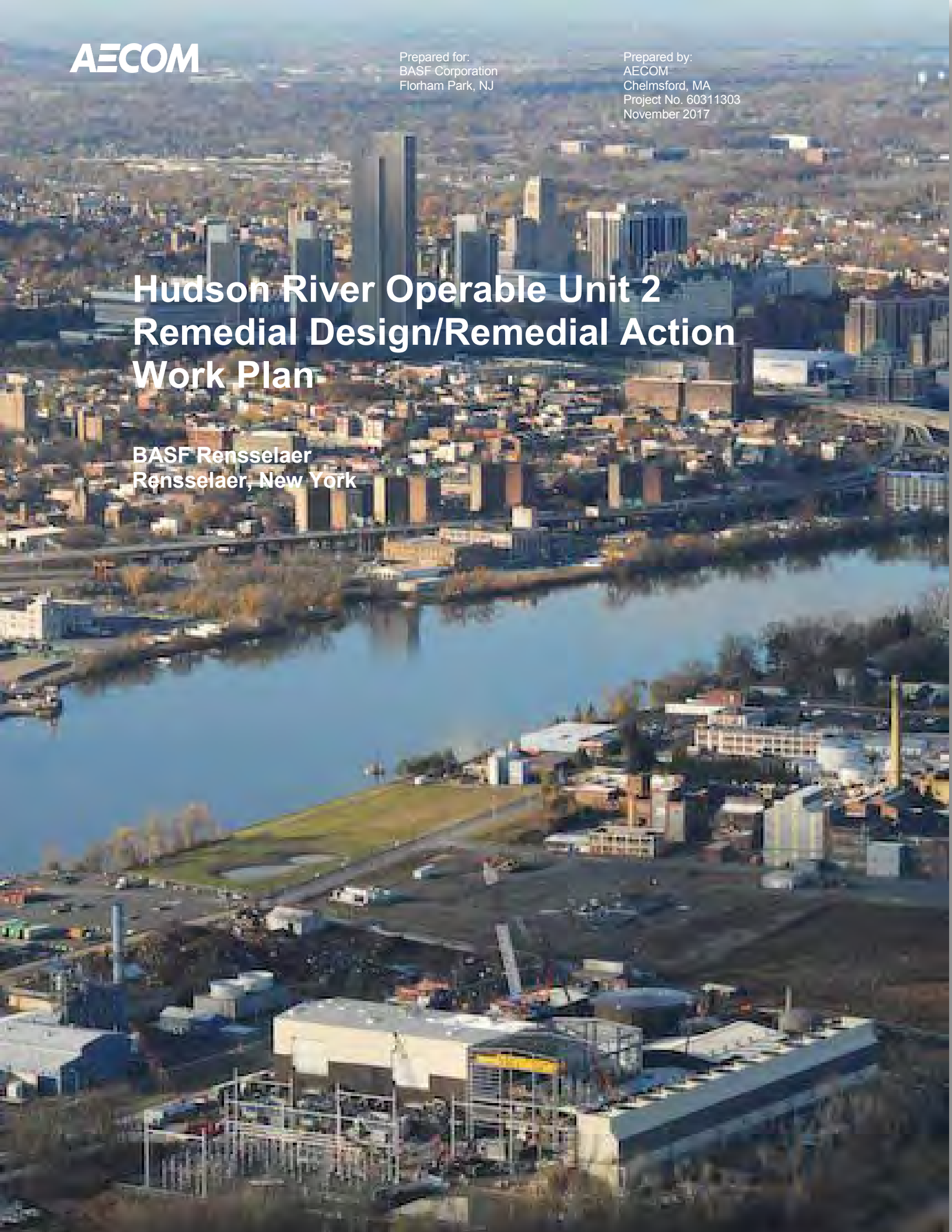
AECOM

Prepared for:
BASF Corporation
Florham Park, NJ

Prepared by:
AECOM
Chelmsford, MA
Project No. 60311303
November 2017

# Hudson River Operable Unit 2 Remedial Design/Remedial Action Work Plan

**BASF Rensselaer**
**Rensselaer, New York**



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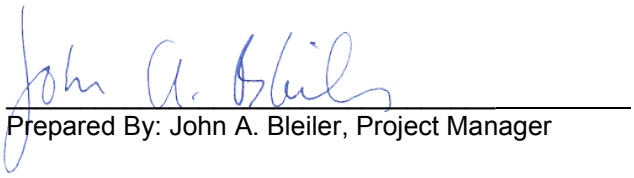

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# Professional Certification

I, Michael J. Gardner, certify that I am currently a NYS Professional Engineer and that this Remedial Design/Remedial Action Work Plan was prepared in accordance with all applicable statues and regulations and in substantial conformance with the Department of Environmental Remediation (DER) Technical Guidance for Site Investigation and Remediation (DER-10) and that all activities were performed in accordance with the DER-approved work plan and any DER-approved modifications.

Signature Michael Gardner Date 11/6/2017

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# List of Acronyms

| | |
|---|---|
| °C | Degrees Celsius |
| ADCP | Acoustic Doppler Current Profiler |
| AECOM | AECOM Technical Services |
| ASTM | American Society for Testing and Materials |
| ATL | Atlantic Testing Laboratories |
| BASF | BASF Corporation |
| BMPs | Best Management Practices |
| CAMP | Community Air Monitoring Plan |
| CERP | Community and Environmental Response Plan |
| CFR | Code of Federal Regulations |
| COCs | Constituents of Concern |
| CWA | Clean Water Act |
| CY | Cubic Yards |
| DAC | D. A. Collins |
| DAR | Division of Air Resources |
| DER | Department of Environmental Remediation |
| ESMI | Environmental Soil Management, Inc. |
| FS | Feasibility Study |
| ft. | Feet |
| GHG | Greenhouse Gas |
| gpm | Gallons per Minute |
| HDPE | High Density Polyethylene |
| HMMP | Habitat Monitoring and Maintenance Plan |
| Hudson River OU-2 | Hudson River area adjacent to the OU-1 upland area, including the NFSSA and SFSSA |
| LKD | Lime Kiln Dust |
| mg/Kg | Milligrams per Kilogram |
| MHW | Mean High Water |
| MLW | Mean Low Water |
| MNR | Monitored Natural Recovery |
| NFSSA | Northern Feasibility Study Study Area |
| NOAA | National Oceanographic and Atmospheric Administration |
| NRDA | Natural Resource Damage Assessment |
| NTUs | Nephelometric Turbidity Units |
| NWP | Nationwide Permit |
| NYCRR | New York Code Rules and Regulations |
| NYS | New York State |
| NYSDEC | New York State Department of Environmental Conservation |
| OSHA | Occupational Safety and Health Administration |
| OU | Operable Unit |
| PCBs | Polychlorinated Biphenyls |

| | |
|---|---|
| POR | Port of Albany |
| psf | Pounds per Square Foot |
| RAMP | Remedial Action Monitoring Plan |
| RAOs | Remedial Action Objectives |
| RCRA | Resource Conservation Recovery Act |
| RD/RA Work Plan | Remedial Design Work Plan |
| RD/RA Work Plan | Remedial Design Work Plan |
| RI | Remedial Investigation |
| RM | River Mile |
| ROD | Record of Decision |
| RTK-DGPS | Real-Time Kinetic Differential Global Positioning Systems |
| SAV | Submerged Aquatic Vegetation |
| SF | Square Feet |
| SFSSA | Southern Feasibility Study Study Area |
| Site | Former BASF Facility |
| SMP | Site Management Plan |
| SPDES | State Pollution Discharge Elimination System |
| SUE | Subsurface Utility Engineering |
| SVOCs | Semivolatile Organic Compounds |
| TAL | Target Analyte List |
| TCLP | Toxicity Characteristic Leaching Procedure |
| TFS | Temporary Fabric Structure |
| TOC | Total Organic Carbon |
| TSCA | Toxic Substances Control Act |
| USACE | Unites States Army Corps of Engineers |
| USEPA | United States Environmental Protection Agency |
| VOCs | Volatile Organic Compounds |

# 1.0 Introduction

This Remedial Design/Remedial Action (RD/RA) Work Plan has been prepared by AECOM Technology Services, Inc. (AECOM) on behalf of BASF Corporation (BASF) to present a description of the remedial action to be employed to address impacted sediment in the Hudson River adjacent to the Former BASF Facility (the "Site") located in Rensselaer, New York (Figure 1-1). The RD/RA Work Plan has been completed in accordance with New York State Department of Environmental Conservation (NYSDEC) Division of Environmental Remediation (DER) requirements, including DER-10 (Technical Guidance for Site Investigation and Remediation, NYSDEC, 2010a) and DER-31 (Green Remediation, NYSDEC, 2010b). The Site is being closed under the New York State (NYS) Inactive Hazardous Waste Disposal Site Remedial Program, also known as the NY State Superfund Program.

There are two Operable Units (OUs) at the Site:

- OU-1 consists of all upland portions of the Site; and
- OU-2 includes off-Site areas, including approximately 14 acres of the Hudson River adjacent to and downstream of the Site.

The remediation of Operable OU-1 has been completed.

This RD/RA Work Plan addresses the Hudson River portion of OU-2 (referred to herein as "Hudson River OU-2").

## 1.1 Overview of Selected Remedy

The remedy for the Hudson River OU-2 is summarized in the March 2016 Record of Decision (ROD) for this portion of the Site (NYSDEC, 2016a). As described in the ROD, the Hudson River OU-2 has been sub-divided into two areas known as the Northern Feasibility Study (FS) Study Area (NFSSA) and the Southern FS Study Area (SFSSA) (Figure 1-2).

The selected remedy for the NFSSA and SFSSA is a combined remedy that includes dredging impacted sediments, installing backfill and cover materials, habitat restoration activities, and monitored natural recovery (MNR).

The remedy is depicted conceptually in Figure 1-3, and presented in additional detail throughout this RD/RA Work Plan.

### 1.1.1 NFSSA Remedy Overview

The approximately 7-acre NFSSA is situated immediately adjacent to the Site, and is bordered by the Hudson River federal navigational channel. The NFSSA extends approximately 300 feet into the river from the eastern shore. Water depths in this area range from 3 to 35 feet, and vary daily due to tidal influences. The Hudson River in the vicinity of the Site is a net depositional environment, where sediments collect from upstream sources. The primary Constituents of Concern (COCs) in NFSSA sediments are related to former operations on the Site and the adjacent property to the north. These COCs include volatile organic compounds (VOCs) (primarily chlorobenzene, dichlorobenzenes, and

benzene), as well as several metals, including lead. Other regional urban sources also contribute to the metals found in sediments in the NFSSA.

The Selected Remedy for the NFSSA includes a combination of dredging, backfill, cover system installation, ecological enhancement, and monitoring. The NFSSA has been operationally sub-divided into four discrete areas, summarized below and depicted in Figure 1-3.

- **Upper NFSSA Reach**. This approximately 0.9 acre area is located at the northern end of the NFSSA. Approximately 0.7 acres of this area will be dredged to a 2-foot depth and covered with a 2-foot cover system.
- **Central NFSSA Reach**. This approximately 2.2 acre area is located in the central portion of the NFSSA. To optimize removal of sediments impacted with VOCs, approximately 1.7 acres of the Central NFSSA Reach will be dredged to a depth ranging from 4 to 8 feet. This area will be restored with backfill and a cover system that will range from 4 to 8 feet in thickness.
- **Lower NFSSA Reach.** This approximately 3.9 acre area is located at the southern end of the NFSSA. Approximately 2.4 acres of the Lower NFSSA will be dredged to a depth of 3 feet in certain areas and to 2 feet in the remaining areas. This area will be restored with a cover system that will range from 2 to 3 feet in depth.
- **Areas of Upstream Deposition**: Sediments in these portions of the NFSSA have undergone natural recovery and the top 4 feet of sediment in these areas is not impacted by Site COCs. Because these regions of the NFSSA are durable and stable, and essentially are covered with an isolation barrier that encapsulates deeper sediment, no active remediation activities are required for the Areas of Upstream Deposition.

The NFSSA remedy will remove approximately 38,400 cubic yards (CY) of impacted sediment, addressing the risk to the ecology that drives the remediation, and will remove approximately 93% of the mass of Site-related VOCs from the river. Additionally, this remedy will provide an approximately 4.8 acre clean cover over the dredged areas where lower concentrations of Site-related COCs remain at depth.

Sediments in the NFSSA are also impacted with non-Site related polychlorinated biphenyl compounds (PCBs)[1]. The selected remedy for the NFSSA, while not specifically designed for PCBs, will result in the removal of sediments with elevated PCBs and will isolate the remaining PCB-impacted sediments beneath a minimum of 2 feet of clean cover material.

The remediation in the NFSSA includes measures to further enhance the ecological habitat at the Site. Where water depths allow, submerged aquatic vegetation (SAV) will be planted and will result in a substantial increase in the surface area of SAV currently at the Site (approximately 0.6 acres of SAV are proposed to replace the existing 0.1 acres that will be removed during remedy implementation). In addition, a 5,000 square feet wetland area will be constructed adjacent to the Lower NFSSA to provide ecological continuity between the riverine environment and the adjacent

[1] Both the United States Environmental Protection Agency (USEPA) and NYSDEC have concluded that PCBs did not originate from the Site and PCBs are not a Site-related COC (Appendix A). However, the PCBs are located within the Hudson River OU-2 where remedial alternatives will be implemented to address metals and VOCs, and PCB-containing sediment will need to be managed appropriately.

vegetated upland (Figure 1-4 presents a conceptual overview of the SAV and wetland creation elements of the project).

### 1.1.2 SFSSA Remedy Overview

The approximately 6.7-acre SFSSA is located in a depositional environment within a historic navigational dredging area. This area has been potentially influenced by the Site, as well as other upstream and anthropogenic sources. The SFSSA extends approximately 500 feet into the Hudson River and water depths commonly exceed 40 feet. Lead and several other inorganic COCs are present in SFSSA surficial sediments, with highest concentrations occurring in the deeper central portions of the river. No VOCs were detected at concentrations above NYSDEC sediment screening values in the SFSSA.

The levels of metals in surface sediments in the SFSSA are expected to gradually decrease overtime as a result of natural processes such as sedimentation and MNR is the Selected Remedy for the SFSSA. Therefore, the remedial design for the SFSSA includes development and implementation of a monitoring plan to evaluate the rate of sediment deposition and changes in sediment chemistry over time.

## 1.2 RD/RA Work Plan Objectives

BASF's overall goals for this remedy are: (1) to eliminate unacceptable risk to benthic ecological receptors by eliminating exposures to Site-related COCs including metals and VOCs in surficial sediments; and (2) to restore and enhance habitat for ecological receptors.

This RD/RA Work Plan has been prepared in sufficient detail to allow regulatory and other stakeholder review of the remedial approach, and to detail the steps and procedures necessary to accomplish the requirements of the ROD. This RD/RA Work Plan identifies applicable federal, state, and local regulations and the requirements for compliance. A critical aspect of the RD/RA Work Plan is identifying work procedures and monitoring requirements to control and contain impacted materials during remediation and to protect human health, as well as fish and wildlife resources. The framework for integrating sustainability into the design and implementation of the remedy is also provided in this RD/RA Work Plan. Additional detail regarding these response actions will be provided in forthcoming 50 percent (%), 90%, and 100% design documents.

## 1.3 Environmental Setting

The Site is located on the Hudson River, approximately 148 river miles (RM) north of New York Harbor, and 10 RM below the Federal Dam in Troy. The Hudson River is tidal below the Federal Dam. In Albany, across the river from and to the west of Rensselaer, the mean tidal range is 4.6 feet and the spring range is 5.0 feet (National Oceanographic and Atmospheric Administration (NOAA), 2011).

The Hudson River is maintained by the U.S. Army Corps of Engineers (USACE) for commercial navigation from New York City to the Port of Albany, at RM 148. The northern end of the Site is located at approximately RM 148. Portions of the NFSSA and the majority of the SFSSA are within the USACE navigational channel (see Figure 1-3). The USACE is required to maintain the shipping channel to a minimum depth of 32 feet and width of 400 feet, although the area has not been dredged by USACE since 1961.

Approximately 1,200 feet downstream of the southern Site boundary is a turning basin maintained by the Port of Albany. This basin has not been dredged since the mid-1980s.

Approximately 0.5 acre of SAV has been historically mapped adjacent to the Site (Kleinschmidt Energy & Water Resource Consultants, 2008; NYSDEC, 2000), although a more recent SAV survey indicates that approximately 0.13 acres are currently present. The majority of these plants are found in areas with less than 4 feet of water at low tide. SAV beds in this area are dominated by water celery (*Vallisnaria americana*).

Several state and federally listed species of interest may be present in the vicinity of the Hudson River OU-2 including shortnose sturgeon (*Acipenser brevirostrum*), a state- and federally-listed endangered species; Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), a federally endangered species; and bald eagle (*Haliaeetus leucocephalus*), a state-threatened species.

Two relatively recent developmental activities have occurred in the river adjacent to the Site and are further considered in the balance of this RD/RA Work Plan:

- **Diffuser Pipe**: In 2008, Empire Generating Project (Empire), as part of an electrical co-generating facility development project, installed a diffuser pipe outfall in the central portion of the NFSSA. This high density polyethylene (HDPE) pipe originates at the natural gas fired power plant located on OU-1. The pipe is buried along the westerly edge of OU-1 beneath approximately 5 feet of fill material. An 18-inch force main pipe runs for approximately 750 linear feet in the upland portion of OU-1, before transitioning to a 30 – inch gravity discharge HPDE diffuser pipe which extends in a westerly direction for approximately 150 linear feet from the bulkhead separating the river from the mainland.
- **Port of Albany/Rensselaer**: In the fall of 2014, reconstruction of the Port of Albany - Rensselaer wharf, which is located on the southern end of the NFSSA, was completed. Although there was a historic wooden wharf situated in this location, cargo traffic at the Rensselaer side of the port halted more than 30 years ago because 600 feet of the wooden wharf that was installed in the 1920s was deteriorating. The new wharf is a heavy-duty concrete and steel structure and maintenance dredging adjacent to the wharf was conducted in March 2015.

## 1.4 Nature and Extent of Sediment Contamination

The primary COCs (select VOCs and metals) are related to former operations on the Site and the adjacent property to the north. Other regional urban sources also contribute significantly to the metals found in sediments in the area.

- **NFSSA:** Concentrations of VOCs in NFSSA sediment range from non-detect levels to levels that exceed the available NYSDEC (NYSDEC, 2014) sediment quality screening guidelines by several orders of magnitude. The highest concentrations of both organic and inorganic constituents are found in the central portion of the NFSSA, with lower concentrations to the south and north. The highest concentrations of VOCs (including benzene, chlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, and 1,4-dichlorobenzene) are found at depths ranging from 2 feet to 10 feet below the sediment surface. These concentrations are generally associated with sampling stations located downstream from three historic OU-1 upland area outfalls (see **Figure 1-3**). Lead and several other inorganic constituents (including arsenic, cadmium, chromium, copper, mercury, and zinc) are also known to be present in sediments in the NFSSA.

- **SFSSA**: Lead and several other inorganic constituents are also present in surficial sediments in the SFSSA area, with highest concentrations occurring in the deeper, central portions of the river, where historic navigational dredging occurred. No VOC concentrations were observed in the SFSSA sediments.

Sediments in the Hudson River OU-2 are also impacted with non-Site related PCBs. The PCBs consist of an aroclor mixture dominated by Aroclor 1242, and in certain locations are present at concentrations greater than 50 milligrams per kilogram (mg/Kg). Because these non-Site related PCBs are located within the Hudson River OU-2 where remedial alternatives will be implemented to address metals and VOCs, PCB-containing sediment will need to be managed appropriately. Therefore, when addressing Site-related COCs (i.e., VOCs and metals), BASF will need to manage PCB-containing materials in excess of the 50 mg/Kg Toxic Substances Control Act (TSCA) standard in accordance with Code of Federal Regulations (CFR) 40 CFR Part 761. In addition, NY State regulations (6 CRR-NY 371.4NY-CRR) consider “all solid wastes containing 50 parts per million (ppm) by weight (on a dry weight basis for other than liquid wastes) or greater of polychlorinated biphenyls (PCBs) are listed hazardous wastes”.

## 1.5 Remedial Action Objectives

The Remedial Action Objectives (RAOs) are based on New York Code Rules and Regulations (NYCRR) (6 NYCRR Part 375) and were presented in the ROD (NYSDEC, 2016a) as follows:

***RAOs for Public Health Protection***

- Prevent direct contact with contaminated sediments.

***RAOs for Environmental Protection***

- 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.

## 1.6 Document Organization

The remainder of this RD/RA Work Plan is organized in the following manner, in accordance with Section 5.2 of DER-10:

- **Section 2.0** presents a summary of the design investigations completed to date.
- **Section 3.0** presents a summary of the design scope and remedy components for the NFSSA
- **Section 4.0** describes the MNR plan for the SFSSA.
- **Section 5.0** summarizes environmental permits and other authorizations relevant to the remedial scope of work.
- **Section 6.0** presents a schedule for the completion of the design, as well as the steps and timing for procurement of the remedial action contractor.
- **Section 7.0** presents a sustainability evaluation and recommendations, including use of best management practices (BMPs) to minimize the environmental and energy “footprint” of the selected remedy.

- **Section 8.0** presents the post-construction plans and requirements, including the post-remedial action site management plan (SMP).
- **Section 9.0** presents a list of additional work plans that will be prepared as part of the design document submittals.
- **Section 10.0** presents the literature cited

Throughout the remainder of this RD/RA Work Plan, BASF Corporation is referred to as the Project Owner; AECOM Technical Services as the Engineer; and a marine remedial contractor (yet to be identified) as the Remediation Contractor.

# 2.0 Design Investigations

Several engineering pilot study programs and engineering evaluations have been completed in support of the FS (AECOM, 2015) and RD/RA Work Plan. These studies were conducted to help BASF develop remedial measures that could potentially be used to manage sediment at the Hudson River OU-2. Additionally, studies in the area by Empire and others provide useful data for the remediation design. The following sub-sections provide a brief summary of the results of these studies (more detailed stand-alone pilot study reports are appended to the FS (AECOM, 2015).

## 2.1 Geotechnical Subsurface Investigations

Geotechnical design data are provided in Atlantic Testing Laboratories (ATL) Report, dated January 17, 2014, which was prepared on behalf of BASF and presented in the FS. In this program, eleven sediment samples were collected by AECOM and tested by ATL for particle size (American Society for Testing and Materials [ASTM]-422) and moisture content (ASTM-2216). Additionally, seven samples were collected in the depth interval just below the proposed bottom of the dredge and cover intervals in the NFSSA and tested for one-dimensional consolidation (ASTM D2435). This geotechnical data set is presented in Appendix B of the Final Hudson River Operable Unit 2 Feasibility Study (FS) (AECOM, 2015).

Three additional geotechnical borings were installed laboratory data were collected in September 2016 to support design of bulkhead enhancements. The boring logs and data are provided in Appendix B of this RD/RA Work Plan.

## 2.2 Dewatering Studies

A dewatering study was conducted in 2008 (Preliminary Dewatering Study, BASF, 2008, Appendix B of FS, AECOM 2015) to evaluate dewatering approaches for sediments at the former BASF facility.

The sediment samples collected for this study had relatively high solids content (64% on average) and passed the paint filter test without dewatering. Hanging bag tests performed on representative sediment samples were not successful at reducing moisture content further primarily due to the material properties which retained moisture and contained fines that masked the filter material. Use of mechanical dewatering devices on the samples was not conclusive, and a decision was made to conduct more refined dewatering studies.

In November 2011, 45 gallons of sediment from three sub-surficial sampling locations were collected from the NFSSA. Two of these samples were comprised of silty sand, while the third sample was silt, as determined by ASTM-422. The samples were collected from the NFSSA for bench-scale dewatering studies, which were conducted by Kemron Environmental Services Laboratory (Kemron). The study objectives were to establish performance requirements for dewatered material and to generate data that will allow vendors to develop a bid for dredging and dredged material management.

The 2011 dewatering study results are included in Appendix B-3 of the FS. Key findings are presented below:

- All sediments passed the paint filter test prior to treatment.

- The silty sample was not a good candidate for mechanical dewatering, due to the nature of the fine particles. Mechanical dewatering of the other sediments showed only minor changes to moisture content.
- When sediments were centrifuged, the moisture content was greatly reduced; however, this method is not cost-effective for use.
- Evaluation of a polymer coagulant and corn-based additives indicated that these additives are not sufficiently effective to be used.

The results of the 2011 dewatering studies indicate that although sediment passes the paint filter test, additional dewatering is likely required for ex situ management, and none of the dewatering treatments tested at that time represent an effective means of ex situ dewatering. It is therefore possible that additional dewatering studies will be required to complete the design for the Hudson River OU-2 remediation.

## 2.3 Sediment Thermal Treatment Pilot Studies (2011)

Following the 2011 dewatering study, Kemron conducted a thermal treatment pilot study of the same sediments collected for the dewatering study. Prior to the thermal treatment, the sediments were tested for the physical characterization and chemical contaminants using the same analyses as the dewatering study. Kemron thermally treated the samples at a temperature of 600 degrees Celsius (°C) for durations of 5 minutes and 15 minutes. During this testing, the samples demonstrated a significant decrease in contaminant mass, as well as concentration. A condensate was collected following the thermal treatment of each sediment sample which contained concentrations of the chemical contaminants previously identified in the sediments.

D.A. Collins and Environmental Soil Management, Inc. (DAC/ESMI) evaluated similar sediment samples for thermal treatment potential, moisture reduction, and treatment characteristics. Prior to thermal treatment, DAC/ESMI added lime kiln dust (LKD) to each sediment type at various ratios to evaluate the dewatering effects of the LKD. The results of these tests indicated that a 7-8% LKD addition prior to thermal treatment would optimize both moisture reduction and material handling characteristics. DAC/ESMI performed a high-temperature treatment of the samples and observed a further decrease in moisture content and dry mass due to the degradation of fibrous organics. The high-temperature treatment of the sediments resulted in effective treatment of VOCs. Use of this technology would require treatment of the exhaust air.

Based on this study, and subsequent communications with vendors, use of thermal treatment technologies may be a viable option for treatment of Site-related VOCs. However, if thermal treatment is employed to address excavated sediments with PCB concentrations equal to or greater than 50 parts per million (ppm), BASF must obtain EPA approval for the thermal treatment system.

## 2.4 Dredged Sediment Treatment Pilot Study (2009-2011)

Empire dredged approximately 600 CY of sediments from the Central Reach of the NFSSA to facilitate installation of their outfall (diffuser) pipe. This allowed an opportunity to observe and learn from the dredging work as well to use the dredged material for testing on shore in pilot studies.

The following observations were made relative to the Empire outfall project:

- Because of USACE permitting requirements and the presence of sensitive ecological receptors, the dredging work was conducted in the winter of 2009. Based on visual

observations during dredging, winter conditions presented exceptional challenges relative to ice formation and water management.

- Although Empire intended to install sheet pile around the dredge area, dewater within piling, and excavate in the dry, the enclosed sheet pile area never dewatered fully due to river water infiltration. Therefore, the contractor determined that wet dredging (rather than mechanical excavation in the dry) was the preferred method for sediment removal. Although an attempt to use a hydraulic dredge was made, sediment properties prevented it from being useful. Consequently, removal was accomplished via mechanical dredging (clamshell bucket).
- It was reported by Empire that the USACE permit limits for water discharge were challenging to meet, especially for PCBs, and that dredged fine-grained sediment on the scow barge did not dewater effectively via gravitational means. Much of the water within the sediment was retained in the silt/clay fraction.
- The BASF field team observed that the dredged material was odoriferous and required active air monitoring and odor management, especially during phases of work that required translocation of materials.

Sediments removed by Empire were used for pilot studies by BASF. A dredged sediment pilot study was completed between 2009 and 2011 (AECOM, 2011). The primary objective of the Dredged Sediment Treatment Pilot Study was to evaluate the feasibility and practicality of operating an ex situ treatment system to reduce concentrations of VOCs in dredged Hudson River sediment to levels that may permit on-Site re-use and/or reduce the potential costs of off-Site disposal. Conclusions from that work were:

- Percent moisture of sediments received from dredging ranged from 33 to 54%. The average percent moisture of 11 samples was 46% (dry weight basis). This equates to a 68% solids content. This is a relatively high starting point for percent solids and thus further removal of water may be challenging.
- The pilot test demonstrated that heat-enhanced low temperature volatilization is a viable technology for reduction of VOCs from amended sediment, with certain limitations (AECOM, 2011).
- Although much of the untreated sediment could be readily disposed of as non-hazardous waste, extracted benzene concentrations in some of the untreated material exceeded the Toxicity Characteristic Leaching Procedure (TCLP) threshold, and therefore, some of the sediment was identified as characteristically hazardous.
- VOC levels in sediment amended with LKD were reduced by almost two-thirds and no TCLP concerns were identified with LKD-amended sediment. Other amendments are available that may accomplish the same objective. Peat provided a degree of permeability enhancement almost equal to that of the LKD at a reduced weight burden, although there was little measurable VOC removal in the test cell which was operated as a biological treatment unit and not a vapor extraction cell. The addition of the peat also served to address benzene TCLP concerns in amended sediment.

## 2.5 River Hydrodynamic Data

In the spring of 2001, a program to collect river velocity data adjacent to the Site was conducted (Applied Coastal Research and Engineering, May 2001). Current measurements were made using a vessel mounted acoustic doppler current profiler (ADCP). The program included measurements on

four transects across the river within the OU-2 area. Data were collected over an 11.4 hour period. Primary observations from this study were as follows:

- The river is characterized as having predominantly down stream flow 95% of the time.
- The maximum observed flow rate was 32,300 cubic feet per second and was directed downstream.
- The maximum observed upstream flow was 10,800 cubic feet per second.
- The maximum recorded water velocity during this study was 1.2 knots (2.02 feet per second) in the downstream direction. The maximum water velocity was observed in the upper water column. Water velocities near the mud line were up to 0.5 knots.
- Upstream currents are strongest along the banks of the river, approaching 1 knot (1.7 feet per second).

These flow and velocity data provide a basis for design of turbidity controls and the erosion layer of the sediment cover system.

## 2.6 Debris Survey by Side Scan Sonar

Limited information is currently available regarding debris which might impact installation of shoring or mechanical dredging in the Hudson River portion of OU-2. Side scan sonar surveys were conducted in 2009 and 2015 to map the Site bathymetry and in 2009 a total of 26 objects in excess of 4 feet in any direction in size were detected during this field effort. The side scan sonar is not effective at detecting deeply buried debris and this survey was not intended to comprehensively identify debris at the Site.

The 2009 data provide a starting point for debris identification but a new survey prior to start of work likely will be required.

## 2.7 River Bathymetric Data

BASF most recently conducted a multi-beam bathymetric survey in the Hudson River adjacent to the Site on May 20 and 21, 2015. The survey reported bathymetry elevations contours in one foot intervals (see Figure 2-1). This bathymetric profile will be used to develop the design drawings; however, a complete bathymetric survey will be conducted immediately prior to dredging to ensure that any erosion/accretion that may have occurred since May 2015 is accounted for prior to dredging.

## 2.8 Supplemental Sediment PCB Data

In accordance with a NYSDEC approved work Plan (AECOM, 2016), additional supplemental sediment PCB samples were collected in September 2016. These data were used to refine the estimated volumes of sediment containing ≥ 50 mg/Kg PCBs (e.g., subject to TSCA jurisdiction). A summary and figure showing these recently collected data is presented in Appendix C of this RD/RA Work Plan.

Twenty-two additional sediment samples were analyzed for Total PCB Aroclors. These samples were predominantly located in the Central portion of the Northern FS Study Area. Ten out of the twenty-two samples contained PCBs equal to or in excess of 50 ppm Total PCBs. In the 0.0-2.0’ horizon, there were 12 samples collected and five of them contained greater than 50 mg/kg (highest

concentration observed at station SD-294 = 350 mg.kg). In the 2.0-4.0’ horizon, there were eight samples collected, and five of them were determined to contain greater than 50 mg/kg for Total PCBs (highest concentration observed at station SD-293 = 285 mg.kg. There was one sample collected in the 4.0-6.0’ horizon at station SD-303 (4.5 mg/kg Total PCBs). The 50% design documents will evaluate these data in the context of the historically collected PCB data from the Site to determine and refine grids containing TSCA-regulated sediment.

# 3.0 NFSSA Remedy Components

The selected remedy for the NFSSA is conceptually presented in Figure 1-3 and includes the following elements:

- **Upper Reach:** Dredge to a depth of 2 feet and install a two foot thick cover/habitat layer.
- **Central Reach:** Dredge to depths of 4, 6, and 8 feet in specific areas and install corresponding backfill/cover/habitat layers of 4, 6, and 8 feet.
- **Lower Reach:** Dredge to depth of 2 feet and 3 feet in specific areas and install corresponding cover/habitat layers of 2 and 3 feet.
- **Areas of Downstream Deposition:** These areas do not require active remedial actions.

