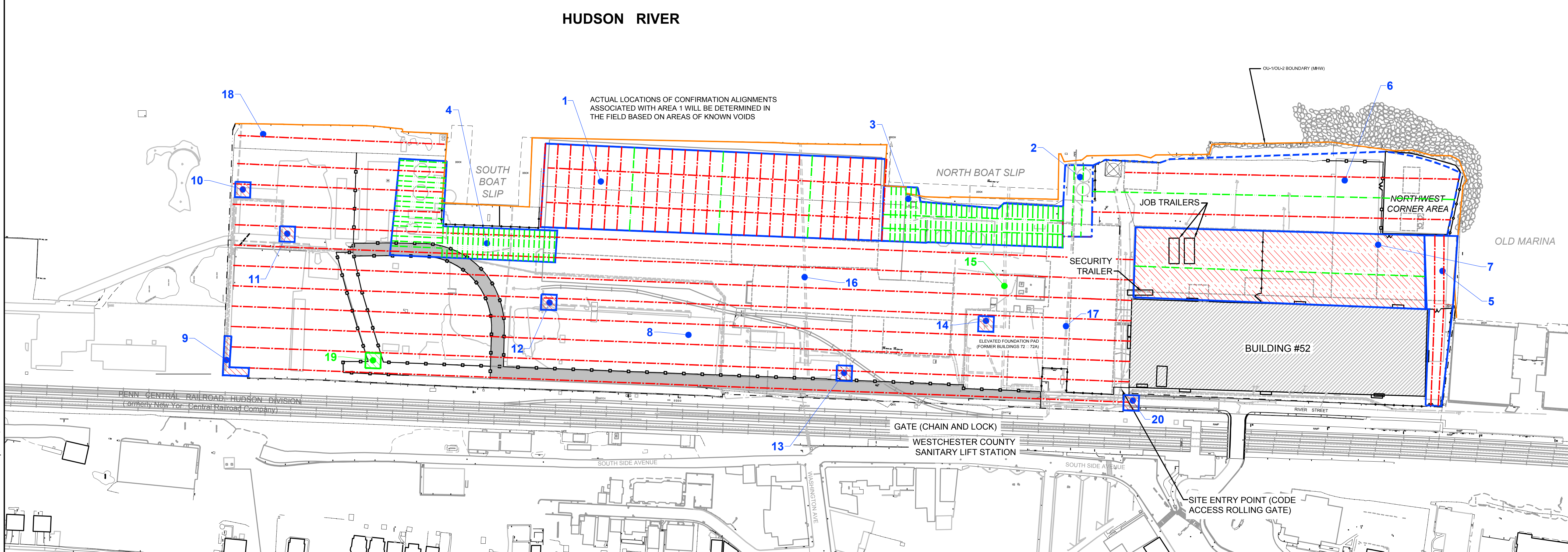
HALEY & ALDRICH

IRM DNAPL EXTRACTION SYSTEM EXPANSION
NYSDEC SITE #3-60-022
HASTINGS-ON-HUDSON, NEW YORK

DATA LOGGER INSTALLATION PLAN

SCALE: AS SHOWN
MARCH 2013

FIGURE 1R



LEGEND

- GPR SCAN AREA
- GPR CONFIRMATION TEST LOCATIONS (ACTUAL ALIGNMENT MAY VARY)
- FULL SCALE TRANSECT LOCATIONS (ACTUAL ALIGNMENT MAY VARY)
- PROPERTY LINE
- RAIL ROAD
- EXISTING STRUCTURES
- FORMER STRUCTURES
- EXISTING FENCE
- TEMPORARY FENCE
- PERMANENT FENCE
- EXISTING BUILDING
- RIP-RAP
- UG DRAINS / SEWER TO RIVER
- ACCESS ROAD TO ADJACENT PROPERTY
- OVERHEAD ELECTRIC
- ELECTRICAL
- EXISTING UTILITY POLE

NOTES

1. BASE PLAN PROVIDED BY BOSWELL ENGINEERING DRAWING NO. 04-209-MW (01/27/2006)
2. OTHER SITE FEATURES BASED ON VARIOUS HISTORICAL DOCUMENTS.
3. ALL PERMANENT FENCE POSTS WERE INSTALLED TO 2 FEET BGS USING HYDRAULIC HAMMER.
4. ACTUAL GPR ALIGNMENTS AND LENGTHS MAY VARY BASED ON FIELD CONDITIONS.

0 100 200 300 400
SCALE IN FEET

HALEY & ALDRICH

IRM DNAPL EXTRACTION SYSTEM EXPANSION
NYSDEC SITE #3-60-022
HASTINGS-ON-HUDSON, NEW YORK

GPR INVESTIGATION PLAN

SCALE: AS SHOWN
MARCH 2013

FIGURE 2R

Drawing Name: G:\28612_HASTINGS\255_IRM DESIGN\CAD\DRAWINGS\R2\DRAWINGS\BASE BID_DNAPL\28612-257-SITE WALK-02.DWG
Operator Name: ARAGONA, KEITH
Plot Date: April 12, 2013
Drawing Layout: GPR_

APPENDIX 2

OU-1 Supplemental Investigation Plan

APPENDIX 2

OU-1 SUPPLEMENTAL INVESTIGATION PLAN

1. INTRODUCTION

This plan describes supplemental onshore investigation activities for OU-1. This task is part of the overall pre-design investigation (PDI) that will be completed at the Former Anaconda Wire & Cable Company site (Site), NYSDEC Site # 3-60-022, located on the east shore of the Hudson River at 1 River Street, Hastings-on-Hudson, New York.

2. BACKGROUND

In order to support the remedy design, several data collection tasks will be conducted. Data gaps that have been identified include updating the current groundwater model, identification of subsurface voids along the shoreline, and investigation of subsurface anomalies, which includes subsurface features that may require special consideration during remedial design (e.g. vaults, sumps, etc.). The primary purpose of these tasks include identifying: subsurface structures or voids that my pose a safety risk to operation of heavy equipment during remedy implementation, subsurface features that may contain residual PCBs, and other anomalies that may require additional investigation.

3. SCOPE OF WORK

The goal of this task is to obtain additional information to support the final remedy design. This plan describes the approach to complete the following tasks:

- Install groundwater wells and operation of pressure transducer data loggers
- Complete baseline sampling of site groundwater
- Evaluate voids adjacent to the shoreline
- Investigate other subsurface anomalies
- Investigate Buildings 15 and 52 outfalls
- Confirm and document existing underground utilities that will remain in place, be relocated, be abandoned, or be removed.

3.1 Groundwater Levels

3.1.1 Monitoring Well Installation

The proposed work scope includes the installation of seven monitoring wells: five shallow wells screened in the Fill unit, and two deep wells screened in the Basal Sand unit (Figure 2-1). Well locations were chosen to establish coverage to better understand tidal influences on the groundwater beneath the site and variation of hydraulic gradients with distance east of the Hudson River for updating the groundwater model. Hydraulic gradients and tides are important parameters which will affect groundwater modeling in support of remedial design.

Monitoring wells will be installed using standard drilling techniques. Shallow wells will be installed to the top of the Marine Silt at depths varying from 15 to 30 feet below ground surface (bgs). Deep monitoring wells will be installed to depths varying from 50 feet near the eastern boundary of the site to 90 feet near the Hudson River. Both shallow and deep wells will be constructed using two-inch-diameter PVC screen (0.010-slot) and riser with appropriately sized sand filter pack. The top of the filter pack will be placed at least two feet above top of screen. A bentonite seal at least two feet in thickness will be placed above the filter pack. Monitoring wells will be grouted to within two feet of ground surface with cement/bentonite grout and will be completed with locking compression caps and flush-mount or stickup well covers. Monitoring wells with flush-mount surface completions will be appropriately marked to facilitate future locating for monitoring activities. Monitoring well construction will be similar to wells installed during previous investigation activities; typical construction logs for shallow and deep wells are shown in Attachment 1. Actual construction specifications may vary based on observed field conditions.

3.1.2 Transducer Deployment

In addition to groundwater level data loggers (pressure transducers) installed during Phase 1 (Appendix 1), additional pressure transducers will be deployed in the newly installed monitoring wells as shown in Figure 2-1.

Pressure transducers will be capable of recording approximately 40,000 data points. Data recording frequency will be calibrated to best support modeling and design objectives. Groundwater levels will be measured manually at each location immediately following deployment of each transducer and during each download event. Barometric pressures will be monitored at an on-site location and will be used to correct water level records for atmospheric variations. Data will be downloaded from the data loggers approximately every two months for a minimum of six months.

3.2 Groundwater Sampling

Baseline groundwater sampling will be completed to monitor shallow groundwater prior to remedial construction to evaluate the long term effectiveness of the remedy.

Baseline groundwater sampling will be completed for three upgradient wells and three Site wells during the PDI (Figure 2-3) and then annually thereafter until the beginning of construction as described below. Groundwater samples will be collected using low flow techniques and analyzed for PCBs, beryllium, copper, lead, and zinc.

The goal of the baseline groundwater sampling program is to sample shallow-screened wells to provide data at both upgradient and down gradient locations across the Site to establish a baseline for groundwater quality; groundwater flow is generally east to west. A description of monitoring wells selected for this program along with a rationale for their selection is provided below.

<u>Upgradient Wells</u>

- PDMW-16S
    - This well is located in the southeast corner of the Site; no known impacted soils are upgradient of this location.
    - Groundwater sampling performed at this location in 2006 showed non-detect (ND) results for PCBs and lead.
    - This location is upgradient of soil contamination in the southwest portion of the Site and upgradient of MW-01A.

- PDMW-20S
  - This well was installed during the 2013 PDI and is located on the eastern portion of the Site; no known impacted soils are upgradient of this location.
  - Groundwater sampling has not been performed at this monitoring well location.
  - This location is upgradient of the water tower area along with other potential sources of contamination and upgradient of MW-05.
- PDMW-19S
  - This well is located in the northeast corner of the Site; no known impacted soils are upgradient of this location.
  - Groundwater sampling performed at this location in 2006 indicated a PCBs result of 0.00061 ppm and a lead result of 0.0043 ppm.
  - This location is upgradient of the Northwest Corner and upgradient of MW-09.

<u>Site Wells</u>

- MW-01A
  - This well is located in the southwestern corner of the Site and adjacent to the Hudson River.
  - Groundwater sampling performed at this location between 1996 and 2000 indicated a range of concentrations for PCBs between ND and 0.0003 ppm and were ND for filtered samples. Lead in groundwater varied from ND to 0.5 ppm and was ND for filtered samples.
  - This location is down gradient of soils containing lead and PCBs that will be removed during implementation of the remedy.
- MW-05
  - This well is located on the western portion of the Site and adjacent to the Hudson River.
  - Groundwater sampling performed at this location between 1997 and 2000 indicated a range of concentrations for PCBs between 0.052 and 0.16 ppm and were ND for filtered samples. Sampling between 1997 and 2005 indicated a range of concentrations for lead between ND and 0.285 ppm and were ND for filtered samples.
  - This location is in an area of onshore and offshore PCB contamination that will be removed during implementation of the remedy as well as down gradient of Building 52.
- MW-09
  - This well is located near the Northwest Corner and northern shoreline.
  - Groundwater sampling performed at this location in 1997 showed a PCB result of 0.0032 ppm and lead sampling in 2005 was ND including an ND for a filtered sample.
  - This location is proximate to the Northwest Corner and associated contamination and adjacent to former Building 55, known as the former Mixing Room.

These well pairs will provide upgradient and down gradient samples in various areas of contamination that will be addressed during implementation of the remedy.

The condition of wells proposed to be included in baseline sampling will be evaluated during the PDI to determine usability for sampling. Groundwater samples will be collected using low flow techniques and analyzed for PCBs, beryllium, copper, lead, and zinc.

3.3 Void Assessment

There are several areas of the Site where evidence of soil erosion or subsidence beneath the concrete slab have been observed. Observations include large holes in the concrete and large void spaces that expose former building foundation structures. These areas are predominantly located between the north and south boat slips. A better understanding of the depth and extent of void spaces beneath the slab is required to:

1. Plan where activities can be safely completed and
2. Provide data to estimate fill quantities.

Void extents will be evaluated through a ground penetrating radar (GPR) program and voids survey. Once the results of the GPR are confirmed (and additional GPR surveys conducted as required), the voids survey will be completed by constructing multiple transects along the shoreline between the north and south boat slips (Figure 2-2). A hammer drill or coring machine will be used to penetrate the concrete so that contact of fill material with the concrete and the concrete thickness can be assessed. The depth from the bottom of the concrete to the top of the fill material will be measured at each location. Once the initial investigation is complete, larger concrete cores will be completed at select locations (approximately 5 - 8) in order to visually confirm measurement results.

3.4 Subsurface Anomalies

There are several areas of the site in which subsurface anomalies (e.g. subsurface features that require special consideration during remedial design such as vaults, sumps, LNAPL, etc.) have been identified during previous investigations and during routine site work that require additional investigation. Locations are shown in Figure 2-4. Investigation of these areas is required to:

1. Assess previously identified significant voids to reduce the potential for safety incidents during construction, if required.
2. Evaluate potential residual material which may be present in the subsurface and/or within features.

The potential presence of other relevant subsurface features will be evaluated using results of previous investigations, evaluation of historical drawings, interviews with site employees, and site reconnaissance. These areas may be investigated using a combination of techniques including coring the surface and using a down hole camera, limited excavation (for the purposes of exposing subsurface structures), lifting manhole and vault lids for inspection, and/or completion of soil borings. Samples may be collected based on field observations. Once subsurface anomalies have been exposed, investigated, and/or evaluated, the area will be surveyed and secured.

3.5 Outfall Investigations

Outfalls that conveyed water from Building 52 to the Hudson River will be further investigated to determine potential PCB impacts to the subsurface resulting from former operations within the building (Figure 2-5).

This will be completed using a multimodal approach as described below.

- Previously test pits were completed at several locations exposing the pipe; samples of the pipe bedding were collected. These documents will be reviewed and the data incorporated into the current investigation program.
- If, based on review of the data from historical evaluations, additional data is required to assess the potential presence of PCBs adjacent to the outfalls, then test pits will be completed. Test pit locations will be determined based on results of document review. Once the pipe is exposed, measurements and materials of construction will be recorded. Additionally, samples of the pipe bedding and adjacent soils may be collected and analyzed to determine the concentration of PCBs. Excavation spoils resulting from test pits will be used as backfill material.
- If, based on test pitting results, the concentration of PCBs are present at concentrations that exceed removal criteria in soil adjacent to the pipe, then existing sampling information will be reviewed and, if necessary, borings may be completed to further evaluate the extents of PCB impacts.

3.6 Evaluate Existing Underground Utilities

The presence, locations, and general conditions of existing utilities will be evaluated for the purposes of determining utilities that enter and exit the site from offsite locations. Additionally, utilities that have been abandoned or are no longer in use will be documented. This information will be incorporated into the design that may determine future easements and discharge permits required. Data collection to support the civil design portion of the remedial design will focus on confirming the locations of existing active utilities that will remain on site after completion of the remedy, be removed or abandoned during completion of the remedy, re-located in support of site redevelopment plans, or protected during construction. Specific civil design components of the remedial design that require special consideration with respect to existing underground utilities may include:

- Grading and drainage: design components may include storm water controls, site ingress/egress, incorporation of existing structures to remain post remedy, and design of grade transitions to adjacent parcels
- Public works utilities, including storm water system, sanitary system, and water supply
- Shore protection and 100 Year Flood Plain; and
- Protection of utilities during construction

The objectives of the activities in this section are to determine the location and condition of existing active utilities on site as follows:

1. The 48-inch Hastings Creek conduit alignment; the location of this alignment identified on surveyed drawings conflicts with field observations. The location of the outfall to the Hudson River is depicted differently on the 2005 Boswell as survey compared to historical drawings. Additionally, the site entrance location from beneath the rail road tracks has not been determined.
2. The 18-inch storm drain/sewer overflow pipe that extends from the existing Westchester County sanitary pump station; the location of this utility has not been verified.
3. The 18-inch storm drain which discharges at a location south of the North Boat Slip; the location of this alignment has not been verified. Additionally, the location at which the storm drain enters the site from the east has not been determined.
4. The alignment of a 30 inch outfall observed in the northern portion of the North Boat Slip.

Additionally, the location of the sanitary sewer will be documented and the abandonment of gas, potable water, and electric utilities which formerly serviced the site will be confirmed.

Methods that will be used to complete the scope may include:

- Requesting data from municipalities to determine the approximate alignment of the utility.
- Locate manholes and document and survey inverts.

Upon completion of this work, storm sewer pipe profiles will be completed based on invert information. Based on this information, additional investigation may be required at a future date to further evaluate the utility including:

- Smoke and/or dye testing to determine the routing and/or outfall locations.
- Video inspection to determine the condition of the interior of the pipe.
- Test pitting to document the materials of construction, location, and condition of the pipe.

Locations of utilities are shown in Figures 2-6 and 2-7. Note that The New York State Department of Environmental Conservation Region 3 Office, Westchester County Health Department and the New York State Department of Health shall be notified prior to dye testing.

3.7 Laboratory Testing

Lab requirements and QA/QC sample frequency are specified in the Quality Assurance Project Plan (QAPP). Sample analysis methods are also specified in the QAPP (e.g. US EPA Method 8082A for PCB Aroclors; US EPA Method 6010C for metals).

3.8 Operating Procedures

The following operating procedures (OP's) are pertinent and are located in Appendix A.

OP3027 – Decontamination Procedure
OP3001 - Preservation and Shipment of Environmental Samples
OP3026 - Chain of Custody
OP3029 – Field Data Recording
OP3030 - Field Instruments: Use and Calibration
OP3012 - Low Stress/Low Flow Groundwater Sample Collection Procedure

4. QUALITY ASSURANCE

Appendix A of the RDWP provides a Quality Assurance Project Plan (QAPP).

5. SUBMITTALS

Applicable data will be included in the PDI Data Summary Report.

6. HEALTH AND SAFETY

Health and safety requirements applicable to all persons entering the site or involved in field activities are described in the Site-specific Health Safety Security and Environmental Plan (HSSEP), these documents will be available for use on Site prior to the commencement of work.

7. ATTACHMENTS

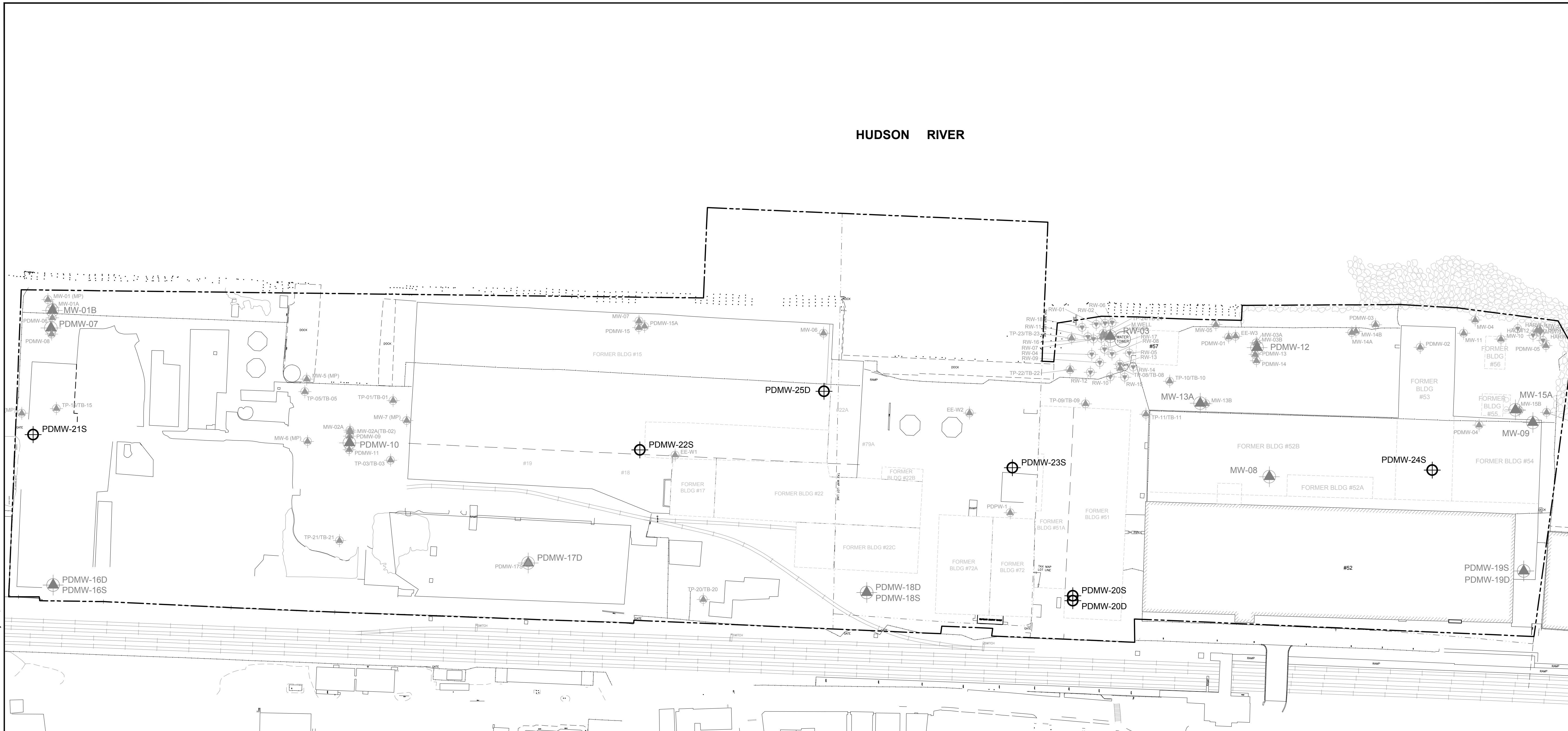
FIGURES

Figure 2-1 Proposed Groundwater Well Installation Plan
Figure 2-2 Proposed Voids Survey
Figure 2-3 2013 PDI Groundwater Well Sampling Locations
Figure 2-4 Subsurface Anomaly Investigation
Figure 2-5 Building 52 Outfall Investigation
Figure 2-6 Site Utilities Investigation (North Area)
Figure 2-7 Site Utilities Investigation (South Area)

ATTACHMENT 1

Example Monitoring Well Construction Logs (2006 PDI)

https://hank.haleyaldrich.com/sites/projects/28612/Shared Documents/289 - RDWP/5-7-14 RTC RDWP/Redline RDWP Edits/App 2 - OU-1 Supplemental-F.docx



LEGEND

- PROPERTY LINE
- RAIL ROAD
- EXISTING STRUCTURES
- FORMER STRUCTURES
- FENCE
- RETAINING WALL
- MONITORING WELL
- RECOVERY WELL
- PROPOSED WELL (PART OF DATA LOGGER INSTALLATION PLAN)
- MONITORING WELL (PART OF DATA LOGGER INSTALLATION PLAN)

NOTES

1. BASE PLAN PROVIDED BY BOSWELL ENGINEERING DRAWING NO. 04-209-MW (01/27/2006).
2. HISTORICAL SURVEY INFORMATION PROVIDED BY PARSONS IN JULY 2005.
3. PROPERTY BOUNDARY INFORMATION PROVIDED BY WENDEL COMPANIES, DRAWING XVE-HUDSON-TOPO.DWG, PROJECT NO. 438504, DATED SEPTEMBER 21, 2012.
4. RIP-RAP DESIGNATION IN THE RIVER IS BASED ON INTERPRETATION OF SIDE SCAN SONAR DATA PROVIDED BY AQUASURVEY INC. IN NOVEMBER 2007.
5. MONITORING WELLS DESIGNATED AS SHALLOW (I.E. PDMW-20S) WILL BE COMPLETED IN THE FILL MATERIAL. MONITORING WELLS DESIGNATED AS DEEP (I.E. PDMW-20D) WILL BE COMPLETED IN THE BASAL SAND.

W S N E

0 80 160 240 320
SCALE IN FEET

HALEY & ALDRICH

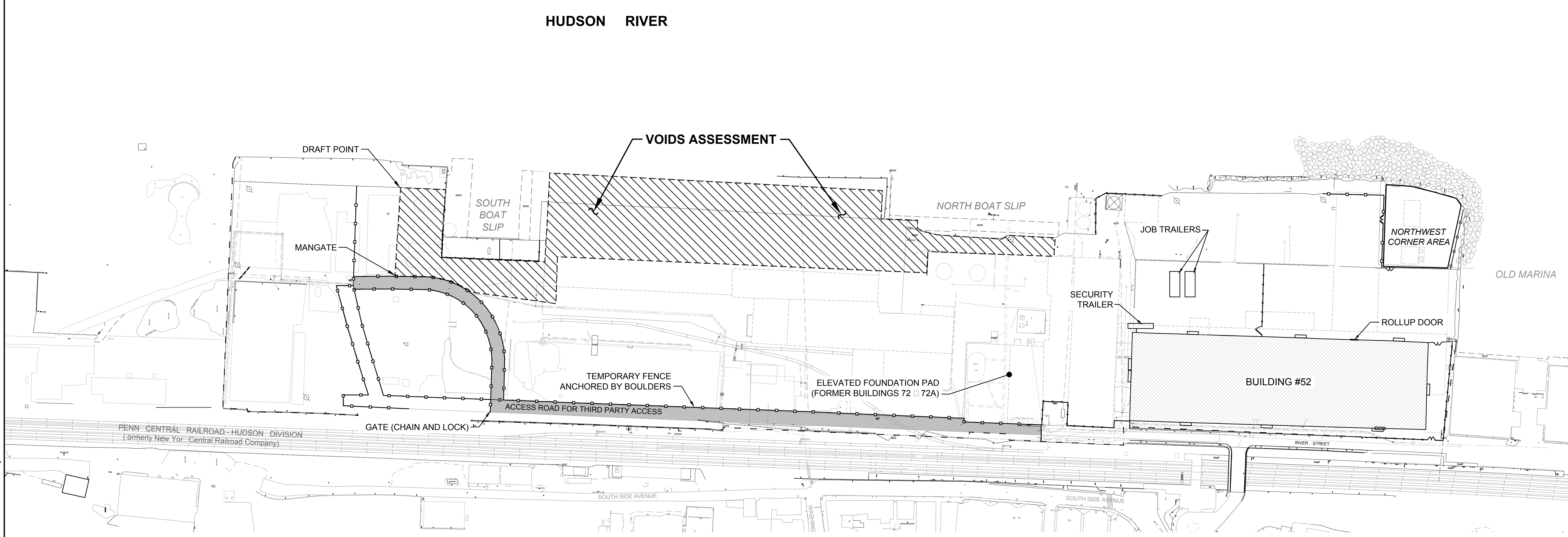
NYSDEC SITE #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

PROPOSED WELLS - DATA LOGGER INSTALLATION PLAN

SCALE: AS SHOWN
MAY 2013

FIGURE 2-1

Drawing Name: S:\28612_HASTINGS\293\CAD\28612-293-007 PROP DATA LOGGER-02.DWG
Operator Name: POSTOLOWSKI, KEVIN
Drawing Layout: FIG 2-1
Plot Date: May 30, 2014



UNKNOWN SUBSURFACE ANOMALY INVESTIGATION LOCATIONS

Drawing Name: S:\28612_HASTINGS\293\CAD\28612-293_006 VOIDS SURVEY.DWG
Operator Name: POSTOLOWSKI, KEVIN
Drawing Layout: FIG 2-2 (5-30-14)
Plot Date: May 30, 2014

LEGEND

- PROPERTY LINE
- RAIL ROAD
- EXISTING STRUCTURES (#52)
- FORMER STRUCTURES
- EXISTING FENCE
- TEMPORARY FENCE
- PERMANENT FENCE
- RIP-RAP
- UG DRAINS / SEWER TO RIVER
- ACCESS ROAD TO ADJACENT PROPERTY
- OVERHEAD ELECTRIC
- ELECTRICAL
- EXISTING UTILITY POLE

NOTES

1. BASE PLAN PROVIDED BY BOSWELL ENGINEERING DRAWING NO. 04-209-MW (01/27/2006)
2. OTHER SITE FEATURES BASED ON VARIOUS HISTORICAL DOCUMENTS.
3. ALL PERMANENT FENCE POSTS WERE INSTALLED TO 2 FEET BGS USING HYDRAULIC HAMMER.
4. CONTRACTOR RESPONSIBLE FOR CONFIRMING ALL OBSTRUCTIONS TO COMPLETING WORK SCOPE.

