From: VanDewalker, Heather <Heather.VanDewalker@arcadis.com>
Sent: Monday, July 20, 2020 3:20 PM
To: Steven DiLella; Spellman, John (DEC)
Cc: Gravelding, Mark; Dievendorf, Eric; Stearns, Brian M.
Subject: RE: EXT || FW: Hudson MGP Site 411005 - Final RD Report
Attachments: 0781611214_HWS RD_Final_Complete.pdf

John-

On behalf of Steven DiLella of National Grid, please find attached the finalized and stamped Final Remedial Design Report for the National Grid Hudson Water Street Site for your review and approval.

Additional text to address the prohibited use of surfactants during remedial activities was added to the Design Report. The location of revisions related to this comment are as follows:

1. Main text document:
    a. Section 4.1.5.2 Sheen Controls and Monitoring; last sentence of first paragraph; page 34 of PDF

2. Appendix A – Design Drawings:
    a. Drawing G-100: General Notes and Abbreviations – Site Management Notes Bullet 16 – Added second sentence; page 228 of PDF

3. Appendix B – Technical Specifications:
    a. Section 013543 – Environmental Protection Procedures Article 3.03 Protection of Surface Waters – Added bullet D.; page 282 of PDF

Regards
Heather

Heather M. VanDewalker, PE | Vice President / Region Manager | heather.vandewalker@arcadis.com
Arcadis | Arcadis of New York, Inc.
One Lincoln Center | 110 West Fayette Street | Suite 300 | Syracuse NY | 13202 | USA
T. +1 315 671 9382 | M. +1 315 391 8391

Professional Registration / PE-NY, 076992-1

From: Dilella, Steven <Steven.Dilella@nationalgrid.com>
Sent: Monday, July 20, 2020 10:20 AM

FINAL REMEDIAL DESIGN REPORT

Operable Unit 2

Hudson (Water Street) Site

Hudson, New York

July 2020

FINALREMEDIAL DESIGN REPORT

Operable Unit 2
Hudson (Water Street) Site
Hudson, New York

Certification Statement:

I, Mark O. Gravelding, certify that I am currently a NYS registered professional engineer and that this Remedial Design Report was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

Mark O. Gravelding, P.E.
Senior Vice President

Prepared for:

National Grid

Syracuse, New York

Prepared by:

Arcadis of New York, Inc.

One Lincoln Center

110 W Fayette Street

Suite 300

Syracuse

New York 13202

Tel 315 446 9120

Fax 315 449 0017

Our Ref.:

30003986.00012

Date:

July 2020

CONTENTS

TABLES

FIGURES

ATTACHMENTS

APPENDICES

ACRONYMS AND ABBREVIATIONS

amsl	above mean sea level
ARC	Area for Remedial Consideration
Arcadis	Arcadis of New York, Inc.
ASI	Aqua Survey, Inc.
ASTM	American Society for Testing and Materials
BMPs	best management practices
bmsl	below mean sea level
bss	below sediment surface
BTEX	benzene, toluene, ethylbenzene, and xylene
CAMP	Community Air Monitoring Plan
CFR	Code of Federal Regulations
cfs	cubic feet per second
COCs	constituents of concern
CPT	cone penetrometer test
CQA	construction quality assurance
CQAP	Construction Quality Assurance Plan
CSIR	Comprehensive Sediment Investigation Report
cy	cubic yards
DOT	Department of Transportation
El.	elevation
ERL	Effects Range Low
FEMA	Federal Emergency Management Agency
FER	Final Engineering Report
GAC	granular-activated carbon
HASP	Health and Safety Plan
LOEL	Lowest Observed Effects Level
LTTD	low temperature thermal desorption
MGP	manufactured gas plant
mg/kg	milligrams per kilogram
MLLW	mean lower low water

NAPL	non-aqueous phase liquid
NAVD88	North American Vertical Datum of 1988
NTU	nephelometric turbidity unit
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OU	Operable Unit
OWS	oil/water separator
PAH	polycyclic aromatic hydrocarbon
PCBs	polychlorinated biphenyls
pcf	pounds per cubic foot
PDI	pre-design investigation
PID	photoionization detector
PPPAH	priority pollutant polycyclic aromatic hydrocarbon
QA	quality assurance
QC	quality control
PPE	personal protective equipment
RA	remedial action
RACP	Remedial Action Contingency Plan
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RD	remedial design
RD Report	Remedial Design Report
RDWP	Remedial Design Work Plan
RFP	Request for Proposal
ROD	Record of Decision
RQD	rock quality designation
Sanborn	Sanborn Map and Publishing Company
SAV	submerged aquatic vegetation
SCG	Standards, Criteria, and Guidance
SMP	Site Management Plan
SOC	soot organic carbon

SPDES	State Pollution Discharge Elimination System
SPME	solid phase microextraction
SPT	standard penetration testing
SWPPP	Storm Water Pollution Prevention Plan
TAMS	TAMS Consultants, Inc.
TCLP	Toxicity Characteristic Leaching Procedure
TPH	total petroleum hydrocarbons
TSS	total suspended solids
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WOE	weight-of-evidence

1 INTRODUCTION

1.1 Purpose

This *Final Remedial Design Report* (RD Report) has been prepared by Arcadis of New York, Inc. (Arcadis) on behalf of National Grid to provide a comprehensive account of design activities and evaluations, modeling, and supporting information to effectively implement the selected remedy for the former National Grid Hudson Water Street manufactured gas plant (MGP) site (the Site) in Hudson, New York (Figure 1). These activities are being performed pursuant to the site-specific remedy selected in the New York State Department of Environmental Conservation's (NYSDEC's) Operable Unit 2 (OU2) Record of Decision (ROD; NYSDEC 2012).

This RD Report has been prepared in general accordance with: 1) the March 2012 ROD (NYSDEC 2012); 2) the *Remedial Design Work Plan* (RDWP; Arcadis 2014), as approved by the NYSDEC in a letter to National Grid dated June 24, 2014; 3) outcomes of an October 6, 2015 meeting with NYSDEC; 4) the NYSDEC April 25, 2019 70% Draft Design Report comments letter and National Grid's October 4, 2019 Response to Comments letter; 5) the NYSDEC letter dated October 7, 2019 concurring with National Grid's letter dated October 4, 2019; and 6) the procedures outlined in the DER-10/Technical Guidance for Site Investigation and Remediation (NYSDEC 2010b).

1.2 Report Organization and Structure

The organization of this RD Report is as follows.

Section	Description
1 – Introduction	Presents the purpose of the RD Design Report, summarizes the report organization, provides background information, presents a description of the site characterization and nature and extent of environmental impacts, and outlines the RAOs and the selected remedy.
2 – Basis of Design	Presents the process and tools used to identify design components.
3 – Pre-Remediation Activities	Describes the activities to be completed prior to implementation of the remedial activities.
4 – Remediation Activities	Summarizes the remedial activities to be conducted as part of the selected remedy.
5 – Summary of Green Remediation Practices	Describes green remediation practices and principles considered in the development of the remedial design to meet the objectives of green remediation.
6 – Post-Remedial Activities	Describes the reporting, monitoring, and administrative activities to be completed following remedial construction.
7 – Schedule	Presents the anticipated schedule for the remedial design and implementation of the remedy.
8 – References	Lists sources used to prepare this report.

Several appendices are included herein to supplement the contents of this RD Report. These appendices provide additional information related to the implementation of the RA activities and include the following:

- Design Drawings (Appendix A);
- Technical Specifications (Appendix B);
- *Construction Quality Assurance Plan* (CQAP; Appendix C);
- *Community Air Monitoring Plan* (CAMP; Appendix D);
- *Storm Water Pollution Prevention Plan* (SWPPP; Appendix E);
- *Remedial Action Contingency Plan* (RACP; Appendix F);
- *Restoration Plan* (Appendix G-1); and
- *Restoration Plan Addendum* (Appendix G-2).

Attachment 1 to this document presents the results of the treatability studies conducted in 2017. Attachment 2 contains supporting remedial design calculations.

1.3 Site Background

This section provides a brief summary of the Site background and history, as well as the current land uses at the Site.

1.3.1 Site Location and Description

The Site is located in and along the east bank of the Hudson River. It includes property where the former MGP was located on Water Street in Hudson, Columbia County, New York, and sediments within a portion of the Hudson River. The Site consists of two operable units, OU1 and OU2, as illustrated on Figure 2.

OU1 is defined as the onsite source area including Embayment #1. Remediation activities for OU1 were completed from April 2004 to September 2005 in accordance with the Final Remedial Design – Contract No. 1 – General (BBL 2003a). The OU1 remediation activities consisted of excavation and offsite disposal of approximately 8,800 cubic yards (cy) of soil from the former gas holder area and former tar tank area of the former MGP; excavation and offsite disposal of approximately 8,600 cy of sediment and soil from Embayment #1 and the surrounding shoreline; and restoration of the Embayment #2 shoreline and the north wall of a building on the City of Hudson property. As described in the Final Engineering Report for the OU1 activities, a permanent sheet pile wall was installed around the sediment removal area and along the western alignment of Embayment #1 (i.e., the mouth of the embayment; Arcadis 2008b). This steel sheet pile wall was left in-place to provide additional protection against the potential lateral subsurface migration of impacted material from surrounding properties (e.g., the former oil terminal) into Embayment #1.

OU2 is defined as the portion of the Hudson River adjacent to the Site extending approximately 1,700 feet along the shoreline from the west end of Ferry Street to the Colarusso Ventures, LLC (Colarusso) property, and approximately 300 feet offshore into the eastern edge of the shipping channel (Figure 2). OU2 includes Embayment #2, Embayment #3, and Embayment #4, and is the subject of this RD Report.

1.3.2 Site History and Current Use

The City of Hudson, New York was settled in the 1700s and became a center for whale oil processing and candle manufacturing. In the 1850s, whale oil streetlamps were replaced with manufactured gas lamps (Bradbury 1908). For more than 100 years, the eastern upland area adjacent to the Site has been used for industrial and commercial purposes. Beginning in the late 1800s, iron and steel works, fuel storage, and metal manufacturing facilities operated near the shoreline of the Site (Beers 1873), and the by-products of these industries were used as fill material for the shoreline areas. The majority of the upland area along the shoreline in the vicinity of the Site was filled with several feet of ash, cinders, brick, clay, sand, and gravel. Railroad spurs were also constructed in the vicinity of the four embayments (see Figure 2) for loading and unloading materials manufactured in the vicinity of the Site. Coal yards and oil tanks were also located along the shoreline of the Site (Sanborn Map and Publishing Company [Sanborn] 1949). MGP operations in this area were active from 1853 until 1949, when natural gas replaced the need for manufactured gas. Subsequent to 1949, industrial and commercial operations at or near the Site have included a motor freight building, an auto scrap yard, and a lumberyard storage area (Sanborn 1961).

Currently, the land immediately adjacent to the Site is used by the public as a park (Henry Hudson Riverfront Park owned by the City of Hudson [City Park]), and land to the east and south of the Site is used for industrial purposes by New York Central Lines and Colarusso (Figure 2). A commuter rail station is located to the east of the Site, across Water Street. The Site is located within the northwestern portion of the City of Hudson, which contains several active industrial facilities, railroads, streets, and parking lots. A storm water outfall that provides drainage for a majority of the northwestern portion of the City of Hudson discharges to Embayment #3 (Figure 2).

The Hudson River in the vicinity of the Site is used as a navigable waterway and for recreational purposes. A large island called Middle Ground Flats divides the river offshore from the Site. The shipping channel is located east of the island and is maintained by the United States Army Corps of Engineers (USACE). A barge docking area is located south of Embayment #4 and adjacent to the Colarusso property. Hudson Cruises, Inc., operates guided boat tours from a dock located just north of Embayment #1 (Spirit of Hudson Dock Area; Figure 2), and a private marina and public boat launch are located to the north of the City Park. A fiber optic line owned by Mid-Hudson Cablevision Inc. (Mid-Hudson Cable) crosses the Hudson River within OU2 (Figure 2). A fish consumption advisory issued by the New York State Department of Health (NYSDOH; NYSDOH 2019) is currently in effect for fish caught from the Hudson River in the vicinity of the Site due to non-site-related contaminants.

1.4 Site Characterization

The following subsections summarize previously provided and NYSDEC-approved information regarding the physical and environmental setting of OU2 and the nature and extent of MGP-related sediment impacts based on the Site data. Additional information can be found in the documents cited herein.

1.4.1 Physical and Environmental Setting

The physical and environmental setting for OU2 and the surrounding area is described in terms of regional and Site geology and hydrology, including specific information about the Hudson River and sediments within OU2.

1.4.1.1 Regional and Site Geology

OU2 and the surrounding vicinity are situated in an area of lacustrine deposits of sand, silt, and clay in the Hudson River Valley with underlying Normanskill gray to black shale bedrock of Ordovician age (Goldring 1943). Shale bedrock outcrops at the surface at locations north of the Site (along the railroad near the public boat launch) and is more than 70 feet below mean sea level (bmsl) in the Hudson River. The lacustrine deposits come from the retreating Wisconsin ice sheet. A post-glacial lake formed in the upper Hudson River Valley, known as Lake Albany, which accumulated thick deposits of fine sediment for up to 5,000 years (Isachsen et al. 1991).

As discussed in Section 1.3.2, the eastern shoreline of the Hudson River adjacent to the Site has supported significant industrial activity, including the placement of fill materials along the shoreline. This shoreline area, similar to many portions of the Hudson River, was filled to support the expansion of industrial facilities in this area, as well as to support the continued growth of the area in the vicinity of the City of Hudson. While historical accounts are limited, it is likely that the riverbank was initially filled to support the railroad infrastructure parallel to the shoreline of the Site. Over time, additional fill materials, consisting of slag, cinder, ash, bricks, and gravel, were also deposited along the riverbank between the existing railroad and the waterway, further encroaching on the Hudson River. This filling continued until the riverbank extended approximately 50 to 100 feet into what was once the Hudson River tidal flats and riverbed. As the industries that used the embayments for transportation ceased operations approximately 100 years ago, the embayments have been slowly filling in. Based on a review of historical maps, it appears that a portion of the eastern end of Embayment #3 has been filled.

The current physical characteristics of the shoreline at the Site reflect the historical filling efforts described above. The shoreline is generally steeply sloped, with slopes between 15 and 90 degrees, consisting of the aforementioned various types of fill materials, riprap, or walled with concrete, piles, and sheet piling.

The river sediment characteristics within OU2 are described as follows:

- The sediment surface layer (0 to 0.5 foot below sediment surface [bss]) and near-surface layer (0.5 to 2 feet bss) in the eastern portion of the channel along the slope was found to generally consist of coarse sand, gravel, and cobbles, with fill and shells. Closer to and within the shipping channel, the sediments grade to finer sands with traces of coarser sands and gravels and fewer shells. In general, the sediment surface is stable due to the presence of a natural armoring layer consisting of cobbles, gravel, coarse sand, coarser fill (e.g., slag and bricks), and shells.
- Thicker layers (greater than 2 to 12 feet) of coarser-grained sediments (i.e., greater sand and gravel content) and more fill materials were observed closer to the eastern shoreline, especially near the floating dock north of Embayment #1.
- Between 0.5 and 12 feet bss, the sand and gravel proportion in the sediment diminishes and the sediment becomes almost entirely silt and fine sands grading to silty clay at depth. In general, the transition depth to the silty clay is shallower farther from the shoreline. The depth to bedrock under this portion of the river is unknown, but based on the result of the geophysical survey, is believed to be deeper than 30 feet bss.

1.4.1.2 Regional and Site Hydrology

The Hudson River is approximately 315 miles long from its source at Lake Tear-of-the-Clouds in the Adirondack Mountains to the Battery in New York City. At the Federal Dam at Troy, New York, the total drainage area is approximately 8,000 square miles. In 2010, at United States Geological Survey (USGS) gauging station 01358000 in Green Island, New York, approximately 40 miles north of the Site, the river flow has an average daily discharge of 14,210 cubic feet per second (cfs). The highest Hudson River flow recorded at Green Island was 215,000 cfs on March 19, 1936, and the lowest was 882 cfs on September 2, 1936 (Stedfast 1982).

The Hudson River flows in a southerly direction across OU2. This portion of the Hudson River is fresh water and tidally influenced (tidal influence extends up to the Federal Dam at Troy, New York). According to NYCRR Title 6 Part 858.4 (NYCRR 1995), the Hudson River in the area of OU2 is classified as a NYSDEC Class A water body. According to the regulations (701.6), "[T]he best usages for Class A water bodies are: a source of water supply for drinking, culinary or food processing purposes; primary and secondary contact recreation and fishing. The waters shall also be suitable for fish propagation and survival" (NYCRR 1995).

In the vicinity of the Site, the Hudson River is a long, narrow estuary, approximately 0.5-mile-wide, formed in a drowned-river valley. Because the river bottom is below sea level, it is not down cut or eroded; rather, upland sediment is filling in the river channel. A large island called Middle Ground Flats divides the river offshore from the Site. The shipping channel is located east of the island and is maintained by the USACE at a width of 400 feet and a depth of approximately 34 feet at mean lower low water (MLLW) (BBL 2000). In the stretch of river adjacent to the Site, a generalized cross-section would be characterized by steep banks, descending to a flat bottom at approximately 45 feet bmsl (North American Vertical Datum [NAVD] 1988).

The tidal influence in the estuary can be observed by the variations in stage and discharge over a complete tidal cycle. Just south of the Federal Dam (approximately 36 miles upstream of the Site), the average range in tidal elevation is 4.7 feet, and at the Site, the elevation change is estimated at 4.1 feet (BBL 2002b). The direction of flow in the estuary reverses four times daily, except during high flows in the spring, which can overshadow the tidal influence. Also, strong north and south winds can significantly influence the river stage. The 100-year flood elevation is 12 feet above mean sea level (amsl), which is above most of the upland areas bordering OU2 (Federal Emergency Management Agency [FEMA] 1989).

1.4.2 Nature and Extent of COCs

As described in the NYSDEC-approved Revised Comprehensive Sediment Investigation Report (CSIR; Arcadis 2010), many sediment samples have been collected at the Site to characterize the nature and extent of former MGP constituents and to assess the bioavailability and potential toxicity of MGP-related constituents. The primary constituents of concern in OU2 sediments are non-aqueous phase liquid (NAPL), PAHs, and (to a lesser extent) benzene, toluene, ethylbenzene, and xylene (BTEX). The distributions of other constituents within the OU2 sediments are independent of PAH distribution; therefore, the other constituents are assumed to be the result of other urban/industrial sources and are not attributable to the former MGP operations at the Site.

NAPLs in OU2 sediments are primarily located along the slope adjacent to Embayment #1 and in a small portion of the shipping channel. NAPL and staining were also observed near the mouth of Embayment #2. NAPL was not observed in the sediments in Embayment #3 or Embayment #4. Deeper NAPL impacts were observed along the shoreline; the depth to NAPL decreases to the west as the river bottom slopes steeply toward the shipping channel.

In general, higher PAH concentrations are associated with sediments containing NAPL and exhibiting staining near Embayment #1. Total "priority pollutant" polycyclic aromatic hydrocarbon (PPPAH)[1] concentrations in both the surface and subsurface sediments are highest in the vicinity of Embayment #1, generally increasing from north to south toward Embayment #1, peaking near the mouth of Embayment #1, and then decreasing southward, downstream of Embayment #1. West of Embayment #1, the highest PPPAH concentrations were observed on the slope between the shore and the shipping channel. In general, total PPPAH concentrations decrease to the north, west, and south of the NAPL-impacted area. At several locations to the south and north of the NAPL-impacted area, and in Embayment #4, PPPAH concentrations approach background levels. Compositionally, PAH concentrations transition from Site-related to background just south and just north of the NAPL-containing sediment area. In Embayment #2, PAHs are characteristic of background (MPE2-1 and MPE2-3) and petroleum (MPE2-2). PAH compositional evaluation and the known presence of a storm water sewer outfall within Embayment #3 together indicate that PAHs in sediments within Embayment #3 are primarily the result of urban/industrial sources not related to the former MGP. With respect to BTEX, the occurrence of higher concentrations correlates to the locations with higher concentrations of PAHs.

As presented in the Revised CSIR, the characterization of the bioavailability and toxicity of PAHs in Site sediments indicates that the PAHs are not as toxic to benthic aquatic organisms as is currently assumed by the NYSDEC regulatory guidance for screening contaminated sediments (Effects Range Low [ERL]). The Lowest Observed Effects Level (LOEL) total PAH_{16} concentration associated with a significant reduction in amphipod survival was 112 milligrams per kilogram (mg/kg; HD142). However, sediment samples with total PAH_{16} concentrations as high as 566 mg/kg (HD151) showed no significant reductions in *H. azteca* survival. The previous work indicates that solid phase microextraction (SPME) pore water TU_{34} concentrations[2] were a more accurate predictor of *H. azteca* survival than total PAH_{16} concentrations. The Site-specific threshold value[3] for Hudson was approximately 5.4 SPME pore water TU_{34}. The relatively high fraction of Soot Organic Carbon (SOC)/TOC in the sediment samples (up to 90% in some Site sediment samples) provides an explanation for why the ERL/ERM screening values for total PAH_{16} concentrations do not predict biological effects. The PAHs are much more strongly bound to sediment organic carbon than is assumed by the standard equilibrium partitioning assumptions, because PAHs sorb to anthropogenic sources of "hard" organic carbon (e.g., charcoal, soot, coal or coke fines, or coal tar pitch) more strongly than to natural sources of "soft" organic carbon (e.g., natural organic matter) (Hong et al. 2003). As a consequence, the total PAH_{16} concentration is not bioavailable. By contrast, the direct measurement of sediment pore water (SPME pore water TU_{34}) only measures the concentration of

[1] PPPAH is used to distinguish the sum of the 16 priority pollutant PAHs (PAH_{16}) by standard USEPA Method 8270C from the measurement of these PAHs for the bioavailability evaluations by other methods.

[2] Sediment pore water concentrations of the 34 National Oceanic and Atmospheric Administration (NOAA) PAHs measured using SPME and expressed as toxic units (SPME pore water TU_{34}), per USEPA (2003) and ASTM Method D7363-07.

[3] the Site-specific threshold of 5.4 is the 95 percent confidence interval for the Lethal Dose, 20 percent (LD_{20}), or the concentration required to kill 20 percent of the test organism population after 28 days).

PAHs that partition from the solid phase (i.e., sediment) to the dissolved phase (i.e., pore water). It is this bioavailable fraction which drives exposure and is therefore a better predictor of biological effects (e.g., *H. azteca* survival).

The weight-of-evidence assessment of sediment chemistry, toxicity testing, and benthic macroinvertebrate survey shows that only the seven Site sediment samples (HD-142, HD-143, HD-146, HD-147, HD-148, HD131 and HD138) with both SPME pore water TU_{34} concentrations greater than the Site-specific threshold of 5.4 and significant reduction in *H. azteca* survival pose a potential risk to benthic macroinvertebrates at the Site. Five of these sample locations correspond to a localized region adjacent to Embayment #1, and two sample locations correspond to an area slightly downriver (just outside the mouth of Embayment #2). These areas of potential sediment toxicity, together with the sediments containing NAPL, are referred to as the Area for Remedial Consideration (ARC).

1.5 Remedial Action Objectives and Description of Selected Remedy

As identified in the ROD (NYSDEC 2012), the Remedial Action Objectives (RAOs) for OU2 are as follows:

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

A Feasibility Study for OU2 was developed to present and evaluate potential remedial alternatives to address the sediments at the Site and achieve the above-listed RAOs for OU2 (Arcadis 2011). Based in part on the evaluation presented therein, Remedial Alternative 7: Excavation of Sediments within the ARC to Full Depth of NAPL (up to 15 feet) with Treatment/Disposal of Excavated Sediments and Backfill of the Excavated Area was selected in the ROD.

Specifically, the elements of the selected remedy include the following:

- A RD program to provide the details necessary for the construction, operation, maintenance, and monitoring of the remedy. Green remediation principles and techniques will be implemented to the extent feasible in the design, implementation, and management of such program, as discussed in Section 5, per DER-31/Green Remediation (NYSDEC 2011).
- Installation and maintenance of appropriate engineering controls around the ARC during remediation, as feasible, to control and contain re-suspended sediments and mobile NAPL that may be generated as a result of dredging activities.
- Removal of debris and shoreline riprap within the ARC for offsite disposal or, in the case of the riprap, reuse as feasible.
- Removal of up to 9,000 cy of NAPL-saturated and potentially toxic sediment within the ARC to depths up to 15 feet bss.

- Management, including dewatering and if necessary, pre-treatment, of the dredged sediment in preparation for offsite treatment and/or disposal at a permitted facility. Installation of a temporary containment structure with an air handling and treatment system over the sediment staging and processing area.
- Installation of a temporary water treatment system to treat water removed from the dredged sediment.
- Restoration of the riverbed and banks to the original bathymetry and, to the extent possible, with material similar to the existing substrate.
- Post-remediation monitoring of remedy effectiveness and restoration success.

As stated in the ROD, implementation of this alternative will comply with the NYSDEC's Standards, Criteria, and Guidance (SCG) to the extent practicable (NYSDEC 2012). Specifically, the source areas of contamination, ecological impacts and demonstrated toxic sediments will be addressed through dredging, treatment, and disposal of the impacted sediments in the ARC. In addition, the impacted sediments will be permanently removed from the Site, resulting in compliance with SCGs, notably addressing sheen producing sediments which are a contravention of water quality standards. The SCGs are summarized in the RDWP (Arcadis 2014).

2 INVESTIGATION SUMMARY AND BASIS OF DESIGN

This section identifies the previous investigations performed within the OU2 area in preparation for design and remediation activities. The applicable results of past remedial investigations and Pre-Design Investigation (PDI) investigations are summarized below.

Also included in this section is the basis of design for key design components including refinement of dredge depths; determination of appropriate resuspension controls; assessment of geotechnical characteristics; and waste characterization.

2.1 Remedial Investigation Summary

Between 1995 and 2009, numerous sediment investigations were completed within OU2 to evaluate the nature and extent of MGP-related constituents, including the spatial distribution of PAHs and NAPL in Site sediments along with physical and geotechnical characteristics. These investigations also included an evaluation of the bioavailability and potential toxicity of PAHs in the OU2 sediments, assessments of the health of the macroinvertebrate community, and evaluations of the extent of natural recovery of sediments containing Site-related PAHs following completion of the OU1 remedial activities. A summary of the OU2 sediment investigations is presented in Table 1. Sediment sample, bioavailability study sample, and/or core locations are illustrated on Figure 3. Additional details can be found in the following NYSDEC-approved reports:

- Revised Comprehensive Sediment Investigation Report for Operable Unit 2 (Arcadis 2010)
- First Year Results of the OU2 Sediment Monitoring Program (Arcadis 2008a)
- Characterization of the Bioavailability and Toxicity of PAHs in Aquatic Sediments near the Hudson MGP Site (RETEC 2007)
- Comprehensive Sediment Investigation Report for Operable Unit 2 (OU2) Sediments (BBL 2003b)
- Embayment #2 Investigation Report (BBL 2002a)
- Draft Site Assessment Report Conrail Site (TAMS 2000)
- Site Investigation Summary Report (BBL 2000)
- Phase II Site Investigation Report (BBL 1997)
- Site Investigation Data Report (BBL 1996)

2.1.1 Summary of Sediment Bioavailability and Toxicity Evaluation

A sediment benthic toxicity evaluation was performed using 41 sediment samples (32 site samples and 9 reference location samples) as part of the 2009 sediment investigation (Arcadis et al. 2010). The evaluation was based on H. azteca toxicity testing and analysis for sediment ammonia, grain size, percent solids, and pH. A weight-of-evidence (WOE) assessment was included as part of the CSIR (Arcadis et al. 2010). The WOE assessment showed that only seven sample locations (HD-142, HD-143, HD-146, HD-147, HD-148, HD131, and HD138; see Figure 3) contained both pore water polycyclic aromatic hydrocarbons (PAHs) at concentrations greater than the site-specific threshold and significant reduction in H. azteca survival ($p < 0.05$). WOE assessment at these locations determined a potential risk to benthic macroinvertebrates at the Site. These samples are generally located within a localized region adjacent to Embayment #1, and within an additional localized region adjacent to Embayment #2. The areas where potentially toxic sediment was observed in surface and/or subsurface sediments were used to determine the horizontal extent of the ARC.

2.1.2 Chemical Data Summary

Samples were collected for chemical analyses from a total of 160 locations in OU2 (including co-located sample locations) between 1995 and 2009 (BBL 1996; BBL 1997; BBL 2000; TAMS 2000; BBL 2002a; BBL 2003b; RETEC 2007; Arcadis 2008a; Arcadis et al. 2010). Historical sediment sample locations are illustrated on Figure 3, and sample parameters are provided in Table 1. The detailed analytical results from the previous sediment sampling events were presented in the CSIR (Arcadis et al. 2010). Evaluation of these sediment analytical results indicated that PAHs are the primary constituents present in OU2 sediments. Other than PAHs, BTEX are the only other constituents observed in OU2 sediments that are potentially site related. Further, because higher BTEX concentrations correlate with higher PAH concentrations in OU2 sediment samples, the overall distribution of site-related constituents can be described using the PAH results. The distributions of other constituents detected in the OU2 sediments are independent of PAH distribution; therefore, the other constituents do not appear to be attributable to the former Site-related MGP operations.

In general, higher PAH concentrations correlate with sediment containing NAPLs (see below). PAH concentrations generally decrease to the north, west, and south of the NAPL-impacted area. At several locations to the south and north of the NAPL-impacted area, PAH concentrations are similar to background concentrations. A forensic PAH analysis presented in the CSIR concluded that, compositionally, PAHs transition from site-related to background just south and just north of the NAPL-impacted sediment area (Arcadis et al. 2010).

2.1.3 Physical/Geotechnical Data Summary

The physical characterization of OU2 sediments was initially based on the results of the 2002 geophysical surveys and geochronological sediment dating and the field observations and descriptions of sediment cores and sediment samples collected from 1995 to 2009 (BBL 1996; BBL 1997; BBL 2000; TAMS Consultants, Inc. [TAMS] 2000; BBL 2002a; BBL 2003b; RETEC 2007; Arcadis 2008a; Arcadis et al.2010). A summary of investigation activities is provided in Table 1. A detailed physical characterization of OU2 is provided in Section 3.1 of the CSIR (Arcadis et al. 2010) and is summarized below.

2.1.3.1 Physical/Geotechnical Characterization

A total of seven sediment cores were collected from OU2 for radioisotope sediment dating. Based on results from the geochronological sampling, sedimentation in the embayments is estimated at a rate of 0.5 to 1.1 inches/year (Arcadis et al. 2010). In the river channel, the rate of sedimentation remains uncertain.