The following sub-sections outline tasks to be accomplished in order to complete the NFSSA remedy.

## 3.1 Complete Design and Obtain Permits

This RD/RA Work Plan will be used to inform the 50% design as well as state and environmental permit submittals, as outlined in Section 5.0. The 50% design will include General Requirements Specifications, Technical Specifications, and Drawings. BASF will provide the 50% design to NYSDEC for review and will also use the 50% design documents for procurement of the remediation contractor(s). A 90% and 100% design will be completed to incorporate comments from regulatory agencies and additional details from the remediation contractor. Work will begin only after the required permits are obtained. Work will be conducted in accordance with permit requirements. In-water work in the navigational channel will begin only after notification to mariners.

As part of the permitting process, in-water work activities may be prohibited during certain months to protect endangered sturgeon species. Based on communications with state and federal authorities, the work window for open water work is anticipated to be September 1 to November 30. This work window will be confirmed during the permit approval process. BASF understands that any required enhancements to the existing Site bulkhead are not subject to this work window, as long as new bulkhead is installed with vibratory techniques.

## 3.2 Bulkhead Enhancements

The bulkhead between OU-1 and the Hudson River was constructed in four sections (built in 1936, 1974, and the 1980s), as depicted in Figure 3-1.

- 1980s: This section of bulkhead has length of approximately 270 linear feet. It is in good structural condition.
- 1974: This section of bulkhead has length of approximately 180 linear feet. It is in good structural condition.
- 1936: This section of bulkhead has length of approximately 260 linear feet. It is in poor condition with corrosion and holes in the tidal zone.
- Pre-1936: This section of bulkhead is at the northern end of the project limits and is a concrete structure founded on timber piles. It is in poor condition.

BASF will design bulkhead enhancements to ensure the bulkhead is stable in the long term and can support any temporary loading generated during the dredging. A Geotechnical Data Report for the Bulkhead and Nearshore Area was prepared by AECOM in March 2010 and included in the FS (AECOM, 2015). Additional geotechnical investigation and a bulkhead stability evaluation were completed in the fall of 2016. The bulkhead enhancements will be designed to ensure the bulkhead is stable under surcharge loadings from equipment operating in the upland adjacent to the top of bulkhead, increased lateral earth pressure induced during dredging, and under long term existing conditions. The bulkhead enhancements will not be designed for ship/barge anchorage.

Permitting for the bulkhead enhancements will be conducted separately from dredging permits discussed in Section 5.0 and will be compliant with local codes. The Remediation Contractor will complete the proposed bulkhead enhancements in a separate mobilization prior to the upland preparation work.

## 3.3 Upland Preparation Work and Mobilization

Portions of OU-1 adjacent to the dredge areas and to the west of Riverside Avenue will serve as staging areas for the OU-2 remedial response actions. This land is subject to the OU-1 Site Management Plan (Roux, 2014), and includes green space, historic building foundations, parking areas, a detention pond, and the capped lagoons.

Certain upland preparation activities may be conducted several months in advance of the dredging, these will include the following elements:

- Installation of soil erosion and siltation controls.
- Clearing of vegetation.
- Level A Subsurface Utility Engineering (SUE) Survey: Utilities will be marked out and utility protection procedures developed and implemented. Among the known active utilities are the Empire Outfall, City of Rensselaer Storm Sewer, Rensselaer water supply, and Town of East Greenbush sewer. Other active and inactive utilities may also be present.
- Improvements to existing fencing and installation of additional gates.
- Installation of parking and truck waiting areas (possibly on the eastern side of Riverside Avenue).
- Placement of a geotextile marker layer.
- Grading (excavation to be minimized, primarily placement of gravel above geotextile marker layer).
- Temporary road construction.
- Installation of temporary utilities (electric, cable, and water).

Once the above activities, are completed, the following will be completed immediately prior to the start of dredging activities:

- Mobilization of Site trailer and sanitary facilities.
- Installation of a tracking pad.
- Construction of dewatering cells.

- Construction of staging/stockpile areas, upland portions of barge docking structure, and drip containment along the shoreline.
- Construction of temporary enclosure and testing of air handling and treatment systems.
- Mobilization of dredging and other related construction equipment.
- Stockpiling of soil amendment materials and cover materials.
- Mobilization of spill response/support boat.
- Set-up of odor suppressing foam unit and testing.
- Set-up of water treatment system.
- Set-up of thermal treatment system (optional). [2]

In accordance with TSCA requirements, separate areas for management of sediments with PCB levels of ≥ 50 mg/Kg will be required.

Sediment management areas are designed to be covered with a temporary fabric structure (TFS). The use of a TFS is anticipated as part of the Dust and Odor Control Plan, which will be submitted with the 100% design package. To the extent practical, the TFS will cover the sediment dewatering, stockpiling, and load-out areas. An air handling system will be employed to operate the TFS under negative pressure and treat exhaust air to remove contaminants.

## 3.4 Construct Water Treatment Plant

Water is expected to be generated from the following sources:

- Free water in the barges and scows used to transport dredged sediment
- Water generated from the landside dewatering cells
- Decontamination liquids

It will not be possible for treated water to be discharged to the local publicly owned water treatment facility (communication from Mr. Gerald Moscinski, Administrative Director, Rensselaer County Sewer District, and AECOM 2015). Discharge to the river is therefore the preferred option. An on-Site water treatment plant will be designed to remove solids, suspended solids, VOCs, and PCBs. Treatment of metals may also be necessary, depending on final discharge limitations which will be included in the SPDES permit equivalent.

The water treatment facility will be sized to keep up with the dredging rate and associated water streams (free water from barges, water from on-shore dewatering, and decontamination water). The amount of water generated during dredging and sediment processing can be conservatively estimated by assuming that the water generation rate will be 20% of sediment dredging rate. The sediment dredging rate for this project will likely be in the range of 200 to 600 cubic yards per day. At the 600 cubic yards per day dredging rate, 120 cubic yards or approximately 24,250 gallons per day of water will be generated. A water treatment capacity of 100 gallons per minute will be sufficiently oversized to treat the water in one shift. Alternatively, BASF may investigate, as part of the

[2] For sediments with elevated VOC levels, subject to regulatory approvals, BASF may choose to deploy and operate a thermal desorption unit on-Site.

development of the 50% design, use of a reduced capacity system (e.g., 20 gpm) which could meet project requirements through operation across multiple shifts. Basic elements of the water treatment plant include the following:

- A minimum of 60,000 gallons storage capacity for untreated water;
- A weir tank for removal of floating materials;
- Settling tank(s);
- Separate treatment trains for TSCA and non-TSCA waters, as appropriate;
- Bag filtration; and
- Treatment by activated carbon absorption.

Additional treatment elements may be added as required for consistently meeting PCB discharge criteria or metals treatment, if required. Storage tanks and process equipment will have spill containment. Automated spill sensors and automated shut off safe guards are required.

## 3.5 Baseline Monitoring of Water Quality

Prior to the start of construction work, a monitoring program will be conducted to determine baseline water quality conditions. Baseline measurements will include real-time continuous sampling for physical parameters including turbidity. Factors that can affect turbidity levels will be recorded in conjunction with the baseline measurements. These factors include tidal stage, river flow direction, water depth, location of nearest outfalls to the river, weather, vessel traffic, waves, and wind. These observations will be useful in understanding factors unrelated to the remediation work that may affect turbidity levels.

Baseline monitoring and monitoring during remediation work will be conducted approximately 300 to 500 feet outside the work area. The work area is defined as the entire area within the outermost ring of double turbidity curtains.

Real-time monitoring will be achieved using dedicated on-water staff or deployable monitoring buoys to monitor for turbidity and other water quality parameters. Turbidity will be measured in nephelometric turbidity units (NTUs) using field instruments with a detection limit of 1 NTU or lower and with an accuracy of ±5% or better (prior to initiation of work, a total suspended solids (TSS)/turbidity calibration curve will be developed to understand the relationship between these 2 measurements). Baseline turbidity data will be collected in the vicinity of the proposed work area during both ebb and flood tides. For the baseline data set, BASF is evaluating collection of average turbidity measurements from three depths (approximately mid-depth in the water column, near-bottom, and near surface) at each baseline monitoring location. If only one depth is used (rather than three), the near-bottom depth will be preferentially selected. Background Turbidity (or TSS) measurements will be made over a two to five day period and will reflect entire tide cycles.

In addition to the turbidity monitoring, provisions for background dissolved phase PCBs, VOCs, and metals monitoring will be included. Monitoring for these constituents during construction will only take place if TSS, turbidity, or visual cues (visible plume outside the double wall silt curtain) are above threshold values indicating that such monitoring is necessary.

Additional detail regarding the water column monitoring program will be provided in the Remedial Action Monitoring Plan (RAMP) which will be provided to NYSDEC with the 90% design documents.

## 3.6 Baseline Bathymetric, Habitat, and Debris Surveys

A debris survey (side scan sonar or other method) and/or updated bathymetric survey will be conducted by the Remediation Contractor. This information will be included in the 100% design package. In addition, the existing habitat map will be updated to include the results of a final pre-construction SAV survey, to be conducted in the spring of 2018. A baseline bathymetric survey will be conducted immediately prior to marine construction (dredging) activities as described below.

## 3.7 Mobilization of Equipment and Materials in River

The following Site preparation activities will be performed to support on-water remedial efforts:

- Automated turbidity monitoring equipment will be installed and/or equipment and personnel for manual measurements deployed.
- Coordination with owners of marinas and other boat docks and companies receiving regular shipments within the project area to minimize disruption to commerce and recreation.
- Notification to United States Coast Guard (notice to mariners).
- Identification of locations and necessary approvals to deploy water based equipment.
- Installation of turbidity curtains.
- Mobilization of in-water equipment (dredging equipment and platform, sediment transfer barges, pumps, and other support equipment).

## 3.8 Turbidity Curtains

A double row of permeable turbidity curtains designed and installed consistent with USACE Silt Curtains Dredging Project Management Practice Guidance Document ERDC TN-DOER-E21 (USACE, 2005) and New York Standards and Specifications for Erosion and Sediment Control (NYSDEC, 2005) is anticipated for the dredging elements of this project. A single row of silt curtains will be installed prior to installation of the bulkhead and prior to backfilling dredged areas. Final silt/turbidity design, deployment, and maintenance will be conducted in accordance with the checklist provided in ERDC TN-DOER-E21. The curtain design and deployment will be continually modified and upgraded as required to achieve the required water quality goals. Given the tides, water velocity, and in some sections water depth, the design, installation, and maintenance of the curtains will be carefully controlled. Typically, the final design and deployment details of the turbidity curtains evolve and are optimized as the project proceeds. Due to the water velocities, the curtains will include water permeable sections. Curtains that reach the river bottom may or may not be more effective compared to curtains that remain a foot or more above the sediment bottom.

The design and placement of turbidity controls will account for the Empire discharge. The Empire cooling water outfall is anticipated to be in operation and actively discharging water during the dredging work (Mr. Craig Terry, maintenance department, Empire, January 16, 2015). Water is discharged by Empire at a rate of 3,000 to 4,000 gallons per minute (gpm) on twenty four hours per day and 7 days per week (24/7) basis in the summer months. In winter months, the discharge rate drops to 1,500 to 2,500 gpm with discharge sometimes discontinued for 8 to 12 hour periods, depending on outside temperature.

The Port of Albany at Rensselaer (POR) is anticipated to be receiving ships during the marine construction period. The marine construction team will work with the POR to schedule dredging and other marine construction activities near the POR at times that provide the least interference with

POR operations. Placement of the turbidity curtains will be coordinated with the POR to allow the access and egress of ships as required by the POR.

The preliminary layout for the turbidity curtains will be included in the 50% design document and the final layout and sequencing of turbidity curtain placement will be developed with the Remediation Contractor and will be presented in the 100% Design.

## 3.9 Debris Removal

Debris removal is expected to be conducted prior to and in conjunction with dredging and bulkhead installation activities. Removal of debris along the alignment of the sheet pile installation is a possible early step. All debris removal, regardless of when it is undertaken, will be conducted within an area of turbidity curtains. In-water monitoring will be conducted during debris removal. Means and methods for debris removal will be developed with the Remediation Contractor and presented in the 100% design documents. If water quality monitoring indicates excessive turbidity, the contractor will modify the method of debris removal.

Debris removed from areas identified as containing PCBs ≥50 mg/Kg will be handled and disposed of separately from debris and other materials from areas of lower PCBs.

Larger debris (over 2 feet in length or width) will be segregated from the other materials prior to treatment and disposal and TSCA debris will be handled in accordance with TSCA regulations. Depending upon the amount of debris encountered, a separate staging area for debris may be required.

## 3.10 Pre-Dredging Bathymetric Surveys

Prior to commencement of marine work, a pre-dredging bathymetric survey of the project area will be conducted. The pre-dredging survey shall be conducted to meet the minimum standards of USACE Manual EM 1110-2-1003 (USACE, 2013).

## 3.11 Dredging

The Upper and Lower Reaches of the NFSSA will be dredged to a depth of 2 to 3 feet below the sediment surface. The Central Reach of the NFSSA is subdivided into dredging areas that range from 4 feet to 8 feet in dredging depth. A breakdown of approximate dredge volumes for each reach is as follows:

- Upper Reach: 6,900 CY
- Central Reach: 28,300 CY
- Lower Reach: 3,200 CY

The dredging volume estimates include a 0.5 foot allowance for over dredging.

Dredging will be conducted using mechanical dredging methods. Dredging equipment and methods will be selected by the Remediation Contractor and specified in detail in the forthcoming design documents. Dredging equipment will be selected to:

- Optimize targeted removal of the impacted sediment
- Optimize targeted placement of the cover material

- Minimize sediment suspension in the water column during dredging and backfill.

It is anticipated that all work will be conducted via mechanical dredging technologies. Mechanical dredges will be equipped with an environmental bucket which will enable optimization of operation from shore and water. Environmental buckets offer the advantages of a large footprint, a level cut, and the capability to remove even layers of sediment. A level-cut bucket reduces the occurrence of ridges and winnows that are typically associated with conventional (clamshell) buckets. Given the fine grain size of surface sediments, generation of turbidity during dredging is unavoidable. The environmental bucket is designed to close after each bite. Overlapping jaws and/or rubber seals are used to provide a water tight bottom. Because the bucket is closed during ascent, releases of contaminated sediment to the water column are minimized. Use of fixed arm articulating environmental buckets will also be evaluated. These systems tend to be more accurate compared to cable mounted bucket systems.

Land-based dredging may be employed for the near shore work. Dredging further from shore will require dredging from a water-based platform. From land-based dredging equipment, sediment may be transferred directly from the dredge bucket to onshore storage/dewatering areas prior to on-Site treatment and/or disposal. From river-based dredging equipment, sediment will be placed on barges and then transferred to onshore storage/dewatering areas. BASF has assumed that barge overflow will not be allowed and that water on the sediment barges will not be discharged or spilled back into the Hudson River. This water will be transferred to the onshore water storage and treatment facility.

Subsequent design submittals will detail where the dredge equipment will be stationed, sequence of dredging, means, methods, and how sediments will be transferred to the onshore storage/dewatering areas

### 3.11.1 Environmental Controls and Monitoring during Dredging

In addition to use of turbidity curtains, implementation of BMPs during remedial activities is important to minimize the release of contaminants to the environment. BMPs will include environmental controls to minimize the release of contaminated sediment to the water column during dredging (e.g., the dredge operator will not be permitted to drain the dredge bucket over the water column) and water quality monitoring to determine the effectiveness of BMPs and whether corrective measures are needed. BMPs for sustainable remediation parameters will also be included in the remedial design.

Dredging will be sequenced such that suspension of contaminated sediment is further minimized; the project sequencing will be developed by the Owner, Remediation Contractor, and Site Engineer and details regarding project sequencing will be provided in the forthcoming design submittals. Operators will be required to have prior experience using environmental dredging equipment. The operator will not overfill the dredge bucket and will adjust the speed of the bucket as required to reduce re-suspension of sediment. Smoothing the contour of the dredge cut with the dredge bucket will not be permitted and sloping will proceed from top of slope to toe of slope, where practical. The dredge operator will not overfill the barges. Barges used for the transport of dredged material onshore will be water tight and regularly inspected.

Additionally, work zones will be physically isolated from the adjacent water column through the use of a double row of silt/turbidity curtains to minimize the transport of suspended sediment (i.e., minimize turbidity levels) beyond the work zone (see Section 3.8).

Surface water quality monitoring will be conducted during dredging and other activities that may disturb the sediment surface (e.g., debris removal, backfill, and cover placement), as required by environmental permits. Details of the surface water quality monitoring will be provided in the RAMP, which will accompany the 90% design submittal. NYSDEC has indicated that the target action level will be for TSS and not turbidity and that if turbidity is used as a surrogate for TSS, then a TSS/turbidity calibration curve should be developed. Furthermore, NYSDEC has indicated that some preliminary monitoring should be conducted outside of the double walled In dredge areas that are surrounded by a double walled silt curtain where soluble PCB's are not a predominant form of the PCB's released by the sediment, then monitoring outside the curtain will only be required if there is a visible plume emanating from the outermost curtain. The visible plume will be sampled at three depths for metals, PCBs, VOCs, and TSS. If PCB is in the soluble form and travels through the silt curtain, more frequent monitoring for PCB will be required.

Monitoring will consist of real-time continuous sampling for turbidity (or TSS) by dedicated on-water staff or via deployed monitoring buoys located at compliance points located outside the work zone. If on-water staff is performing the monitoring, they can log, record, and transmit the water quality data to site environmental personnel. Additionally, they can direct any corrective measures that need to be employed based on field observations collected during dredging operations. If the buoys are deployed, real-time data will be transmitted to field personnel via a data logger outfitted with a cellular modem. Alarms will activate if target action levels above background developed as part of the baseline monitoring program are exceeded. This will trigger corrective measures to reduce turbidity concentrations below target action levels.

Corrective measures for turbidity exceedance may include:

- Inspection, repair, or relocation of turbidity controls
- Slowing or suspending work until current or wind conditions improve
- Changes in dredge process (slower removal speed, smaller dredge “bite,” etc.)
- Changes in backfill placement rate or method
- Other means as required to reduce turbidity to suitable levels

In response to a request from NYSDEC, the RAMP will also include contingency sampling for PCBs, TSS, metals, and VOCs in the water column, if turbidity thresholds are exceeded.

Due to the presence of VOCs in the sediments and the anoxic condition of the sediment, odors are a potential issue during handling of the sediment. BMPs to be implemented relative to odors are as follows:

- Implementation of a Dust and Odor Control Plan (to be prepared by the Remediation Contractor as part of the Technical Execution Plan)
- Implementation of a Community Air Monitoring Plan (CAMP)(to be provided as part of the 90% design deliverable)
- Use of enclosures, such as the TFS, for storage and load-out of impacted sediments
- Use of odor suppressing foams as needed
- Maintenance of clean and orderly work areas

### 3.11.2 Compliance Survey for Dredge Targets

When the Remediation Contractor has determined that dredging in a series of grids is complete, a post-dredging bathymetric survey will be conducted to verify that target dredge elevations were reached within the required level of accuracy and as a basis for payment for dredging. Grids where the average elevations are greater than the target elevations will be re-dredged until the target elevation is met and verified. No backfill or cover placement will be conducted until the post-dredging survey is completed and the Site Engineer certifies that the dredge target elevations and horizontal limits have been met.

### 3.11.3 Dredging of Sediments with PCBs ≥50 mg/Kg (TSCA materials)

Of the approximately 38,400 CY of material to be dredged, approximately 5,400 CY have been identified as TSCA material containing ≥ 50 mg/Kg PCBs (Figure 3-2). Dredging will be conducted in a manner to assure that TSCA materials do not co-mingle with non-TSCA material. To the extent practical, TSCA grids with high levels of VOCs will be managed separately from TSCA grids with low level VOCs.

Equipment (dredged buckets, transfer barges, etc.) that comes into contact with material in the TSCA grids will be decontaminated prior to be being used on other materials (non-TSCA materials). Material dredged from the TSCA grids will be transferred to on-shore receiving, handling, and load-out facilities within the TFS and designated specifically for TSCA materials. These materials will be segregated and managed separately throughout the process.

## 3.12 Transfer of Dredged Material to Shore

From land-based dredging equipment (if used), sediment will be transferred directly from the dredge bucket to the designated stockpile and dewatering areas within the TFS. Sediment dredged from on-water equipment will be transferred from the dredge bucket to a barge and later transferred to the designated on-land stockpile. On-water dredging and direct transfer to onshore sediment storage areas is also possible.

For each sediment type (material from grids with ≥50 mg/Kg PCBs and materials from grids with <50 mg/Kg PCBs), separate, standalone stockpile/dewatering areas will be constructed and used.

Use of barges to transport the sediment to an alternative unloading area or directly to a handling/disposal facility is an option that is currently under consideration for portions of the area to be dredged.

## 3.13 Thermal Treatment Option

The March 2016 Record of Decision for the Hudson River portion of OU-2 includes provisions for ex situ thermal treatment of sediment, should it be practicable. BASF and the Engineer will work with the Remediation Contractor to determine if Site conditions warrant use of ex situ thermal technologies for treatment of dredged sediments, and recommendations for the use of such a system will be included in the design phase if it is determined that use of an on-site thermal treatment unit starts represents an economically viable and permittable alternative.

Should this technology be employed, the general approach to managing sediments impacted with VOCs would include the following elements:

- Place dredged material in stockpile area for gravity dewatering;

- Add amendments to further reduce or contain remaining moisture;
- Test sediments to determine VOC levels;
- Sediments that meet acceptance criteria at a cost-effective non-hazardous waste facility may be loaded for off-site disposal, however it is envisioned that VOC-impacted sediments may also be prepared for on-site treatment;
- Prior to thermal treatment, the sediments may be amended to increase permeability and material throughput characteristics;
- A typical thermal desorption unit is a large rotating cylinder that is heated. In this case the heating temperature would be in the range of 800 degrees Fahrenheit (°F). As the soil passes through the cylinder, the VOCs are released and removed for further processing. VOCs are either condensed into a liquid form or captured in air treatment devices. Monitoring programs are put in place to assure that VOCs are not released to the air and that treated soils meet the treatment criteria.
- Typically the thermal desorption unit and support equipment occupies about a 100 by 200 foot area. The treatment unit would be contained within the TFS.
- On-site treatment of VOC-impacted materials is not likely to be feasible if concentrations of PCBs exceed 50 mg/kg and EPA determines that all TSCA permitting requirements apply. Thermal treatment of TSCA-regulated material typically requires additional permits and entails additional restrictions beyond those required for VOCs alone

## 3.14 Onshore Sediment Handling, Dewatering, and Conditioning

The sediments to be dredged contain varying levels of VOCs, metals, and PCBs. BASF does not expect that the metals concentrations in sediment will significantly impact the preparation of the sediment for offsite disposal. As described in the FS (AECOM, 2015), four categories of sediment are anticipated to be generated through this effort:

- Sediment with low VOC levels (not Resource Conservation Recovery Act [RCRA] characteristic waste) and low total PCB levels (not TSCA material)
- Sediment with higher VOC levels (may exceed RCRA characteristic waste thresholds) and low total PCB levels (not TSCA material)
- Sediment with low VOC levels (not RCRA characteristic waste) and total PCB levels ≥ 50 mg/Kg (TSCA material)
- Sediment with higher VOC levels (may exceed RCRA characteristic waste thresholds) and total PCB levels ≥ 50 mg/Kg (TSCA material)

These various sediment types will be managed separately. Sediment stockpiling, dewatering, amendment addition, thermal treatment (currently being evaluated), and load-out will be conducted within the TFS enclosed structure under negative pressure. Some management of sediment with low VOC content outside the structure may occur provided the odor minimization and air quality goals set forth in the CAMP are met.

Dredged material will be transferred from a barge to the dewatering cells or directly to the dewatering cells from land-based or water-based equipment. The pace and technique of placing sediments into the dewatering cells will be designed to minimize spills. Spill containment measures will be installed and maintained between the shoreline and dewatering pads. Sediments will be carefully placed in the

dewatering pads to avoid splashing outside the pads. The spill containment measures and dewatering pads will be regularly inspected.

The goals for dewatering sediments are as follows:

- Pass the paint filter test for absence of free liquids.
- Minimize the potential for water to shake free during transport.
- Reduce the percent moisture in sediments to reduce energy cost for thermal desorption, should this technology be employed to help manage high VOC/Non-TSCA sediments.
- Reduce the percent moisture to the extent economical to reduce disposal costs.

During full-scale dredging, significant amounts of free water may accumulate in the transfer barge. The barges will be designed and filled, to the extent practical, in a manner to facilitate pumping of free water prior to transfer of sediments to the shore. Water pumped from the transfer barges will be processed through the on-Site water treatment plant.

All water generated during dewatering activities will be processed through an on-Site water treatment system.

Additional details regarding sediment dewatering will be provided in the forthcoming 50% and 100% design documents.

## 3.15 Disposal of Sediments

The dredging will yield sediments with varying concentrations of PCBs and VOCs which will be managed separately.

It is anticipated that dredged sediments will be processed in approximately 200 to 500 CY batches. Each batch will have a designated number and will be tracked from placement in the dewatering basin to load-out. Signs will be used to identify each batch. Tracking sheets for each batch will include dates dredged, approximate volume, gravity drying time, amount of amendment added, results of visual inspection conducted, results of laboratory testing, waste classification (Non-Haz, RCRA Haz, TSCA, Non-TSCA), and load-out dates.

The following approach to sampling and ultimate classification of materials will be followed:

- Materials designed as TSCA materials based on *in situ* testing will remain designated as TSCA materials regardless of any subsequent *ex situ* testing.
- Materials designated as non-TSCA materials based on in situ testing will be sampled ex situ prior to shipment to meet the requirements of the specific receiving facility.
- The final determination of RCRA status (hazardous or non-hazardous) of dredged sediments will be based on waste characteristics of material determined by *ex situ* sampling of material prior to shipment. Materials passing the TCLP will be designated as Non-RCRA hazardous waste. Materials failing the TCLP will be designated as hazardous waste by characteristic. TCLP testing frequency and parameters as determined by the receiving facilities.

The specific treatment for each sediment type and specific facilities receiving the sediments will be identified in 100% design document. A general discussion of the sediment types and likely treatment

and disposal options area are provided below. Specific disposal facilities to be employed for this project will be identified in the 100% design submittals.

- **Non-RCRA hazardous waste and non-TSCA material:** These sediments will be prepared for shipment (dewatering and amended as necessary), sampled for waste characteristics, and shipped to an off-Site Subtitle D disposal facility (to be identified in the 100% design submittal). Waste characteristic sampling frequency and parameters will be determined by the receiving facility. Test results will be reviewed to assure that the material meets all acceptance criteria at the receiving facility prior to shipment. Options to barge this material directly to permitted off-site processing and disposal facilities will also be considered during the design phase.
- **Sediments with High VOC levels (fails TCLP criteria for VOCs) and non-TSCA levels of PCBs:** The final disposition of this material will be based on TCLP testing to be conducted on-shore in the stockpiles after dewatering and preparation for shipment. The sampling frequency will be in the range of one sample every 200 to 500 CY of material. Material that fails the TCLP test may either be sent directly for off-Site treatment/disposal at a Subtitle C hazardous waste facility, treated on Site with amendments, or thermally treated on-Site. On-Site thermal treatment would be designed to remove VOCs. Treated sediments that pass the TCLP test will be sent off-Site to a non-hazardous waste facility. The decision to use on-Site thermal treatment or to ship these materials directly will be contained in the 50% and 100% design submittals.
- **TSCA Materials (PCBs ≥ 50 mg/Kg).** Sediments with 50 mg/Kg or more PCBs (based on in situ sampling results) will be managed as TSCA materials and will be dredged, stockpiled, and dewatered separately and will be disposed of at an appropriate off-Site facility. Materials that are TSCA waste and fail TCLP (hazardous waste) will be handled separately than materials that are TSCA/non-hazardous and will likely be disposed of at separate facilities (to be defined in the 100% design submittal).

Transport of Materials Off-Site: Following the receipt of waste classification results and acceptance of a batch of material by the receiving facility, material will be staged for loading. Waste manifests or bills of lading will be prepared for each shipment.

It is likely that the majority of sediment will be shipped via truck; however rail transport and/or barge transport are also under consideration. Trucks will be loaded in the designated loading areas. Trucks will be inspected upon arrival at the Site to ensure the beds are empty and no free water is present. Trucks will be lined prior to loading. The means to ensure that trucks are not filled above their weight limits will be determined by the contractor. Trucks will be covered before leaving the Site. Trucks will be decontaminated and inspected prior to leaving the Site. Truck routing and staging will be conducted in accordance with a Traffic Management Plan.

## 3.16 Control of Impacts to Adjacent Properties

Construction work, including Site preparation and demobilization, will take approximately 12 to 24 months to complete. Minimizing potential impacts to nearby residences and businesses is a key feature of the remedial design. The following practices and procedures will be implemented to minimize impacts to adjacent properties:

- The Site layout plan will include a buffer between Site work and off-Site properties. Activities that may create noise or odors such as sediment stockpiling of treatment, will not be conducted within the buffer zone.

- Work areas will be fenced in.
- Monitoring will be conducted for dust, odor, and noise in accordance to the Dust, Odor, and Noise Plan (to be provided with the 100 % design documents).
- Continuous air monitoring of the work zone perimeter will be conducted in accordance with the Community Air Monitoring Plan (to be provided with the 100% design documents).
- Working hours may be limited based on local ordinances.
- The flow of traffic into and around the Site will be designed to minimize any adverse impacts to residences or nearby businesses. Traffic control details will be provided in a Traffic Control Plan (to be provided with the 100% design documents). Truck traffic will be directed to the south of the Site, in order to avoid residential neighborhoods located to the north.

## 3.17 Cover Placement

As dredging and verification of target elevations are completed and verified, placement of the sediment cover will proceed. The cover designs are driven by habitat restoration goals for specific areas of the Site. Upon remedy completion, three habitat types are envisioned.

- In areas of deeper water (e.g., deeper than 9 feet at Mean High Water (MHW) and therefore not suitable for SAV plantings), the restored Site will be suitable for colonization by benthic organisms.
- In areas of shallow water depth (e.g., nine feet or less at MHW), the surface completion will include SAV plantings.
- A constructed fringe wetland will be built along a portion of the shoreline.

General locations for the three habitat types are shown in Figure 1-4, and typical cover system cross-sections are shown in Figure 3-3.

The cover has been designed with an erosion protection layer to serve as a permanent feature in the river. As such, the cover will withstand typical estuarine riverine forces including erosional and shear stresses, bioturbation, propeller wash, wave action, current and tide fluctuations, and ice scour. The erosion resistance requirement will be achieved by incorporating a 6 inch layer of 2 inch diameter stone in to the cover design.

Additional details regarding cover system installation, means, and methods will be provided in the forthcoming 50% and 100% design submittals.

### 3.17.1 General Requirements for Cover Material Quality, Placement, and Verification

This section discusses general requirements for the quality, placement, and verification of cover materials. BASF is also working with various stakeholders to evaluate alternative sources for cover materials, including beneficial reuse of sediments dredged from historically filled areas of the Hudson River.

#### 3.17.1.1 General requirements for cover materials

All cover material shall meet the requirements of 6 NYCRR Part 375-6.7(d).

Minimum requirements for all cover material are as follows:

- All cover material shall be from approved sources as approved by the Engineer and NYSDEC.
- Cover materials shall be tested by the Contractor according to the frequencies established in Section 5.4 of the NYSDEC's DER-10 Technical Guidance for Site Investigation and Remediation (May, 2010). Soil will be sampled for VOCs, SVOCs, inorganics, and PCBs/pesticides at the higher frequency of the DER-10 frequency or a frequency of 2 discrete samples and 1 composite sample (as defined by DER-10) per 5,000 cubic yards of material from each source as approved by the CM or Engineer.
- In accordance with DER-10, laboratory chemical testing is not required for gravel, rock and stone backfill materials that consists of virgin material from a permitted mine or quarry and have a grain size distribution with less than 10% passing the #80 sieve.
- All cover material will be free of stumps, rubbish, frozen materials, and other objectionable materials. Roots, wood, and other natural organic matter is allowable in the habitat layer.
- A sieve analysis shall be conducted for all material sources. Sieve analysis shall be conducted as each new source is introduced and at a frequency of one of one sample for every 500 CY for the first 1,500 CY from each source) and every 5,000 CY thereafter.
- Lightweight pieces (floating) shall be less than 0.5%. This criterion does not apply to the habitat layer.

#### 3.17.1.2 Alternative Sources for Cover Materials

BASF will continue to evaluate the use of soil/sediments dredged from elsewhere in the Hudson River for use as backfill or cover material as part of the Natural Resource Damage Assessment (NRDA) settlement.