W S N E

0 100 200 300 400
SCALE IN FEET

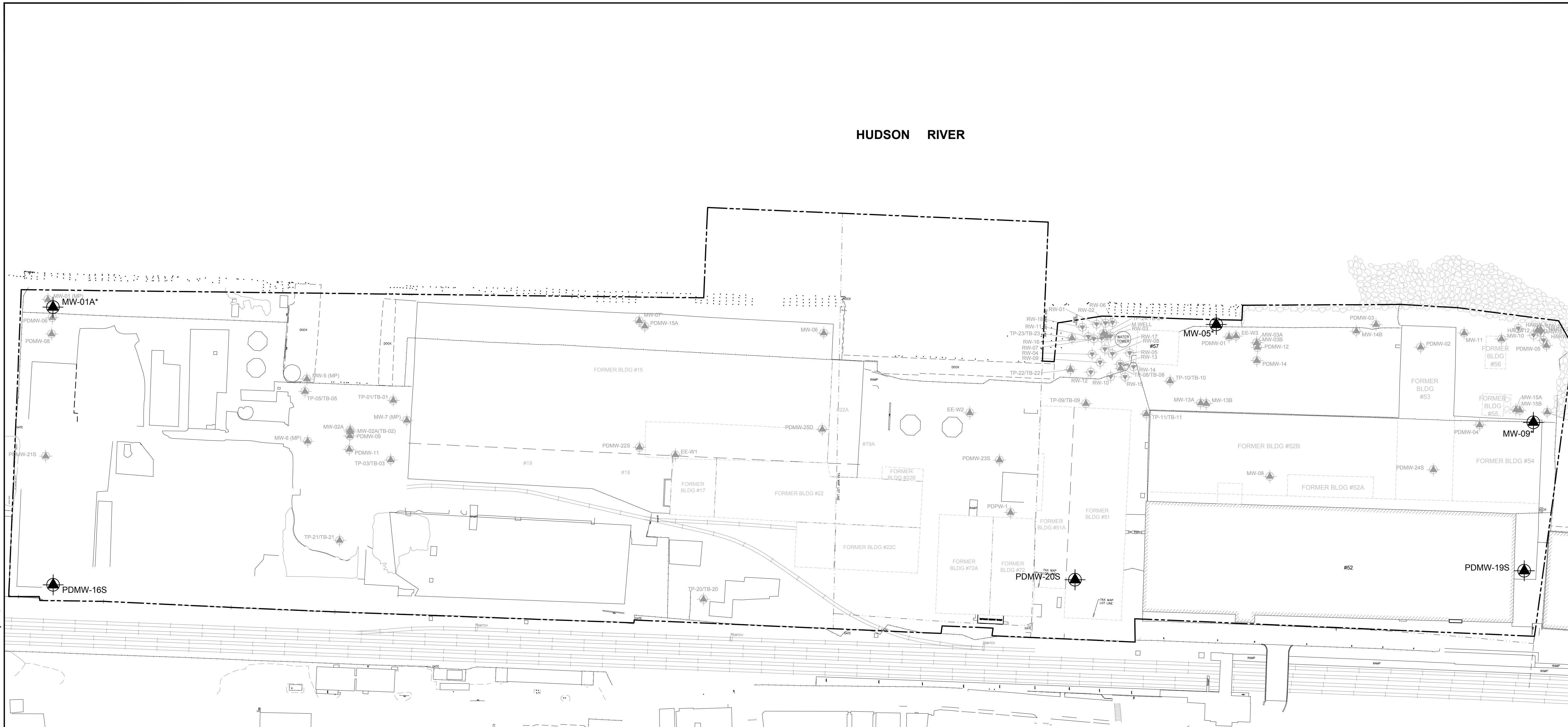
HALEY & ALDRICH

NYSDEC SITE #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

VOIDS SURVEY - SUBSURFACE ANOMALY INVESTIGATION

SCALE: AS SHOWN
MAY 2013

FIGURE 2-2



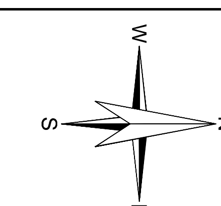
Drawing Name: S:\28612_HASTINGS\293\CAD\2006 OU1 SAMPLING_D2.DWG
Operator Name: POSTOLOWSKI, KEVIN
Drawing Layout: FIG 2-3 (5-30-14)
Plot Date: May 30, 2014

LEGEND

- PROPERTY LINE
- RAIL ROAD
- EXISTING STRUCTURES
- FORMER STRUCTURES
- FENCE
- RETAINING WALL
- PDI SAMPLING WELL LOCATION
- EXISTING MONITORING WELL
- RECOVERY WELL

NOTES

1. BASE PLAN PROVIDED BY BOSWELL ENGINEERING DRAWING NO. 04-209-MW (01/27/2006).
2. HISTORICAL SURVEY INFORMATION PROVIDED BY PARSONS IN JULY 2005.
3. PROPERTY BOUNDARY INFORMATION PROVIDED BY WENDEL COMPANIES, DRAWING XVE-HUDSON-TOPO.DWG, PROJECT NO. 438504, DATED SEPTEMBER 21, 2012.
4. RIP-RAP DESIGNATION IN THE RIVER IS BASED ON INTERPRETATION OF SIDE SCAN SONAR DATA PROVIDED BY AQUASURVEY INC. IN NOVEMBER 2007.



0 80 160 240 320
SCALE IN FEET

HALEY & ALDRICH

NYSDEC SITE #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

2013 OU1 PDI GROUNDWATER WELL SAMPLING LOCATIONS

SCALE: AS SHOWN
MAY 2014

FIGURE 2-3

ANOMALY TYPE 1 (SUBSURFACE STRUCTURES):

PURPOSE:
EVALUATE SUBSURFACE STRUCTURES PRESENT IN AREAS OUTSIDE THE LIMITS OF PROPOSED EXCAVATION AREAS.

SCOPE:
- EVALUATE EXTENTS.
- ACCESS THE STRUCTURE INTERIOR USING A SMALL DIAMETER CORE AND OBSERVE PHYSICAL FEATURES SUCH AS POTENTIAL PRESENCE OF NAPL, TAKE PID READING, ETC.
- OBSERVE PHYSICAL CONDITION OF THE STRUCTURE.
- COLLECT SAMPLES IF VISUAL OBSERVATIONS INDICATE PRESENCE OF CONTAMINATION.
- REVIEW EXISTING SOIL DATA IN VICINITY OF STRUCTURE AND IF NECESSARY COMPLETE APPENDIX 3 EXCAVATION PREDELINEATION BORINGS.

ANOMALY TYPE 2 (SUBSURFACE SOIL):

PURPOSE:
EVALUATE PRESENCE OF CONTAMINANTS IN POTENTIALLY SUSPECT AREAS BASED ON INFORMATION PROVIDED BY SITE WORKERS.

SCOPE:
- EVALUATE HISTORICAL RECORDS TO DETERMINE WHETHER THIS ANOMALY WAS PART OF A FORMER SITE PROCESS.
- COMPLETE SOIL BORING(S) TO DETERMINE THE PRESENCE OF CONTAMINATION.
- IF CONTAMINATION PRESENT, COMPLETE APPENDIX 3 EXCAVATION PREDELINEATION BORINGS.

ANOMALY TYPE 3 (POTENTIAL HISTORIC WELLS):

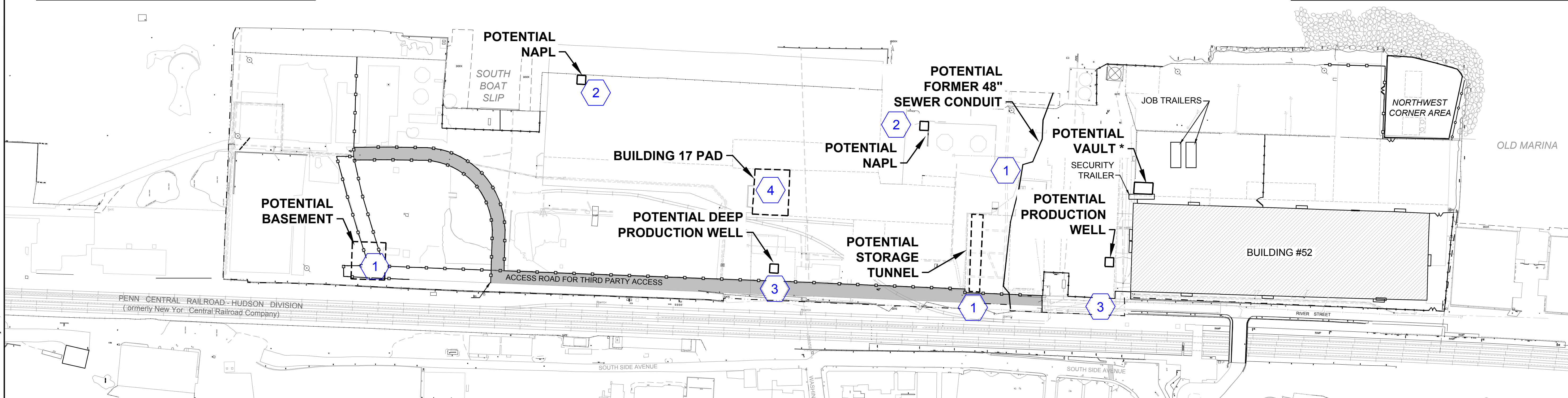
PURPOSE:
EVALUATE ACCESS AND STATUS OF ABANDONMENT OF FORMER PRODUCTION WELLS IDENTIFIED ON HISTORICAL DRAWINGS.

SCOPE:
- IF PRESENT, LOCATE WELLS.
- DETERMINE WHETHER THE WELLS WERE ABANDONED.
- DOCUMENT RESULTS OF SURVEY.

ANOMALY TYPE 4 (BUILDING 17 PAD):

PURPOSE:
EVALUATE SOIL BENEATH FORMER SLAB AREAS THAT HISTORICALLY CONTAINED HIGH CONCENTRATIONS OF PCBS WITHIN THE CONCRETE.

SCOPE:
- REVIEW HISTORICAL INFORMATION TO DETERMINE WHETHER PROCESS RELATED FEATURES WERE PRESENT AT THIS ANOMALY.
- IF HISTORICAL DATA SHOWS PROCESS RELATED FEATURES WERE PRESENT, COMPLETE UP TO 2 BORINGS AT DEPTHS BASED ON DOCUMENTED SUBSURFACE FEATURES (0-2 FEET IF FEATURES NOT IDENTIFIED).
- IF CONTAMINATION PRESENT, COMPLETE APPENDIX 3 EXCAVATION PREDELINEATION BORINGS.



UNKNOWN SUBSURFACE ANOMALY INVESTIGATION LOCATIONS

* BASED ON RESULTS OF 2013 PDI INVESTIGATION, ADDITIONAL INVESTIGATION NOT REQUIRED

1 ANOMALY TYPE

Plot Date: May 30, 2014

Drawing Name: S:\28612_HASTINGS\293\CAD\28612-293_006 VOIDS SURVEY_D2.DWG
Drawing Layout: FIG 2-4
Operator Name: POSTOLOWSKI, KEVIN

LEGEND

- PROPERTY LINE
- RAIL ROAD
- EXISTING STRUCTURES
- FORMER STRUCTURES
- EXISTING FENCE
- TEMPORARY FENCE
- PERMANENT FENCE
- RIP-RAP
- UG DRAINS / SEWER TO RIVER
- ACCESS ROAD TO ADJACENT PROPERTY
- OVERHEAD ELECTRIC
- ELECTRICAL
- EXISTING UTILITY POLE

NOTES

1. BASE PLAN PROVIDED BY BOSWELL ENGINEERING DRAWING NO. 04-209-MW (01/27/2006)
2. OTHER SITE FEATURES BASED ON VARIOUS HISTORICAL DOCUMENTS.
3. ALL PERMANENT FENCE POSTS WERE INSTALLED TO 2 FEET BGS USING HYDRAULIC HAMMER.

W S N E

0 100 200 300 400
SCALE IN FEET

HALEY & ALDRICH

NYSDEC SITE #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

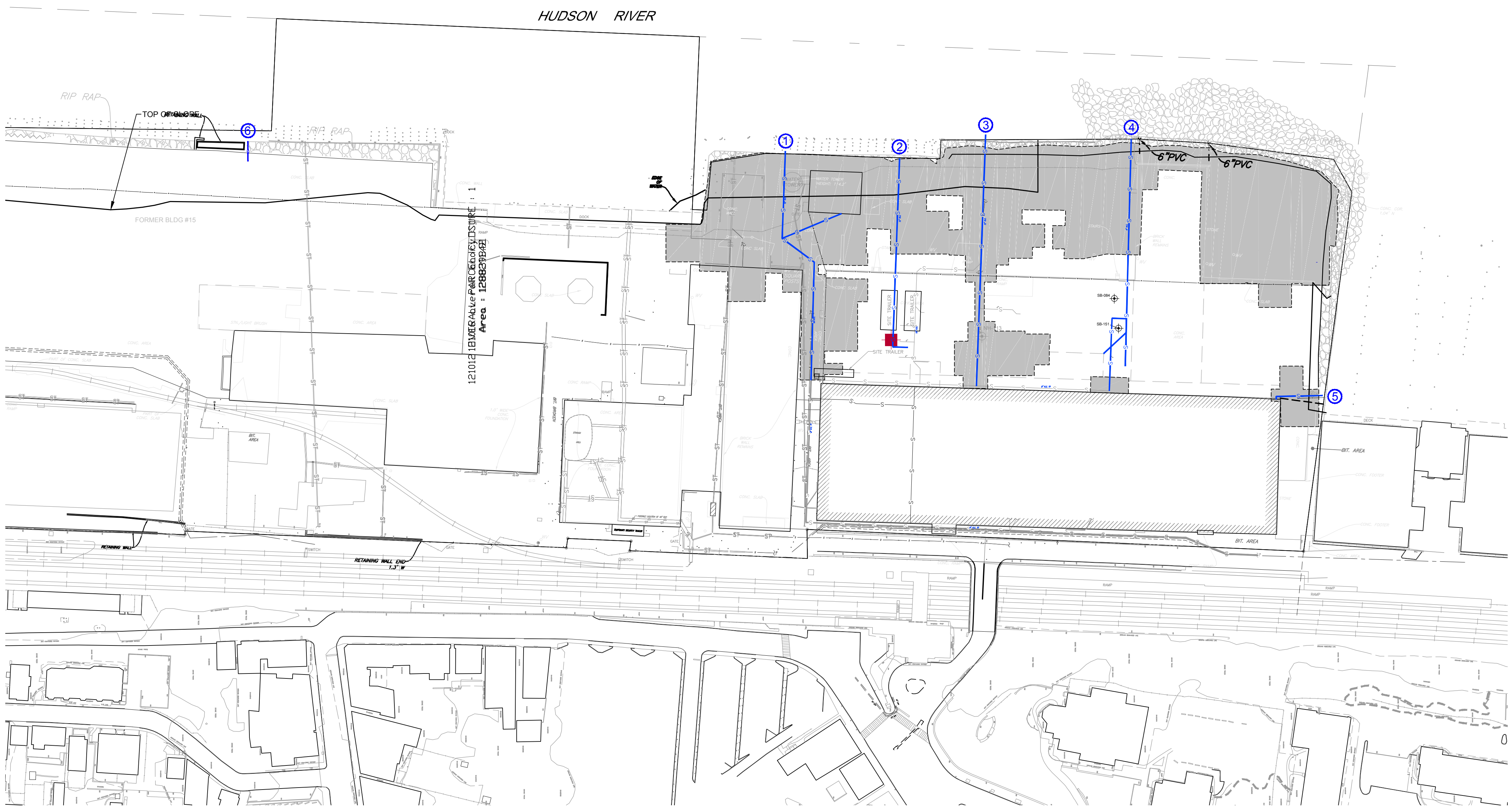
SUBSURFACE ANOMALY INVESTIGATION

SCALE: AS SHOWN
MAY 2014

FIGURE 2-4

LEGEND:

- PROPOSED TEST PIT (NUMBER AND LOCATION OF TEST PITS ARE SUBJECT TO CHANGE BASED ON SITE CONDITION.)
- BORING SAMPLES
- BUILDING 52 PROCESS LINES TO OUTFALLS
- BUILDING 15 PROCESS LINE TO OUTFALL
- PROPERTY LINE
- EXISTING STRUCTURES
- FORMER STRUCTURES
- FENCE
- RIP-RAP
- PROPOSED EXCAVATION LIMITS



BUILDING 52 OUTFALLS:

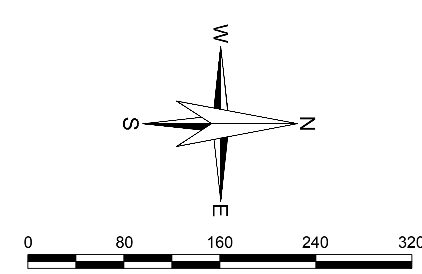
1. ENTIRE FOOTPRINT OF OUTFALL CONTAINED WITHIN LIKELY AREA OF EXCAVATION – NO APPENDIX 2 INVESTIGATION REQUIRED.
2. INVESTIGATE OUTFALL AS DESCRIBED IN APPENDIX 2
3. ENTIRE FOOTPRINT OF OUTFALL CONTAINED WITHIN LIKELY AREA OF EXCAVATION – NO APPENDIX 2 INVESTIGATION REQUIRED.
4. BASED ON RESULTS OF DELINEATION OF SB-084 AND SB-151, ENTIRE FOOTPRINT OF OUTFALL MAY BE CONTAINED WITHIN AREA OF EXCAVATION – SEE APPENDIX 3.
5. ENTIRE FOOTPRINT OF OUTFALL CONTAINED WITHIN LIKELY AREA OF EXCAVATION – NO APPENDIX 2 INVESTIGATION REQUIRED.

BUILDING15 OUTFALL:

6. ENTIRE FOOTPRINT OF OUTFALL CONTAINED WITHIN LIKELY AREA OF EXCAVATION – NO APPENDIX 2 INVESTIGATION REQUIRED.

NOTES:

1. BASE PLAN PROVIDED BY BOSWELL ENGINEERING DRAWING NO. 04-209-MW (01/27/2006).
2. HISTORICAL SURVEY INFORMATION PROVIDED BY PARSONS IN JULY 2005.
3. MEAN HIGH AND MEAN LOW WATER ARE EL. +2.2 AND EL. -2.0, BASED ON HISTORICAL SITE REPORTS. THE MEAN HIGH LINE IS ESTIMATED AT ELEVATION +2.2 FEET. MEAN LOW IS SHOWN AT ELEVATION -1.0 FEET, BUT IS UNDERSTOOD TO BE AT APPROXIMATELY ELEVATION -2.0 FEET.
4. RIP-RAP DESIGNATION IN THE RIVER IS BASED ON INTERPRETATION OF SIDE SCAN SONAR DATA PROVIDED BY AQUASURVEY INC. IN NOVEMBER 2007.
5. BORING LOCATIONS ON SHORE SURVEYED BY BOSWELL ENGINEERING IN SEPTEMBER 2007 – APRIL 2008.
6. EXISTING DATA BASED ON 2008 MODIFIED SITE CONCEPTUAL MODEL.



HALEY & ALDRICH

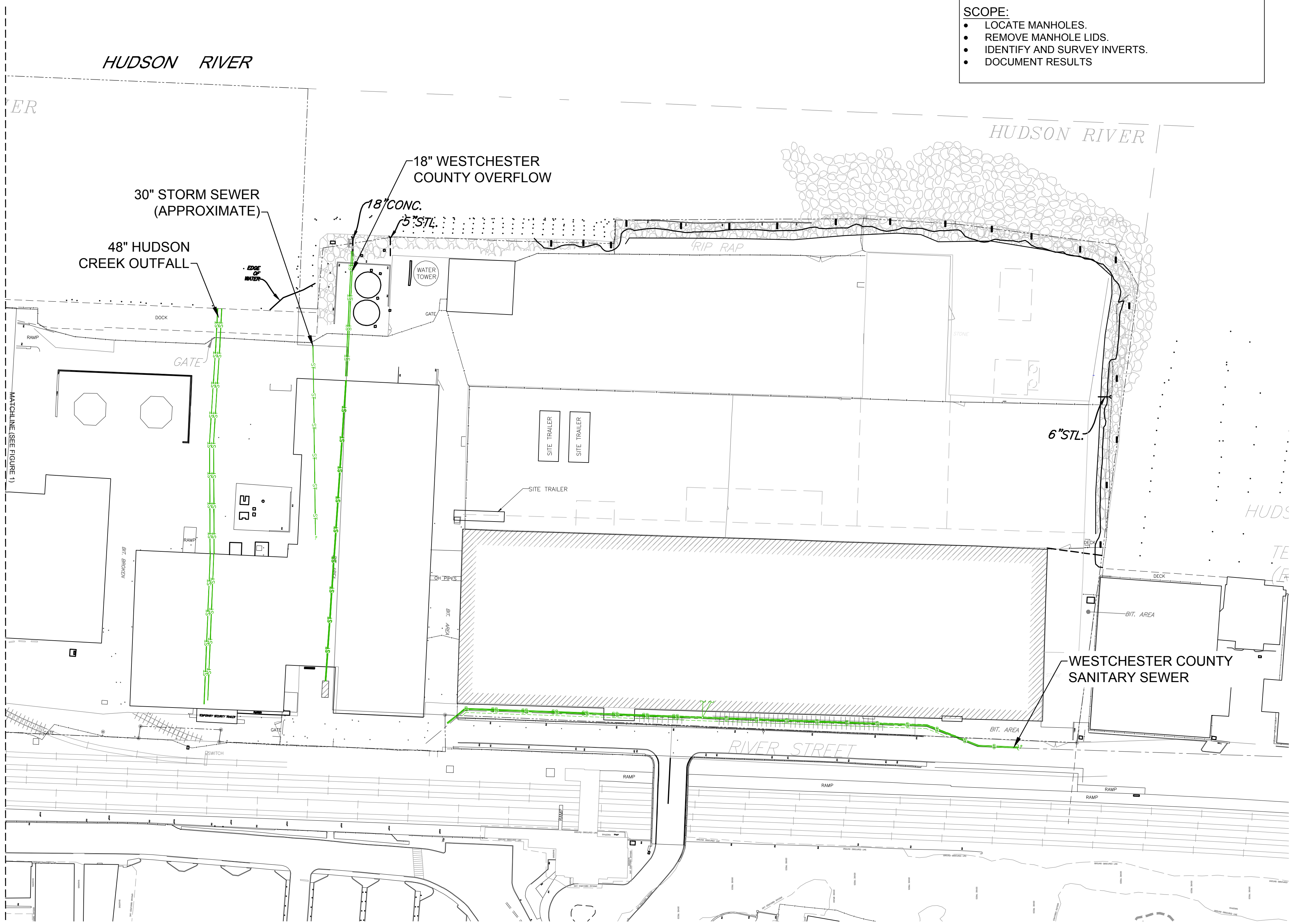
NYSDEC SITE #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

BUILDING 52
OUTFALL INVESTIGATIONS

SCALE: AS SHOWN
MAY 2014

FIGURE 2-5

G:\28612\GLOBAL\CAD\28612-250-0012 BUILDING INVESTIGATIONS 2014-REV.DWG



PURPOSE:
EVALUATE PRESENCE AND LOCATION OF ACTIVE UTILITIES THAT ENTER AND LEAVE THE SITE.

SCOPE:
- LOCATE MANHOLES.
- REMOVE MANHOLE LIDS.
- IDENTIFY AND SURVEY INVERTS.
- DOCUMENT RESULTS

LEGEND:
- SANITARY SEWER LINES TO OUTFALLS
- STORM SEWER LINES TO OUTFALLS
- PROPOSED EXCAVATION LIMITS
- PROPERTY LINE
- EXISTING STRUCTURES
- FORMER STRUCTURES
- FENCE
- RIP-RAP

NOTES:
1. BASE PLAN PROVIDED BY BOSWELL ENGINEERING DRAWING NO. 04-209-MW (01/27/2006).
2. HISTORICAL SURVEY INFORMATION PROVIDED BY PARSONS IN JULY 2005.
3. MEAN HIGH AND MEAN LOW WATER ARE EL. +2.2 AND EL. -2.0, BASED ON HISTORICAL SITE REPORTS. THE MEAN HIGH LINE IS ESTIMATED AT ELEVATION +2.2 FEET. MEAN LOW IS SHOWN AT ELEVATION -1.0 FEET, BUT IS UNDERSTOOD TO BE AT APPROXIMATELY ELEVATION -2.0 FEET.
4. RIP-RAP DESIGNATION IN THE RIVER IS BASED ON INTERPRETATION OF SIDE SCAN SONAR DATA PROVIDED BY AQUASURVEY INC. IN NOVEMBER 2007.
5. BORING LOCATIONS ON SHORE SURVEYED BY BOSWELL ENGINEERING IN SEPTEMBER 2007 - APRIL 2008.
6. EXISTING DATA BASED ON 2008 MODIFIED SITE CONCEPTUAL MODEL.

HALEY & ALDRICH

NYSDEC SITE #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

SITE UTILITIES INVESTIGATION
NORTH AREA

SCALE: AS SHOWN
MAY 2014

FIGURE 2-6

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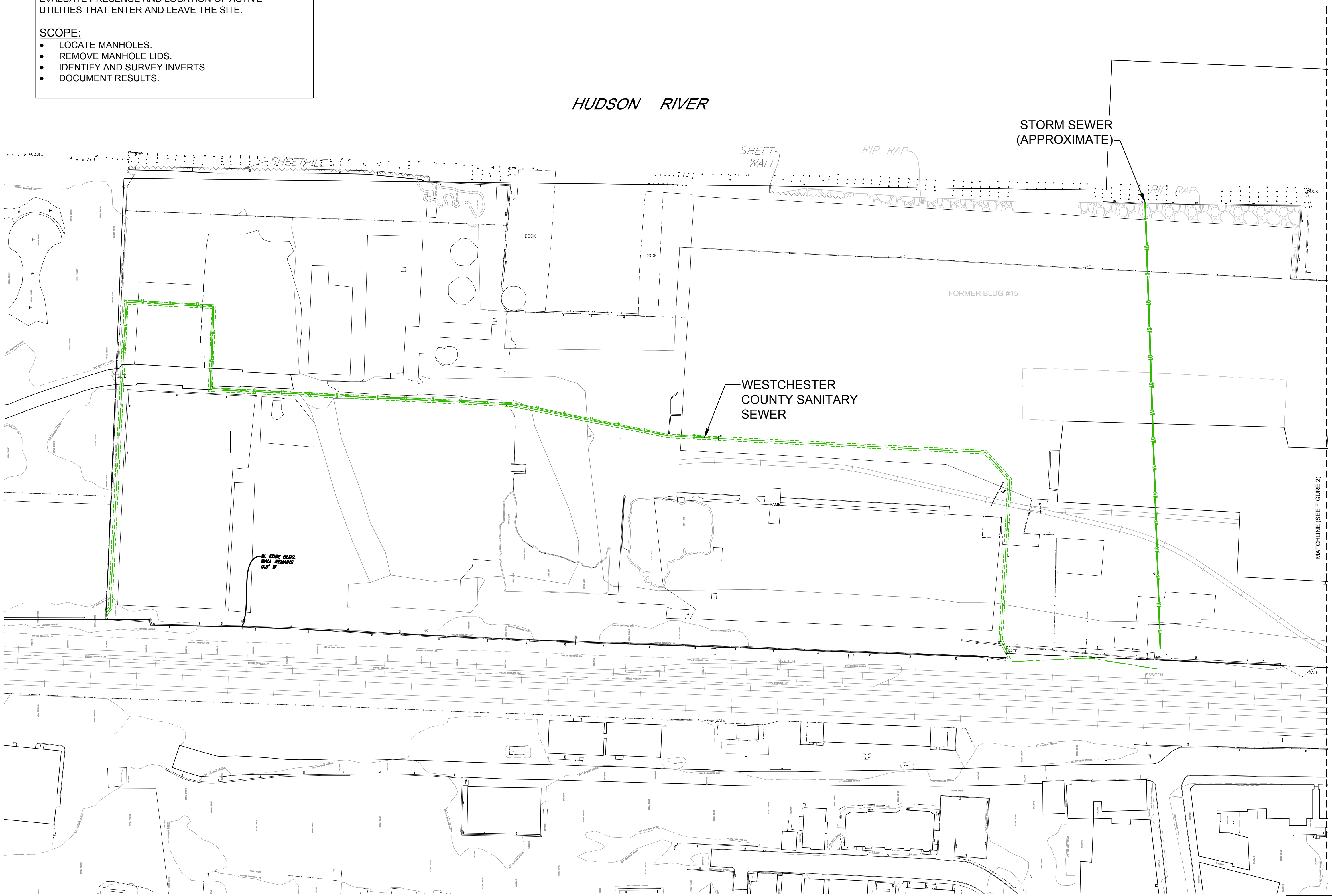
PURPOSE:
EVALUATE PRESENCE AND LOCATION OF ACTIVE UTILITIES THAT ENTER AND LEAVE THE SITE.

SCOPE:
- LOCATE MANHOLES.
- REMOVE MANHOLE LIDS.
- IDENTIFY AND SURVEY INVERTS.
- DOCUMENT RESULTS.