In-situ vane shear testing was performed at 10 core locations using American Society for Testing and Materials (ASTM) Method D2573 at various depths between 0 and 14 feet (Arcadis et al. 2010). Shear strength was found to increase with depth and distance from the shoreline and proximity to the shipping channel. This increase in strength indicates a higher level of sediment stability in the river.

A total of 36 sediment samples were collected from 13 locations for grain-size analysis (from depths between 0 and 8 feet bss; BBL 1996; BBL 1997; BBL 2000; BBL 2003b; Arcadis et al. 2010). The results of grain size analyses show that, in general, finer sediments (fine sand to medium silt and clay) are observed in the embayments and in the shipping channel portion of the investigation area (where water depths are more than 40 feet deep). Coarser sediments (fine to coarse sands and gravels with shells, wood, and anthropogenic materials such as slag, cinders, coal, brick, and other fill materials) are most frequently observed in the surface layer (0 to 0.5 foot bss) and near-surface layers (0.5 to 2 feet bss) at water depths between 14 and 40 feet in the Hudson River channel slope, while finer materials (fine sand, silt, and clay) are generally found in the deeper sediments of these areas.

2.1.4 Summary of Non-Aqueous Phase Liquid Distribution

The extent of NAPL was delineated during previous investigation activities as described in the CSIR (Arcadis et al. 2010). In summary, during investigations completed prior to issuance of the ROD, NAPL was observed in sediments in the eastern portion of the river channel along the slope adjacent to Embayment #1, and potentially in a small portion of the shipping channel at T-13. NAPL was not observed in Embayment #2, except near the mouth of this embayment at the MPE2-1 location. NAPL was not observed in the sediments in Embayment #3 or Embayment #4. Deeper NAPL impacts were observed along the shoreline; the depth to NAPL decreases closer to the shipping channel as the shoreline slopes steeply toward the shipping channel. The approximate horizontal extent of NAPL in sediments, as determined by the previous investigations, was used to define the ARC as it was presented in the ROD (NYSDEC 2012).

2.2 Summary of Pre-Design Investigation Activities

Subsequent to issuance of the ROD, pre-design investigation (PDI) activities were conducted in 2013 and 2015 to obtain information to further the understanding of Site conditions with the intent of developing information to support the RD. Data collected as part of PDI activities include the following.

- Additional physical/geotechnical data
- Further assessment of the distribution of NAPL
- Submerged aquatic vegetation and diver survey
- Additional survey information

Details pertaining to these PDI activities are included in the RDWP (Arcadis 2014); results of 2015 PDI efforts were presented in the October 6, 2015 meeting with NYSDEC.

2.2.1 Summary of Physical/Geotechnical Data

The physical characterization of OU2 sediments was initially based on the results of the RI data described in Section 2.1.3. For the purpose of supporting the development of the RD, additional geotechnical soil investigations were performed within the ARC in September 2013 as part of the PDI activities (Arcadis 2014).

A summary of investigation activities including details of the physical/geotechnical data set is provided in Table 1. A detailed summary of the geotechnical soil investigations performed as part of the 2013 PDI activities is provided in Section 1.5.3 of the RDWP (Arcadis 2014) and is summarized below.

The physical/geotechnical data summarized below have been used to support the dredging design within the ARC, as discussed in Section 2.3 below.

2.2.1.1 Physical/Geotechnical PDI

Geotechnical soil investigations to support the dredging design within the ARC were conducted as part of the 2013 PDI, including:

- Installation of five geotechnical soil borings (GT-1 through GT-5)
- Standard penetration testing (SPT) and geotechnical soil sampling (i.e., split spoons and Shelby tubes)
- Installation of five cone penetrometer tests (CPTs; CPT-1, -2, -2A, -3, and -4)
- Geotechnical laboratory analyses

The geotechnical boring logs and laboratory testing results were presented in Appendix E of the RDWP (Arcadis 2014).

In addition to split spoon samples, seven relatively undisturbed Shelby tube samples were collected in general accordance with ASTM D1587 for laboratory testing. Laboratory testing included particle size distribution (with and without hydrometer) analysis per ASTM D422, moisture content analysis per ASTM D4959, Atterberg limits per ASTM D4318, organic content per ASTM D2974, consolidated- and unconsolidated-undrained triaxial compression tests per ASTM D4767 and D2850 respectively, one-dimensional consolidation per ASTM D2435, and specific gravity per ASTM D854.

Based on the visual field characterization and the laboratory testing, the sediment layers encountered generally consist of a 15 to 25-foot thick sand and gravel layer underlain by a very soft clay layer until till is encountered between -90 and -110 ft NAVD 88. GT-5, located near the shoreline, did not encounter the sand and gravel layer, and generally consisted of soft clay until refusal on top of the till.

At locations GT-1 through GT-4, the sand and gravel layer was generally classified as an SP to SM and had a density ranging from loose to medium dense. The layer began at the sediment surface and terminated at elevation (El.) -35.8 feet NAVD88 near the shoreline (GT-1) to El. -50.8 feet NAVD88 within the shipping channel (GT-3). Moisture contents in the sand and gravel layer ranged from 21.6% to 29.4%, and organic contents ranged from 0.7% to 3.1%.

The clay and silt layer was observed to be greenish black, greenish-gray, or gray and ranged from very soft to stiff in consistency. This layer extended to the till layer ranging from approximately El. -88.8 feet

NAVD88 near the shoreline to El. -109.8 feet NAVD88 near the shipping channel. Particle size distribution analyses indicated that over 95% of the material from this layer passed the #200 sieve (fine material). Atterberg limit analysis indicated that the material generally classified as a CL or ML. Moisture contents ranged from 17.4% to 48.7%. Six Shelby tube samples were tested within the clay and silt layer for specific gravity, consolidated-undrained triaxial compression test, unconsolidated-undrained triaxial compression test, and one-dimensional consolidation test. Specific gravity averaged 2.77. Results of the testing indicate a dry unit weight ranging from 70.2 pounds per cubic foot (pcf) to 86.8 pcf and averaging 82.5 pcf. Triaxial compression test results indicated that an undrained shear strength of the silt and clay layer ranging from 144 pounds per square foot (psf) at a depth of 18 ft bss to 1,700 psf at 67 ft bgs with the undrained strength generally increasing with depth.

Underlying the silt and clay layer, glacial till was encountered at all five locations, consisting of primarily sand and gravel. At borings GT-1 through GT-5, SPT refusal was encountered within the till layer at elevations ranging between El. -90.8 feet NAVD88 near the shoreline (GT-5) and El. -108.8 feet NAVD near the shipping channel (GT-2). Apparent weathered rock was encountered below the till layer. Rock coring was performed at borings GT-3 through GT-5; installation observations indicated that the weathered rock alternated between softer zones and harder zones before encountering apparent competent rock. Ten feet of rock coring was attempted in GT-3 from El. -101.3 NAVD88 to El. -111.3 feet NAVD88 and at GT-5 from El. -91.8 feet NAVD88 to El. -101.8 feet NAVD88. Five feet of rock coring was attempted at GT-4 from -116.8 feet NAVD88 to -121.6 feet NAVD88. Recovery ranged from 0 inches to 16 inches, and the rock quality designation (RQD) ranged from 0 to 10.8%. RQD indicates a rough measure of the degree of jointing or fracture in a rock mass, measured as a percentage of the drill core in lengths of 4 inches or greater. The sum of these core pieces longer than 4 inches divided by the total length of the core run represents the RQD percentage. RQD is used to determine rock mass quality; RQD less than 25% represents very poor quality rock. The relative strength of the rock core recovered was field tested to be R0-R1, very weak to weak. Overall, the rock core recovered was highly weathered and highly fractured.

CPT soundings were performed using a 10-centimeter electronic piezocone that was pushed from the sediment surface at locations CPT-1 through CPT-4. CPT-2 was terminated early due to loss of equipment but was reattempted at CPT-2A. The geologic units identified during testing are shown on the CPT logs provided in Appendix E of the RDWP. Generally, the CPT results align similarly to what was sampled and tested for in the SPT borings. Sediment surface elevation in the CPT logs ranged from El. -17.8 feet NAVD88 to El. -42.4 feet NAVD88. The upper 10 to 16 feet of sediment consists of a silty sand; underlying materials are clayey silts and silty clays. CPT refusal was assumed to be on the till layer encountered in the borings. Termination elevations range from El. -86.8 feet NAVD88 to -112.4 feet NAVD88.

2.2.1.2 Treatability/Processing Testing

Samples for laboratory bench-scale treatability testing were also collected during 2013 PDI activities. During installation of the environmental borings, approximately 20 gallons of representative sediment, from within the limits of the ARC, was collected, homogenized, and placed in 5-gallon buckets. The samples were saturated with river water, sealed, and shipped to the Arcadis treatability laboratory located in Durham, North Carolina for storage at ambient temperature.

Treatability testing for dewatering using these materials was performed in 2017. The results of these studies are included in Attachment 1.

2.2.2 Summary of Non-Aqueous Phase Liquid Distribution

During the 2013 PDI activities, environmental borings were advanced to confirm the horizontal extent of the ARC and refine the vertical extent of the sediment removal limits within the ARC. In total, 17 environmental borings were advanced within the ARC, and the logs were presented in Appendix A of the RDWP (Arcadis 2014). Based on the observations of NAPL depths inside the ARC boundary, the dredge limits (horizontal and vertical) within the ARC have been refined, as discussed in Section 2.3 below. The basis and extent of the refinements to the ARC were presented in an October 4, 2019 letter to NYSDEC and are described in Section 2.3 below.

2.2.3 Summary of Submerged Aquatic Vegetation and Diver Survey

As part of the PDI, a desktop review and physical survey (with divers) was performed of the submerged aquatic vegetation (SAV) near the ARC. In addition, the diver survey was utilized to determine the substrate of the sediments within and near the ARC, and identify large debris located in and around the ARC.

The preliminary desktop review of SAV determined that various entities have verified SAV beds in other areas of the upper (tidal) Hudson River; however, SAV was not been observed in the ARC during previous sampling events (Arcadis et al.2010), nor was it identified in the ARC during the 2013 PDI activities.

The results of the 2013 PDI diver survey indicated that the substrate within and along the front of Embayments #1 and #2 is soft silt (a few feet to a few inches) over rock. With increasing distance from the shoreline, the substrate is entirely rock and gravel with most substrate covered in zebra mussels. In front of Embayments #1 and #2, a tongue of the soft silt extends out and covers the rock substrate. This is likely caused by the surge created by the wakes of large ships passing through the navigation channel adjacent to the Site causing finer grained sediments to move into/out of the embayments. During the diver survey, Arcadis divers observed the surge into/out of the embayments and could also feel the movement while underwater.

The 2013 PDI diver survey also identified what appears to be a remnant bulkhead feature running the length of the waterfront – immediately offshore of the peninsula between Embayments # 1 and #2 and continuing along the shore-side of the Hudson River Cruise boat docks. Due to poor underwater visibility, it was difficult to determine the configuration of the structure, but there appeared to be two parallel timber-pile walls with 3 to 4 feet of void space between them. Various pieces of timber-piles and driftwood/logs were caught in the void space. The lack of visibility and entrapment hazards associated with that void space precluded any further investigation of the timber-pile wall. The feature appeared to be consistent over the entire length of the Site waterfront except in front of Embayment #1 and appeared to be in various states of degradation.

2.2.4 Additional Survey

Additional river-based survey was conducted in 2015 to define the river-bottom bathymetry and identify potential debris and consisted of the following:

- Updated bathymetric survey
- Additional topographic survey of the nearshore, shallow water areas
- Side scan sonar survey
- Acoustic sub-bottom profiling
- Magnetometer survey
- River velocity data measurements

The updated survey information, including updated bathymetry contours and debris and obstruction locations, were originally presented in the October 6, 2015 meeting with NYSDEC and is shown in the Design Drawings (Appendix A). River velocity data measurements indicated that velocities typically range from 0.5 to 2 feet per second in the ARC near the shoreline, varying with the tidal cycle.

2.3 Refinement of Dredge Limits within ARC

As discussed above, the ARC boundary presented in the ROD was defined using a combination of analytical results and field observations from the remedial investigations performed prior to 2013, and the extent was subsequently confirmed based on the 2013 PDI field observations and associated laboratory analytical results. The ARC is approximately 1.1 acres in size (Figure 4).

As discussed in Section 2.2.1 above, environmental borings were advanced during the 2013 PDI activities to refine the horizontal and vertical extents of the sediment removal limits within the ARC from what was presented in the ROD. The RDWP presented results of the 2013 PDI borings program (Arcadis 2014). The NAPL observations from the 2013 PDI borings and the NAPL observations from previous investigations are illustrated on Figure 5 and were used to assign bottom of NAPL elevations for each sediment sample location within the ARC to achieve the applicable RAOs for the selected remedy. The vertical extent of removal varies throughout the ARC and has been defined by the removal depth required to remove material in which NAPL was visually observed. This surface was generated by interpolating the extent of NAPL in sediment samples throughout the proposed ARC, then refining the grades for constructability. The final removal extent is shown on Design Drawing G-200 (Appendix A). The sediment removal volume was estimated based on the sediment surface observed during the bathymetric survey conducted by Aqua Survey, Inc. (ASI) from April 23-29, 2015, as well as the vertical delineation of NAPL observations as indicated by the available sampling results.

Following issuance of the RDWP, further adjustments were made to the ARC boundary. The proposed limits at the northeastern extent were trimmed as further evaluation of the data showed that removal would not be required in this area, because NAPL was not observed in samples in this area. The ARC boundary also was adjusted near the existing permanent dock because NAPL was not observed in samples in this area. Additional areas along the shoreline were reduced based on a detailed survey of the shoreline, which was performed as part of the 2015 PDI. The adjusted boundary was presented to NYSDEC in the October 6, 2015 meeting and is shown on Design Drawing G-200 (Appendix A).

The ARC boundary was again revised following NYSDEC's review of the 70% Draft RD Report. The northern boundary was extended further upstream to the Bioavailability Study sampling location HD-153, which demonstrated, under the WOE assessment, high survivability results. The extension of the ARC boundary is now inclusive of the 2013 environmental boring EB-1, which exhibited toxicity measurements exceeding the 5.4 toxic unit criterion for the Site. The adjusted boundary was agreed to by the NYSDEC via letter on October 7, 2019 and is shown on Design Drawing G-200 (Appendix A).

The actual volume to be removed will need to account for operational considerations such as allowances for sloping that may be necessary to stabilize deeper excavations and method of dredge operation (Palermo et al., 2008). To account for sloping and actual dredging operations, the final dredge prism was modified from the polygons presented in the RDWP for the ARC. The dredge prism is depicted on Drawing G-300. The dredge prism includes, at a minimum, the removal elevation defined by sampling. In addition, the dredge prism accounts for the general assumptions/boundary conditions listed below.

- Along the perimeter of the ARC removal area, the removal will be tapered in order to limit sloughing of side slopes to transition to the existing grade outside of the sediment removal area limit.
- The dredge prism has been designed with consideration for constructability (e.g., range of accuracy of dredging equipment, reasonable tolerances, dredge slope stability, etc.). As such, the dredge prism surface has been smoothed to allow for more gradual transitions between target dredge elevations. Shoreline areas where stable slopes could not be achieved through contouring alone were evaluated for the installation of steel sheet pile support systems, as discussed in Section 2.5.

The resulting dredge prism provides the areal extent and elevations that would need to be achieved during dredging activities and is used to determine the resulting removal volume. The anticipated neat removal volume based on the dredge prism is approximately 7,945 cy. As described in Specification Section 352023 – Dredging and Subaqueous Backfill (Appendix B), up to 6 inches of overdredging will be acceptable, which could lead to up to 900 additional cubic yards of removed material.

2.4 Determination of Appropriate Resuspension Controls

As stated in the ROD (NYSDEC 2012), appropriate engineering controls are required around the ARC during remediation, as feasible, to control and contain re-suspended sediments and mobile NAPL that may be generated as a result of dredging activities. As further stated in the ROD,

> "There is uncertainty regarding the technical feasibility of installing the sheet pile containment due to site conditions, including water depths of up to 45 feet at the far edge of the removal area. Water velocity in the ARC is greater than 3 ft/sec with 4-foot tidal fluctuations, and an assumed depth of 30 feet of sediment above bedrock. If it can be installed, the sheet pile containment wall will not be able to withstand vessel impacts (a potential risk due to the known boat traffic in this section of the river), nor will it be able to withstand ice loading."

As such, several potential systems were considered for this site and presented in an October 6, 2015 meeting with NYSDEC. The options considered use of monitoring, absorbents, operational controls/work sequencing, turbidity curtains (of varying configuration and length), deflector walls, and shallow/deep sheeting alone or in combination.

On April 25, 2019, NYSDEC requested the use of a physical barrier control (i.e., turbidity curtain fixed between the barge and shoreline in shallow water and a moon pool turbidity curtain in deep water) as the primary resuspension control measure and implementing visual monitoring, applying absorbents, and sequencing work as the secondary resuspension control measure required during dredging and sheet pile installation.

As such, resuspension will be controlled primarily using a physical barrier control during remedial activities (e.g., sediment dredging and sheet pile installation) at the Site. Installation of a boundary/perimeter containment boom and oil absorbent boom will be the primary sheen control measures. Monitoring, sheen response personnel, and operational controls/work sequencing will also be performed to supplement the primary sheen control measures as needed. This approach is detailed in Specification Sections 013543 – Environmental Protection Procedures and 352023 – Dredging and Subaqueous Backfill (Appendix B).

2.5 Assessment of Geotechnical Characteristics of Sediment in the ARC

An assessment was performed for the existing sheet pile wall along the mouth of Embayment #1 to determine if it could function as a dredge support or if an additional retaining structure would be needed. Additionally, a new excavation support wall was assessed for the shoreline areas where target dredge depths of the dredge prisms might cause instability issues for upland areas. Based on the investigation data and subsurface information outlined in Section 2.2.1.1, shoring analyses were performed for the four sections along the dredge area limits near the shoreline. Detailed calculations are provided in Attachment 2. In summary:

- A new AZ 17-700 sheet pile wall will be installed east of Embayment #1 along the ARC limits parallel to the shoreline to a depth of -60 ft NAVD88 as shown in the Design Drawings.
- The existing AZ-18 sheet piles across the mouth of Embayment #1 is sufficient for dredge support since it was installed to approximately -59 ft NAVD88, which is deeper than the required -39 ft NAVD88 wall penetration needed based on the dredge analysis.
- A new AZ 12-770 sheet pile wall will be installed in between Embayment #1 and Embayment #2 to -37 ft NAVD88.
- A new AZ 12-770 sheet pile wall will be installed west of Embayment #2 to -36 ft NAVD88.

For the perimeter of the ARC along the mouth of Embayment #2, the dredge will be sloped up towards the relatively flat mudline elevation of -8 ft NAVD88. Based on the estimated internal friction angle of the shallow silty sand and the current dredge slopes shown in the design drawings, the factor of safety for veneer sloughing is satisfactory. Detailed calculations for the slope stability of this slope are provided in Attachment 2.

2.6 Waste Characterization

Waste characterization samples were collected to determine treatment and/or disposal requirements for sediment removed during implementation of the selected remedy. Two composite sediment samples were collected from the ARC: one from the northern half of the dredging area, and one from the southern half of the dredging area. Sample analyses included the following: TPH, total volatile organic compounds, total semivolatile organic compounds, total polychlorinated biphenyls, total metals, total cyanide, percent sulfur, and heat content. The results of the waste characterization analyses are presented on Table 2.

A screening evaluation of the two samples collected during the PDI activities from the sediments subject to removal was performed to assess whether the excavated sediments would constitute characteristic hazardous waste subject to regulation under the Resource Conservation and Recovery Act (RCRA). This screening evaluation consisted of comparing the analytical data for the sediments subject to excavation to a value equal to 20 times the Toxicity Characteristic Leaching Procedure (TCLP) regulatory limit for each constituent for which such a regulatory limit exists, as shown on Table 2. Based on this screening evaluation, the sediments subject to removal do not constitute characteristic hazardous waste subject to regulation under RCRA. Additional TCLP waste characterization sampling may be conducted if required by the selected offsite disposal facility(ies). Such results will be reviewed with representatives of the selected offsite disposal facility(ies) prior to transporting the material offsite.

3 PRE-REMEDIAL ACTIVITIES

The following pre-remediation activities will be implemented by National Grid and/or its representatives.

- Citizen Participation Plan;
- Preparation of pre-mobilization submittals;
- Obtaining appropriate permits and access agreements; and
- Pre-construction conference.

Additional information regarding each of these pre-remedial activities is provided below.

3.1 Citizen Participation Plan

To facilitate public outreach and citizen participation for the Site, National Grid has made project-specific information (e.g., work plans, technical reports, information sheet summaries, etc.) available to the public at a document repository established for the Site (Hudson Area Library, 51 N. 5th Street, Hudson, NY 12534); promoted communication among stakeholders including the creation of contact lists; and conducted open meetings notifying the public of document availability and major program milestones.

Consistent with NYSDEC Program Policy DER-23, Citizen Participation Handbook for Remedial Programs (NYSDEC 2010a), before field work begins, a Notice and Fact Sheet will be developed and sent to parties on the site contact list (i.e., residents and business owners within a specified radius of the Site, as well as additional community and political personnel). National Grid will work with the NYSDEC (as appropriate) to develop the Notice to be sent to all parties on the site contact list and to the document repository. The Notice will include a Fact Sheet that describes the upcoming remediation work. The NYSDEC is ultimately responsible for preparing and distributing the Notice and Fact Sheet. Additionally, National Grid will continue to update the document repository and participate in a public availability session if one is scheduled by NYSDEC prior to the start of construction.

3.2 Preparation of Pre-Mobilization Submittals

The Contractor will be required to prepare certain pre-mobilization submittals. The purpose of these submittals is to gauge the Contractor’s understanding of the Final RD Report and its construction, objectives, procedures, and outcomes, and to identify potential misunderstandings and provide clarifications prior to the start of RA construction activities. The Contractor will not be allowed to mobilize to the Site prior to review and approval of all required pre-mobilization submittals.

These submittals will include, but not be limited to, the following:

- *Operations Plan* – The Operations Plan will present the Contractor’s detailed approach for implementing the pertinent work activities (incorporating, as necessary, specifications, site maps, details, flow diagrams, charts, and schedules), including contingency measures required by the Technical Specifications (Appendix B).

- *Health and Safety Plan* – The Contractor will be required to prepare and submit a project-/site-specific Health and Safety Plan (HASP) (for use by the Contractor's onsite personnel during the RA construction activities) to provide a mechanism for establishing safe working conditions at the Site. The HASP will be prepared in accordance with all applicable rules and regulations, including Parts 1910 and 1926 of Title 29 of the Code of Federal Regulations (29 CFR 1910 and 29 CFR 1926), and will be certified by a Certified Industrial Hygienist. The Contractor is required to take all necessary precautions for the health and safety of all onsite Contractor employees in compliance with all applicable provisions of federal, state, and local health/safety laws and the provisions associated with the HASP. The Contractor will assume sole responsibility for the accuracy and content of its HASP.
- *Contingency Plan* – The Contractor's Contingency Plan will detail (at a minimum) the following procedures for emergency preparedness and contingencies: emergency access/egress; emergency evacuation of personnel from the work site; and methods to contain gasoline/diesel fuel or hydraulic oil spills. The Contingency Plan will also include a listing of all contact personnel and emergency phone numbers. Construction-related contingencies will be included in the Contractor's Operations Plan.

Additional information regarding the required contents of these submittals and overall submittal process is presented in Appendix B under Materials and Performance (M&P) – Sections 011100 (Summary of Work) and 013300 (Submittals), respectively. Once reviewed, select pre-mobilization submittals will be provided to the NYSDEC for review. Other submittals required prior to Contractor mobilization will be coordinated with the Contractor.

3.3 Permits and Access Agreements

Certain federal, state, and local permits and other authorizations will be required for the implementation of the RA. These permits and other authorizations are summarized in Table 3, based on a review of pertinent local, state, and federal regulations. National Grid will obtain all permits, except those required to comply with local ordinances, which will be obtained by the Contractor.

The Contractor must meet the requirements of applicable environmental permits and/or regulations, and all other permits that may be required under local jurisdictions. These permits may include, but are not necessarily limited to, those related to work within the public roadways, work within public waterways, and zoning regulations.

The Indiana bat (*Myotis sodalis*; endangered), the Northern Long-eared bat (*Myotis septentrionalis*; proposed endangered), and the bog turtle (*Glyptemys muhlenbergii*; threatened); are included on the U.S. Fish and Wildlife Service list of Federally Listed Endangered and Threatened Species and Candidate Species in New York for Columbia County (U.S. Fish and Wildlife Service 2020), and will need to be considered during the permit authorization process. The National Marine Fisheries Service lists the Shortnose sturgeon and Atlantic sturgeon as endangered throughout their habitat in the Hudson River. As a result, it is understood based on communication with NYSDEC that, as part of the permit authorization process and in consideration of a fish protection period, work in the river will be limited to between September 1 and November 30.

All appropriate permits must be maintained, and a copy must be at the Site throughout the duration of the project.

National Grid will be responsible for obtaining access agreements with affected property owners (including coordination for removal of existing docking, if applicable). At a minimum, these are anticipated to include the City of Hudson and Colarusso. Based on conversation in April 2015 with the affected property owner, the proposed plan assumes access will be granted to the Colarusso property. As of April 2020, the property is still owned by Colarusso; National Grid will confirm access and layout of the property is viable prior to procurement. The Contractor will be expected to abide by provisions of the access agreements once in place.

3.4 Pre-Construction Conference

A pre-construction conference will be held to designate responsible personnel, establish working relationships, discuss preliminary schedules submitted by the Contractor, and review administrative and procedural requirements for the remedial construction activities. Requirements of the pre-construction conference are included in Specification Section 013100 – Project Management and Coordination (Appendix B). Prior to the conference, the Contractor will provide the required submittals as presented in Specification Section 013300 – Submittals (Appendix B).

4 REMEDIAL ACTIVITIES

This section presents a description of the anticipated approach to completing the remedial activities for the Site. As described in the ROD (NYSDEC 2002) and the RDWP (Arcadis 2014), the remedial activities will include the following primary components:

- Mobilization and Site Preparation
- Temporary Removal of Riprap
- Debris Removal
- Sediment Removal and Handling
- Temporary Water Treatment System
- Site Restoration and Demobilization

These RA components are discussed in further detail below. Additional details on the RA program can be found on the figures and in Appendix A (Design Drawings) and Appendix B (Technical Specifications). In addition, Appendices C through G provide the RD plans that will be used to support the RA components.

4.1 Mobilization and Site Preparation

Following the receipt of regulatory permits, approval of necessary pre-mobilization work plans, and execution of property access agreements with the City of Hudson and Colarusso (and any other property owners as appropriate), the Contractor will mobilize the necessary equipment, materials, and personnel to implement the RA program and begin site preparation activities. The Contractor will be responsible for the following general activities and others included in the Specifications and Drawings.

- Mobilizing personnel, equipment, and materials to the project area.
- Verifying the existing project area conditions, including updated bathymetric and shoreline surveys of the project area.
- Installing and maintaining provisions for site control and access, such as temporary fencing and signage, to limit unauthorized access to the work area.
- Identifying the location of aboveground and subsurface utilities (e.g., electric, gas, water, sewer, telephone), equipment, and structures and protecting such features as necessary.
- Installing erosion and sedimentation control measures.
- Mobilizing and setting up provisions for air monitoring.
- Clearing and disposing of vegetation and surface debris in areas planned for construction support.
- Constructing temporary site traffic controls (as needed) for ingress and egress of construction equipment and for use in transporting excavated soil/sediment to the onsite, material staging area(s).
- Establishing and constructing temporary equipment and material staging area(s), including an open-span enclosed structure for excavated/dredged materials requiring offsite treatment/ disposal.

- Constructing equipment and personnel decontamination area(s).
- Installing other temporary project support facilities (e.g., field offices, sanitary facilities).
- Assist in coordinating with the City of Hudson, United States Coast Guard, local police and fire departments, Hudson River Cruises, adjacent property owners, and others as necessary.
- Obtaining permits and issuing Notice to Mariners.

The main components of these activities are discussed in further detail below. As the access agreements between National Grid and/or the City of Hudson or Colarusso have not been finalized, there may be modifications to site preparation activities, subject to the final access agreement.

4.1.1 Work Area Security and Traffic Control

Site control and access measures will be designed to minimize disruption to the existing facilities and infrastructure. The Contractor will be required to coordinate work activities with the activities conducted by the property owner. Appropriate temporary fencing and other barriers will be installed in appropriate locations and maintained to restrict access to active work areas of the Site and to protect monitoring and construction equipment. A visitor sign-in and sign-out protocol will be implemented at the construction office trailer for the work area to monitor all non-worker traffic within work areas, and if necessary, security guards will be retained to monitor work areas and equipment during non-working hours. In addition, a dedicated traffic control (e.g., signage, flag person) will be provided (and maintained), as necessary, where construction activities may interfere with normal vehicle or pedestrian traffic in the vicinity of the work area.

Additional detail and requirements can be found in Specification Sections 011400 – Work Restrictions, 015000 – Temporary Facilities and Controls, and 101400 – Signage (Appendix B).

4.1.2 Identification and Relocation of Utilities

Prior to initiating any intrusive subsurface activities (e.g., soil disturbance for staging area construction, sediment removal, etc.), the Contractor will be responsible for identifying, marking, relocating, protecting, or abandoning utilities, pipelines, monitoring wells, and structures, as required, to facilitate the remedial construction activities. Certain utilities are known to be present within and adjacent to OU2, as shown on Design Drawing G-101. Underground utilities near the work area include fiber optic cable, and potential gas, storm sewer, water, and electric lines, and aboveground utilities include overhead power lines. The Contractor will be responsible for coordinating with Dig Safely New York to determine the locations of all utilities at the start of work and for coordinating with the owners of the utilities regarding the protection/relocation/termination of any utilities, as required.

Additional detail and requirements can be found in Specification Section 011400 – Work Restrictions (Appendix B).

4.1.3 Installation of Erosion and Sedimentation Controls

Prior to construction, environmental control measures will be installed by the Contractor. Such control measures and devices include but are not limited to erosion and sedimentation controls (e.g., rolled erosion control materials) and absorbent booms and pads. Environmental control devices will be monitored and maintained as necessary throughout the project. These devices will be modified, as needed, based on work area conditions and planned work activities.