#### 3.17.1.3 Final Elevation Targets and Precision Requirements for Cover

Achieving target cover thickness and final grades is important to ensure proper cover stability, chemical isolation, and habitat function. Additionally, accurate placement of the cover to final design grades must not interfere with navigation in the river and must preserve the river's current flood capacity.

The use of automatic positioning such as Real-Time Kinetic Differential Global Positioning Systems (RTK–DGPS) coupled with radio telemetry and data logging technology during cover placement will enable target cover thicknesses and final grades to be achieved to within +0.5/- 0.5 feet..

#### 3.17.1.4 Cover Placement Methods

After the target dredging elevations have been confirmed in a series of grids, the Remediation Contractor will be authorized to begin placement of cover material. To avoid re-contamination, cover placement will not be allowed in a grid until all adjacent grids have been dredged to their target elevations and verified. Design considerations for placement of the cover are as follows:

- The cover material must be accurately placed and stay in place.
- The cover thicknesses and final grades must be achieved to required level of accuracy.
- Placement of cover material should minimize turbidity levels to the extent possible to minimize potential impacts to the environment.

- To the extent practical, applied cover material should not become mixed with underlying sediments.

In general, Site conditions are favorable for the placement of a cover. The poorly compacted surface sediments will be removed during dredging. The underlying sediments are primarily well compacted silts and clay. This material is expected to provide a sufficiently firm base for placement of the cover material. The primary fill/cover material is expected to place easily and be relatively self-leveling and self-compacting.

For some cover materials (near surface for SAV areas and wetland area), the presence of fine organic materials may complicate cover placement. Use of a closed bucket and release near the river bottom may be necessary. Tremie techniques may also be viable. The Remediation Contractor may propose alternative means for placement of fine materials. The final placement methods will be presented in the forthcoming design submittals.

#### 3.17.1.5 Monitoring During Placement of Cover

Surface water quality monitoring will be conducted during cover placement). Monitoring will consist of real-time continuous sampling for turbidity located at compliance points located outside the work zone (the forthcoming RAMP, to be included with the 90% design submittal, will detail compliance points) and visual observations of turbidity conditions. Monitoring outside the containment area will only be necessary if there is a visible plume emanating from the containment system. If this is the case, the plume shall be sampled for TSS.

## 3.18 Habitat Restoration and Enhancement

The completed restoration cover (top 2 feet in 3-, 4-, 6-, and 8-foot dredge areas, and top 1.5 feet in 2-foot dredge areas) will provide ecological functions and values equal to or greater than current conditions. There are three types of habitat restorations proposed for this project.

### 3.18.1 Habitat 1: Benthic Organisms

Habitat 1 is located primarily in the western portions of the NFSSA and is designed primarily to support use by benthic organisms. In this area, the water is generally considered to be too deep to support SAV. To provide habitat for benthic organisms, the particle size distribution and textural soil classifications shown in Tables 3-1 and 3-2, respectively, have been selected.

**Table 3-1 Particle Size Distribution for Habitat Layer**

| Sieve Size | Percent Passing |
|---|---|
| 8- inch | 100 |
| 3-inch | 65 to 75 |
| No. 4 | 35 to 45 |
| No. 200 | 5 to15 |

**Table 3-2 Material Types for Cover Materials**

| Classification | Approximate Percentage |
|---|---|
| Run of the River Small Cobble | 25 to 35 |
| Course and fine run of the river gravel | 25 to 35 |
| Fine to coarse sand | 25 to 35 |
| Mix of inorganic and organic fines (0.075 millimeter and smaller) | 5 to 15 |
| Total Organic Carbon Content (TOC) | 1.5 – 3.0 % (5 to 10 percent organic matter) |

The pH of the material will be neutral (6.5 to 7.5 pH units). This range of particle sizes, carbon content, and pH is appropriate for recolonization of the area by benthic species. The selected particle sizes and TOC fall within the existing range of values observed in the area during the Remediation Investigation (RI)/FS sampling events. The data collected in the NFSSA during the Remedial Investigation program are summarized in Table 3-3.

**Table 3-3 Summary of Average Total Organic Carbon and Grain Size Distribution**

| Horizon (ft) | TOC (%) | Gravel (%) | Clay (%) | Sand (%) | Silt (%) |
|---|---|---|---|---|---|
| 0-0.5 | 1.8 | 1.9 | 5.9 | 50.4 | 41.8 |
| 0-2.0 | 1.9 | 2.0 | 9.7 | 45.8 | 42.5 |

The proposed cover materials will provide a suitable habitat for colonization and use by benthic infauna. In addition to benthic invertebrates, fish species will benefit from improved habitat through the installation of the clean substrate and cover system. The completed cover system will provide ecological functions and values similar to other open water habitats in this urbanized river system.

### 3.18.2 Habitat 2: SAV Plantings

The second habitat type is located along the shoreline where the water depth is typically 1 to 9 feet. Based on historic vegetation surveys of existing conditions, portions of this area are capable of supporting SAV. The goal of this habitat enhancement is to create an estimated 0.6 acres of SAV. This is a significant expansion to the existing area of SAV (which has ranged from approximately 0.13 to 0.5 acres in the past decade). The habitat layer fill material used in Habitat 1 (Tables 3-1 and 3-2) is also well suited as a base for SAV plantings and will be used as cover material for the top 1.5 to 2 feet in Habitat 2.

SAV plantings will consist of potted units of wild celery (*Vallisneria americana*) that will be procured from a regional commercial nursery specializing in native plants. The proposed SAV installation will result in improved habitat conditions on-Site for a variety of species, especially young of year fish and smaller prey species which utilize SAV habitat for foraging, cover, and predator avoidance. In addition, waterfowl and reptiles may utilize the SAV for forage, spawning, and cover purposes.

Additional detail regarding the proposed SAV monitoring and maintenance will be included in the forthcoming 90% and 100% design documents).

Habitat enhancement features to be included in the SAV planting area are outlined in Table 3-3.

### 3.18.3 Habitat 3: Fringe Wetland

The third habitat enhancement associated with the proposed project involves creation of an approximately 1,700 square feet (SF) of perched wetland and 3,300 SF of tidal emergent fringe wetland area. Portions of this wetland will be exposed above the river water level during normal low tides and be subject to regular tidal cycling and periods of inundation and soil saturation. The wetland will be planted with emergent vegetation. In addition, a wildlife ramp is proposed in the work area to connect the proposed wetland shelf to upland areas.

Potential habitat features to be incorporated into the wetland design include those outlined in Table 3-3, and a preliminary planting list is included in Table 3-4. Additional detail regarding the wetland features will be provided in the 50% and 100% design submittals.

**Table 3-3 Potential Fringe Wetland Shelf and SAV Habitat Features**

| Feature | Construction Notes | Purpose |
|---|---|---|
| Gravel Saucers | Heavy gravel placed in a clumped fashion. Potentially embedded in a concrete mixture. Used in conjunction with gabion blocks to reduce wave action. | Create spawning habitat suitable for sturgeon and other species |
| Cobble Bands | Coarse material placed in the uppermost habitat layer, in wide bands extending towards the shipping channel. | Create spawning habitat suitable for sturgeon and other species |
| Hummocks | Micro elevation increases utilizing mounded soil with gravel support created within fringe wetland. | Proposed to provide heterogeneity with respect to the soil surface for vegetation plantings. Designed to provide habitat, forage, resting and cover for fauna. |
| SAV | Generally be planted starting at the top of the Mean Low Water (MLW) extending outward approximately 15 to 18 linear feet (into deep water areas). Median water depths for the SAV area will be 4 feet with tidal cycling changing the depths from 1 foot to 9 feet under most conditions. | Replicating and enhancing impacted SAV. Designed to provide habitat, forage, resting, and cover for fauna. |
| Large Boulder | Placed via crane or excavator outside of navigational areas. | Designed to provide habitat, forage, resting, and cover for fish |

**Table 3-4 Potential Riverine Fringe Wetland Species**

| Common Name | Scientific Name | Anticipated spacing | Notes |
|---|---|---|---|
| Soft rush | *Juncus effusus* | 1 ft. on center | Bare root plants to be sourced from commercial nurseries. |
| Soft stemmed Bulrush | *Scirpus tabermontanii* | 1 ft. on center | Bare root plants to be sourced from commercial nurseries. |
| Lurid sedge | *Carex lurida* | 1 ft. on center | Bare root plants to be sourced from commercial nurseries. |
| Dwarf Sagittaria | *Sagittaria subulata* | 1 ft. on center | To be sourced from commercial nurseries. To be installed in soil hummocks at lower fringe wetland elevations. |

| Common Name | Scientific Name | Anticipated spacing | Notes |
|---|---|---|---|
| Broad-Leaved Arrowhead | *Sagittaria latifolia* | 1 ft. on center | To be sourced from commercial nurseries. To be installed in soil hummocks at lower fringe wetland elevations. |
| Pickerelweed | *Pontederia cordata* | 1 ft. on center | To be sourced from commercial nurseries. To be installed in soil hummocks at lower fringe wetland elevations. |
| Greater Bur-Reed | *Sparganium eurycarpum* | 1 ft. on center | To be sourced from commercial nurseries. To be installed in soil hummocks at lower fringe wetland elevations. |
| Blueflag Iris | *Iris Versicolor* | 1.5 ft. on center | To be sourced from commercial nurseries. Plant in drifts of 7-9, along edge of fringe wetland where inundation is 2”-4” |
| American bur-weed | *Sparganium americanum* | 1 ft. on center | To be sourced from commercial nurseries. To be installed in soil hummocks at lower fringe wetland elevations. |

In order to connect the wetland to the upland areas, a “wildlife ramp” consisting of a sloped area will be constructed on the southern end of the wetland. A small amount of clean fill material (less than 100 CY) may be used to tie the proposed wetland shelf to the existing riverbank. The slope will include plantings of bushes and shrubs and use of bioengineered structures to prevent erosion and to provide a starting point for vegetative cover. In addition to shrub and emergent vegetation plantings, application of an appropriate floodplain seed mix is anticipated along the wetland ramp. Seeded areas would be secured with erosion control measures to prevent seeds from being washed away.

Additional detail regarding the proposed wildlife ramp monitoring and maintenance will be included in the 90% and 100% design submittals.

## 3.19 Post Construction Maintenance and Monitoring

Following completion of the cover placement, maintenance and monitoring will be conducted. Performance goals and monitoring requirements vary with cover types. The following narrative presents a conceptual overview of post-closure monitoring – additional details will be provided in monitoring plans associated with the 90% and 100% design submittals, which will include definitions of success and failure criteria in terms of percent cover, aerial cover, and./or density of plantings .

### 3.19.1 In-Water Cover System Post Construction Monitoring and Maintenance

The primary post-remedy performance goal is resistance to erosion. Some amount of deposition and erosion is anticipated and is not evidence of failure of the cover. Failure of the cover is defined as erosion that exposes the underlying sediments that are impacted with COCs. While this level of erosion is unlikely with the placement of a stone layer (the erosion control layer), verification monitoring is proposed.

Annual inspection of the cover for the first three years following placement will be conducted. A combination of visual inspections and/or bathymetric surveys will be used to confirm the erosion protection layer remains in place. If these techniques indicate that sediment has eroded substantively, additional inspections and/or repairs to the affected grids may need to be conducted.

Additional inspections may include coring of the cover to evaluate the properties of the remaining material. The bathymetric survey will also allow a trend analysis of the thickness of the sediment layer overlying the erosion layer. The visual inspection will document any areas of scour, exposure of the erosion layer, or failure of the erosion layer.

Annual reports will document results of inspections, any areas of observed failure, corrective actions taken, and any recommended changes in the monitoring program. Inspection and reporting may be terminated after three years; the frequency of cover inspections will be determined in the Site Management Plan. .

### 3.19.2 Post Construction Monitoring and Maintenance of SAV

The approximately 0.6 - acre area of the NFSSA to be planted with SAV will be monitored for a period of 3 years following installation (details to be provided in forthcoming 50% and 100% design submittals). Monitoring will be conducted through the use of visual inspection of areal coverage of the SAV community through boat-based surveys. SAV inspections will be conducted annually between June 15 and August 1 of each year of the monitoring which coincides with peak growing season foliar cover. Ocular estimates of areal coverage will be conducted using quadrat surveys combined with float overs of the entire SAV community.

### 3.19.3 Post Construction Monitoring and Maintenance of Constructed Wetland

The fringe wetland will be visually inspected in spring, summer, and fall of each year for approximately 5 years following construction. Percent coverage of vegetation and any observations of wildlife will be documented. Areas of scour will be noted. The condition and effectiveness of the wildlife ramp will be documented. Corrective measures will be implemented as necessary. Corrective measures may include replacement of cover materials and replanting of vegetation. Corrective measures will be conducted in accordance with the Habitat Monitoring and Maintenance Plan, which will be developed as part of the 90% and 100% design submittals.

## 3.20 Demobilization

As certain on-water activities are completed, the Remediation Contractor will begin demobilization. Demobilization activities and probable sequence are as follows:

- Complete cover placement and verification of final elevations.
- Verify background levels of turbidity inside the water quality control devices and remove environmental control devices and monitoring equipment (e.g., silt/turbidity curtain, data buoys).
- Decontaminate and demobilize dredging equipment and equipment used for cover placement.

The Site Engineer will verify that equipment and materials are decontaminated prior to removal from the Site. The Site Engineer will create a checklist of all demobilization issues. The Remediation Contractor will follow through on checklist items. The Site Engineer and Remediation Contractor will conduct a final Site walk to confirm that all items have been removed and the Site is in an acceptable condition.

Once all remedial activities have been completed, the Remediation Contractor will begin demobilization and Site restoration activities on land. Those activities and probable sequence are as follows:

1. Remove dewatering pads, staging and stockpile pads, tracking pad, and sediment loading pad
2. Sample underlying soils as required by the TCSA regulations
3. Clean, sample, and remove water treatment tanks and equipment
4. Remove all trash and debris
5. Stabilize disturbed soils if applicable
6. Remove soil erosion controls (see Erosion Control Plan for timing of removal)
7. Remove land-based equipment
8. Remove Site trailer
9. Remove temporary Site fence

The Site Engineer will verify that equipment and materials are decontaminated prior to removal from the Site. Equipment and materials exposed to TSCA materials will require decontamination and sampling in accordance with the TSCA management plan. The Site Engineer will create a checklist of all demobilization issues. The Remediation Contractor will follow through on checklist items. The Site Engineer and Remediation Contractor will conduct a final Site walk to confirm that all items have been removed and the Site is in an acceptable condition.

The upland restoration work will comply with the SMP (Remedial Engineering/ Roux Associates, 2014). The completed restoration work will be inspected by the Environment Professional tasked with assuring compliance with the SMP.

# 4.0 SFSSA Monitored Natural Recovery

The selected remedy for the SFSSA is MNR. The goal of monitoring in the SFSSA is to document changes in bathymetry and sediment chemistry. Sampling events will be conducted in year 1 (that is, in the first full year following completion of the NFSSA remediation) and then every fifth year. While the monitoring may extend for as long as 30 years, a shorter monitoring period may be proposed after a sampling event, but not before the first 5 years of results have been reported. After each sampling event, a report will be prepared to document the findings, identify possible trends, and to recommend changes in the sampling program, as appropriate. The accumulation of fresh sediment and generally lower metals concentrations will be indications of natural recovery in the area and a confirmation that no active remedy is required.

The sampling program will include the following elements:

- **Multi-beam Bathymetric Survey**: Similar equipment and methods will be used during each sampling event. Survey transects parallel to shore will be spaced 25 feet or less apart, and cross tie lines will not be greater than 250 feet apart. After each survey the results of the previous surveys will be overlain to identify areas of deposition and areas of erosion. A total area of deposition and average deposition rate will be calculated. If areas of erosion are identified, the total area of erosion and rate of erosion will be calculated. The net rate of deposition or net rate of erosion will be calculated for each sampling event by comparison to the previous survey and to the year 1 survey.
- **Sediment Sampling:** Ten sediment samples will be collected from a uniform grid covering the SFSSA. Two additional samples, one up river, and one down river will also be collected during each sampling event. Samples will be collected from a depth of 0 to 6 inches. Metals analysis will include the primary constituent of concern for this area (lead) as well as other constituents previously detected (zinc, arsenic, cadmium, chromium, mercury, and copper). For each sampling event basic statistics for each metal (average, mean, maximum, and minimum) will be calculated. As data from subsequent sampling events become available, additional statistical analysis may be conducted.

The SFSSA Monitoring Plan will be submitted as part of 90% and 100% design documents.

# 5.0 Permits and Other Authorizations

The following permits and authorizations will be obtained prior to commencement of remedial response actions at the Hudson River OU-2.

## 5.1 Air Permits

On-Site thermal desorption of VOCs is an option for treatment of dredged sediments. On-Site thermal treatment of VOC impacted sediment will require air treatment devices to ensure that VOCs are not released to the air. The relevant regulations/permits listed below may apply to the operation of the air treatment equipment and the associated air emissions:

- Clean Air Act
- NYS 6 NYCRR Part 201 Air Pollution Control Permit

It is expected that, based on the nature of the temporary treatment facility, an exemption for the NYS Air Pollution Control Permit will be warranted as it will be constructed for the purpose of remediation. The exemption will be based on the anticipated mass emission rate (in tons per year) that is expected to be discharged by the air treatment equipment. The anticipated mass rate will be calculated using the Division of Air Resources (DAR-1) review process and will be completed prior to Site mobilization.

Whether or not on-Site thermal treatment of sediments is viable will be determined in the design phase of work.

## 5.2 State and Federal Environmental Permits

Several permits and approvals are required before any work related to dredging, on-Site treatment, and off-Site disposal of dredge spoils can begin. In addition, the remedial activities will need to comply with federal and state waste regulations, Occupational Safety and Health Administration (OSHA) standards, and local regulations. It is anticipated that the following permits will be required:

- Since the volume of sediment to be managed on-Site exceeds the 100 CY threshold per COMAR 26.17.01.05, an erosion and sediment control plan will be required for handling the sediment on-Site.
- A temporary New York State Pollution Discharge Elimination System (SPDES) permit is required for discharge of treated water to the Hudson River or other surface water body.
- A Joint Application Permit (JAP) will be submitted to the United States Army Corps of Engineers (USACE) seeking authorizations under Section 404 of the Clean Water Act (CWA) and Section 10 of the Rivers and Harbors Act of 1899 under its Nationwide Permit (NWP) Program in NYS; to the NYSDEC for CWA Section 401 Water Quality Certification, authorizations under the NYSDEC Protection of Waters program, Tidal Wetlands, Coastal Erosion Management and NYS Endangered/Threatened Species programs; a Coastal Consistency Review from the NYS Department of State; and, authorization from the NYS Office of General Services for work in State Owned Lands Under Water. Additionally, BASF

will be seeking review and approval of the proposed activities from the NYS Office of Parks, Recreation, and Historic Preservation under the State Historic Preservation Act.

# 6.0 Schedule

Key factors affecting the schedule are:

- **Obtaining the necessary permits, primarily for in-water work:** A Joint Application Permit is under development and anticipated for submittal in the fall of 2017. A six month review period is anticipated. A Nationwide Permit Application for Bulkhead Enhancement (non-remedial) activities may be completed in the spring of 2017.
- **United States Environmental Protection Agency (USEPA) Approval of TSCA Work Elements:** As discussed in **Section 3.0**, some sediments are subject to TSCA regulations and handling of these materials will be conducted in accordance TSCA regulations.
- **Permit Work Windows:** The open water remedial work will likely be restricted to September 1 to November 31. Bulkhead enhancement activities can occur year round, with appropriate vibrational installation techniques.

With the above considerations, the goal is a start date for in-water work bulkhead enhancement work is September 2017 and for remedial work the anticipated start date September 2018. These start dates are primarily contingent on the approval of the RD/RA Work Plan and design documents, in-water work permits, TSCA approvals, and timely award of contracts for the remediation work.

Major timeline milestones include the following:

- Order on Consent Effective Date: February 25, 2017
- Citizen Participation Plan: April 26, 2017
- 50% Design: Fall 2017
- Procure Contractors: Fall 2017
- Environmental Permitting (Bulkhead Enhancement): Spring/Summer/Fall 2017
- Environmental Permitting (Remediation): Fall/Winter 2017/2018
- 100% Bulkhead Design: Fall 2017
- Bulkhead Improvement Field Work: Fall/Winter 2017
- 90% and 100% Remediation Design: Winter 2017/2018
- Upland Site Preparation Field Work: Spring/Summer 2018
- Hudson River Remediation Field Work: Fall 2018/Fall 2019 (if needed)
- SAV and Wetland Plantings: Spring/Summer following completion of Remediation Field Work
- The Final Engineering Report (FER) and Site Management Plan (SMP) (following completion of remedy, 2020)

# 7.0 Sustainability Evaluation and Recommendations

NYSDEC has developed a policy for identifying and implementing green remediation opportunities for remedial actions (DER-31/Green Remediation, NYSDEC, 2010b [revised 2011]). The following "green remediation" metrics (NYSDEC, 2010b) have been considered:

- Consideration of the environmental impacts of treatment technologies and remedy stewardship over the long term when choosing a site remedy.
- Reducing direct and indirect greenhouse gas (GHG) emissions.
- Increasing energy efficiency and minimizing use of non-renewable energy.
- Conserving and efficiently managing resources and materials.
- Reducing waste, increasing recycling, and increasing re-use of materials which would otherwise be considered waste.
- Maximizing habitat value and creating habitat when appropriate.
- Fostering green and healthy communities and working landscapes which balance ecological, economic, and social goals.

Based on the sustainability evaluation, provided in the FS, dredging of the most impacted sediments has been selected as the design strategy. In this way, the adverse impacts (greenhouse gas (GHG) emissions and waste generation) are balanced against obtaining the most benefits in terms of habitat restoration and potential reuse options. The remedy has been designed to improve the habitat value by reducing impacts to ecological receptors (e.g., incorporation of seasonal dredge windows). In addition, the manner in which the remedy will be implemented minimizes the short term impacts and waste disposal. The remedial strategy relies upon an ecologically enhanced cover system to isolate limited quantities of sediments exceeding the guidance values. Furthermore, removal of the highest levels of VOCs in sediment may allow the residual levels of VOCs in sediments to naturally attenuate over time.

The remedial action includes other significant habitat enhancements. The design includes substantially increasing the area of SAV and construction of a fringe wetland habitat. The wetland will be connected to the upland area via a wildlife ramp and will create a linkage to the river. The remedial actions for the river (OU2) are designed to complement habitat enhancements completed or in progress in the upland areas (OU1).

The bid specifications will require that the contractor conduct an evaluation of construction methods and identify specific areas where sustainability can be improved. Guidance documents developed by BASF to optimize sustainability during remediation will be followed.

In order to meet these goals, a list of opportunities has been identified (Table 7-1). Each of these opportunities has specific project benefits.

**Table 7-1 General Opportunities For Green Remediation**

| Opportunity | Description | Measurement |
|---|---|---|
| Human Health and Safety | Compile a robust Health and Safety Plan with a goal of no incidents throughout the project. Identify opportunities to promote healthy living for workers through educational postings and distribution of guides for non-smoking, diet, and exercise. | The number of educational products distributed via this project and worker incidents resulting from this work. |
| Stakeholder Involvement | Proactively and continuously interface with and integrate stakeholder representatives into the project team. Ensure the safety of the neighboring community through correct transportation requirements and noise and light requirements. Utilize local sources of labor, equipment, and supplies. | The number of formal stakeholder communications and the quantity of local sources of labor, equipment, and supplies utilized. |
| GHG Emission Reduction | Continuously investigate and implement project measures to reduce GHG emissions. Potential reductions include the use of alternate fuel and energy sources, nearby backfill sources and disposal facilities, and proper equipment use. | The quantity of fuel and energy use including both on-Site activities and off-Site transportation activities. |
| Water Use | Utilize stormwater controls and diversions to reduce the water runoff on-Site. In addition, treated water should be used in-lieu of public water for any on-Site water needs, as practicable. | The quantity of water treated at the Site and, if practicable, the quantity of water reused on-Site. |
| Waste Minimization | Minimize the creation of waste through the use of recycling, the establishment of electronic networks, and the optimization of waste volumes through proper water content limits | The quantity of waste disposed. |
| Planting and Vegetation | Identify areas of current or previously existing habitat within the project area and replace with new habitat. | The quantity of plants installed |

During remediation activities each of these goals will be monitored and communicated to stakeholders. Monitoring will be dependent upon the established remedial component and the benefit to the project and stakeholders. Collected data will be completed at the end of remediation activities and made available for future review.

# 8.0 Post-Construction Plans and Requirements

Once the remedial construction has been completed at the Site, BASF will submit a Construction Completion Report and Final Engineering Report in accordance with DER-10 Section 5.8. The report will include:

- Documentation of in-water quality sampling.
- Air monitoring results collected in accordance with the CAMP.
- As-built drawings of the horizontal and vertical limits of dredging.
- As-built drawings of the cover system.
- Documentation of any materials treated on-Site.
- All manifests and weight tickets associated with the material sent off-Site for disposal will be compiled and submitted. This will include the total tons of material removed from the Site.
- A discussion of any deviations from Remedial Design and of problems encountered and the resolution of those problems.
- Documentation of compliance with permit requirements.
- Documentation of the initial SAV and fringe wetland plantings.
- Description and survey of areas where COCs will remain in place.
- Site Management Plan addressing remaining COCs in sediment.

BASF will prepare and submit a Remedial Action Completion Report in accordance with the requirements of the NYSDEC. A final report to USEPA relative to management of sediment impacted with PCBs ≥50 mg/Kg may also be required.

If required by NYSDEC, a Site Management Plan will be prepared at this time.

# 9.0 Supporting Documents

A CERP will be prepared with the 100% design submittals. The CERP will document the monitoring and controls implemented to protect community and environmental receptors during the remediation. The CERP will include the following documents:

- Remedial Action Monitoring Plan (RAMP)
- Community Air Monitoring Plan (CAMP)
- Habitat Monitoring and Maintenance Plan (HMMP)
- Dust, Odor, and Noise Control Plan (DONP)
- Traffic Management Plan (TMP)
- Soil Erosion Control Plan (SECP)
- PCB Waste Storage, Handling, and Disposal Plan, if required by USEPA
- SFSSA MNR Monitoring Plan

The Draft SFFSA, RAMP, CAMP, and HMMP will be provided to NYSDEC with the 90% design submittal, and revised in response to agency comments for submittal with the 100% design submittals. The remaining CERP work plans (DONP, TMP, SECP) will be developed with the Remedial Contractor and submitted with the 90% and 100% design.

# 10.0 References

AECOM Technical Services, Inc., 2011. Dredged Sediment Treatment Pilot Study, BASF Rensselaer, Rensselaer, New York.

AECOM, 2015. Final Hudson River Operable Unit 2 Feasibility Study, BASF Rensselaer, Rensselaer, New York. March 2015.

Applied Coastal Research and Engineering, 2001. Total Current Observations, Hudson River, Rensselaer, NY, March 27, 2001. May 2001.

BASF, 2008. Preliminary Dewatering Study, BASF Rensselaer.

Kleinschmidt Energy & Water Resource Consultants, 2008. Submerged Aquatic Vegetation Report, Hudson River, BASF Facility, Rensselaer, NY. October 2008.

National Oceanic and Atmospheric Administration (NOAA), 2011. Tidal Staion Locations and Range. Available at www.tidesandcurrents.noaa.gov.

New York State Department of Environmental Conservation (NYSDEC), 2016a. Record of Decision, BASF- Manufacturing Plant Operable Unit Number 02: Hudson River Sediment and Off-site Areas, State Superfund Project, Rensselaer, Rensselaer County, March 2016

NYSDEC, 2016b. Proposed Remedial Action Plan for the BASF – Manufacturing Plant site, Operable Unit No. 02, February 2016

NYSDEC, 2014. Technical Guidance for Screening Contaminated Sediments. Division of Fish, Wildlife and Marine Resources.

NYSDEC, 2010a. DER-10: Technical Guidance for Site Investigation and Remediation. May 2010.

NYSDEC, 2010b. DER-31: Green Remediation. August 2010, Last Revised January 2011.

NYSDEC, 2005. Division of Water New York Standards and Specifications for Erosion and Sediment Control. August 2005.

NYSDEC, 2000. Hudson River Sediment and Biological Survey, Division of Water, Bureau of Watershed Assessment and Research

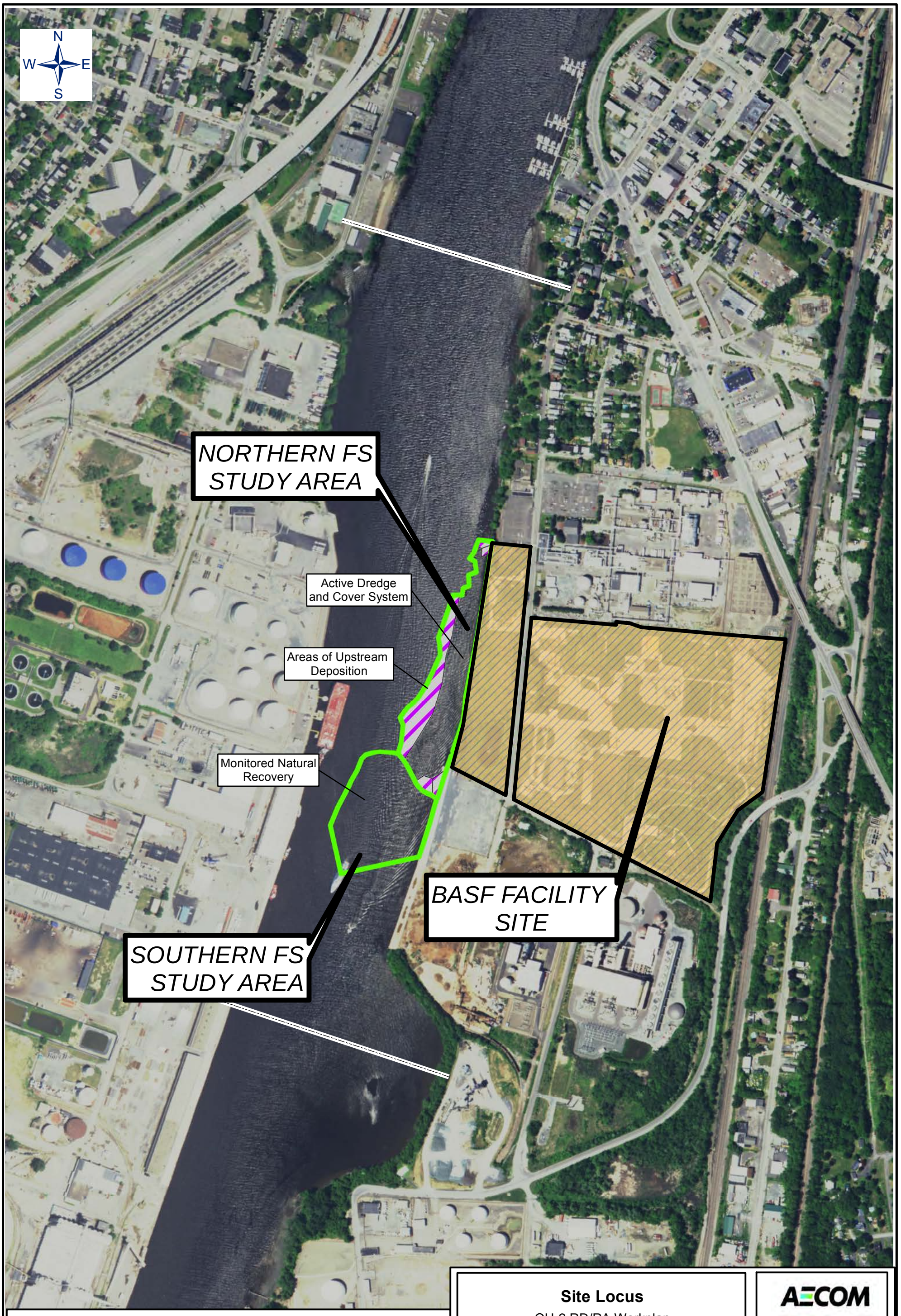
Rensselaer County Sewer District, 2015. Personal Communication from Mr. Gerald Moscinski, Administrative Director to Craig MacPhee January 15, 2015.

United States Army Corps of Engineers (USACE), 2005. Silt Curtains Dredging Project Management Practice Guidance Document, ERDC TN-DOER-E21. September 2005.

USACE, 2013. NAVSTAR Global Positioning System Surveying, Manual EM 1110-2-1003, November 2013.