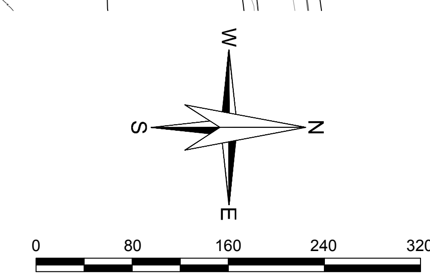


LEGEND:

- SANITARY SEWER LINES TO OUTFALLS
- STORM SEWER LINES TO OUTFALLS
- PROPOSED EXCAVATION LIMITS
- PROPERTY LINE
- EXISTING STRUCTURES
- FORMER STRUCTURES
- FENCE
- RIP-RAP

NOTES:

1. BASE PLAN PROVIDED BY BOSWELL ENGINEERING DRAWING NO. 04-209-MW (01/27/2006).
2. HISTORICAL SURVEY INFORMATION PROVIDED BY PARSONS IN JULY 2005.
3. MEAN HIGH AND MEAN LOW WATER ARE EL. +2.2 AND EL. -2.0, BASED ON HISTORICAL SITE REPORTS. THE MEAN HIGH LINE IS ESTIMATED AT ELEVATION +2.2 FEET. MEAN LOW IS SHOWN AT ELEVATION -1.0 FEET, BUT IS UNDERSTOOD TO BE AT APPROXIMATELY ELEVATION -2.0 FEET.
4. RIP-RAP DESIGNATION IN THE RIVER IS BASED ON INTERPRETATION OF SIDE SCAN SONAR DATA PROVIDED BY AQUASURVEY INC. IN NOVEMBER 2007.
5. BORING LOCATIONS ON SHORE SURVEYED BY BOSWELL ENGINEERING IN SEPTEMBER 2007 – APRIL 2008.
6. EXISTING DATA BASED ON 2008 MODIFIED SITE CONCEPTUAL MODEL.



HALEY & ALDRICH

NYSDEC SITE #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

SITE UTILITIES INVESTIGATION
SOUTH AREA

SCALE: AS SHOWN
MAY 2014

FIGURE 2-7

G:\28612\GLOBAL\CAD\28612-250-0012 UTILITY INVESTIGATIONS 2014.DWG

ATTACHMENT 1

Example Monitoring Well Construction Logs (2006 PDI)

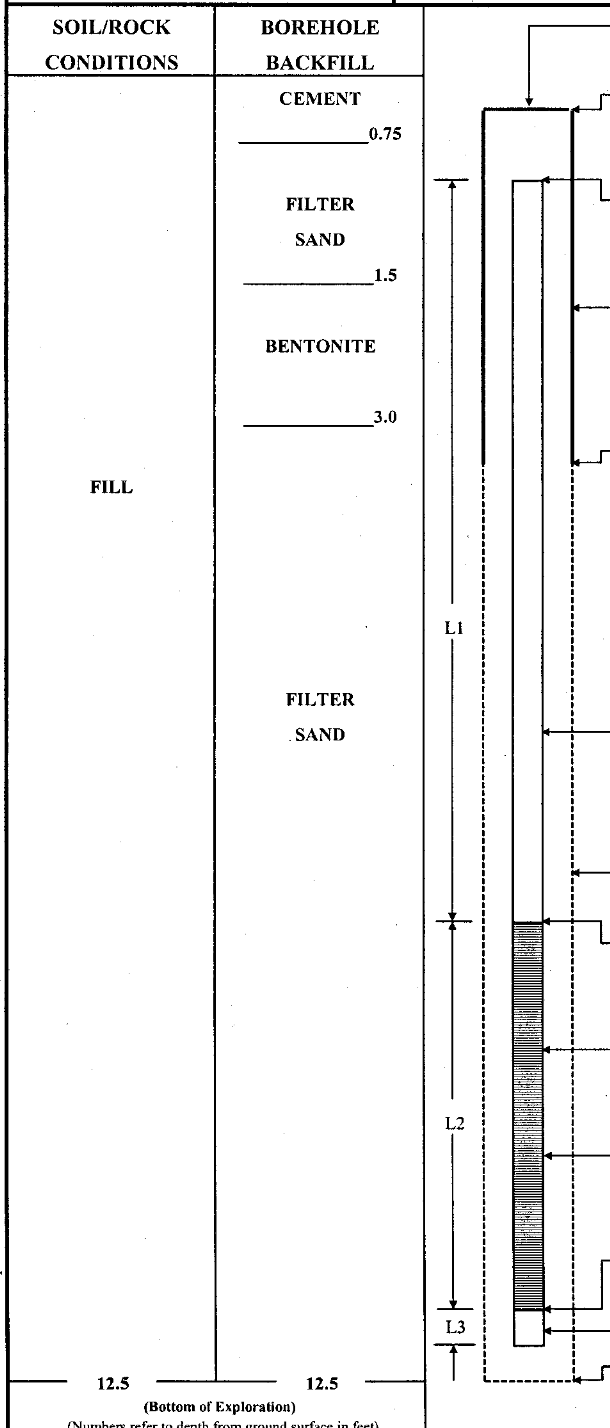
HALEY & ALDRICH

OBSERVATION WELL INSTALLATION REPORT

Well No. **PDMW-19S**
Boring No. **PDMW-19**

PROJECT	ONE RIVER STREET	**H&A FILE NO.**	28612-118
LOCATION	HASTINGS ON HUDSON, NY	**PROJECT MGR.**	W. HARDISON
CLIENT	ATLANTIC RICHFIELD COMPANY	**FIELD REP.**	J. BODE
CONTRACTOR	WARREN GEORGE, INC.	**DATE INSTALLED**	4/12/2006
DRILLER	R. BRIDGEPAL	**WATER LEVEL**	

Ground El. ______ ft **Location** SEE PLAN ☐ **Guard Pipe**
El. Datum ______ ☑ **Roadway Box**



Type of protective cover	9/16 Bolted Cover	
Height/Depth of top of roadway box above/below ground surface	0.0	ft
Depth of top of riser pipe below ground surface	0.3	ft
Type of protective casing:	Roadway Box	
Length	1.1	ft
Inside Diameter	5.0	in
Depth of bottom of roadway box	1.1	ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Concrete	0.0	0.75
Bentonite Seal	1.5	1.5

Type of riser pipe:	Sch 40 PVC Solid	
Inside diameter of riser pipe	2.0	in
Type of backfill around riser	Filter Sand / Bentonite	
Diameter of borehole	4.5	in
Depth to top of well screen	4.2	ft
Type of screen	Machine Slotted Sch 40 PVC	
Screen gauge or size of openings	0.010	in
Diameter of screen	2.0	in
Type of backfill around screen	Filter Sand	
Depth of bottom of well screen	12.2	ft
Bottom of Silt trap	-	ft
Depth of bottom of borehole	12.5	ft

4.0 ft (Riser Pay Length (L1)) + 8.0 ft (Length of screen (L2)) + - ft (Length of silt trap (L3)) = 12.0 ft (Pay length)

COMMENTS: Weather: Sun, 60°

G:\28612\118\OW Installation Report 4/26/06

Form 2007

HALEY & ALDRICH

OBSERVATION WELL INSTALLATION REPORT

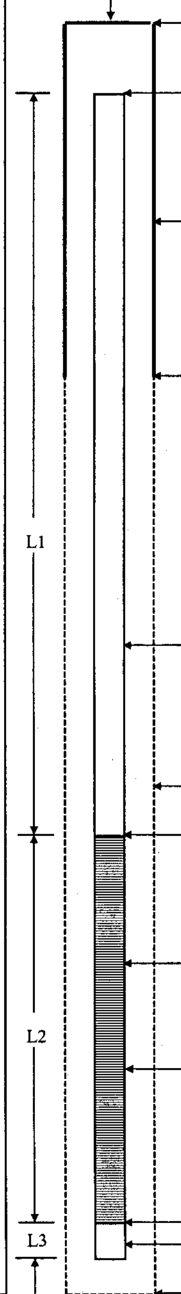
Well No.	PDMW-19D
Boring No.	PDMW-19

PROJECT	ONE RIVER STREET	H&A FILE NO.	28612-118
LOCATION	HASTINGS ON HUDSON, NY	PROJECT MGR.	W. HARDISON
CLIENT	ATLANTIC RICHFIELD COMPANY	FIELD REP.	J. BODE
CONTRACTOR	WARREN GEORGE, INC.	DATE INSTALLED	4/10/2006 to 4/11/2006
DRILLER	R. BRIDGEPAL	WATER LEVEL	

Ground El. ______ ft Location SEE PLAN ☐ Guard Pipe
El. Datum ______ ☑ Roadway Box

SOIL/ROCK CONDITIONS	BOREHOLE BACKFILL
FILL	CEMENT (0 – 0.75)
13.0	CEMENT GROUT
MARINE DEPOSITS (Silt)	35.0
37.0	BENTONITE
MARINE DEPOSITS (Basal Sands)	40.0
	FILTER SAND
48.0	48.0

(Bottom of Exploration)
(Numbers refer to depth from ground surface in feet)



(Not to Scale)

Type of protective cover	9/16 Bolted Cover	
Height/Depth of top of roadway box above/below ground surface	0.0	ft
Depth of top of riser pipe below ground surface	0.5	ft
Type of protective casing:	Roadway Box	
Length	1.1	ft
Inside Diameter	8.0	in
Depth of bottom of roadway box	1.1	ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Concrete	0.0	0.75
Cement Grout	0.75	34.25
Bentonite Seal	35.0	4.0

Type of riser pipe:	Sch 40 PVC Solid	
Inside diameter of riser pipe	2.0	in
Type of backfill around riser	Bentonite / Cement Grout	
Diameter of borehole	5.0	in
Depth to top of well screen	42.7	ft
Type of screen	Machine Slotted Sch 40 PVC	
Screen gauge or size of openings	0.010	in
Diameter of screen	2.0	in
Type of backfill around screen	Filter Sand	
Depth of bottom of well screen	47.7	ft
Bottom of Silt trap	-	ft
Depth of bottom of borehole	48.0	ft

42.7 ft + 5.0 ft + - ft = 47.7 ft
Riser Pay Length (L1) + Length of screen (L2) + Length of silt trap (L3) = Pay length

COMMENTS: Permanenet 5.0 in. steel casing installed from ground surface to 20.0 ft. Weather: Sun, 50-60

G:\28612\118\OW Installation Report 4/26/06

Form 2007

APPENDIX 3

OU-1 Excavation Pre-delineation Plan

APPENDIX 3

OU-1 EXCAVATION PRE-DELINEATION PLAN

1. INTRODUCTION

This plan describes excavation pre-delineation activities for OU-1. This task is part of the overall pre-design investigation (PDI) that will be completed at the Former Anaconda Wire & Cable Company site (Site), NYSDEC Site # 3-60-022, located on the east shore of the Hudson River at 1 River Street, Hastings-on-Hudson, New York.

2. BACKGROUND

The Record of Decision Amendment (NYSDEC, 2012) (ROD) for Operable Unit No. 1 (OU-1) requires that:

> *"2. At the Northwest Corner of the site and along the Northern Shoreline, excavation of surface soil (0- 12 inches) containing greater than 1ppm PCB and subsurface soil containing greater than 10 ppm PCB to a maximum depth of 9 feet. Outside of the Northwest Corner and the Northern Shoreline areas, excavation of surface soil (0-12 inches) containing greater than 1ppm PCB and subsurface soil containing greater than 10 ppm PCB, to a maximum depth of 12 feet. (modified)*
> *3. Outfalls and associated pipe bedding from Building 52 that are potential PCB source areas will be excavated, sampled and removed, or decommissioned as approved by the Department. (new)*
> *4. Excavation of shallow soils from the southern portion of the site that are identified as "lead hotspots". These correspond to lead levels between 2,160 ppm and 43,200 ppm. (unchanged) "*

This excavation pre-delineation sampling program was designed to comply with sampling requirements set forth in DER-10, Technical Guidance for Site Investigation and Remediation, May 2010 (DER-10). Relevant sections are excerpted below:

From Chapter & Section 5.4(b)

1. *Documentation samples, as defined in paragraph 1.3(b)12, are generally required by a site remedy when the soil cleanup is based on (an) excavation(s) to pre-specified excavation limits described in the remedy decision document and delineated during remedial design. Documentation samples are collected and analyzed to document the soil levels achieved by the remedy.*

2. *"Confirmation samples, as defined in paragraph 1.3(b)3, are required when the limits of soil removal are to be determined by achieving a soil cleanup level in the field. Confirmation samples are to demonstrate that the remedy has achieved the soil cleanup levels identified by the decision document, determined as follows:*
    - i. *the use of averages, means or other statistical techniques are generally not allowed, however, recognizing the heterogeneity of contaminated sites and the uncertainty of sampling and analysis of samples, the DER project manager may judge that remediation is complete for sites when:*
        1. *there is a large number of confirmatory samples;*

2. the vast majority of confirmation samples indicate that the soil cleanup levels for the site have been achieved; and
3. those that do not achieve the SCO exceed it only by a small amount; and

ii. should the remedial party disagree with the professional judgment of the DER project manager, the remedial party may submit a justification that there is a 95% confidence level that the soil cleanup levels have been achieved using the procedure defined in the EPA guidance document Supplemental Guidance to RAGS: Calculating the Concentration Term. USEPA Publication 9285.7-081 (May 1992). DER will evaluate this information and make a determination whether the sampling adequately documents that the objectives have been achieved."

5. *"The following are minimum confirmation sampling frequencies for soil excavations of:*
   - *i. less than 20 feet in perimeter, include one bottom sample and one sidewall sample biased in the direction of surface runoff;*
   - *ii. 20 to 300 feet in perimeter, where the remedy is seeking to achieve:*
     1. *surface soil levels, one sample from the top of each sidewall for every 30 linear feet of sidewall and one sample from the excavation bottom for every 900 square feet of bottom area; and*
     2. *subsurface soil cleanup levels, one sample from the bottom of each sidewall for every 30 linear feet of sidewall and one sample from the excavation bottom for every 900 square feet of bottom area;*
   - *iii. greater than 300 feet in perimeter, should be in accordance with either:*
     4. *subparagraph ii above; or*
     5. *a DER-approved reduced sampling frequency, where the remedial party submits a proposed sampling frequency, with supporting rationale, in accordance with section 1.6;*
   - *iv. in an excavation where multiple layers of contamination have been visually or analytically identified, additional side wall samples in the horizon in which contamination was identified are necessary;*
   - *v. each excavation within a larger excavation will be considered a separate excavation and should comply with subparagraphs i through iii above; and*
   - *vi. for side or bottom samples, for volatile organic compounds in an excavation:*
     1. *within 24 hours of excavation, they should be taken from the zero to six-inch interval at the excavation floor; or*
     2. *after 24 hours, the samples should be taken at six to twelve inches; and*
   - *vii. no water should be present in the excavation bottom where bottom samples are collected."*

6. *Confirmation and/or documentation sample locations and depth should be biased toward the:*
   - *viii. areas and depths of highest contamination identified during previous sampling episodes unless field indicators such as field instrument measurements or visual contamination identified during the remedial action indicate that other locations and depths may be more heavily contaminated; and*
   - *ix. locations and depths of the highest expected contamination*

3. SCOPE OF WORK

The goal of this task is to pre-delineate onshore excavation limits using pre-excavation sampling. Establishing excavation limits (area and depth) in this manner will streamline design, reduce uncertainty during construction, increase worker safety during construction, and reduce changes in the field which may result from completing excavation confirmation sampling during remedial construction. Examples of potential issues include:

- Lack of specific shoring design and potential re-installation associated with changing excavation limits
- Unknown waste volumes and water treatment needed during dewatering activities
- Unknown thickness and extent of concrete in excavation locations

This plan describes the approach to delineate the extents of excavation at locations where existing data points indicate PCB or lead above the ROD remedial action criteria (criteria). This will be accomplished by collecting supplemental data at select existing data points (resampling) and performing new explorations to delineate the horizontal and vertical extents of impacts above criteria.

The site has been generally divided into three sections in order to facilitate presentation of investigation plans and discussion of data:

1. The southern portion of the site extends from the southern property boundary northward to the south wall of Former Building 51 between the eastern property boundary and the Hudson River shoreline.
2. The northern portion of the site extends from the south wall of Former Building 51 northward to the northern property boundary between the eastern property boundary and the west edge of the Building 52B pad.
3. The northwest portion of the site extends from the northern boundary of the North Boat Slip northward to the northern property boundary between the west edge of the Building 52B pad to the Hudson River shoreline.

3.1 Existing Data

Existing onsite data are the basis for determining the locations of potential remedial excavation areas that require pre-delineation. A summary of existing on site data used as a basis of the excavation pre-delineation program can be found in the 2008 Modified Conceptual Site Model (CSM) for the site, which can be observed in Attachment 1 of this Appendix 3 of the RDWP. These data were used, where available, to establish the vertical extends of PCB soils that exceed criteria and establish the basis for new borings. In many existing boring locations, data can be used to adequately establish additional sampling locations and resampling, as required. Existing data points that do not contain adequate information will be resampled at sampling intervals where data is needed.

3.2 Pre-Delineation Sampling Program Design

The excavation pre-delineation sampling program was designed based on requirements set forth in DER-10 and quoted in Section 2 of this document. In general, excavation limits will be defined by completing additional borings in locations near existing borings with PCB criteria exceedances. The program proceeds as follows:

1) Evaluate existing locations to 'resample' where needed;
2) Complete sampling around the perimeter of the initials excavation limits which are typically 'offsets' from the existing data at specified depth intervals;
3) Based on the results of the 'offset' locations, the final excavation area will be established or a revised excavation perimeter will be created and 'step out' locations will be sampled;
4) Additional rounds of 'step outs' will be completed until the excavation area confirms no exceedances.

The goal of the offsets is to collect the appropriate number of samples to satisfy the requirement for "confirmation/documentation sampling" described in DER-10 technical guidance. Since the entire Site will receive a minimum of 2 feet of clean cover, all existing materials which remain in place will be defined as subsurface materials whether they consist of soil or other materials (brick, concrete, etc.) and therefore must meet the subsurface exceedance criteria.

3.2.1 Horizontal Distribution of Excavation Pre-delineation Samples

In general, the excavation pre-delineation program investigates an existing criteria exceedance by sampling at a offset borings 15 feet laterally in each direction from the existing data point (See Figures 3-1, 3-2, and 3-3 for proposed resample and offset locations) resulting in a 30 foot by 30 foot gridded "investigation unit". Due to the proximity of other existing data points (above or below criteria), other subsurface features, or concentrations of PCBs relative to the exceedance criteria, many areas will require the use of a non-standard offset. Specific examples of these areas can be observed on the drawings and are described in the table. Evaluation of locations that exceed criteria will generally fall into one of three categories as described below.

1. An "isolated" existing data point describes an existing data point location in which no other data or subsurface features, which exhibits the potential to be a source of PCBs, exist in the vicinity. These areas will generally be investigated as a 30 foot by 30 foot investigation unit unless supplemental site or chemical information indicates that reducing the area is appropriate.
2. A "linear feature" is one or more data points with a criteria exceedance that may be associated with a utility or other liquid conveying site feature (e.g. outfalls and associated pipe bedding from Building 52 that are potential PCB source areas). Criteria exceedances associated with these features may be related to the gravel bedding parallel to the feature and result in horizontal distribution of impacts in the direction parallel to the feature more than in the directions perpendicular to the feature. Therefore, the approach for pre-delineating excavation limits will be to position offsets closer in the direction perpendicular to the feature (e.g. 5 feet) and the standard sampling interval (i.e. 30 feet) in the direction parallel to the feature. Presence of supplemental site or chemical information may indicate that reducing the offset distance is appropriate.
3. A "cluster" location refers to an area where multiple existing data points with criteria exceedances exist within close proximity to one another in an area greater than 900 square feet. For this case, the initial geometry of the investigation units is defined based on the existing data and offset samples are placed around the perimeter. Within a "cluster" one data point may serve as a documentation sample for the side wall of an adjacent area.

Based on a review of the existing data and actual site conditions, there are areas in which modifications to the abovementioned approaches were encountered. Some examples of these areas are described below. Each occurrence of these exceptions is noted in Table 3-1.

1. Existing exceedances located adjacent to property boundaries. Completion of offsets or step outs during this PDI will be limited to within the property boundary. Samples completed in close proximity to property boundaries may be used as documentation samples.
2. Existing exceedances located adjacent to Building 52 or other structures. Offsets adjacent to Building 52 may be used as documentation samples. PCBs are present at concentrations that exceed removal criteria beneath Building 52 as identified in the CSM. No sampling within Building 52 is included in this PDI. If the long term status of Building 52 changes, a separate pre-delineation plan for the building may be completed.
3. Multiple linear features in close proximity to each other. In these instances, offsets may straddle both utilities.
4. Existing data points that exhibit concentrations of PCBs only slightly higher than exceedance criteria. Within areas that do not indicate the presence of widespread impacts above criteria, offsets may be located less than 15 feet from the existing data point.

The initial sampling sequence will be evaluated prior to PDI execution. Explorations will be completed strategically so that sample results can be used to refine offset and step-out locations and depth intervals. Modifications will be discussed with the DEC prior to altering the sampling location plan.

In the event that an exceedance is observed in offset samples, a new perimeter will be established. Step out borings will be determined considering field conditions in the vicinity, concentrations observed, etc. If exceedances occur after multiple step out attempts, alternate methods to delineate PCB criteria exceedances may be reviewed with NYSDEC.

3.2.2 Structure of Table 3-1

Table 3-1 provides important information about each excavation area. Below is a description of each column in the table.

Excavation Area ID	Area Type	Existing Samples in Area	Notes / Exceptions
Each excavation area is provided a unique ID as defined in figures.	Identifies the approach (isolated, linear feature, cluster) selected for pre-delineation.	Lists each existing location with a criteria exceedance within the area.	Describes supplemental information about the excavation area, modifications to the standard approach, etc.

3.2.3 Vertical Distribution of Excavation Pre-delineation Samples

Similar to the horizontal pre-delineation, the vertical (bottom) extents of PCB criteria exceedances within each excavation area will be established through pre-excavation sampling and analysis. Sampling depths intervals will be determined relative to existing grade.

Determination of excavation limits requires sidewall and bottom samples that exhibit concentrations of PCBs below exceedance criteria as follows:

- Bottom sample will be collected as required. Note that the initial excavation depth will be established as the top of the clean sampling interval (e.g. if the existing data point (or resample) indicates the presence of PCBs below criteria at a depth of 8 – 10 feet and above criteria at 6 – 8 feet, then the excavation bottom would be established at 8 feet).
- Bottom of sidewall samples will be collected from borings at the bottom two foot interval of the proposed excavation.
- Horizon samples will be collected, if applicable, at sidewalls (i.e. offsets and step outs) where multiple horizons of exceedances are identified in the existing sample location:

  - At intervals of elevated concentrations which are separated by an interval with significantly lower concentrations.

Vertical sampling intervals will be:

- 0-2 ft for lead hotspots
- Two foot intervals for bottom of excavation samples
- Horizon samples, if applicable, will be collected at the 2 foot interval that corresponds with interval of elevated concentration identified in the existing data point.

Sample interval depths have been identified to define maximum excavation depths as follows:

- 9 feet bgs in the Northern Shoreline Area
- In other areas of the site where PCB impacts above criteria extend below 12 feet, excavation pre-delineation sampling may be proposed to stop at 9 feet. The DEC will be consulted in these specific areas prior to altering the sampling program.

Lead hotspot locations have a pre-determined excavation depth of 2 ft. Therefore, offset borings will only be completed to determine the horizontal distribution of subsurface impacts as specified in the ROD.

If exceedances occur after multiple step out attempts, alternate methods to delineate PCB criteria exceedances may be reviewed with NYSDEC.

3.3 Excavation Pre-delineation Sampling Methods

3.3.1 Survey Control

Existing boring locations will be located via survey and marked for the purposes of resampling, where required, and establishment of perimeter or offset locations.

3.3.2 Concrete and Pavement Coring

Many potential excavation locations are overlain by concrete 6 inches or more in thickness or by asphalt. These areas will be cored using a 6 to 10 inch core barrel to access the subsurface. The diameter of each core will be dependent upon the total anticipated depth of each sample. Each cored sampling location will be surveyed and recorded on field forms.

3.3.3 Surface and Shallow Soils Sampling

A 3-inch diameter by 6-inch long steel hand auger will be used to collect shallow soils (up to approximately 2 feet in depth). Hand auger tools will be decontaminated between borings.

3.3.4 Mid-Depth Soils Sampling

Utilities and other subsurface obstructions at all exploration locations will be hand cleared to a depth of approximately 6 – 7 feet. This will be completed by excavating using an air knife or other clearing technique to each target sampling depth. An air knife consists of using high pressure, compressed air to loosen soils while a vacuum removes the soils from the hole. Once the target depth is reached, a hand auger will be used to collect the sample. The air knife will be used after samples are taken to increase the boring diameter to allow for additional sampling. This process of air knifing/hand augering will continue until a sampling depth of 6-7 feet. The water table in many portions of the site is less than six feet bgs. Attempts will be made to continue hand clearing below the water table. Sampling tools and equipment that comes into contact with potentially contaminated soils will be decontaminated between borings.

3.3.5 Deep Soils Sampling

Standard drilling techniques (e.g. mini-sonic drill rig, direct push) will be used to collect samples at depths greater than 6 – 7 feet or below water table if other techniques are unsuccessful. Borings will be advanced using standard drilling techniques provided by the drilling contractor. Drilling tools will be decontaminated between borings.

3.4 Laboratory Testing

Lab requirements and QA/QC sample frequency are specified in the Quality Assurance Project Plan (QAPP). Sample analysis methods are also specified in the QAPP (e.g. US EPA Method 8082A for PCB Aroclors; US EPA Method 6010C for metals).

The table below summarizes the extent of sample collection based on the initial investigation. These locations and samples are limited to offset sampling but is should be noted that additional samples will be collected, as required, based on initial sampling results. Lead Hotspots will be analyzed for Lead to determine the need for additional step outs with final perimeter location samples being analyzed for additional metals (copper, zinc) for documentation purposes.

PDI Activity	No. of Offsets (Step outs are TBD)	Medium/ Matrix	Sampling Depths (ft.)	Analytical Parameter
South Area (Lead Hotspots)	4 locations 1 sample per location	Soil	0-2	Lead
South Area	59 locations Typically 2-3 samples per location	Soil	Samples will be collected at 2 foot intervals up to 14 as appropriate.	PCBs
North Area	81 locations Typically 2-3 samples per location	Soil	Samples will be collected at 2 foot intervals up to 14 as appropriate.	PCBs

Northwest Area	72 locations Typically 2-3 samples per location	Soil	Samples will be collected at 2 foot intervals up to 9 feet as appropriate.	PCBs

3.5 Operating Procedures

The following operating procedures (OP's) are pertinent and are located in Appendix A.

OP2000 - Monitoring Field Explorations
OP2001 - Identification and Description of Soils Using Visual-Manual Methods
OP3001 - Preservation and Shipment of Environmental Samples
OP3003HOH – Subsurface Soil Sampling
OP3026 - Chain of Custody
OP3027 – Decontamination Procedure
OP3029 – Field Data Recording
OP3030 - Field Instruments: Use and Calibration

4. QUALITY ASSURANCE

Appendix A of the RDWP provides a Quality Assurance Project Plan (QAPP).

5. SUBMITTALS

Applicable data will be included in the PDI Data Summary Report.

6. HEALTH AND SAFETY

Health and safety requirements applicable to all persons entering the site or involved in field activities are described in the Site-specific Health Safety Security and Environmental Plan (HSSEP), these documents will be available for use on Site prior to the commencement of work.

7. ATTACHMENTS

Table 3-1 – Excavation Area Sample Location Rationale
Figure 3-1 – Proposed Explorations (South Area)
Figure 3-2 – Proposed Explorations (North Area)
Figure 3-3 – Proposed Explorations (Northwest Area)
Attachment 1 – 2008 Modified CSM Figures

8. REFERENCES

DER-10 Technical Guidance for Site Investigation and Remediation

Modified Conceptual Site Model, Harbor at Hastings Site, Haley & Aldrich of New York 2008

TABLE 3-1
EXAMPLE SAMPLING RATIONALE FOR OU1 PRE-EXCAVATION DELINEATION PROGRAM

Excavation Area ID PD2-EL-XX	Area Type	Existing Samples in Area	Notes/Exceptions (describe non-standard information/condition)
SOUTH			
SA	Linear	HB-01 SB-012 + DUP SB-112 SB-118	The existing data points are located adjacent to the property boundary and a building slab. Existing soil data indicates exceedances adjacent to a property boundary. Completion of offsets or step outs during this PDI will be limited to the property boundary. During the preliminary design, samples completed in close proximity may be used as documentation samples. Existing data point SB-146 (below criteria at the target sampling interval) located 40 feet west of SB-118 indicates a westwardly offset of 15 ft may be sufficient to establish excavation limits. Since data associated with exceedances within SB-112 and SB-012 does not appear to be associated with an underground utility and may be limited by the concrete slab, the northerly offset will be 15 feet and the westardly offset will be placed approximately 3 feet inside the slab.
SB	Linear	SB-152 PDSS-11	This existing data point is located adjacent to the property boundary. Existing soil data indicates exceedances adjacent to a property boundary. Completion of offsets or step outs during this PDI will be limited to the property boundary. During the preliminary design, samples completed in close proximity may be used as documentation samples. Existing data point PDSS-11 (below criteria at the target sampling interval) located adjacent to SB-152 indicates a non standard offset (7.5 feet due to presence of PDSS-11) shown on the drawing may be sufficient to establish excavation limits.
SC	Isolated	SB-111	Due to the low concentration of PCBs (relative to the removal criteria) at the existing data point, 10 ft offsets may be sufficient to establish excavation limits.
SD	Isolated	HB-06 PDSB-36	Existing data indicates exceedances are limited to the upper 2 ft, which lies in the footprint of the shoreline slope back cut area. Since a large area will removed for the slope back construction, pre-delineation is not require at this time.
SE	Linear	PDSB-100/ SB-088	Based on historical data review, PDSB-100 appears to be a resample of the missing interval at SB-088 and therefore additional data refinement is not required. Existing soil data indicates exceedances are located within 4 feet of a property boundary. Completion of offsets or step outs during this PDI will be limited to the property boundary. During the preliminary design, samples completed in close proximity may be used as documentation samples. Due to the low concentration of PCBs (relative to the removal criteria) at the existing data point, 15 ft offsets (to the east and west) and an offset on the north side of the suspected adjacent utility may be sufficient to establish excavation limits.
SF	Isolated	EE-04 + DUP PDSB-102	The field duplicate associated with EE-04 indicates the results in the 5-7 ft interval were 2.9 mg/kg. Based on the sample results of field duplicate collected at EE-04 and the proximity of PDSB-102 to EE-04, removal criteria does not appear to be exceeded and additional investigation is not required.