Preliminary plans related to the implementation of such erosion control measures are illustrated on Design Drawing G-102. Additional detail and requirements can be found in Specification Section 013543 – Environmental Protection Procedures (Appendix B). The specific locations of these controls may be modified in the field based on site-specific considerations related to drainage, topography, work activities, and other factors.

Erosion and sedimentation control devices will be monitored and maintained as necessary throughout the project. These devices will be modified, as needed, based on site conditions and planned site activities. Following the completion of site restoration activities, all temporary erosion and sedimentation control measures will be removed and disposed offsite.

4.1.4 Air Monitoring and Control

It is anticipated that the use of a temporary enclosure for handling impacted materials will reduce the potential for air exposures to onsite personnel and the community. The Contractor will install/establish community and work zone air monitoring locations, as required, prior to initiating any intrusive and/or potential dust or odor-generating activities. The community air monitoring program will be the responsibility of the Contractor; however, it may be implemented by a third-party subcontractor (under contract with the Contractor) experienced with remediation projects.

Community air monitoring will be performed at both upwind and downwind locations, as specified in the Community Air Monitoring Plan (CAMP; Appendix D) and will be initiated when the intrusive construction activities begin. The use of temporary enclosures and air monitoring will be implemented during the handling of dredged sediments. Both real-time monitoring for volatile organic compounds (VOCs) and particulates (PM_{10}) will be performed. Real-time monitoring will include two fixed monitoring locations (one upwind and one downwind).

In addition, the Contractor and/or the Contractor’s air monitoring subcontractor will perform work area/worker breathing zone monitoring. Dust, volatile emissions, and odors from the soil and sediment excavation and dredging areas and during transport to the soil/sediment handling facilities will be controlled to limit potential offsite impacts. The following dust, emission, and odor controls may be used during RA activities: water spray, misters, Biosolve® or equivalent product, foam, and absorbent booms (CAMP; Appendix D).

The Contractor and/or the Contractor’s air monitoring subcontractor will walk/boat the work area perimeter on a regular basis to detect any nuisance odors that would not be detected by the monitors. Any noticeable odors will be reported to the Construction Manager and the Contractor’s Health and Safety Supervisor and corrected immediately. As needed, engineering controls will be implemented immediately to reduce odors. In the event of an odor complaint, a VOC monitor will be set up at the location of complaint, vapor emissions documented, and the results reviewed with NYSDEC, National Grid, and the property owner. The Contractor, at a minimum, will have one spare photoionization detector (PID) available at the site as a result of an odor complaint. As needed, odor suppression will also be implemented.

Additional detail and requirements can be found in Specification Section 013543 – Environmental Protection Procedures (Appendix B).

4.1.5 Resuspension and Sheen Controls and Water Monitoring

Resuspension controls to be used include physical barrier controls, turbidity monitoring, and operational controls/work sequencing. Sheen controls to be used include containment booms, oil absorbent booms, visual monitoring for sheens, and sheen response personnel equipped with oil absorbent materials.

4.1.5.1 Resuspension Controls and Monitoring

Starting approximately one week prior to construction and continuing daily during construction, the Engineer will monitor environmental conditions in the adjacent Hudson River to verify that there are no adverse impacts to the river associated with construction activities. Specifically, turbidity levels will be monitored outside of the work area at two locations in the Hudson River (200 feet both upstream and downstream of the ARC) allowing for a direct assessment of the potential contribution of the construction activities to the environmental conditions in the river.

The physical barrier control will be the primary resuspension control during remedial activities (e.g., sediment dredging, sheet pile installation, transport of dredged material, vessel movement, and backfill placement) at the Site. In addition, the Contractor will implement the following practices and operational controls intended to minimize resuspension of sediment during all in-river operations:

- Minimizing the number of bucket bites in any given dredge location.
- To the extent possible, complete closing of the dredge bucket before it is lifted from the river bottom, unless prohibited by debris.
- Moving buckets continuously and in the most efficient path to the scow once the bucket breaks the water surface.
- Not re-handling or stockpiling of material on the river bottom.
- Not using the dredge bucket to drag sediment on the river bottom.
- Minimizing the number of attempts to remove debris.
- Prohibiting raking for debris removal.
- Not grounding barges or other project vessels. Allowing water levels to rise before attempting to free grounded vessels.
- Conducting tow boat operations in a location or manner to minimize resuspension due to prop-wash.
- Not misplacing dredged materials.
- Limiting tugboat or push boat engine revolutions per minute (RPMs) (except in emergency situations) in shallow water areas to minimize resuspension due to prop-wash.

The intrusive in-water work will be monitored using both real-time turbidity monitoring equipment and visual monitoring. Real-time turbidity monitoring will be performed at the two locations described above. The corrective action level of 50 NTUs will be compared to the absolute value of the difference in turbidity reading between locations. Visual monitoring for distinct turbid plumes outside the limits of the physical barrier control will be based on substantial visual contrast to natural conditions (6 CRR-NY 703.2) and performed over the course of the workday.

In the instance that the corrective action level is exceeded, contingency measures will be employed after 4 or more consecutive readings that exceed the corrective action level. These may include:

- Investigate the cause of the exceedance to confirm if it is associated with project-related activities
- Conduct additional water column monitoring to investigate the cause of the exceedance and/or until levels are within the specified criteria
- Review in-water construction operations to evaluate if the cause of the exceedance can be readily identified and corrected
- Identify possible modifications to equipment (e.g., different dredge bucket or dredge head).
- Implementation of turbidity contingency measures will be discussed in the field in consultation with the NYSDEC.

4.1.5.2 Sheen Controls and Monitoring

Boundary/perimeter containment boom with skirt will be installed a nominal distance upstream and downstream of the ARC throughout the duration of intrusive in-water activities. An oil absorbent boom will be installed on the interior side of the containment boom to capture any contained sheen. In addition, the Contractor will be required to continuously observe water conditions and take appropriate measures (e.g., absorbent booms, absorbent pads, skimmers) to control accumulated oil and sheens on the water surface, if any, to prevent accumulation. Containment measures will be inspected by the Contractor to confirm both the location and condition are appropriate for the current activities and field conditions. The application of any type of surfactants to the river to control accumulated oil and/or sheen is not permitted.

If NAPL/sheens are observed, the following procedures will be initiated:

- Notification will be made to National Grid and NYSDEC or their onsite representatives.
- Absorbent boom(s) and/or pad(s) will be deployed immediately by the Contractor to contain the NAPL/sheen. This procedure will be repeated until the NAPL/sheen is contained. If the boom(s) or pad(s) appears to be saturated, another absorbent boom and/or pad will be deployed to replace the existing and/or additional boom. In addition, ongoing removal and replacement procedures will be reviewed and modified, as appropriate.

Specification Section 013543 – Environmental Protection Procedures (Appendix B) and Section 5 of the CQAP (Appendix C) provide additional detail.

4.1.6 Clearing of Vegetation and Surface Debris

Following installation of erosion control measures, minor brush and tree clearing will be performed, as needed, to provide access to the work area. Brush and trees may also be removed from areas planned for project support facilities, storage areas, and staging areas. Efforts will be made to minimize disturbances to existing vegetation, to the extent practicable.

The brush and trees may be chipped, shredded, or cut into pieces for potential subsequent use onsite as landscaping materials, or mixed with excavated materials to facilitate soil stabilization. This debris will be stockpiled temporarily in a designated location for onsite use or disposed offsite at a National Grid-approved facility. Additional detail and requirements can be found in Specification Section 311000 – Site Clearing (Appendix B).

4.1.7 Temporary Access Roads

The existing surface of the upland work area generally is sufficient for vehicle operation without the construction of temporary access roads. Existing roads will be used for transportation of materials offsite, and a construction entrance/exit pad will be placed at the access point connecting the work area to public roads, as shown on Design Drawing G-500. At their discretion and in discussion with the property owner, the Contractor may place Type 2 stone on the existing site surfaces and haul roads. The anticipated truck routes are shown on Design Drawing G-103. Additional detail and requirements can be found in Specification Section 011400 – Work Restrictions (Appendix B).

4.1.8 Staging Area and Materials Handling Areas

To facilitate the processing of excavated sediments for offsite treatment/disposal, dredged sediment will be dewatered and processed on the sediment dewatering pad. The location for the temporary staging area is illustrated on Design Drawing G-102. An open-span enclosed structure will be constructed over a portion of the temporary staging area to allow for processing of sediments. The remaining temporary staging area will be used for storage of imported materials, equipment, the temporary water treatment facility, and stabilizing agents. The proposed areas will generally be constructed as follows:

- For the open-span enclosed structure area:
  - An area, approximately 100 by 200 feet in size, will be cleared and grubbed, and prepared with a smooth, firm subgrade. The area will be graded and sloped to drain to a collection sump to contain any water that drains from the removed sediment.
  - A 40-mil HDPE geomembrane liner will be placed on the compacted subgrade.
  - Six inches of a NYSDOT Type 2 stone will be placed over the HDPE geomembrane as a subbase.
  - To facilitate drainage, materials handling, and operation of heavy equipment, the entire area will be covered with an asphalt surface (i.e., paved).
  - Separate bins will be constructed inside the open span enclosed structure to facilitate stabilization, waste characterization, and processed material load-out operations.
- For the section of the staging area not within the open span enclosed structure:
  - The area will be cleared and grubbed, and prepared with a smooth, firm subgrade.
  - Perimeter berms will be constructed around the import and water treatment system staging areas, as shown on Design Drawing G-501, to mitigate the potential for surface-water run-on/runoff and to contain any spills associated with the temporary water treatment system.

- A sand and gravel layer will be installed over the subgrade, as necessary, to provide a stable working surface. The sand and gravel layer will be graded to promote drainage of liquids toward a collection sump(s).

Additional detail and requirements can be found in Specification Section 015000 – Temporary Facilities and Controls (Appendix B).

4.1.9 Decontamination Area

During site preparation activities, the Contractor will construct a decontamination area for personnel and equipment that comes into contact with impacted materials during the remedial activities. The decontamination area will either be a prefabricated steel containment system or will be constructed onsite using an impermeable liner and bermed and sloped to contain and collect fluids. It is currently anticipated that the decontamination area will be constructed adjacent to the open-span enclosed structure; however, the final location will be proposed by the Contractor and subject to approval. The design of the decontamination area will consider the size of the Contractor's proposed equipment and measures needed to allow containment of sprayed wash water during decontamination activities. The preliminary location and layout of the decontamination area are illustrated on Design Drawing G-102. Details related to the siting and construction of decontamination areas are provided on Design Drawing G-502. Additional detail and requirements can be found in Specification Section 015000 – Temporary Facilities and Controls (Appendix B).

4.1.10 Installation of Temporary Project Support Facilities

To facilitate construction management, temporary project support facilities (e.g., trailers, sanitary facilities) will be constructed at one or more locations on the Site. The proposed location for the temporary support facilities is illustrated on Design Drawing G-102. Upon completion of construction of the temporary project support facilities, any necessary utilities (e.g., electricity, telephone, and internet service) will be installed at this time. Additional detail and requirements can be found in Specification Section 015000 – Temporary Facilities and Controls (Appendix B).

4.2 Debris and Riprap Removal

Existing riprap and surface debris along the shoreline of the Hudson River, within the ARC, will be removed to facilitate the installation of excavation supports and to facilitate the sediment removal activities. The riprap will be temporarily stockpiled in a designated staging area for reuse during restoration activities.

As part of the PDI program, several obstructions were noted, as identified on Design Drawing G-200. The Contractor is required to remove all debris (as well as materials washed onto the riverbank that are not part of the riprap bank material) from areas needed to access and/or perform the work, including submerged wooden piles, and dispose offsite. Prior to sediment removal, the Contractor may elect to perform an additional debris survey in the area to be dredged to identify such debris. Remaining subsurface debris will be removed during dredging activities as encountered and necessary to facilitate construction. This debris will be removed and stored temporarily in a pre-determined location before being transported offsite for disposal or recycling. Additional information regarding procedures for removal of unanticipated obstructions encountered during construction activities is presented in the RACP (Appendix F).

Additional detail and requirements can be found in Specification Section 352023 – Dredging and Subaqueous Backfill (Appendix B).

4.3 Sheet Pile Installation and Removal

Sheet piles will be installed to provide excavation support east of Embayment #1, between Embayment #1 and Embayment #2, and west of Embayment #2 as shown on the Design Drawings. The existing sheet pile across the mouth of Embayment #1 is sufficient for excavation support in this area. The sheet pile will be installed as defined on the Design Drawings and Specification Section 315000 – Excavation Support and Protection. Upon completion of remediation and during site restoration activities the newly installed sheet piles will be cut at the mudline and left in place. The cut sections of sheet pile will be removed.

4.4 Sediment Removal and Backfill

Sediment generally will be removed to depths ranging from 2 to 15 feet bss, and from an overall area of approximately 1.1 acres. It is currently anticipated that removal of sediment will be performed in the wet using GPS-guided mechanical dredging equipment, however final methods will be determined by the Contractor. Dredged sediment will be transported to a staging area for processing and eventual transport offsite for treatment/disposal. If riprap removal is necessary in nearshore areas, the riprap will be stockpiled for reuse. Following completion of removal activities, clean backfill will be placed over the dredged area.

The dredging equipment will be operated so as to minimize resuspension of material during the remediation. Dredged materials will be transferred to scows and transported to an onsite unloading area for transfer to haul trucks for transport to an onsite temporary staging area. The specific methods will be determined by the Contractor; a portion of an existing bulkhead adjacent to the upland support area will be available for offloading the scow. Use of the bulkhead will be coordinated with the property owner. Sediment that is dredged may require dewatering prior to offsite transport for treatment/disposal. Additional detail and requirements can be found in Specification Section 352023 – Dredging and Subaqueous Backfill (Appendix B).

After the Contractor has completed sediment removal to the appropriate depth as indicated on the Design Drawings (Appendix A), the Contractor will conduct a post-dredging bathymetric survey to verify that the proposed removal limit has been reached. This survey will be performed prior to initiating backfill activities in accordance with Specification Section 022100 – Survey (Appendix B).

The goal of backfill placement is to restore the river bottom to the approximate pre-removal elevation and composition in accordance with the Restoration Plan (Appendix G-1). The final grades will also need to be stable based on the characteristics of the fill material. During the design process, changes were made to the restoration grades to provide additional stability in steeper areas near the shoreline (i.e., additional fill) and to deeper water areas to achieve a final condition with no net fill, as detailed in the Restoration Plan Addendum (Appendix G-2). All dredging will be completed prior to initiating backfilling operations.

Individual cells will need to be established within the larger dredge area if the Contractor prefers to initiate placement of backfill materials before dredging activities are complete.

The dredged areas shown on Design Drawings G-300 through G-302 will be backfilled to within 2 feet of final grade using general fill; the final 2 feet will be backfilled with river backfill, as detailed in the Technical Specifications (Appendix B), the Restoration Plan (Appendix G-1), and the Restoration Plan Addendum (Appendix G-2). Those backfill materials with unknown sources (non-DOT-approved materials or those without previous sampling documentation) will be sampled prior to delivery to the site to confirm that they are suitable for their intended use, and sampling frequencies and testing requirements are included in the CQAP (Appendix C). Backfill will be placed through the water column by conventional equipment operating from land (i.e., for near-shore areas) and/or from a barge. The backfill material will be placed from the deepest portions up toward the surface in a manner to maintain slope stability. Following completion of backfill placement, a post-backfill bathymetric survey will be performed to confirm placement of material to the required design elevations.

In near-shore areas and along the riverbank, riprap will be replaced to prevent erosion/scour of bank materials as a result of tidal fluctuation, wave action, prop wash, and other dynamic erosive forces (e.g., ice scour). Riprap removed during sediment removal activities will be cleaned of visual impacts related to the remediation, if any, in a contained area, replaced, and additional riprap will be imported, if necessary. Details of the restoration are provided in Design Drawings G-400 through G-402 and Specification Section 352023 – Dredging and Subaqueous Backfill (Appendix B). Backfill and riprap specifications are provided in Specification Section 312323 – Selected Fill (Appendix B).

4.5 Material Handling and Disposition

This section describes the various material handling and disposition activities associated with the dredged materials and associated wastes expected to be generated during the OU2 remedial activities. Such activities will be performed in a manner that minimizes the potential for inadvertent releases to the environment and/or unsafe conditions for onsite and offsite personnel. Refer to Figure 6 for a conceptual process flow diagram of the material handling procedures.

4.5.1 Onsite Handling and Temporary Staging

In general, the transportation of materials between the Hudson River and the temporary staging area(s) will be considered “onsite”. The specific methods of handling removed sediments and debris will be developed by the Contractor in consideration of: (a) the nature and characteristics of the removed materials; (b) onsite processes needed to prepare the materials for temporary staging and subsequent disposition (e.g., dewatering of materials containing excessive water); (c) the overall sequence and schedule of the removal actions; and (d) the need to avoid disrupting the property owner. Based on these considerations, several handling-related activities will be performed between the time that the debris and sediments are removed from the river and the time they are transported offsite for final disposition.

Debris removed from the river bottom will be placed onto a barge for transport to shore. To the extent practicable, all debris removed from the river bottom will be raised to the surface through and suspended over the removal area. Prior to placement on the barge, debris will be allowed to dewater by gravity into the river. Debris will be off-loaded from the barge and placed into lined vehicles for transport for temporary stockpiling. As necessary, certain debris items may be placed on near shore lined and bermed staging areas, to be cut to size to facilitate transport/disposal. The Contractor will take the necessary precautions to protect the existing surface from possible contamination.

Assuming sediments are removed mechanically, it is anticipated that, similar to the debris removal activities, they will be directly loaded into barges or scows for transport to the temporary staging area.

Sediment will be transferred to a land-based staging and loading area for dewatering and stabilization prior to being loaded into trucks for offsite disposal/treatment. Sediment will be dewatered by gravity drainage and/or by the addition of a stabilization agent, as needed. A treatability study will be performed by the Engineer prior to bidding the design to refine the appropriate agent and blending ratio. Dewatered sediment will meet the treatment or disposal facility requirements prior to transport.

The material will be characterized prior to loading for offsite treatment and/or disposal. Removed sediment is anticipated to be treated/disposed via low temperature thermal desorption (LTTD) or to be disposed of as a non-hazardous solid waste facility. Removed sediment will be characterized onsite to determine offsite treatment/disposal requirements. Sediment impacted with visible NAPL as determined by the Engineer and/or containing total PAHs at concentrations greater than or equal to 1,000 mg/kg, or that is characteristically hazardous for benzene, will be treated by LTTD. Remaining removed material will be disposed of as a non-hazardous waste at a solid waste landfill.

Existing waste characterization is discussed in Section 2.5. Based on this screening evaluation, the sediments subject to removal do not constitute characteristic hazardous waste subject to regulation under RCRA. Additional TCLP waste characterization sampling may be conducted if required by the selected offsite disposal facility(ies). Such results will be reviewed with representatives of the selected offsite disposal facility(ies) prior to transporting the material offsite. Unless further sampling is required, only sediment impacted with visual NAPL as determined by the Engineer is anticipated to require LTTD treatment.

Additional detail and requirements can be found in Specification Section 015000 – Temporary Facilities and Controls (Appendix B).

4.5.2 Offsite Treatment and/or Disposal

Potential transportation routes are illustrated on Design Drawing G-103 (Appendix B). Over-the-road transport of waste materials will be performed by licensed haulers in accordance with appropriate local, state, and federal regulations. Dump trailers leaving the work area will be lined to reduce the potential for spillage during transportation, manifested, and placarded in accordance with federal and state requirements using waste manifests or bills of lading. The Contractor will be required to comply with all offsite transportation and disposal requirements, and to implement procedures associated with the transport of excavated materials from the work area to the treatment and/or disposal facilities as discussed in Specification Section 028100 - Transport and Disposal of Impacted Materials (Appendix B).

4.6 Water Handling and Treatment

A temporary onsite water treatment system will be installed to treat liquid waste streams generated during the remedial activities (i.e., surface water that collects in the upland work areas and staging area(s), fluids from sediment dewatering, decontamination fluids that collect in the decontamination area, and decant water that collects in the sediment transfer barge). The temporary onsite water treatment system will be provided, constructed, and operated by the Contractor. It is anticipated that treated water will be discharged to the Hudson River under the requirements of a State Pollution Discharge Elimination System (SPDES) permit to be obtained by the Owner (a SPDES permit was been issued previously for OU1 activities at the Site).

This section describes the temporary onsite water treatment system that will be used to treat liquid waste streams generated by remedial activities. The system will be capable of processing at least 100 gallons per minute based on the assumed water content of the sediment and production rates, will be sized accordingly to accommodate the Contractor’s means and methods (including proposed production rates), and will meet the effluent limitations to be set forth in a Discharge Permit Equivalent anticipated to be issued by the NYSDEC. The remainder of this section presents the objectives of the treatment activities, a general overview and description of the anticipated components of the system, and an overview of the system operation, maintenance, and monitoring activities, including requirements for sampling treated effluent.

Additional detail and requirements can be found in Specification Section 444000 – Water Handling and Disposal (Appendix B).

4.6.1 Treatment Objectives

The objective of the temporary onsite treatment system is to reduce the concentration of site-related constituents in the liquid waste streams generated by remedial activities. Once constituent concentrations are reduced, the treated effluent will be discharged to the Hudson River under a SPDES permit equivalent.

4.6.2 Treatment System Components Overview

The temporary onsite water treatment system will be provided, operated, and constructed by the Contractor. At this time, it is anticipated that the temporary water treatment system will include the following components:

- influent holding tank(s)
- oil/water separator (OWS)
- solids filtration/removal
- granular-activated carbon (GAC) vessels
- effluent holding tank(s)

Water generated during the remedial activities will be pumped into the influent storage/settling tank(s). The treatment system will be designed to provide for a minimum influent storage of two times the daily flow capacity. This capacity will allow adequate time for settling of large particles. Water will be pumped from the influent storage/settling tanks to the OWS followed by pumping through solids filtration and GAC vessel(s) to provide filtration and polishing of the treated water. Treated water will flow to effluent storage tanks and be sampled to comply with discharge criteria and permit requirements.

4.6.3 Operation, Maintenance, and Monitoring

The water treatment system will be operated, maintained, and controlled by a water treatment system operator to be provided by the Contractor. The system will be manually controlled by the operator through a series of valves, visual readings, and pump controls, as necessary, to accommodate the various modes of operation.

It is anticipated that the treatment system effluent will be monitored for the site-specific following parameters such as pH, oil & grease, benzene, ethylbenzene, toluene, total xylene, and methylnaphthalene. Once the treatment system is operational in continuous mode, it is anticipated that one sample each from the influent, mid-fluent, and effluent will be collected following treatment of 10,000 gallons of water. Sampling of the treated effluent will also likely be performed at 25,000 and 40,000 gallons (cumulative volume). After 40,000 gallons, the required sampling frequency will be decreased to twice per week (if water is treated each week) and will include mid-fluent and effluent sampling. This sampling protocol will be applied each time a change is made to the configuration of the treatment system (e.g., upon change-out of granular activated carbon treatment units or other treatment train components) to verify that the system is operating effectively. Effluent discharge limits are anticipated to be set forth in a SPDES Permit Equivalent.

Each component of the treatment system will be monitored and maintained as necessary. Potential maintenance activities include:

- Monitoring sediment and debris build-up in the settling tank(s) and removing sediment/debris with a vac truck as necessary. Removed sediment/debris would be disposed of with sediment/debris removed during dredging operations.
- Monitoring the OWS for oil build-up and removing oil with sorbent pads as necessary. Spent sorbent pads would be disposed of with sediment/debris removed during dredging operations.
- Monitoring effluent concentrations from the filtration and GAC vessels. If effluent concentrations from any vessel exceed permitted discharge concentrations, that vessel will be backwashed or replaced, as appropriate, and the spent media will be disposed of with sediment/debris removed during dredging operations.

4.7 Site Restoration and Demobilization Activities

Following the completion of RA activities, areas disturbed as a result of construction will be restored to pre-existing conditions to the extent practicable. Demobilization of equipment and personnel will follow. The following activities are anticipated to be performed:

- Importing and placing select fill materials to restore the riverbed and banks to the final bathymetry (as discussed in Section 4.3 and the Restoration Plan [Appendix G]);
- Cut sheet piles at the mudline;
- Restoring the existing riprap-lined shoreline area by replacing riprap along the riverbank and in near-shore areas, as necessary, to prevent erosion/scour;

- Importing, placing, and compacting select fill materials to disturbed upland areas to the original topography;
- Removing constructed staging and support areas;
- Re-vegetating upland areas disturbed as a result of construction activities;
- Restoring surface features disturbed, damaged, or destroyed as the result of work activities;
- Properly disposing of excess project materials, supplies, and work-derived waste materials;
- Disconnecting any temporary utilities;
- Removing erosion and sedimentation control measures;
- Decontamination of equipment and other project materials associated with RA activities; and
- Demobilizing unused materials, equipment, and personnel from the work area and from the Site.

To the extent possible, restoration will be completed with materials similar to the existing substrate. Select fill material imported to the Site will be sampled to confirm that the materials are suitable for use prior to delivery to the Site. Certain erosion control measures will be left in place until vegetation in the restored areas becomes established.

Further design information and details related to site restoration and demobilization are illustrated on Design Drawing G-400. Technical Specifications associated with materials necessary for restoration are included in Specification Sections 312323 – Selected Fill and 329000 –Site Restoration (Appendix B). All restoration and demobilization activities will be conducted in accordance with the CQAP (Appendix C) and meet the requirements of the Restoration Plan (Appendix G) and Article 15 of the New York State Environmental Law and 6 New York Codes, Rules, and Regulations Part 608.

5 SUMMARY OF GREEN REMEDIATION PRACTICES

Green remediation practices and principles have been considered in the development of the remedial design to be implemented. Specifically, the design considerations discussed herein meet the objectives of green remediation of DER-31/Green Remediation (NYSDEC 2011) by:

- Protecting human health and the environment;
- Supporting human and ecological use and reuse of remediated land;
- Utilizing technologies and practices that are sustainable, to the extent practicable, to reduce air emissions and greenhouse gas production; and
- Utilizing technologies and practices, to the extent practicable, to conserve natural resources and energy.

The following specific procedures and protocols will be adopted during implementation, where feasible:

- Use of solar powered monitoring equipment and/or battery chargers.
- Use recycled materials (e.g., paper, lubrication oil) instead of virgin materials, where practicable.
- Recycle all non-contaminated debris and construction waste at a site (asphalt, metals, etc.) to the extent practicable.
- Use of biodegradable fluids for equipment and environmentally acceptable lubricants for oil-water interfaces, to the extent practicable.
- Minimizing clearing of vegetation.

The Contractor will execute remediation activities to minimize the potential for negative impacts on the environment through implementation of best management practices (BMPs). Examples of such BMPs include the following.

- Minimizing access routes into the work areas and maintaining designated vehicular traffic routes onsite to protect ecosystems.
- Limiting, where practical, the “footprint” of equipment staging material processing areas, remediation areas, and field offices. The footprint will be restored to original condition upon completion of the project.
- Collection and onsite treatment of all potentially impacted wastewaters encountered during operations.
- Maintaining pollution prevention and waste minimization programs from initiation of mobilization activities to project close out.
- Inspecting onsite equipment on a daily basis for clean operation.
- Maintaining good site housekeeping practices.
- Utilization of low emission diesel equipment and fuel.
- Reducing project emissions by minimizing idle time for equipment by shutting down equipment not being actively used.

6 POST-REMEDIAL ACTIVITIES

A Final Engineering Report (FER), including Record Drawings and Site Management Plan (SMP), will be prepared and submitted to the NYSDEC following completion of the RA activities described herein for OU2. In addition, this FER will also include the OU1 FER as an appendix, providing the final remedial actions for both operable units in one comprehensive document. These documents are explained in the following sections.

6.1 Final Engineering Report

Subsequent to the completion of the RA activities, an FER will be prepared and submitted to the NYSDEC for review and approval. The purpose of the FER will be to document the RA activities for the OU2 area and note any deviations from the Final RD Report. The FER will be prepared under the direction of, and certified by a Professional Engineer licensed in the State of New York directly involved in the RA activities, and will contain the following information:

- Background, site description and RAOs;
- Description of the selected remedy;
- Summary of the RA activities performed;
- Record Drawings documenting the removal limits and final configuration of installed restoration;
- Copies of permits, regulatory documents, and approvals, and relevant project correspondence, as appropriate;
- A description of any deviations from or modifications to the NYSDEC-approved Final RD Report;
- Copies of waste manifests, bills of lading, and/or certificates of treatment/disposal, as appropriate;
- QA/QC testing results;
- Summaries of monitoring results obtained during construction (e.g., water column, air);
- Representative project photographs taken during the RA; and
- Engineer's certification statement.

6.2 Site Management Plan

Subsequent to the completion of the RA activities for the Site, an amendment to the approved OU1 SMP will be prepared and submitted to the NYSDEC for OU2. Due to the extent of the removal activities, no post-remediation monitoring is anticipated and no institutional or engineering controls will be required. The SMP amendment will confirm that the RA achieved the required goals and that future activities will not be necessary for OU2, however OU1 post-remedial monitoring, as described in the OU1 SMP, will continue.

7 SCHEDULE

A preliminary schedule for the remainder of the RD activities, project permitting, and RA activities is presented as Figure 7.

National Grid will address any comments provided by the NYSDEC on the Final RD Report, which will be incorporated into the Revised Final RD Report. Assuming limited comments by NYSDEC on the draft, it is anticipated that the Revised Final RD Report will be submitted to the NYSDEC in the second quarter of 2020. Following NYSDEC approval of the Revised Final RD Report, pre-construction activities will continue (e.g., Contractor procurement, submittal of permit applications, access agreements, etc.). NYSDEC comments on this Final RD Report are anticipated no later than late June 2020 and NYSDEC approval of the Revised Final RD Report is anticipated no later than August 2020. It is anticipated that the preliminary permitting and Contractor procurement (i.e., bid document preparation and contractor pre-qualification) activities will be initiated in the second quarter of 2020 and continue through to the second quarter of 2021.

Barring any delays caused by weather, permitting, or site access, it is anticipated that the remedial construction activities will be initiated in the third quarter of 2021. Further details regarding the schedule for the RA and sequencing of the work will be presented in a final RA schedule to be submitted to the NYSDEC once the permits for the project have been received from USACE and the NYSDEC, and the Contractor has been selected by National Grid. The work will be sequenced/phased based on the Contractor's approach, and in consideration of weather/climatic conditions and any permit requirements or other regulatory conditions. All site work, including site restoration, is anticipated to be completed by the end of 2021. Site restoration is weather dependent and may need to be performed in 2022. The need to extend the schedule beyond this date will be determined once the Contractor is selected and production rates estimated based on the Contractor's selected means and methods in consideration of site-specific conditions. In-water work will only be performed between September 1 and November 30, as noted in Section 3.3.