Remedial Engineering, P.C. /Roux Associates, 2014. Site Management Plan BASF Manufacturing Plant Site Operable Unit NO.1 (OU1) Former BASF Manufacturing Plant, Riverside Avenue Rensselaer, New York

# Figures




**Legend**

- Study Areas
- Area of Upstream Deposition
- Site

**Distance From Site**

- 1500 River Feet
- 2 River Miles

**Site Locus**

OU-2 RD/RA Workplan
BASF Corporation
Rensselaer, New York

| SCALE | DATE | PROJECT NO. |
|---|---|---|
| 1:6,000 | 11/17 | 60323713 |

AECOM

Figure Number

1-1

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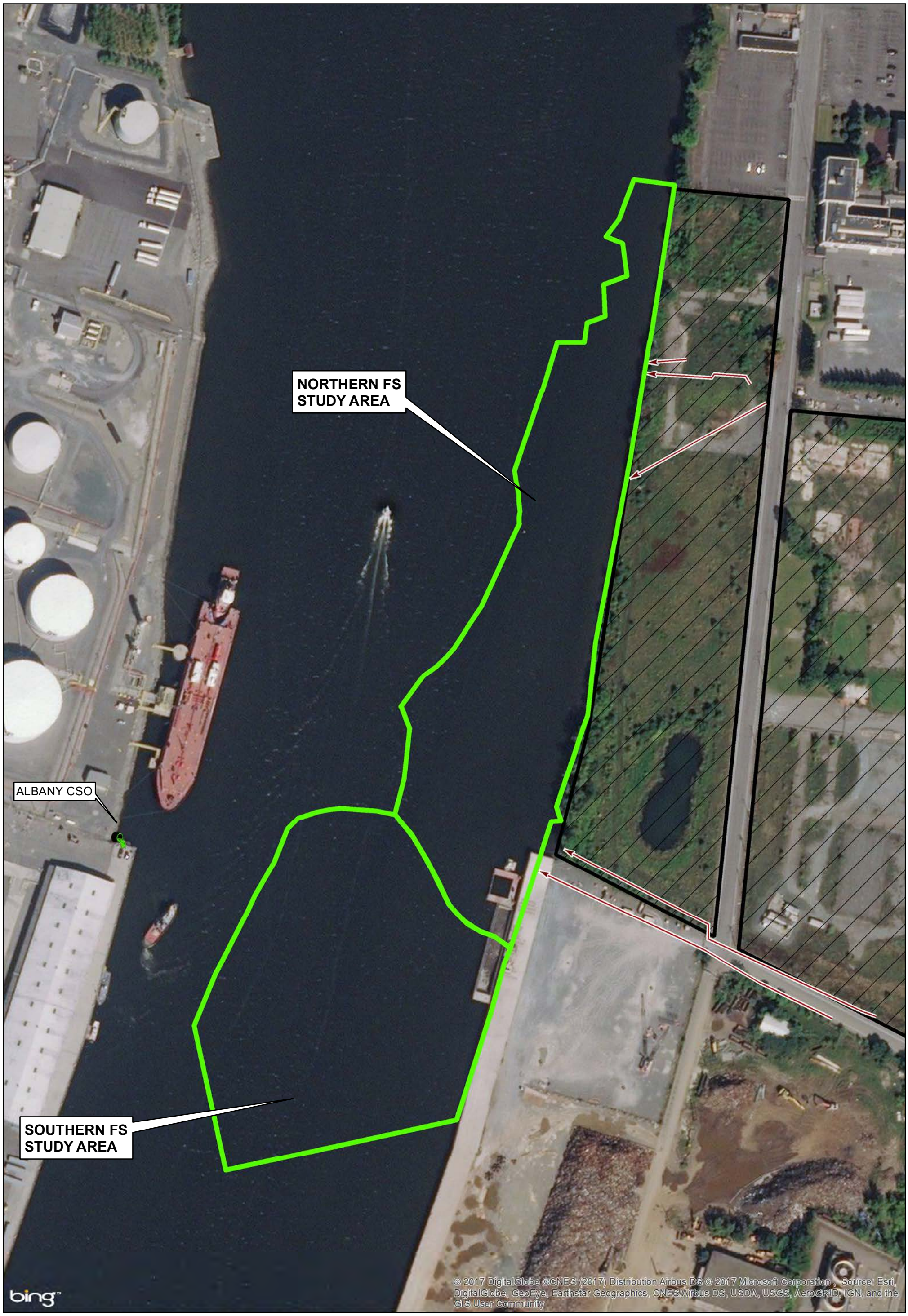


Study Area

Former BASF Facility Site

Approximate Locations of Outfall Pipes

Albany CSO

0 125 250 500 Feet

**Sediment Management Areas**

**OU-2 RD/RA Workplan**
**BASF Corporation**
**Rensselaer, New York**

| SCALE | DATE | PROJECT NO. |
|---|---|---|
| 1:2000 | 11/17 | 60323713 |

AECOM

Figure Number

1-2

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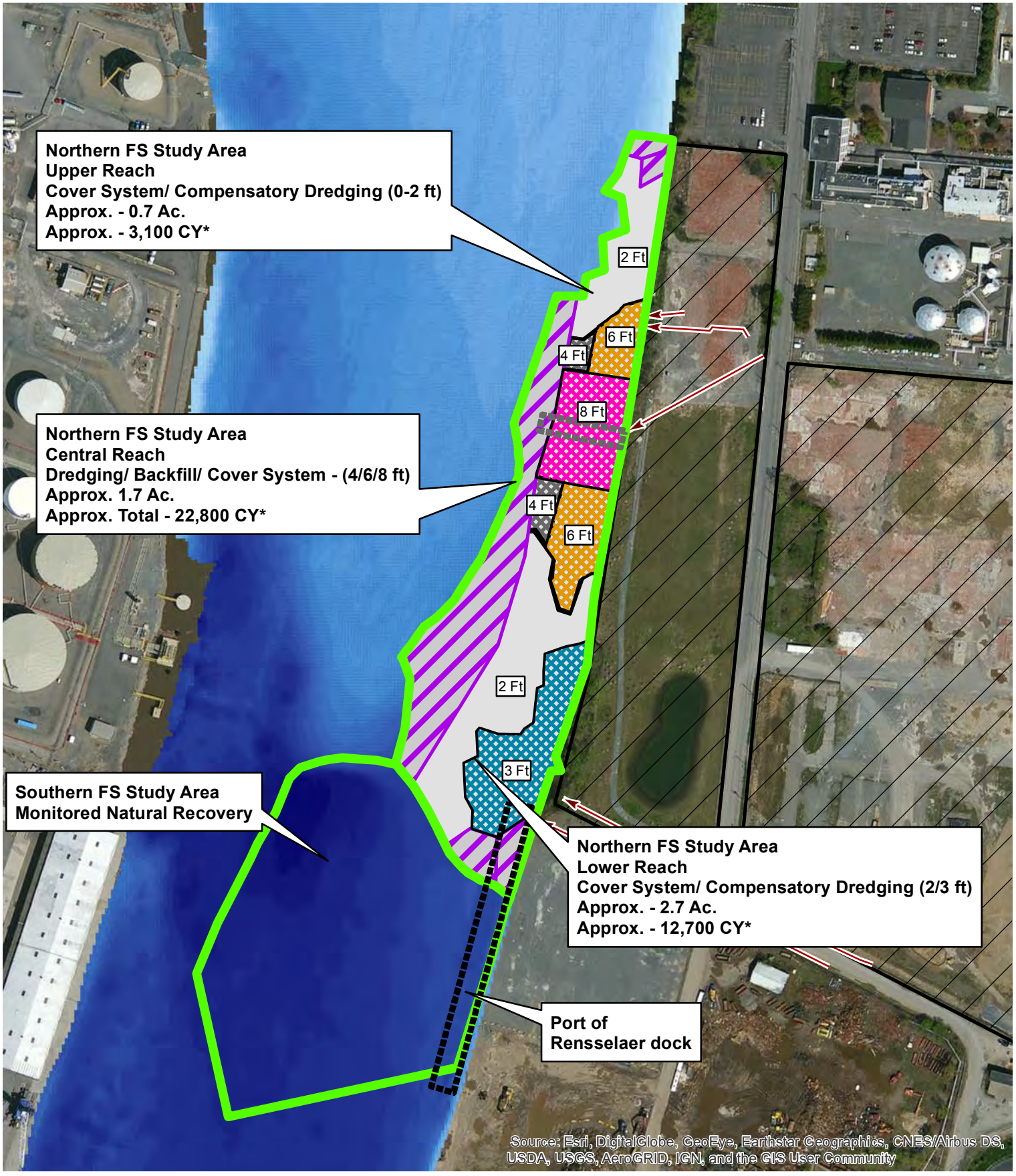


Depth (Feet)

45 - 40 | 39 - 35 | 34 - 30 | 29 - 25 | 24 - 20 | 19 - 15 | 14 - 10 | 9 - 5 | 4 - 0

0 50 100 200 300 400 500 Feet

Study Area
2 ft Removal Area
3 Ft Removal Area
4 Ft Removal Area
6 Ft Removal Area
8 Ft Removal Area
Area of Upstream Deposition
Approximate Locations of Outfall Pipes
Approximate Property Boundaries
Approx Location of Diffuser Pipe
Approx Location of New Dock

*Note: Dredge volumes include 0.5 foot overdredge and 15% side wall slough factor

**Selected Remedy: Hudson River NSMA and SSMA**

OU-2 RD/RA Workplan
BASF Corporation
Rensselaer, New York

| SCALE | DATE | PROJECT NO. |
|---|---|---|
| 1:3000 | 11/17 | 60323713 |

AECOM

Figure Number

1-3

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SURVEYED 2002
SAV AREA
(22,000 SQ FT)

APPROX.
PROPOSED
SAV AREA
(~0.6 ACRES)

DEEP WATER HABITAT

SURVEYED 2008
SAV AREA
(7,300 SQ FT)

PROPOSED
WETLAND AREAS
(5,000 SQ FT)

SURVEYED 2015
SAV AREA
(5,500 SQ FT)

WILDLIFE RAMP

OUTFALL PIPES

bing™



Locations of SAV Beds (NYSDEC, 2002)
Locations of SAV Beds (Kleinschmidt, 2008)
Locations of SAV Beds (AECOM, 2015)
NSMA
SSMA

* Actual location of SAV / wetland restoration to be determined in Design stage.

Approximate Property Boundaries
Proposed Wetland Restoration
Proposed SAV Restoration
Approximate Locations of Outfall Pipes

0 125 250 500 Feet

**Existing and Proposed SAV and Wetland Habitat Restoration Features**

**OU-2 RD/RA Workplan**
**BASF Corporation**
**Rensselaer, New York**

| SCALE | DATE | PROJECT NO. |
|---|---|---|
| 1:2000 | 11/17 | 60323713 |

AECOM

Figure Number

1-4

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RM 148
NORTHERN EXTENT OF
ACOE DREDGING

ALBANY CSO

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

**2015 Bathymetry (DEPTH, FEET)**

-43.4 - -42
-41.9 - -40
-39.9 - -38
-37.9 - -36
-35.9 - -34
-33.9 - -32
-31.9 - -30
-29.9 - -28
-27.9 - -26
-25.9 - -24
-23.9 - -22
-21.9 - -20
-19.9 - -18
-17.9 - -16
-15.9 - -14
-13.9 - -12
-11.9 - -10
-9.9 - -8
-7.9 - -6
-5.9 - -4
-3.9 - -2
-1.9 - 0

Site
Outfall Pipe Locations
USACE Channel (approx)
RM 148

0 105 210 420
Feet

**2015 Bathymetric Survey**

**OU-2 RD/RA Workplan**
**BASF Corporation**
**Rensselaer, New York**

| SCALE | DATE | PROJECT NO. |
|---|---|---|
| 1:2500 | 11/17 | 60323713 |

AECOM

Figure Number

2-1

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NORTHERN FS
STUDY AREA

SITE

Depth (Feet)

-45 - -40
-39 - -35
-34 - -30
-29 - -25
-24 - -20
-19 - -15
-14 - -10
-9 - -5
-4 - 0

Approximate Property Boundaries

Approximate Locations of Outfall Pipes

1974 Sheet Pile Bulkhead

1980's Sheet Pile Bulkhead

1936 Sheet Pile Bulkhead

Concrete Bulkhead

0 50 100 200 Feet

**Existing Bulkhead Configuration**

**OU-2 RD/RA Workplan**
**BASF Corporation**
**Rensselaer, New York**

| SCALE | DATE | PROJECT NO. |
|---|---|---|
| AS NOTED | 11/17 | 60323713 |

AECOM

Figure Number

**3-1**

0-2 Feet

2-4 Feet

4-6 Feet

6-8 Feet

8-10 Feet

SD213 is ND at 10-11.4'

Southern FS Study Area samples are 0.0-0.5'

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Notes:
1) Duplicates are averaged.
2) Units are mg/kg
3) Target locations are displayed
4) Data are sum of Aroclors, detects only

**Total PCBs (mg/kg)**

- < 50
- ≥ 50

0 200 400 800 1,200 1,600 Feet

**Legend**

- Site
- Outfall Pipe Locations
- Approx. Location of Diffuser Pipe
- Albany CSO
- Area of Upstream Deposition
- NFSSA & SFSSA

Depth (Feet)

-45 - -40 | -39 - -35 | -34 - -30 | -29 - -25 | -24 - -20 | -19 - -15 | -14 - -10 | -9 - -5 | -4 - 0

STUDY AREA

SITE

**Distribution of TSCA Sediment at the Site**

OU-2 RD/RA Workplan
BASF Corporation
Rensselaer, New York

| SCALE | DATE | PROJECT NO. |
|---|---|---|
| 1:4800 | 08/16 | 60323713 |

AECOM

Figure Number

3-2

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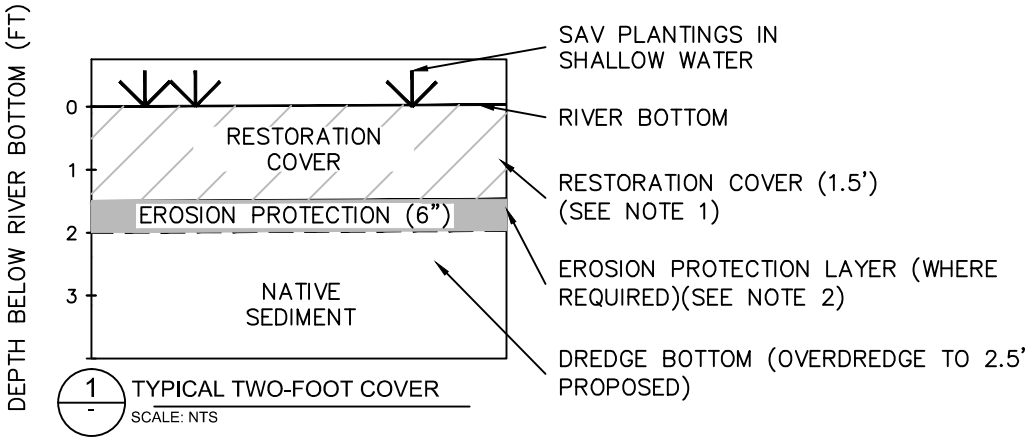
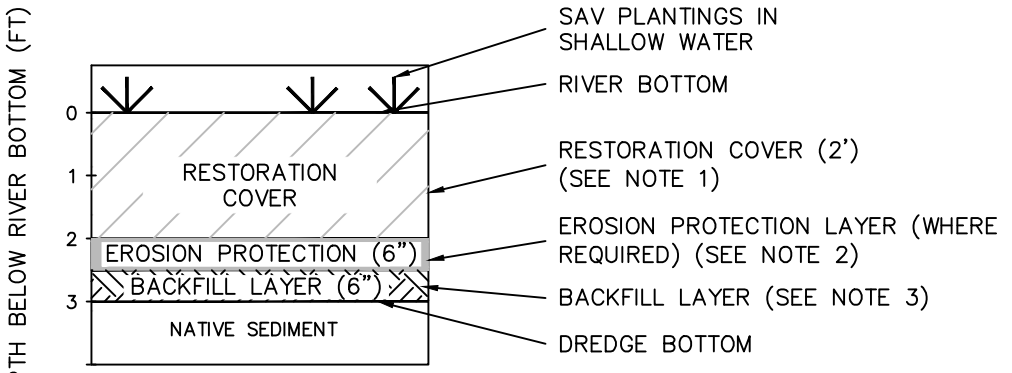
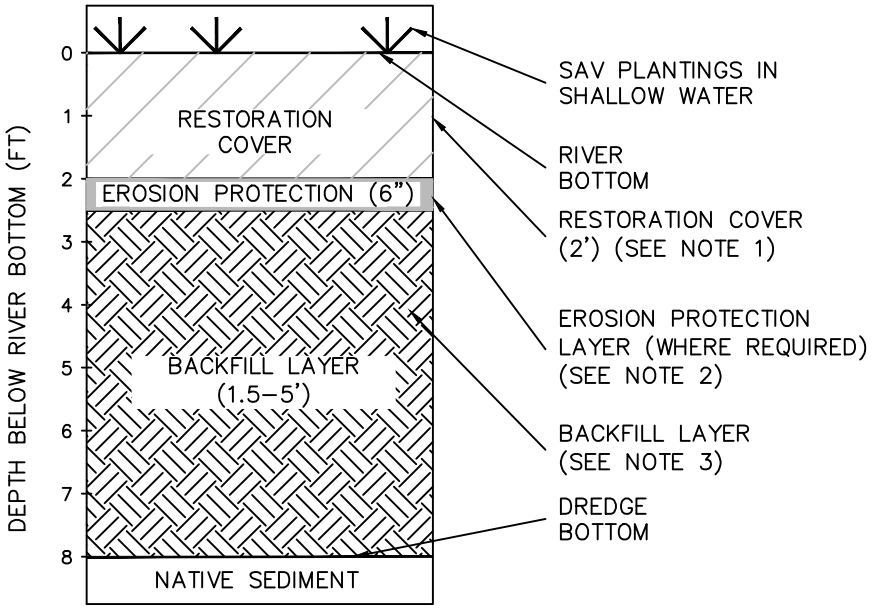



1 - TYPICAL TWO-FOOT COVER
SCALE: NTS




2 - TYPICAL THREE-FOOT BACKFILL/COVER
SCALE: NTS




3 - TYPICAL FOUR TO EIGHT-FOOT BACKFILL/COVER
SCALE: NTS

NOTE:
1. RESTORATION LAYER TO CONSIST OF BLEND OF SMALL COBBLE, GRAVEL, SAND, AND FINES WITH TOTAL ORGANIC CARBON CONTENT OF 5–10%. SEE SPECIFICATIONS FOR ADDITIONAL DETAILS.
2. EROSION PROTECTION LAYER TO CONSIST OF 2–INCH WASHED STONE. SEE SPECIFICATIONS FOR ADDITIONAL DETAILS.USE OF 1–INCH STONE SECURED IN GEOTEXTILE WEB WITH MINIMAL THICKNESS OF 3 INCHES IS AN ACCEPTABLE ALTERNATIVE.
3. BACKFILL LAYER TO CONSIST OF SMALL COBBLE, GRAVEL, SAND AND FINES BLEND WITH TOTAL ORGANIC CARBON CONTENT OF 5–10%. SEE SPECIFICAITONS FOR ADDITIONAL DETAILS.

AECOM

| | |
|---|---|
| OU-2 RD/RA Workplan<br>BASF Corporation<br>Rensselaer, New York | **COVER SYSTEM DETAIL** |
| DATE: AUG 2016 \| DRWN: KM | **FIGURE 3-3** |

# Appendix A – USEPA and NYSDEC PCB Communications

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 2
2890 WOODBRIDGE AVENUE
EDISON, NEW JERSEY 08837-3679

0' 30 2015

**CERTIFIED MAIL - RETURN RECEIPT REQUESTED**
**Article Number: 7012 3460 0002 1646 4125**

Mr. Douglas Reid-Green
BASF Corporation
100 Park Avenue
Florham Park, New Jersey 07932

**Re: Polychlorinated Biphenyl (PCB) Waste Storage, Handling, and Disposal Plan Former BASF Corporation Manufacturing Facility, Rensselaer, New York**

Dear Mr. Reid-Green:

This is in response to the March 30, 2015 correspondence from AECOM, submitted on behalf of BASF Corporation (BASF), transmitting the document entitled "PCB Waste Storage, Handling, and Disposal Plan" (WSHP). The WHSP was developed for cleanup activities associated with BASF's former manufacturing facility in Rensselaer, New York (the Site). The document addresses the management of PCB-contaminated sediments, located within the Hudson River, which will be encountered during BASF's cleanup of sediments contaminated with volatile organic compounds (VOCs) and metals.

Please be advised that the United States Environmental Protection Agency (EPA) has reviewed the WSHP and has prepared the following comments.

**The Source of the PCBs in the Sediment:** BASF asserts that the PCBs present in the Hudson River adjacent to the Site could not have originated from the Site, and the company provided documentation from the New York State Department of Environmental Conservation (NYSDEC) indicating NYSDEC concurrence with this conclusion. BASF's rationale for its assertion includes the following:

- PCBs were not used as part of any process, technology, or treatment system at the Site;
- while PCBs were found in the sediment at concentrations up to 220 parts per million (ppm), the maximum PCB concentration in the on-site soil was 3.19 ppm;
- the low levels of PCBs detected at the Site were from different Aroclor mixtures than have been detected in the Hudson River sediment adjacent to the Site; and
- the discharge of VOCs to the Hudson River ceased in 1976, prior to BASF acquiring the Site. Since the VOCs identified in the sediments were released prior to 1978 the co-located PCBs likely were also released prior to 1978.

While the differing Aroclor mixtures may be the result of weathering of the PCBs, based on the other information provided, EPA believes that the PCBs found in the Hudson River adjacent to the Site are not likely associated with the Site and therefore the likely result of a pre-1978 release. PCBs from a pre-1978 release that are present at as-found concentrations of less than 50 ppm are not regulated for disposal under the Toxic Substances Control Act (TSCA). Furthermore, PCBs from a pre-1978 release that are present at as-found concentrations of 50 ppm or greater are presumed not to present an unreasonable risk of injury to health or the environment (unless the EPA Regional Administrator determines otherwise). Since we agree with BASF that the PCBs in this location of the Hudson River are not likely associated with the Site, EPA will not, at this time, require the cleanup of PCBs that are not co-located with Site-related contaminants. However, please be advised that EPA may modify its position if new or additional information is presented to the Agency for review.

**Delineation of PCBs:** It is EPA's understanding that BASF vertically averaged discrete samples from individual sample cores to obtain an average concentration at each sample location. This vertically-averaged concentration will then be used to evaluate disposal options. Under TSCA, vertical averaging of discrete samples constitutes dilution and is therefore not allowed. BASF must evaluate its disposal options for PCBs based on the discrete sample results.

**PCB Disposal**: Under TSCA, PCBs that were released into the environment before 1978 and which are currently at concentrations below 50 ppm are not regulated for disposal. However, sediments with PCB concentrations at or above 50 ppm are regulated and may be disposed in a TSCA-permitted facility, without an EPA approval, under the performance-based provisions of 40 CFR 761.61(b). Please confirm that it is BASF's intent to dispose of PCBs in this manner.

**Thermal Treatment of Sediments:** BASF proposes on-site thermal treatment of sediments with elevated levels of VOCs, provided that the PCB concentrations in the excavated sediments are below 50 ppm. Please note that if the pre-excavation PCB concentrations are equal to or above 50 ppm (and the concentration is reduced to below 50 ppm due to dilution from the excavation process) then BASF must obtain an EPA approval for the thermal treatment system (please see 40 CFR 761.60(e)).

Based on the above comments EPA cannot, at this time, concur with BASF's proposal for addressing PCBs. Should you have any questions or wish to discuss this matter, please contact James S. Haklar at (732) 906-6817 or at haklar.james@epa.gov.

Sincerely yours,

for John Gorman, Chief
Pesticides and Toxic Substances Branch

cc: John Strang, NYSDEC

**New York State Department of Environmental Conservation**
**Office of General Counsel, 14th Floor**
625 Broadway, Albany, New York 12233-1500
**Fax:** (518) 402-9018 or (518) 402-9019
**Website:** www.dec.ny.gov

Joe Martens
Commissioner

July 12, 2011

Nan Bernardo, Esq.
Senior Environmental Counsel
BASF Corporation
100 Campus Drive
Florham Park, NJ 07932

Re: BASF Manufacturing Plant, Site No. 442027, Rensselaer
PCBs in Hudson River Sediment

Dear Nan:

This letter is a response to BASF's request for the Department's position on BASF's responsibility for PCBs that have been found in Hudson River sediment adjacent to the former Rensselaer facility.

In forming our position, the Department has reviewed a March 31, 2009 letter and attached materials from Roux Associates, a November 8, 2010 letter and attached materials from you in response to my request for additional information, and the various sediment data that has been collected during investigations of the Hudson River as part of Operable Unit 2 for the BASF Manufacturing Plant site.

As a result of our review, the Department has found no evidence to date which indicates that BASF used or disposed of PCBs during the history of industrial practices at the Rensselaer facility. Accordingly, the Department will limit BASF's investigation and remediation of PCBs to those areas of Hudson River sediment that are co-located with contamination from BASF's operations. The Department will require BASF to properly characterize and remediate PCB contaminated sediment that is commingled with contamination caused by its operations, but BASF will only be required to continue remediation until remedial obligations are achieved, as determined by the Department, for the contamination caused by BASF-related operations. Please note that our position is based on information known to the Department at this time, and our position is subject to change based on discovery of new information or unknown conditions.

The Department is currently reviewing work plans submitted by BASF, including a PCB Sampling and Analysis Work Plan, and the Department will contact BASF under separate cover responding to such work plans.

Nothing herein waives any of the Department's rights and the Department expressly reserves all rights with respect to BASF and any other party under applicable law.

Very Truly Yours,

Andrew Guglielmi

ec: Doug Reid-Green, BASF
John Strang, DEC

# Appendix B - Bulkhead Design and Geotechnical Data

# Bulkhead Design

Hudson River Operable Unit 2
BASF Rensselaer
Rensselaer, New York

**Prepared for:**
BASF Corporation
Florham Park, New Jersey

**Prepared by:**
AECOM
40 British American Blvd.
Latham, NY 12110

December 2016

**Table of Contents**

## 1.0 INTRODUCTION

### TASK

Design new bulkhead system along a similar alignment to the existing 1936 and pre-1936 bulkheads to allow for dredge excavation of impacted soils.

### REFERENCES

1. Geo-Institute, Guidelines of Engineering Practice for Braced and Tied-Back Excavations, Geotechnical Special Publication No. 74, ASCE, 1997
2. MacNab, Alan, P.Eng., Earth Retention Systems Handbook, McGraw-Hill Handbooks, 2002
3. Puller, Malcom, Deep Excavations: A Practical Manual, 2nd Edition, Thomas Telford, London, 2003
4. United States Steel, Steel Sheet Piling Design Manual, July 1975
5. AISC, Steel Construction Manual, 13th Edition, December 2005
6. Salmon, Charles G., and John E. Johnson, Steel Structures: Design and Behavior, 4th Edition, Prentice Hall, 1996

## 2.0 SUBSURFACE CONDITIONS

Test borings generally encountered the following soil strata along the bulkhead alignment, from the surface downward:

- Fill: Brown sand with varying quantities of silt, gravel, clay, and miscellaneous debris, including cinders, wood, brick, metal, organics, and other debris. Based on standard penetration test resistance values, the fill is typically loose to medium compact. Fill was encountered on the land side of the bulkhead, extending to depths of up to approximately 18 feet. It was presumably placed behind the bulkhead to create useable land.

- Sand and Silt: Brown and gray sand and silt with varying quantities of gravel and clay. Based on standard penetration test resistance values, this stratum is typically loose to medium compact. On the land side of the bulkhead, the sand and silt is about 9 to 18 feet thick, extending to depths of approximately 24 to 26 feet below grade. This stratum pinches out to the west (i.e., towards the river).

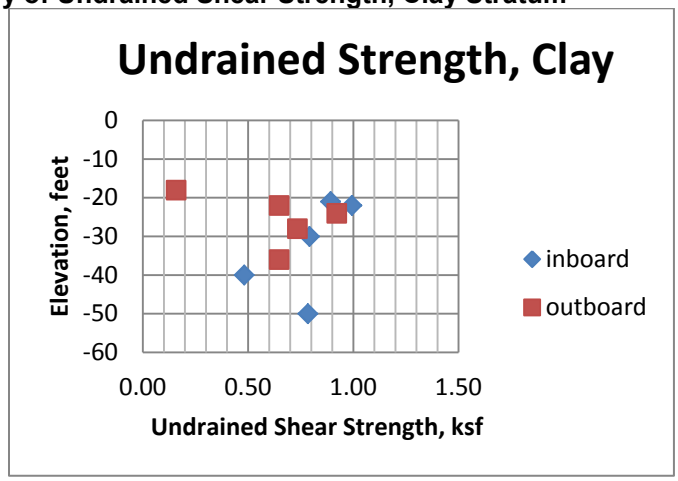
- Clay: Gray silty clay. Standard penetration test resistance values in this soil varied from Weight of Hammer (WH) to 6 blows per foot. The clay stratum has a thickness varying from about 17 to 42 feet. These soils correspond to glacial lacustrine silts and clays deposited in the former proglacial Lake Albany at the end of the Wisconsin Ice Age. Based on laboratory strength testing, this clay soil is generally medium stiff.

- Sand and Gravel: Dark gray sand and gravel with varying quantities of silt, clay, and rock fragments. Based on standard penetration test resistance values, this stratum is typically medium compact to very compact. The sand and gravel extends to top of weathered shale bedrock

### 2.1 Geotechnical Design Parameters

Laboratory testing of the clay soils indicate that they have undrained shear strength generally ranging from about 0.5 to 1.0 ksf. The data infers that the undrained shear strength of these soils is somewhat lower on the outboard side of the bulkhead relative to the strength behind the bulkhead, as illustrated in Figure No. 1:

**Figure No. 1. Summary of Undrained Shear Strength, Clay Stratum**



The shear strength of the cohesionless soils in the soil profile was estimated based on correlation with SPT blow counts.

Design parameters are summarized in Table No. 1:

**Table No. 1. Geotechnical Design Parameters**

| Parameter | Fill | Sand & Silt | Clay (Inboard) | Clay Outboard | Sand & Gravel |
|---|---|---|---|---|---|
| Total Unit Weight, pcf | 120 | 120 | 120 | 120 | 125 |
| Friction Angle, φ, degrees | 30 | 30 | N/A | N/A | 36 |
| Undrained Shear Strength, $s_{u,}$ psf | N/A | N/A | 750 | 600 | N/A |
| Interface Friction Angle, δ (degrees) (steel sheetpile against soil, passive side only) | 11 | 11 | N/A | N/A | 14 |

## 3.0 SHEETPILE ANALYSIS

The 1936 bulkhead is in poor condition. Because of its poor condition, the performance of this wall during remediation construction is uncertain. Therefore, it should be upgraded with a new steel sheetpile bulkhead to facilitate proposed remediation construction.

The old concrete/timber bulkhead structure is also in poor condition. Accordingly, it is recommended that a new steel sheetpile bulkhead be constructed where this bulkhead will be impacted by remediation construction.

### 3.1 Design of the Sheetpile Bulkhead within the Existing 1936 Bulkhead

The sheet pile bulkhead has been designed using the soil parameters and geometry cited in section 2.1. Shoring Suite was used to compute the minimum sheet pile embedment and bracing loads. Shoring Suite used traditional wedge analysis to determine lateral pressures from soil, water, and surcharge. The clay layer was modeled as a clay equivalent with cohesionless soil properties. The program recommends using the clay equivalent feature since cohesion is not reliable in shoring design. Due to the total wall height and the need to dredge in front of the existing wall, the sheet pile walls will require additional support from a deadman system. Prosheet was used to design the anchor wall. See attached section locations, computer software output files and bracing design.

The sheetpile bulkhead section X-X was analyzed based on the following assumptions:

- Assumptions for Design:
    - Proposed Top of wall, Elev. +11
    - Mudline, Elev. -5
    - Mean lower low water, Elev. -1.8. Assume 1.0’ differential water pressure.
    - Ground slope behind wall, +6 degrees
    - Mudline slope in front of wall, -7 degrees
    - Tie rod 5’ below top of wall, Elev. +6
    - Top of clay, Elev. -18
    - Maximum Dredge depth of 8 Feet, Elev. -13
    - Maximum live load surcharge, 400psf
    - Wall friction neglected on active side for fill/sand soil. This is conservative.
    - Existing wall does not provide lateral support.

### 3.2 Design of the Sheetpile Bulkhead within the Existing Pre-1936 Bulkhead

The sheetpile bulkhead section Y-Y was analyzed based on the following assumptions:

- Assumptions for Design:
    - Proposed Top of wall, Elev. +11
    - Mudline, Elev. -4
    - Mean lower low water, Elev. -1.8. Assume 1.0’ differential water pressure.
    - Ground slope behind wall, +6 degrees & varies to +16.5 degrees
    - Mudline slope in front of wall, -6 degrees
    - Tie rod 5’ below top of wall, Elev. +6
    - Maximum Dredge depth of 4 Feet, Elev. -8
    - Top of clay, Elev. -11
    - Maximum live load surcharge, 400psf
    - Wall friction neglected on active side for fill/sand soil. This is conservative.
    - Existing wall does not provide lateral support.