TABLE 3-1
EXAMPLE SAMPLING RATIONALE FOR OU1 PRE-EXCAVATION DELINEATION PROGRAM

Excavation Area ID PD2-EL-XX	Area Type	Existing Samples in Area	Notes/Exceptions (describe non-standard information/condition)
SG	Cluster	EE-01 EE-02 EE-03 + DUP MW-01A PDSB-36 SB-147 SB-148	Excavation will be evaluated as a cluster of points due to locations of seven existing data points (three exceedances, four non-exceedances). Existing data points indicating non exceedances are being used as excavation boundaries. Some of these locations require additional sampling in order to coincide with target sampling intervals. The field duplicate associated with EE-03 indicates the results in the 5-7 ft interval were 5.6 mg/kg (non-exceedance).
SH	Isolated	SB-058 PDSB-37	Existing data points lie within shoreline slope back area. A non standard 12 foot offset was chosen due to the presence of PDSB-37, which exhibits a known bottom at 2-4 feet.
SI	Isolated	SB-131	Total Lead Exceedance (no PCB exceedances) at 0-2 ft
SJ	Isolated	SB-128	Total Lead Exceedance (no PCB exceedances) at 0-2 ft
SK	Isolated	SB-100	Total Lead Exceedance (no PCB exceedances) at 0-2 ft
SL	Isolated	PDSB-106	Non-standard excavation shape recommended due to possibility of building foundation or utility limiting potential limits of excavation. The utililty is a sanitary sewer and likely is not a source of PCBs.
SM	Isolated	SB-095A	Due to the low concentration of PCBs (relative to the removal criteria) at the existing data point and the proximity of PDSS-14, an offset of 5 ft may be sufficient to establish excavation limits.
SN	Isolated	PDSB-109	Due to the proximity of PDSS-21, PDSB-109 may be in the vicinity of a sump. Therefore, 7.5 ft offsets may be sufficient to establish excavation limits.
SO	Isolated	SB-077 PDSS-06	Existing slab may limit northerly extents of PCBs. Existing data point PDSS-06 indicates west excavation boundary.
SP	Linear	SB-093	Historical data indicates a second concrete slab is located approximately 2-4 ft below surface slab. Offset locations are nonstandard due to location of trench with respect to existing data point SB-093.
SQ	Linear	SB-069	Offset locations are nonstandard due to location of trench with respect to existing data point SB-069.

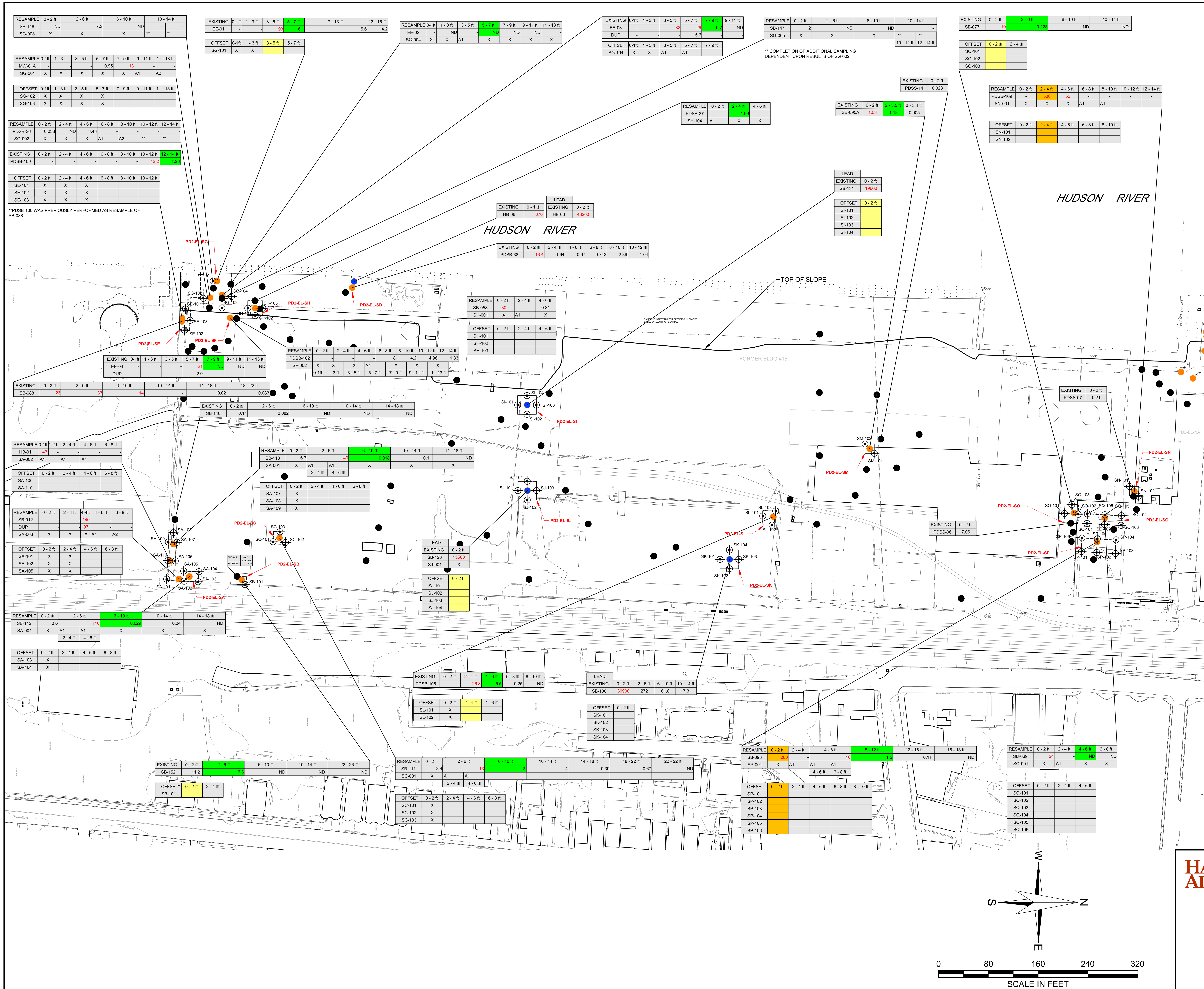
TABLE 3-1
EXAMPLE SAMPLING RATIONALE FOR OU1 PRE-EXCAVATION DELINEATION PROGRAM

Excavation Area ID PD2-EL-XX	Area Type	Existing Samples in Area	Notes/Exceptions (describe non-standard information/condition)
NORTH			
NA	Isolated	SB-085	Due to the low concentration (relative to removal criteria) of PCBs at one interval and significantly lower concentrations at deeper depths, an offset of 7.5 ft may be sufficient to establish excavation limits. Exceedances at 18-22 ft depth indicates that PCBs cannot be removed to below criteria at 12 feet and, therefore, the bottom of excavation may be established at 9 ft.
NB	Isolated	SB-082	Due to the low concentration of PCBs (relative to the removal criteria) at the existing data point, an offset of 7.5 ft may be sufficient to establish excavation limits.
NC	Linear	SB-075 SB-076 SB-153 TB-14	Long Linear feature containing several existing data points exhibiting PCB impacts above removal criteria at multiple depths. A 12 foot offset to the east was chosen due to low concentrations of PCBs (relative to the removal criteria) in existing borings located approximately 20 feet east of SB-153 (EE-10 and PDSB-114).
ND	Isolated	PDSB-14	Standard offsets will be completed for an Isolated point.
NE	Isolated	SB-103	Standard offsets will be completed for an Isolated point.
NF	Isolated	PDSB-16 PDSB-111	High concentration of PCBs deep may indicate the presence of a sump. Additional samples will be collected at the existing location in order to establish a bottom of excavation depth. Due to the presence of a potential sump, a non standard offset was chosen in order to define the limits of excavation. These borings are in the vicinity of an existing construction trailer, which is secured to the slab. Offset locations may vary slightly in order to accomodate this site feature.
NG	Linear	PDSB-31	This area will be investigated as a standard Linear. However, due to the presence of Building 52, NG-101, NG-102, and NG-103 will serve as documentation samples. Excavation is not expected to be completed within 4 feet of Building 52 wall.
NH	Linear / Cluster	PDSB-26 SB-072 SB-073 SB-079 SB-080 SB-081	Cluster area composed of a Linear and Isolated locations extending from the Building 52 wall to the west. Excavation areas evaluated as isolated points are located on the north and south sides of the Linear with impacts present in the existing sample at varying depths. Existing samples and additional samples will be used to evaluate changes in excavation depths within the footprint.
NI	Linear	SB-084 SB-151	Existing data points associated with this area may or may not be associated with subsurface utilities. Offsets from these existing data points will be evaluated once characterization of potential Building 52 outfalls is complete.
NJ	Cluster	PDSB-25 SB-098	Existing data points associated with this area completed as a cluster of existing data points. Due to the low concentration of PCBs (relative to the removal criteria) at the existing data point SB-098, an offset of 10 ft may be sufficient to establish excavation limits at this location. Standard offset will be used for PDSB-25 due to a higher concentration at this point.

TABLE 3-1
EXAMPLE SAMPLING RATIONALE FOR OU1 PRE-EXCAVATION DELINEATION PROGRAM

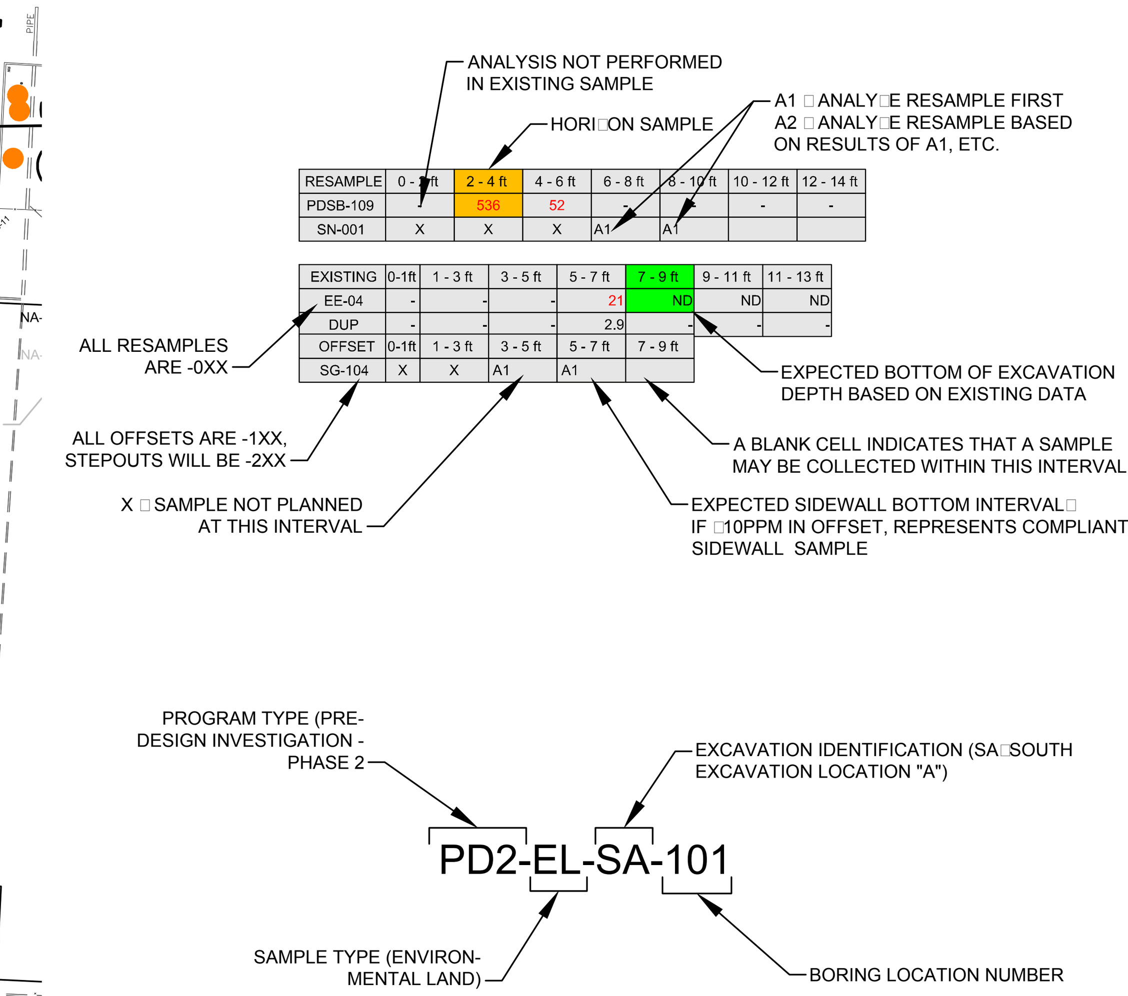
Excavation Area ID PD2-EL-XX	Area Type	Existing Samples in Area	Notes/Exceptions (describe non-standard information/condition)
NK	Linear	PDSB-33	This area will be investigated as a non-standard Linear. Based on the relatively low concentration of PCBs (relative to the removal criteria) and the apparent end of the utility just south of PDSB-33, a 5 foot offset to the north and 15 feet to the south. Due to the presence of Building 52, NK-102 will serve as a documentation sample. Excavation is not expected to be completed within 4 feet of Building 52 wall.
NL	Isolated	PDSS-02 SB-102	This area known to be in the vicinity of a sump. Therefore, 7.5 ft offsets used for evaluation. Maximum excavation depth is 9 feet as described in the ROD.
NM	Isolated	SB-121	Standard offsets for an Isolated. Maximum excavation depth is 9 feet as described in the ROD.
NN	Cluster	PDSB-34 SB-154	Standard 15 foot offsets for a cluster Maximum excavation depth is 9 feet as described in the ROD.
NO	Isolated	CAM-S0-01	A non standard 7.5 foot offset was chosen due to the presence of low concentration PCBs (relative to the removal criteria).
NP	Isolated	None	Existing data points associated with this area may or may not be associated with subsurface utilities. Offsets from these existing data points will be evaluated once characterization of potential Building 52 outfalls is complete.
NQ	Isolated	None	Investigation borings were not completed in this area. Therefore, the suspected pipe will be located and accessed (if located) to assess the potential for this area being a source area as described in the document.
NR	Isolated	None	Isolated point of a surface exceendance with an existing data point below critieria within 10 feet. Access of drilling equipment may be an obstacle to obtaining a sample every 30 feet. Therefore, the number of samples required to maintain an average of one sample per 30 feet was maintained. Maximum excavation depth is 9 feet as described in the ROD.
WEST			
WA	Cluster	Multiple	Area that includes many existing data points, evaluated for large-scale excavation to 9 ft depth as described in the ROD.
WB	Isolated	SB-123	Standard isolated point offset; maximum excavation depth is 9 feet as described in the ROD.
WC	Isolated(s)	PDSB-22 SB-063	Exceedances for both existing data points are 6 ft or shallower. Maximum excavation depth is 9 feet as described in the ROD Two Isolated excavations combined, share confirmatory sample locations.
WD	Isolated(s)	FL-21	Evaluated using non standard offsets due to the shared boarder of excavation WA and low concentrations in the existing sample point. Maximum excavation depth is 9 feet as described in the ROD.
WE	Cluster	PDSB-30 TB-17	Evaluated using non standard offsets due to the shared boarder of excavation WA and low concentrations in TB-17. WE-105 may serve as a step up sample. Maximum excavation depth is 9 feet as described in the ROD.

NOTES:
TBD - To Be Determined
N/A - Not Applicable



LEGEND:

- PROPOSED INVESTIGATION BORING
- PROPOSED EXCAVATION LIMITS
- PROPERTY LINE
- EXISTING STRUCTURES
- FORMER STRUCTURES
- FENCE
- RIP-RAP
- RESULT LESS THAN CRITERIA
- RESULT GREATER THAN CRITERIA
- LEAD HOTSPOT
- STORM DRAIN/SANITARY
- EXISTING STORM SEWER



NOTES:

1. BASE PLAN PROVIDED BY BOSWELL ENGINEERING DRAWING NO. 04-209-MW (01/27/2006).
2. HISTORICAL SURVEY INFORMATION PROVIDED BY PARSONS IN JULY 2005.
3. MEAN HIGH AND MEAN LOW WATER ARE EL. +2.2 AND EL. -2.0, BASED ON HISTORICAL SITE REPORTS. THE MEAN HIGH LINE IS ESTIMATED AT ELEVATION +2.2 FEET. MEAN LOW IS SHOWN AT ELEVATION -1.0 FEET, BUT IS UNDERSTOOD TO BE AT APPROXIMATELY ELEVATION -2.0 FEET.
4. RIP-RAP DESIGNATION IN THE RIVER IS BASED ON INTERPRETATION OF SIDE SCAN SONAR DATA PROVIDED BY AQUASURVEY INC. IN NOVEMBER 2007.
5. BORING LOCATIONS ON SHORE SURVEYED BY BOSWELL ENGINEERING IN SEPTEMBER 2007 & APRIL 2008.
6. EXISTING DATA BASED ON 2008 MODIFIED SITE CONCEPTUAL MODEL.

HALEY & ALDRICH

NYSDEC SITE #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

PROPOSED EXPLORATIONS
(SOUTH AREA)

SCALE: AS SHOWN
MAY 2013

FIGURE 3-1

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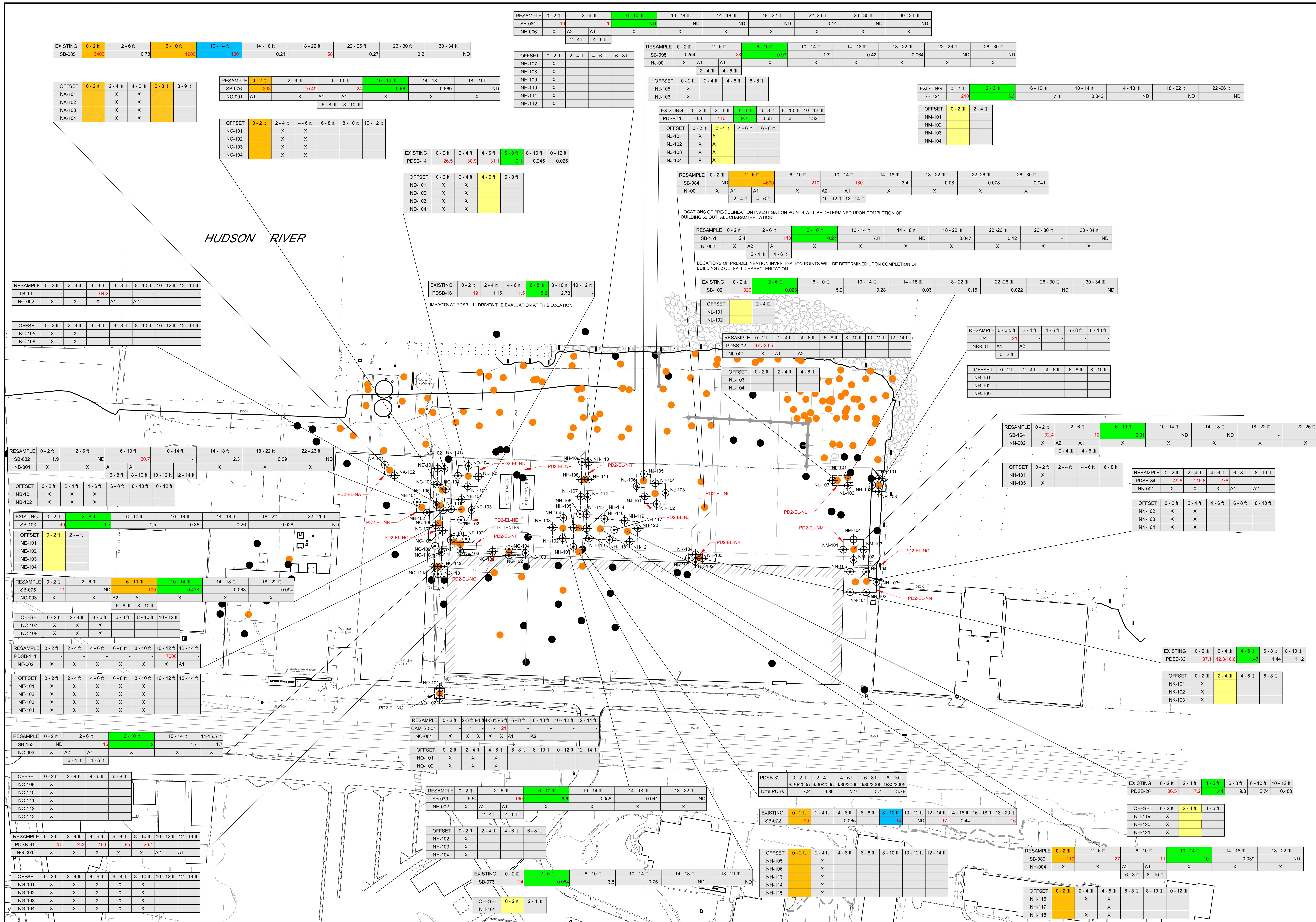

LEGEND:

- PROPOSED INVESTIGATION BORING
- PROPOSED EXCAVATION LIMITS
- PROPERTY LINE
- EXISTING STRUCTURES
- FORMER STRUCTURES
- FENCE
- RIP-RAP
- RESULT LESS THAN CRITERIA
- RESULT GREATER THAN CRITERIA
- STORM DRAIN/SANITARY
- EXISTING STORM SEWER
- EXCAVATION BOTTOM MAY BE ESTABLISHED AT 9

ANALYSIS NOT PERFORMED IN EXISTING SAMPLE

HORIZON SAMPLE

A1 ANALYZE RESAMPLE FIRST
A2 ANALYZE RESAMPLE BASED ON RESULTS OF A1, ETC.

ALL RESAMPLES ARE -0XX

ALL OFFSETS ARE -1XX, STEPOUTS WILL BE -2XX

X SAMPLE NOT PLANNED AT THIS INTERVAL

EXPECTED BOTTOM OF EXCAVATION DEPTH BASED ON EXISTING DATA

A BLANK CELL INDICATES THAT A SAMPLE WILL BE COLLECTED WITHIN THIS INTERVAL.

EXPECTED SIDEWALL BOTTOM INTERVAL IF 10PPM IN OFFSET, REPRESENTS COMPLIANT SIDEWALL SAMPLE

PROGRAM TYPE (PRE-DESIGN INVESTIGATION - PHASE 2)

EXCAVATION IDENTIFICATION (NA NORTH EXCAVATION LOCATION "A")

PD2-EL-NA-101

SAMPLE TYPE (ENVIRONMENTAL LAND)

BORING LOCATION NUMBER

NOTES:

1. BASE PLAN PROVIDED BY BOSWELL ENGINEERING DRAWING NO. 04-209-MW (01/27/2006).
2. HISTORICAL SURVEY INFORMATION PROVIDED BY PARSONS IN JULY 2005.
3. MEAN HIGH AND MEAN LOW WATER ARE EL. +2.2 AND EL. -2.0, BASED ON HISTORICAL SITE REPORTS. THE MEAN HIGH LINE IS ESTIMATED AT ELEVATION +2.2 FEET. MEAN LOW IS SHOWN AT ELEVATION -1.0 FEET, BUT IS UNDERSTOOD TO BE AT APPROXIMATELY ELEVATION -2.0 FEET.
4. RIP-RAP DESIGNATION IN THE RIVER IS BASED ON INTERPRETATION OF SIDE SCAN SONAR DATA PROVIDED BY AQUASURVEY INC. IN NOVEMBER 2007.
5. BORING LOCATIONS ON SHORE SURVEYED BY BOSWELL ENGINEERING IN SEPTEMBER 2007 APRIL 2008.
6. EXISTING DATA BASED ON 2008 MODIFIED SITE CONCEPTUAL MODEL.

SCALE IN FEET: 0 80 160 240 320

HALEY & ALDRICH

NYSDEC SITE #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

PROPOSED EXPLORATIONS (NORTH AREA)

SCALE: AS SHOWN
MAY 2013

FIGURE 3-2

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OFFSET SAMPLING REGIME FOR EXCAVATION WA

Offset ID	0-2	2-4	4-6	6-8	8-10	Reference Sample for Offset
WA-101	X	X	X	resample existing		SB-059
WA-102	X	X	X	resample existing		
WA-103	X	X	X	X	A1	PDSB-11
WA-104	X	X	X	X	A1	
WA-105	X	X	X	X	A1	TB-09
WA-106	X	X	X	X	A1	
WA-107	X	X	X	X	A1	PDSB-07
WA-108	X	X	X	X	A1	PDSB-08
WA-109	X	X	X	X	A1	PDSB-12
WA-110	X	X	X	X	A1	
WA-111	X	X	X	X	A1	
WA-112	X	X	X	X	A1	
WA-113	A1	X	X	X	A1	SB-116
WA-114	X	X	X	X	A1	TB-10
WA-115	X	X	X	X	A1	
WA-116	X	X	X	X	A1	
WA-117	A1	X	X	X	A1	PDSB-10
WA-118	A1	X	X	X	A1	
WA-119	A1	resample existing		X	X	SB-115
WA-120	A1	X	X	X	A1	PDSB-15,
WA-121	A1	X	X	X	A1	EE-15
WA-122	X	X	X	X	A1	PDSB-17
WA-123	X	A1	X	X	A1	SB-035
WA-124	X	A1	X	X	A1	PDSB-20
WA-125	X	A1	X	X	A1	
WA-126	X	A1	X	X	A1	
WA-127	X	A1	X	X	A1	PDSB-21
WA-128	X	A1	A1	A1	A1	
WA-129	A1	X	X	X	A1	SB-062
WA-130	X	A1	X	X	A1	PDSB-18,
WA-131	X	A1	X	X	A1	SB-064
WA-132	X	A1	X	X	A1	SB-066
WA-133	X	A1	X	X	A1	PDSB-23
WA-134	X	A1	X	X	A1	
WA-135	X	A1	X	X	A1	
WA-136	X	X	X	X	A1	PDSB-24
WA-137	X	X	X	X	A1	SB-067
WA-138	X	X	X	X	A1	
WA-139	X	X	X	X	A1	
WA-140	X	X	X	X	A1	DB-30
WA-141	X	X	X	X	A1	DB-29
WA-142	X	X	X	X	A1	
WA-143	X	X	X	X	A1	DB-28
WA-144	X	X	X	X	A1	
WA-145	X	X	X	X	A1	DB-20
WA-146	X	X	X	X	A1	
WA-147	X	X	X	X	A1	DB-22
WA-148	X	X	X	X	A1	
WA-149	X	X	X	A1	A1	PDSB-28
WA-150	X	X	X	X	A1	HA-116
WA-151	X	X	X	X	A1	
WA-152	X	X	X	A1	A1	PDSB-29,
WA-153	X	X	X	X	A1	TB-17
WA-154	X	X	A1	X	A1	HA-115,
WA-155	X	X	A1	X	A1	PDSB-30

EXISTING SAMPLE DATA REFERENCED FOR OFFSET LOCATIONS CAN BE FOUND IN ATTACHMENT 1 OF APPENDIX 3 OF THE RDWP.