8 REFERENCES

Arcadis. 2019. National Grid Comment Response Letter. Hudson Water Street Former MGP Site, Operable Unit Number 02: Hudson River, Hudson, Columbia County, Site No. 411005. National Grid. October 4.

Arcadis. 2014. Remedial Design Work Plan, Operable Unit 2, Hudson (Water Street) Site. Hudson, New York. April 14.

Arcadis. 2011. Feasibility Study for Operable Unit 2, Hudson (Water Street) Site. Hudson, New York. April 29.

Arcadis (with Foth and GEI Consultants). 2010. Revised Comprehensive Sediment Investigation Report for Operable Unit 2, Hudson (Water Street) Site. Hudson, New York. May 20.

Arcadis. 2008a. First Year Results of the OU2 Sediment Monitoring Program, Hudson (Water Street) Site. Hudson, New York. April 22.

Arcadis. 2008b. Final Engineering Report – Remedial Action Implementation for Operable Unit 1, Hudson (Water Street) Site. Hudson, New York. May.

BBL. 2003a. Final Remedial Design – Remedial Action for Operable Unit 1 – Contract No. 1 – General, Hudson (Water Street) Site. Hudson, New York. July.

BBL. 2003b. Comprehensive Sediment Investigation Report for Operable Unit 2 (OU2) Sediments, Hudson (Water Street) Site. Hudson, New York. September.

BBL. 2002a. Embayment #2 Investigation Report. Hudson (Water Street) Site. Hudson, New York. March 25.

BBL. 2002b. Final (100%) Remedial Design Basis of Design Report. Remedial Action for Operable Unit 1. Hudson (Water Street) Site. Hudson, New York. June 2002.

BBL. 2000. Site Investigation Summary Report. Hudson (Water Street) Site. Hudson, New York. July.

BBL. 1997. Phase II Site Investigation Report. Hudson (Water Street) Site. Hudson, New York. February.

BBL. 1996. Site Investigation Data Report. Hudson (Water Street) Site. Hudson, New York. June.

Beers, D.G. 1873. Atlas of Columbia County, New York. Churchville, New York.

Bradbury, A.R. 1908. History of the City of Hudson New York. Hudson, New York.

Federal Emergency Management Agency (FEMA). 1989. Flood Insurance Study-City of Hudson, New York, Columbia County.

Goldring, Winfred. 1943. *Geology of the Coxsackie Quadrangle, New York*. New York State Museum Bulletin. Albany, New York.

Hong, L., U. Ghosh, T. Mahajan, R.N. Zare, and R.G. Luthy. 2003. *PAH Sorption Mechanism and Partitioning Behavior in Lampblack-Impacted Soils from Former Oil-Gas Plant Site.* Environmental Science & Technology. Vol. 37. No. 16.

Isachsen, Y.W. et al., eds. 1991. *Geology of New York, A Simplified Account*. New York State Museum/Geological Survey. Albany, New York.

New York Code of Rules and Regulations (NYCRR). 1995. New York. Official Compilation of Codes, Rules, and Regulations (NYCRR) Title 6. Environmental Conservation. 1995 Reissue.

NYSDEC. 2019a. Comment Letter. Hudson Water Street Former MGP Site, Operable Unit Number 02: Hudson River, Hudson, Columbia County, Site No. 411005. Division of Environmental Remediation. April 25.

NYSDEC. 2019b. National Grid Comment Response Letter. Hudson Water Street Former MGP Site, Operable Unit Number 02: Hudson River, Hudson, Columbia County, Site No. 411005. National Grid. October 7.

NYSDEC. 2012. Record of Decision. NM - Hudson MGP, Operable Unit Number 02: Hudson River, Hudson, Columbia County, Site No. 411005. Division of Environmental Remediation. March 28.

NYSDEC. 2011. DER-31 / Green Remediation. January 20. Available at http//www.dec.ny.gov/docs/remediation_hudson_pdf/der31/pdf.

NYSDEC. 2010a. Division of Environmental Remediation-23. Citizen Participation Handbook for Remedial Programs. January.

NYSDEC. 2010b. DER-10 / Technical Guidance for Site Investigation and Remediation. May 3. Available at: http://www.dec.ny.gov/docs/remediation_hudson_pdf/der10.pdf. Accessed on April 7, 2020.

NYSDOH. 2019. Hudson River Tributaries Region Fish Advisories: Hudson River, Troy Dam south to Rip Van Winkle Bridge at Catskill (Columbia County). November. Available at: http://www.health.ny.gov/environmental/outdoors/fish/health_advisories/regional/hudson_river_and_tributaries.htm. Accessed on April 7, 2020.

NYSDOH. 2009. Qualitative Human Health Exposure Assessment. Appendix 3B. Draft DER-10, Technical Guidance for Site Investigation and Remediation. NYSDEC. November 2009.

Palermo, M.R., Schroeder, P.R., Estes, T.J, and Francingues, N.R. 2008. Technical Guidelines for Environmental Dredging of Contaminated Sediments. United States Army Corps of Engineers, prepared for United States Environmental Protection Agency, Washington, DC.

RETEC. 2007. Characterization of the Bioavailability and Toxicity of PAHs in Aquatic Sediments near the Hudson MGP Site – Hudson, New York.

Sanborn. 1949 and 1961. Hudson, New York. ERIIS. Herndon, Virginia and Syracuse University Library. Syracuse, New York.

Stedfast, D.A. 1982. Flow Model of the Hudson River Estuary from Albany to New Hamburg, *USGS Water-Resources Investigation 81-55*, U.S. Geological Survey, Albany, New York, p. 75.

TAMS. 2000. Draft Site Assessment Report Conrail Site City of Hudson, New York Site No. 4-11-013. For NYSDEC Superfund Standby Program. Albany, New York. April 2000.

USEPA. 2003. Equilibrium partitioning sediment guidelines (ESGs) for the protection of benthic organisms: PAH mixtures. Office of Science and Technology and Office of Research and Development.

U.S. Fish and Wildlife Service. 2020. Federally Listed Endangered and Threatened Species and Candidate Species in New York (By County). Available at: https://ecos.fws.gov/ecp0/reports/species-by-current-range-county?fips=36021. Accessed on April 7, 2020.

TABLES

Table 1
Summary of Investigation Activities
Final Remedial Design Report for Operable Unit 2
National Grid - Hudson (Water Street) Site, Hudson, New York

ARCADIS Design & Consultancy for natural and built assets

Title	Time Period	Location	Analytical Scope	Other Scope	Reference
Remedial Investigations					
Phase I Investigation	November 1995	20 sediment borings: Eighteen sediment borings (SD-1 through SD-18) for Embayment #1 and two background sediment borings (SD-19 and SD-20) approximately 1 mile upstream of the site.	VOCs, SVOCs, PCBs, TPH, TOC, inorganics, RCRA characteristics, diesel fuel, kerosene, lube oil, gasoline, heating value, percent sulfur	N/A	*Site Investigation Data Report* ; BBL 1996
Phase II Investigation	August and September 1996	12 sediment borings (SD-21 through SD-32): three within Embayment #2 and nine in the Hudson River downstream of Embayment #2.	VOCs, SVOCs, PCBs, TPH, TOC, geotechnical parameters, RCRA characteristics, lead-210, cesium-137, beryllium-7	N/A	*Phase II Site Investigation Report* ; BBL 1997
Phase III Investigation	March and April 1998	14 sediment borings (SD-33 to SD-46) in the Hudson River near the eastern shore south of the site and across the shipping channel along the western shore of the Hudson River	BTEX, PAHs, inorganics	N/A	*Sediment Investigation Report* ; BBL 2000
1998 Hudson Petroleum Corp. Site Investigation	1998	5 surface sediment samples at Hudson Petroleum Corporation property north of the site	VOCs, SVOCs, TPH, inorganics	N/A	*Draft Site Investigation/Remedial Alternatives Report Hudson Petroleum Corp. Site* ; C&A 1998
2000 Sediment Investigation	August 2000	12 sediment samples: Nine sediment samples (XSD-1 to XSD-6) within Embayment #3 and three sediment samples (XSD-7 to XSD-9) within Embayment #4	VOCs, SVOCs, PCBs, inorganics, pesticides, inorganics	N/A	*Draft Site Assessment Report, Conrail Site, Hudson, New York* ; TAMS 2000
Embayment #2 Investigation	2001	8 sediment borings within Embayment #2 (SD-58 to SD-65)	BTEX, PAHs, PCBs, RCRA metals, TOC	N/A	*Embayment #2 Investigation Report* ; BBL 2002
2002 Sediment Investigation	April to June 2002	45 sediment borings: 14 previously sampled locations and 22 new locations [SD-66 to SD-88]	PAHs, TOC, geotechnical parameters	Geophysical survey, in-situ vane shear testing, geochronological sampling, benthic macroinvertebrate survey	*Comprehensive Sediment Investigation Report* ; BBL 2003
2003-2006 PAH Bioavailability and Sediment Toxicity Investigation Activities	2003 to 2006	26 sediment locations within OU2	PAHs (total extractable and porewater)	Toxicity testing (17 locations in OU2)	*Characterization of the Bioavailability and Toxicity of PAHs in Aquatic Sediments near the Hudson MGP Site, Hudson, New York* ; RETEC 2007
2007 Supplemental Sediment Sampling Activities	October 2007	7 sediment borings (SD-87R, SD-91 through SD-96)	PAHs, forensic PAHs, TOC	N/A	*2007 Supplemental Sediment Sampling Letter Report* ; ARCADIS BBL 2008
2007-2009 OU2 Sediment Monitoring Program	2007, 2008, 2009	16 sediment monitoring locations for Embayment #1; 3 sediment monitoring locations for Embayment #2	PAH_{16}s (9 locations); forensic PAHs and TPH (10 locations); NAPL TPH and PAH (2 locations)	N/A	*Revised Comprehensive Sediment Investigation Report* ; ARCADIS 2011
2009 Supplemental Sediment Investigation	October 2009	62 surface sediment samples: 53 from the Hudson River adjacent to the site and nine reference location samples north, west, and south of the site; 22 TarGOST™ sediment borings; 5 NAPL confirmation borings	Porewater NOAA PAHs and PAH_{16}s; Bulk Sediment NOAA PAHs, PAH_{16}s, TOC, SOC, ammonia, pH	Grain size; PAH bioavailability and benthic macroinvertebrate survey (41 locations); TarGOST™ survey (22 locations)	*Revised Comprehensive Sediment Investigation Report* ; ARCADIS 2011
Pre-Design Investigations					
2013 Pre-Design Investigation	Between August 7 and September 17, 2013	Submerged aquatic vegetation survey; 21 environmental borings: 17 borings within the ARC, 4 borings south of the ARC; Forensic evaluation of TPH; 5 geotechnical soil borings with SPT and geotechnical soil sampling, geotechnical laboratory analysis; 4 cone penetrometer test installations with geotechnical laboratory analysis	PAHs in porewater by solidphase microextraction; forensic PAHs; forensic TPH; toxicity characteristic leaching procedure	Diver survey; geotechnical analysis (particle size, moisture content, atterberg limit, percent organics, triaxial compression, 1D consolidation properties, specific gravity	*Remedial Design Work Plan* ; ARCADIS 2014
2015 Pre-Design Investigation	Between April 23 and May 28, 2015	Within and around the ARC	N/A	Updated bathymetric survey; additional topographic survey of the nearshore, shallow water areas; side scan sonar survey; acoustic sub-bottom profiling; magnetometer survey; river velocity data measurement	Section 2.2.4 of this *Remedial Design Report*

Notes:

ARC = Area of Remedial Consideration
BTEX = Benzene, toluene, ethylbenzene, and total xylene
N/A = not applicable
NAPL = Non-aqueous phase liquid
NOAA PAHs = 34 National Oceanic and Atmospheric Administration PAHs
OU = Operable Unit
PAHs = Polycyclic aromatic hydrocarbons
PAH_{16} = 16 priority pollutant PAHs
PCB = Polychlorinated biphenyl
SOC = soot organic carbon
SPT = Standard penetration testing
SVOC = Semivolatile organic compound
RCRA = Resource Conservation and Recovery Act hazardous waste characteristics (ignitability, corrosivity, reactivity, toxicity)
TOC = Total organic carbon
TPH = Total petroleum hydrocarbons
VOC = Volatile organic compound

Table 2
Summary of Waste Characterization Analyses
Final Remedial Design Report for Operable Unit 2
National Grid - Hudson (Water Street) Site, Hudson, New York

ARCADIS Design & Consultancy for natural and built assets

Location ID: Date Collected:	TCLP Criteria (mg/L)	20x TCLP Criteria (mg/L)	Sample Units	WC-NORTH 09/09/13	WC-SOUTH 09/09/13
PCBs					
PCB-1016	--	--	mg/kg	0.042 U	0.040 U
PCB-1221	--	--	mg/kg	0.042 U	0.040 U
PCB-1232	--	--	mg/kg	0.042 U	0.040 U
PCB-1242	--	--	mg/kg	0.042 U	0.040 U
PCB-1248	--	--	mg/kg	0.042 U	0.040 U
PCB-1254	--	--	mg/kg	0.042 U	0.040 U
PCB-1260	--	--	mg/kg	0.042 U	0.040 U
Miscellaneous					
Cyanide	--	--	mg/kg	0.15 U	0.14 U
Heat Content	--	--	BTU/lb	988	1,220
Solids, percent	--	--	%	76.7	79.3
Sulfur, percent	--	--	%	0.10 U	0.20
Volatile Organic Compounds					
1,1-Dichloroethane	--	--	mg/kg	0.740 U	0.150 U
1,2-Dichloroethane	0.5	10	mg/kg	0.740 U	0.150 U
1,1-Dichloroethene	0.7	14	mg/kg	0.740 U	0.150 U
cis-1,2-Dichloroethene	--	--	mg/kg	0.740 U	0.150 U
trans-1,2-Dichloroethene	--	--	mg/kg	0.740 U	0.150 U
1,2-Dichloropropane	--	--	mg/kg	0.740 U	0.150 U
cis-1,3-Dichloropropene	--	--	mg/kg	0.740 U	0.150 U
trans-1,3-Dichloropropene	--	--	mg/kg	0.740 U	0.150 U
1,1,2,2-Tetrachloroethane	--	--	mg/kg	0.740 U	0.150 U
1,1,1-Trichloroethane	--	--	mg/kg	0.740 U	0.150 U
1,1,2-Trichloroethane	--	--	mg/kg	0.740 U	0.150 U
2-Butanone	200.0	4000	mg/kg	1.80 U	0.370 U
2-Hexanone	--	--	mg/kg	1.80 U	0.370 U
4-Methyl-2-pentanone	--	--	mg/kg	1.80 U	0.370 U
Acetone	--	--	mg/kg	3.70 U	0.750 U
Benzene	0.5	10	mg/kg	0.534	0.037 U
Bromodichloromethane	--	--	mg/kg	0.740 U	0.150 U
Bromoform	--	--	mg/kg	0.740 U	0.150 U
Bromomethane	--	--	mg/kg	0.740 U	0.150 U
Carbon disulfide	--	--	mg/kg	1.80 U	0.370 U
Carbon Tetrachloride	0.5	10	mg/kg	0.740 U	0.150 U
Chlorobenzene	100.0	2000	mg/kg	0.740 U	0.150 U
Chloroethane	--	--	mg/kg	1.80 U	0.370 U
Chloroform	6.0	120	mg/kg	0.740 U	0.150 U
Chloromethane	--	--	mg/kg	1.80 U	0.370 U
Dibromochloromethane	--	--	mg/kg	0.740 U	0.150 U
Ethylbenzene	--	--	mg/kg	6.85	0.150 U
Methylene chloride	--	--	mg/kg	0.740 U	0.150 U
Styrene	--	--	mg/kg	1.80 U	0.370 U
Tetrachloroethene	0.7	14	mg/kg	0.740 U	0.150 U
Toluene	--	--	mg/kg	1.80 U	0.370 U
Trichloroethene	0.5	10	mg/kg	0.740 U	0.150 U
TPH-GRO	--	--	mg/kg	7.1 U	7.2 U
Vinyl chloride	0.2	4	mg/kg	0.740 U	0.150 U
Xylene	--	--	mg/kg	5.44	0.150 U

Table 2
Summary of Waste Characterization Analyses
Final Remedial Design Report for Operable Unit 2
National Grid - Hudson (Water Street) Site, Hudson, New York

Location ID: Date Collected:	TCLP Criteria (mg/L)	20x TCLP Criteria (mg/L)	Sample Units	WC-NORTH 09/09/13	WC-SOUTH 09/09/13
Semi-Volatile Organic Compounds					
1,2-Dichlorobenzene	--	--	mg/kg	1.60 U	0.300 U
1,2,4-Trichlorobenzene	--	--	mg/kg	1.60 U	0.300 U
1,3-Dichlorobenzene	--	--	mg/kg	1.60 U	0.300 U
1,4-Dichlorobenzene	7.5	150	mg/kg	1.60 U	0.300 U
bis (2-Chloroethoxy) methane	--	--	mg/kg	1.60 U	0.300 U
bis (2-Chloroethyl) ether	--	--	mg/kg	1.60 U	0.300 U
bis (2-Chloroisopropyl) ether	--	--	mg/kg	1.60 U	0.300 U
2-Chloronaphthalene	--	--	mg/kg	1.60 U	0.300 U
2-Chlorophenol	--	--	mg/kg	1.60 U	0.300 U
bis (2-Ethylhexyl) phthalate	--	--	mg/kg	1.60 U	0.300 U
2-Methylnaphthalene	--	--	mg/kg	34.6	0.120 U
2-Methylphenol	200	4000	mg/kg	3.20 U	0.600 U
2-Nitroaniline	--	--	mg/kg	3.20 U	0.600 U
2-Nitrophenol	--	--	mg/kg	3.20 U	0.600 U
2,4-Dichlorophenol	--	--	mg/kg	3.20 U	0.600 U
2,4-Dimethylphenol	--	--	mg/kg	3.20 U	0.600 U
2,4-Dinitrophenol	--	--	mg/kg	6.30 U	1.20 U
2,4-Dinitrotoluene	0.13	2.6	mg/kg	3.20 U	0.600 U
2,4,5-Trichlorophenol	400.0	8000	mg/kg	3.20 U	0.600 U
2,4,6-Trichlorophenol	2.0	40	mg/kg	3.20 U	0.600 U
2,6-Dinitrotoluene	--	--	mg/kg	3.20 U	0.600 U
3-Nitroaniline	--	--	mg/kg	3.20 U	0.600 U
3,3'-Dichlorobenzidine	--	--	mg/kg	1.60 U	0.300 U
3&4-Methylphenol	200	4000	mg/kg	3.20 U	0.600 U
4-Bromophenyl phenyl ether	--	--	mg/kg	1.60 U	0.300 U
4-Chloro-3-methyl phenol	--	--	mg/kg	3.20 U	0.600 U
4-Chloroaniline	--	--	mg/kg	3.20 U	0.600 U
4-Chlorophenyl phenyl ether	--	--	mg/kg	1.60 U	0.300 U
4-Nitroaniline	--	--	mg/kg	3.20 U	0.600 U
4-Nitrophenol	--	--	mg/kg	6.30 U	1.20 U
4,6-Dinitro-o-cresol	--	--	mg/kg	3.20 U	0.600 U
Acenaphthene	--	--	mg/kg	26.3	0.120 U
Acenaphthylene	--	--	mg/kg	1.62	0.120 U
Anthracene	--	--	mg/kg	11.5	0.120 U
Benzo (a) anthracene	--	--	mg/kg	8.03	0.120 U
Benzo (a) pyrene	--	--	mg/kg	6.91	0.120 U
Benzo (b) fluoranthene	--	--	mg/kg	3.51	0.120 U
Benzo (g,h,i) perylene	--	--	mg/kg	3.47	0.120 U
Benzo (k) fluoranthene	--	--	mg/kg	3.16	0.120 U
Butyl benzyl phthalate	--	--	mg/kg	1.60 U	0.300 U
Carbazole	--	--	mg/kg	1.19	0.120 U
Chrysene	--	--	mg/kg	6.84	0.120 U
Dibenzo (a,h) anthracene	--	--	mg/kg	0.959	0.120 U
Dibenzofuran	--	--	mg/kg	3.15	0.120 U
Di-n-butyl phthalate	--	--	mg/kg	1.60 U	0.300 U
Di-n-octyl phthalate	--	--	mg/kg	1.60 U	0.300 U
Diethyl phthalate	--	--	mg/kg	1.60 U	0.300 U
Dimethyl phthalate	--	--	mg/kg	1.60 U	0.300 U

Table 2
Summary of Waste Characterization Analyses
Final Remedial Design Report for Operable Unit 2
National Grid - Hudson (Water Street) Site, Hudson, New York

Location ID: Date Collected:	TCLP Criteria (mg/L)	20x TCLP Criteria (mg/L)	Sample Units	WC-NORTH 09/09/13	WC-SOUTH 09/09/13
Fluoranthene	--	--	mg/kg	18.8	0.170
Fluorene	--	--	mg/kg	9.51	0.120 U
Hexachlorobenzene	0.13	2.6	mg/kg	1.60 U	0.300 U
Hexachlorobutadiene	0.5	10	mg/kg	1.60 U	0.300 U
Hexachlorocyclopentadiene	--	--	mg/kg	3.20 U	0.600 U
Hexachloroethane	3.0	60	mg/kg	1.60 U	0.300 U
Indeno (1,2,3-cd) pyrene	--	--	mg/kg	2.63	0.120 U
Isophorone	--	--	mg/kg	1.60 U	0.300 U
Naphthalene	--	--	mg/kg	52.8	0.120 U
Nitrobenzene	--	--	mg/kg	1.60 U	0.300 U
N-Nitroso-di-n-propylamine	--	--	mg/kg	1.60 U	0.300 U
N-Nitrosodiphenylamine	--	--	mg/kg	1.60 U	0.300 U
Pentachlorophenol	100	2000	mg/kg	3.20 U	0.600 U
Phenanthrene	--	--	mg/kg	43.2	0.196
Phenol	--	--	mg/kg	1.60 U	0.300 U
Pyrene	--	--	mg/kg	22.5	0.145
TPH-DRO	--	--	mg/kg	1180	20 U
Inorganics					
Arsenic	5.0	100	mg/kg	4.0	2.4
Barium	100.0	2000	mg/kg	52.9	19.0
Cadmium	1.0	20	mg/kg	0.33 U	0.38 U
Chromium	5.0	100	mg/kg	9.6	5.9
Lead	5.0	100	mg/kg	50.7	6.0
Mercury	0.2	4	mg/kg	0.092	0.041
Selenium	1.0	20	mg/kg	0.81 U	0.95 U
Silver	5.0	100	mg/kg	0.41 U	0.47 U

Notes:
1. Samples collected by Arcadis on the dates indicated.
2. Samples analyzed by Accutest in Marlborough, MA and Dayton, NJ.
3. Shading indicates that the analyte was detected.
4. U - The compound was analyzed for but not detected. The associated value is the compound reporting limit.
5. Regulatory levels obtained from: https://www.epa.gov/sites/production/files/2015-06/documents/tclp.pdf

Abbreviations:
BTU/lb = British thermal unit per pound
mg/kg = milligram per kilogram
mg/L = milligram per liter
PCB = polychlorinated biphenyl
TCLP = toxicity characteristic leaching procedure

Table 3
Permits and Review Requirements Summary
Final Remedial Design Report for Operable Unit 2
National Grid – Hudson (Water Street) Site, Hudson, New York

Required Permit	Timeline	Requirement Satisfied
Permits to be Obtained by National Grid/Arcadis		
Joint Permit Application	75-120 days	Clean Water Act (CWA) Section 401, Water Quality Certification (WQC) CWA Section 404 Section 10 of the Rivers and Harbors Act New York State Department of State, Coastal Management Program Public Lands Law, Article 6, Section 75 New York State Protection of Waters Program, Environmental Conservation Law (ECL) Article 15, Title 5/6 the New York Codes, Rules, and Regulations (5/6 NYCRR) Part 608
Consultation with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service (NMFS)	60-90 days	Section 7 of the Endangered Species Act (ESA) and Fish and Wildlife Coordination Act of 2002
National Historic Preservation Act (NHPA) – Assessment of Adverse Effects	60-90 days	Section 106 of the NHPA
State Historic Preservation Office (SHPO) – Assessment of Adverse Effects	60-90 days	Section 106 of the NHPA New York State Historic Preservation Act of 1980, Section 14.09
State Pollutant Discharge Elimination System (SPDES) General Permit for Stormwater Discharges from Construction Activity (see Note 3)	75-120 days	SPDES, ECL Article 17, Titles 7 and 8 Clean Water Act, 33 USC Part 1250 et seq.
SPDES Equivalency Permit (see Note 3)	75-120 days	SPDES, ECL Article 17, Titles 7 and 8 Clean Water Act, 33 USC Part 1250 et seq.
Permits to be Obtained by Contractor		
City of Hudson Permits	30 days	Hudson Code of Ordinances

Notes:

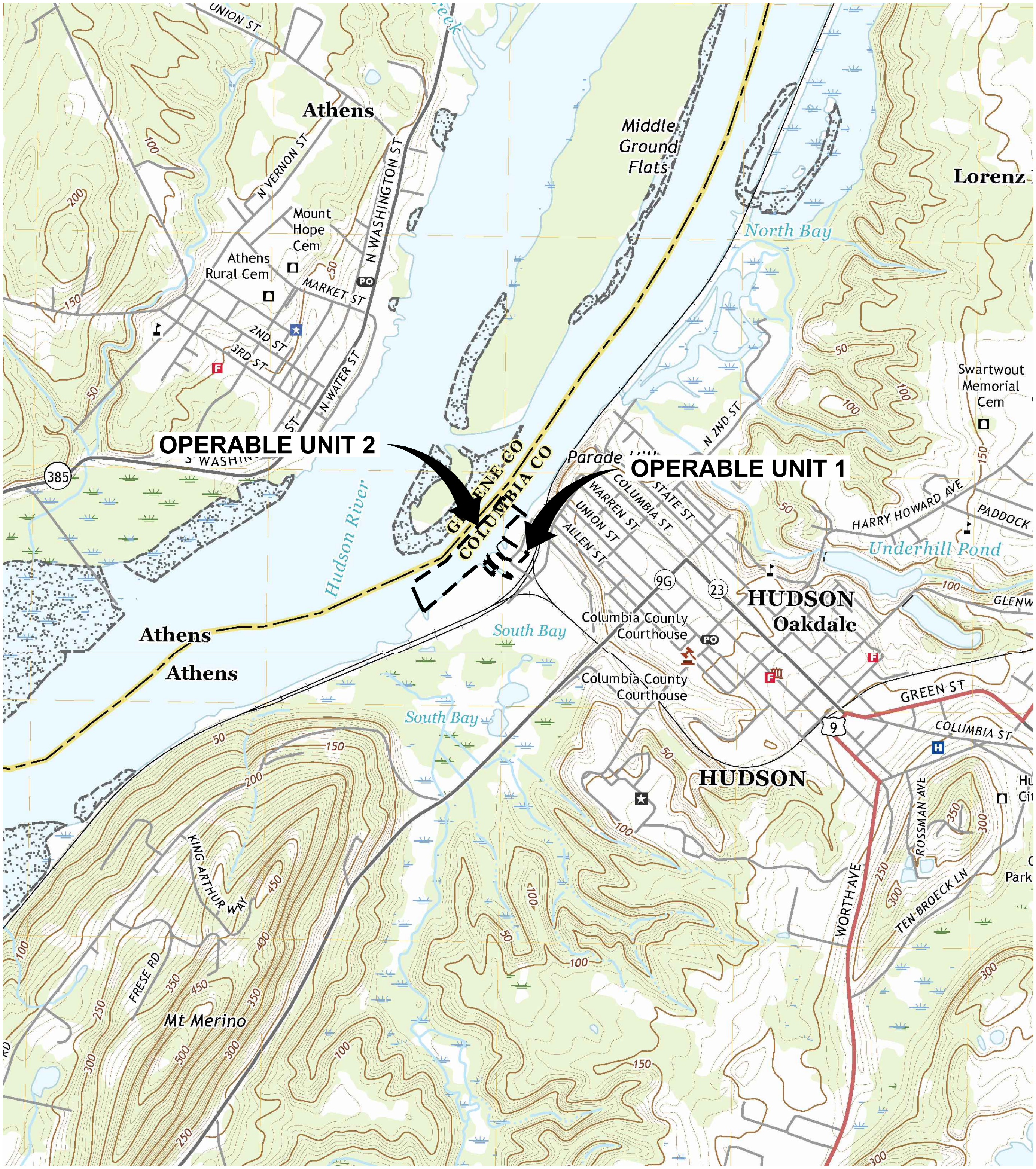
1. The following federal regulations and guidance may also be applicable to the activities associated with implementing the RA:
   - Emergency Planning and Community Right-to-Know Act, 40 CFR 302, 350, 355, 370
   - Occupational Safety and Health Administration Standards, 29 CFR 1910 and 1926
   - United States Department of Transportation, Transportation Requirements, 49 CFR
   - Marine Safety, United States Coast Guard Regulations

- American Society for Testing and Materials, D3740 (Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction) and E329 (Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection)
   - International Organization for Standardization, ISO 9000 Quality Management Systems
   - American National Standards Institute, ANSI/ASQC E4-1994

2. At the time of preparing this Remedial Design, the City of Hudson does not have an approved Waterfront Revitalization Program. As such, neither a City of Hudson Project Review nor a State Environmental Quality Review Act (SEQRA) Environmental Assessment Form is required for this project. Approved Waterfront Revitalization Programs are listed at: http://www.dos.ny.gov/opd/programs/WFRevitalization/LWRP_status.html.
3. A SPDES permit was obtained for the 2004-2005 remedial construction at OU-1.

FIGURES

CITY: MUMBAI DIV/GROUP: ENVCAD DB: Y. NIMBARGIKAR, M.A.SHAIKH LD: PIC: PM: TM:
C:\Users\Ksartori\BIM 360\Arcadis\ANA - National Grid\Project Files\Hudson (Water Street) Site OU2\2020\30003986\01-DWG\NG-HWS-Fig 1-SLM.dwg LAYOUT: 1 SAVED: 3/6/2020 4:48 AM ACADVER: 23.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 3/27/2020 11:55 AM
BY: SARTORI, KATHERINE



MAP SOURCE: USGS 7.5. MIN. TOPO. QUAD., HUDSON NORTH, NY, 2019, AND HUDSON NORTH, NY, 2019.