## 4.0 SUMMARY

See attached section locations, computer software output files and bracing design.

**Table No. 2 Summary of Sheetpile Design**

| Case | Location / Description | Dredge Depth, feet | Surcharge Load, ksf | Wall Height, feet | Max. Moment, kip-ft | Required Section Modulus, in^3/ft | Sheetpile Length, ft (without safety factor) | Sheetpile Length, feet (Add 25% Embedment Length) | Anchor Force, kips/foot |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| 1A* | Cantilever Along 1936 Sheetpile | 0 | 400 | 11 | 77.73 | 28.3 | 39.30 | 46.38 | N/A |
| 1B | Along 1936 Sheetpile | 8 | 400 | 24 | 90.19 | 32.8 | 41.67 | 46.09 | 12.5 |
| 2A* | Cantilever Along Pre-1936 Sheetpile | 0 | 400 | 10 | 53.50 | 19.5 | 33.90 | 39.88 | N/A |
| 2B | Along Pre-1936 Sheetpile | 4 | 400 | 19 | 40.96 | 14.9 | 32.90 | 36.38 | 11.9 |

*The cantilever analyses (1A and 2A) are prior to the installation of the tie rod anchors.

- All steel sheetpiling shall have a minimum yield strength of 50 ksi and a minimum section modulus of 33.5in$^3$/ft. The proposed AZ18-700 meet both requirements (Section Modulus of 33.5in$^3$/ft).
- All wide flange shapes (“c” channels) and steel plates shall be new and shall have a minimum yield strength of 50 ksi.
- All welding shall be performed with E70XX electrodes in accordance with the AISC Manual of Steel Construction, 14$^{th}$ Edition. Welding shall be performed by AWS Certified Welders.
- Prior to the installation of the proposed sheetpile wall, pre-cut area directly behind the existing wall to the proposed deadman tie rod elevation (Elevation +6.0’). Install proposed sheeting and lateral bracing prior to backfilling and compacting to the proposed top elevation of the sheet pile wall (Elevation +11.0’) and/or dredging operations.
- Internal bracing shall consist of members and connections shown on the drawings unless otherwise approved by the engineer.
- Excavation depths shall not exceed the proposed maximum dredge cuts without first notifying the engineer.
- The proposed maximum surcharge load of 400psf has been incorporated into the design and shall not be exceeded without first notifying the engineer.
- See drawings for additional information regarding the internal bracing and sheeting layout.

## Plan View and Design Sections

2 FT

4 FT

6 FT

8 FT

4 FT

6 FT

2 FT

A

A'

B

B'

C

C'

D

D'

APPROXIMATE LOCATION OF EMPIRE OUTFALL DIFFUSER PIPE

APPROXIMATE LOCATION OF EXISTING SHEET PILE SHORING

INACTIVE STORMWATER OUTFALL PIPE (APPROX. LOCATION)

1974 STEEL SHEET PILE BULKHEAD WALL

1980 STEEL SHEET PILE BULKHEAD WALL

1936 STEEL SHEET PILE BULKHEAD WALL

PRE-1936 CONCRETE BULKHEAD WALL

TB-1

TB-2

TB-3

TB-4

INACTIVE PRODUCTION SEWER (TEMPORARY) (APPROX. LOCATION)

INACTIVE PRODUCTION SEWER (APPROX. LOCATION)

FILL TO ELEVATION 17'

FILL TO ELEVATION 19'

FILL TO ELEVATION 18'

Section X-X

Section Y-Y

TWO 8'8" SWING GATES

ONE 24' ROLLER GATE

TWO 19'8" SWING GATES

EXISTING 6' FENCE

NOTE:

1. LIMITS OF WORK ARE WITHIN FENCE ON-SITE. TREES SHOWN ON PLAN SHALL BE PROTECTED FROM DAMAGE. REMAINING AREA SHALL BE MOWED PRIOR TO GRADING WORK. CONTRACTOR SHALL MAINTAIN A BUFFER OF UNDISTURBED VEGETATION 15 FEET FROM BULKHEAD AND TOP OF BANK.
2. GRADED AREAS WILL BE FILLED WITH COMMON FILL MATERIAL TO WITHIN 1 FOOT OF FINAL GRADE. SUB BASE MATERIAL WILL BE PLACED OVER COMMON FILL MATERIAL AND GRADED TO FINAL GRADES AS SHOWN.

0 40' 80'

PRIVILEGED & CONFIDENTIAL
PREPARED AT THE REQUEST OF COUNSEL

| NO | DRWN | DATE | REVISION | CHKD | DATE | APPVD | DATE |
|---|---|---|---|---|---|---|---|
| 7 | | | | | | | |
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BASF CORPORATION
HUDSON RIVER OU-2
RENSSELAER, NEW YORK

PROJ. NUMBER: 60323713

DATE: 11/04/2016

# BULKHEAD ANALYSIS

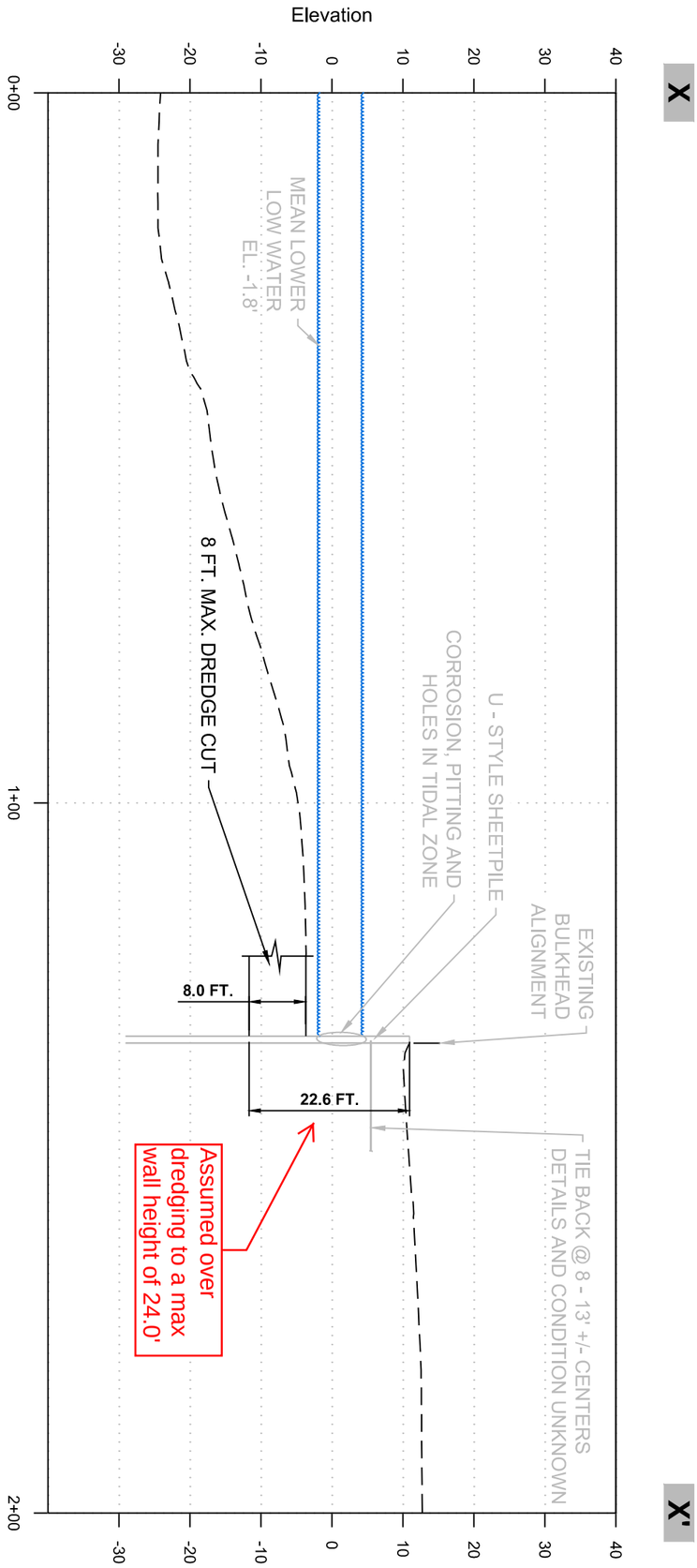
UPLAND SITE PREPARATION
SEDIMENT REMEDIATION DESIGN

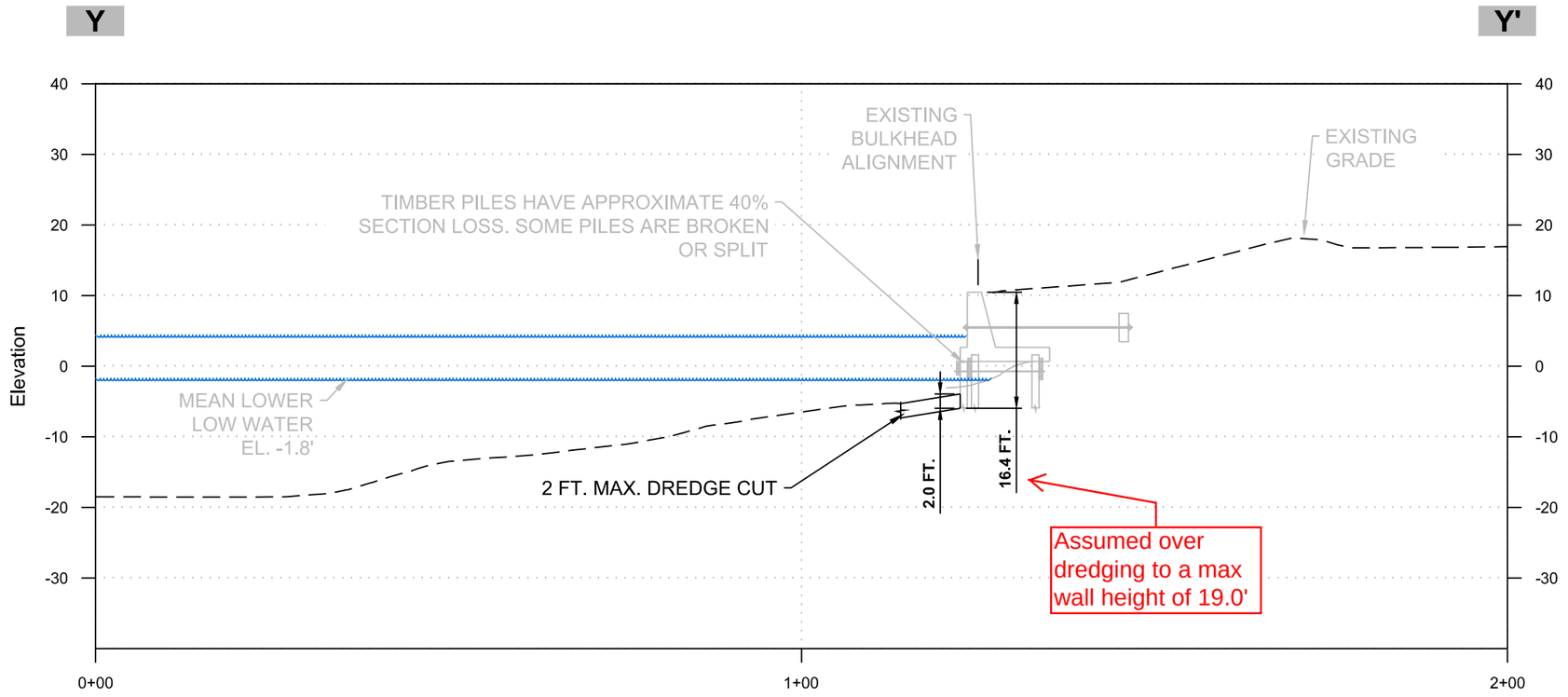
DRAWING NUMBER:

SHEET NUMBER:

REVISION 0

**SECTION X - X'**
**1936 BULKHEAD**






## SECTION Y - Y'
## PRE-1936 CONCRETE BURKHEAD

NOTE:

CONCRETE BULKHEAD BASED ON AVAILABLE DRAWINGS.

AECOM

Figure: YY

BULKHEAD ANALYSIS
SECTION Y - Y'
PRE-1936 CONCRETE BULKHEAD
EXISTING

SEDIMENT REMEDIATION DESIGN
HUDSON RIVER OU-2
BASF CORPORATION
Project No.: 60323713 Date: DECEMBER 2016

**Shoring Suite Files**

*Model Results are Available  Upon Request*

# Bulkhead Analysis Report

Hudson River Operable Unit 2
BASF Rensselaer
Rensselaer, New York

**Prepared for:**
BASF Corporation
Florham Park, New Jersey

**Prepared by:**
AECOM
40 British American Blvd.
Latham, NY 12110

November 2016

**Table of Contents**

## 1.0 INTRODUCTION

This Report presents the results of analyses performed for the existing bulkhead wall at the eastern shore of the Hudson River at the former BASF Rensselaer facility. The bulkhead comprises four sections. From the south and progressing northward, these sections are dated approximately 1974, 1980, 1936, and pre-1936. The condition of the bulkhead varies from good to poor, correlating with the age of the structure.

The primary goals of this study were tailored to the following objectives:

1. Determine the existing condition of the four bulkhead sections. This was based on field inspections and diver surveys, plus review of available drawings.

2. Analyze the bulkhead sections to evaluate stability under existing conditions and during remediation dredging with anticipated cuts of up to 8 feet.

In summary, proposed dredging can be performed in front of the 1974 and 1980s bulkhead provided that measures are taken to minimize increase in tieback anchor loads. These may include:

- Do not allow construction surcharge loads behind the bulkhead during dredging operations; and

- Enhance bulkhead stability by providing a precut behind the bulkhead to reduce lateral pressures and/or by installing supplemental tieback anchors.

The 1936 bulkhead is in poor condition. It should be replaced to facilitate planned dredging to depths up to 8 feet.

The older concrete and timber pile bulkhead is likewise in poor condition and should also be replaced to allow dredging.

## 2.0 EXISTING BULKHEAD STRUCTURE

The existing bulkhead comprises four different sections of wall that range in exposed wall height from approximately 12' to 15.5' high. These are described below, beginning in the south and progressing northward.

### 2.1 1974 Bulkhead

Based on field measurements, the 1974 section of the bulkhead extends approximately 270 lineal feet.

An available drawing (*Pollution Abatement Project, GAF Corp. & Winthrop Laboratories Bulkhead, Plan, Section & Details, prepared by Nebolsine, Toth, McPhee Associates, 2/1/74)* indicates that this bulkhead was constructed using PZ-27 sheetpiles that penetrated a minimum of 18' below river bottom. This corresponds to sheetpile tip at Elev. -23' (or deeper), assuming river bottom to be approximately Elev. -5' as shown on the drawing. The minimum sheetpile length is therefore about 34 feet, assuming top of bulkhead at Elev. +11 as shown on the drawing. (The elevation datum is not defined on the drawing.)

The drawing also indicates that tieback anchors are positioned approximately 5 feet below the top of bulkhead (Elev. +6.0). Tiebacks are shown to comprise 2½" tierods at maximum 12-foot centers connected to a continuous reinforced concrete deadman positioned 55' behind the bulkhead. The deadman is shown to have depth of 4 feet and thickness of 1.5 feet. Tierods are connected to a double channel wale (MC-12) attached to the outboard face of the bulkhead.

Field measurements made in 2009 and 2016 are summarized in Table No. 1. These indicate that the existing sheetpiles in the 1974 bulkhead have approximate width of 20 inches, depth of 12 inches, and thickness of about 0.4 inches. These dimensions do not appear to conform to PZ-27 sheetpiles, which have a (driving) width of only 18 inches. Because AECOM does not have as-built information for this section of the bulkhead, the actual sheetpile section is unknown. Based on measured dimensions, it would have a lower Section Modulus than PZ-27 sheets.

**Table No. 1.**
**Summary of Field Measurements, 1974 Sheetpile Bulkhead**

| Item | Dimensions | Remarks |
|---|---|---|
| Sheetpile Cross Section | 20" wide by 12" deep by 3/8" thick | Measured dimensions do not conform to PZ 27 sheets shown on drawings. |
| Double Channel Wale | 3.5" x 12" channels | Wale on outboard side, approximately 5' below top of bulkhead (conforms to drawing). |
| Tie Rod | 2-1/8" diameter, spaced at approximately 12'-3" | Drawing indicates 2½" tierod and maximum spacing of 12'. |
| Tie Rod Bearing Plate | 3" x 3" x ¼" | Some plates are bent. Bearing plate not defined on drawing. |

During the 2009 field inspection, the 1974 sheetpiles were found to be near vertical and in good alignment. Although there was some evidence of minor scaling and pitting in the tidal zone (less than 1/16"), the sheetpiles were found to be in good structural condition with little section loss. The steel for the external waler was also in good condition with no evidence of significant section loss. The thickness

of the sheetpile steel was measured at random locations using a "d-meter" and found to range from 0.38" to 0.42". One significant defect was found, an apparent horizontal crack at mudline (approximately 2' long), located at a distance of approximately 210 feet from the southern end of the bulkhead.

During the 2009 field inspection it was also noted that several of the 6" by 6" by ¼" thick steel bearing plates for the tie rods are bent between the nut of the tie rod and the bearing area on the wale channels. It is not known whether these bearing plates have been overloaded or were under-designed. The structural condition of the tie rods, deadmen, and internal connections are unknown because they are buried behind the sheeting and could not be observed.

### 2.2 1980's Bulkhead

The next section of the sheet pile wall is approximately 180 feet long and was constructed in the 1980's.

Based on available drawings (Clough Harbour & Associates, 2/28/81, 3 sheets), this "newer" steel sheet pile bulkhead was constructed using PZ-27 or PDA-27 sheetpiles with lengths of 40 feet. Top of the sheetpile bulkhead is indicated to be Elev. 11.75'. Elevations are referenced to "BASF Wyandotte Corporation Datum Relative to Monument No. 25."

The drawings also indicate that tieback anchors are positioned approximately 6 feet below the top of bulkhead (Elev. +5.75'). Tiebacks are shown to comprise 2" tierods at about 9-foot centers connected to individual reinforced concrete deadman positioned approximately 20' behind the bulkhead. Tierods are connected to a double channel wale (C12×25) attached to the inboard side of the bulkhead.

Field measurements made in 2009 are summarized in Table No. 2. These indicate that the existing sheetpiles in the 1980s bulkhead have approximate width of 18.5 inches, depth of 12 inches, and flange thickness of about 0.4 inches. These dimensions appear to conform to PZ-27 sheetpiles.

**Table No. 2.**
**Summary of Field Measurements, 1980's Sheetpile Bulkhead**

| Item | Dimensions | Remarks |
|---|---|---|
| Sheetpile Cross Section | 18.5" wide by 12" deep by 3/8" thick | Measured dimensions appear to conform to PZ 27 sheetpiles shown on drawings. |
| Double Channel Wale | On inboard side; not visible | - |
| Tie Rod | On inboard side; not visible. | - |
| Tie Rod Bearing Plate | On inboard side; not visible | - |

The newer 1980's steel sheetpile bulkhead was also found to be in good condition with near vertical sheets all in good alignment. There were no visible signs of structural deficiencies in the steel sheet piles. The measured thickness of this section of steel sheetpile ranged from 0.39" to 0.43", indicating little to no loss of section.

The structural condition of the wale channels, tie rods, deadmen, and internal connections are unknown because they are buried behind the sheeting.

Approximately 130 feet north from the start of these sheets, a 20 foot section of steel sheet piles was pulled in 2009 to install an outfall structure for a nearby facility. When the outfall structure was completed

the pulled sheets were reinstalled in this area. However, one of these sheet pile joints was observed to not connect or align properly, leaving a gap of about 1½ inches.

### 2.3 1936 Bulkhead

The remaining 260± feet of steel sheetpile bulkhead to the north of the newer sections was reportedly constructed around 1936. Tie rods were field measured to have non-uniform spacing that ranged from approximately 8' to 13'. These sheetpiles are "U" shaped with approximate dimensions of 15.75" (width) by 6.3" (depth) by 0.4" (thickness).

The 1936 steel sheet pile bulkhead was found to be nearly vertical and in relatively good alignment. Upon close inspection, these sheet piles revealed structural deficiencies in the tidal zone, extending over a height of approximately 2.5 to 3 feet, approximately 12 feet below the top of the sheets. Along the entire length of bulkhead, areas of corrosion, pitting, and ¼" to ½" diameter holes were randomly found in each sheet. The thickness of steel around these "Swiss cheese" like holes ranged between 0.17" to 0.31". On the less corroded areas the measured steel thickness ranged from 0.35" to 0.42".

Approximately 160 feet north from the start of these sheets, there are signs of significant section loss in the remaining northern steel sheeting. The sheeting in this area had larger holes ranging in size from 5" by ¼" to the largest a 30' horizontal length by 2' high "Swiss cheese" like area with nearly 100% section loss in the tidal zone.

Approximately 10 feet north from the start of these sheets, there was evidence of collision damage, approximately 5' high by 3' wide in the sheeting near the connection to the newer sheets to the south.

Throughout this wall section there are a few missing connections and/or anchors between the interior bracing system and the steel sheeting.

### 2.4 Pre-1936 Concrete Bulkhead

To the north of the 1936 sheetpiles, the bulkhead changes to a concrete bulkhead structure founded on timber piles. This concrete bulkhead appears to be the original wall and also runs behind the steel sheet pile bulkhead. This concrete bulkhead continues north for quite some length and inspection of this portion of the wall was limited to a length of approximately 100 feet.

This section of the original concrete bulkhead also showed signs of structural deficiencies. The concrete wall and footing have transverse and longitudinal cracking. There are areas of the footing that have broken off and are missing. The concrete has substantial losses due to scaling, honeycombing, and wear from the river. The timber foundation piles have approximately 40% section loss and there is evidence that some piles are broken or split. The diver probed the timber piles to determine if there were any soft areas. Despite the advanced deterioration of the concrete bulkhead there were no signs of displacement or movement in the portion of the wall inspected.

## 3.0 SUBSURFACE CONDITIONS

Test borings generally encountered the following soil strata along the bulkhead alignment, from the surface downward:

- Fill: Brown sand with varying quantities of silt, gravel, clay, and miscellaneous debris, including cinders, wood, brick, metal, organics, and other debris. Based on standard penetration test resistance values, the fill is typically loose to medium compact. Fill was encountered on the land side of the bulkhead, extending to depths of up to approximately 18 feet. It was presumably placed behind the bulkhead to create useable land.

- Sand and Silt: Brown and gray sand and silt with varying quantities of gravel and clay. Based on standard penetration test resistance values, this stratum is typically loose to medium compact. On the land side of the bulkhead, the sand and silt is about 9 to 18 feet thick, extending to depths of approximately 24 to 26 feet below grade. This stratum pinches out to the west (i.e., towards the river).

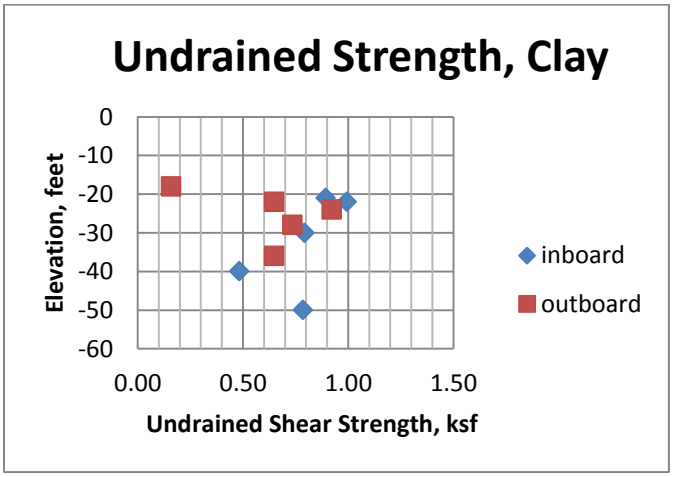
- Clay: Gray silty clay. Standard penetration test resistance values in this soil varied from Weight of Hammer (WH) to 6 blows per foot. The clay stratum has a thickness varying from about 17 to 42 feet. These soils correspond to glacial lacustrine silts and clays deposited in the former proglacial Lake Albany at the end of the Wisconsin Ice Age. Based on laboratory strength testing, this clay soil is generally medium stiff.

- Sand and Gravel: Dark gray sand and gravel with varying quantities of silt, clay, and rock fragments. Based on standard penetration test resistance values, this stratum is typically medium compact to very compact. The sand and gravel extends to top of weathered shale bedrock

### 3.1 Geotechnical Design Parameters

Laboratory testing of the clay soils indicate that they have undrained shear strength generally ranging from about 0.5 to 1.0 ksf. The data infers that the undrained shear strength of these soils is somewhat lower on the outboard side of the bulkhead relative to the strength behind the bulkhead, as illustrated in Figure No. 1:

**Figure No. 1. Summary of Undrained Shear Strength, Clay Stratum**



The shear strength of the cohesionless soils in the soil profile was estimated based on correlation with SPT blow counts.

Design parameters are summarized in Table No. 3:

**Table No. 3. Geotechnical Design Parameters**

| Parameter | Fill | Sand & Silt | Clay (Inboard) | Clay Outboard | Sand & Gravel |
|---|---|---|---|---|---|
| Total Unit Weight, pcf | 120 | 120 | 120 | 120 | 125 |
| Friction Angle, φ, degrees | 30 | 30 | N/A | N/A | 36 |
| Undrained Shear Strength, $s_{u,}$ psf | N/A | N/A | 750 | 600 | N/A |
| Interface Friction Angle, δ (degrees) (steel sheetpile against soil, passive side only) | 11 | 11 | N/A | N/A | 14 |

## 4.0 SHEETPILE ANALYSIS

The stability of the 1974 and 1980s bulkheads were analyzed for existing conditions and for temporary conditions during proposed remediation construction. Dredge depths ranging from 2 to 8 feet were considered. In addition, the feasibility of construction surcharge loads immediately behind the bulkhead was also evaluated.

The 1936 bulkhead is in poor condition. Therefore, it should be upgraded with a new steel sheetpile bulkhead to facilitate proposed remediation construction.

The old concrete/timber bulkhead structure is also in poor condition. Accordingly, it is recommended that a new steel sheetpile bulkhead also be constructed where this bulkhead will be impacted by remediation construction.

### 4.1 Analysis of the 1974 Bulkhead

The 1974 sheetpile bulkhead was analyzed based on the following assumptions:

- Anchored Sheetpile Bulkhead:
    - Top of wall, Elev. +11
    - Sheetpile length = 34'
    - Sheetpile section unknown. Assume ASTM A328 with 25 ksi allowable stress. Assume section modulus ≈ 24 $in^3$/ft (≈ 80% of PZ 27)
    - Mudline, Elev. -3
    - Mean lower low water, Elev. -1.8. Assume 1.0' differential water pressure.
    - Ground slope behind wall, +4 degrees
    - Mudline slope in front of wall, -7 degrees
    - Deadman anchor tierod, 2⅛" diameter, grade 36; 70± kip allowable capacity
    - Tieback spacing, 12'-3" centers
    - Tierod 5' below top of wall, Elev. +6
- Subsurface Conditions:
    - Top of clay, Elev. -12
    - Wall friction neglected on active side for fill/sand soil. This is conservative.

Analyses were performed for 11 different cases as summarized in Table No. 4. These include existing conditions, dredging to various depths, and surcharge load conditions. Results indicate that:

1. In general, the tiebacks are the "weak link," limiting the depth of dredging and magnitude of surcharge loads behind the bulkhead.

2. The existing steel bearing plates between the anchor nut and the double channel wale are bent and deformed, indicating that they have been overstressed in the past. Since dredging (or adding surcharge loads) will increase the anchor force relative to existing conditions, these bearing plates need to be strengthened or replaced with more robust ones. (See attached calculations.)

3. To minimize increase in the anchor force, surcharge loads should not be applied behind the bulkhead during dredging operations. However, modest surcharge loads of up to about 250 psf are permissible when dredging is <u>not</u> taking place.

4. Dredging up to approximately 4 feet (Elev. -7) is permissible directly in front of the bulkhead. Greater dredging depths will overstress the anchor tierods.

5. Dredging to depths greater than about 4 feet (Elev. -7) would require measures to reduce loads or upgrade the bulkhead. These may include:

    a. Precut the soil behind the bulkhead to reduce lateral earth pressures. For example, a temporary precut behind the wall to a depth of 2 feet, Elev. +9, would allow dredging to a depth of 8 feet.

    b. Install additional tieback anchors. For example, it may be feasible to install a wale and shallow tieback anchors with sheetpile deadmen along the top of the bulkhead wall. These anchors can be positioned midway between the existing anchors, and they can be temporary or permanent. The intent would be to reduce loads in the existing tiebacks during dredging operations.

**Table No. 4. Summary or Sheetpile Analyses, 1974 Bulkhead**

| Case | Description | Dredge Depth, feet | Surcharge Load, ksf | Wall Height, feet | Max. Moment, kip-ft | Required Section Modulus, in^3/ft | Sheetpile Length, ft (without safety factor) | Sheetpile Length, feet (Add 25% Embedment Length) | Anchor Force, kips/foot (without safety factor) | Design Anchor Force, kips/foot (increase by 25%) | Design Anchor Force, kips (anchors at 12'-3" centers) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |
| 1 | Existing Conditions | 0 | 0 | 14 | 11.88 | 5.70 | 22.46 | 24.6 | 3.40 | 4.3 | 52 |
| 2 | Dredge 2' | 2 | 0 | 16 | 17.99 | 8.64 | 24.8 | 27.0 | 4.13 | 5.2 | 63 |
| 3 | Dredge 4' | 4 | 0 | 18 | 24.08 | 11.56 | 26.87 | 29.1 | 4.77 | 6.0 | 73 |
| 4 | Dredge 6' | 6 | 0 | 20 | 29.25 | 14.37 | 28.74 | 30.9 | 5.27 | 6.6 | 81 |
| 5 | Dredge 8' | 8 | 0 | 22 | 32.88 | 15.78 | 30.48 | 32.6 | 5.60 | 7.0 | 86 |
| | | | | | | | | | | | |
| 6 | Dredge 6' with 2' precut | 6 | 0 | 20 | 23.37 | 11.49 | 26.9 | 28.6 | 3.87 | 4.8 | 59 |
| 7 | Dredge 8' with 2' precut | 8 | 0 | 22 | 25.87 | 12.42 | 28.02 | 29.5 | 4.10 | 5.1 | 63 |
| | | | | | | | | | | | |
| 8 | 250 psf surcharge, no dredging | 0 | 0.25 | 14 | 14.70 | 7.06 | 23.36 | 25.7 | 4.67 | 5.8 | 72 |
| 9 | 500 psf surcharge, no dredging | 0 | 0.5 | 14 | 17.93 | 8.83 | 26.64 | 29.8 | 5.99 | 7.6 | 93 |
| | | | | | | | | | | | |
| 10 | Dredge 6' & 250 psf surcharge | 6 | 0.25 | 20 | 37.35 | 17.93 | 32.19 | 35.2 | 7.01 | 8.8 | 107 |
| 11 | Dredge 6' & 500 psf surcharge | 6 | 0.50 | 20 | 51.35 | 24.65 | 40.62 | 45.8 | 9.24 | 11.6 | 141 |

### 4.2 Analysis of the 1980s Bulkhead

The 1980s sheetpile bulkhead was analyzed based on the following assumptions:

- Anchored Sheetpile Bulkhead:
    - Top of wall, Elev. +11
    - Sheetpile length = 40'
    - PZ 27 Sheetpiles. Assume ASTM A328 with 25 ksi allowable stress. Section modulus = 30.2 $in^3$/ft
    - Mudline, Elev. -3
    - Mean lower low water, Elev. -1.8. Assume 1.0' differential water pressure.
    - Ground slope behind wall, +4 degrees
    - Mudline slope in front of wall, -9 degrees
    - Deadman anchor tierod, 2" diameter, grade 36; 60± kip allowable capacity
    - Tieback spacing, 9'± centers
    - Tierod 6' below top of wall, Elev. +5

- Subsurface Conditions:
    - Top of clay, Elev. -18
    - Wall friction neglected on active side for fill/sand soil. This is conservative.

Analyses were performed for 11 different cases as summarized in Table No. 5. These include existing conditions, dredging to various depths, and varying surcharge load conditions. Results are similar to the 1974 bulkhead as summarized below:

1. In general, the tiebacks are the "weak link," limiting the depth of dredging and magnitude of surcharge loads behind the bulkhead.

2. To minimize increase in the anchor force, surcharge loads should not be applied behind the bulkhead during dredging operations. However, modest surcharge loads of up to about 250 psf are permissible when dredging is <u>not</u> taking place.

3. Dredging up to approximately 4 feet (Elev. -7) is permissible directly in front of the bulkhead. Greater dredging depths will overstress the anchor tierods.