EXISTING	0 - 2 ft	2 - 6 ft	6 - 10 ft	10 - 14 ft	14 - 18 ft	18 - 22 ft	22 - 26 ft	26 - 30 ft	30 - 34 ft
SB-123	1300	0.27	0.054	0.036	ND	ND	ND	0.4	ND

OFFSET	0 - 2 ft	2 - 4 ft	4 - 6 ft
WB-101	A1		
WB-102	A1		
WB-103	A1		
WB-104	A1		

RESAMPLE	0 - 2 ft	2 - 4 ft	4 - 6 ft	6 - 8 ft	8 - 10 ft	10 - 12 ft
PDSB-22	-	50	-	5.3	-	-
WC-002	X	X	A1	X	X	X

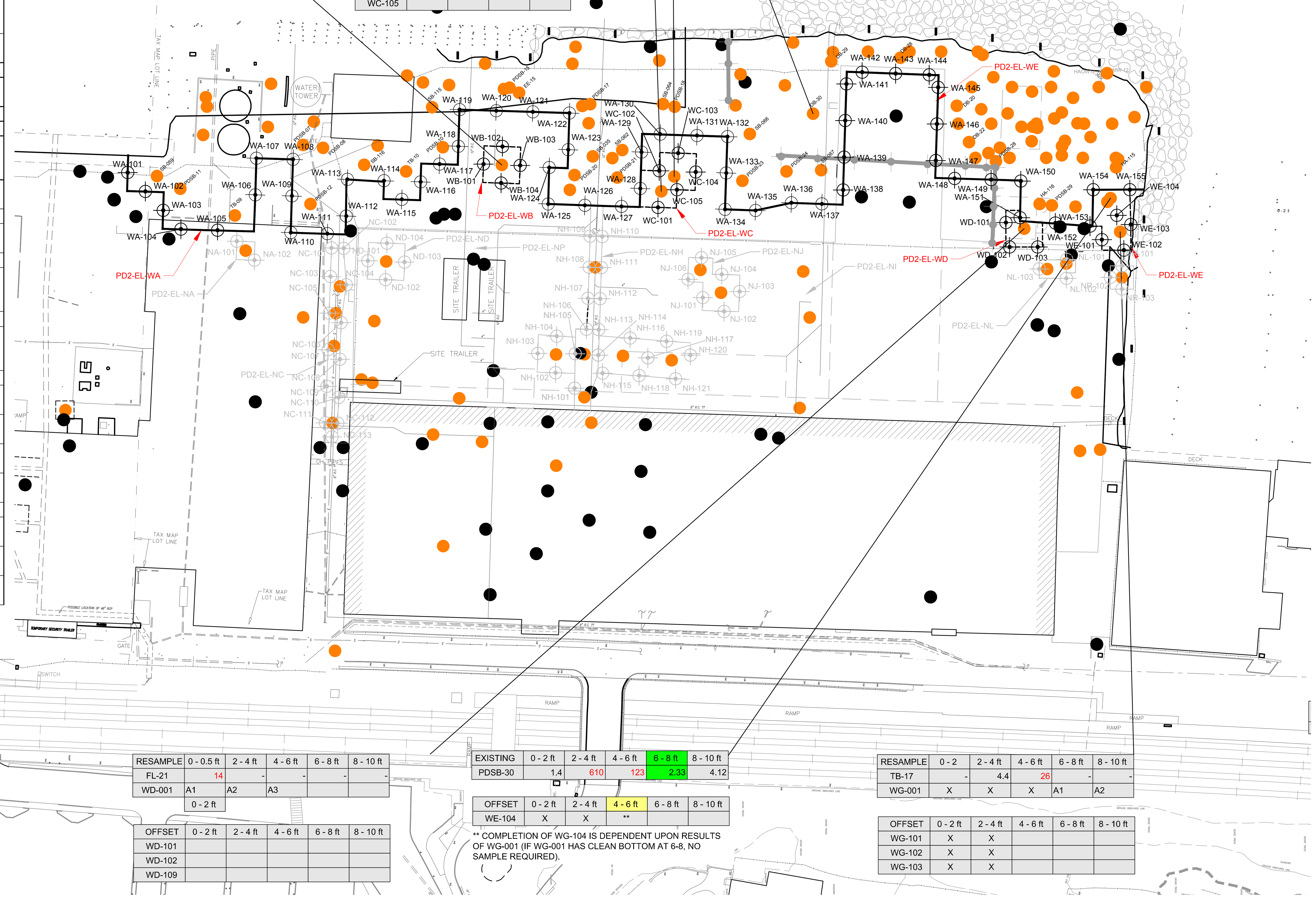
OFFSET	0 - 2 ft	2 - 4 ft	4 - 6 ft	6 - 8 ft	8 - 10 ft
WC-103	X				
WC-104	X				

RESAMPLE	0 - 2 ft	2 - 4 ft	4 - 6 ft	6 - 8 ft	8 - 10 ft	10 - 12 ft
SB-063	100	-	8.5	-	8.9	-
WC-001	X	A1	X	X	X	X

OFFSET	0 - 2 ft	2 - 4 ft	4 - 6 ft	6 - 8 ft
WC-101				
WC-102				
WC-105				

RESAMPLE	0 - 2 ft	2 - 4 ft	4 - 6 ft	6 - 8 ft	8 - 10 ft	10 - 12 ft	12 - 14 ft	14 - 16 ft	16 - 18 ft	18 - 20 ft	20 - 22 ft
DB-30	7.3	-	92	-	110	0.31	-	ND	0.049	ND	0.043

RIVER



RESAMPLE	0 - 0.5 ft	2 - 4 ft	4 - 6 ft	6 - 8 ft	8 - 10 ft
FL-21	14	-	-	-	-
WD-001	A1	A2	A3		
	0 - 2 ft				

OFFSET	0 - 2 ft	2 - 4 ft	4 - 6 ft	6 - 8 ft	8 - 10 ft
WD-101					
WD-102					
WD-109					

EXISTING	0 - 2 ft	2 - 4 ft	4 - 6 ft	6 - 8 ft	8 - 10 ft
PDSB-30	1.4	610	123	2.33	4.12

OFFSET	0 - 2 ft	2 - 4 ft	4 - 6 ft	6 - 8 ft	8 - 10 ft
WE-104	X	X	**		

** COMPLETION OF WG-104 IS DEPENDENT UPON RESULTS OF WG-001 (IF WG-001 HAS CLEAN BOTTOM AT 6-8, NO SAMPLE REQUIRED).

RESAMPLE	0 - 2	2 - 4 ft	4 - 6 ft	6 - 8 ft	8 - 10 ft
TB-17	-	4.4	26	-	
WG-001	X	X	X	A1	A2

OFFSET	0 - 2 ft	2 - 4 ft	4 - 6 ft	6 - 8 ft	8 - 10 ft
WG-101	X	X			
WG-102	X	X			
WG-103	X	X			

LEGEND:

- PROPOSED INVESTIGATION BORING
- PROPOSED EXCAVATION LIMITS
- PROPERTY LINE
- EXISTING STRUCTURES
- FORMER STRUCTURES
- FENCE
- RIP-RAP
- RESULT LESS THAN CRITERIA
- RESULT GREATER THAN CRITERIA
- STORM DRAIN/SANITARY
- EXISTING STORM SEWER
- DEADMAN AND EXTENSION ALIGNMENT AND PROBES (SEE APPENDIX 4)

ANALYSIS NOT PERFORMED IN EXISTING SAMPLE

HORIZON SAMPLE

A1 ANALYZE RESAMPLE FIRST
A2 ANALYZE RESAMPLE BASED ON RESULTS OF A1, ETC.

ALL RESAMPLES ARE -0XX

ALL OFFSETS ARE -1XX, STEPOUTS WILL BE -2XX

X SAMPLE NOT PLANNED AT THIS INTERVAL

EXPECTED BOTTOM OF EXCAVATION DEPTH BASED ON EXISTING DATA

A BLANK CELL INDICATES THAT A SAMPLE MAY BE COLLECTED WITHIN THIS INTERVAL.

EXPECTED SIDEWALL BOTTOM INTERVAL IF 10PPM IN OFFSET, REPRESENTS COMPLIANT SIDEWALL SAMPLE

PROGRAM TYPE (PRE-DESIGN INVESTIGATION - PHASE 2)

EXCAVATION IDENTIFICATION (WA NORTHWEST EXCAVATION LOCATION "A")

PD2-EL-WA-101

SAMPLE TYPE (ENVIRONMENTAL LAND)

BORING LOCATION NUMBER

NOTES:

1. BASE PLAN PROVIDED BY BOSWELL ENGINEERING DRAWING NO. 04-209-MW (01/27/2006).
2. HISTORICAL SURVEY INFORMATION PROVIDED BY PARSONS IN JULY 2005.
3. MEAN HIGH AND MEAN LOW WATER ARE EL. +2.2 AND EL. -2.0, BASED ON HISTORICAL SITE REPORTS. THE MEAN HIGH LINE IS ESTIMATED AT ELEVATION +2.2 FEET. MEAN LOW IS SHOWN AT ELEVATION -1.0 FEET, BUT IS UNDERSTOOD TO BE AT APPROXIMATELY ELEVATION -2.0 FEET.
4. RIP-RAP DESIGNATION IN THE RIVER IS BASED ON INTERPRETATION OF SIDE SCAN SONAR DATA PROVIDED BY AQUASURVEY INC. IN NOVEMBER 2007.
5. BORING LOCATIONS ON SHORE SURVEYED BY BOSWELL ENGINEERING IN SEPTEMBER 2007 APRIL 2008.
6. EXISTING DATA BASED ON 2008 MODIFIED SITE CONCEPTUAL MODEL.

W
S N
E

0 60 120 180 240
SCALE IN FEET

HALEY & ALDRICH

NYSDEC SITE #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

PROPOSED BORINGS
(NORTHWEST AREA)

SCALE: AS SHOWN
MAY 2013

FIGURE 3-3

C:\USERS\KMA\DESKTOP\DESKTOP FILES\28612-250-0011 DATABOX PROP BORINGS 2013_R11 052313.DWG

ATTACHMENT 1

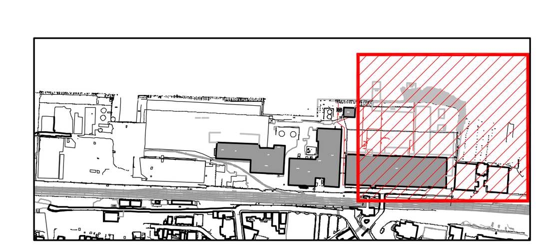
2008 Modified CSM Figures

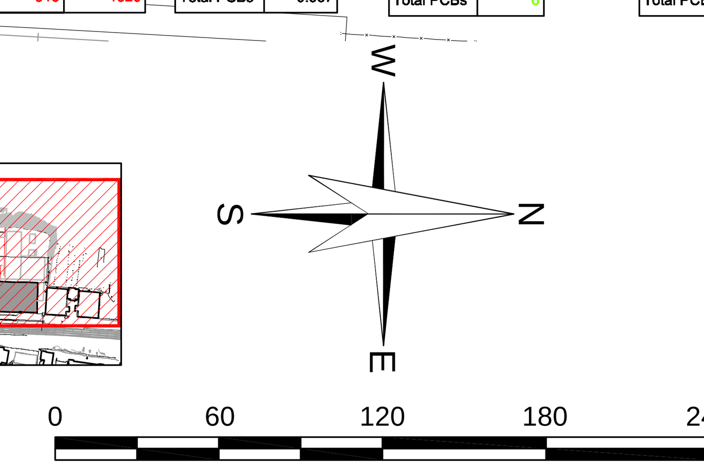
LEGEND:

- PROPERTY LINE
- EXISTING STRUCTURES
- FORMER STRUCTURES
- FENCE
- RIP-RAP
- RESULT <1 MG/KG
- RESULT >1 AND <=10 MG/KG
- RESULT >10 AND <=50 MG/KG
- RESULT >50 MG/KG
- STORM DRAIN/SANITARY
- EXISTING STORM SEWER
- UNKNOWN

NOTES:

1. BASE PLAN PROVIDED BY BOSWELL ENGINEERING DRAWING NO. 04-209-MW (01/27/2006).
2. HISTORICAL SURVEY INFORMATION PROVIDED BY PARSONS IN JULY 2005.
3. MEAN HIGH AND MEAN LOW WATER ARE EL. +2.2 AND EL. -2.0, BASED ON HISTORICAL SITE REPORTS. THE MEAN HIGH LINE IS ESTIMATED AT ELEVATION +2.2 FEET. MEAN LOW IS SHOWN AT ELEVATION -1.0 FEET, BUT IS UNDERSTOOD TO BE AT APPROXIMATELY ELEVATION -2.0 FEET.
4. RIP-RAP DESIGNATION IN THE RIVER IS BASED ON INTERPRETATION OF SIDE SCAN SONAR DATA PROVIDED BY AQUASURVEY INC. IN NOVEMBER 2007.
5. BORING LOCATIONS ON SHORE SURVEYED BY BOSWELL ENGINEERING IN SEPTEMBER 2007 & APRIL 2008.
6. MAXIMUM RESULT SHOWN IN EACH DEPTH INTERVAL.
7. RESULTS IN DATABOXES SCREENED AGAINST SITE-SPECIFIC CRITERIA: < 1MG/KG, >1 AND <=10 MG/KG, >10 MG/KG AND <=50 MG/KG, AND >50 MG/KG.
8. ALL RESULTS SHOWN IN MG/KG.
9. SAMPLES COLLECTED POST 2005 INCLUDE AROCLOR 1262 AND 1268. SEE SECTION 6.1.1 IN MODIFIED CONCEPTUAL SITE MODEL REPORT FOR MORE INFORMATION.





HALEY & ALDRICH

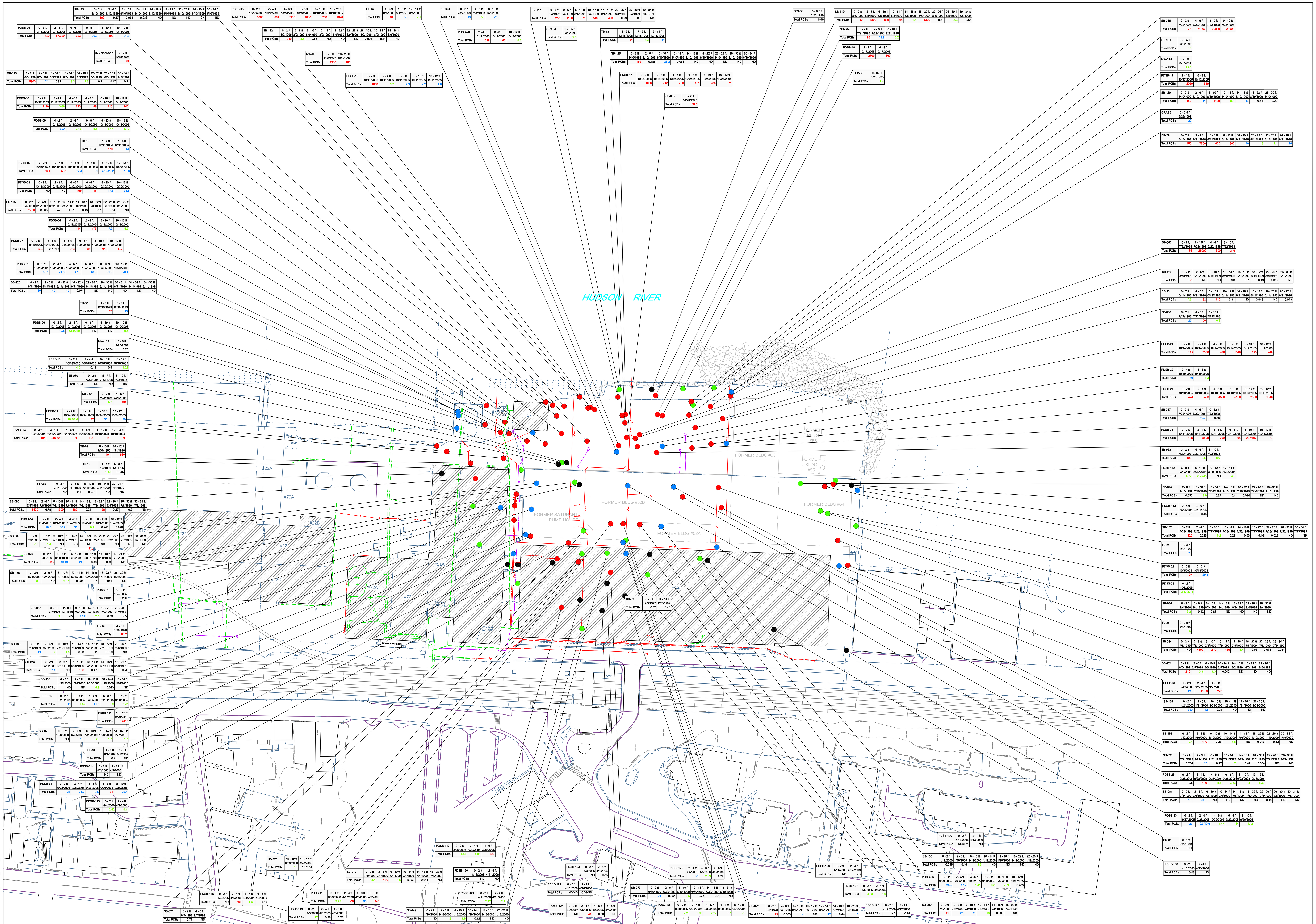
NYSDEC SITE #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

TOTAL PCB CONCENTRATIONS IN SOIL (NORTHWEST CORNER)

SCALE: AS SHOWN
AUGUST 2008

FIGURE 7A

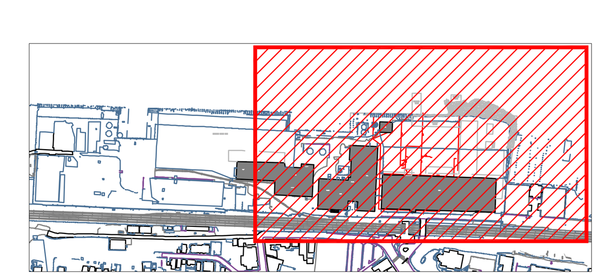
G:\28612_HASTINGS\GLOBAL\CAD\28612-DATABOX_SOIL_PCB_R2.DWG



LEGEND:

- PROPERTY LINE
- EXISTING STRUCTURES
- FORMER STRUCTURES
- FENCE
- RIP-RAP
- RESULT <1 MG/KG
- RESULT >1 AND <=10 MG/KG
- RESULT >10 AND <=50 MG/KG
- RESULT >50 MG/KG
- STORM DRAIN/SANITARY
- EXISTING STORM SEWER
- UNKNOWN

NOTES:
1. BASE PLAN PROVIDED BY BOSWELL ENGINEERING DRAWING NO. 04-209-MW (01/27/2006).
2. HISTORICAL SURVEY INFORMATION PROVIDED BY PARSONS IN JULY 2005.
3. MEAN HIGH AND MEAN LOW WATER ARE EL. +2.2 AND EL. -2.0, BASED ON HISTORICAL SITE REPORTS. THE MEAN HIGH LINE IS ESTIMATED AT ELEVATION +2.2 FEET. MEAN LOW IS SHOWN AT ELEVATION -1.0 FEET, BUT IS UNDERSTOOD TO BE AT APPROXIMATELY ELEVATION -2.0 FEET.
4. RIP-RAP DESIGNATION IN THE RIVER IS BASED ON INTERPRETATION OF SIDE SCAN SONAR DATA PROVIDED BY AQUASURVEY INC. IN NOVEMBER 2007.
5. BORING LOCATIONS ON SHORE SURVEYED BY BOSWELL ENGINEERING IN SEPTEMBER 2007 & APRIL 2008.
6. MAXIMUM RESULT SHOWN IN EACH DEPTH INTERVAL.
7. RESULTS IN DATABOXES SCREENED AGAINST SITE-SPECIFIC CRITERIA: < 1MG/KG, >1 AND <=10 MG/KG, >10 MG/KG AND <=50 MG/KG, AND >50 MG/KG.
8. ALL RESULTS SHOWN IN MG/KG.
9. SAMPLES COLLECTED POST 2005 INCLUDE AROCLOR 1262 AND 1268. SEE SECTION 6.1.1 IN MODIFIED CONCEPTUAL SITE MODEL REPORT FOR MORE INFORMATION.



SITE KEY: NTS

HALEY & ALDRICH

NYSDEC SITE #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

TOTAL PCB CONCENTRATIONS IN SOIL (NORTH REMAINDER AREA)

SCALE: AS SHOWN
AUGUST 2008

FIGURE 7B

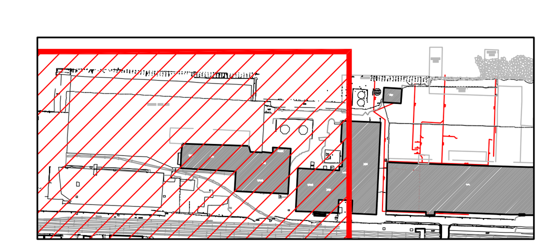
G:\28612_HASTINGS\GLOBAL\CAD\28612-DATABOX_SOIL_PCB_R2.DWG

LEGEND:

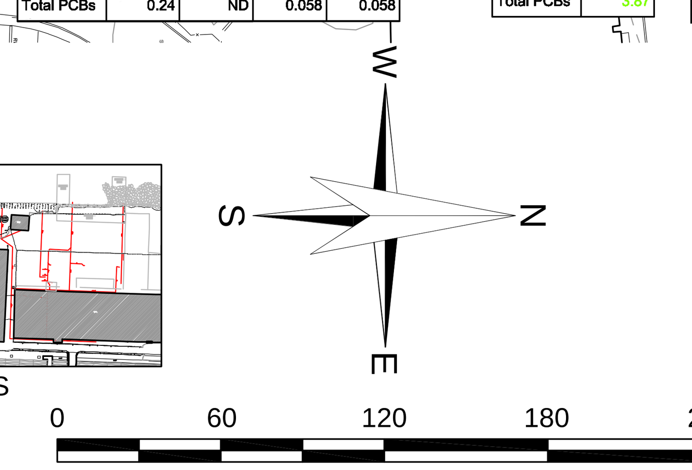
- PROPERTY LINE
- EXISTING STRUCTURES
- FORMER STRUCTURES
- FENCE
- RIP-RAP
- RESULT <1 MG/KG
- RESULT >1 AND <=10 MG/KG
- RESULT >10 AND <=50 MG/KG
- RESULT >50 MG/KG
- STORM DRAIN/SANITARY
- EXISTING STORM SEWER
- UNKNOWN

NOTES:

1. BASE PLAN PROVIDED BY BOSWELL ENGINEERING DRAWING NO. 04-209-MW (01/27/2006).
2. HISTORICAL SURVEY INFORMATION PROVIDED BY PARSONS IN JULY 2005.
3. MEAN HIGH AND MEAN LOW WATER ARE EL. +2.2 AND EL. -2.0, BASED ON HISTORICAL SITE REPORTS. THE MEAN HIGH LINE IS ESTIMATED AT ELEVATION +2.2 FEET. MEAN LOW IS SHOWN AT ELEVATION -1.0 FEET, BUT IS UNDERSTOOD TO BE AT APPROXIMATELY ELEVATION -2.0 FEET.
4. RIP-RAP DESIGNATION IN THE RIVER IS BASED ON INTERPRETATION OF SIDE SCAN SONAR DATA PROVIDED BY AQUASURVEY INC. IN NOVEMBER 2007.
5. BORING LOCATIONS ON SHORE SURVEYED BY BOSWELL ENGINEERING IN SEPTEMBER 2007 & APRIL 2008.
6. MAXIMUM RESULT SHOWN IN EACH DEPTH INTERVAL.
7. RESULTS IN DATABOXES SCREENED AGAINST SITE-SPECIFIC CRITERIA: < 1MG/KG, >1 AND <=10 MG/KG, >10 MG/KG AND <=50 MG/KG, AND >50 MG/KG.
8. ALL RESULTS SHOWN IN MG/KG.
9. SAMPLES COLLECTED POST 2005 INCLUDE AROCLOR 1262 AND 1268. SEE SECTION 6.1.1 IN MODIFIED CONCEPTUAL SITE MODEL REPORT FOR MORE INFORMATION.



SITE KEY: NTS



HALEY & ALDRICH

NYSDEC SITE #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

TOTAL PCB CONCENTRATIONS IN SOIL (SOUTH AREA)

SCALE: AS SHOWN
AUGUST 2008

FIGURE 7C

G:\28612_HASTINGS\GLOBAL\CAD\28612-DATABOX_SOIL_PCB_R2.DWG

APPENDIX 4

Extension Alignment Investigation Plan

APPENDIX 4

EXTENSION ALIGNMENT INVESTIGATION PLAN

1. INTRODUCTION

This plan describes PCB Material (PCBM) and riprap probes. This task is part of the overall pre-design investigation (PDI) that will be completed at the Former Anaconda Wire & Cable Company site (Site), NYSDEC Site # 3-60-022, located on the east shore of the Hudson River at 1 River Street, Hastings-on-Hudson, New York.

2. BACKGROUND

Design and construction of the bulkhead extension in the Northwest Corner described in the OU-2 ROD requires confirmation of the absence of PCB Material as DNAPL or Semi-solid material and the absence of major obstructions (e.g. riprap) along the alignment for the new bulkhead extension. Previous investigations have identified the presence of riprap and PCB Material in the area but further delineation is required for design.

3. SCOPE OF WORK

3.1 Purpose and Scope

The purpose of the PCBM and riprap probes is to evaluate the presence of both PCBM and obstructions along the alignments of the proposed bulkhead extension wall and deadman. These factors are important for several reasons:

- To provide the required lateral resistance, the deadman and bulkhead extension wall must be driven to the Basal Sand. It is important to confirm that semi-solid or liquid PCBM do not exist along the alignment, since it could be dragged down to the Basal Sand during construction of the wall.

- To provide sufficient containment, the extension wall must be installed outboard of liquid PCBM.

- To properly install the sheetpile for the wall, it must be located outboard of large or significant thickness of obstructions (such as riprap) that could prevent proper installation.

In the current design concept, the bulkhead extension wall and deadman are anticipated to consist of a king pile wall with 66-in. diameter pipe piles at 10-foot centers, with sheetpiles between.

A phased approach of probes is planned in the vicinity of the planned extension wall and deadman, with the actual number and locations of probes to be determined as the work progresses, depending on conditions encountered. The proposed probe procedure utilizes methods that have been successfully employed at the site during previous investigations, which include the adhesion testing performed in 2008 to observe presence of PCBM, and the riprap probes performed in 2010 to initially evaluate the extent and thickness of riprap.

3.2 PCBM Adhesion Testing

In general, samples will be obtained from the probes and will be evaluated to determine visual evidence of PCBM. A procedure to visually observe PCBM in sediment samples, called adhesion testing, was previously performed at the site in 2008.

Initial physical screening of the PCBM indicated that the material readily adheres to steel. As such, stainless steel laboratory spatulas were used in 2008 to examine each sample for presence and adhesion of PCBM. A similar procedure will be used for this task of the PDI. A steel spatula will be probed into the soil along the length of each sample, and visual observations will be made of whether PCBM is visible in the sample, or visible adhering to the spatula.

If trace PCBM is suspected after the adhesion testing, pull testing will also be performed, in which a small amount of soil from the sample is collected and compacted, and then pulled apart to identify if string-like material can be observed.

Samples will be visually inspected, probed with the stainless steel spatula, and logged for PCBM observations and soil stratigraphy. Samples where PCBM is positively identified will be photographically recorded. After observation, samples will be drummed for disposal. Samples will not be retained.

3.3 Off-shore Probes

3.3.1 Off-shore Probe Procedure

Off-shore probes will be advanced using rotary wash drilling techniques, using a drilling rig mounted on a barge. Casing will be advanced through the sediment by pushing using the weight of the rig. Split spoon samples will also be advanced in front of the casing, and samples will be examined for PCBM as discussed in the preceding section. If no recovery is obtained, observations will be made to evaluate whether PCBM is visibly adhered to the split spoon sampler. The split spoons will be advanced either to the top of the Marine Silt, or until hammer blowcounts indicate the potential presence of riprap.

If assumed riprap is encountered, the rollerbit will be inserted into the hole and spun to confirm refusal. Observations will be made of the thickness and likely size of the riprap (as inferred based on drilling action). In the intervals where the roller bit is advanced, no split spoon samples will be obtained (and no PCBM observations of samples will be made) since the materials being drilled (cobbles and boulders) exceed the sampler size. If the roller bit cannot be advanced through the riprap, the location will be terminated due to rollerbit refusal and the barge will be moved to the next probe location.

Split spoon samples will be obtained from mudline to 5 feet below the top of the Marine Silt (except for the obstruction zones or in locations where roller bit refusal is encountered). The top of Marine Silt will be estimated based on contour plans that have been prepared from borings that have previously been drilled in the northwest area.

After each probe, the casing and rollerbit will be examined for any evidence of PCB Material and decontaminated if required. Additionally, residual sediment will be removed from the casing and rollerbit.

3.3.2 Off-shore Probe Sequence

The general sequence of the work is anticipated to be as follows:

Probes will be initiated on the alignment shown as Round 1 on Figure 4-1. Generally, the Round 1 alignment is offset 13 feet from locations where PCBM has been observed in the past. The 13 foot offset amount is chosen based on a desired 10 foot (approximate) buffer between the edge of the wall and a positive PCBM observation, plus the 3 foot (approximate) distance from edge of wall to centerline of wall (based on the currently anticipated 66-in. diameter pipe piles). Some isolated locations of "inferred potential PCB material" (i.e. based on an interpretation of historical observations prior to the adhesion testing program) are located in shallow sediment which would be removed prior to installation of the bulkhead and therefore do not constrain the bulkhead alignment.