N

0 2,000 4,000'

APPROXIMATE SCALE 1 in. = 2,000 ft.

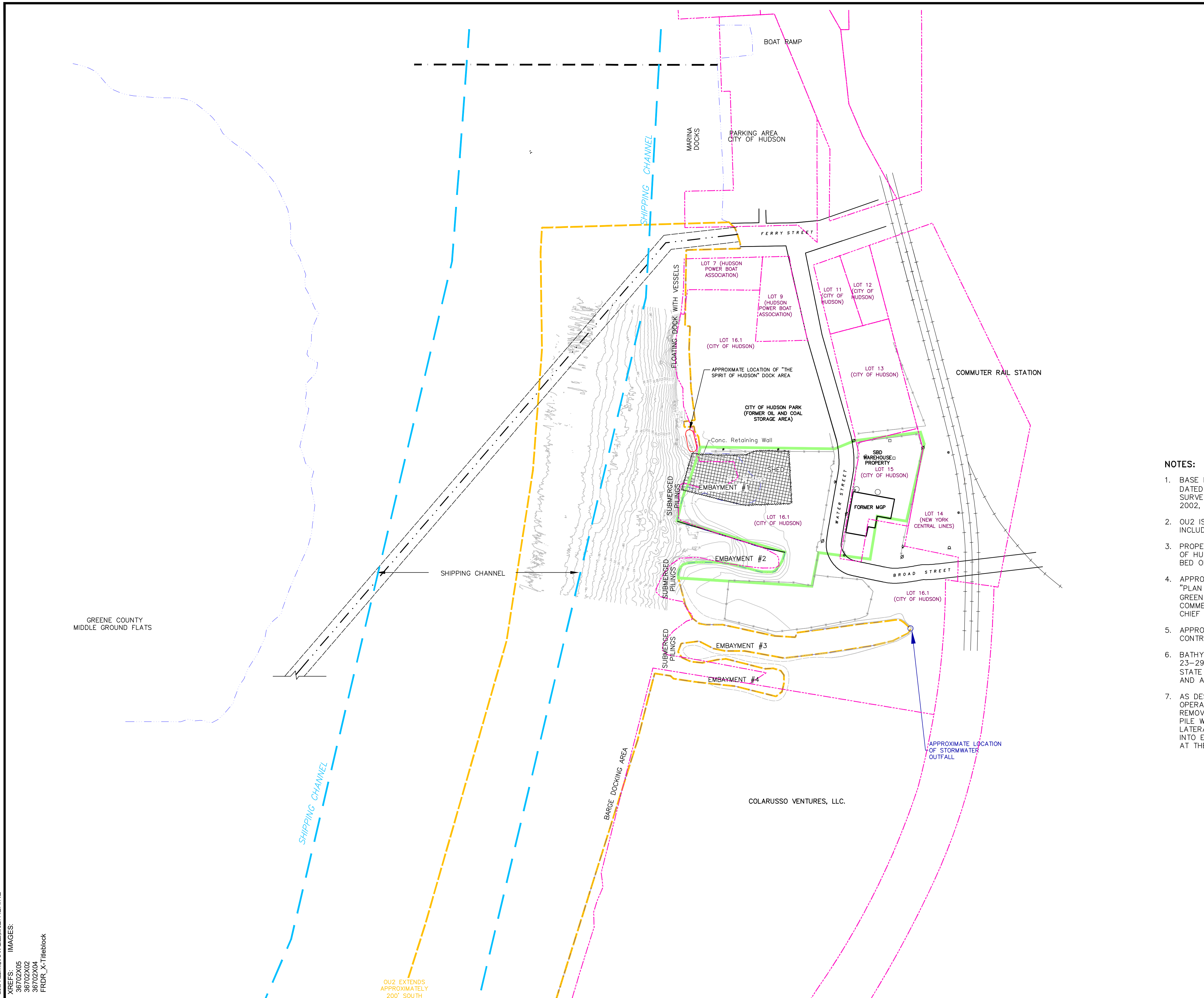
NEW YORK

NATIONAL GRID
HUDSON (WATER STREET) SITE, HUDSON, NEW YORK
FINAL REMEDIAL DESIGN REPORT

SITE LOCATION MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURE
1



LEGEND:

- BOUNDARY OF OPERABLE UNIT 1
- APPROXIMATE EXTENT OF OPERABLE UNIT 2
- APPROXIMATE TAX PARCEL LINE
- CHAIN–LINK FENCE
- RAIL LINES
- BATHYMETRIC CONTOUR (2–FOOT INTERVAL)
- APPROXIMATE FIBER OPTIC CABLE EASEMENT
- APPROXIMATE FIBER OPTIC CABLE LOCATION
- APPROXIMATE COPPER CABLE LOCATION
- APPROXIMATE BOUNDARY OF THE SHIPPING CHANNEL
- EMBAYMENT 1 REMEDIATED AREA
- EXISTING SHEETPILE (SEE NOTE #7)

NOTES:

1. BASE MAP FROM TOPOGRAPHIC SURVEY BY BOSK ASSOCIATES, DRAWING FILE HUDSONDL.DWG, DATED 3/24/95. 2. THE RIVER SHORELINE WAS SURVEYED BY ARCADIS USING SURVEY–GRADE GPS EQUIPMENT IN DECEMBER 1995, AUGUST 1996, MARCH 1998, SPRING 2002, AND OCTOBER 2009.
2. OU2 IS IDENTIFIED BY NYSDEC AS A PORTION OF THE HUDSON RIVER ADJACENT TO THE SITE INCLUDING SEDIMENTS IN EMBAYMENTS #2, #3, AND #4.
3. PROPERTY BOUNDARIES AND ADDITIONAL SHORELINE INFORMATION WERE OBTAINED FROM CITY OF HUDSON TAX MAP, 1009.11, DATED SEPTEMBER 2016. THE HUDSON RIVER, INCLUDING THE BED OF THE HUDSON RIVER, IS OWNED BY THE STATE OF NEW YORK.
4. APPROXIMATE LOCATION OF BURIED FIBER OPTIC CABLES SCANNED FROM SHEET 2 OF 2 "PLAN & PROFILE HUDSON RIVER CROSSING BETWEEN HUDSON AND ATHENS, COLUMBIA AND GREEN COUNTIES, NEW YORK" BARRETT, BONACCI, HYMAN AND VANWEELE, P.C., 175 A COMMERCE DRIVE, HAUPPAUGE, NEW YORK, OCTOBER 13, 1993. RECEIVED FROM DAVID FINGER, CHIEF ENGINEER, MID–HUDSON CABLE, CATSKILL, NEW YORK.
5. APPROXIMATE LOCATION OF UNBURIED COPPER CABLE POINTED OUT BY GERALD DALY, CONTRACT INSPECTOR, VERIZON SOUTH CAIRO, NEW YORK ON APRIL 17, 2002.
6. BATHYMETRIC SURVEY AND DEBRIS SURVEY CONDUCTED BY AQUA SURVEY, INC. ON APRIL 23–29 2015. GRID SYSTEM FOR SURVEY IS IN U.S. SURVEY FEET RELATIVE TO THE NEW YORK STATE PLANE COORDINATE SYSTEM, EAST ZONE (3101), NAD83. ALL ELEVATIONS ARE IN FEET AND ARE REFERENCED TO NAVD88.
7. AS DESCRIBED IN THE FINAL ENGINEERING REPORT – REMEDIAL ACTION IMPLEMENTATION OF OPERABLE UNIT 1, A PERMANENT SHEETPILE WALL WAS INSTALLED AROUND THE SEDIMENT REMOVAL AREA AND ALONG THE WESTERN ALIGNMENT OF EMBAYMENT #1. THIS STEEL SHEET PILE WALL WAS LEFT IN PLACE TO PROVIDE ADDITIONAL PROTECTION AGAINST THE POTENTIAL LATERAL SUBSURFACE MIGRATION OF IMPACTED MATERIAL FROM SURROUNDING PROPERTIES INTO EMBAYMENT #1. THE SHEETPILE WALL AT THE MOUTH OF EMBAYMENT #1 WAS CUT OFF AT THE MUDLINE FOLLOWING COMPLETION OF THE OU1 REMEDIATION.

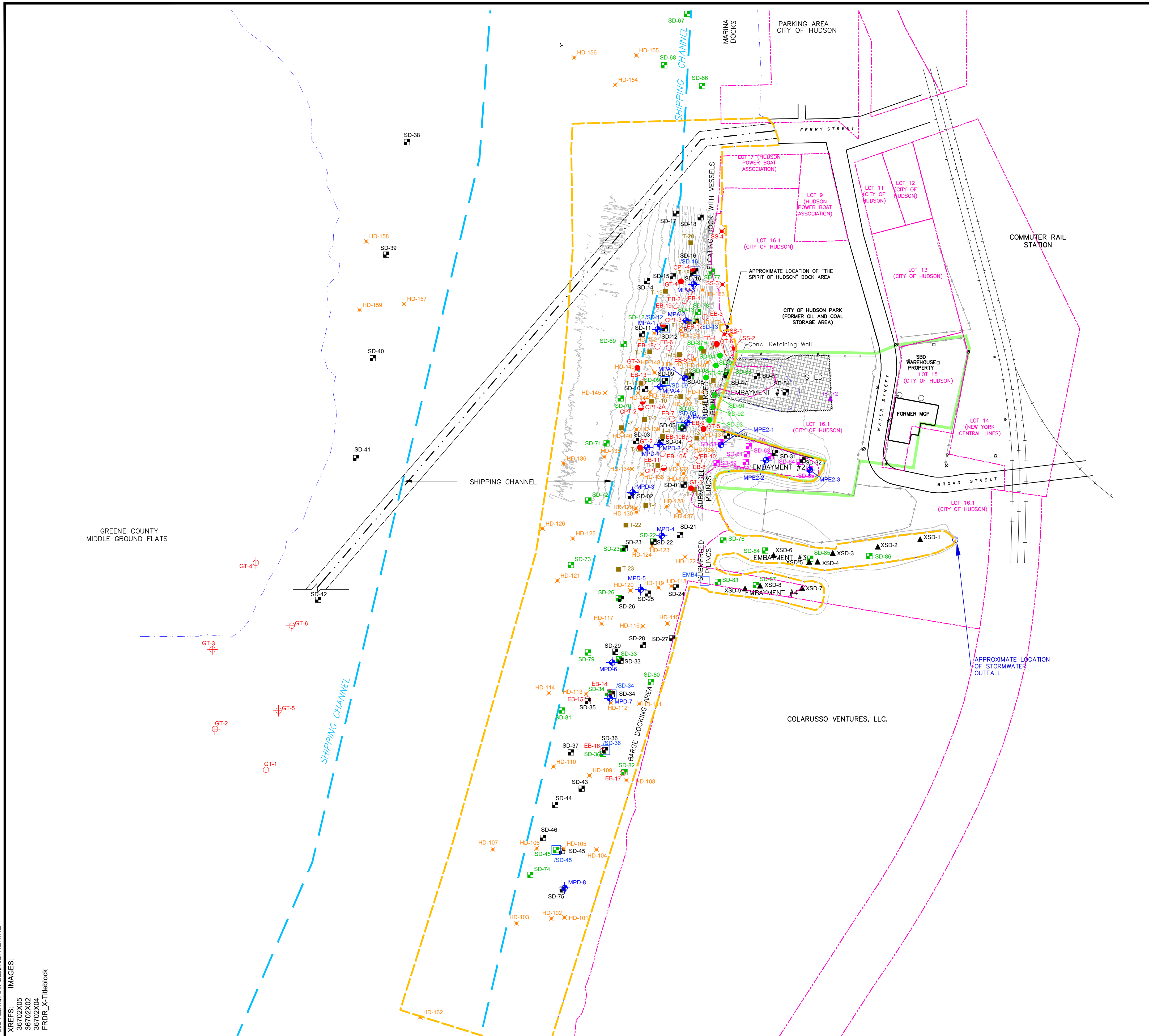
0 100' 200'
GRAPHIC SCALE

NATIONAL GRID
HUDSON (WATER STREET) SITE, HUDSON, NEW YORK
FINAL REMEDIAL DESIGN REPORT

SITE PLAN

ARCADIS Design & Consultancy for natural and built assets

FIGURE
2



LEGEND:

- EMB4 — BENTHIC SURVEY SAMPLE LOCATION
- HD-132 — BIOAVAILABILITY STUDY SAMPLING LOCATION
- T-2 — TARGOST AND/OR TARGOST CONFIRMATION BORING LOCATION
- MPD-2 — 2007 – 2009 OU2 SEDIMENT MONITORING PROGRAM LOCATION
- SD-21 — 1995/1996 SEDIMENT CORE AND/OR SAMPLE LOCATION
- SS-1 — 1998 C & A SEDIMENT SAMPLING LOCATION
- XSD-1 — 1999 TAMS SEDIMENT SAMPLING LOCATION
- SD-55 — 2001 SEDIMENT SAMPLE LOCATION
- SD-05 — 2002 SEDIMENT SAMPLE LOCATION
- SD-91 — 2007 SUPPLEMENTAL SEDIMENT CORE AND/OR SAMPLE LOCATION
- EB-3 — 2013 IN-WATER ENVIRONMENTAL BORING
- CPT-4 — 2013 IN-WATER GEOTECHNICAL SOUNDING
- SS-1 — 2013 IN-WATER GEOTECHNICAL BORING
- APPROXIMATE LIMITS OF OPERABLE UNIT 1
- APPROXIMATE LIMITS OF OPERABLE UNIT 2
- APPROXIMATE TAX PARCEL LINE
- CHAIN-LINK FENCE
- RAIL LINES
- BATHYMETRIC CONTOUR (2-FOOT INTERVAL)
- APPROXIMATE FIBER OPTIC CABLE EASEMENT
- APPROXIMATE FIBER OPTIC CABLE LOCATION
- APPROXIMATE VERIZON COPPER CABLE LOCATION
- APPROXIMATE BOUNDARY OF THE SHIPPING CHANNEL
- EMBAYMENT 1 REMEDIATED AREA
- EXISTING SHEETPILE (SEE NOTE #7)

NOTES:

1. BASE MAP FROM TOPOGRAPHIC SURVEY BY BOSK ASSOCIATES, DRAWING FILE HUDSONDL.DWG, DATED 3/24/95. 2. THE RIVER SHORELINE WAS SURVEYED BY ARCADIS USING SURVEY-GRADE GPS EQUIPMENT IN DECEMBER 1995, AUGUST 1996, MARCH 1998, SPRING 2002, AND OCTOBER 2009.
2. OU2 IS IDENTIFIED BY NYSDEC AS A PORTION OF THE HUDSON RIVER ADJACENT TO THE SITE INCLUDING SEDIMENTS IN EMBAYMENTS #2, #3, AND #4.
3. PROPERTY BOUNDARIES AND ADDITIONAL SHORELINE INFORMATION WERE OBTAINED FROM CITY OF HUDSON TAX MAP, 1009.11, DATED SEPTEMBER 2016. THE HUDSON RIVER, INCLUDING THE BED OF THE HUDSON RIVER, IS OWNED BY THE STATE OF NEW YORK.
4. APPROXIMATE LOCATION OF BURIED FIBER OPTIC CABLES SCANNED FROM SHEET 2 OF 2 "PLAN & PROFILE HUDSON RIVER CROSSING BETWEEN HUDSON AND ATHENS, COLUMBIA AND GREEN COUNTIES, NEW YORK" BARRETT, BONACCI, HYMAN AND VANWEELE, P.C., 175 A COMMERCE DRIVE, HAUPPAUGE, NEW YORK, OCTOBER 13, 1993. RECEIVED FROM DAVID FINGER, CHIEF ENGINEER, MID-HUDSON CABLE, CATSKILL, NEW YORK.
5. APPROXIMATE LOCATION OF VERIZON UNBURIED COPPER CABLE POINTED OUT BY GERALD DALY, CONTRACT INSPECTOR, VERIZON SOUTH CAIRO, NEW YORK ON APRIL 17, 2002.
6. BATHYMETRIC SURVEY AND DEBRIS SURVEY CONDUCTED BY AQUA SURVEY, INC. ON APRIL 23–29 2015. GRID SYSTEM FOR SURVEY IS IN U.S. SURVEY FEET RELATIVE TO THE NEW YORK STATE PLANE COORDINATE SYSTEM, EAST ZONE (3101), NAD83. ALL ELEVATIONS ARE IN FEET AND ARE REFERENCED TO NAVD88.
7. AS DESCRIBED IN THE FINAL ENGINEERING REPORT – REMEDIAL ACTION IMPLEMENTATION OF OPERABLE UNIT 1, A PERMANENT SHEETPILE WALL WAS INSTALLED AROUND THE SEDIMENT REMOVAL AREA AND ALONG THE WESTERN ALIGNMENT OF EMBAYMENT #1. THIS STEEL SHEET PILE WALL WAS LEFT IN PLACE TO PROVIDE ADDITIONAL PROTECTION AGAINST THE POTENTIAL LATERAL SUBSURFACE MIGRATION OF IMPACTED MATERIAL FROM SURROUNDING PROPERTIES INTO EMBAYMENT #1. THE SHEETPILE WALL AT THE MOUTH OF EMBAYMENT #1 WAS CUT OFF AT THE MUDLINE FOLLOWING COMPLETION OF THE OU1 REMEDIATION.
8. SEDIMENT SAMPLE/CORE LOCATIONS AND PORTIONS OF THE RIVER SHORELINE WERE SURVEYED BY ARCADIS USING SURVEY-GRADE GPS EQUIPMENT IN DECEMBER 1995, AUGUST 1996, MARCH 1998, SPRING 2002, AND OCTOBER 2009.
9. AN "R" WAS ADDED TO SAMPLE ID "SD-87R" TO DISTINGUISH THE 2007 SUPPLEMENTAL SEDIMENT SAMPLING LOCATION FROM THE 2002 SAMPLE LOCATION, SD-87 LOCATED IN EMBAYMENT #4.

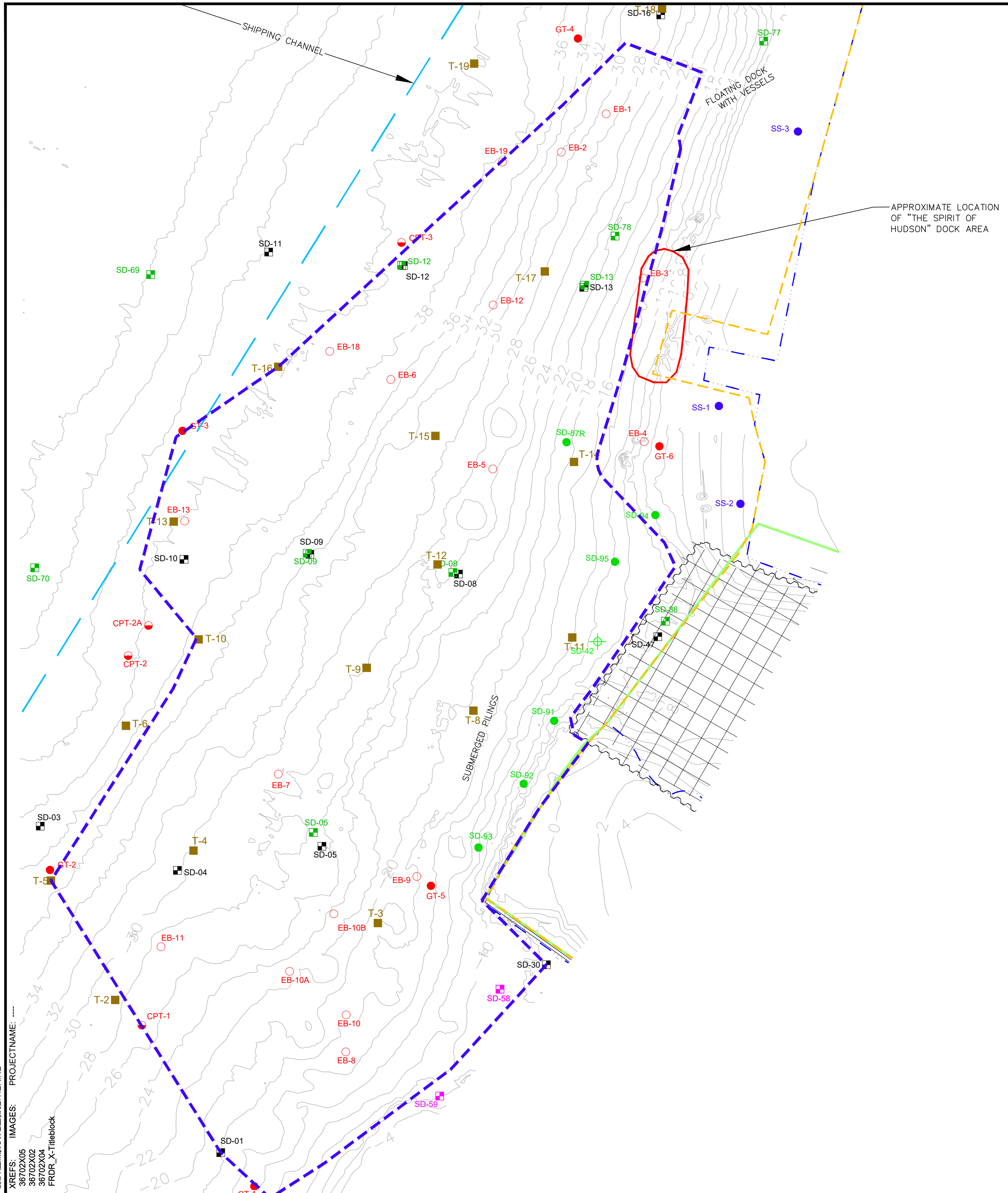
NATIONAL GRID
HUDSON (WATER STREET) SITE, HUDSON, NEW YORK
FINAL REMEDIAL DESIGN REPORT

SEDIMENT/GEOTECHNICAL SAMPLE LOCATIONS

ARCADIS Design & Consultancy for natural and built assets

FIGURE
3

XREFS: 36702X05 36702X02 36702X04 FRDR_X-Titleblock
IMAGES:



LEGEND:

- GEOTECHNICAL BORING (PRIOR TO 2013)
- 2013 IN-WATER ENVIRONMENTAL BORING
- 2013 IN-WATER GEOTECHNICAL SOUNDING
- 2013 IN-WATER GEOTECHNICAL BORING
- TARGOST AND/OR TARGOST CONFIRMATION BORING LOCATION
- 1995/1996 SEDIMENT CORE AND/OR SAMPLE LOCATION
- 1998 C & A SEDIMENT SAMPLING LOCATION
- 2001 SEDIMENT SAMPLE LOCATION
- 2002 SEDIMENT SAMPLE LOCATION
- 2007 SUPPLEMENTAL SEDIMENT CORE AND/OR SAMPLE LOCATION
- BOUNDARY OF OPERABLE UNIT 1
- APPROXIMATE EXTENT OF OPERABLE UNIT 2
- BATHYMETRIC CONTOUR (2-FOOT INTERVAL)
- APPROXIMATE BOUNDARY OF THE SHIPPING CHANNEL
- EMBAYMENT #1 REMEDIATED AREA
- EXISTING SHEETPILE (SEE NOTE #5)
- AREA FOR REMEDIAL CONSIDERATION

NOTES:

1. BASE MAP FROM TOPOGRAPHIC SURVEY BY BOSK ASSOCIATES, DRAWING FILE HUDSONDL.DWG, DATED 3/24/95. 2. THE RIVER SHORELINE WAS SURVEYED BY ARCADIS USING SURVEY-GRADE GPS EQUIPMENT IN DECEMBER 1995, AUGUST 1996, MARCH 1998, SPRING 2002, AND OCTOBER 2009.
2. OU2 IS IDENTIFIED BY NYSDEC AS A PORTION OF THE HUDSON RIVER ADJACENT TO THE SITE INCLUDING SEDIMENTS IN EMBAYMENTS #2, #3, AND #4.
3. PROPERTY BOUNDARIES AND ADDITIONAL SHORELINE INFORMATION WERE OBTAINED FROM CITY OF HUDSON TAX MAP, 1009.11, DATED SEPTEMBER 2016. THE HUDSON RIVER, INCLUDING THE BED OF THE HUDSON RIVER, IS OWNED BY THE STATE OF NEW YORK.
4. BATHYMETRIC SURVEY AND DEBRIS SURVEY CONDUCTED BY AQUA SURVEY, INC. ON APRIL 23–29 2015. GRID SYSTEM FOR SURVEY IS IN U.S. SURVEY FEET RELATIVE TO THE NEW YORK STATE PLANE COORDINATE SYSTEM, EAST ZONE (3101), NAD83. ALL ELEVATIONS ARE IN FEET AND ARE REFERENCED TO NAVD88.
5. AS DESCRIBED IN THE FINAL ENGINEERING REPORT – REMEDIAL ACTION IMPLEMENTATION OF OPERABLE UNIT 1, A PERMANENT SHEETPILE WALL WAS INSTALLED AROUND THE SEDIMENT REMOVAL AREA AND ALONG THE WESTERN ALIGNMENT OF EMBAYMENT #1. THIS STEEL SHEET PILE WALL WAS LEFT IN PLACE TO PROVIDE ADDITIONAL PROTECTION AGAINST THE POTENTIAL LATERAL SUBSURFACE MIGRATION OF IMPACTED MATERIAL FROM SURROUNDING PROPERTIES INTO EMBAYMENT #1. THE SHEETPILE WALL AT THE MOUTH OF EMBAYMENT #1 WAS CUT OFF AT THE MUDLINE FOLLOWING COMPLETION OF THE OU1 REMEDIATION.

0 20' 40'
GRAPHIC SCALE

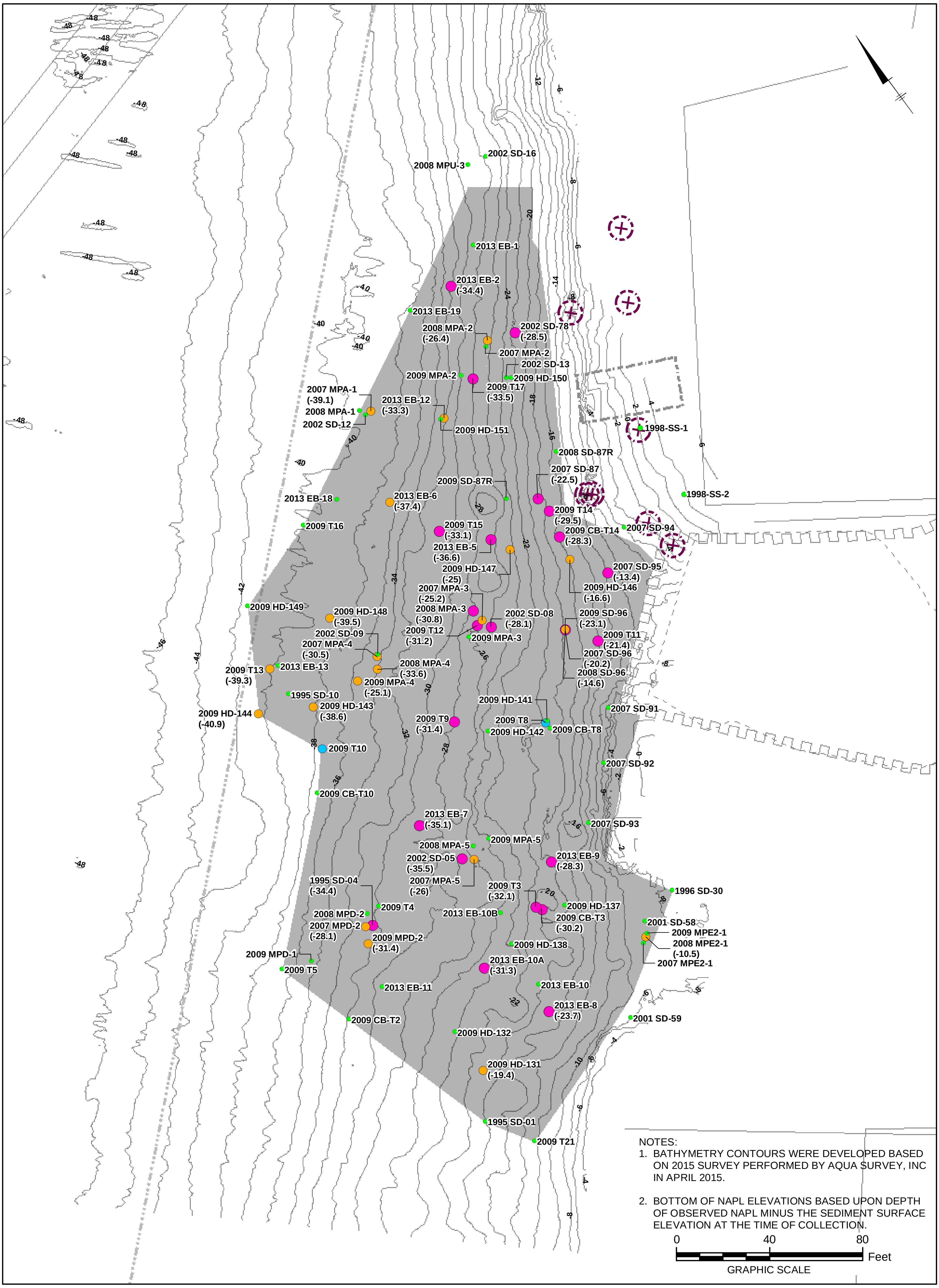
NATIONAL GRID
HUDSON (WATER STREET) SITE, HUDSON, NEW YORK
FINAL REMEDIAL DESIGN REPORT

AREA FOR REMEDIAL CONSIDERATION

ARCADIS Design & Consultancy for natural and built assets

FIGURE
4

CITY:(CLEVELAND) DIV/GROUP:(ENV/GIS) DB:L.GREENE Last Saved By: jrapp
PROJECT: NATIONAL GRID, WATER STREET
Z:\GISProjects_ENV\NationalGrid\HudsonWaterStreet\RemedialDesignReport\mxd\TargetDepthPrismElevations_v3.mxd 3/27/2020 8:29:58 AM



NOTES:
1. BATHYMETRY CONTOURS WERE DEVELOPED BASED ON 2015 SURVEY PERFORMED BY AQUA SURVEY, INC IN APRIL 2015.
2. BOTTOM OF NAPL ELEVATIONS BASED UPON DEPTH OF OBSERVED NAPL MINUS THE SEDIMENT SURFACE ELEVATION AT THE TIME OF COLLECTION.