4. Dredging to depths greater than about 4 feet (Elev. -7) would require measures to reduce loads or upgrade the bulkhead. These may include:

    a. Precut the soil behind the bulkhead to reduce lateral earth pressures. For example, a temporary precut behind the wall to a depth of 2 feet, Elev. +9, would allow dredging to a depth of 8 feet (Elev. -11).

    b. Install additional tieback anchors. For example, it may be feasible to install shallow tieback anchors at the top of bulkhead using sheetpile deadmen. These can be temporary or permanent. The intent would be to reduce loads in the existing tiebacks during dredging operations.

**Table No. 5. Summary or Sheetpile Analyses, 1980s Bulkhead**

| Case | Description | Dredge Depth, feet | Surcharge Load, ksf | Wall Height, feet | Max. Moment, kip-ft | Required Section Modulus, in^3/ft | Sheetpile Length, ft (without safety factor) | Sheetpile Length, feet (Add 25% Embedment Length) | Anchor Force, kips/foot (without safety factor) | Design Anchor Force, kips/foot (increase by 25%) | Design Anchor Force, kips (anchors at 9' centers) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |
| 1 | Existing Conditions | 0 | 0 | 14 | 10.56 | 5.07 | 22.79 | 25.0 | 3.69 | 4.6 | 42 |
| 2 | Dredge 2' | 2 | 0 | 16 | 16.89 | 8.11 | 25.84 | 28.3 | 4.49 | 5.6 | 51 |
| 3 | Dredge 4' | 4 | 0 | 18 | 24.75 | 11.88 | 28.88 | 31.6 | 5.34 | 6.7 | 60 |
| 4 | Dredge 6' | 6 | 0 | 20 | 34.23 | 16.43 | 32.18 | 35.2 | 6.24 | 7.8 | 70 |
| 5 | Dredge 8' | 8 | 0 | 22 | 45.12 | 21.66 | 35.56 | 39.0 | 7.15 | 8.9 | 80 |
| | | | | | | | | | | | |
| 6 | 6' dredge with 2' precut | 6 | 0 | 20 | 28.09 | 13.48 | 30.58 | 33.2 | 4.71 | 5.9 | 53 |
| 7 | 8' dredge with 2' precut | 8 | 0 | 22 | 36.57 | 17.55 | 33.07 | 35.8 | 5.44 | 6.8 | 61 |
| | | | | | | | | | | | |
| 8 | 250 psf surcharge, no dredging | 0 | 0.25 | 14 | 12.83 | 6.16 | 23.71 | 26.1 | 5.06 | 6.3 | 57 |
| 9 | 500 psf surcharge, no dredging | 0 | 0.5 | 14 | 15.43 | 7.41 | 24.6 | 27.3 | 6.45 | 8.1 | 73 |
| | | | | | | | | | | | |
| 10 | Dredge 6' & 250 psf surcharge | 6 | 0.25 | 20 | 42.07 | 20.19 | 35.17 | 39.0 | 8.08 | 10.1 | 91 |
| 11 | Dredge 6' & 500 psf surcharge | 6 | 0.50 | 20 | 54.37 | 26.10 | 42.94 | 48.7 | 10.27 | 12.8 | 116 |

## 5.0 CONCLUSIONS AND RECOMMENDATIONS

The existing bulkhead comprises four sections. From the south and progressing northward, these sections are dated approximately 1974, 1980, 1936, and pre-1936. The condition of the bulkhead varies from good to poor, correlating with the age of the structure.

In summary, results of sheetpile stability analyses indicate that proposed dredging can be performed in front of the 1974 and 1980s bulkhead provided that the deficient 1974 tieback bearing plates are strengthened and provided that measures are taken to minimize increase in tieback anchor loads. These measures include:

- Construction surcharge loads should not be permitted behind the bulkhead during dredging operations; and

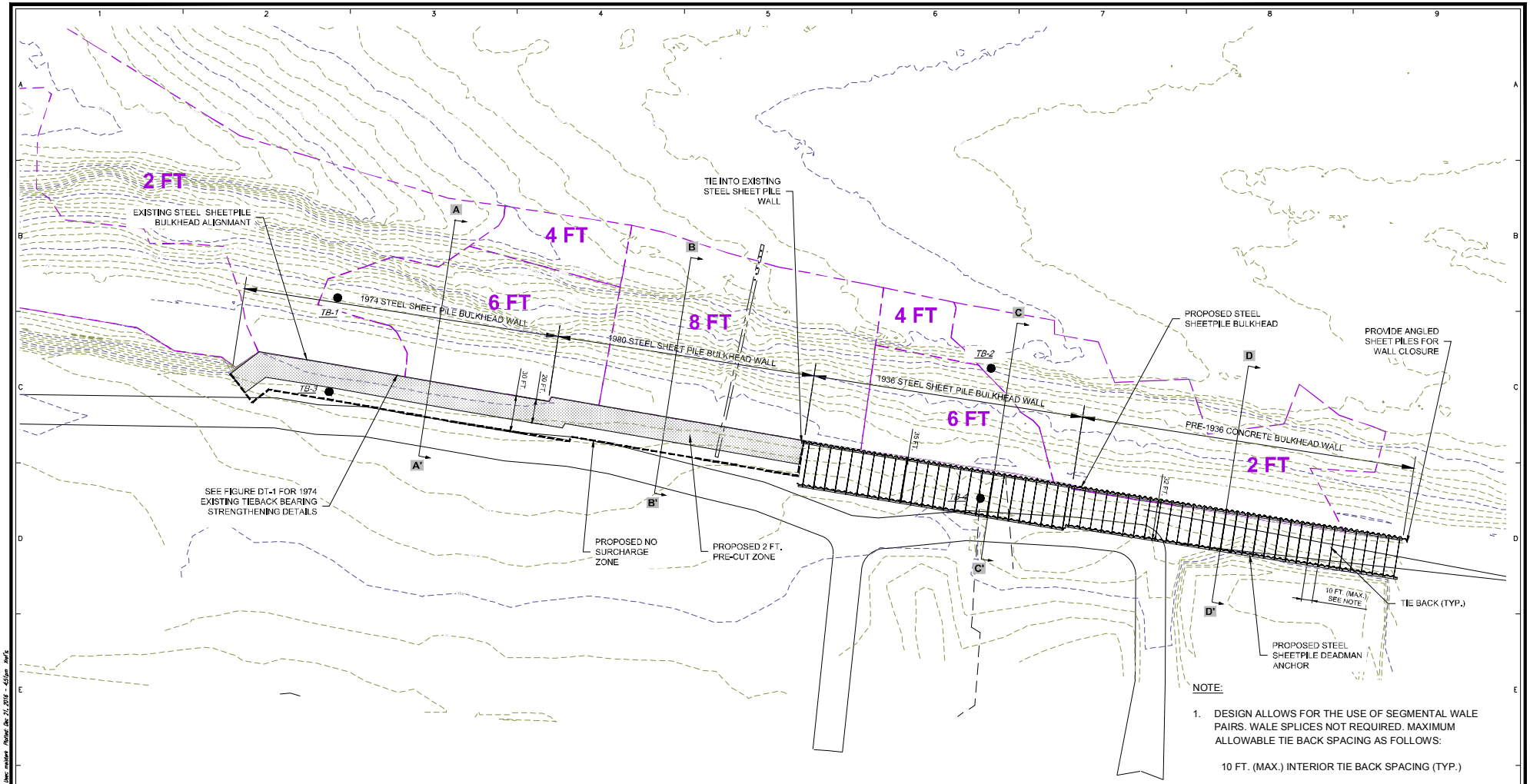
- Bulkhead stability should be enhanced by excavating a "precut" behind the bulkhead to reduce lateral earth pressures. A minimum 2-foot precut (≈ Elev. +9) is recommended in areas where dredge depths range from about 4 to 8 feet. A precut is not necessary for dredge cuts less than about 4 feet, provided that no surcharge is permitted behind the bulkhead.

- Monitor bulkhead performance during remediation construction. This would include real-time monitoring of lateral deflection of the bulkhead during dredging. In addition, it would be prudent to monitor axial loads in representative tieback anchors using load cells. This would provide a direct measure of tierod loads and reduce risk of anchor failure. It would also be prudent to expose and inspect the tierod and wale at representative locations to verify that severe corrosion has not occurred.

The 1936 bulkhead is in poor condition. To facilitate planned dredging to depths up to 8 feet, it should be replaced with a new anchored bulkhead structure.

The older concrete and timber pile bulkhead is likewise in poor condition and should also be replaced to allow dredging.

# Figures




NOTE:

1. DESIGN ALLOWS FOR THE USE OF SEGMENTAL WALE PAIRS. WALE SPLICES NOT REQUIRED. MAXIMUM ALLOWABLE TIE BACK SPACING AS FOLLOWS:

   10 FT. (MAX.) INTERIOR TIE BACK SPACING (TYP.)

   5 FT. (MAX.) CANTILEVERED TIE BACK SPACING AT ENDS OF SEGMENTS (TYP.)

PRIVILEGED & CONFIDENTIAL
PREPARED AT THE REQUEST OF COUNSEL

| NO | DRWN | DATE | REVISION | CHKD | DATE | APPVD | DATE |
|---|---|---|---|---|---|---|---|
| 7 | | | | | | | |
| 6 | | | | | | | |
| 5 | | | | | | | |
| 4 | | | | | | | |
| 3 | | | | | | | |
| 2 | | | | | | | |
| 1 | | | | | | | |
| 0 | AC | 05/15/15 | 50% ISSUE FOR BID – PACKAGE 1 | | | | |

AECOM
AECOM
250 APOLLO DRIVE
CHELMSFORD, MA 01824
www.aecom.com

BASF CORPORATION
HUDSON RIVER OU-2
RENSSELAER, NEW YORK

PROJ. NUMBER: 60323713

DATE: 12/21/2016

# BULKHEAD ANALYSIS AND DESIGN

UPLAND SITE PREPARATION
SEDIMENT REMEDIATION DESIGN

DRAWING NUMBER:

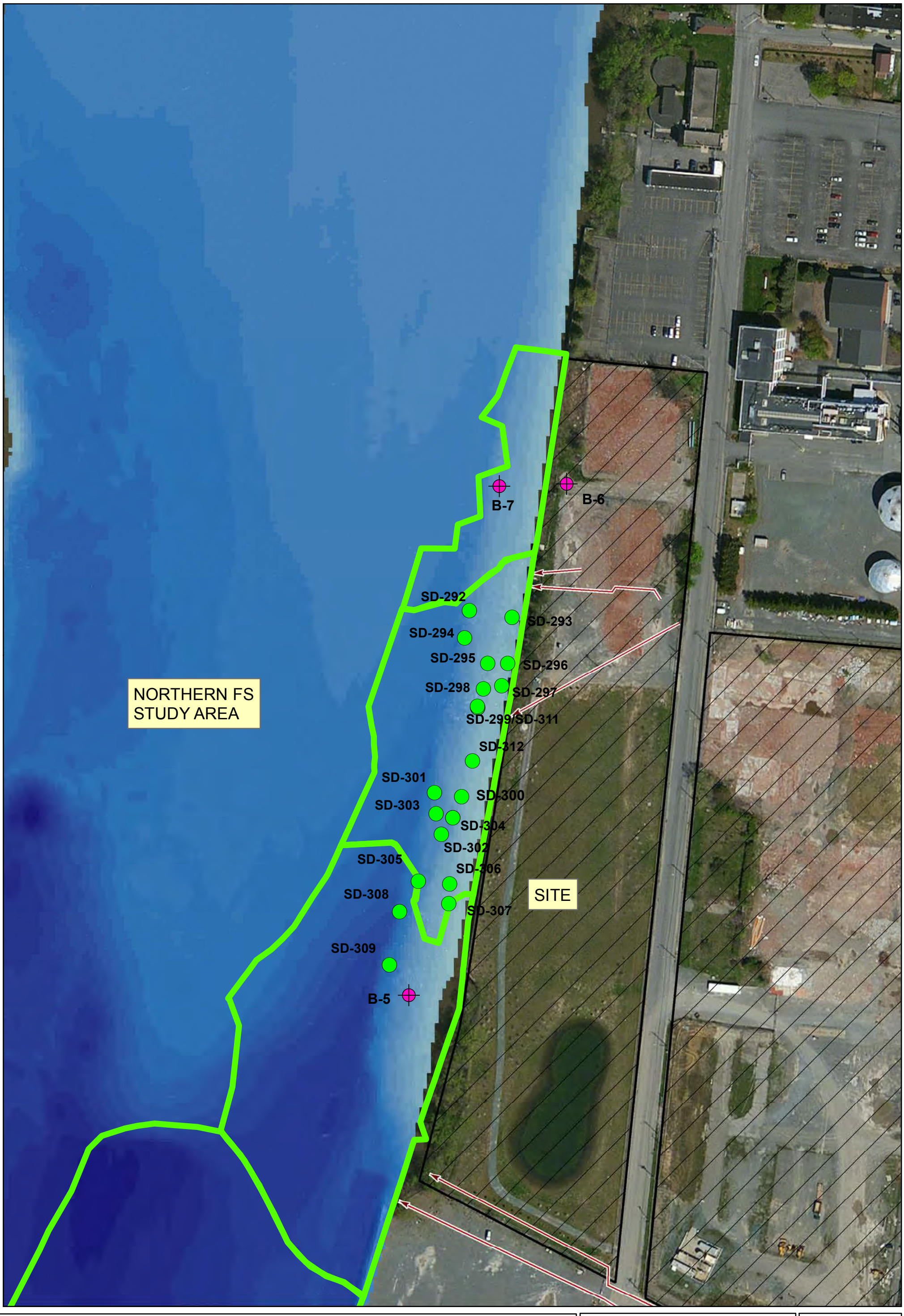
SHEET NUMBER:

REVISION 0

**Sheetpile Analyses**

**1974**
**1980s**

*Model Results are Available  Upon Request*




Depth (Feet)

-45 - -40 | -39 - -35 | -34 - -30 | -29 - -25 | -24 - -20 | -19 - -15 | -14 - -10 | -9 - -5 | -4 - 0

Approximate Property Boundaries

Approximate Locations of Outfall Pipes

Vibracore Locations

Deep Borings

0 125 250 500 Feet

**2016 Supplemental PCB Sampling Locations**

**OU-2 RD/RA Workplan**
**BASF Corporation**
**Rensselaer, New York**

| SCALE | DATE | PROJECT NO. |
|---|---|---|
| AS NOTED | 11/17 | 60323713 |

AECOM

Appendix

*Project Number:* 60323713
*Client:* BASF

*Site Location:* Rensselaer, NY

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

# *Boring Log*

*Boring Number:* **TB-5**
*Sheet:* 1 of 2
*Surface Elevation (ft-asl):*
*Equipment:* Hollow Stem
*Inside Diameter:* 4"
Boring Depth: 45.5 bgs

*Project Manager: John Bleiler*
*Drilling Contractor: ATL*
*Logged By: Helen Jones*
*Date Started: 9/7/2016*
*Date Completed: 9/7/2016*

| Depth (Feet) | Sample Depth | Sample ID | Blow Counts (6") | Rec (ft/ft) | USCS | PID (ppm) | Description |
|---|---|---|---|---|---|---|---|
| 0 | | | | | | | |
| 1 | | | WOR | 0.4 | SM | 0.5 | Dark brown SILT, little fine to medium sand, loose, wet |
| 2 | | | | | | | |
| 3 | | | WOR | 2 | OH | 8.7 | Dark brown silty CLAY, soft, wet - moist<br>Slight hydrocarbon-like sheen at 3.5 ft bgs |
| 4 | | | WOH | | | 10.4 | |
| 5 | | | WOH | 2 | OL<br>SM<br>CH | 4.6 | 4-5' Dark brown silty CLAY, soft, moist<br>5.1-5.2' Dark brown fine to medium silty SAND, loose, moist<br>5.2-6' Grey CLAY, medium firm, moist |
| 6 | | | | | | 2.8 | |
| 7 | 6-8 | TB-5(6-8) | | 1.9 | CH | | Collect shelby tube of clay at 0935 |
| 8 | | | WOH | | | | |
| 9 | | | WOH<br>2<br>3 | 1.5 | CH | 0 | |
| 10 | | | 1 | | | | Same as above, moist |
| 11 | | | 1<br>2 | 1.8 | CH | 0 | |
| 12 | | | 2 | | | | |
| 13 | | | WOH<br>WOH<br>WOH | 1.7 | CH | 0 | |
| 14 | | | 1 | | | | |
| 15 | | | WOH<br>1<br>2 | 2 | CH | 0 | |
| 16 | | | 1 | | | | |
| 17 | | | WOH<br>WOH<br>WOH | 2 | CH | 0 | |
| 18 | | | 1 | | | | |
| 19 | 18-20 | TB-5(18-20) | WOH<br>1<br>1 | 2 | CH | 0 | Composite sample of clay at 1345 |
| 20 | | | 2 | | | | |
| 21 | | | | | | | |
| 22 | | | | | | | |
| 23 | | | | | | | |
| 24 | | | | | | | |
| 25 | | | | | | | |

Notes:

bgs = below ground surface
WOR = weight of rod
WOH = weight of hammer
Water depth: 15.4 ft at 1130

*Project Number:* 60323713
*Client:* BASF

*Site Location:* Rensselaer, NY

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

# *Boring Log*

*Boring Number:* **TB-5**
*Sheet:* 2 of 2
*Surface Elevation (ft-asl):*
*Equipment:* Hollow Stem
*Inside Diameter:* 4"
Boring Depth: 45.5 bgs

*Project Manager: John Bleiler*
*Drilling Contractor: ATL*
*Logged By: Helen Jones*
*Date Started: 9/7/2016*
*Date Completed: 9/7/2016*

| Depth (Feet) | Sample Depth | Sample ID | Blow Counts (6") | Rec (ft/ft) | USCS | PID (ppm) | Description |
|---|---|---|---|---|---|---|---|
| 25 | | | | | | | Grey CLAY, medium firm, moist |
| 26 | | | WOH<br>WOH<br>WOH<br>1 | 2 | CH | 0 | |
| 27 | | | | | | | |
| 28 | | | | | | | |
| 29 | | | | | | | |
| 30 | | | 2<br>3<br>13<br>12 | 2 | CH<br>SP | 0 | |
| 31 | | | | | | | Grey fine SAND, homogenous, loose, moist |
| 32 | | | | | | | |
| 33 | | | | | | | |
| 34 | | | | | | | |
| 35 | | | 7<br>9<br>11<br>13 | 1.5 | SP | 0 | |
| 36 | | | | | | | |
| 37 | | | | | | | |
| 38 | | | | | | | |
| 39 | | | | | | | |
| 40 | | | 10<br>13<br>18<br>20 | 1.9 | TILL | 0 | |
| 41 | | | | | | | Grey SILT, some fine to medium gravel, rounded/subrounded, little fine sand, compact, moist |
| 42 | | | | | | | |
| 43 | | | | | | | |
| 44 | | | | | | | |
| 45 | | | 50/1 | 0.5 | BEDRO | 0 | Dark grey weathered BEDROCK-shale, refusal at 45.5 ft |
| 46 | | | | | | | |
| 47 | | | | | | | |
| 48 | | | | | | | |
| 49 | | | | | | | |

Notes:

bgs = below ground surface
WOR = weight of rod
WOH = weight of hammer
Water depth: 15.4 ft at 1130

*Project Number:* 60323713
*Client:* BASF

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

*Site Location:* Rensselaer, NY

# *Boring Log*

*Boring Number:* **TB-6**
*Sheet:* 1 of 3
*Surface Elevation (ft-asl):*
*Equipment:* Hollow Stem
*Inside Diameter:* 4"
Boring Depth: 55.5 bgs

*Project Manager: John Bleiler*
*Drilling Contractor: ATL*
*Logged By: Keith Stahle*
*Date Started: 9/12/2016*
*Date Completed: 9/12/2016*

| Depth (Feet) | Sample Depth | Sample ID | Blow Counts (6") | Rec (ft/ft) | USCS | PID (ppm) | Description |
|---|---|---|---|---|---|---|---|
| 0 | | | | | | | |
| 1 | | | 17<br>10<br>17<br>17 | 6 | SM | 0.0 | 0-0.5' Asphalt<br>0.5-2' Brown fine SAND, some medium to coarse gravel, trace silt, loose, dry |
| 2 | | | | | | | |
| 3 | | | 8<br>7<br>7<br>8 | 1.5 | | 0.0 | Becomes moist |
| 4 | | | | | | | |
| 5 | | | 11<br>11<br>9<br>6 | 1.0 | GM | 0.0 | Brown medium to coarse GRAVEL, some fine medium sand, little silt, loose, wet |
| 6 | | | | | | | |
| 7 | | | 6<br>4<br>3<br>3 | .75 | | 0.0 | Becomes wet |
| 8 | | | | | | | |
| 9 | | | 11<br>10<br>7<br>6 | 0 | | | No recovery |
| 10 | | | | | | | |
| 11 | | | 10<br>4<br>7<br>6 | 0.5 | GW | 0.0 | Brown fine to coarse GRAVEL, little medium to coarse sand, loose, wet |
| 12 | | | | | | | |
| 13 | | | 8<br>15<br>14<br>7 | 1 | | 0.0 | |
| 14 | | | | | | | |
| 15 | | | 7<br>7<br>3<br>1 | 0 | | 0.0 | No recovery, rock in tip of spoon |
| 16 | | | | | | | |
| 17 | | | 3<br>3<br>3<br>3 | 0.5 | | 0.0 | |
| 18 | | | | | | | |
| 19 | | | 4<br>5<br>7<br>5 | 0.5 | MH | 0.0 | Grey SILT, some fine to medium sand, trace clay, loose, wet |
| 20 | | | | | | | |
| 21 | | | 5<br>6<br>7<br>3 | 2.0 | CH | 0.1 | |
| 22 | | | | | | | Grey CLAY, soft, wet |
| 23 | | | | | | | |
| 24 | | | | | | | |
| 25 | | | | 1.9 | | | Shelby Tube--Tube had substantial dents-discarded |

Notes:

bgs = below ground surface
WOR = weight of rod
WOH = weight of hammer
Shelby tube at 24-26 ft was damaged and discarded. Tube did contain clay.

*Project Number:* 60323713
*Client:* BASF

*Site Location:* Rensselaer, NY

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

# *Boring Log*

*Boring Number:* **TB-6**
*Sheet:* 2 of 3
*Surface Elevation (ft-asl):*
*Equipment:* Hollow Stem
*Inside Diameter:* 4"
Boring Depth: 55.5 bgs

*Project Manager: John Bleiler*
*Drilling Contractor: ATL*
*Logged By: Keith Stahle*
*Date Started: 9/12/2016*
*Date Completed: 9/12/2016*

| Depth (Feet) | Sample Depth | Sample ID | Blow Counts (6") | Rec (ft/ft) | USCS | PID (ppm) | Description |
|---|---|---|---|---|---|---|---|
| 25 | | | | | CH | | |
| 26 | | | | | | | Shelby Tube from 26 to 28 ft |
| 27 | | | | 1.9 | | | |
| 28 | | | | | | | |
| 29 | | | | | | | |
| 30 | | | WOH | | CH | | Grey CLAY, medium soft, moist |
| 31 | | | 1 | 2.0 | | 0.0 | |
| 32 | | | 1<br>2 | | | | |
| 33 | | | | | | | |
| 34 | | | | | | | |
| 35 | | | 1 | | | | Grey CLAY, medium soft, moist |
| 36 | | | 2 | 2.0 | | 0.0 | |
| 37 | | | 1<br>3 | | | | |
| 38 | | | | | | | |
| 39 | | | | | | | |
| 40 | | | 1 | | | | Grey CLAY, medium soft, moist |
| 41 | | | 1 | 2.0 | | 0.0 | |
| 42 | | | 1<br>1 | | | | |
| 43 | | | | | | | |
| 44 | | | | | | | |
| 45 | | | 3 | | SM | | Grey silty fine SAND, compact, moist |
| 46 | | | 7 | 2.0 | | 0.1 | |
| 47 | | | 6<br>7 | | | | |
| 48 | | | | | | | |
| 49 | | | | | | | |

Notes:

bgs = below ground surface
WOR = weight of rod
WOH = weight of hammer
Shelby tube at 24-26 ft was damaged and discarded. Tube did contain clay.

*Project Number:* 60323713
*Client:* BASF

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

*Site Location:* Rensselaer, NY

# *Boring Log*

*Boring Number:* **TB-6**
*Sheet:* 2 of 3
*Surface Elevation (ft-asl):*
*Equipment:* Hollow Stem
*Inside Diameter:* 4"
Boring Depth: 55.5 bgs

*Project Manager: John Bleiler*
*Drilling Contractor: ATL*
*Logged By: Keith Stahle*
*Date Started: 9/12/2016*
*Date Completed: 9/12/2016*

| Depth (Feet) | Sample Depth | Sample ID | Blow Counts (6") | Rec (ft/ft) | USCS | PID (ppm) | Description |
|---|---|---|---|---|---|---|---|
| 50 | | | | | | | |
| 51 | | | 18<br>15<br>14<br>23 | 2.0 | SM | 0.0 | Brown fine to coarse SAND and fine to coarse GRAVEL, trace silt, loose, wet |
| 52 | | | | | | | |
| 53 | | | | | | | |
| 54 | | | | | | | |
| 55 | | | 75 | 0.5 | BED-ROCK | 0.0 | Black; Slate Fragments; Angular; Compact; Dry<br>End of boring at 55.5 ft |
| 56 | | | | | | | |
| 57 | | | | | | | |
| 58 | | | | | | | |
| 59 | | | | | | | |
| 60 | | | | | | | |
| 61 | | | | | | | |
| 62 | | | | | | | |
| 63 | | | | | | | |
| 64 | | | | | | | |
| 65 | | | | | | | |
| 66 | | | | | | | |
| 67 | | | | | | | |
| 68 | | | | | | | |
| 69 | | | | | | | |
| 70 | | | | | | | |
| 71 | | | | | | | |
| 72 | | | | | | | |
| 73 | | | | | | | |
| 74 | | | | | | | |

Notes:

bgs = below ground surface
WOR = weight of rod
WOH = weight of hammer
Shelby tube at 24-26 ft was damaged and discarded. Tube did contain clay.

*Project Number:* 60323713
*Client:* BASF

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

*Site Location:* Rensselaer, NY

# *Boring Log*

*Boring Number:* **TB-7**
*Sheet:* 1 of 2
*Surface Elevation (ft-asl):*
*Equipment:* Hollow Stem
*Inside Diameter:* 4"
Boring Depth: 40.3 bgs

*Project Manager: John Bleiler*
*Drilling Contractor: ATL*
*Logged By: Helen Jones*
*Date Started: 9/8/2016*
*Date Completed: 9/8/2016*

| Depth (Feet) | Sample Depth | Sample ID | Blow Counts (6") | Rec (ft/ft) | USCS | PID (ppm) | Description |
|---|---|---|---|---|---|---|---|
| 0 | | | | | | | |
| 1 | | | WOR | 0.8 | OL | 0.6 | Dark brown silty CLAY, trace organics, soft, wet |
| 2 | | | | | | | |
| 3 | | | WOR | 2 | | 6.8 | |
| 4 | | | | | | 21.1 | |
| 5 | | | WOR<br>WOR<br>WOR | 2 | | 12.9 | |
| 6 | | | WOR | | CH | | 5.7-6' Grey CLAY medium stiff, wet, high plasticity |
| 7 | | | WOH | 2 | CH | 0 | Grey CLAY, medium stiff, moist, high plasticity |
| 8 | | | | | | | |
| 9 | | | | 1.9 | | | Collect Shelby Tube |
| 10 | | | | | | | |
| 11 | | | WOH<br>WOH<br>1 | 2 | | 0 | |
| 12 | | | 2 | | | | |
| 13 | | | WOH<br>WOH<br>WOH | 2 | CH | 0 | Same as above; stiff |
| 14 | | | 2 | | | | |
| 15 | | | WOH<br>2<br>3 | 2 | | 0 | |
| 16 | | | 1 | | | | |
| 17 | | | WOH<br>1<br>1 | 2 | | 0 | |
| 18 | | | 1 | | | | |
| 19 | | | 2<br>1 | 2 | | 0 | |
| 20 | | | 2 | | | | |
| 21 | | | | 25" | | | Collect Shelby Tube |
| 22 | | | | | | | |
| 23 | | | | | | | |
| 24 | | | | | | | |
| 25 | | | 7 | | SP | 0 | Grey fine SAND, homogenous, loose, moist |

Notes:

bgs = below ground surface
WOR = weight of rod
WOH = weight of hammer
N - 1384524.550 E - 693633.934 Elevation 3.6
Water depth: 15.2 ft at start
Collect Shelby Tube TB-7(8-10) at 0935
Jar of clay TB-7(10-12) at 0945
Jar of clay TB-7(16-18) at 1015
Shelby Tube TB-7(20-22) at 1055

| | | | |
|---|---|---|---|
| *Project Number:* 60323713<br>*Client:* BASF | AECOM<br>250 Apollo Drive<br>Chelmsford, Massachusetts<br>(978) 905-2100 | | ***Boring Log*** |
| *Site Location:* Rensselaer, NY | | | *Boring Number:* **TB-7**<br>*Sheet:* 2 of 2<br>*Surface Elevation (ft-asl):* |
| *Project Manager: John Bleiler* | *Logged By: Helen Jones* | *Date Started: 9/8/2016* | *Equipment:* Hollow Stem<br>*Inside Diameter:* 4" |
| *Drilling Contractor: ATL* | | *Date Completed: 9/8/2016* | Boring Depth: 40.3 bgs |

| Depth (Feet) | Sample Depth | Sample ID | Blow Counts (6") | Rec (ft/ft) | USCS | PID (ppm) | Description |
|---|---|---|---|---|---|---|---|
| 25 | | | | | | | |
| 26 | | | 7<br>8<br>7<br>10 | 1.2 | SP | 0 | Grey fine SAND, homogenous, loose, moist |
| 27 | | | | | | | |
| 28 | | | | | | | |
| 29 | | | | | | | |
| 30 | | | 6<br>7<br>6<br>7 | 1.2 | SM | 0 | 31.5-32' Grey; silty fine SAND, homogenous, loose, moist |
| 31 | | | | | | | |
| 32 | | | | | | | |
| 33 | | | | | | | |
| 34 | | | | | | | |
| 35 | | | 10<br>30<br>28<br>29 | 2 | SM<br>SM | 0 | Grey fine to medium SAND, some fine to coarse subangular gravel, trace silt, moist, loose<br>Grey fine to medium SAND, trace silt, moist, loose |
| 36 | | | | | | | |
| 37 | | | | | | | |
| 38 | | | | | | | |
| 39 | | | | | | | |
| 40 | | | 50/1 | 0.3/0.3 | BED-ROCK | 0 | Shale fragments in the tip of spoon. Refusal at 40.3 |
| 41 | | | | | | | |
| 42 | | | | | | | |
| 43 | | | | | | | |
| 44 | | | | | | | |
| 45 | | | | | | | |
| 46 | | | | | | | |
| 47 | | | | | | | |
| 48 | | | | | | | |
| 49 | | | | | | | |

Notes:

bgs = below ground surface
WOR = weight of rod
WOH = weight of hammer
N - 1384524.550 E - 693633.934 Elevation 3.6
Water Depth: 15.2 ft at start
Collect Shelby Tube TB-7(8-10) at 0935
Jar of clay TB-7(10-12) at 0945
Jar of clay TB-7(16-18) at 1015
Shelby Tube TB-7(20-22) at 1055

# Appendix C – Supplemental Sediment PCB Data


Depth (Feet)

-45 - -40 | -39 - -35 | -34 - -30 | -29 - -25 | -24 - -20 | -19 - -15 | -14 - -10 | -9 - -5 | -4 - 0

Approximate Property Boundaries

Approximate Locations of Outfall Pipes

Vibracore Locations

Deep Borings

0 125 250 500 Feet

**2016 Supplemental PCB Sampling Locations**

**OU-2 RD/RA Workplan**
**BASF Corporation**
**Rensselaer, New York**

| SCALE | DATE | PROJECT NO. |
|---|---|---|
| AS NOTED | 11/17 | 60323713 |

AECOM

Appendix

Appendix C
2016 PCB Sediment Data
BASF Hudson River OU-2 RD/ RA Work Plan
Rensselaer, NY

| SAMPLE_ID | NORTHING | EASTING | Date | Start (ft) | End (ft) | Total PCBs (mg/Kg)* |
|---|---|---|---|---|---|---|
| SD-292 | 1384330.257 | 693587.351 | 9/8/2016 | 0 | 2 | 110 |
| SD-294 | 1384287.278 | 693579.399 | 9/8/2016 | 0 | 2 | 350 |
| SD-298 | 1384207.604 | 693609.019 | 9/8/2016 | 0 | 2 | 66 |
| SD-299 | 1384178.293 | 693600.199 | 9/9/2016 | 0 | 2 | 13 |
| SD-300 | 1384038.972 | 693574.827 | 9/8/2016 | 0 | 2 | 31 |
| SD-301 | 1384045.384 | 693532.404 | 9/8/2016 | 0 | 2 | 15 |
| SD-302 | 1384012.541 | 693535.393 | 9/8/2016 | 0 | 2 | 37 |
| SD-304 | 1383979.985 | 693543.033 | 9/9/2016 | 0 | 2 | 47 |
| SD-305 | 1383906.804 | 693507.397 | 9/9/2016 | 0 | 2 | 0.18 |
| SD-306 | 1383902.858 | 693556.14 | 9/9/2016 | 0 | 2 | 81 |
| SD-307 | 1383871.73 | 693554.775 | 9/9/2016 | 0 | 2 | 60 |
| SD-308 | 1383859.053 | 693477.926 | 9/9/2016 | 0 | 2 | 0 |
| SD-309 | 1383776.257 | 693462.334 | 9/9/2016 | 0 | 2 | 0 |
| SD-293 | 1384319.656 | 693653.926 | 9/8/2016 | 2 | 4 | 285 |
| SD-295 | 1384247.587 | 693615.928 | 9/8/2016 | 2 | 4 | 90 |
| SD-296 | 1384247.491 | 693647.057 | 9/8/2016 | 2 | 4 | 150 |
| SD-297 | 1384212.581 | 693637.818 | 9/8/2016 | 2 | 4 | 94 |
| SD-299 | 1384178.293 | 693600.199 | 9/9/2016 | 2 | 4 | 19 |
| SD-303 | 1384005.894 | 693561.026 | 9/9/2016 | 2 | 4 | 44 |
| SD-311 | 1384180.337 | 693599.577 | 9/9/2016 | 2 | 4 | 23 |
| SD-312 | 1384094.674 | 693592.118 | 9/9/2016 | 2 | 4 | 130 |
| SD-303 | 1384005.894 | 693561.026 | 9/9/2016 | 4 | 6 | 4.5 |

* - Total PCBs calculated as sum of detects only.