- Round 1 - Perform probes generally at 30-foot centers along the line shown as Round 1 on Figure 4-1. At locations adjacent to an existing positive PCBM observation, the probe spacing will be decreased to 15 feet. For each probe, obtain split-spoon samples at 2-foot intervals to a depth corresponding to 5 feet below the estimated top of the Marine Silt. Perform adhesion testing on each split spoon sample. If obstructions are encountered when pushing the split spoon, the roller bit will be advanced through the obstruction to the extent possible, to obtain information on thickness and size of riprap. (Again, note that split spoon samples for PCB observation will not be obtained within the obstruction/rollerbit zones, since the obstructions will exceed the size of the sampler). If no PCBM is observed in any sample taken from Round 1, and if no significant riprap thickness is encountered, the program will be complete. For locations where PCBM is observed in Round 1 samples, and/or if significant riprap thickness is encountered, continue to Round 2 at those locations.

- Round 2 – Perform probes 13 feet outboard from Round 1, in locations where positive Round 1 PCBM observations are identified, and/or riprap is encountered. Spacing of Round 2 probes will be determined based on conditions encountered in Round 1. Adhesion testing and riprap probing will be performed as described above. If no PCBM is observed in any sample taken from Round 2 and if no riprap is encountered, the program will be complete. For locations where PCBM or riprap are observed in Round 2 samples, continue to Round 3 at those locations.

  Note that riprap refusal is not expected on the Round 2 alignment, based on information obtained from the 2010 riprap probes.

- Round 3 – Perform probes 13 feet outboard from Round 2, in locations where positive Round 2 PCBM observations are identified, and/or riprap refusal is encountered. Spacing of Round 3 probes will be determined based on conditions encountered in Round 2. Adhesion testing and riprap probing will be performed as described above.

Up to approximately 27 probes are expected to be completed for Round 1. See Figure 4-1 for approximate Round 1, 2, and 3 alignments and approximate Round 1 probing locations.

Round 2 and Round 3 lines are shown for reference purposes only and probes will not necessarily be performed along these lines. Individual probe locations along Round 2 or Round 3 will be field-determined based on the preceding Round 1 (or 2) results, as described above, and will be performed only in locations where adjacent Round 1 (or 2) probes encounter PCBM and/or obstructions.

Also, the Round 1 probe number and sequence is subject to change based on initial probe results. Round 1 probes will be initiated in the vicinity of locations where PCBM observations are mostly likely to occur, adjacent to existing positive PCBM observations (such as HA-217, HA-P12, and HA-204). Subsequent Round 1 locations may be adjusted or eliminated based on these results.

For the probes planned in the Old Marina area, some of the existing piles and dock structures may be removed prior to the work, to allow access for the drilling barge. The Round 1 line shown adjacent to the Old Marina is approximate and subject to change based on access restrictions for the drilling barge.

3.4 Probes along North Property Line

The purpose of the probes planned to be drilled adjacent to the north property line ("North Property Line Probes" on Figure 4-1) is to determine presence or absence of PCBM and riprap, as discussed above, with the added objective of determining whether the wall alignment can be moved south to coincide with the property line along the Old Marina. The current alignment shown in the RFS is north of the property line.

Due to the sloped shoreline and tidal conditions, a drill rig cannot physically be positioned to install vertical borings at the property line. Therefore, the drill rig will be positioned on-shore as near as possible to the property line, and an angled boring will be completed to evaluate conditions at the property line. The boring angle will be adjusted to avoid penetrating the Fill / Marine Silt interface at the former wooden bulkhead that may exist along the property line, as identified during previous borings.

Most of the property line probes will be spaced 30 feet apart, similar to the probes described previously, except for the area immediately adjacent to the borings that have encountered liquid PCBM in the past (HA-114, HAOW12, HARW-4). In the four probes nearest these borings, the spacing will be reduced to 15 feet.

The property line probes will be advanced using either mini-sonic or rotary wash drilling techniques, and the riprap procedures described above will also be used (the rollerbit will be spun through intervals of suspected riprap, based on drilling action and/or hammer blows). Samples will be obtained from ground surface to 5 feet below the top of the Marine Silt.

3.5 Additional On-shore Probes

Two more areas of on-shore probes will also be drilled, and are shown on Figure 4-1:

- Deadman: Due to the fact that the deadman will be required to penetrate into the Basal Sand, a line of PCBM probes will also be advanced along the approximate deadman alignment.

- Extension wall continuation: A continuation of the bulkhead extension wall is required at the transition between the higher elevation upland created by filling behind the wall, versus the lower elevation sloped shore just south of the northwest extension area. This continuation of the bulkhead extension wall may also need to be driven to the Basal Sand.

The on-shore probes will be advanced using sonic drilling techniques. Soil samples will be extracted in 5 or 10 foot long sleeves from ground surface to 5 feet below the top of the Marine Silt. As with the off-shore probes, the top of Marine Silt will be estimated based on contour plans that have been prepared based on the borings that have previously been drilled in the northwest area.

After each probe, the drill tooling will be examined for any evidence of PCB Material and decontaminated if required. Additionally, residual soil will be removed from the drill tooling.

A Round 1, 2, and 3 phased approach will be used, and each will be offset by 13 feet, similar to the approach described above for the off-shore probes.

3.6 Laboratory Testing

No laboratory testing is planned for this task. Presence of PCBM will be determined based on visual observation only.

3.7 Relevant Field Operating Procedures

Field investigations will be performed in general accordance with the following Operating Procedures (OPs). Refer to Appendix A.

OP1002 – Drilling Safety
OP1008 – Operations Over, Near, or On Water
OP2000 – Monitoring Field Explorations
OP2001 – Identification and Description of Soils Using Visual-Manual Methods
OP2005 – Test Borings, Sampling, Standard Penetration Testing and Borehole Abandonment

4. QUALITY ASSURANCE

Appendix A of the RDWP provides a Quality Assurance Project Plan (QAPP).

5. SUBMITTALS

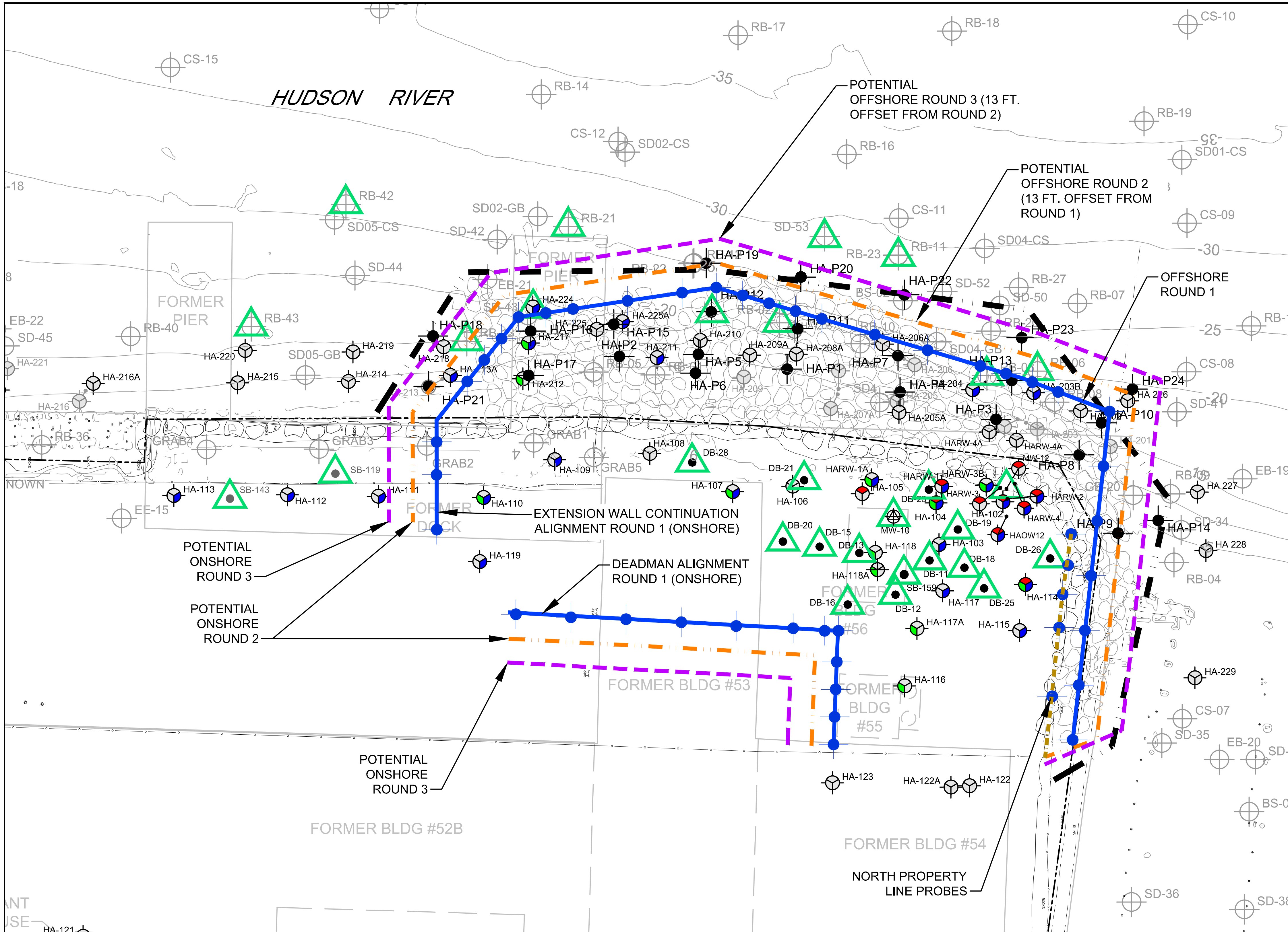
Applicable data will be included in the PDI Data Summary Report.

6. HEALTH AND SAFETY

Health and safety requirements applicable to all persons entering the site or involved in field activities are described in the Site-specific Health Safety Security and Environmental Plan (HSSEP), these documents will be available for use on Site prior to the commencement of work.

7. ATTACHMENTS

Figure 4-1 Proposed Exploration Location Plan, PCBM/Riprap Probes



LEGEND:

- EXISTING STRUCTURES
- PROPOSED NORTHWEST EXTENSION WALL ALIGNMENT SHOWN IN RFS
- PROPERTY BOUNDARY
- RIP-RAP
- EXPLORATION LOCATION TO MARINE SILT INTERFACE
- LEADER INDICATING ACTUAL EXPLORATION LOCATION
- EXPLORATION LOCATION WHERE MARINE SILT WAS NOT ENCOUNTERED DUE TO REFUSAL
- HISTORICAL SAMPLE LOCATION (DEPTH VARIES)
- HISTORICAL SAMPLE LOCATION (DEPTH VARIES)
- 2010 RIP-RAP INVESTIGATION PROBE
- APPROXIMATE / CONCEPTUAL LOCATION OF PROPOSED PCB / RIPRAP PROBE

SAMPLE LEGEND:

- LIQUID PCB MATERIAL
- SEMISOLID PCB MATERIAL
- TRACE PCB MATERIAL
- LIQUID PCB MATERIAL OBSERVED
- SEMISOLID PCB MATERIAL OBSERVED
- TRACE PCB MATERIAL OBSERVED
- NO PCB MATERIAL OBSERVED
- INFERRED POTENTIAL PCB MATERIAL LOCATION

NOTES:

1. BASE PLAN PROVIDED BY BOSWELL ENGINEERING DRAWING NO. 04-209-MW (01/27/2006).
2. RIP-RAP DESIGNATION IN THE RIVER IS BASED ON INTERPRETATION OF SIDE SCAN SONAR DATA PROVIDED BY AQUASURVEY INC. IN NOVEMBER 2007.
3. THE ROUND 1 LINE IN THE OLD MARINA IS APPROXIMATE AND SUBJECT TO CHANGE BASED ON ACCESS RESTRICTIONS FOR THE DRILLING BARGE.
4. ROUND 2 AND ROUND 3 LINES ARE SHOWN FOR REFERENCE PURPOSES ONLY AND PROBES WILL NOT NECESSARILY BE PERFORMED ALONG THESE LINES. INDIVIDUAL PROBES ALONG ROUND 2 OR ROUND 3 WILL BE PERFORMED ONLY IN LOCATIONS WHERE ADJACENT ROUND 1 PROBES ENCOUNTER PCBM AND/OR OBSTRUCTIONS.
5. THE ROUND 1 PROBE LOCATIONS ARE CONCEPTUAL AND SUBJECT TO CHANGE BASED ON FIELD CONDITIONS AND OBSERVATIONS MADE IN ADJACENT ROUND 1 PROBES AS THE WORK PROGRESSES.

HALEY & ALDRICH

NYSDEC SITE #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

PROPOSED LOCATION PLAN
PCBM / RIPRAP PROBES

AS SHOWN
MAY 2013

FIGURE 4-1

G:\PROJECTS\28612\250 - RFS\CAD\PLAN VIEWS □ SECTIONS\28612-PCB MATERIAL EXTENTS R2.DWG

APPENDIX 5

Deepwater Investigation Plan

APPENDIX 5

DEEPWATER INVESTIGATION PLAN

1. INTRODUCTION

This plan describes the Deepwater Investigation. This investigation is part of the overall pre-design investigation that will be completed at the Former Anaconda Wire & Cable Company site (Site), NYSDEC Site # 3-60-022, located on the east shore of the Hudson River at 1 River Street, Hastings-on-Hudson, New York.

2. BACKGROUND

The Record of Decision (NYSDEC, 2012) (ROD) for Operable Unit No. 2 (OU-2) requires removing sediment in portions of OU-2 including deepwater areas defined as areas beyond feasible deployment of silt curtain and within the extents defined by OU-2. For the deepwater areas where dredging activities cannot be fully contained, the ROD states:

"Removal of sediment from a targeted area outside the northwest extension area in deeper than 15 feet of water that is defined by PCB concentrations greater than 50 ppm, to maximum depth of 6 feet. During the design, sampling will be performed to determine whether additional areas of PCBs greater than 50 ppm exist. Based upon an evaluation of the significance of the distribution of contaminants and the feasibility of removal, additional areas of sediment may be targeted for dredging."

3. SCOPE OF WORK

The goal of this investigation is to examine deepwater areas where PCBs in excess of 50 mg/kg (ppm) (elevated PCB concentrations) are known or suspected to be present, but where insufficient data exists to confirm the presence of PCB deposits with concentrations greater than 50 mg/kg that may require remediation. This investigation will gather data for making decisions regarding remedial action, and will provide information to delineate dredge areas.

This investigation addresses areas in the proximity of existing exceedances and areas between EB-10 and EB-14. Areas previously identified in the ROD to be dredged are pre-delineated in a separate investigation (see RDWP Appendix 6). The deepwater investigation sediment sampling, which will be conducted within an area located approximately 300 feet off-shore of the Site (approximately 4 acres), will be used to further understand lateral and vertical PCB contamination, within specific deepwater areas.

This investigation is comprised of four tasks as described below. Additional details are provided in Section 3.1.

- **Task 1: Resampling - Resample specific locations with elevated PCB concentrations**
  This task investigates areas in the proximity of specific existing exceedances. Specifically, this task will re-sample areas proximate to three previously sampled deepwater locations where elevated PCB concentrations were detected (EB-10, EB-14, CS-19). Sampling at these locations will be used to 1) confirm the presence of elevated PCB concentrations at each location, 2)

confirm the depths of elevated PCB concentration previously detected, and 3) observe physical characteristics at each location. Refer to Figure 5-1 for proposed sampling locations (VC-101 through VC-103).

- **Task 2: Investigation Unit Sampling - Sample the area between EB-10 and EB-14**
  This task samples areas between EB-10 and EB-14. Sampling at these locations will be used to 1) identify the presence of elevated PCB concentrations at each location, 2) to identify the depths of elevated PCB concentration if present, 3) determine whether additional sampling (i.e. step-out sampling) is necessary, and 4) observe physical characteristics at each location. Sediment samples will be collected in a 160-foot triangulation grid pattern to divide the investigation area into hexagonal Investigation Units. Refer to Figure 5-1 for proposed sampling locations and Investigation Units (VC-104 through VC-108).

- **Task 3: Decision Unit Sampling - Including Step-out Investigation (as needed)**
  Investigation Unit(s) will be divided into smaller hexagonal Decision Units. This investigation task will further assess the nature and extent of elevated PCB concentrations emerging from Task 2 and will support decisions regarding the need for remedial action. Refer to Figure 5-1 for proposed sampling locations (VC-109 through VC-132) and Decision Units including other additional potential step-out Decision Units.

- **Task 4: Variability of Sediment Concentrations**
  Additional sampling will be completed at VC-101, VC-102 and VC-103 to assess the variability of the sediment concentrations to better understand if the concentrations are uniform or if exceedances are sporadic. Based on the results from the initial sampling, additional locations may be selected to help assess the contaminant mass distribution in relevant areas. Three additional cores will be added in close proximity to each location being evaluated.

3.1 Sampling Program Design

The sampling program employs a 160-foot triangulation grid for investigation areas and an 80-foot triangulation grid for refinement of extents of contamination. All tasks will be performed during a single field event to the extent feasible. As currently planned, the sampling vessel will remain on site until all locations are completed. At a minimum, sampling described in Task 1, Task 2, Task 4, Task 3 locations associated with historical locations (EB-10, EB-14, CS-19) and other Task 3 locations (VC-109 thru VC-132) will all be completed during the first sampling round (32 locations). After analysis and review with the NYSDEC, additional Task 3 samples may be completed (up to 16 or more locations).

This program selected vibracore technology to collect sediment cores for sampling based on previous successful sampling programs at the site and other factors (See Section 3.4). Vibracore, along with ponar grabs for surface samples, will be collected from barge or boat-mounted equipment. The vibracore diameter is anticipated to be 4 inches and may change in the field based on sediment conditions and recovery.

Sediment samples will be collected and submitted for PCB analysis according to requirements and procedures described herein and the pertinent operating procedures. Sample locations will be documented using a survey grade differential GPS with a sub-meter accuracy along with a depth sounder as necessary.

3.1.1 Vertical Distribution of Samples

Considering that previous samples indicated PCB exceedances are predominantly within the top 3 feet of sediment. The following approach will be used to establish vertical sample intervals to delineate PCB concentrations in targeted sediment deposits:

Below is a list of depth intervals and rationale for sampling:

- 0.0-0.5 foot:
  - Consistent with previous sampling programs as the surface sediment sampling interval
  - Represents the zone with highest bioactivity
  - Collected using petit ponar sampler or equivalent
  - Represents the most recently deposited sediments
- 0.5-1 and 1-2 foot:
  - Consistent with the ROD which stated that "The majority of targeted PCB dredging areas identified in the deepwater are within the top two feet. Therefore, the targeted dredging will remove sediments which have the highest levels of PCBs and the greatest potential to migrate and be an ongoing source to the environment."
- 2-3 foot:
  - Depth intervals to better define vertical thickness of impacted sediment, to help provide appropriate dredge limits and to prevent unnecessary over-dredging
- 3-4 foot:
  - Provides information on underlying sediments
- 4-6 and 6-8 foot:
  - Provides additional information (as necessary) to document weather the maximum dredge depth of 6 ft is needed and, if so, what residual concentrations would exist

Note that if the preceding shallower interval is < 50 mg/kg then the deeper interval(s) (>4 foot) would not be analyzed. Concentration levels associated with the deepest analyzed interval will be discussed with the DEC prior to discarding archived deeper samples to determine whether further analysis is warranted.

3.1.2 Spatial Distribution of Samples

As discussed above the sampling program employs a 160-foot triangulation grid for investigation areas and an 80-foot triangulation grid for refinement of extents of contamination. This grid system creates hexagonal areas referred to as Investigation and Decision Units, respectively. Additionally, step-out sampling will be implemented where required to adequately delineate locations where spatial extents are not fully bounded.

This grid system was applied uniformly because the investigation area is not directly adjacent to suspected onshore point sources and the sediment material is uniform across this site. Previous grain size analysis data indicate that sediments are predominantly fine grained material of similar properties and direct observations of surface sediments also support this conclusion.

3.1.3 Task 1: Re-Sampling

This investigation task will consist of re-sampling at the three previously sampled deepwater locations where PCB concentrations were detected above 50 mg/kg within the top 3 feet of sediment (EB-10, EB-14, and CS-19) shown on Figure 5-1. These locations will comprise the three initial Investigation Units.

The table below presents the previous PCB concentration data and associated sample depths:

Previous Sediment Sample Locations and Dates Sampled	Sample Depth Interval (feet)	PCB Concentration (mg/kg)
EB-10 (May 2001)	0-0.5	2.1
	1-2	**97**
	2.3-4	ND
	4-6	ND
EB-14 (May 2001)	0-0.5	ND
	1-2	**260**
	2-4	2.4
	4.5-6.5	ND
	7.5-8.5	ND
	8.5-10.5	0.94
	11-12.5	ND
CS-19 (October 1999)	0-0	ND
	0.5-2	ND
	2-2.7	**380**
	2.7-3.2	**140**

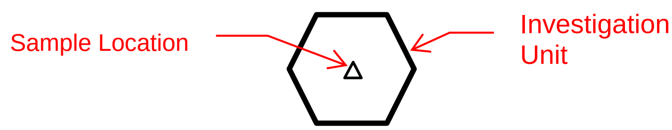
Each of the three sample locations (VC-101 thru VC-103) corresponding to the former EB-10, EB-14, and CS-19 locations will be used to construct an Investigation Unit. Investigation Units are shown and discussed in Section 3.1.4.

In an effort to confirm historic sampling results and evaluate the area proximate to each location, sediment samples will be collected at all depth intervals up to 8 feet (consistent with section 3.1.1). This task will allow comparison of the newly collected data to both the historic data and additional data collected in Task 2. Sediment sampling depths and sediment thickness inconsistencies are anticipated between the historic sample locations and newly proposed confirmatory sampling locations due to sediment deposition since the 1999 and 2001 sampling. This sampling task will provide a more accurate representation of current conditions that will be considered during remedy selection and design.

3.1.4 Task 2: Investigation Unit Sampling

This investigation task will be conducted to further evaluate the potential presence of PCB exceedances as described previously.

The figure below shows how an investigation unit and the corresponding sampling location within that investigation unit are associated. The Investigation Unit size and locations are based on a triangular spacing of approximately 160 feet, each representing approximately 0.5 acres, starting from the former EB-10 Investigation Unit and extending north toward the EB-14 Investigation Unit. A total of 5 locations (VC-104 through VC-108) were identified for consideration and will be located at the center of each additional Investigation Unit (Figure 5-1).



Evaluation of Investigation Unit Data

Results for each new location (VC-104 through VC-108) will be used to characterize each Investigation Unit and to determine whether additional sampling for that Investigation Unit is required beyond locations identified in Task 3 below.

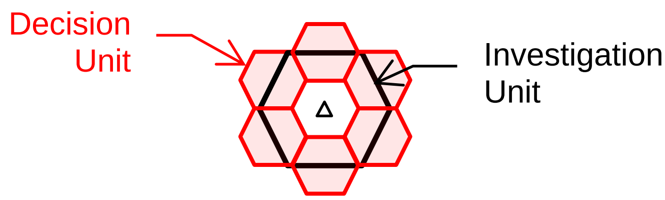
- If Investigation Unit location data indicates all samples are significantly < 50 mg/kg then no further investigation is required (i.e. perimeter decision unit samples are not required).
- If the data does not indicate that all samples are significantly < 50 mg/kg, then additional investigation requirements will be based on consultation with the NYSDEC and will consider:
  - Depth and thickness of PCB exceedances
  - Variability of concentrations
  - Type of environment (erosion or deposition)
  - Concentration levels and thickness of sediments above the PCB exceedances
- Locations that require additional investigation will proceed to Task 3 and will be added to the sampling locations identified in Task 3 below.

3.1.5 Task 3: Decision Unit Sampling

Decision Units are defined by sampling locations placed on an 80-foot triangulation grid. Each decision unit will be representative of approximately 0.13 acres. Decision Units that will be sampled include:

- Locations around the perimeter of EB-10, EB-14 and CS-19 (VC-109 thru VC-126)
- Locations VC-127 thru VC-132
- Supplemental locations determined to require additional investigation from Task 2
- Supplemental locations determined to require additional investigation from Task 3 (step-outs from existing 80-foot grid locations)

The step-out sampling depth intervals and locations will consider Task 1, Task 2 and any previously completed Task 3 sampling results as described previously. The diagram below illustrates Decision Units placed around an Investigation Unit that requires additional investigation. The Sampling location would be at the center of each Decision Unit.



During step-out sampling, Decision Unit samples may be collected and analyzed incrementally.

Evaluation of Decision Unit Data

Results of each decision unit will be evaluated to determine if additional investigation is required.

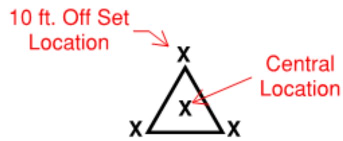
- If Decision Unit location data indicates all samples are significantly < 50 mg/kg then no further investigation is required (i.e. step-out decision unit samples are not required).
- If the data does not indicate that all samples are significantly < 50 mg/kg, then data will be reviewed with the NYSDEC and additional locations may be selected for investigation (additional step-out locations).

An evaluation of the collected data will be performed during the remedial design in order to determine the appropriate remedial action and define any dredging that may be required. The following factors, as specified in the ROD, would be considered during remedial design in determining the appropriate remedial action:

- Depth of PCB exceedances
- Type of environment (erosion or deposition)
- Thickness of clean sediment above the PCB exceedances
- Duration of dredging and associated potential for migration of re-suspended sediments
- Area weighted surface concentrations of PCBs

3.1.6 Task 4: Variability of Sediment Concentrations

Variability sampling will be completed at VC-101, VC-102 and VC-103 to help assess the contaminant mass distribution. These locations target areas of known contamination at different depths including VC-103 in close proximity to EB-15 which was less than 1 ppm at all sampled intervals. The sampling procedure includes conducting three additional sediment cores offset approximately 10 feet from the point being evaluated (see diagram below). Samples would be collected and analyzed for intervals between 0.5 feet and 4 feet with samples up to 8 feet retained for analysis if required. Variability sampling will be conducted during the first sampling round. Results of each cluster of samples will be evaluated and then recorded for use during remedial design.



The variability of the data collected during the initial sampling will be considered to determine if supplemental information could be relevant to determining the appropriate remedial action. Additional samples may be proposed to assess the variability of the sediment concentrations to better understand if the concentrations are uniform or if exceedances are sporadic. For example, the presence of a contiguous area of high contamination could be considered differently than an area with highly variable concentrations with an average concentration much lower than the maximum detection.

3.2 Laboratory Testing

Lab requirements and QA/QC sample frequency are specified in the Quality Assurance Project Plan (QAPP). Sample analysis methods are also specified in the QAPP (e.g. US EPA Method 8082A for PCB Aroclors).

The following table provides a summary of the proposed deepwater sediment sample analyses:

PDI Activity	No. of Samples	Medium/Matrix	Sampling Depths (feet)	Analytical Parameter
Investigation Unit Re-sampling (Task 1)	7 samples per core	Sediment	0-0.5 (ponar) 0.5-1 1–2 2-3 3-4 4-6 6-8	PCBs
Investigation Unit Sampling (Task 2)	7 samples per core	Sediment	0-0.5 (ponar) 0.5-1 1–2 2-3 3-4 4-6 6-8	PCBs
Decision Unit Sampling (Task 3)	7 samples per core	Sediment	0-0.5 (ponar) 0.5-1 1–2 2-3 3-4 4-6 6-8	PCBs
Sediment Variability (Task 4)	6 samples per core 3 additional cores per location	Sediment	0.5-1 1–2 2-3 3-4 4-6 6-8	PCBs

3.3 Relevant Field Operating Procedures

Field investigations will be performed in general accordance with the following Operating Procedures (OPs). Refer to Appendix A.

OP2000 - Monitoring Field Explorations
OP2001 - Identification and Description of Soils Using Visual-Manual Methods
OP3001- Preservation and Shipment of Environmental Samples
OP3004 - Sediment Sampling
OP3026 - Chain of Custody
OP3029 – Field Data Recording
OP3030 - Field Instruments: Use and Calibration

3.4 Vibracoring

Vibracoring sampling techniques will be used to collect sediment core samples at each of the proposed Deepwater Investigation sampling locations (except for the surface ponar grabs). Vibracoring is the process of collecting samples within core liners that provide a continuous, minimally disturbed sediment core sample from unconsolidated sediments.

Various sediment coring techniques were evaluated for use during the proposed Deepwater Investigation. Vibracoring was chosen due to several factors including; sediment properties, prior successful use in the proposed investigation areas, minimal sediment compaction throughout length of core, minimal sediment disturbance throughout length of core, and greater recovery potential of sediment sample. Where allowable according to sediment properties and density, sediment coring may be conducted without introduction of vibrations, to further decrease the potential for disturbance of near surface sediment. Due to potential disturbance of the 0-0.5 foot interval ponar grabs will be collected for this interval.

While some debris may be encountered, requiring adjustment of sample locations, the extent and type of debris in the investigation area is not expected to interfere with sample collection. The depth of the silt and sediment has been previously documented and therefore reducing the potential for issues related to a false indication of "refusal" resulting from debris.

The sediment-related exploration and sampling program discussed herein will be conducted by the coring subcontractor along with a Haley & Aldrich representative on board a sampling vessel, outfitted with sediment sampling equipment for acquisition of data in shallow and deepwater environments, along with typical oceanographic and marine navigation equipment.