LEGEND
- NAPL ADDRESSED BY 2 FOOT REMOVAL
- NAPL REMAINING BELOW 2FT
- MAY NOT REPRESENT NAPL
- NO OBSERVED NAPL
- BATHYMETRY CONTOUR
- TARGET REMEDIAL AREA

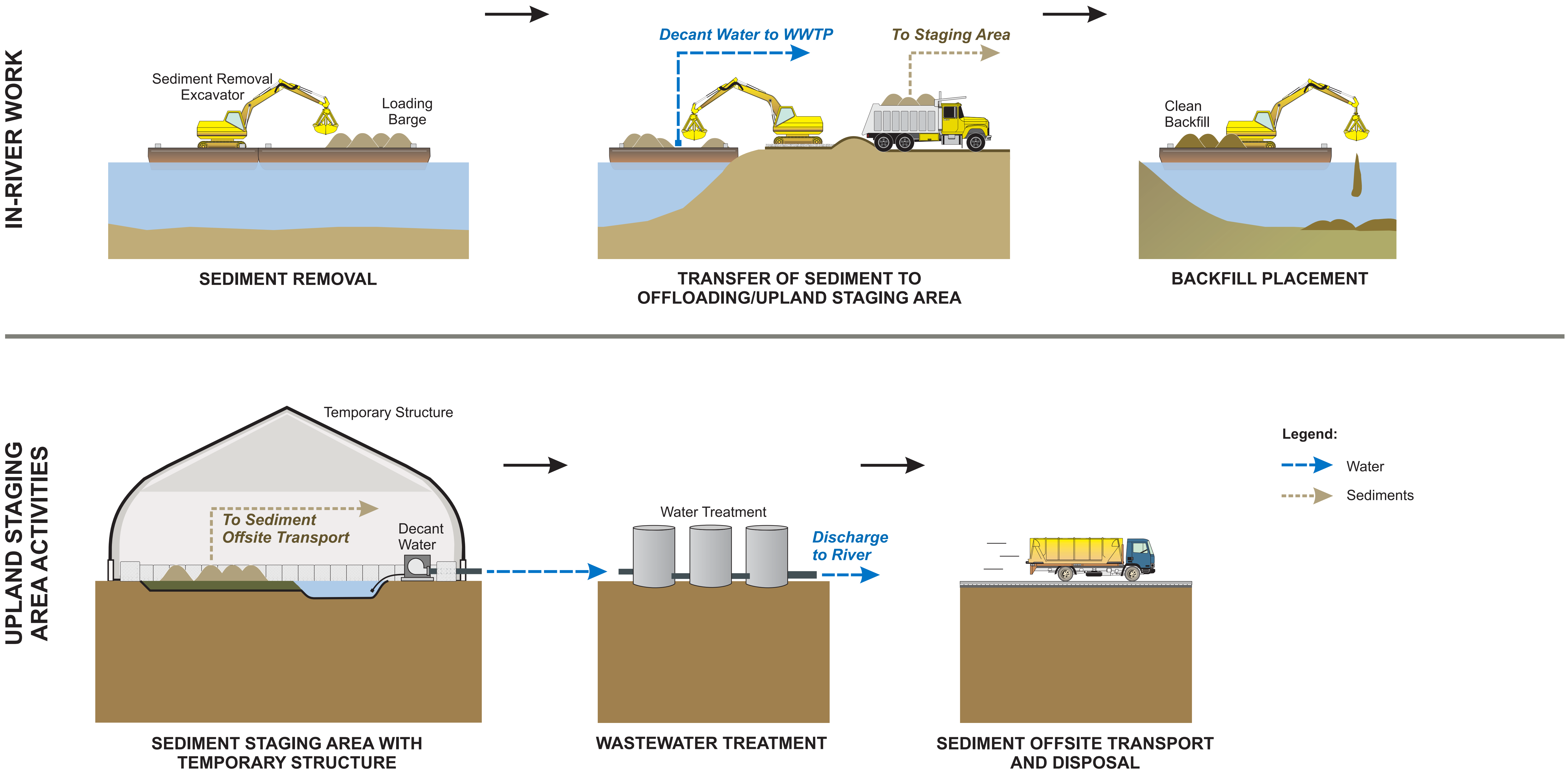
2007 SD-95 (-13.4) - LOCATION ID (ELEVATION TO BOTTOM OF NAPL)

NATIONAL GRID
HUDSON (WATER STREET) SITE, HUDSON, NEW YORK
FINAL REMEDIAL DESIGN REPORT

SEDIMENT CORE
NAPL ELEVATION SUMMARY

ARCADIS Design & Consultancy for natural and built assets

FIGURE
5



NOTE:
Other methods for removal, dewatering, and water treatment may be used pending receipt of Contractor's Operations Plan.

NATIONAL GRID
HUDSON (WATER STREET) SITE, HUDSON, NEW YORK
FINAL REMEDIAL DESIGN REPORT

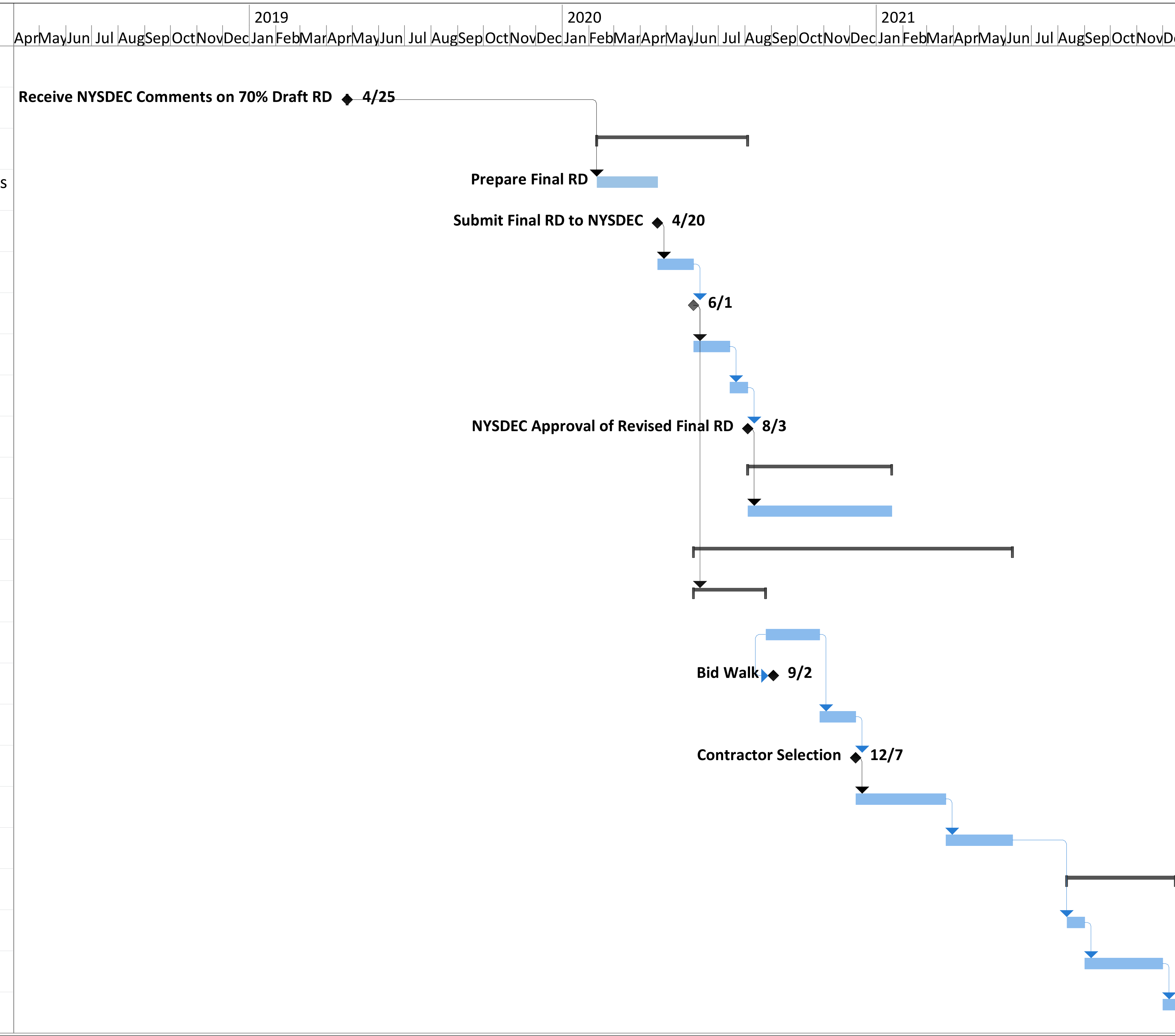
CONCEPTUAL PROCESS FLOW DIAGRAM

ARCADIS Design & Consultancy for natural and built assets

FIGURE
6

FIGURE 7
PRELIMINARY PROJECT SCHEDULE
NATIONAL GRID
HUDSON (WATER STREET) SITE, HUDSON, NEW YORK
FINAL REMEDIAL DESIGN REPORT

ID	Task Name	Duration	Start	Finish	Predecessors
1	**70% Draft Remedial Design (RD)**	**0 days**	**Thu 4/25/19**	**Thu 4/25/19**	
2	Receive NYSDEC Comments on 70% Draft RD	0 days	Thu 4/25/19	Thu 4/25/19	
3	**Final Remedial Design**	**126 days**	**Mon 2/10/20**	**Mon 8/3/20**	
4	Prepare Final RD	51 days	Mon 2/10/20	Mon 4/20/20	2FS+207 days
10	Submit Final RD to NYSDEC	0 days	Mon 4/20/20	Mon 4/20/20	9
11	NYSDEC Review of Final RD	30 days	Tue 4/21/20	Mon 6/1/20	10
12	Receive NYSDEC Comments on Final RD	0 days	Mon 6/1/20	Mon 6/1/20	11
13	Revise Final RD	30 days	Tue 6/2/20	Mon 7/13/20	12
14	NYSDEC Review of Revised Final RD	15 days	Tue 7/14/20	Mon 8/3/20	13
15	NYSDEC Approval of Revised Final RD	0 days	Mon 8/3/20	Mon 8/3/20	14
16	**Permitting**	**120 days**	**Tue 8/4/20**	**Mon 1/18/21**	
17	Permitting	120 days	Tue 8/4/20	Mon 1/18/21	15
18	**Bidding**	**266 days**	**Tue 6/2/20**	**Tue 6/8/21**	
19	Prepare Bid Documents	60 days	Tue 6/2/20	Mon 8/24/20	12
23	Bid Period	45 days	Tue 8/25/20	Mon 10/26/2(	22
24	Bid Walk	0 days	Wed 9/2/20	Wed 9/2/20	23SS+7 days
25	Review of Bids	30 days	Tue 10/27/20	Mon 12/7/20	23
26	Contractor Selection	0 days	Mon 12/7/20	Mon 12/7/20	25
27	Procurement/Contracting	75 days	Tue 12/8/20	Mon 3/22/21	26
28	Pre-Mobilization Contractor Submittals	56 days	Tue 3/23/21	Tue 6/8/21	27
29	**Commence Construction**	**91 days**	**Wed 8/11/21**	**Wed 12/15/2:**	
30	Mobilization and Site Preparation	15 days	Wed 8/11/21	Tue 8/31/21	28
31	In-Water Construction	65 days	Wed 9/1/21	Tue 11/30/21	30
32	Upland Restoration and Demobilization	11 days	Wed 12/1/21	Wed 12/15/21	31



Project: Fig 7 Schedule_revised Date: 4/20/20	Task		Split		Milestone		Summary		Manual Progress	

NOTE: Durations for document review are estimated. Other line items that are dependent on document review may need to be adjusted pending achievement of proposed review durations. Construction schedule to be determined by selected Contractor.

ATTACHMENTS

ATTACHMENT 1

2017 Dewatering Treatability Study Memorandum

DRAFT MEMO

To:

Steven DiLella, National Grid

Brian Stearns, P.E., National Grid

Copies:

Mark Gravelding, P.E., Arcadis

Eric Dievendorf, P.E., Arcadis

Heather VanDewalker, P.E., Arcadis

Arcadis of New York, Inc.
One Lincoln Center
110 West Fayette Street
Suite 300
Syracuse
New York 13202
Tel 315 446 9120
Fax 315 449 0017

From:

Arcadis Treatability Laboratory

Date:

December 21, 2017

Arcadis Project No.:

B0036702.0002

Subject:

Hudson Water Street Dewatering Treatability Study Memorandum

Introduction and Background

This sediment dewatering memorandum describes the methods and results of the treatability study conducted in 2017 to evaluate the optimal stabilization amendment(s) and mix ratio that will produce the required moisture content/free liquid and strength to support handling, transport, and offsite disposal of dredged spoils during implementation of the sediment removal remedial action (RA) at Operable Unit 2 (OU-2) at the former National Grid Hudson Water Street manufactured gas plant (MGP) site (the Site) in Hudson, New York. These results will be used to refine the design of RA implementation methods.

The sediment samples that were used in the treatability study were collected as part of pre-design investigation (PDI) activities in 2013. The samples were collected from representative locations within the Area for Remedial Consideration (ARC) and composited into four buckets for shipment to the Arcadis Treatability Laboratory in Durham, North Carolina. These samples remained sealed in a controlled environment from the time of receipt until the treatability study commenced. The Arcadis Treatability Laboratory was responsible for preparing samples, performing certain testing directly, and coordinating the remaining testing with Geotechnics, Inc. (Geotechnics), a subcontracted geotechnical laboratory in Raleigh, North Carolina.

Performance Objectives

Excavated materials will need to meet two performance standards for disposal:

- Materials being transported offsite must be sufficiently dewatered to meet the requirement of no free liquid using paint filter testing (USEPA Method 9095B) in conformance with 40 CFR §264.314(b). In addition, the stabilization process should minimize the amount of free water released from the stabilized material as a result of transportation.
- Materials disposed of at an offsite landfill facility may be required to meet minimum strength standards to be suitable for supporting additional material and the final cover system with limited consolidation. This requirement varies by facility, and may not always be required, but is typically a minimum compaction of 85% of the maximum dry unit weight.

Amendments Tested

Dewatering amendments are considered amendments that are capable of physically or chemically binding water to result in improved sediment handling characteristics (e.g., passing paint filter testing). Solidification amendments are considered amendments that result in the development of strength formation. The treatability study was designed to select an amendment that will serve both functions.

The following amendments were tested in this treatability study:

- Portland cement (PC) – La Farge, New England
- Cement kiln dust (CKD) – La Farge, Michigan
- Calciment - Mintek Resources, Inc.

Phased Testing Procedures and Results

To allow for adaptive decision making regarding successful mixing strategies, the treatability study was conducted using a multi-step, phased approach in which the results from each step were evaluated to guide further bench scale testing.

Step 1: Sample Preparation and Baseline Analyses

Baseline Homogenization and Geotechnical Characterization

Approximately four to five gallons of sediment from each of four boring locations were shipped to the Arcadis Treatability Laboratory in sealed, screw-top plastic buckets. The samples were stored at ambient room temperature inside the original containers until further processing. The sediment samples then were composited individually within the respective buckets using an electric drill and steel mixing auger. One-gallon subsamples of each homogenized sediment sample were collected in plastic buckets and submitted to Geotechnics, Inc. in Raleigh, NC for baseline grain size and Atterberg limits analysis by ASTM D422 and ASTM D4318, respectively. The results of the baseline geotechnical characterization are presented in Table 1. It should be noted that the USCS Classification listed for Composites 3 and 4 is Silty Clay. This classification is a default setting for auto-generated soil classifications with high silt/clay content based on sieve analysis results. By evaluating the Atterberg limits and hydrometer data (USDA Classification), Arcadis recommends considering this material as Clayey Silt for geotechnical purposes.

Table 1. Baseline Geotechnical Characterization Results

Sample ID	Atterberg Limits (ASTM D4318)	USCS Classification and Particle Size (ASTM D422)				USDA Classification				
		Gravel	Sand	Silt/Clay	Class	Gravel	Sand	Silt	Clay	Class
Composite 1	Non-Plastic	15.01%	44.50%	40.48%	Silty Sand w/ Gravel	19.94%	46.01%	25.59%	8.46%	Sandy Loam
Composite 2	Non-Plastic	1.37%	33.59%	65.04%	Sandy Silt	3.12%	39.17%	51.03%	6.68%	Silt Loam
Composite 3	Non-Plastic	0.79%	12.87%	86.34%	Silty Clay*	1.51%	17.75%	59.78%	20.96%	Silt Loam
Composite 4	Non-Plastic	2.24%	26.69%	71.07%	Silty Clay* w/ Sand	4.45%	33.21%	52.22%	10.12%	Silt Loam

*Note: Silty Clay is a default lab designation. Based on the Atterberg limits and hydrometer data (USDA Classification), Arcadis recommends considering this material as Clayey Silt for geotechnical purposes.

Gravity Dewatering Analysis

Subsamples of each of the four composites then were processed for gravity dewatering and subsequent paint filter testing. A known mass of sediment was placed onto an 18 x 14 mesh screen fitted over a one-gallon plastic bucket. The samples then were covered using two-gallon plastic buckets (placed upside down over the gravity dewatering apparatus) and allowed to drain for 24 hours. After 24 hours of gravity dewatering, the mass of water drained from each sample was recorded, the moisture content of the sediment retained on the mesh screen was processed, and the retained sediment was tested for free liquids by EPA Method 9095B. Under this method, a sample is considered passing if free liquids are not present following the 5-minute test period, whereas a failing sample will drip or otherwise release free liquid during the 5-minute test period. The results of these tests are presented in Table 2. All four gravity dewatered sediment samples passed the paint filter test after 24 hours of gravity dewatering.

Table 2. Baseline Gravity Dewatering and Paint Filter Results

Sample ID	Wet sediment placed on screen (g)	Water dripped (g)	Gravimetric Moisture Content of Retained Sediment	Geotechnical Moisture Content of Retained Sediment	Paint Filter Testing (Pass/Fail)
Composite 1	878	5	22.10%	28.37%	Pass
Composite 2	739	18	19.63%	24.43%	Pass
Composite 3	987	1	21.87%	27.99%	Pass
Composite 4	861	7	20.70%	26.10%	Pass

Step 2. Initial Sediment Dewatering/Solidification

Composite 2 sediment was selected for Step 2 testing as a conservatively representative material. That is, the material in this sample exhibited a higher fines content than the average material at the site (more similar to Composite 1), but was not an extreme case (such as Composite 3). The material was moisture content-amended to target 10% standing water by total volume, which is anticipated to be representative of sediment conditions following mechanical dredging and provide a conservative scenario for further chemical dewatering tests. Tap water from the Treatability Laboratory was added to the Composite 2 bucket and mixed thoroughly into the sediment using an electric drill and steel mixing auger. Duplicate moisture samples were collected and processed on the moisture-amended sediment; an average geotechnical moisture content of 33.84% resulted following the water addition. A subsample of the moisture-amended Composite 2 sediment was tested for free liquids by paint filter, which failed within the 5-minute window.

Using subsamples of the moisture-amended Composite 2 sediment, the three dewatering amendments then were blended into the sediment at a 10% addition rate by sediment dry mass using an electric drill and stainless-steel propeller (Mixes C2-1, C2-2, and C2-3 in Table 3). These mixes were tested for free liquids after one-hour and 24-hour curing intervals, with all samples passing (no free liquids). Pocket penetrometer readings then were obtained on these mixes after 24hours of curing. The 10% PC mix exceeded the 4.5 tons per square foot (tsf) range of the penetrometer, while the 10% calciment and 10% CKD mixes did not develop any recordable strength.

A series of mixes at a 5% addition rate by sediment dry mass were then created using moisture-amended Composite 2 sediment (Mixes C2-4, C2-5, and C2-6 in Table 3). All three of these mixes failed the paint filter test for free liquids at the one-hour curing interval, and all three mixes passed at the 24-hour curing interval. Next, a series of 7.5% addition rate mixes were created and tested for free liquids (Mixes C2-7, C2-8, and C2-9 in Table 3). The PC and calciment mixes passed at the one-hour curing interval, while the CKD mix failed at this time. All three mixes passed at the 24-hour curing interval.

Step 3: Additional Sediment Dewatering/Solidification and Analysis of Test Results

Sediment remaining from Composites 1, 3, and 4 (21.8 kg, 19.0 kg, and 23.0 kg, by sediment wet mass, respectively) were homogenized together in a single 20-gallon plastic tub using an electric drill and steel mixing auger to support the next step of dewatering analyses. This composite was created to simulate field conditions where material from across the dredge area may be mixed during handling in the transport barge and at the staging area, as well as to provide sufficient material quantities to support subsequent geotechnical characterization of candidate mixes in Step 4. Note that insufficient Composite 2 material remained following Step 2 testing to allow homogenization at an equal rate to the other material sources for all Step 3 and Step 4 tests. Duplicate moisture samples of this sample, designated Composite 1,3,4, were processed and used to target a geotechnical moisture content identical to that of the previously tested Composite 2 sample, 33.84%. The average amended moisture content of Composite 1,3,4 was determined to be 34.95%. This sample was paint filter tested for free liquids and passed, so the sample was adjusted to a higher moisture content until it failed the paint filter test. At a geotechnical moisture content of 38.09%, the Composite 1,3,4 sample failed the paint filter test for free liquids and was utilized for further testing at this moisture content.

Based on the results of free liquids testing on Composite 2 in Step 2, CKD was eliminated from further consideration in Step 3. A series of test mixes was created using Composite 1,3,4 moisture-amended sediment with PC and calciment at addition rates of 10% and 7.5% by sediment dry weight (Mixes C134-1, C134-2, C134-3, and C134-4 in Table 3). Mixes were blended in plastic one-gallon buckets using an electric drill and stainless-steel mixing propeller. A portion of each mix was transferred into a two-inch by four-inch plastic cylindrical geotechnical mold to support pocket penetrometer testing. Pocket penetrometer analysis of each test mold was conducted at one day and three days of curing. The remainder of each mix was left in the original one-gallon plastic mixing bucket to cure. At curing times of one hour and 24 hours, each mix was tested for free liquids by paint filter test. All four mixes passed at both curing intervals. Moisture content was processed on each mix at the 24-hour curing interval. The results of pocket penetrometer, paint filter, and moisture content analysis of these mixes are presented in Table 4. The PC mixes developed early strength, and, by day three of curing, both mixes exceeded the range of the pocket penetrometer. The calciment mixes failed to achieve measurable strength by day three.

At 24 hours of cure time, the remaining sample from each mix was placed onto a sieve shaker in the original one-gallon buckets. These samples were subjected to one hour of shaking and agitation to simulate the effects of transport in a dump truck and any resulting release of free liquids. At the end of the one-hour shake test, the lids of each bucket were opened and the samples were visually assessed for the liberation of free-standing water. No visual evidence of free water released following the shake test was noted for any of the four mixes.

Table 3. Test Mix Design Recipes: Steps 2, 3, and 4

Mix Number	Sediment Type	Mix Description	Sediment Wet Wt	Sediment Moisture (gravimetric)	Sediment Dry Wt	PC Addition	PC	Calciment Addition	Calciment	CKD Addition	CKD
			g	%	g	%	g	%	g	%	g
C2-1	Composite 2 (MC Amended)	10% Portland Cement	500.0	25.29%	373.6	10%	37.4	-	-	-	-
C2-2		10% Calciment	500.0	25.29%	373.6	-	-	10%	37.4	-	-
C2-3		10% CKD	500.0	25.29%	373.6	-	-	-	-	10%	37.4
C2-4		5% Portland Cement	500.0	25.29%	373.6	5%	18.7	-	-	-	-
C2-5		5% Calciment	500.0	25.29%	373.6	-	-	5%	18.7	-	-
C2-6		5% CKD	500.0	25.29%	373.6	-	-	-	-	5%	18.7
C2-7		7.5% Portland Cement	500.0	25.29%	373.6	7.5%	28.0	-	-	-	-
C2-8		7.5% Calciment	500.0	25.29%	373.6	-	-	7.5%	28.0	-	-
C2-9		7.5% CKD	500.0	25.29%	373.6	-	-	-	-	7.5%	28.0
C134-1	Composite 1,3,4 (MC Amended)	10% Portland Cement	1500.0	27.58%	1086.2	10%	108.6	-	-	-	-
C134-2		7.5% Portland Cement	1500.0	27.58%	1086.2	7.5%	81.5	-	-	-	-
C134-3		10% Calciment	1500.0	27.58%	1086.2	-	-	10%	108.6	-	-
C134-4		7.5% Calciment	1500.0	27.58%	1086.2	-	-	7.5%	81.5	-	-
Final - 1		7.5% Portland Cement	27000	27.58%	19552	7.5%	1466	-	-	-	-
Final - 2		7.5% Calciment	26400	27.58%	19118	-	-	7.5%	1434	-	-

"-" denotes the mix did not receive a dose of the particular admixture

Table 4. Step 3 Pocket Penetrometer, Paint Filter, and Moisture Content Results

Mix Number	Sediment Type	Mix Description	Pocket Penetrometer Reading (tsf)		Paint Filter Testing (Pass/Fail)		24-Hour Moisture Content	
			Day 1	Day 3	1-Hour	24-Hours	Gravimetric MC	Geotechnical MC
C134-1	Composite 1,3,4 (MC Amended	10% Portland Cement	> 4.5	> 4.5	Pass	Pass	25.04%	33.40%
C134-2		7.5% Portland Cement	3.25	> 4.5	Pass	Pass	26.33%	35.74%
C134-3		10% Calciment	NR	NR	Pass	Pass	24.81%	33.00%
C134-4		7.5% Calciment	NR	NR	Pass	Pass	25.29%	33.86%

NR = No reading obtained, material too soft

Step 4. Geotechnical Testing

Following the evaluation of results from Steps 2 and 3 described above, 7.5% addition rates of PC and calciment were selected for further processing. To support the large sample volume requirements of standard proctor testing by ASTM D698 and unconsolidated-undrained triaxial compression testing (UU test) by ASTM D2850, five-gallon mixes of 7.5% PC and 7.5% calciment were created using Composite 1,3,4 sediment (Mixes Final-1 and Final-2 in Table 3). Mixes were thoroughly blended using an electric drill and steel mixing auger, then submitted to Geotechnics for compaction and compression testing. A confining pressure of 15 pounds per square inch (psi) was used during the unconsolidated-undrained triaxial compression test. The Geotechnics report containing results of ASTM D698 and ASTM D2850 analyses on the final mixes is included as Appendix A.

Results for the compaction testing indicate that the maximum dry density is 93.0 pcf for Final-1 and 111.1 pcf for Final-2. During placement of the material during remediation/construction, it may be necessary to test the compaction of the material for 90% or 95% maximum dry density to achieve the desired strength. Results for the one-point Final-1 and Final-2 UU tests indicate a shear strength of 26 psi. These results indicate that the anticipated shear strength for both the PC and calciment at 7.5% addition rate will be similar; however, the blended material shall be placed to the associated maximum dry density of the selected amendment during construction.

Conclusions

Through initial testing in Step 2 and additional testing in Step 3, this treatability testing program identified 7.5% addition rates, by sediment dry weight, of either PC or calciment as being able to reduce the free water content of site sediments such that the free liquid content of the sediment was reduced to pass paint filter test. No free water was liberated from these mixes during shake testing, which simulated transport via dump truck. Pocket penetrometer and geotechnical testing indicated that the 7.5% PC mix will achieve strength sufficient to support itself within the landfill and provide strength for light future use of the landfill area, while the 7.5% calciment mix did not achieve measurable strength.

If bearing strength is required by the disposal facility as a performance metric for amended sediments, 7.5% PC is recommended for use. If stabilization for offsite trucking is the only performance metric, 7.5% calciment is sufficient and likely will be a lower cost option than PC.

APPENDIX A

Geotechnical Laboratory Data

July 21 2017

Project No. R-2017-679-002

Mr. David Liles
David.Liles@arcadis-us.com
Arcadis U.S., Inc.
4915 Prospectus Drive, Suite F
Durham, NC 27713

Cc: Andrew.Baumeister@arcadis-us.com

Transmittal
Laboratory Test Results
National Grid - Hudson

Please find attached the laboratory test results for the above referenced project. The tests were outlined on the Project Verification Form that was transmitted to your firm prior to the testing. The testing was performed in general accordance with the methods listed on the enclosed data sheets. The test results are believed to be representative of the samples that were submitted for testing and are indicative only of the specimens which were evaluated. We have no direct knowledge of the origin of the samples and imply no position with regard to the nature of the test results, i.e. pass/fail and no claims as to the suitability of the material for its intended use.

The test data and all associated project information provided shall be held in strict confidence and disclosed to other parties only with authorization by our Client. The test data submitted herein is considered integral with this report and is not to be reproduced except in whole and only with the authorization of the Client and Geotechnics. The remaining sample materials for this project will be retained for a minimum of 90 days as directed by the Geotechnics' Quality Program.

We are pleased to provide these testing services. Should you have any questions or if we may be of further assistance, please contact our office.

Respectively submitted,
Geotechnics, Inc.

Michael P. Smith
Regional Manager

We understand that you have a choice in your laboratory services and we thank you for choosing Geotechnics.