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 8/16 1530 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD292 (0-2) | **Units:** | µg/Kg |
| **Lab Code:** | R1609593-001 | **Basis:** | Dry |
| | | **Percent Solids:** | 42.2 |

## Polychlorinated Biphenyls (PCBs) by GC

**Analytical Method:** 8082A
**Prep Method:** EPA 3541

| Analyte Name | Result | Q | MRL | MDL | Dilution Factor | Date Extracted | Date Analyzed | Extraction Lot | Analysis Lot | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| Aroclor 1016 | 78000 | U | 78000 | 41000 | 1000 | 9/16/16 | 9/22/16 17:29 | 271082 | 515559 | |
| Aroclor 1221 | 160000 | U | 160000 | 81000 | 1000 | 9/16/16 | 9/22/16 17:29 | 271082 | 515559 | |
| Aroclor 1232 | 78000 | U | 78000 | 41000 | 1000 | 9/16/16 | 9/22/16 17:29 | 271082 | 515559 | |
| Aroclor 1242 | **110000** | | 78000 | 41000 | 1000 | 9/16/16 | 9/22/16 17:29 | 271082 | 515559 | |
| Aroclor 1248 | 78000 | U | 78000 | 41000 | 1000 | 9/16/16 | 9/22/16 17:29 | 271082 | 515559 | |
| Aroclor 1254 | 78000 | U | 78000 | 46000 | 1000 | 9/16/16 | 9/22/16 17:29 | 271082 | 515559 | |
| Aroclor 1260 | 78000 | U | 78000 | 41000 | 1000 | 9/16/16 | 9/22/16 17:29 | 271082 | 515559 | |

| Surrogate Name | %Rec | | Control Limits | Date Analyzed | Q |
|---|---|---|---|---|---|
| Decachlorobiphenyl | 0 | * | 22-128 | 9/22/16 17:29 | D |
| Tetrachloro-m-xylene | 0 | * | 14-119 | 9/22/16 17:29 | D |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 8/16 1530 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD292 (0-2) | | |
| **Lab Code:** | R1609593-001 | **Basis:** | NA |

**General Chemistry Parameters**

| Analyte Name | Method | Result | Q | Units | MRL | Dilution Factor | Date Extracted | Date Analyzed | Note |
|---|---|---|---|---|---|---|---|---|---|
| Total Solids | ALS SOP | 42.2 | | Percent | | 1 | NA | 9/13/16 14:30 | |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 8/16 1540 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD293 (2-4) | **Units:** | µg/Kg |
| **Lab Code:** | R1609593-002 | **Basis:** | Dry |
| | | **Percent Solids:** | 55.8 |

**Polychlorinated Biphenyls (PCBs) by GC**

**Analytical Method:** 8082A
**Prep Method:** EPA 3541

| Analyte Name | Result | Q | MRL | MDL | Dilution Factor | Date Extracted | Date Analyzed | Extraction Lot | Analysis Lot | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| Aroclor 1016 | 59000 | U | 59000 | 31000 | 1000 | 9/16/16 | 9/22/16 19:12 | 271082 | 515559 | |
| Aroclor 1221 | 120000 | U | 120000 | 61000 | 1000 | 9/16/16 | 9/22/16 19:12 | 271082 | 515559 | |
| Aroclor 1232 | 59000 | U | 59000 | 31000 | 1000 | 9/16/16 | 9/22/16 19:12 | 271082 | 515559 | |
| Aroclor 1242 | **170000** | | 59000 | 31000 | 1000 | 9/16/16 | 9/22/16 19:12 | 271082 | 515559 | |
| Aroclor 1248 | 59000 | U | 59000 | 31000 | 1000 | 9/16/16 | 9/22/16 19:12 | 271082 | 515559 | |
| Aroclor 1254 | 59000 | U | 59000 | 35000 | 1000 | 9/16/16 | 9/22/16 19:12 | 271082 | 515559 | |
| Aroclor 1260 | 59000 | U | 59000 | 31000 | 1000 | 9/16/16 | 9/22/16 19:12 | 271082 | 515559 | |

| Surrogate Name | %Rec | | Control Limits | Date Analyzed | Q |
|---|---|---|---|---|---|
| Decachlorobiphenyl | 0 | * | 22-128 | 9/22/16 19:12 | D |
| Tetrachloro-m-xylene | 0 | * | 14-119 | 9/22/16 19:12 | D |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 8/16 1540 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD293 (2-4) | | |
| **Lab Code:** | R1609593-002 | **Basis:** | NA |

**General Chemistry Parameters**

| Analyte Name | Method | Result | Q | Units | MRL | Dilution Factor | Date Extracted | Date Analyzed | Note |
|---|---|---|---|---|---|---|---|---|---|
| Total Solids | ALS SOP | 55.8 | | Percent | | 1 | NA | 9/13/16 14:30 | |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 8/16 1545 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD293D (2-4) | **Units:** | µg/Kg |
| **Lab Code:** | R1609593-003 | **Basis:** | Dry |
| | | **Percent Solids:** | 50.0 |

**Polychlorinated Biphenyls (PCBs) by GC**

**Analytical Method:** 8082A
**Prep Method:** EPA 3541

| Analyte Name | Result | Q | MRL | MDL | Dilution Factor | Date Extracted | Date Analyzed | Extraction Lot | Analysis Lot | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| Aroclor 1016 | 66000 | U | 66000 | 34000 | 1000 | 9/16/16 | 9/22/16 19:38 | 271082 | 515559 | |
| Aroclor 1221 | 130000 | U | 130000 | 68000 | 1000 | 9/16/16 | 9/22/16 19:38 | 271082 | 515559 | |
| Aroclor 1232 | 66000 | U | 66000 | 34000 | 1000 | 9/16/16 | 9/22/16 19:38 | 271082 | 515559 | |
| Aroclor 1242 | 66000 | U | 66000 | 34000 | 1000 | 9/16/16 | 9/22/16 19:38 | 271082 | 515559 | |
| Aroclor 1248 | **400000** | | 66000 | 34000 | 1000 | 9/16/16 | 9/22/16 19:38 | 271082 | 515559 | |
| Aroclor 1254 | 66000 | U | 66000 | 38000 | 1000 | 9/16/16 | 9/22/16 19:38 | 271082 | 515559 | |
| Aroclor 1260 | 66000 | U | 66000 | 34000 | 1000 | 9/16/16 | 9/22/16 19:38 | 271082 | 515559 | |

| Surrogate Name | %Rec | | Control Limits | Date Analyzed | Q |
|---|---|---|---|---|---|
| Decachlorobiphenyl | 0 | * | 22-128 | 9/22/16 19:38 | D |
| Tetrachloro-m-xylene | 0 | * | 14-119 | 9/22/16 19:38 | D |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 8/16 1545 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD293D (2-4) | | |
| **Lab Code:** | R1609593-003 | **Basis:** | NA |

**General Chemistry Parameters**

| Analyte Name | Method | Result | Q | Units | MRL | Dilution Factor | Date Extracted | Date Analyzed | Note |
|---|---|---|---|---|---|---|---|---|---|
| Total Solids | ALS SOP | 50.0 | | Percent | | 1 | NA | 9/13/16 14:30 | |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 8/16 1620 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD294 (0-2) | **Units:** | µg/Kg |
| **Lab Code:** | R1609593-004 | **Basis:** | Dry |
| | | **Percent Solids:** | 44.4 |

## Polychlorinated Biphenyls (PCBs) by GC

**Analytical Method:** 8082A
**Prep Method:** EPA 3541

| Analyte Name | Result | Q | MRL | MDL | Dilution Factor | Date Extracted | Date Analyzed | Extraction Lot | Analysis Lot | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| Aroclor 1016 | 74000 | U | 74000 | 39000 | 1000 | 9/16/16 | 9/23/16 11:27 | 271082 | 515782 | |
| Aroclor 1221 | 150000 | U | 150000 | 77000 | 1000 | 9/16/16 | 9/23/16 11:27 | 271082 | 515782 | |
| Aroclor 1232 | 74000 | U | 74000 | 39000 | 1000 | 9/16/16 | 9/23/16 11:27 | 271082 | 515782 | |
| Aroclor 1242 | 74000 | U | 74000 | 39000 | 1000 | 9/16/16 | 9/23/16 11:27 | 271082 | 515782 | |
| Aroclor 1248 | **350000** | | 74000 | 39000 | 1000 | 9/16/16 | 9/23/16 11:27 | 271082 | 515782 | |
| Aroclor 1254 | 74000 | U | 74000 | 43000 | 1000 | 9/16/16 | 9/23/16 11:27 | 271082 | 515782 | |
| Aroclor 1260 | 74000 | U | 74000 | 39000 | 1000 | 9/16/16 | 9/23/16 11:27 | 271082 | 515782 | |

| Surrogate Name | %Rec | | Control Limits | Date Analyzed | Q |
|---|---|---|---|---|---|
| Decachlorobiphenyl | 0 | * | 22-128 | 9/23/16 11:27 | D |
| Tetrachloro-m-xylene | 0 | * | 14-119 | 9/23/16 11:27 | D |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 8/16 1620 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD294 (0-2) | | |
| **Lab Code:** | R1609593-004 | **Basis:** | NA |

**General Chemistry Parameters**

| Analyte Name | Method | Result | Q | Units | MRL | Dilution Factor | Date Extracted | Date Analyzed | Note |
|---|---|---|---|---|---|---|---|---|---|
| Total Solids | ALS SOP | 44.4 | | Percent | | 1 | NA | 9/13/16 14:30 | |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 8/16 1630 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD295 (2-4) | **Units:** | µg/Kg |
| **Lab Code:** | R1609593-005 | **Basis:** | Dry |
| | | **Percent Solids:** | 52.7 |

**Polychlorinated Biphenyls (PCBs) by GC**

**Analytical Method:** 8082A
**Prep Method:** EPA 3541

| Analyte Name | Result | Q | MRL | MDL | Dilution Factor | Date Extracted | Date Analyzed | Extraction Lot | Analysis Lot | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| Aroclor 1016 | 31000 | U | 31000 | 17000 | 500 | 9/16/16 | 9/23/16 11:52 | 271082 | 515782 | |
| Aroclor 1221 | 64000 | U | 64000 | 33000 | 500 | 9/16/16 | 9/23/16 11:52 | 271082 | 515782 | |
| Aroclor 1232 | 31000 | U | 31000 | 17000 | 500 | 9/16/16 | 9/23/16 11:52 | 271082 | 515782 | |
| Aroclor 1242 | **90000** | | 31000 | 17000 | 500 | 9/16/16 | 9/23/16 11:52 | 271082 | 515782 | |
| Aroclor 1248 | 31000 | U | 31000 | 17000 | 500 | 9/16/16 | 9/23/16 11:52 | 271082 | 515782 | |
| Aroclor 1254 | 31000 | U | 31000 | 19000 | 500 | 9/16/16 | 9/23/16 11:52 | 271082 | 515782 | |
| Aroclor 1260 | 31000 | U | 31000 | 17000 | 500 | 9/16/16 | 9/23/16 11:52 | 271082 | 515782 | |

| Surrogate Name | %Rec | | Control Limits | Date Analyzed | Q |
|---|---|---|---|---|---|
| Decachlorobiphenyl | 0 | * | 22-128 | 9/23/16 11:52 | D |
| Tetrachloro-m-xylene | 0 | * | 14-119 | 9/23/16 11:52 | D |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 8/16 1630 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD295 (2-4) | | |
| **Lab Code:** | R1609593-005 | **Basis:** | NA |

**General Chemistry Parameters**

| Analyte Name | Method | Result | Q | Units | MRL | Dilution Factor | Date Extracted | Date Analyzed | Note |
|---|---|---|---|---|---|---|---|---|---|
| Total Solids | ALS SOP | 52.7 | | Percent | | 1 | NA | 9/13/16 14:30 | |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 8/16 1645 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD296 (2-4) | **Units:** | µg/Kg |
| **Lab Code:** | R1609593-006 | **Basis:** | Dry |
| | | **Percent Solids:** | 48.4 |

## Polychlorinated Biphenyls (PCBs) by GC

**Analytical Method:** 8082A
**Prep Method:** EPA 3541

| Analyte Name | Result | Q | MRL | MDL | Dilution Factor | Date Extracted | Date Analyzed | Extraction Lot | Analysis Lot | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| Aroclor 1016 | 68000 | U | 68000 | 36000 | 1000 | 9/16/16 | 9/22/16 20:55 | 271082 | 515559 | |
| Aroclor 1221 | 140000 | U | 140000 | 71000 | 1000 | 9/16/16 | 9/22/16 20:55 | 271082 | 515559 | |
| Aroclor 1232 | 68000 | U | 68000 | 36000 | 1000 | 9/16/16 | 9/22/16 20:55 | 271082 | 515559 | |
| Aroclor 1242 | 68000 | U | 68000 | 36000 | 1000 | 9/16/16 | 9/22/16 20:55 | 271082 | 515559 | |
| Aroclor 1248 | **150000** | | 68000 | 36000 | 1000 | 9/16/16 | 9/22/16 20:55 | 271082 | 515559 | |
| Aroclor 1254 | 68000 | U | 68000 | 40000 | 1000 | 9/16/16 | 9/22/16 20:55 | 271082 | 515559 | |
| Aroclor 1260 | 68000 | U | 68000 | 36000 | 1000 | 9/16/16 | 9/22/16 20:55 | 271082 | 515559 | |

| Surrogate Name | %Rec | | Control Limits | Date Analyzed | Q |
|---|---|---|---|---|---|
| Decachlorobiphenyl | 0 | * | 22-128 | 9/22/16 20:55 | D |
| Tetrachloro-m-xylene | 0 | * | 14-119 | 9/22/16 20:55 | D |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 8/16 1645 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD296 (2-4) | | |
| **Lab Code:** | R1609593-006 | **Basis:** | NA |

**General Chemistry Parameters**

| Analyte Name | Method | Result | Q | Units | MRL | Dilution Factor | Date Extracted | Date Analyzed | Note |
|---|---|---|---|---|---|---|---|---|---|
| Total Solids | ALS SOP | 48.4 | | Percent | | 1 | NA | 9/13/16 14:30 | |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 8/16 1700 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD297 (2-4) | **Units:** | µg/Kg |
| **Lab Code:** | R1609593-007 | **Basis:** | Dry |
| | | **Percent Solids:** | 44.2 |

**Polychlorinated Biphenyls (PCBs) by GC**

**Analytical Method:** 8082A
**Prep Method:** EPA 3541

| Analyte Name | Result | Q | MRL | MDL | Dilution Factor | Date Extracted | Date Analyzed | Extraction Lot | Analysis Lot | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| Aroclor 1016 | 37000 | U | 37000 | 20000 | 500 | 9/16/16 | 9/23/16 12:18 | 271082 | 515782 | |
| Aroclor 1221 | 76000 | U | 76000 | 39000 | 500 | 9/16/16 | 9/23/16 12:18 | 271082 | 515782 | |
| Aroclor 1232 | 37000 | U | 37000 | 20000 | 500 | 9/16/16 | 9/23/16 12:18 | 271082 | 515782 | |
| Aroclor 1242 | **94000** | | 37000 | 20000 | 500 | 9/16/16 | 9/23/16 12:18 | 271082 | 515782 | |
| Aroclor 1248 | 37000 | U | 37000 | 20000 | 500 | 9/16/16 | 9/23/16 12:18 | 271082 | 515782 | |
| Aroclor 1254 | 37000 | U | 37000 | 22000 | 500 | 9/16/16 | 9/23/16 12:18 | 271082 | 515782 | |
| Aroclor 1260 | 37000 | U | 37000 | 20000 | 500 | 9/16/16 | 9/23/16 12:18 | 271082 | 515782 | |

| Surrogate Name | %Rec | | Control Limits | Date Analyzed | Q |
|---|---|---|---|---|---|
| Decachlorobiphenyl | 0 | * | 22-128 | 9/23/16 12:18 | D |
| Tetrachloro-m-xylene | 0 | * | 14-119 | 9/23/16 12:18 | D |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 8/16 1700 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD297 (2-4) | | |
| **Lab Code:** | R1609593-007 | **Basis:** | NA |

**General Chemistry Parameters**

| Analyte Name | Method | Result | Q | Units | MRL | Dilution Factor | Date Extracted | Date Analyzed | Note |
|---|---|---|---|---|---|---|---|---|---|
| Total Solids | ALS SOP | 44.2 | | Percent | | 1 | NA | 9/13/16 14:30 | |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 8/16 1715 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD298 (0-2) | **Units:** | µg/Kg |
| **Lab Code:** | R1609593-008 | **Basis:** | Dry |
| | | **Percent Solids:** | 53.1 |

## Polychlorinated Biphenyls (PCBs) by GC

**Analytical Method:** 8082A
**Prep Method:** EPA 3541

| Analyte Name | Result | Q | MRL | MDL | Dilution Factor | Date Extracted | Date Analyzed | Extraction Lot | Analysis Lot | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| Aroclor 1016 | 31000 | U | 31000 | 16000 | 500 | 9/16/16 | 9/23/16 12:44 | 271082 | 515782 | |
| Aroclor 1221 | 63000 | U | 63000 | 32000 | 500 | 9/16/16 | 9/23/16 12:44 | 271082 | 515782 | |
| Aroclor 1232 | 31000 | U | 31000 | 16000 | 500 | 9/16/16 | 9/23/16 12:44 | 271082 | 515782 | |
| Aroclor 1242 | **66000** | | 31000 | 16000 | 500 | 9/16/16 | 9/23/16 12:44 | 271082 | 515782 | |
| Aroclor 1248 | 31000 | U | 31000 | 16000 | 500 | 9/16/16 | 9/23/16 12:44 | 271082 | 515782 | |
| Aroclor 1254 | 31000 | U | 31000 | 18000 | 500 | 9/16/16 | 9/23/16 12:44 | 271082 | 515782 | |
| Aroclor 1260 | 31000 | U | 31000 | 16000 | 500 | 9/16/16 | 9/23/16 12:44 | 271082 | 515782 | |

| Surrogate Name | %Rec | | Control Limits | Date Analyzed | Q |
|---|---|---|---|---|---|
| Decachlorobiphenyl | 0 | * | 22-128 | 9/23/16 12:44 | D |
| Tetrachloro-m-xylene | 0 | * | 14-119 | 9/23/16 12:44 | D |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 8/16 1715 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD298 (0-2) | | |
| **Lab Code:** | R1609593-008 | **Basis:** | NA |

**General Chemistry Parameters**

| Analyte Name | Method | Result | Q | Units | MRL | Dilution Factor | Date Extracted | Date Analyzed | Note |
|---|---|---|---|---|---|---|---|---|---|
| Total Solids | ALS SOP | 53.1 | | Percent | | 1 | NA | 9/13/16 14:30 | |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 8/16 1735 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD300 (0-2) | **Units:** | µg/Kg |
| **Lab Code:** | R1609593-009 | **Basis:** | Dry |
| | | **Percent Solids:** | 51.0 |

**Polychlorinated Biphenyls (PCBs) by GC**

**Analytical Method:** 8082A
**Prep Method:** EPA 3541

| Analyte Name | Result | Q | MRL | MDL | Dilution Factor | Date Extracted | Date Analyzed | Extraction Lot | Analysis Lot | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| Aroclor 1016 | 13000 | U | 13000 | 6700 | 200 | 9/16/16 | 9/23/16 13:10 | 271082 | 515782 | |
| Aroclor 1221 | 26000 | U | 26000 | 14000 | 200 | 9/16/16 | 9/23/16 13:10 | 271082 | 515782 | |
| Aroclor 1232 | 13000 | U | 13000 | 6700 | 200 | 9/16/16 | 9/23/16 13:10 | 271082 | 515782 | |
| Aroclor 1242 | **31000** | | 13000 | 6700 | 200 | 9/16/16 | 9/23/16 13:10 | 271082 | 515782 | |
| Aroclor 1248 | 13000 | U | 13000 | 6700 | 200 | 9/16/16 | 9/23/16 13:10 | 271082 | 515782 | |
| Aroclor 1254 | 13000 | U | 13000 | 7500 | 200 | 9/16/16 | 9/23/16 13:10 | 271082 | 515782 | |
| Aroclor 1260 | 13000 | U | 13000 | 6700 | 200 | 9/16/16 | 9/23/16 13:10 | 271082 | 515782 | |

| Surrogate Name | %Rec | | Control Limits | Date Analyzed | Q |
|---|---|---|---|---|---|
| Decachlorobiphenyl | 0 | * | 22-128 | 9/23/16 13:10 | D |
| Tetrachloro-m-xylene | 0 | * | 14-119 | 9/23/16 13:10 | D |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 8/16 1735 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD300 (0-2) | | |
| **Lab Code:** | R1609593-009 | **Basis:** | NA |

**General Chemistry Parameters**

| Analyte Name | Method | Result | Q | Units | MRL | Dilution Factor | Date Extracted | Date Analyzed | Note |
|---|---|---|---|---|---|---|---|---|---|
| Total Solids | ALS SOP | 51.0 | | Percent | | 1 | NA | 9/13/16 14:30 | |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 8/16 1750 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD301 (0-2) | **Units:** | µg/Kg |
| **Lab Code:** | R1609593-010 | **Basis:** | Dry |
| | | **Percent Solids:** | 59.3 |

**Polychlorinated Biphenyls (PCBs) by GC**

**Analytical Method:** 8082A
**Prep Method:** EPA 3541

| Analyte Name | Result | Q | MRL | MDL | Dilution Factor | Date Extracted | Date Analyzed | Extraction Lot | Analysis Lot | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| Aroclor 1016 | 5600 | U | 5600 | 2900 | 100 | 9/16/16 | 9/23/16 13:35 | 271082 | 515782 | |
| Aroclor 1221 | 11000 | U | 11000 | 5800 | 100 | 9/16/16 | 9/23/16 13:35 | 271082 | 515782 | |
| Aroclor 1232 | 5600 | U | 5600 | 2900 | 100 | 9/16/16 | 9/23/16 13:35 | 271082 | 515782 | |
| Aroclor 1242 | **15000** | | 5600 | 2900 | 100 | 9/16/16 | 9/23/16 13:35 | 271082 | 515782 | |
| Aroclor 1248 | 5600 | U | 5600 | 2900 | 100 | 9/16/16 | 9/23/16 13:35 | 271082 | 515782 | |
| Aroclor 1254 | 5600 | U | 5600 | 3300 | 100 | 9/16/16 | 9/23/16 13:35 | 271082 | 515782 | |
| Aroclor 1260 | 5600 | U | 5600 | 2900 | 100 | 9/16/16 | 9/23/16 13:35 | 271082 | 515782 | |

| Surrogate Name | %Rec | | Control Limits | Date Analyzed | Q |
|---|---|---|---|---|---|
| Decachlorobiphenyl | 0 | * | 22-128 | 9/23/16 13:35 | D |
| Tetrachloro-m-xylene | 0 | * | 14-119 | 9/23/16 13:35 | D |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 8/16 1750 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD301 (0-2) | | |
| **Lab Code:** | R1609593-010 | **Basis:** | NA |

**General Chemistry Parameters**

| Analyte Name | Method | Result | Q | Units | MRL | Dilution Factor | Date Extracted | Date Analyzed | Note |
|---|---|---|---|---|---|---|---|---|---|
| Total Solids | ALS SOP | 59.3 | | Percent | | 1 | NA | 9/13/16 14:30 | |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 8/16 1810 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD302 (0-2) | **Units:** | µg/Kg |
| **Lab Code:** | R1609593-011 | **Basis:** | Dry |
| | | **Percent Solids:** | 46.0 |

## Polychlorinated Biphenyls (PCBs) by GC

**Analytical Method:** 8082A
**Prep Method:** EPA 3541

| Analyte Name | Result | Q | MRL | MDL | Dilution Factor | Date Extracted | Date Analyzed | Extraction Lot | Analysis Lot | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| Aroclor 1016 | 14000 | U | 14000 | 7400 | 200 | 9/16/16 | 9/23/16 14:01 | 271082 | 515782 | |
| Aroclor 1221 | 29000 | U | 29000 | 15000 | 200 | 9/16/16 | 9/23/16 14:01 | 271082 | 515782 | |
| Aroclor 1232 | 14000 | U | 14000 | 7400 | 200 | 9/16/16 | 9/23/16 14:01 | 271082 | 515782 | |
| Aroclor 1242 | **37000** | | 14000 | 7400 | 200 | 9/16/16 | 9/23/16 14:01 | 271082 | 515782 | |
| Aroclor 1248 | 14000 | U | 14000 | 7400 | 200 | 9/16/16 | 9/23/16 14:01 | 271082 | 515782 | |
| Aroclor 1254 | 14000 | U | 14000 | 8300 | 200 | 9/16/16 | 9/23/16 14:01 | 271082 | 515782 | |
| Aroclor 1260 | 14000 | U | 14000 | 7400 | 200 | 9/16/16 | 9/23/16 14:01 | 271082 | 515782 | |

| Surrogate Name | %Rec | | Control Limits | Date Analyzed | Q |
|---|---|---|---|---|---|
| Decachlorobiphenyl | 0 | * | 22-128 | 9/23/16 14:01 | D |
| Tetrachloro-m-xylene | 0 | * | 14-119 | 9/23/16 14:01 | D |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 8/16 1810 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD302 (0-2) | | |
| **Lab Code:** | R1609593-011 | **Basis:** | NA |

**General Chemistry Parameters**

| Analyte Name | Method | Result | Q | Units | MRL | Dilution Factor | Date Extracted | Date Analyzed | Note |
|---|---|---|---|---|---|---|---|---|---|
| Total Solids | ALS SOP | 46.0 | | Percent | | 1 | NA | 9/13/16 14:30 | |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 9/16 0745 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD304 (0-2) | **Units:** | µg/Kg |
| **Lab Code:** | R1609593-012 | **Basis:** | Dry |
| | | **Percent Solids:** | 48.0 |

**Polychlorinated Biphenyls (PCBs) by GC**

**Analytical Method:** 8082A
**Prep Method:** EPA 3541

| Analyte Name | Result | Q | MRL | MDL | Dilution Factor | Date Extracted | Date Analyzed | Extraction Lot | Analysis Lot | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| Aroclor 1016 | 14000 | U | 14000 | 7100 | 200 | 9/16/16 | 9/23/16 14:27 | 271082 | 515782 | |
| Aroclor 1221 | 28000 | U | 28000 | 15000 | 200 | 9/16/16 | 9/23/16 14:27 | 271082 | 515782 | |
| Aroclor 1232 | 14000 | U | 14000 | 7100 | 200 | 9/16/16 | 9/23/16 14:27 | 271082 | 515782 | |
| Aroclor 1242 | **47000** | | 14000 | 7100 | 200 | 9/16/16 | 9/23/16 14:27 | 271082 | 515782 | |
| Aroclor 1248 | 14000 | U | 14000 | 7100 | 200 | 9/16/16 | 9/23/16 14:27 | 271082 | 515782 | |
| Aroclor 1254 | 14000 | U | 14000 | 8000 | 200 | 9/16/16 | 9/23/16 14:27 | 271082 | 515782 | |
| Aroclor 1260 | 14000 | U | 14000 | 7100 | 200 | 9/16/16 | 9/23/16 14:27 | 271082 | 515782 | |

| Surrogate Name | %Rec | | Control Limits | Date Analyzed | Q |
|---|---|---|---|---|---|
| Decachlorobiphenyl | 0 | * | 22-128 | 9/23/16 14:27 | D |
| Tetrachloro-m-xylene | 0 | * | 14-119 | 9/23/16 14:27 | D |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 9/16 0745 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD304 (0-2) | | |
| **Lab Code:** | R1609593-012 | **Basis:** | NA |

**General Chemistry Parameters**

| Analyte Name | Method | Result | Q | Units | MRL | Dilution Factor | Date Extracted | Date Analyzed | Note |
|---|---|---|---|---|---|---|---|---|---|
| Total Solids | ALS SOP | 48.0 | | Percent | | 1 | NA | 9/13/16 14:30 | |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 9/16 0800 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD305 (0-2) | **Units:** | µg/Kg |
| **Lab Code:** | R1609593-013 | **Basis:** | Dry |
| | | **Percent Solids:** | 79.0 |

## Polychlorinated Biphenyls (PCBs) by GC

**Analytical Method:** 8082A
**Prep Method:** EPA 3541

| Analyte Name | Result | Q | MRL | MDL | Dilution Factor | Date Extracted | Date Analyzed | Extraction Lot | Analysis Lot | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| Aroclor 1016 | 42 | U | 42 | 22 | 1 | 9/20/16 | 9/23/16 17:02 | 271300 | 515782 | |
| Aroclor 1221 | 85 | U | 85 | 43 | 1 | 9/20/16 | 9/23/16 17:02 | 271300 | 515782 | |
| Aroclor 1232 | 42 | U | 42 | 22 | 1 | 9/20/16 | 9/23/16 17:02 | 271300 | 515782 | |
| Aroclor 1242 | **180** | | 42 | 22 | 1 | 9/20/16 | 9/23/16 17:02 | 271300 | 515782 | |
| Aroclor 1248 | 42 | U | 42 | 22 | 1 | 9/20/16 | 9/23/16 17:02 | 271300 | 515782 | |
| Aroclor 1254 | 42 | U | 42 | 25 | 1 | 9/20/16 | 9/23/16 17:02 | 271300 | 515782 | |
| Aroclor 1260 | 42 | U | 42 | 22 | 1 | 9/20/16 | 9/23/16 17:02 | 271300 | 515782 | |

| Surrogate Name | %Rec | Control Limits | Date Analyzed | Q |
|---|---|---|---|---|
| Decachlorobiphenyl | 78 | 22-128 | 9/23/16 17:02 | |
| Tetrachloro-m-xylene | 68 | 14-119 | 9/23/16 17:02 | |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 9/16 0800 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD305 (0-2) | | |
| **Lab Code:** | R1609593-013 | **Basis:** | NA |

**General Chemistry Parameters**

| Analyte Name | Method | Result | Q | Units | MRL | Dilution Factor | Date Extracted | Date Analyzed | Note |
|---|---|---|---|---|---|---|---|---|---|
| Total Solids | ALS SOP | 79.0 | | Percent | | 1 | NA | 9/13/16 14:30 | |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 9/16 0820 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD306 (0-2) | **Units:** | µg/Kg |
| **Lab Code:** | R1609593-014 | **Basis:** | Dry |
| | | **Percent Solids:** | 51.6 |