The coring subcontractor will maintain at least a two-person crew during the sampling survey to navigate the vessel, perform the sediment coring, and collect sediment samples. A Haley & Aldrich representative will be on board during the program to document field observations and to assist with the sediment sampling. Sediment coring will be collected from the sampling vessel at locations shown on Figure 5-1.

4. QUALITY ASSURANCE

Appendix A of the RDWP provides a Quality Assurance Project Plan (QAPP).

5. SUBMITTALS

Applicable data will be included in the PDI Data Summary Report.

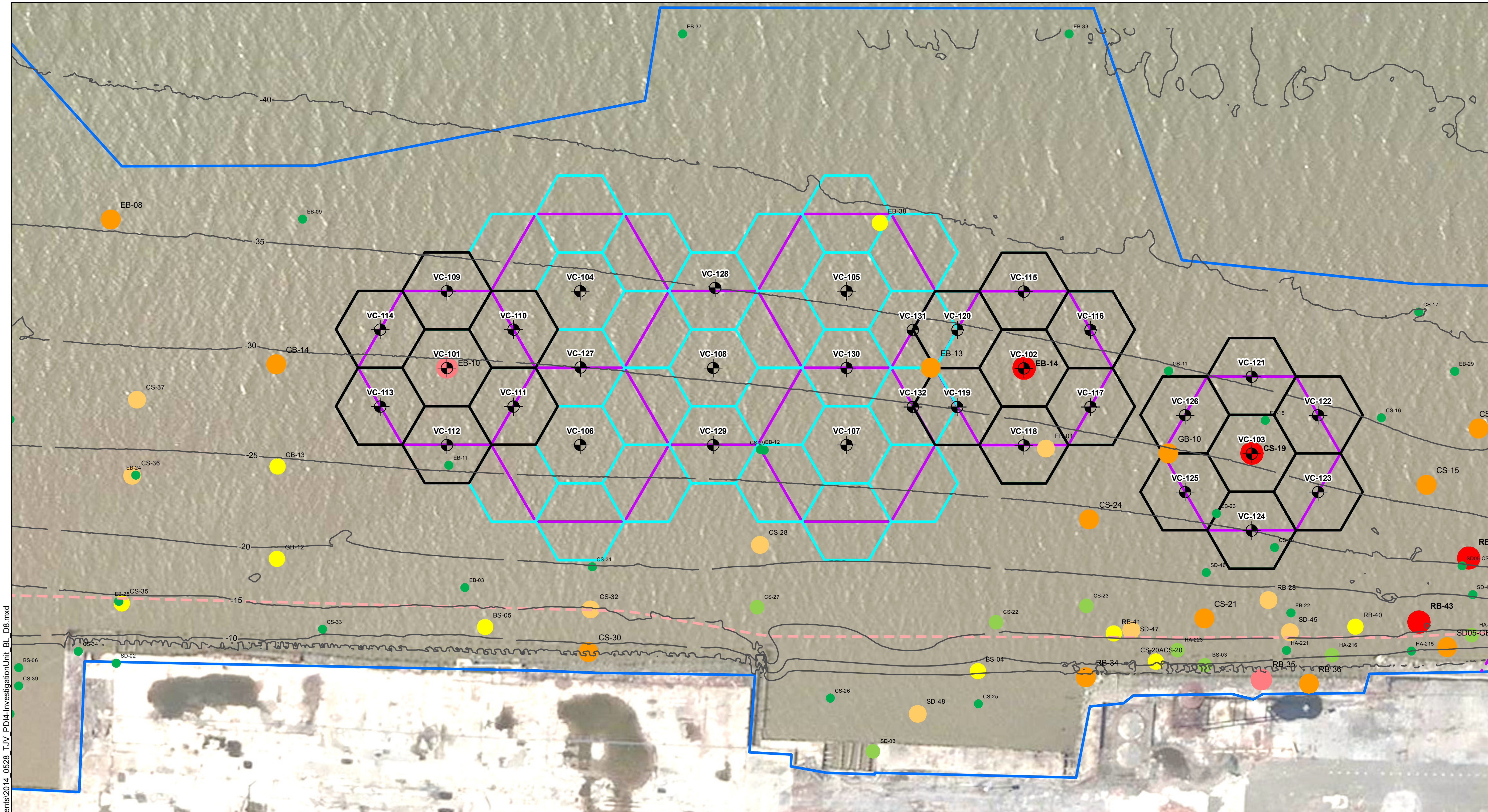
6. HEALTH AND SAFETY

Health and safety requirements applicable to all persons entering the site or involved in field activities are described in the Site-specific Health Safety Security and Environmental Plan (HSSEP), these documents will be available for use on Site prior to the commencement of work.

7. ATTACHMENTS

Figure 5-1 –Deepwater Investigation Locations

https://hank.haleyaldrich.com/sites/projects/28612/Shared Documents/Approved Workplans/_FINAL RDWP/App 5/App 5 - OU-2 Deepwater-F_accepted.061014.docx



BATHYMETRIC CONTOUR
SILT CURTAIN
NORTHWEST EXTENSION
OU-2 BOUNDARY
INVESTIGATION UNIT

POTENTIAL DECISION UNIT (AS REQUIRED BASED ON TASK 2 RESULTS)
DECISION UNIT (BASED ON TASK 1 LOCATIONS)
SAMPLE LOCATION

0-1 mg/kg
1 - 2 mg/kg
2 - 5 mg/kg
5 - 10 mg/kg
10 - 50 mg/kg
50 - 100 mg/kg
>100 mg/kg

NOTES:
1) AIR PHOTO COURTESY OF TERRASERVER, 2012.
2) BATHYMETRY COURTESY OSI, INC., 2013.

0 100 200
SCALE IN FEET

HALEY & ALDRICH

NYSDEC SITE #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

DEEPWATER INVESTIGATION LOCATIONS

SCALE: AS SHOWN
MAY 2014

FIGURE 5-1

G:\Projects\28612\Global\GIS\Map Documents\2014_0528_TJV_PDI4-InvestigationUnit_BL_D8.mxd

APPENDIX 6

Off-shore Pre-delineation Plan

APPENDIX 6

OFFSHORE PRE-DELINEATION PLAN

1. INTRODUCTION

This plan describes pre-delineation for remedial dredging. This investigation is part of the overall pre-design investigation (PDI) that will be completed at the Former Anaconda Wire & Cable Company site (Site), NYSDEC Site # 3-60-022, located on the east shore of the Hudson River at 1 River Street, Hastings-on-Hudson, New York.

2. BACKGROUND

The Record of Decision (NYSDEC, 2012) for Operable Unit No. 2 (OU-2) calls for removing sediment containing greater than 1 ppm PCB and metals exceeding background from the nearshore and backwater areas, where the potential for public health and environmental exposures are most likely. For the deepwater areas where dredging activities cannot be fully contained, the ROD indicates that the selected remedy removes PCBs in targeted areas at a higher threshold. Specifically, the ROD states:

Removal of sediment and fill that contains PCB concentrations greater than 1 ppm and/or copper, zinc and lead concentrations above the background concentrations listed in Table 2 of Exhibit A, to a maximum excavation depth of 6 feet within the area where sediment resuspension controls, such as a fixed silt curtain, are feasible. This area generally corresponds to a water depth of 15 feet and a distance from the shoreline into the river of approximately 60 to 80 feet and along approximately 2000 feet of shoreline.

Removal of sediment from a targeted area outside the northwest extension area in deeper than 15 feet of water that is defined by PCB concentrations greater than 50 ppm, to maximum depth of 6 feet. During the design, sampling will be performed to determine whether additional areas of PCBs greater than 50 ppm exist. Based upon an evaluation of the significance of the distribution of contaminants and the feasibility of removal, additional areas of sediment may be targeted for dredging.

3. SCOPE OF WORK

The purpose of this investigation is to examine the various offshore areas where PCBs or metals in excess of project-specific criteria (criteria) are known or suspected to be present, in order to gather supplementary data for making decisions regarding remedial action.

This investigation will include delineation activities in three areas shown in Figures 6-1 and 6-2, and described below. The purpose of the delineation work is to further define vertical and lateral remediation boundaries within the targeted OU-2 offshore sediment delineation areas, based on sediment concentrations above PCB and metals criteria.

- **Nearshore Areas**
  The nearshore portion of the Offshore Pre-Delineation program (Figure 6-1) will consist of delineating sediment present in excess of criteria in the areas along the site shoreline defined by the expected silt curtain alignment on the west and the OU-1/OU-2 Boundary on the east (i.e., river area where mudline is shallower than El. -15).

- **Backwater Areas**
  The backwater portion of the Offshore Pre-Delineation program (Figure 6-1) will consist of delineating the sediment present in excess of criteria in the backwater areas of the site located within the nearshore portion of OU-2 boundary, at the area of slower river velocities and increased deposition; namely, the Old Marina, North Boat Slip, and South Boat Slip areas.

- **Deepwater Areas (adjacent to the Northwest Offshore Area)**
  The deepwater portion of the Offshore Pre-Delineation program (Figure 6-2) will consist of delineating the sediment with PCBs in excess of 50 ppm in a localized offshore area west of the bulkhead extension where dredging has been specified by the ROD. Sampling in other deepwater areas (see RDWP Appendix 5) is similar but has a focus on investigation of data gaps rather than refining dredging limits specified by the ROD.

3.1 Sampling Program Design

Existing data collected and evaluated from the nearshore, backwater, and deepwater delineation areas of the OU-2 site have been limited in scope, with varying depth intervals sampled and inconsistencies identified in spatial distribution of sampling locations. The existing data was sufficient for completion of the feasibility study but the following supplemental data is necessary for further delineation of areas for potential remedial action. A gridded sampling program was developed, with consistent sampling intervals and spacing, to be conducted across much of the nearshore and portions of the backwater areas to address these data gaps and to better delineate the presence and concentration of sediment exceeding criteria. A step-out sampling approach was developed in other appropriate areas of OU-2 including portions of the deepwater and backwater.

The OU-2 delineation data set obtained from this sampling program will be evaluated and incorporated, along with existing data, into the design of the dredging program.

Sediment samples will be collected and submitted for analysis for PCBs and metals (copper, lead and zinc) according to the requirements and procedures described in this plan and the pertinent operating procedures (OPs).

This program selected vibracore technology to collect sediment cores for sampling based on successful historical sampling programs at the site, among other reasons (see Section 3.5). Vibracore along with ponar grabs for surface samples will be collected from barge or boat-mounted equipment. The vibracore diameter is anticipated to be 4 inches but may be changed in the field based on sediment conditions and recovery. Up to approximately 8 feet of sediment will be sampled at each of the proposed locations to be consistent with the maximum depth of dredge as specified in the ROD and to document sediment concentrations that will be left in place. Re-sampling will be completed for deepwater locations to confirm depth and concentration data and provide reference for step-out sampling. Additional re-sampling may also be conducted at other previously sampled locations to confirm existing data where elevated PCB and metals concentrations were detected. It should be noted that additional sampling may be required to fully document the sediment concentrations remaining after remedial action.

Sample locations will be documented using a survey grade differential GPS with a sub-meter accuracy along with a depth sounder as necessary.

3.1.1 Vertical Distribution of Samples

The following approach will be used to establish vertical sample intervals to delineate PCB and metal concentrations in targeted sediment deposits:

Below is a list of depth intervals and rationale for sampling:

- 0-0.5 foot:
  - Consistent with previous sampling programs as the surface sediment sampling interval
  - Represents the zone with highest bioactivity
  - Collected using petit ponar sampler or equivalent
  - Represents the most recently deposited sediments
- 0.5-1 foot:
  - Supplement the surface sampling interval to maintain continuous sampling
- One foot sampling intervals from 1 to 6 feet:
  - Define vertical thickness of impacted sediment,
  - Provide appropriate dredge limits and to prevent unnecessary over-dredging
  - Document sediment concentrations that will be left in place after remedial action
- Two foot sampling interval(s) from 6 to 8 or 10 feet:
  - Document sediment concentrations that will be left in place after remedial action

Note that if the preceding shallower interval is less than the criteria then the deeper interval(s) (>4 foot) would not be analyzed. Concentration levels associated with the deepest analyzed interval will be discussed with the DEC prior to discarding archived deeper samples to determine whether further analysis is warranted.

3.1.2 Spatial Distribution of Samples

Sampling locations were selected based on the following spatial (horizontal) distributions and considered the presence of existing data. The sampling program employs a sampling grid in order to fill data gaps or address uneven distribution of existing data. Grid spacing is approximately 80 feet and will provide a consistent basis for understanding the distribution of contaminants in the sediment to refine dredge extents and provide a basis for remedial design. Additionally, step-out sampling will be implemented where required to adequately delineate locations where spatial extents are not fully bounded.

It is anticipated that the dredging program will be defined by grid areas to a corresponding depth interval unless additional data is available to refine dredge extents.

3.1.3 Nearshore Areas

The nearshore portion of this delineation program will be conducted to further assess and delineate sediment exhibiting concentrations in excess of criteria within the top 6 feet of sediment column in OU-2. This area is generally within approximately 15 feet of water depth, corresponding to approximately 60 to 80 feet west of the OU-1 shoreline boundary. Refer to Figure 6-1 for proposed nearshore sampling locations.

A grid based sampling program (as discussed above) will be utilized to provide a current and consistent data set over the nearshore area. Sampling and analysis for PCBs and metals (copper, lead, zinc) will be conducted in sediments up to 8 feet deep in the sediment column. Up to eight samples (dependent upon core recovery) will be collected from each sediment core.

Since this is a grid based sampling program, step-out sampling is not part of this task. Results will be evaluated to determine if additional action is required (e.g. higher density sampling) and then recorded for use during remedial design.

3.1.4 Backwater Areas

Similar to the nearshore delineation program, the backwater portion of the delineation program will be conducted to further delineate sediment exhibiting criteria exceedances in OU-2. Refer to Figure 6-1 for proposed backwater sampling locations.

The Backwater Area is divided into the three following delineation areas; Old Marina Area located at the northern limit of the site, North Boat Slip Area located in the central portion of the offshore site, and the South Boat Slip Area located at the southern end of the site. Refer to

- **North Boat Slip Area**
  A grid based sampling program (as discussed above) will be utilized where existing data gaps have been identified in this area. Sampling and analysis for PCBs and metals (copper, lead, zinc) will be conducted in sediments up to 10 feet deep in the sediment column. Up to nine samples (dependent on core recovery) will be collected from each sediment core advanced at the North Boat Slip sampling locations, representative of the target depth intervals.

- **South Boat Slip Area**
  A step-out sampling program will be used to sample four locations around the previously sampled CS-38 location which identified a significant lead exceedance within the 0-2 foot interval. This location will be resampled and 4 surrounding sample will be place at a 20 foot offset. Sampling and analysis for lead will be conducted in sediments up to 8 feet deep in the sediment column. Eight lead samples will be collected from each sediment core advanced at the South Boat Slip sampling locations, representative of the target depth intervals. Additional step-out locations will be added if exceedances of criteria are identified in the initial samples.

- **Old Marina Area**
  A grid based sampling program (as discussed above) will be utilized where existing data gaps have been identified in this area. Sampling and analysis for PCBs and metals (copper, lead, zinc) will be conducted in sediments up to 10 feet deep in the sediment column. Eleven Old Marina delineation sampling locations were chosen based on; existing sampling locations and data; the potential source of criteria exceedance located in the southeastern portion of the Old Marina area near a potential building 52 outfall and where data gaps have been identified within this backwater area.

  The delineation sampling will be focused in the southeastern portion of the Old Marina area adjacent to the existing RB-37 sampling location where PCBs were detected at 22 mg/kg (0.0-0.5 foot depth below sediment surface), and where data gaps are present. The proposed grid will be extended north if additional delineation is required with supplementary locations added based on the results of the previous sampling.

Additional sampling is not currently proposed at the western portion of the Old Marina since existing data is sufficient for delineation, and the area is bound to the south by the shoreline.

Sampling locations may be adjusted in the field according to access due to the numerous existing wooden piles and the shallow water depths currently present in the Old Marina backwater area.

As in Section 3.1.3; results will be evaluated to determine if additional action is required (e.g. higher density sampling) and then recorded for use during remedial design.

3.1.5 Deepwater Areas (adjacent to the Northwest Offshore Area)

The deepwater portion of the offshore delineation program will consist of further assessing and delineating the presence of sediments that exceed the PCB criteria. Evaluation of sampling results will be consistent with areas addressed as part of the Deepwater Investigation Plan (Appendix 5). Previous samples indicated PCB exceedances of criteria are within the top 3 or 6 feet of the sediment column, but there is insufficient data to evaluate whether they are isolated. Re-sampling will be completed for these locations to confirm depth and concentration data, to provide reference for additional sampling and to provide a more accurate representation of current conditions. Sediment sampling depths and sediment thickness inconsistencies are anticipated between the historic sample locations and proposed confirmatory sampling locations due to sediment deposition since the previous sampling. Proposed new sample locations were established on a step-out system where three to four locations will be sampled within approximately 25 feet of the original impacted sampling locations. This additional sampling will provide data to assess whether additional investigation is required and support determination of deepwater dredge limits during design. Refer to Figure 6-2 for proposed deepwater delineation sampling locations.

The Deepwater delineation area is located offshore immediately west and southwest of the Northwest Off-shore area portion of OU-2 up to approximately 225 feet from the shoreline, as shown in the ROD, and can be further divided into the two following areas:

- **Shallow Contamination Area (up to 2 feet)** – Where dredging up to 2 feet, areas will initially evaluate a 3 foot depth and further delineated for PCB concentrations greater than 50 mg/kg.

- **Deep Contamination Area (up to 6 feet)** – Where dredging up to 6 feet, areas will evaluate a 8 foot depth and further delineated for PCB concentrations greater than 50 mg/kg.

Approximately eight (8) samples will be collected from each sediment core advanced at the deep water locations, representative of the target depth intervals. Within the Shallow Contamination Area, samples collected to 3 foot depths will be analyzed with remaining samples analyzed if the preceding shallower interval is greater than the criteria. Within the Deep Contamination Area, all sample depths will be analyzed. Note that concentration levels associated with the deepest analyzed interval will be discussed with the DEC prior to discarding archived deeper samples to determine whether further analysis is warranted.

If required, additional step-out sampling locations will be based on consideration of the previous sample results in consultation with the NYSDEC.

Sampling Goals for Each Existing Location

Each location is discussed below to establish the special conditions considered for constructing step-out sampling locations. Values below are mg/kg (ppm) for PCBs. (See Figure 6-2)

Existing Shallow PCB Criteria Exceedance Sample Locations:

- RB-43: Proposed step-out north, south and west. East bounded by silt curtain.

Location	0-0.5 ft	0.5-2 ft	2-4 ft	4-6 ft	6-8 ft
RB-43	1.41	490	5.2	--	ND

- RB-12: Proposed step-out north, south and west. East bounded by Northwest Extension Bulkhead. Surface grabs in the vicinity include RB-22 (17 mg/kg).

Location	0-2	2-4 ft	4-6 ft	6-8 ft
RB-12	69	2.2	ND	--

- SD-53, RB-11 and SD-52: Potential contiguous area with step-outs surrounding these points. The existing location CS-11 provides sufficient data for the step-out in the direction of this sample. East bounded by Northwest Extension Bulkhead and associated sampling. Surface grabs in the vicinity include RB-23 (0.7 mg/kg) and BS-02 (1.0 mg/kg).

Location	0-2	2-4 ft	4-6 ft	6-8 ft
SD-53	1960	24.7	9.5	4.5
RB-11	5200	--	--	170
SD-52	153	31.1	290	34.3

Step-out	0-0.5 ft	0.5-2 ft	2-3.8 ft	3.8-4.3 ft	4.3-8 ft
CS-11	ND	ND	ND	ND	--

- RB-14 and CS-12: Potential contiguous area with step-outs surrounding these points. The existing location SD02-CS provides sufficient data for the step-out in the direction of this sample. Surface grabs in the vicinity include SD02-CS (1.0 mg/kg) as shown below.

Location	0-0.5 ft	0.5-3 ft		3-6 ft	6-8 ft
RB-14	120	0.058		ND	0.085
	0-0.5 ft	0.5-2.4 ft	2.4-2.9 ft	3-6 ft	6-8 ft
CS-12	170	ND	ND	--	--

Step-out	0-0.5 ft	0.5-8 ft
SD02-CS	0.99	--

Existing Deep PCB Criteria Exceedance Sample Locations:

- RB-42 and RB-21: Step-out locations to evaluation/delineation and/or to confirm concentration levels and thickness of sediments above the PCB exceedances. Surface grabs in the vicinity include SD05-CS (0.4 mg/kg) and SD02-GB (0.4 mg/kg) respectively.

Location	0-0.5 ft	0.5-2 ft	2-3 ft	4 ft	6-8 ft
RB-42	0.417	0.235	7.9	420	0.074
	0-0.5 ft	0.5-2 ft	2-3 ft	4-5ft	5-6 ft
RB-21	13	30	15	1400	6.9

Evaluation of Data

Results from each interval for each location will be used to characterize each location and will be used to determine if additional investigation for that location is required.

- If perimeter step-out data indicates all samples are < 50 mg/kg then no further investigation is required (i.e. additional step-out samples are not required).
- Additional investigation requirements will be based on consultation with the NYSDEC and will consider:
  - Depth and thickness of PCB exceedances
  - Variability of concentrations
  - Type of environment (erosion or deposition)
  - Concentration levels and thickness of sediments above the PCB exceedances

3.2 Tidal Schedule

Sampling scheduling and sequencing of sampling efforts will be affected by and adjusted to tidal ranges present in the Hudson River due to shallow water depths present in several of the nearshore and backwater sampling locations.

3.3 Laboratory Testing

Lab requirements and QA/QC sample frequency are specified in the Quality Assurance Project Plan (QAPP). Sample analysis methods are also specified in the QAPP (e.g. US EPA Method 8082A for PCB Aroclors; US EPA Method 6010C for metals).

The following table provides a summary of the proposed deepwater sediment sample analyses:

PDI Activity	No. of Samples	Medium/Matrix	Sampling Depths (ft.)	Analytical Parameter
Nearshore	22 sampling locations 8 samples per location	Sediment	0-0.5, 0.5-1, 1-2, 2-3, 3-4, 4-5, 5-6, 6-8	PCBs, Metals (Cu, Pb, Zn)
Backwater	**Old Marina**: 11 sampling locations 8 samples per location	Sediment	0-0.5, 0.5-1, 1-2, 2-3, 3-4, 4-5, 5-6, 6-8 (8-10 in South Slip & Old Marina)	PCBs, Metals (Cu, Pb, Zn) (*South Slip, Pb only)
	North Slip: 3 sampling locations 8 samples per location			
	South Slip: 5 sampling locations 8 samples per location			
Deepwater	**2 foot**: 25 sampling locations 8 samples per location	Sediment	0-0.5, 0.5-1, 1-2, 2-3, 3-4, 4-5, 5-6, 6-8	PCBs
	6 foot: 8 sampling location 8 samples per location			

3.4 Relevant Field Operating Procedures

Field investigations will be performed in general accordance with the following Operating Procedures (OPs). Refer to Appendix A.

OP2000 - Monitoring Field Explorations
OP2001 - Identification and Description of Soils Using Visual-Manual Methods
OP3001- Preservation and Shipment of Environmental Samples
OP3004 - Sediment Sampling
OP3026 - Chain of Custody
OP3029 – Field Data Recording
OP3030 - Field Instruments: Use and Calibration

3.5 Vibracoring

Vibracoring sampling techniques will be used to collect sediment core samples at each of the proposed Offshore Pre-Delineation sampling locations (except for the surface ponar grabs). Vibracoring is the process of collecting samples within core liners that provide a continuous, minimally disturbed sediment core sample from unconsolidated sediments.

Various sediment coring techniques were evaluated for use during the proposed Offshore Pre-Delineation. Vibracoring was chosen due to several factors including: sediment properties, prior successful use in the proposed delineation areas, minimal sediment compaction throughout length of core, minimal sediment disturbance throughout length of core, and greater recovery potential of sediment sample. Where allowable according to sediment properties and density, sediment coring may be conducted without introduction of vibrations, to further decrease the potential for disturbance of near surface sediment (0-0.5 foot). Due to potential disturbance of the 0-0.5 foot interval ponar grabs will be collected for this interval in deepwater areas with shallow contamination.

While some debris may be encountered, requiring adjustment of sample locations, the extent and type of debris in the delineation area is not expected to interfere with sample collection. The depth of the silt and sediment has been previously documented and therefore reduces the potential for issues related to a false indication of "refusal" resulting from debris.

The sediment-related exploration and sampling program discussed herein will be conducted by the coring subcontractor along with a Haley & Aldrich representative on board a sampling vessel, outfitted with sediment sampling equipment for acquisition of data in shallow and deepwater environments, along with typical oceanographic and marine navigation equipment.

The coring subcontractor will maintain at least a two-person crew during the sampling survey to navigate the vessel, perform the sediment coring, and collect sediment samples. A Haley & Aldrich representative will be on board during the program to document field observations and to assist with the sediment sampling. Sediment coring will be collected from the sampling vessel at locations shown on Figures 6-1 and 6-2.

4. QUALITY ASSURANCE

Appendix A of the RDWP provides a Quality Assurance Project Plan (QAPP).

5. SUBMITTALS

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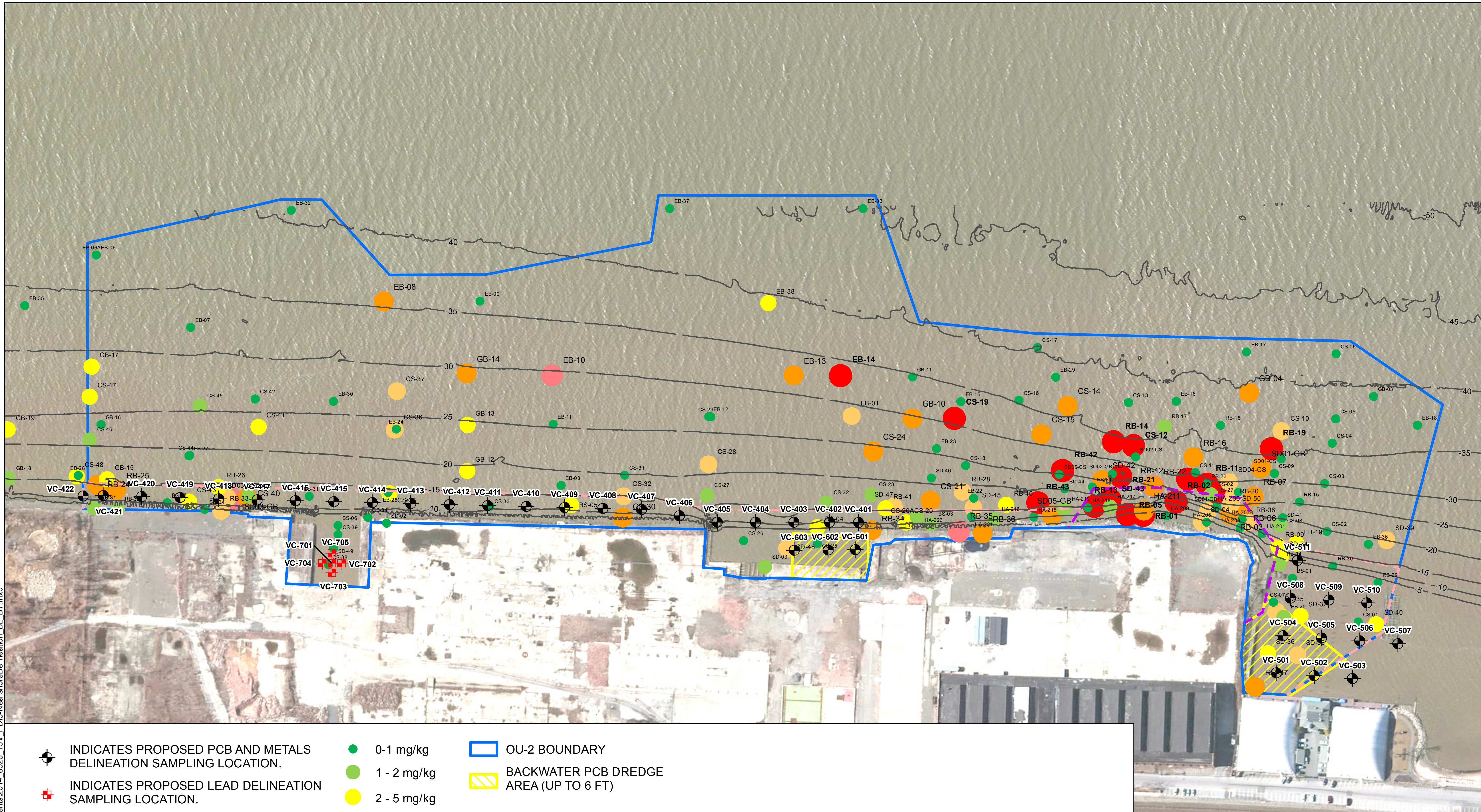
6. HEALTH AND SAFETY

Health and safety requirements applicable to all persons entering the site or involved in field activities are described in the Site-specific Health Safety Security and Environmental Plan (HSSEP), these documents will be available for use on Site prior to the commencement of work.