DCN: Data Transmittal Letter Date: 1/28/05 Rev.: 1

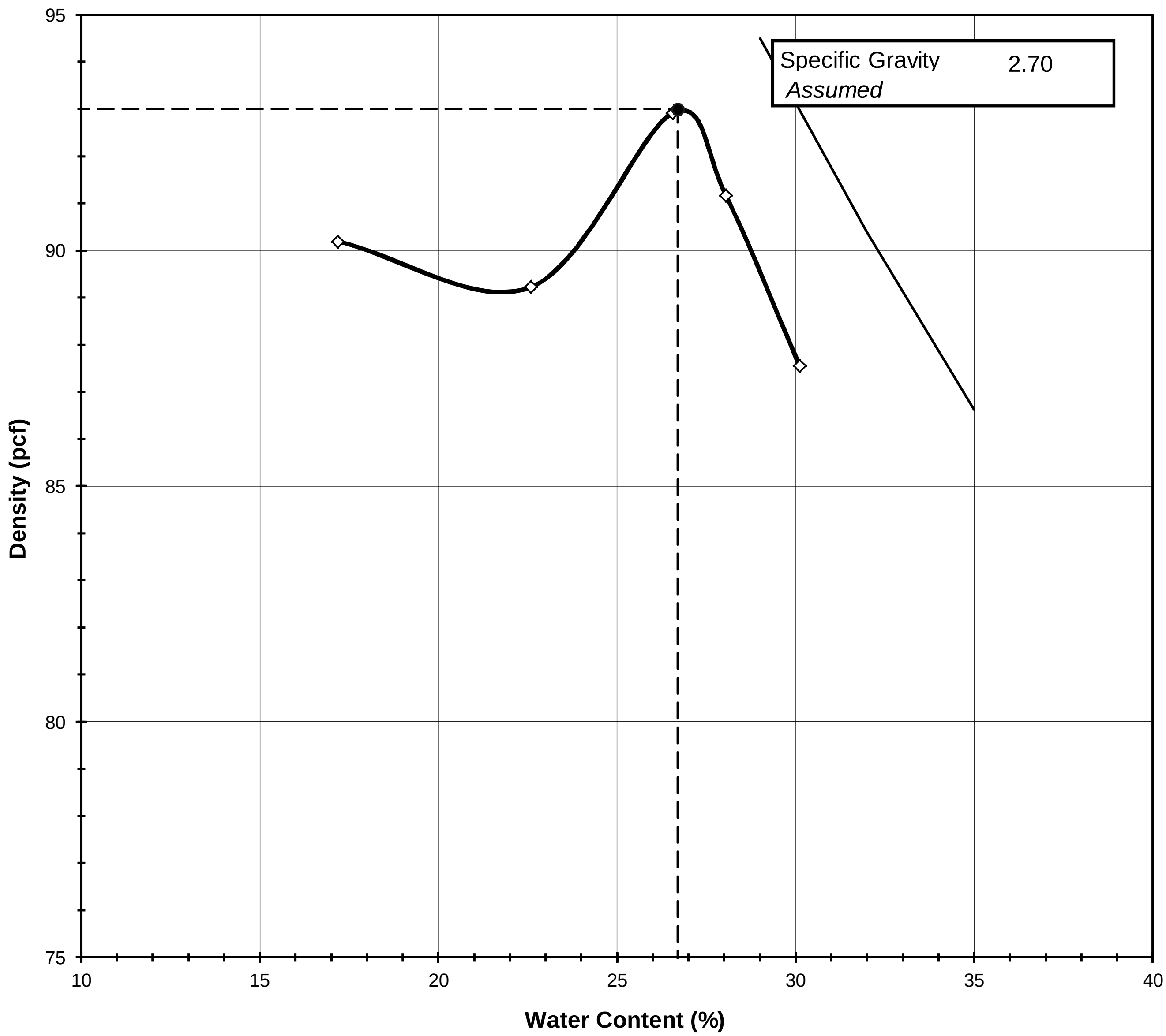
MOISTURE DENSITY RELATIONSHIP

ASTM D 698-12e2

Client:	Arcadis U.S., Inc.	Boring No.:	NA
Client Reference:	National Grid - Hudson	Depth (ft):	NA
Project No.:	R-2017-679-002	Sample No.:	Final-1
Lab ID:	R-2017-679-002-001	Test Method	**STANDARD**

Visual Description: DARK GRAY SILT

Optimum Water Content	**26.7**
Maximum Dry Density	**93.0**



Tested By	*NPL*	*Date*	*7/14/17*	*Checked By*	*GEM*	*Date*	*7/17/17*

2200 Westinghouse Blvd., Suite 103 • Raleigh, NC 27604 • Phone (919) 876-0405 • Fax (919) 876-0460 • www.geotechnics.net

MOISTURE - DENSITY RELATIONSHIP

ASTM D 698-12e2

Client:	Arcadis U.S., Inc.	Boring No.:	NA
Client Reference:	National Grid - Hudson	Depth (ft):	NA
Project No.:	R-2017-679-002	Sample No.:	Final-1
Lab ID:	R-2017-679-002-001		

Visual Description: DARK GRAY SILT

Total Weight of the Sample (g)	28850
As Received Water Content (%)	NA
Assumed Specific Gravity	2.70
Percent Retained on 3/4"	3
Percent Retained on 3/8"	1
Percent Retained on #4	NA
Oversize Material	Not included
Procedure Used	A

Test Type		**STANDARD**
Rammer Weight (lb)		5.5
Rammer Drop (in)		12
Rammer Type		MECHANICAL
Machine ID	R	174
Mold ID	R	173
Mold diameter		6"
Weight of the Mold (g)		5507
Volume of the Mold (cm^3)		2119

Mold / Specimen

Point No.	**1**	**2**	**3**	**4**	**5**
Wt. of Mold & Wet Sample (g)	9097	9222	9501	9472	9376
Wt.of Mold (g)	5507	5507	5507	5507	5507
Wt. of Wet Sample (g)	3590	3715	3994	3965	3869
Mold Volume (cm^3)	2119	2119	2119	2119	2119

Moisture Content / Density

Tare Number	317	866	314	307	312
Wt. of Tare & Wet Sample (g)	350.50	372.60	346.00	377.70	378.00
Wt. of Tare & Dry Sample (g)	311.40	319.90	291.10	319.00	310.00
Wt. of Tare (g)	84.00	86.60	84.40	109.70	84.20
Wt. of Water (g)	39.10	52.70	54.90	58.70	68.00
Wt. of Dry Sample (g)	227.40	233.30	206.70	209.30	225.80

Wet Density (g/cm^3)	1.69	1.75	1.88	1.87	1.83
Wet Density (pcf)	105.7	109.4	117.6	116.7	113.9
Moisture Content (%)	**17.2**	**22.6**	**26.6**	**28.0**	**30.1**
Dry Density (pcf)	**90.2**	**89.2**	**92.9**	**91.2**	**87.5**

Zero Air Voids

Moisture Content (%)	29.0	32.0	35.0
Dry Unit Weight (pcf)	94.5	90.4	86.6

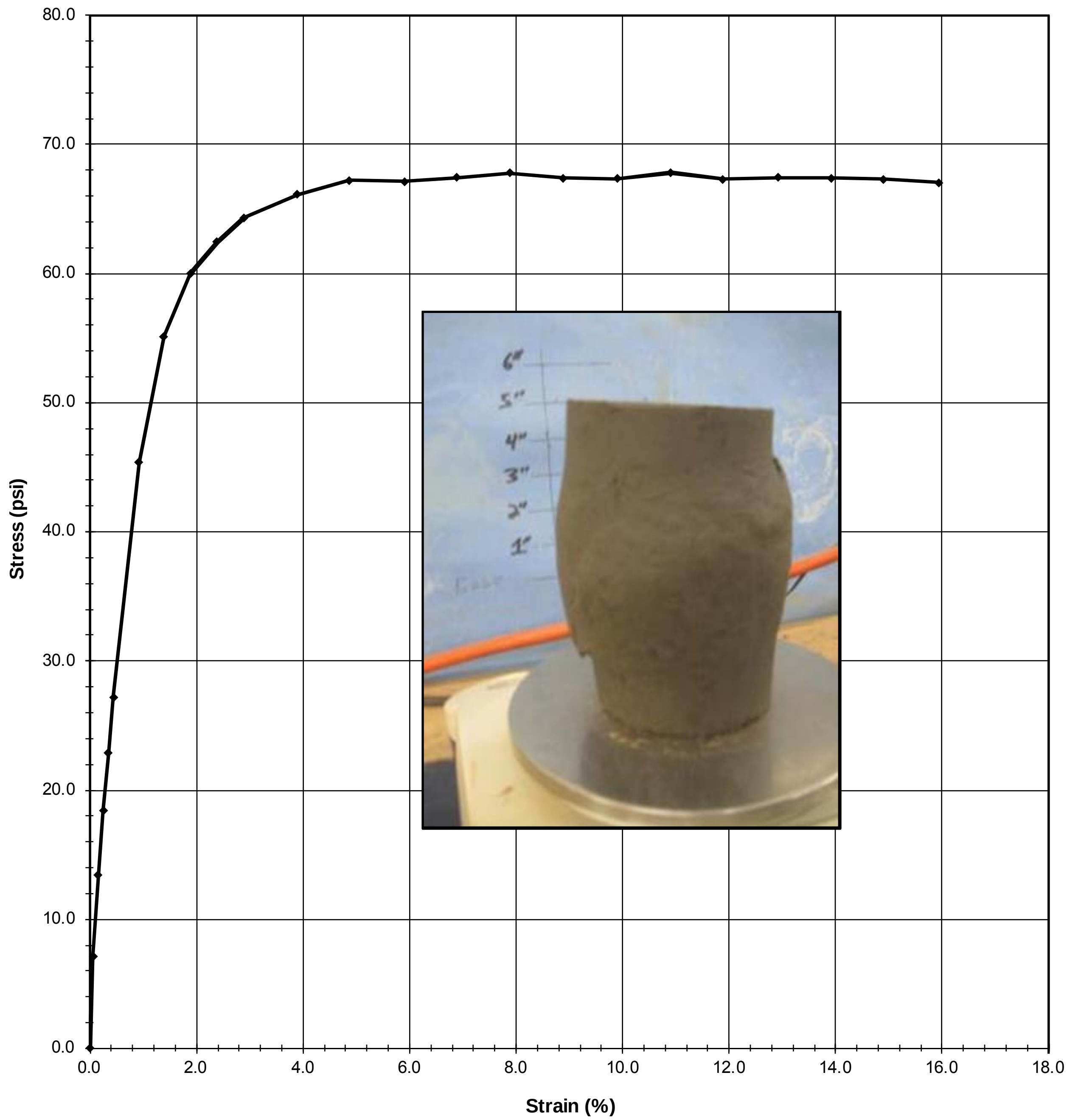
Tested By NPL *Date* 7/14/17 *Checked By* GEM *Date* 7/17/17

2200 Westinghouse Blvd., Suite 103 • Raleigh, NC 27604 • Phone (919) 876-0405 • Fax (919) 876-0460 • www.geotechnics.net

UNCONSOLIDATED UNDRAINED TRIAXIAL
ASTM D2850-15

Client	Arcadis U.S., Inc.	Boring No.	N/A
Client Reference	National Grid - Hudson	Depth (ft.)	N/A
Project No.	R-2017-679-002	Sample No.	Final-1
Lab ID	R-2017-679-002-001	Visual	DARK GRAY SOIL CEMENT MIX

CONFINING STRESS (psi) **15.0**



Tested By SFS Date 7/19/17 Approved By MPS Date 7/21/17

DCN: CT-S29 DATE: 3-20-06 REVISION: 2 *Z:\2017 PROJECTS\2017-679 ARCADIS - NATIONAL GRID - HUDSON\[2017-679-002-001 GEOTAC-UU.xls]Sheet1*

2200 Westinghouse Blvd., Suite 103 • Raleigh, NC 27604 • Phone (919) 876-0405 • Fax (919) 876-0460 • www.geotechnics.net

UNCONSOLIDATED UNDRAINED TRIAXIAL
ASTM D2850-15

Client	Arcadis U.S., Inc.	Boring No.	N/A
Client Reference	National Grid - Hudson	Depth (ft.)	N/A
Project No.	R-2017-679-002	Sample No.	Final-1
Lab ID	R-2017-679-002-001	Visual	DARK GRAY SOIL CEMENT MIX

INITIAL SAMPLE DIMENSIONS

Length 1 (in)	5.995	Top Dia. (in)	2.864
Length 2 (in)	5.995	Mid. Dia. (in)	2.864
Length 3 (in)	5.995	Bot. Dia. (in)	2.864
Avg.Length (in)	5.995	Area (in^2.)	6.442

WATER CONTENT (AFTER TEST)

Total Wt. of Sample	1138.02
Tare No.	SS-8
Wt. Tare + WS.(gms)	547.58
Wt. Tare + DS.(gms)	452.02
Wt. of Tare(gms)	99.70
% Moisture	27.1

UNIT WEIGHT

Remolded Specimen

Wt. Tube & WS.(gms.)	2701.19	Sample Volume(cc.)	632.9
Wt. Of Tube(gms.)	1551.44	Unit Wet Wt.(gms/cc)	1.82
Wt. Of WS.(gms.)	1149.75	Unit Wet Wt.(pcf.)	113.36
Diameter (in.)	2.86	Moisture Content, %	27.1
Length (in.)	5.98	Unit Dry Wt.(pcf.)	89.2
Length (cm.)	15.23		

Initial Dial Reading , mils 98

CONFINING STRESS (psi) **15.0** Dial Reading Before Shearing, mils 115

DEFORMATION (in)	*LOAD (lbs)*	*ELAPSED TIME (min.)*	*STRAIN (%)*	*STRESS (psi)*
0.000	3.8	0.0	0.00	0.00
0.003	49.6	0.1	0.06	7.11
0.009	90.4	0.2	0.15	13.42
0.015	122.7	0.3	0.25	18.41
0.021	151.5	0.4	0.35	22.85
0.026	179.9	0.5	0.44	27.21
0.055	298.7	1.0	0.91	45.35
0.083	363.9	1.5	1.38	55.12
0.112	397.6	2.0	1.88	59.98
0.142	416.0	2.5	2.38	62.46
0.173	430.5	3.0	2.90	64.32
0.232	447.0	4.0	3.89	66.12
0.291	458.9	5.0	4.87	67.20
0.353	463.5	6.0	5.91	67.14
0.412	470.3	7.0	6.89	67.43
0.471	477.7	8.0	7.88	67.77
0.532	480.3	9.0	8.89	67.39
0.592	485.3	10.0	9.90	67.34
0.652	494.0	11.0	10.90	67.79
0.711	496.0	12.0	11.89	67.32
0.773	502.6	13.0	12.93	67.42
0.831	508.0	14.0	13.91	67.38
0.891	513.4	15.0	14.90	67.32
0.953	517.5	16.0	15.94	67.03

Tested By SFS Date 7/19/17 Input Checked By GEM Date 7/21/17

DCN: CT-S29 DATE: 3-20-06 REVISION: 1 *Z:\2017 PROJECTS\2017-679 ARCADIS - NATIONAL GRID - HUDSON\[2017-679-002-001 GEOTAC-UU.xls]Sheet1*

2200 Westinghouse Blvd., Suite 103 • Raleigh, NC 27604 • Phone (919) 876-0405 • Fax (919) 876-0460 • www.geotechnics.net

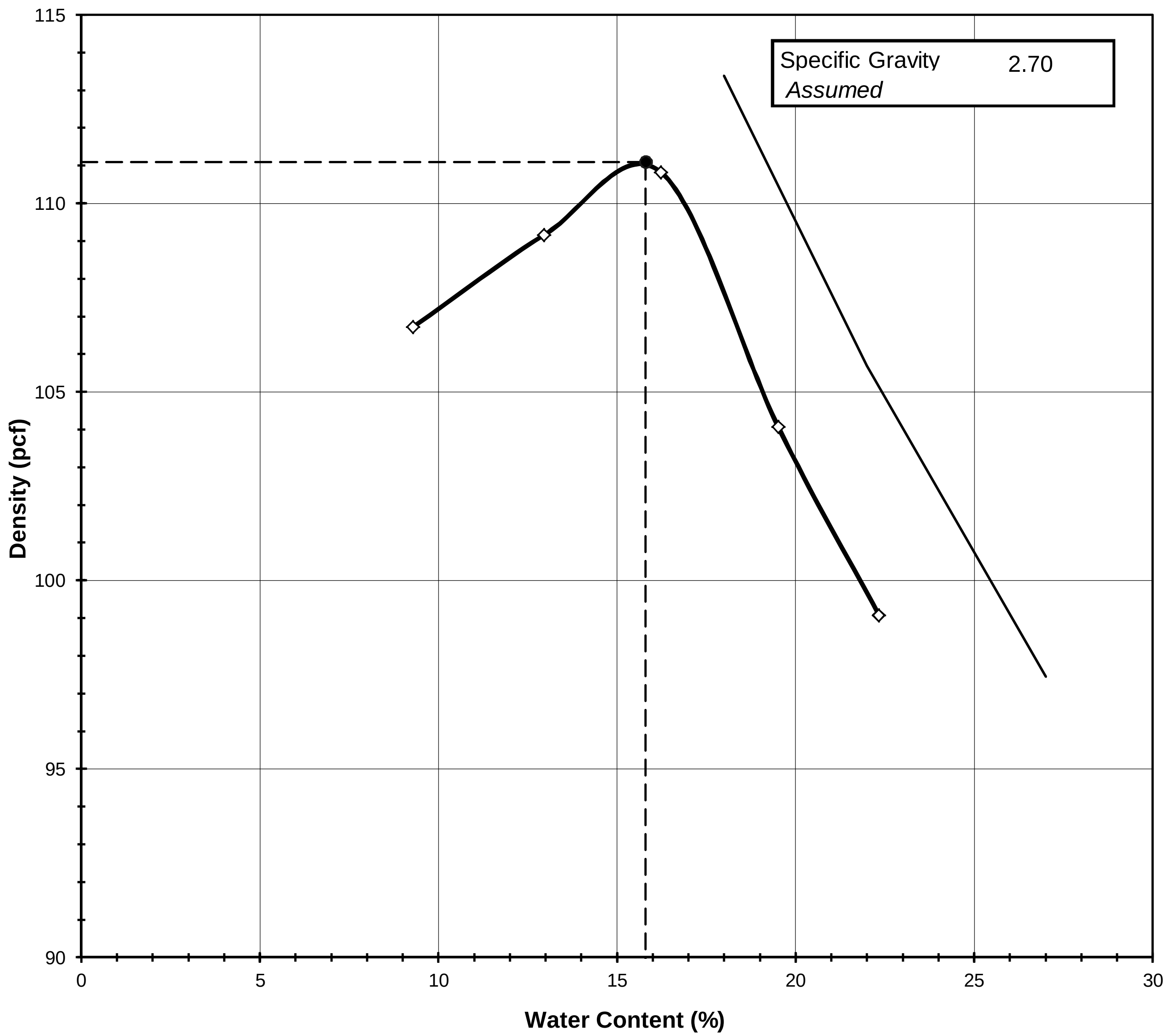
MOISTURE DENSITY RELATIONSHIP

ASTM D 698-12e2

Client:	Arcadis U.S., Inc.	Boring No.:	NA
Client Reference:	National Grid - Hudson	Depth (ft):	NA
Project No.:	R-2017-679-002	Sample No.:	Final-2
Lab ID:	R-2017-679-002-002	Test Method	**STANDARD**

Visual Description: DARK GRAY SILT

Optimum Water Content	**15.8**
Maximum Dry Density	**111.1**



Tested By	*NPL*	*Date*	*7/14/17*	*Checked By*	*GEM*	*Date*	*7/17/17*

2200 Westinghouse Blvd., Suite 103 • Raleigh, NC 27604 • Phone (919) 876-0405 • Fax (919) 876-0460 • www.geotechnics.net

MOISTURE - DENSITY RELATIONSHIP

ASTM D 698-12e2

Client:	Arcadis U.S., Inc.	Boring No.:	NA
Client Reference:	National Grid - Hudson	Depth (ft):	NA
Project No.:	R-2017-679-002	Sample No.:	Final-2
Lab ID:	R-2017-679-002-002		

Visual Description: DARK GRAY SILT

Total Weight of the Sample (g)	28200
As Received Water Content (%)	NA
Assumed Specific Gravity	2.70
Percent Retained on 3/4"	1
Percent Retained on 3/8"	1
Percent Retained on #4	NA
Oversize Material	Not included
Procedure Used	B

Test Type		**STANDARD**
Rammer Weight (lb)		5.5
Rammer Drop (in)		12
Rammer Type		MECHANICAL
Machine ID	R	174
Mold ID	R	552
Mold diameter		4"
Weight of the Mold (g)		4248
Volume of the Mold (cm^3)		943

Mold / Specimen

Point No.	**1**	**2**	**3**	**4**	**5**
Wt. of Mold & Wet Sample (g)	6011	6112	6195	6128	6080
Wt.of Mold (g)	4248	4248	4248	4248	4248
Wt. of Wet Sample (g)	1763	1864	1947	1880	1832
Mold Volume (cm^3)	943	943	943	943	943

Moisture Content / Density

Tare Number	837	TB-11	TB-05	TB-01	834
Wt. of Tare & Wet Sample (g)	593.20	383.10	381.20	366.00	515.19
Wt. of Tare & Dry Sample (g)	565.00	354.60	346.80	328.30	468.70
Wt. of Tare (g)	261.50	134.80	134.90	135.10	260.50
Wt. of Water (g)	28.20	28.50	34.40	37.70	46.49
Wt. of Dry Sample (g)	303.50	219.80	211.90	193.20	208.20

Wet Density (g/cm^3)	1.87	1.98	2.06	1.99	1.94
Wet Density (pcf)	116.6	123.3	128.8	124.4	121.2
Moisture Content (%)	**9.3**	**13.0**	**16.2**	**19.5**	**22.3**
Dry Density (pcf)	**106.7**	**109.2**	**110.8**	**104.1**	**99.1**

Zero Air Voids

Moisture Content (%)	18.0	22.0	27.0
Dry Unit Weight (pcf)	113.4	105.7	97.4

Tested By NPL *Date* 7/14/17 *Checked By* GEM *Date* 7/17/17

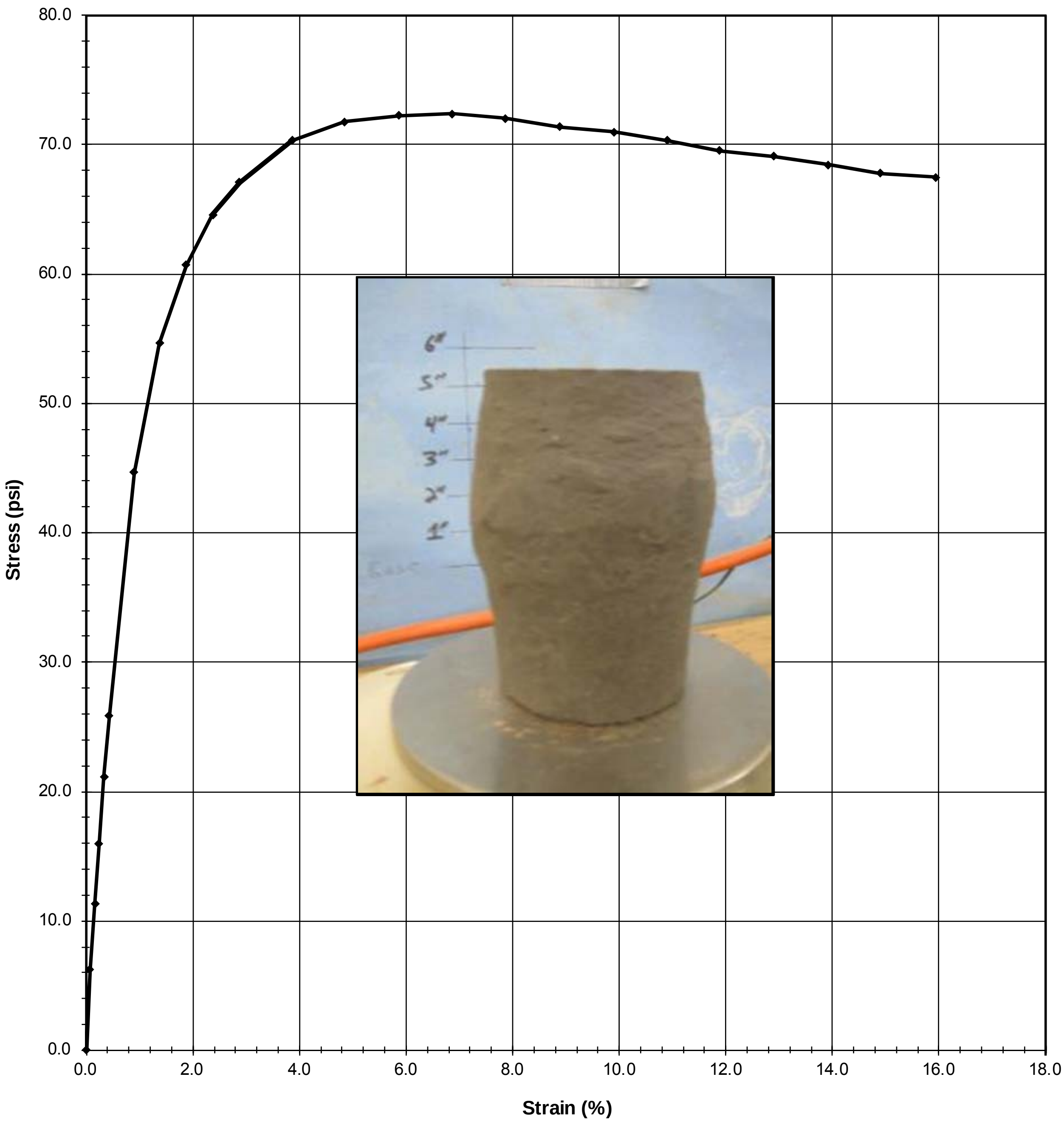
2200 Westinghouse Blvd., Suite 103 • Raleigh, NC 27604 • Phone (919) 876-0405 • Fax (919) 876-0460 • www.geotechnics.net

geotechnics
geotechnical & geosynthetic testing

UNCONSOLIDATED UNDRAINED TRIAXIAL
ASTM D2850-15

Client	Arcadis U.S., Inc.	Boring No.	N/A
Client Reference	National Grid - Hudson	Depth (ft.)	N/A
Project No.	R-2017-679-002	Sample No.	Final-2
Lab ID	R-2017-679-002-002	Visual	DARK GRAY SOIL CEMENT MIX

CONFINING STRESS (psi) **15.0**



Tested By SFS Date 7/19/17 Approved By MPS Date 7/21/17

DCN: CT-S29 DATE: 3-20-06 REVISION:2 *I:\2017 PROJECTS\2017-679 ARCADIS - NATIONAL GRID - HUDSON\[2017-679-002-002 GEOTAC-UU.xls]DATA*

2200 Westinghouse Blvd., Suite 103 • Raleigh, NC 27604 • Phone (919) 876-0405 • Fax (919) 876-0460 • www.geotechnics.net

geotechnics geotechnical & geosynthetic testing

UNCONSOLIDATED UNDRAINED TRIAXIAL

ASTM D2850-15

Client	Arcadis U.S., Inc.	Boring No.	N/A
Client Reference	National Grid - Hudson	Depth (ft.)	N/A
Project No.	R-2017-679-002	Sample No.	Final-2
Lab ID	R-2017-679-002-002	Visual	DARK GRAY SOIL CEMENT MIX

INITIAL SAMPLE DIMENSIONS

Length 1 (in)	5.995	Top Dia. (in)	2.864
Length 2 (in)	5.995	Mid. Dia. (in)	2.864
Length 3 (in)	5.995	Bot. Dia. (in)	2.864
Avg.Length (in)	5.995	Area (in^2.)	6.442

WATER CONTENT (AFTER TEST)

Total Wt. of Sample	1221.95
Tare No.	SS-5
Wt. Tare + WS.(gms)	508.16
Wt. Tare + DS.(gms)	458.25
Wt. of Tare(gms)	99.70
% Moisture	13.9

UNIT WEIGHT

Remolded Specimen

Wt. Tube & WS.(gms.)	2786.26	Sample Volume(cc.)	632.9
Wt. Of Tube(gms.)	1551.44	Unit Wet Wt.(gms/cc)	1.95
Wt. Of WS.(gms.)	1234.82	Unit Wet Wt.(pcf.)	121.75
Diameter (in.)	2.86	Moisture Content, %	13.9
Length (in.)	5.97	Unit Dry Wt.(pcf.)	106.9
Length (cm.)	15.23		

Initial Dial Reading , mils 67

CONFINING STRESS (psi) **15.0** Dial Reading Before Shearing, mils 88

DEFORMATION (in)	*LOAD (lbs)*	*ELAPSED TIME (min.)*	*STRAIN (%)*	*STRESS (psi)*
0.000	8.1	0.0	0.00	0.00
0.004	48.3	0.1	0.06	6.23
0.010	81.2	0.2	0.16	11.32
0.014	111.3	0.3	0.24	15.98
0.020	144.8	0.4	0.33	21.15
0.025	175.3	0.5	0.42	25.84
0.054	298.5	1.0	0.90	44.67
0.082	365.0	1.5	1.37	54.63
0.112	406.5	2.0	1.87	60.68
0.142	434.2	2.5	2.37	64.57
0.172	453.1	3.0	2.87	67.08
0.230	479.4	4.0	3.86	70.34
0.289	494.1	5.0	4.84	71.78
0.351	502.7	6.0	5.87	72.26
0.410	508.9	7.0	6.87	72.39
0.470	511.6	8.0	7.86	72.01
0.531	512.9	9.0	8.89	71.39
0.591	515.7	10.0	9.90	70.99
0.651	516.5	11.0	10.90	70.30
0.710	516.4	12.0	11.89	69.52
0.771	519.3	13.0	12.91	69.10
0.831	520.4	14.0	13.92	68.45
0.890	521.4	15.0	14.90	67.79
0.952	525.4	16.0	15.94	67.49

Tested By SFS Date 7/19/17 Input Checked By GEM Date 7/21/17

DCN: CT-S29 DATE: 3-20-06 REVISION:2 *\\2017 PROJECTS\\2017-679 ARCADIS - NATIONAL GRID - HUDSON\\[2017-679-002-002 GEOTAC-UU.xls]DATA*

2200 Westinghouse Blvd., Suite 103 • Raleigh, NC 27604 • Phone (919) 876-0405 • Fax (919) 876-0460 • www.geotechnics.net

ATTACHMENT 2

Remedial Design Calculations

Calculation Sheet

Client: National Grid **Project:** B0036702.0002

Prepared by: AJB **Date:** 08.18.2016

Title: Hudson Water Street OU2

Reviewed By: **Rory Kilkenny** **Date:** 08.19.2016

Subject: Hudson Water Street OU2, Hudson, New York: Shoring Design.

OBJECTIVE: Determine the following:

- The required components of the structural near shore retention of upland soils during dredging.
- Check sloped dredge area across Embayment #2.

REFERENCES:

1. National Grid. 2008. Final Engineering Report Remedial Action Implementation for Operable Unit 1.

2. National Oceanic and Atmospheric Administration (NOAA). 2013. Station Seletion – NOAA Tides & Currents. Retreived from: http://co-ops.nos.noaa.gov/stations.html?type=Datums. March 2015.

3. Skyline Steel. 2014. Product Data Sheet. AZ and HZ-M Steel Wall Systems.

4. Terzaghi, Karl. Peck, Ralph. Mesri, Gholamreza. *Soil Mechanics in Engineering Practice, Third Edition*. 1996

5. U.S. Army Corps of Engineers (USACE). *Design of Sheet Pile Walls*, Manual No. 1110-2-2504, March 1994.

6. Gregg Drilling and Testing, Inc (GREGG). *Guide to Cone Penetration Testing for Geotechnical Enigeering*. 2012.

7. Prosheet 2.2. 2009. ProfileARBED.

8. CivilTech Software. 2010. Shoring Suite (Version 8.12c)

TABLES:

1. Table 1 – Summary of Analysis Results

Calculation Sheet

ATTACHMENTS:

A. BOD Profiles.

B. Boring and CPT Logs (ARCADIS 2013, 2014) and Lab Results.

C. Prosheet Earth Pressure Outputs.

D. Shoring Suite Analysis Outputs.

E. Existing Sheet Pile Data.

ASSUMPTIONS:

1. The dredge areas were assumed to be laid out and to depths shown in the Attachment A.

2. The retaining walls were analyzed at four locations along the shoreline to incorporate the different dredge depths and existing structures.