**Polychlorinated Biphenyls (PCBs) by GC**

**Analytical Method:** 8082A
**Prep Method:** EPA 3541

| Analyte Name | Result | Q | MRL | MDL | Dilution Factor | Date Extracted | Date Analyzed | Extraction Lot | Analysis Lot | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| Aroclor 1016 | 13000 | U | 13000 | 6600 | 200 | 9/20/16 | 9/26/16 11:03 | 271300 | 515824 | |
| Aroclor 1221 | 26000 | U | 26000 | 14000 | 200 | 9/20/16 | 9/26/16 11:03 | 271300 | 515824 | |
| Aroclor 1232 | 13000 | U | 13000 | 6600 | 200 | 9/20/16 | 9/26/16 11:03 | 271300 | 515824 | |
| Aroclor 1242 | **81000** | | 13000 | 6600 | 200 | 9/20/16 | 9/26/16 11:03 | 271300 | 515824 | |
| Aroclor 1248 | 13000 | U | 13000 | 6600 | 200 | 9/20/16 | 9/26/16 11:03 | 271300 | 515824 | |
| Aroclor 1254 | 13000 | U | 13000 | 7400 | 200 | 9/20/16 | 9/26/16 11:03 | 271300 | 515824 | |
| Aroclor 1260 | 13000 | U | 13000 | 6600 | 200 | 9/20/16 | 9/26/16 11:03 | 271300 | 515824 | |

| Surrogate Name | %Rec | | Control Limits | Date Analyzed | Q |
|---|---|---|---|---|---|
| Decachlorobiphenyl | 0 | * | 22-128 | 9/26/16 11:03 | D |
| Tetrachloro-m-xylene | 0 | * | 14-119 | 9/26/16 11:03 | D |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 9/16 0820 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD306 (0-2) | | |
| **Lab Code:** | R1609593-014 | **Basis:** | NA |

**General Chemistry Parameters**

| Analyte Name | Method | Result | Q | Units | MRL | Dilution Factor | Date Extracted | Date Analyzed | Note |
|---|---|---|---|---|---|---|---|---|---|
| Total Solids | ALS SOP | 51.6 | | Percent | | 1 | NA | 9/13/16 14:30 | |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 9/16 0840 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD307 (0-2) | **Units:** | µg/Kg |
| **Lab Code:** | R1609593-015 | **Basis:** | Dry |
| | | **Percent Solids:** | 52.5 |

## Polychlorinated Biphenyls (PCBs) by GC

**Analytical Method:** 8082A
**Prep Method:** EPA 3541

| Analyte Name | Result | Q | MRL | MDL | Dilution Factor | Date Extracted | Date Analyzed | Extraction Lot | Analysis Lot | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| Aroclor 1016 | 13000 | U | 13000 | 6500 | 200 | 9/20/16 | 9/23/16 17:53 | 271300 | 515782 | |
| Aroclor 1221 | 26000 | U | 26000 | 13000 | 200 | 9/20/16 | 9/23/16 17:53 | 271300 | 515782 | |
| Aroclor 1232 | 13000 | U | 13000 | 6500 | 200 | 9/20/16 | 9/23/16 17:53 | 271300 | 515782 | |
| Aroclor 1242 | **60000** | | 13000 | 6500 | 200 | 9/20/16 | 9/23/16 17:53 | 271300 | 515782 | |
| Aroclor 1248 | 13000 | U | 13000 | 6500 | 200 | 9/20/16 | 9/23/16 17:53 | 271300 | 515782 | |
| Aroclor 1254 | 13000 | U | 13000 | 7300 | 200 | 9/20/16 | 9/23/16 17:53 | 271300 | 515782 | |
| Aroclor 1260 | 13000 | U | 13000 | 6500 | 200 | 9/20/16 | 9/23/16 17:53 | 271300 | 515782 | |

| Surrogate Name | %Rec | | Control Limits | Date Analyzed | Q |
|---|---|---|---|---|---|
| Decachlorobiphenyl | 0 | * | 22-128 | 9/23/16 17:53 | D |
| Tetrachloro-m-xylene | 0 | * | 14-119 | 9/23/16 17:53 | D |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 9/16 0840 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD307 (0-2) | | |
| **Lab Code:** | R1609593-015 | **Basis:** | NA |

**General Chemistry Parameters**

| Analyte Name | Method | Result | Q | Units | MRL | Dilution Factor | Date Extracted | Date Analyzed | Note |
|---|---|---|---|---|---|---|---|---|---|
| Total Solids | ALS SOP | 52.5 | | Percent | | 1 | NA | 9/13/16 14:30 | |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 9/16 0910 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD308 (0-2) | **Units:** | µg/Kg |
| **Lab Code:** | R1609593-016 | **Basis:** | Dry |
| | | **Percent Solids:** | 69.6 |

## Polychlorinated Biphenyls (PCBs) by GC

**Analytical Method:** 8082A
**Prep Method:** EPA 3541

| Analyte Name | Result | Q | MRL | MDL | Dilution Factor | Date Extracted | Date Analyzed | Extraction Lot | Analysis Lot | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| Aroclor 1016 | 47 | U | 47 | 25 | 1 | 9/20/16 | 9/23/16 18:19 | 271300 | 515782 | |
| Aroclor 1221 | 96 | U | 96 | 49 | 1 | 9/20/16 | 9/23/16 18:19 | 271300 | 515782 | |
| Aroclor 1232 | 47 | U | 47 | 25 | 1 | 9/20/16 | 9/23/16 18:19 | 271300 | 515782 | |
| Aroclor 1242 | 47 | U | 47 | 25 | 1 | 9/20/16 | 9/23/16 18:19 | 271300 | 515782 | |
| Aroclor 1248 | 47 | U | 47 | 25 | 1 | 9/20/16 | 9/23/16 18:19 | 271300 | 515782 | |
| Aroclor 1254 | 47 | U | 47 | 28 | 1 | 9/20/16 | 9/23/16 18:19 | 271300 | 515782 | |
| Aroclor 1260 | 47 | U | 47 | 25 | 1 | 9/20/16 | 9/23/16 18:19 | 271300 | 515782 | |

| Surrogate Name | %Rec | Control Limits | Date Analyzed | Q |
|---|---|---|---|---|
| Decachlorobiphenyl | 88 | 22-128 | 9/23/16 18:19 | |
| Tetrachloro-m-xylene | 76 | 14-119 | 9/23/16 18:19 | |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 9/16 0910 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD308 (0-2) | | |
| **Lab Code:** | R1609593-016 | **Basis:** | NA |

**General Chemistry Parameters**

| Analyte Name | Method | Result | Q | Units | MRL | Dilution Factor | Date Extracted | Date Analyzed | Note |
|---|---|---|---|---|---|---|---|---|---|
| Total Solids | ALS SOP | 69.6 | | Percent | | 1 | NA | 9/13/16 14:30 | |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 9/16 0930 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD309 (0-2) | **Units:** | µg/Kg |
| **Lab Code:** | R1609593-017 | **Basis:** | Dry |
| | | **Percent Solids:** | 78.7 |

## Polychlorinated Biphenyls (PCBs) by GC

**Analytical Method:** 8082A
**Prep Method:** EPA 3541

| Analyte Name | Result | Q | MRL | MDL | Dilution Factor | Date Extracted | Date Analyzed | Extraction Lot | Analysis Lot | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| Aroclor 1016 | 42 | U | 42 | 22 | 1 | 9/20/16 | 9/23/16 18:45 | 271300 | 515782 | |
| Aroclor 1221 | 85 | U | 85 | 44 | 1 | 9/20/16 | 9/23/16 18:45 | 271300 | 515782 | |
| Aroclor 1232 | 42 | U | 42 | 22 | 1 | 9/20/16 | 9/23/16 18:45 | 271300 | 515782 | |
| Aroclor 1242 | 42 | U | 42 | 22 | 1 | 9/20/16 | 9/23/16 18:45 | 271300 | 515782 | |
| Aroclor 1248 | 42 | U | 42 | 22 | 1 | 9/20/16 | 9/23/16 18:45 | 271300 | 515782 | |
| Aroclor 1254 | 42 | U | 42 | 25 | 1 | 9/20/16 | 9/23/16 18:45 | 271300 | 515782 | |
| Aroclor 1260 | 42 | U | 42 | 22 | 1 | 9/20/16 | 9/23/16 18:45 | 271300 | 515782 | |

| Surrogate Name | %Rec | Control Limits | Date Analyzed | Q |
|---|---|---|---|---|
| Decachlorobiphenyl | 79 | 22-128 | 9/23/16 18:45 | |
| Tetrachloro-m-xylene | 71 | 14-119 | 9/23/16 18:45 | |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 9/16 0930 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD309 (0-2) | | |
| **Lab Code:** | R1609593-017 | **Basis:** | NA |

**General Chemistry Parameters**

| Analyte Name | Method | Result | Q | Units | MRL | Dilution Factor | Date Extracted | Date Analyzed | Note |
|---|---|---|---|---|---|---|---|---|---|
| Total Solids | ALS SOP | 78.7 | | Percent | | 1 | NA | 9/13/16 14:30 | |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 9/16 1020 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD303 (2-4) | **Units:** | µg/Kg |
| **Lab Code:** | R1609593-018 | **Basis:** | Dry |
| | | **Percent Solids:** | 58.0 |

**Polychlorinated Biphenyls (PCBs) by GC**

**Analytical Method:** 8082A
**Prep Method:** EPA 3541

| Analyte Name | Result | Q | MRL | MDL | Dilution Factor | Date Extracted | Date Analyzed | Extraction Lot | Analysis Lot | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| Aroclor 1016 | 5700 | U | 5700 | 3000 | 100 | 9/20/16 | 9/23/16 19:36 | 271300 | 515782 | |
| Aroclor 1221 | 12000 | U | 12000 | 5900 | 100 | 9/20/16 | 9/23/16 19:36 | 271300 | 515782 | |
| Aroclor 1232 | 5700 | U | 5700 | 3000 | 100 | 9/20/16 | 9/23/16 19:36 | 271300 | 515782 | |
| Aroclor 1242 | **44000** | | 5700 | 3000 | 100 | 9/20/16 | 9/23/16 19:36 | 271300 | 515782 | |
| Aroclor 1248 | 5700 | U | 5700 | 3000 | 100 | 9/20/16 | 9/23/16 19:36 | 271300 | 515782 | |
| Aroclor 1254 | 5700 | U | 5700 | 3300 | 100 | 9/20/16 | 9/23/16 19:36 | 271300 | 515782 | |
| Aroclor 1260 | 5700 | U | 5700 | 3000 | 100 | 9/20/16 | 9/23/16 19:36 | 271300 | 515782 | |

| Surrogate Name | %Rec | | Control Limits | Date Analyzed | Q |
|---|---|---|---|---|---|
| Decachlorobiphenyl | 0 | * | 22-128 | 9/23/16 19:36 | D |
| Tetrachloro-m-xylene | 0 | * | 14-119 | 9/23/16 19:36 | D |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 9/16 1020 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD303 (2-4) | | |
| **Lab Code:** | R1609593-018 | **Basis:** | NA |

**General Chemistry Parameters**

| Analyte Name | Method | Result | Q | Units | MRL | Dilution Factor | Date Extracted | Date Analyzed | Note |
|---|---|---|---|---|---|---|---|---|---|
| Total Solids | ALS SOP | 58.0 | | Percent | | 1 | NA | 9/13/16 14:30 | |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 9/16 1030 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD303 (4-6) | **Units:** | µg/Kg |
| **Lab Code:** | R1609593-019 | **Basis:** | Dry |
| | | **Percent Solids:** | 65.7 |

## Polychlorinated Biphenyls (PCBs) by GC

**Analytical Method:** 8082A
**Prep Method:** EPA 3541

| Analyte Name | Result | Q | MRL | MDL | Dilution Factor | Date Extracted | Date Analyzed | Extraction Lot | Analysis Lot | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| Aroclor 1016 | 1000 | U | 1000 | 520 | 20 | 9/20/16 | 9/23/16 20:02 | 271300 | 515782 | |
| Aroclor 1221 | 2000 | U | 2000 | 1100 | 20 | 9/20/16 | 9/23/16 20:02 | 271300 | 515782 | |
| Aroclor 1232 | 1000 | U | 1000 | 520 | 20 | 9/20/16 | 9/23/16 20:02 | 271300 | 515782 | |
| Aroclor 1242 | **4500** | | 1000 | 520 | 20 | 9/20/16 | 9/23/16 20:02 | 271300 | 515782 | |
| Aroclor 1248 | 1000 | U | 1000 | 520 | 20 | 9/20/16 | 9/23/16 20:02 | 271300 | 515782 | |
| Aroclor 1254 | 1000 | U | 1000 | 580 | 20 | 9/20/16 | 9/23/16 20:02 | 271300 | 515782 | |
| Aroclor 1260 | 1000 | U | 1000 | 520 | 20 | 9/20/16 | 9/23/16 20:02 | 271300 | 515782 | |

| Surrogate Name | %Rec | | Control Limits | Date Analyzed | Q |
|---|---|---|---|---|---|
| Decachlorobiphenyl | 0 | * | 22-128 | 9/23/16 20:02 | D |
| Tetrachloro-m-xylene | 0 | * | 14-119 | 9/23/16 20:02 | D |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 9/16 1030 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/10/16 |
| **Sample Name:** | SD303 (4-6) | | |
| **Lab Code:** | R1609593-019 | **Basis:** | NA |

**General Chemistry Parameters**

| Analyte Name | Method | Result | Q | Units | MRL | Dilution Factor | Date Extracted | Date Analyzed | Note |
|---|---|---|---|---|---|---|---|---|---|
| Total Solids | ALS SOP | 65.7 | | Percent | | 1 | NA | 9/13/16 14:30 | |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | 9/ 9/16 1200 |
| **Sample Matrix:** | Water | **Date Received:** | 9/10/16 |
| **Sample Name:** | EB01 | **Units:** | µg/L |
| **Lab Code:** | R1609593-020 | **Basis:** | NA |

## Polychlorinated Biphenyls (PCBs) by GC

**Analytical Method:** 8082A
**Prep Method:** EPA 3510C

| Analyte Name | Result | Q | MRL | MDL | Dilution Factor | Date Extracted | Date Analyzed | Extraction Lot | Analysis Lot | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| Aroclor 1016 | 0.94 | U | 0.94 | 0.50 | 1 | 9/13/16 | 9/15/16 14:26 | 270635 | 514417 | |
| Aroclor 1221 | 1.9 | U | 1.9 | 1.0 | 1 | 9/13/16 | 9/15/16 14:26 | 270635 | 514417 | |
| Aroclor 1232 | 0.94 | U | 0.94 | 0.50 | 1 | 9/13/16 | 9/15/16 14:26 | 270635 | 514417 | |
| Aroclor 1242 | 0.94 | U | 0.94 | 0.50 | 1 | 9/13/16 | 9/15/16 14:26 | 270635 | 514417 | |
| Aroclor 1248 | 0.94 | U | 0.94 | 0.50 | 1 | 9/13/16 | 9/15/16 14:26 | 270635 | 514417 | |
| Aroclor 1254 | 0.94 | U | 0.94 | 0.50 | 1 | 9/13/16 | 9/15/16 14:26 | 270635 | 514417 | |
| Aroclor 1260 | 0.94 | U | 0.94 | 0.50 | 1 | 9/13/16 | 9/15/16 14:26 | 270635 | 514417 | |

| Surrogate Name | %Rec | Control Limits | Date Analyzed | Q |
|---|---|---|---|---|
| Decachlorobiphenyl | 27 | 10-149 | 9/15/16 14:26 | |
| Tetrachloro-m-xylene | 43 | 15-131 | 9/15/16 14:26 | |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | NA |
| **Sample Matrix:** | Water | **Date Received:** | NA |
| **Sample Name:** | Method Blank | **Units:** | µg/L |
| **Lab Code:** | RQ1610740-01 | **Basis:** | NA |

## Polychlorinated Biphenyls (PCBs) by GC

**Analytical Method:** 8082A
**Prep Method:** EPA 3510C

| Analyte Name | Result | Q | MRL | MDL | Dilution Factor | Date Extracted | Date Analyzed | Extraction Lot | Analysis Lot | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| Aroclor 1016 | 1.0 | U | 1.0 | 0.50 | 1 | 9/13/16 | 9/15/16 09:18 | 270635 | 514417 | |
| Aroclor 1221 | 2.0 | U | 2.0 | 1.0 | 1 | 9/13/16 | 9/15/16 09:18 | 270635 | 514417 | |
| Aroclor 1232 | 1.0 | U | 1.0 | 0.50 | 1 | 9/13/16 | 9/15/16 09:18 | 270635 | 514417 | |
| Aroclor 1242 | 1.0 | U | 1.0 | 0.50 | 1 | 9/13/16 | 9/15/16 09:18 | 270635 | 514417 | |
| Aroclor 1248 | 1.0 | U | 1.0 | 0.50 | 1 | 9/13/16 | 9/15/16 09:18 | 270635 | 514417 | |
| Aroclor 1254 | 1.0 | U | 1.0 | 0.50 | 1 | 9/13/16 | 9/15/16 09:18 | 270635 | 514417 | |
| Aroclor 1260 | 1.0 | U | 1.0 | 0.50 | 1 | 9/13/16 | 9/15/16 09:18 | 270635 | 514417 | |

| Surrogate Name | %Rec | Control Limits | Date Analyzed | Q |
|---|---|---|---|---|
| Decachlorobiphenyl | 65 | 10-149 | 9/15/16 09:18 | |
| Tetrachloro-m-xylene | 59 | 15-131 | 9/15/16 09:18 | |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | NA |
| **Sample Matrix:** | Soil | **Date Received:** | NA |
| **Sample Name:** | Method Blank | **Units:** | µg/Kg |
| **Lab Code:** | RQ1610985-01 | **Basis:** | Dry |

## Polychlorinated Biphenyls (PCBs) by GC

**Analytical Method:** 8082A
**Prep Method:** EPA 3541

| Analyte Name | Result | Q | MRL | MDL | Dilution Factor | Date Extracted | Date Analyzed | Extraction Lot | Analysis Lot | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| Aroclor 1016 | 33 | U | 33 | 17 | 1 | 9/16/16 | 9/22/16 12:46 | 271082 | 515559 | |
| Aroclor 1221 | 67 | U | 67 | 34 | 1 | 9/16/16 | 9/22/16 12:46 | 271082 | 515559 | |
| Aroclor 1232 | 33 | U | 33 | 17 | 1 | 9/16/16 | 9/22/16 12:46 | 271082 | 515559 | |
| Aroclor 1242 | 33 | U | 33 | 17 | 1 | 9/16/16 | 9/22/16 12:46 | 271082 | 515559 | |
| Aroclor 1248 | 33 | U | 33 | 17 | 1 | 9/16/16 | 9/22/16 12:46 | 271082 | 515559 | |
| Aroclor 1254 | 33 | U | 33 | 19 | 1 | 9/16/16 | 9/22/16 12:46 | 271082 | 515559 | |
| Aroclor 1260 | 33 | U | 33 | 17 | 1 | 9/16/16 | 9/22/16 12:46 | 271082 | 515559 | |

| Surrogate Name | %Rec | Control Limits | Date Analyzed | Q |
|---|---|---|---|---|
| Decachlorobiphenyl | 87 | 22-128 | 9/22/16 12:46 | |
| Tetrachloro-m-xylene | 73 | 14-119 | 9/22/16 12:46 | |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609593 |
| **Project:** | BASF/60323713 | **Date Collected:** | NA |
| **Sample Matrix:** | Soil | **Date Received:** | NA |
| **Sample Name:** | Method Blank | **Units:** | µg/Kg |
| **Lab Code:** | RQ1611127-01 | **Basis:** | Dry |

## Polychlorinated Biphenyls (PCBs) by GC

**Analytical Method:** 8082A
**Prep Method:** EPA 3541

| Analyte Name | Result | Q | MRL | MDL | Dilution Factor | Date Extracted | Date Analyzed | Extraction Lot | Analysis Lot | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| Aroclor 1016 | 33 | U | 33 | 17 | 1 | 9/20/16 | 9/23/16 15:44 | 271300 | 515782 | |
| Aroclor 1221 | 67 | U | 67 | 34 | 1 | 9/20/16 | 9/23/16 15:44 | 271300 | 515782 | |
| Aroclor 1232 | 33 | U | 33 | 17 | 1 | 9/20/16 | 9/23/16 15:44 | 271300 | 515782 | |
| Aroclor 1242 | 33 | U | 33 | 17 | 1 | 9/20/16 | 9/23/16 15:44 | 271300 | 515782 | |
| Aroclor 1248 | 33 | U | 33 | 17 | 1 | 9/20/16 | 9/23/16 15:44 | 271300 | 515782 | |
| Aroclor 1254 | 33 | U | 33 | 19 | 1 | 9/20/16 | 9/23/16 15:44 | 271300 | 515782 | |
| Aroclor 1260 | 33 | U | 33 | 17 | 1 | 9/20/16 | 9/23/16 15:44 | 271300 | 515782 | |

| Surrogate Name | %Rec | Control Limits | Date Analyzed | Q |
|---|---|---|---|---|
| Decachlorobiphenyl | 64 | 22-128 | 9/23/16 15:44 | |
| Tetrachloro-m-xylene | 68 | 14-119 | 9/23/16 15:44 | |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609641 |
| **Project:** | BASF/6032371301300 | **Date Collected:** | 9/ 9/16 1500 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/13/16 |
| **Sample Name:** | SD299 (0-2) | **Units:** | µg/Kg |
| **Lab Code:** | R1609641-001 | **Basis:** | Dry |
| | | **Percent Solids:** | 55.6 |

## Polychlorinated Biphenyls (PCBs) by GC

**Analytical Method:** 8082A
**Prep Method:** EPA 3541

| Analyte Name | Result | Q | MRL | Dilution Factor | Date Extracted | Date Analyzed | Extraction Lot | Analysis Lot | Note |
|---|---|---|---|---|---|---|---|---|---|
| Aroclor 1016 | 3000 | U | 3000 | 50 | 9/20/16 | 9/23/16 21:19 | 271300 | 515782 | |
| Aroclor 1221 | 6000 | U | 6000 | 50 | 9/20/16 | 9/23/16 21:19 | 271300 | 515782 | |
| Aroclor 1232 | 3000 | U | 3000 | 50 | 9/20/16 | 9/23/16 21:19 | 271300 | 515782 | |
| Aroclor 1242 | **13000** | | 3000 | 50 | 9/20/16 | 9/23/16 21:19 | 271300 | 515782 | |
| Aroclor 1248 | 3000 | U | 3000 | 50 | 9/20/16 | 9/23/16 21:19 | 271300 | 515782 | |
| Aroclor 1254 | 3000 | U | 3000 | 50 | 9/20/16 | 9/23/16 21:19 | 271300 | 515782 | |
| Aroclor 1260 | 3000 | U | 3000 | 50 | 9/20/16 | 9/23/16 21:19 | 271300 | 515782 | |

| Surrogate Name | %Rec | | Control Limits | Date Analyzed | Q |
|---|---|---|---|---|---|
| Decachlorobiphenyl | 0 | * | 22-128 | 9/23/16 21:19 | D |
| Tetrachloro-m-xylene | 0 | * | 14-119 | 9/23/16 21:19 | D |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609641 |
| **Project:** | BASF/6032371301300 | **Date Collected:** | 9/ 9/16 1500 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/13/16 |
| **Sample Name:** | SD299 (0-2) | | |
| **Lab Code:** | R1609641-001 | **Basis:** | NA |

**General Chemistry Parameters**

| Analyte Name | Method | Result | Q | Units | MRL | Dilution Factor | Date Extracted | Date Analyzed | Note |
|---|---|---|---|---|---|---|---|---|---|
| Total Solids | ALS SOP | 55.6 | | Percent | | 1 | NA | 9/14/16 15:10 | |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609641 |
| **Project:** | BASF/6032371301300 | **Date Collected:** | 9/ 9/16 1510 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/13/16 |
| **Sample Name:** | SD299 (2-4) | **Units:** | µg/Kg |
| **Lab Code:** | R1609641-002 | **Basis:** | Dry |
| | | **Percent Solids:** | 57.9 |

## Polychlorinated Biphenyls (PCBs) by GC

**Analytical Method:** 8082A
**Prep Method:** EPA 3541

| Analyte Name | Result | Q | MRL | Dilution Factor | Date Extracted | Date Analyzed | Extraction Lot | Analysis Lot | Note |
|---|---|---|---|---|---|---|---|---|---|
| Aroclor 1016 | 5700 | U | 5700 | 100 | 9/20/16 | 9/26/16 11:28 | 271300 | 515824 | |
| Aroclor 1221 | 12000 | U | 12000 | 100 | 9/20/16 | 9/26/16 11:28 | 271300 | 515824 | |
| Aroclor 1232 | 5700 | U | 5700 | 100 | 9/20/16 | 9/26/16 11:28 | 271300 | 515824 | |
| Aroclor 1242 | **19000** | | 5700 | 100 | 9/20/16 | 9/26/16 11:28 | 271300 | 515824 | |
| Aroclor 1248 | 5700 | U | 5700 | 100 | 9/20/16 | 9/26/16 11:28 | 271300 | 515824 | |
| Aroclor 1254 | 5700 | U | 5700 | 100 | 9/20/16 | 9/26/16 11:28 | 271300 | 515824 | |
| Aroclor 1260 | 5700 | U | 5700 | 100 | 9/20/16 | 9/26/16 11:28 | 271300 | 515824 | |

| Surrogate Name | %Rec | | Control Limits | Date Analyzed | Q |
|---|---|---|---|---|---|
| Decachlorobiphenyl | 0 | * | 22-128 | 9/26/16 11:28 | D |
| Tetrachloro-m-xylene | 0 | * | 14-119 | 9/26/16 11:28 | D |

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609641 |
| **Project:** | BASF/6032371301300 | **Date Collected:** | 9/ 9/16 1510 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/13/16 |
| **Sample Name:** | SD299 (2-4) | | |
| **Lab Code:** | R1609641-002 | **Basis:** | NA |

## General Chemistry Parameters

| Analyte Name | Method | Result | Q | Units | MRL | Dilution Factor | Date Extracted | Date Analyzed | Note |
|---|---|---|---|---|---|---|---|---|---|
| Total Solids | ALS SOP | 57.9 | | Percent | | 1 | NA | 9/14/16 15:10 | |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609641 |
| **Project:** | BASF/6032371301300 | **Date Collected:** | 9/ 9/16 1525 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/13/16 |
| **Sample Name:** | SD312 (2-4) | **Units:** | µg/Kg |
| **Lab Code:** | R1609641-003 | **Basis:** | Dry |
| | | **Percent Solids:** | 45.6 |

**Polychlorinated Biphenyls (PCBs) by GC**

**Analytical Method:** 8082A
**Prep Method:** EPA 3541

| Analyte Name | Result | Q | MRL | Dilution Factor | Date Extracted | Date Analyzed | Extraction Lot | Analysis Lot | Note |
|---|---|---|---|---|---|---|---|---|---|
| Aroclor 1016 | 14000 | U | 14000 | 200 | 9/20/16 | 9/23/16 22:11 | 271300 | 515782 | |
| Aroclor 1221 | 29000 | U | 29000 | 200 | 9/20/16 | 9/23/16 22:11 | 271300 | 515782 | |
| Aroclor 1232 | 14000 | U | 14000 | 200 | 9/20/16 | 9/23/16 22:11 | 271300 | 515782 | |
| Aroclor 1242 | **130000** | | 14000 | 200 | 9/20/16 | 9/23/16 22:11 | 271300 | 515782 | |
| Aroclor 1248 | 14000 | U | 14000 | 200 | 9/20/16 | 9/23/16 22:11 | 271300 | 515782 | |
| Aroclor 1254 | 14000 | U | 14000 | 200 | 9/20/16 | 9/23/16 22:11 | 271300 | 515782 | |
| Aroclor 1260 | 14000 | U | 14000 | 200 | 9/20/16 | 9/23/16 22:11 | 271300 | 515782 | |

| Surrogate Name | %Rec | | Control Limits | Date Analyzed | Q |
|---|---|---|---|---|---|
| Decachlorobiphenyl | 0 | * | 22-128 | 9/23/16 22:11 | |
| Tetrachloro-m-xylene | 0 | * | 14-119 | 9/23/16 22:11 | |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609641 |
| **Project:** | BASF/6032371301300 | **Date Collected:** | 9/ 9/16 1525 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/13/16 |
| **Sample Name:** | SD312 (2-4) | | |
| **Lab Code:** | R1609641-003 | **Basis:** | NA |

**General Chemistry Parameters**

| Analyte Name | Method | Result | Q | Units | MRL | Dilution Factor | Date Extracted | Date Analyzed | Note |
|---|---|---|---|---|---|---|---|---|---|
| Total Solids | ALS SOP | 45.6 | | Percent | | 1 | NA | 9/14/16 15:10 | |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609641 |
| **Project:** | BASF/6032371301300 | **Date Collected:** | 9/ 9/16 1610 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/13/16 |
| **Sample Name:** | SD311 (2-4) | **Units:** | µg/Kg |
| **Lab Code:** | R1609641-004 | **Basis:** | Dry |
| | | **Percent Solids:** | 56.3 |

**Polychlorinated Biphenyls (PCBs) by GC**

**Analytical Method:** 8082A
**Prep Method:** EPA 3541

| Analyte Name | Result | Q | MRL | Dilution Factor | Date Extracted | Date Analyzed | Extraction Lot | Analysis Lot | Note |
|---|---|---|---|---|---|---|---|---|---|
| Aroclor 1016 | 5900 | U | 5900 | 100 | 9/20/16 | 9/23/16 22:37 | 271300 | 515782 | |
| Aroclor 1221 | 12000 | U | 12000 | 100 | 9/20/16 | 9/23/16 22:37 | 271300 | 515782 | |
| Aroclor 1232 | 5900 | U | 5900 | 100 | 9/20/16 | 9/23/16 22:37 | 271300 | 515782 | |
| Aroclor 1242 | **23000** | | 5900 | 100 | 9/20/16 | 9/23/16 22:37 | 271300 | 515782 | |
| Aroclor 1248 | 5900 | U | 5900 | 100 | 9/20/16 | 9/23/16 22:37 | 271300 | 515782 | |
| Aroclor 1254 | 5900 | U | 5900 | 100 | 9/20/16 | 9/23/16 22:37 | 271300 | 515782 | |
| Aroclor 1260 | 5900 | U | 5900 | 100 | 9/20/16 | 9/23/16 22:37 | 271300 | 515782 | |

| Surrogate Name | %Rec | | Control Limits | Date Analyzed | Q |
|---|---|---|---|---|---|
| Decachlorobiphenyl | 0 | * | 22-128 | 9/23/16 22:37 | D |
| Tetrachloro-m-xylene | 0 | * | 14-119 | 9/23/16 22:37 | D |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609641 |
| **Project:** | BASF/6032371301300 | **Date Collected:** | 9/ 9/16 1610 |
| **Sample Matrix:** | Soil | **Date Received:** | 9/13/16 |
| **Sample Name:** | SD311 (2-4) | | |
| **Lab Code:** | R1609641-004 | **Basis:** | NA |

**General Chemistry Parameters**

| Analyte Name | Method | Result | Q | Units | MRL | Dilution Factor | Date Extracted | Date Analyzed | Note |
|---|---|---|---|---|---|---|---|---|---|
| Total Solids | ALS SOP | 56.3 | | Percent | | 1 | NA | 9/14/16 15:10 | |

**ALS Group USA, Corp. dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | AECOM | **Service Request:** | R1609641 |
| **Project:** | BASF/6032371301300 | **Date Collected:** | NA |
| **Sample Matrix:** | Soil | **Date Received:** | NA |
| **Sample Name:** | Method Blank | **Units:** | µg/Kg |
| **Lab Code:** | RQ1611127-01 | **Basis:** | Dry |

## Polychlorinated Biphenyls (PCBs) by GC

**Analytical Method:** 8082A
**Prep Method:** EPA 3541

| Analyte Name | Result | Q | MRL | Dilution Factor | Date Extracted | Date Analyzed | Extraction Lot | Analysis Lot | Note |
|---|---|---|---|---|---|---|---|---|---|
| Aroclor 1016 | 33 | U | 33 | 1 | 9/20/16 | 9/23/16 15:44 | 271300 | 515782 | |
| Aroclor 1221 | 67 | U | 67 | 1 | 9/20/16 | 9/23/16 15:44 | 271300 | 515782 | |
| Aroclor 1232 | 33 | U | 33 | 1 | 9/20/16 | 9/23/16 15:44 | 271300 | 515782 | |
| Aroclor 1242 | 33 | U | 33 | 1 | 9/20/16 | 9/23/16 15:44 | 271300 | 515782 | |
| Aroclor 1248 | 33 | U | 33 | 1 | 9/20/16 | 9/23/16 15:44 | 271300 | 515782 | |
| Aroclor 1254 | 33 | U | 33 | 1 | 9/20/16 | 9/23/16 15:44 | 271300 | 515782 | |
| Aroclor 1260 | 33 | U | 33 | 1 | 9/20/16 | 9/23/16 15:44 | 271300 | 515782 | |

| Surrogate Name | %Rec | Control Limits | Date Analyzed | Q |
|---|---|---|---|---|
| Decachlorobiphenyl | 64 | 22-128 | 9/23/16 15:44 | |
| Tetrachloro-m-xylene | 68 | 14-119 | 9/23/16 15:44 | |