7. ATTACHMENTS

Figure 6-1 – Nearshore and Backwater Pre-Delineation Sampling Locations
Figure 6-2 – Offshore Pre-Delineation Sampling Locations

https://hank.haleyaldrich.com/sites/projects/28612/Shared Documents/289 - RDWP/5-7-14 RTC RDWP/Redline RDWP Edits/App 6 - OU-2 PreDelin-F.docx



INDICATES PROPOSED PCB AND METALS DELINEATION SAMPLING LOCATION.

INDICATES PROPOSED LEAD DELINEATION SAMPLING LOCATION.

BATHYMETRIC CONTOUR

SILT CURTAIN

NORTHWEST EXTENSION

0-1 mg/kg

1 - 2 mg/kg

2 - 5 mg/kg

5 - 10 mg/kg

10 - 50 mg/kg

50 - 100 mg/kg

>100 mg/kg

OU-2 BOUNDARY

BACKWATER PCB DREDGE AREA (UP TO 6 FT)

NOTES:
1) AIR PHOTO COURTESY OF TERRASERVER, 2012.
2) BATHYMETRY COURTESY OSI, INC., 2013 AND MARINE SCIENCES RESEARCH CENTER, 2007.

W S N E

0 200 400

SCALE IN FEET

HALEY & ALDRICH

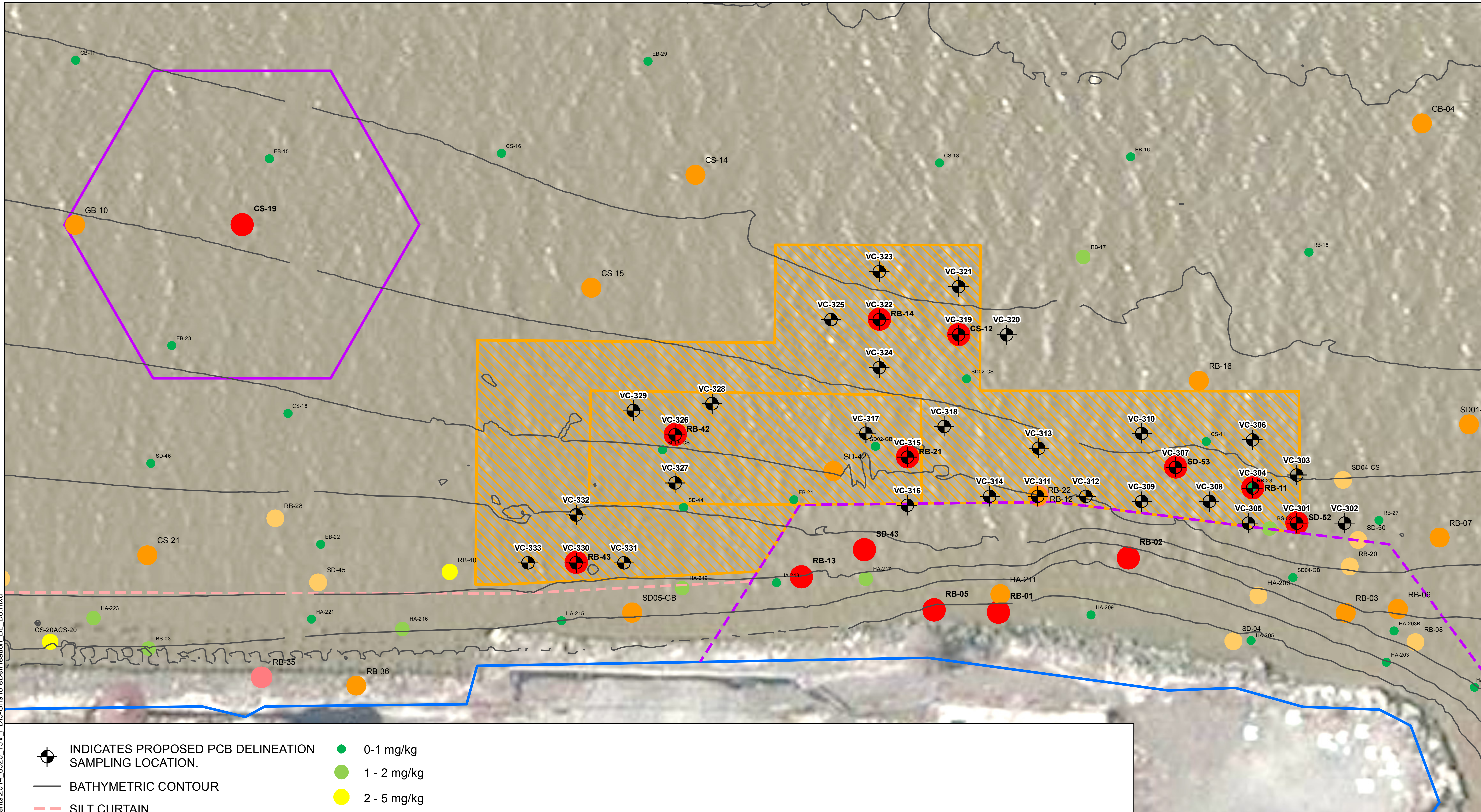
NYSDEC SITE #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

NEARSHORE AND BACKWATER PRE-DELINEATION SAMPLING LOCATIONS

SCALE: AS SHOWN
MAY 2014

FIGURE 6-1

G:\Projects\28612\Global\GIS\Map Documents\2014_0528_TJV_PDI5-NearshoreDelineation_BL_D7.mxd



- INDICATES PROPOSED PCB DELINEATION SAMPLING LOCATION.
- BATHYMETRIC CONTOUR
- SILT CURTAIN
- NORTHWEST EXTENSION
- INVESTIGATION UNIT
- OU-2 BOUNDARY
- DEEPWATER DREDGE AREA (UP TO 6 FT)

- 0-1 mg/kg
- 1 - 2 mg/kg
- 2 - 5 mg/kg
- 5 - 10 mg/kg
- 10 - 50 mg/kg
- 50 - 100 mg/kg
- \>100 mg/kg

NOTES:
1) AIR PHOTO COURTESY OF TERRASERVER, 2012.
2) BATHYMETRY COURTESY OSI, INC., 2013.

0 50 100
SCALE IN FEET

W S N E

HALEY & ALDRICH

NYSDEC SITE #3-60-022
1 RIVER STREET
HASTINGS-ON-HUDSON, NEW YORK

OFFSHORE PRE-DELINEATION SAMPLING LOCATIONS

SCALE: AS SHOWN
MAY 2014

FIGURE 6-2

G:\Projects\28612\Global\GIS\Map Documents\2014_0528_TJV_PDI5-OffshoreDelineation_BL_D8.mxd

APPENDIX 7

Geotechnical Exploration Plan

APPENDIX 7

GEOTECHNICAL EXPLORATION PLAN

1. INTRODUCTION

This plan describes geotechnical explorations in OU-1 and OU-2. This task is part of the overall pre-design investigation (PDI) that will be completed at the Former Anaconda Wire & Cable Company site (Site), NYSDEC Site # 3-60-022, located on the east shore of the Hudson River at 1 River Street, Hastings-on-Hudson, New York.

2. BACKGROUND

The remedy described in the OU-1 ROD Amendment and OU-2 ROD requires geotechnical engineering analysis and design. Prior investigations have collected geotechnical data, however, data gaps remain.

3. SCOPE OF WORK

3.1 Purpose and Scope

The purpose of the geotechnical explorations is to provide additional stratigraphy information in several areas: in the general vicinity of the planned deadman anchor (which will be located west of Building 52), in the general vicinity of the planned Northwest Extension bulkhead wall, and in the general off-shore area between the North Boat Slip and the South Boat Slip. The information will be used for bulkhead and deadman design, excavation support design, design of the sloped shore, and general site geotechnical analysis (such as settlement). Up to two test borings on land and up to nine test borings in the river are planned to be drilled at the general locations shown on Figure 7-1.

Additionally, some test pits are planned to be excavated at select locations around the site where sheetpile support of excavation (SOE) is planned to be used during construction (i.e., “hot spot” excavation locations that are about 6 ft bgs or greater), or at existing building foundations. The purpose of the test pits is to gather information on soil conditions, excavation effort, and potential obstructions that could affect the design and/or construction of the sheetpile SOE walls.

3.2 Geotechnical Test Borings

The borings will be advanced using rotary wash drilling techniques. For the offshore borings, the drilling rig will be mounted on a barge. On land, boring locations will be pre-cleared to a depth of approximately 6.5 feet using an air knife or other clearing technique, to check for the presence of utilities.

Samples will be obtained using the Standard Penetration Test (SPT) in general accordance with ASTM D1586, sampling generally every 5 to 10 feet for both on-shore and off-shore borings, except that on land, sampling will be performed continuously (every 2 feet) through the Fill soils or to a depth of at least 12 feet. Some undisturbed samples from the Marine Silt will be obtained using a thin-walled Shelby tube sampler. A 5-foot rock core will be obtained in some of the borings, and the borings will be terminated either 10 feet below the top of the Basal Sand, at the top of rock, or 5 feet below the top of rock, depending on the location.

The estimated depth for on-shore borings is approximately 50 to 100 feet below ground surface, and estimated depth for the off-shore borings is approximately 70 to 100 feet below mudline, depending on location and the termination criteria discussed above.

Soil samples will be visually classified using the Unified Soil Classification System (USCS). The borings will be grouted on completion and cuttings will be drummed for disposal. For the off-shore locations, boring locations will be determined using a barge-mounted GPS unit, and mudline elevations will be approximately determined using an on-site tide board. For the on-shore borings, as-drilled boring locations and ground surface elevations will be determined by survey.

Sampling equipment will be decontaminated between samples and drilling equipment will be decontaminated between locations if required.

The locations of the borings planned to be advanced along the Northwest Extension bulkhead wall will be chosen after completion of the PCBM/Riprap probes described in Appendix 4, so that more information is available relative to the likely location of the wall. In general, the number and locations of the borings shown on Figure 7-1 are approximate and subject to change based on conditions encountered during the work.

3.3 Geotechnical Test Pits

One to two weeks of test pits are planned to be excavated at SOE locations around the site. Preliminary locations are shown on Figure 7-1 but are approximate and subject to change based on conditions encountered during the work. In general, the excavation area will be 4 feet by 10 feet and will be enlarged as necessary based on sidewall stability and field conditions. The excavations will typically be 8 to 12 feet deep. It is anticipated that 2 to 3 test pits will be excavated each day, and that the total number of geotechnical test pits will be on the order of 5 to 10; however, the number of test pits is approximate and subject to change based on the progress of the work and field conditions. Excavation will be performed in accordance with the Atlantic Richfield Remediation Management Defined Practice for Ground Disturbance.

During excavation, excavated soils will be placed on plastic sheeting. At the completion of excavation, the soils will be placed back in the excavation in the reverse order of excavation, so that the soils excavated from the bottom of the pit will be replaced back in the bottom.

3.4 Geotechnical Laboratory Testing

Representative soil samples will be submitted to a geotechnical laboratory and tested for the following parameters. No tests are planned to be performed on rock core samples. Note that some tests may be added or deleted, depending on the number and quality of samples obtained.

- Moisture Content (ASTM D2216)
- Grain-Size Analysis (ASTM D422)
- Atterberg Limits (ASTM D4318)
- Organic Content (ASTM D2974)
- Specific Gravity (ASTM D854)
- One-Dimensional Consolidation (ASTM D4186) (undisturbed samples only)
- UU Triaxial Test (ASTM D2850) (undisturbed samples only)
- CU Triaxial Test (ASTM D4767) (undisturbed samples only)

3.5 Relevant Field Operating Procedures

Field investigations will be performed in general accordance with the following Operating Procedures (OPs), which are provided in Appendix A.

OP1001 – Excavation and Trenching
OP1002 – Drilling Safety
OP1004 – Operation / Calibration of PID Photoionization Detector
OP1008 – Operations Over, Near, or On Water
OP1020 – Work Near Utilities
OP2000 – Monitoring Field Explorations
OP2001 – Identification and Description of Soils Using Visual-Manual Methods
OP2005 – Test Borings, Sampling, Standard Penetration Testing and Borehole Abandonment
OP2007 – Undisturbed Fixed Piston Tube Sampling

4. QUALITY ASSURANCE

Appendix A of the RDWP provides a Quality Assurance Project Plan (QAPP).

5. SUBMITTALS

Applicable data will be included in the PDI Data Summary Report.

6. HEALTH AND SAFETY

Health and safety requirements applicable to all persons entering the site or involved in field activities are described in the Site-specific Health Safety Security and Environmental Plan (HSSEP), these documents will be available for use on Site prior to the commencement of work.

7. ATTACHMENTS

Figure 7-1 Proposed Exploration Location Plan: Geotechnical Explorations

LEGEND

PD2-GR-009 — DESIGNATION AND APPROXIMATE LOCATION OF PROPOSED GEOTECHNICAL TEST BORING. NUMBER AND LOCATION OF EXPLORATIONS IS SUBJECT TO CHANGE BASED ON FIELD CONDITIONS.

PROPOSED TEST PIT LOCATIONS. NUMBER OF TEST PITS AND LOCATIONS ARE APPROXIMATE AND SUBJECT TO CHANGE BASED ON SITE CONDITIONS.

PROPERTY LINE

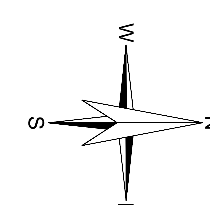
RAIL ROAD

EXISTING STRUCTURES

NORTHWEST EXTENSION WALL LOCATION

NOTES

1. PROPERTY BOUNDARY INFORMATION PROVIDED BY WENDEL COMPANIES, DRAWING XVE-HUDSON-TOPO.DWG, PROJECT NO. 438504, DATED SEPTEMBER 21, 2012.
2. GRID SYSTEM IS THE NEW YORK STATE PLANE COORDINATE SYSTEM, EAST ZONE, NAD 83, U.S. SURVEY FEET.
3. SHORELINE AND ONSHORE FEATURES ARE APPROXIMATE AND ARE BASED ON DIGITAL ORTHOPHOTO QUADRANGLES FLOWN IN 2009 AND OBTAINED FROM THE NEW YORK STATE GIS CLEARINGHOUSE (NYGIS).
4. THE CONTOUR INFORMATION PRESENTED ON THIS DRAWING REPRESENTS THE RESULTS OF A SURVEY PERFORMED BY OCEAN SURVEYS, INC. ON 10-16 DECEMBER 2012 AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS EXISTING AT THAT TIME.



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SCALE IN FEET

HALEY & ALDRICH

PRE-DESIGN INVESTIGATION
NYSDEC SITE #3-60-022
HASTINGS-ON-HUDSON, NEW YORK

PROPOSED LOCATION PLAN - GEOTECHNICAL BORINGS AND TEST PITS

SCALE: AS SHOWN
JUNE 2014

FIGURE 7-1

Drawing Name: S:\28612_HASTINGS\286\CAD\28612-286_008 PROP TEST PITS R4.DWG
Operator Name: POSTOLOWSKI, KEVIN
Drawing Layout: FIGURE 7-1
Plot Date: June 9, 2014

APPENDIX 8

Bench Tests

APPENDIX 8
BENCH TEST WORK PLANS

1. INTRODUCTION

This plan describes bench tests to support remedial design. This task is part of the overall pre-design investigation (PDI) that will be completed at the Former Anaconda Wire & Cable Company site (Site), NYSDEC Site # 3-60-022, located on the east shore of the Hudson River at 1 River Street, Hastings-on-Hudson, New York.

2. BACKGROUND

Design of the site remedy may include management of saturated soils and sediment, treatment of water during construction and long-term treatment of groundwater as part of a groundwater management system. The following sections provide the specific bench scale testing to address these potential design scenarios for the remedial design.

3. SCOPE OF WORK

Prior to remedial design at the Site, a series of bench-scale treatability tests will be performed to identify effective treatment technologies and associated design parameters for the potential full scale system. These technologies include:

- Solids Dewatering: Methods and basic design parameters for the dewatering of water-laden excavated soils and dredged sediments;
- Stabilization: Methods and basic design parameters for the solidification of construction materials to be re-used on-site for various purposes, which may include structural fill;
- Construction Water Treatment: Methods and basic design parameters for the potential treatment of various metals and PCBs in water generated during construction activities (e.g., solids dewatering supernatant and on-shore excavation dewatering); and
- Long-Term Groundwater Treatment: Initial testing of treatment methods for residual groundwater: to screen technology and provide basic design parameters for further testing, if needed.

The results of the bench testing will be used during design for process selection and equipment specification.

The Department will be notified when a subcontractor laboratory is selected to perform these bench tests. The environmental testing will be completed in compliance with the QAPP.

The following sections outline the procedures and methods to be used during bench-scale testing.

3.1 Solids Dewatering

The purpose of this bench test is to measure the effectiveness of two dewatering techniques (gravity settling and plate-and-frame filtration) on the dewatering of recovered saturated solids which will be generated during remedial construction.

On-shore soils dewatering was bench tested in 2006. Bench testing results indicated that gravity settling was ineffective in meeting Liquid Release and Paint Filter testing for material transport; however filter press operation at 100 psig was sufficient to meet these requirements. Similar testing will be performed on sediments, identifying the effectiveness of dewatering for both on-site treatment (e.g., solidification) and off-site transport.

Sediment will be tested for the effectiveness of both gravity settling and plate-and-frame filtration. The sediment will be tested under two conditions: the raw material and the raw material with diatomaceous earth added as a dewatering aid. After each test, sediment will be tested for the appropriate parameters for design purposes.

3.1.1 Sampling:

Two, 2-gallon samples of sediments will be obtained as a part of the sampling program. Samples will be composited in the lab and kept at 4 degrees C for the duration of the test.

Samples for testing: The composite will be split into two (2) samples and prepared for testing, as follows:

(1) Raw Sample; and
(2) Raw sample with added 5% diatomaceous earth.

Analysis of the raw composite will be as follows:

(1) Moisture content;
(2) Solids content;
(3) Paint Filter Test;
(4) Grain Size Distribution; and
(5) Atterburg Limits.

3.1.2 Gravity Drainage Testing:

Gravity drainage testing will be performed to evaluate the reduction in moisture content that can be achieved by allowing the site material to gravity drain while stockpiled during field operation. Appropriate volumes of each of the samples will be placed in a Buchner funnel with filter paper and covered. A sample of each sediment will be removed at days 3, 5, and 7 and tested for the following parameters:

(1) Mass of filter cake and fluids;
(2) Moisture content; and
(3) Solids content.

Following completion of the 7-day test, the remaining sample will also be analyzed for the following parameters:

(1) Paint Filter; and
(2) Liquid Release Test.

3.1.3 Filter Press Testing:

Filter press testing will be performed to evaluate the reduction in moisture content that can be achieved by the application of a positive pressure to the saturated material. Appropriate volumes of each of the two samples will be placed in a bench filter press apparatus and pressure will be applied until breakthrough occurs. The filter press will likely be tested at the following pressures: 50 psig, 75 psig, 100 psig, 125 psig, and 150 psig, or until the treated sample passes both the Paint Filter and Liquid Release Tests.

Samples will be analyzed for:

(1) Mass of final filter cake and fluids released;
(2) Moisture content;
(3) Solids content;
(4) Paint Filter; and
(5) Liquid Release Test.

3.1.4 Optional Testing

If testing results indicate that diatomaceous earth addition has a beneficial effect on the ability to dewater the sediments, additional testing may be performed to provide testing of sediment with on-site soils used as an additive, rather than diatomaceous earth. Two test runs at the optimum conditions may be performed, with 5% and 10% addition of on-site soils to the sediment prior to dewatering.

3.2 Stabilization

The purpose of this test is to measure the effectiveness of combinations of additives to construction-generated media, to determine the effectiveness of these additives to sufficiently stabilize engineering or geotechnical properties of the material so that on-site re-use is feasible. Only materials that meet beneficial reuse criteria will be considered for stabilization and on-site re-use; as such, there is no chemical testing performed as part of the stabilization bench test.

Up to three separate sets of tests will be performed on sediments of potentially differing properties; on-shore saturated soils, near-shore sediments and deep-water sediments. Note that physical properties testing of the near-shore and deep-water sediments will verify that sediments have different physical properties. If properties are similar, only two tests will be performed: on-shore soils and (composited) sediments.

Each sample will be tested to determine the effectiveness of the admixtures to provide durable and stable materials for use as fill on-shore at the subject site. Each material shall have a minimum of four admixtures at up to two addition rates tested over time, up to the 28-day point. The most successful admixture for each of the media will be further tested.

3.2.1 Sampling:

Seven (7) to ten (10) 5-gallon samples of each material (on-site saturated soils, near-shore sediment and deep water sediments) will be collected. Samples will be composited in the lab and kept at 4 degrees C for the duration of the test. These samples may also be used for other testing.

3.2.2 Mixture Design:

The testing laboratory will prepare a minimum of four combinations of stabilizing agents for use on each of the samples. Mixtures will include varying percentages of Portland cement, hydrated lime, fly ash, cement kiln dust and/or other additives deemed likely for success by the laboratory.

3.2.3 Mixture Testing:

Each of the additives will be added at a minimum of two addition rates to each of the sample media.

After initial screening of the admixtures, four admixture/ratio combinations will be tested further. Additional composite sediment samples will be utilized and additional mixtures will be prepared for testing. These stabilized samples will be tested for various geotechnical parameters, such as durability and strength.

Based on evaluation of the stabilized materials, additional geotechnical testing may be performed on the two most successful tests. Two samples of each material may be tested for additional strength parameters, to be determined as the program progresses.

3.3 Construction Water Treatment

The purpose is to determine the effectiveness of various water treatment technologies on water generated during construction. Treatment methods to be tested will include filtration, metals precipitation (through pH adjust), and carbon adsorption.

Waters will be tested to determine optimum treatment technologies and initial design parameters for water treatment during construction. On-shore excavation dewatering water as well as supernatant from sediment dewatering (see previous test) will be tested separately for treatment of the primary contaminants of metals and PCBs. A combined stream will be tested at the end for overall acceptability.

3.3.1 Sampling:

Two, 5-gallon samples of site shallow groundwater will be obtained as part of the sampling program. Samples will be composited in the lab and kept at 4 degrees C for the duration of the test.

Ten (10) to fifteen (15) 5-gallon samples of sediments (combined shallow and deep water) will be obtained as a part of the sampling program. Final volumes of sediment required will be dependent on upon the quantity of water that can be extracted from the sediments, as determined in the dewatering bench test (previously described). Sediment samples will be dewatered using the selected method as part of the dewatering bench test. Supernatant water will be collected for testing under this plan.

Each of the water samples will be composited in the lab. Pre-treatment samples of the water will be analyzed for:

(1) Total Metals (Beryllium (Be), Copper (Cu), Lead (Pb)and Zinc (Zn))
(2) Dissolved Metals (Be, Cu, Pb and Zn)
(3) Total Suspended Solids
(4) Total Dissolved Solids
(5) PCBs as Aroclors

3.3.2 Filtration Testing:

A portion of each of the two samples will be passed through progressively smaller filters and analyzed for total metals, solids and PCBs after each filtration. Filtration levels shall include 10 micron, 5 micron, 1 micron, 0.5 micron, and 0.1 micron filters. Results will indicate if filtration alone is sufficient for meeting discharge limitations. Each of the filtered water samples will be analyzed for:

(1) Total Metals (Be, Cu, Pb and Zn)
(2) Dissolved Metals (Be, Cu, Pb and Zn)
(3) Total Suspended Solids
(4) Total Dissolved Solids
(5) PCBs as Aroclors

3.3.3 Precipitation Testing:

A portion of each of the two samples be subject to pH adjust and precipitation testing. Actual pH levels to be tested will be dependent upon concentrations and metals and concentrations present in the raw water. A minimum of three pH levels, varying by a minimum of 0.5 SU will be tested. These tests will be performed with a minimum of two precipitating agents. After pH adjustment, the water sample will be filtered to 10 micron and analyzed for:

(1) Total Metals (Be, Cu, Pb and Zn)
(2) Dissolved Metals (Be, Cu, Pb and Zn)
(3) Total Suspended Solids
(4) Total Dissolved Solids
(5) PCBs as Aroclors

3.3.4 Carbon Adsorption Testing:

A portion of each of the two samples will be subject to Granular Activated Carbon (GAC) adsorption testing. Water samples will be filtered to 10 micron prior to passing through the carbon. A minimum of two carbon types will be tested for each of the two water streams, with two empty bed contact times each, as recommended by the manufacturer. After passing through the carbon bed, the water samples will be analyzed for:

(1) Total Suspended Solids
(2) Total Dissolved Solids
(3) PCBs as Aroclors

3.3.5 Complete System Testing:

After completion of the individual component and water stream testing, a composite of the two water streams will be composited and tested through a complete stream of treatment. This may include filtration, pH adjustment, additional filtration and carbon adsorption, as testing indicates is necessary. Composite water will be tested before and after each unit process, for a total of up to 5 analyses, for the following:

(1) Total Metals (Be, Cu, Pb and Zn)
(2) Dissolved Metals (Be, Cu, Pb and Zn)
(3) Total Suspended Solids
(4) Total Dissolved Solids
(5) PCBs as Aroclors

3.4 Long-Term Groundwater Treatment

Purpose is to provide an initial screening of the effectiveness of several adsorptive media on low flow, passive treatment of groundwater after construction.

On-site groundwater will be tested to determine the long term effectiveness of a low-flow, flow-through carbon adsorption system. This is preliminary testing to provide options for long term treatment of potential low level residual groundwater impacts after the implementation of the remedy.

3.4.1 Sampling:

Four, 5-gallon samples of site shallow groundwater will be obtained as part of the sampling plan. Samples will be composited in the lab and kept at 4 degrees C for the duration of the test. Note: final sample volumes will be based on estimated design flows through the groundwater treatment system.

Each of the water samples will be composited in the lab. Pre-treatment samples of the water will be analyzed for:

(1) Total Metals (Be, Cu, Pb and Zn)
(2) Dissolved Metals (Be, Cu, Pb and Zn)
(3) Total Suspended Solids
(4) Total Dissolved Solids
(5) PCBs as Aroclors

3.4.2 Low Flow Adsorption Testing:

The composite sample will be split into four samples for testing. Two types of GAC will be selected and small samples of each of the GAC will be placed in vessels. Site groundwater will be pumped through the samples at two separate empty bed contact times, designed to simulate flow conditions anticipated to be encountered after remedial construction. Effluent treated groundwater samples will be collected at 50%, 75%, 100%, 125% and 150% of predicted carbon capacity and analyzed for:

(1) Total Metals (Be, Cu, Pb and Zn)
(2) Dissolved Metals (Be, Cu, Pb and Zn)
(3) Total Suspended Solids
(4) Total Dissolved Solids
(5) PCBs as Aroclors

4. QUALITY ASSURANCE

Appendix A of the RDWP provides a Quality Assurance Project Plan (QAPP). Sample container, preservation, handling requirements, reporting limits and data quality indicators for the analyses to be performed will be consistent with analytical methods and procedures provided in the QAPP.

Laboratory data for the analyses will be presented in NYSDEC Analytical Services Protocol Category B (ASP-B) and electronic EQuIS format for data and full data validation as prescribed in Appendix A will be performed.

Estimated sample and analytical quantities are as follows:

Bench Test	*Moisture Content*	*Solids Content*	*Grain Size distribution*	*Atterberg Limits*	*Paint Filter Test*	*Liquid Release Test*	*Geotechnical (TBD)*	*Total Metals*	*Dissolved Metals*	*TSS*	*TDS*	*PCBs as Aroclors*
Solids Dewatering	20	20	2	2	15	15						
Stabilization							50					
Construction Water Treatment								25	25	30	30	30
Long-Term Groundwater Treatment										5	5	5
TOTALS	*20*	*20*	*2*	*2*	*15*	*15*	*50*	*25*	*25*	*35*	*35*	*35*

Analytical Test methods will be as follows:

- Solids / Moisture Content (ASTM D2216)
- Grain Size Distribution (ASTM D422)
- Atterberg Limits (ASTM 4318)
- Paint Filter Test (EPA Method 9095)
- Liquid Release Test (EPA Method 9096)
- Total Metals (Be, Cu, Pb and Zn) (EPA 6010C)
- Dissolved Metals (Be, Cu, Pb and Zn) (EPA Method 6010C)
- Total Suspended Solids (Standard Methods 2450)
- Total Dissolved Solids (Standard Methods 2450)
- PCBs as Aroclors (EPA 8082A)

Geotechnical analyses to be performed as part of the Stabilization Bench Test may include those listed above but shall be determined at a later time. Reporting limits for likely geotechnical parameters (e.g., Grain size analysis, Atterberg Limits, Triaxial tests, etc.) are included in the QAPP.

5. SUBMITTALS

Applicable data will be included in the PDI Data Summary Report.

6. HEALTH AND SAFETY

Health and safety requirements applicable to all persons entering the site or involved in field activities are described in the Site-specific Health Safety Security and Environmental Plan (HSSEP), these documents will be available for use on Site prior to the commencement of work.