    1. Section 1 – Retain upland soil with new cantilever sheet pile wall with 16 ft dredge depth. Upland inclined back slope conservatively analyzed at 2:1 slope.
    2. Section 2 – Analyze existing AZ-18 sheet pile wall to retain 14 ft dredge depth. Upland embayment is flat.
    3. Section 3 – Retain upland soil with new cantilever sheet pile wall with 16 ft dredge depth. Upland back slope inclined at 8:1 slope.
    4. Section 4 – Retain upland with new cantilever sheet pile wall with 14 ft dredge depth. Upland back slope inclined at 4:1 slope.

3. Top of existing sheet pile wall cut at sediment surface and new sheet piles assumed to be installed down to sediment surface with sheeting sticking up to mean water level.

4. The shoring design soil layer depths are laid out in the Basis of Design profiles presented in Attachment A.

5. The design sections for the dredge supports are interpreted from soil borings and CPT locations collected on-site from 2013 to 2014. Boring and CPT locations, boring logs and CPT interpretations can be found in Attachment B.

    The topography of the area and bathymetry were surveyed in NAVD88 by ARCADIS and included in the design area layout (Attachment A).

6. The earth pressures acting on the walls were determined using the computer program Prosheet (Reference 7). Driving pressures were calculated with active earth pressure coefficients and resisting pressures were calculated with passive earth pressure

Calculation Sheet

coefficients determined by Prosheet.

7. Drained and undrained cases were analyzed for all sections.

8. Shoring section modulus (Sx) and moment of inertia (I) were assumed based on the Skyline Steel product data sheets (Reference 3).

9. The minimum acceptable safety factor for structural integrity (yielding) is 2.0.

10. The minimum acceptable safety factor for geotechnical integrity (rotation) is 1.5 for free-draining soils and 2.0 for clay (NYSDOT. 2015 and U.S. Army Corps of Engineers. 1994).

11. To avoid compounding factors of safety, the sheet pile structural components will be designed using a factor of safety for passive pressures of 1.0 to calculate the forces and moments produced from passive and active earth pressures.

12. Steel was assumed to have a yield strength of 50 ksi and have a Modulus of Elasticity of 29,000 ksi.

13. Deflections were assumed to be limited to less than 2 inches.

CALCULATIONS:

Basis of Design Soil Parameters:

The basis of design soil profiles can be found in Attachment A. The soil parameters were determined based on established correlations and engineering judgment. The N-values from the borings and correlated CPT N values were used in conjunction with laboratory data (Attachment B) and engineering judgment to estimate the engineering properties of the soils. The estimation was based on information found in Terzaghi, Peck, Mesri (Reference 4), USACE's Design of Sheet Pile Walls (Reference 5), and GREGG's Guide to Cone Penetration Testing for Geotechnical Engineering (Reference 6).

1. For Section 1, lithology was based on subsurface data and soil properties estimated on average properties of data collected from GT-3, GT-4, CPT-3, and CPT-4 (Attachment B).
2. For Section 2, lithology was based on subsurface data and soil properties estimated on average properties of data collected from GT-3, CPT-3, and CPT-2B (Attachment B).
3. For Section 3, lithology was based on subsurface data and soil properties estimated on average properties of data collected from GT-5, CPT-1, and CPT-2 (Attachment B).
4. For Section 4, lithology was based on subsurface data and soil properties estimated on average properties of data collected from GT-1, GT-5, CPT-1, and CPT-2 (Attachment B).

Calculation Sheet

Shoring Analysis:

The shoring design calculations were performed using the Shoring Suite computer program by Civil Tech Software 2010. Shoring Suite requires soil properties to be input, and then determines moment, shear, deflection, embedment, and normalized deflections based on force equilibrium (References 8). Earth pressures were calculated in Prohseet for drained and undrained conditions and entered within Shoring Suite.

The analysis sections for the two wall sections were analyzed to evaluate the structural requirements of the dredge supports at the Hudson Water Street site. Prosheet and Shoring Suite results and outputs for each design section can be found in Attachment C and D.

From the various analysis sections, the drained case governed the final wall dimensions. In order for the sheet pile walls to support the planned dredging, the individual section deflections control the wall type. The analysis results are shown in Table 1 with a shortened summary table of the results below showing the final wall required lengths and wall section types.

Section	Depth of Wall (ft)	Sediment Surface (ft NAVD88)	Wall Tip Elevation (ft NAVD88)	Wall Section	Max Deflection (in)	Wall Weight (lb/ft^2)
Section 01	44.33	-15	-60	AZ 17-700	1.71	21.38
Section 02	29.29	-9	-39	AZ-18	0.39	24.19
Section 03	34.55	-2	-37	AZ 12-770	1.12	19.31
Section 04	31.57	-4	-36	AZ 12-770	0.79	19.31

Dredge Side Slope Check:

Based on the CPT and geotechnical borings collected at the site, the upper Silty Sand layer was conservatively estimated to have an internal friction angle of 28 degrees. A check was performed for the sloped dredge planned across Embayment #2 in order to maintain a sufficient factor of safety for the stability of this area. As the Embayment is relatively flat, the slope mainly needs to not overcome the internal friction angle of the Silty Sand. Therefore, the factor of safety for the slope:

$$2.5:1 \text{ slope} = \text{Tan}^{-1}(1/2.5) = 21.80 \text{ degrees}$$

$$\text{Factor of Safety} = 28°/21.80° = 1.28$$

Calculation Sheet

Conclusions:

Based on these results:

1. A new AZ 17-700 sheet pile wall will be installed east of the existing sheet pile wall to a depth of -60 ft NAVD88 along the shore.
2. The existing AZ-18 sheet piles across Embayment #1 is sufficient for dredge support since it was installed to approximately -59 ft NAVD88 (Attachment E), which is deeper than the required -39 ft NAVD88 wall penetration needed
3. A new AZ 12-770 sheet pile wall will installed in between Embayment #1 and Embayment #2 to -37 ft NAVD88.
4. A new AZ 12-770 sheet pile wall will be installed west of Embayment #2 to -36 ft NAVD88.

The sheet pile designs presented above is only applicable for the assumed site conditions. Conditions that would affect the capacity would include:

- Variations in soil thickness
- Variation in in-situ geotechnical properties.

Table 1
Summary of Analysis Results

Conceptual Analysis
Hudson Water Street

Wall Design

Analysis ID	Wall Condition	Soil Condition	Sediment Surface depth (ft NAVD88)	Dredge (ft bss)	Water Differential (ft)	Depth of Sheets (ft)	Min. Section Modulus (in^3/ft)	Required Section	Elastic Section Modulus (in^3/ft)	Moment Of Inertia (in^4)	Max Deflection (in)	Wall weight (lb/ft^2)
01-U	New	Undrained	-15	16	0	24.3	8.7	AZ 17-700	32.2	265.30	0.38	21.38
01-D		Drained				44.33	28.7				1.71	
02-U	**Existing**	Undrained	-9	14	0	23.41	5.6	AZ-18	33.5	250.40	0.20	24.19
02-D		Drained				29.29	6.8				0.39	
03-U	New	Undrained	-2	16	0	22.79	5.7	AZ 12-770	23.2	156.90	0.37	19.31
03-D		Drained				34.55	11.6				1.12	
04-U	New	Undrained	-4	14	0	31.01	9.2	AZ 12-770	23.2	156.90	0.69	19.31
04-D		Drained				31.57	9.2				0.79	

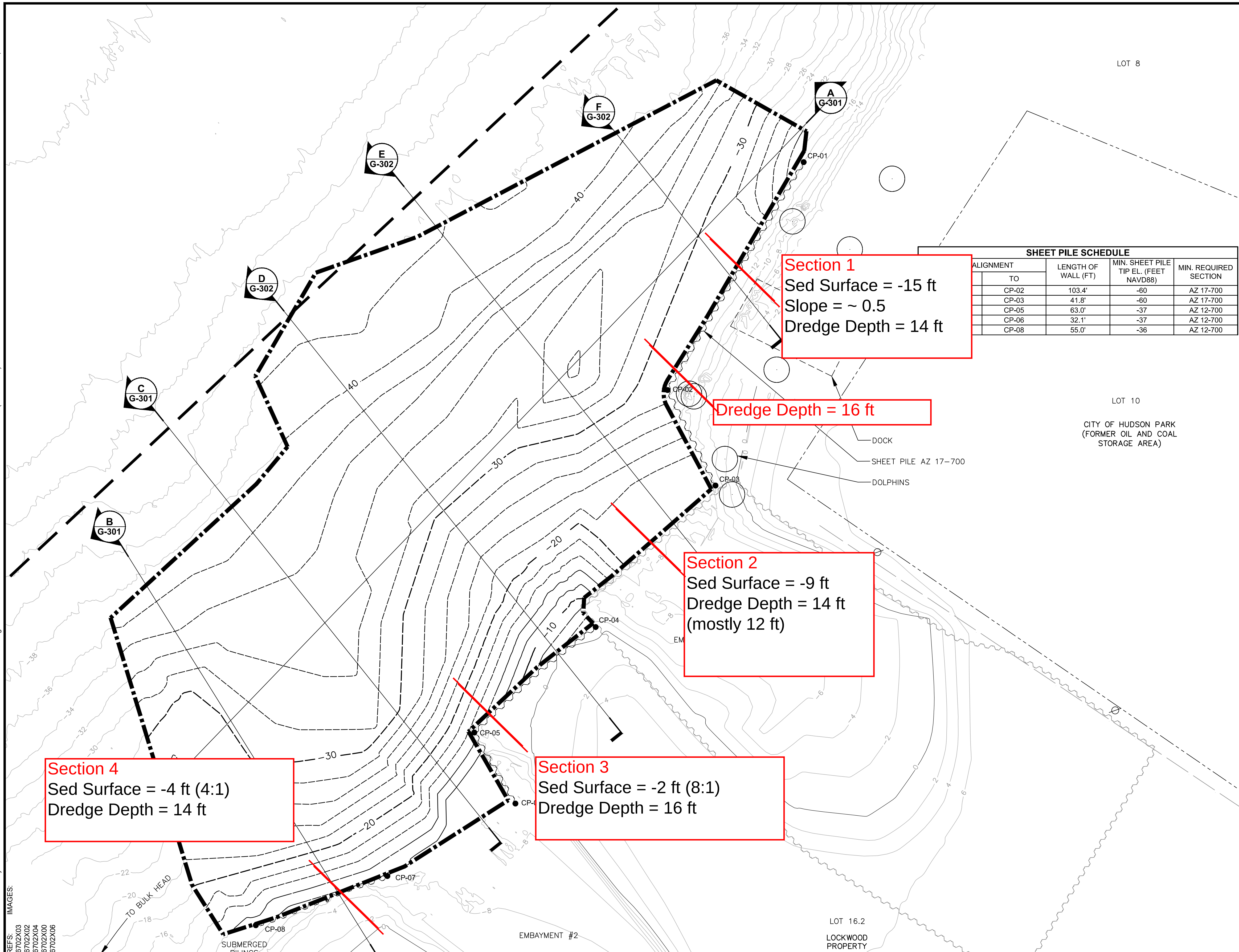
* Sheet depth only from sediment surface

Notes:
1) Required Section selected to limit deflections to less than 2 inches.

= Controlling Condition

ATTACHMENT A

BOD Profiles



		SHEET PILE SCHEDULE		
ALIGNMENT		LENGTH OF WALL (FT)	MIN. SHEET PILE TIP EL. (FEET NAVD88)	MIN. REQUIRED SECTION
	TO			
	CP-02	103.4'	-60	AZ 17-700
	CP-03	41.8'	-60	AZ 17-700
	CP-05	63.0'	-37	AZ 12-700
	CP-06	32.1'	-37	AZ 12-700
	CP-08	55.0'	-36	AZ 12-700

LEGEND:

- APPROXIMATE PROPERTY LINE
- CHAIN–LINK FENCE
- EXISTING BATHYMETRIC CONTOUR (2–FOOT INTERVAL)
- EXISTING SHEETPILE
- DREDGE AREA LIMIT
- APPROXIMATE BOUNDARY OF THE SHIPPING CHANNEL
- PROPOSED REMOVAL CONTOUR (MAJOR)
- PROPOSED REMOVAL CONTOUR (MINOR)
- EXISTING PERMANENT DOCK
- EXISTING DOLPHIN
- APPROXIMATE PROPOSED TEMPORARY AZ 17–700 SHEET PILE WALL

NOTE:

1. IF RIPRAP REQUIRES REMOVAL, STOCKPILE FOR REUSE DURING RESTORATION.

NOT FOR CONSTRUCTION

20' 0 20' 40'
1"=20'

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

THIS DRAWING IS THE PROPERTY OF THE ARCADIS ENTITY IDENTIFIED IN THE TITLE BLOCK AND MAY NOT BE REUSED OR ALTERED IN WHOLE OR IN PART WITHOUT THE EXPRESS WRITTEN PERMISSION OF SAME.

Professional Engineer's Name: MARK GRAVELDING
Professional Engineer's No.: 0699□5-1
State: NY | Date Signed: | Project Mgr.: HMV
Designed by: ESD | Drawn by: KLS | Checked by: (CHK)

DRAFT

ARCADIS Design & Consultancy for natural and built assets
ARCADIS OF NEW YORK, INC.
NO ALTERATIONS PERMITTED HEREON EXCEPT AS PROVIDED UNDER SECTION 7209 SUBDIVISION 2 OF THE NEW YORK STATE EDUCATION LAW

NATIONAL GRID • HUDSON (WATER STREET) SITE, HUDSON, NEW YORK
70□ DRAFT REMEDIAL DESIGN REPORT FOR OPERABLE UNIT 2

SEDIMENT REMOVAL PLAN

ARCADIS Project No. B0036702.0002.00005
Date SEPTEMBER 2016
ARCADIS
6723 TOWPATH ROAD
P.O. BOX 66
SYRACUSE, NY 13214
TEL: 315.466.9120

G-300

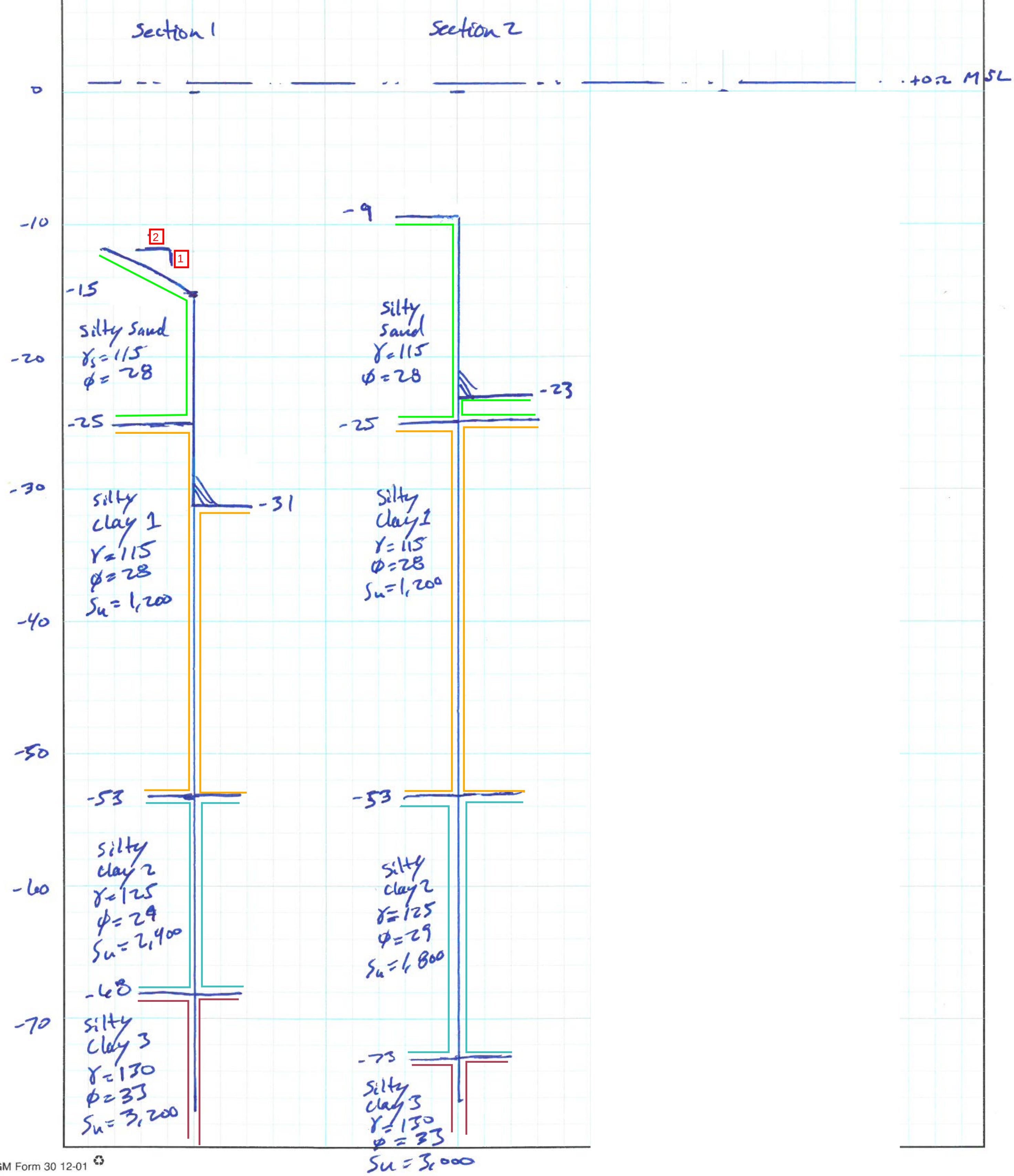
ARCADIS

SUBJECT: Hudson Water Street
Dredge Retaining Wall Analyses
JOB NO: B0036702.0002

BY: DATE:
CHKD: DATE:

PAGE

SHEET 1



ARCADIS

SUBJECT: Hudson Water Street Dredge Retaining Wall Analyses

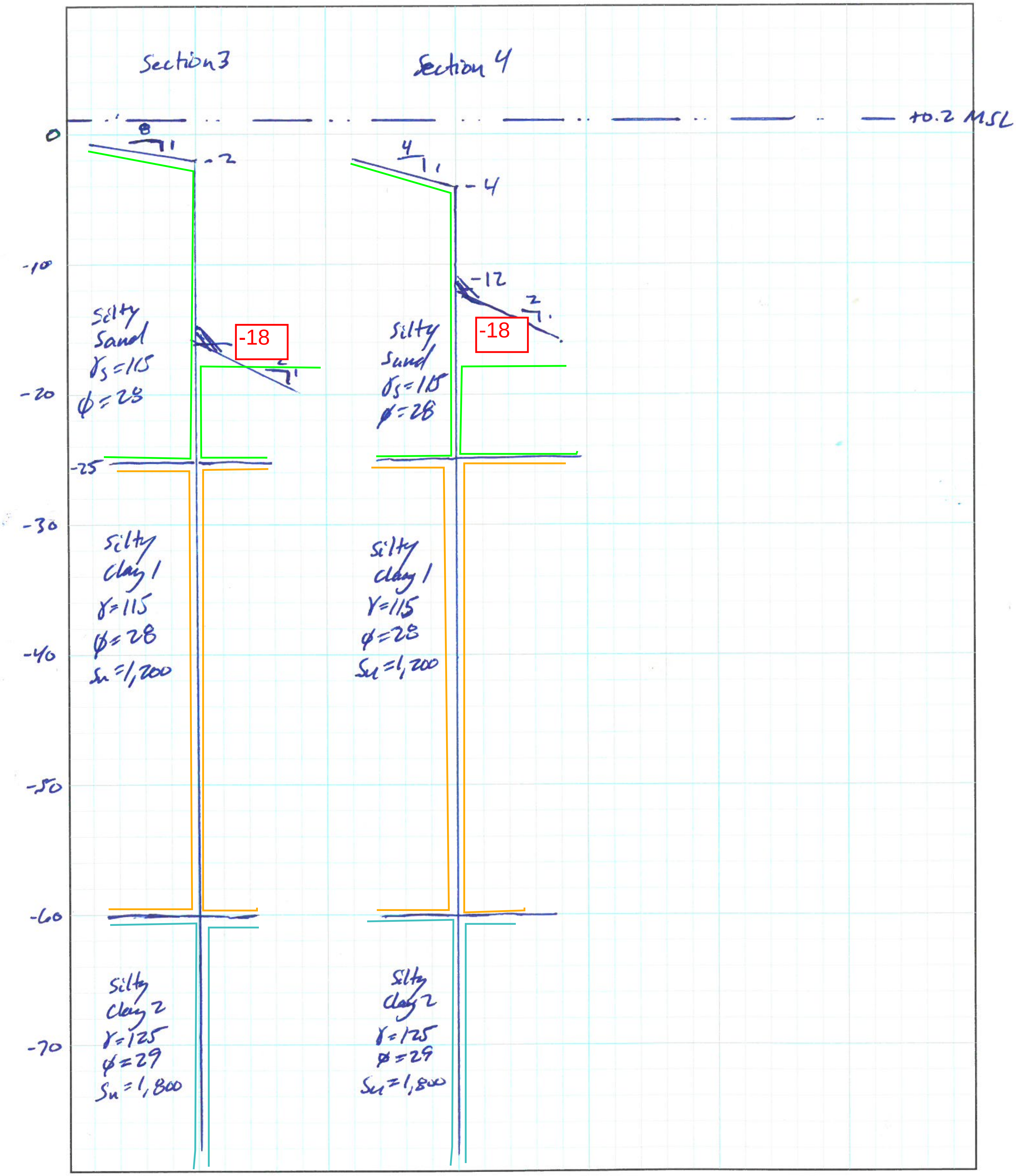
JOB NO: B0036702.0002

BY: DATE:

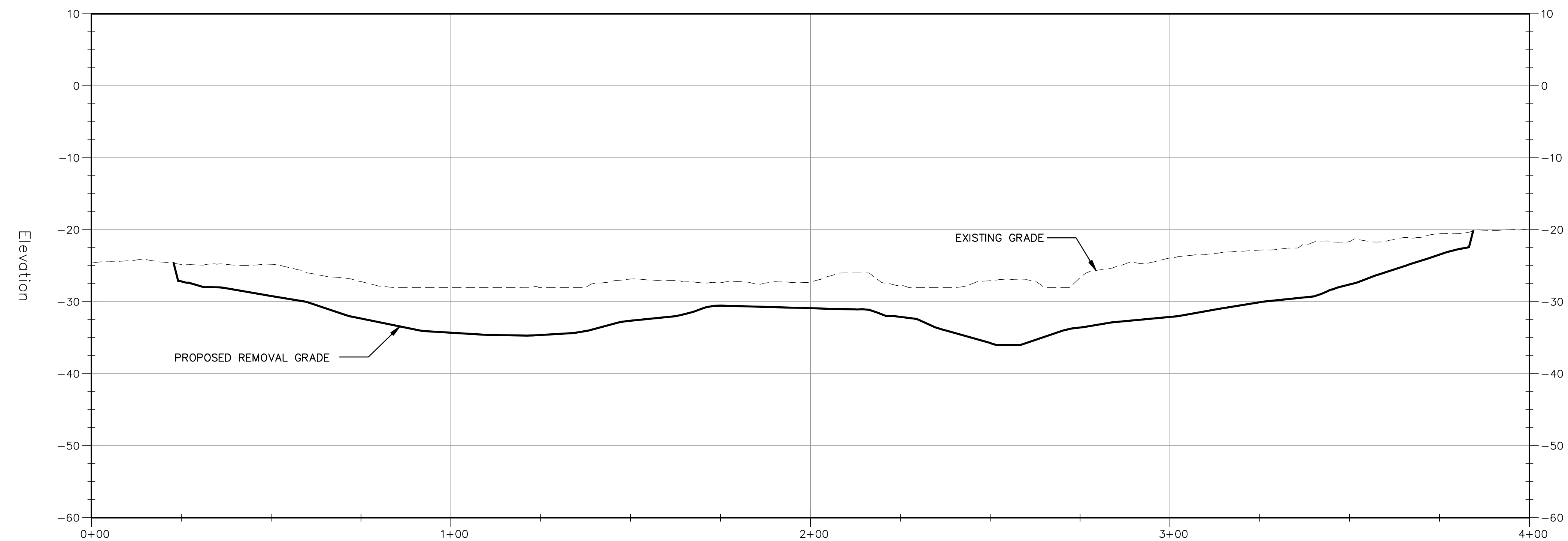
CHKD: DATE:

PAGE

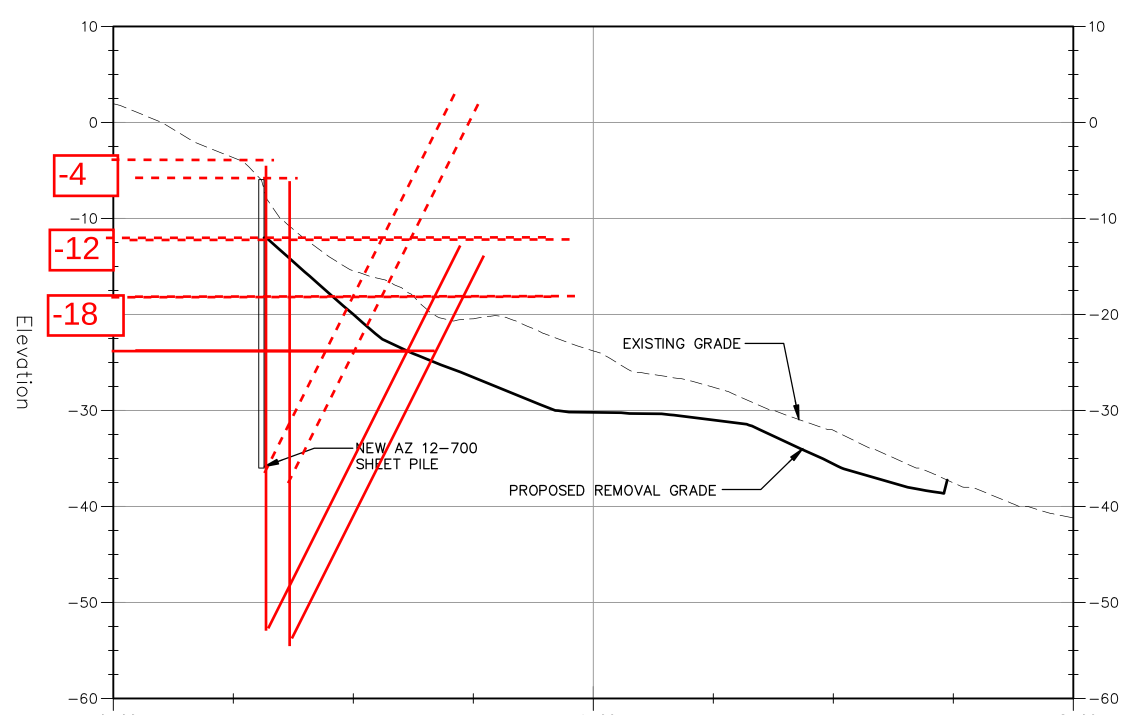
SHEET 1



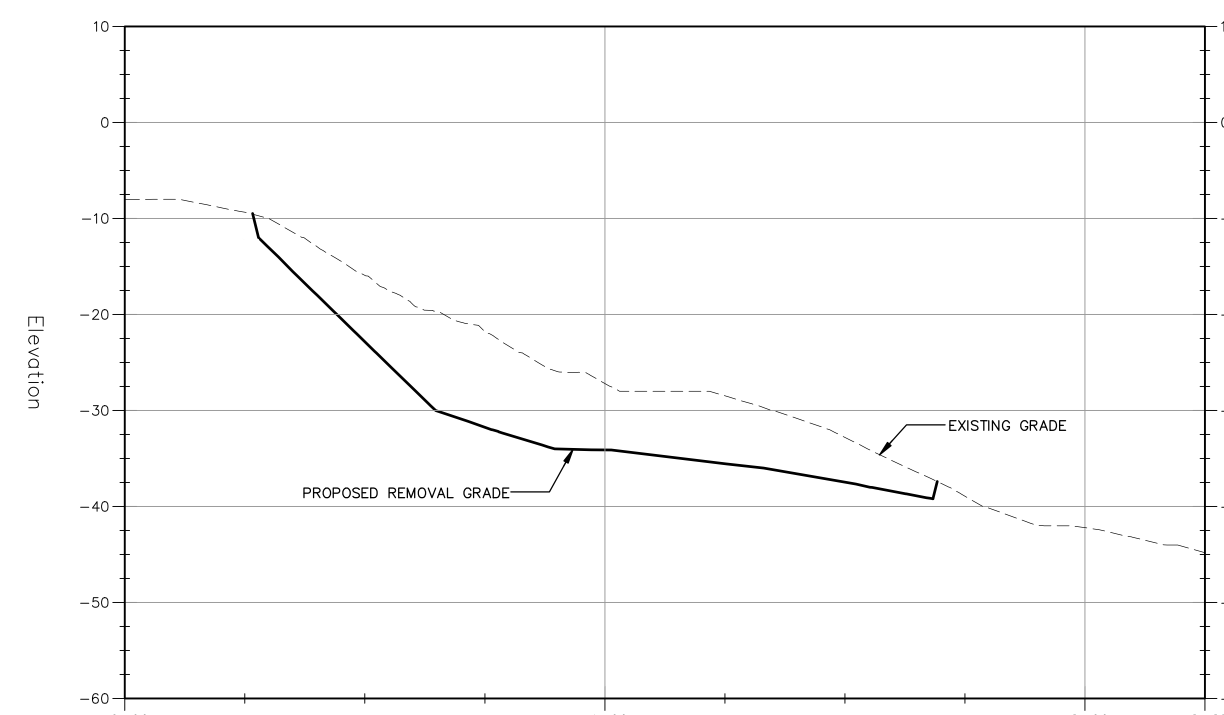
AGM Form 30 12-01



PROFILE A



PROFILE B



PROFILE C

NOT FOR CONSTRUCTION

HORIZONTAL SCALE: 1"=20'

HORIZONTAL SCALE: 1"=10'

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name: **MARK GRAVELDING**
Professional Engineer's No.: 0699□5-1

State	Date Signed	Project Mgr.
NY		HMV
Designed by	Drawn by	Checked by
ESD	KLS	(CHK)

DRAFT

ARCADIS OF NEW YORK, INC.

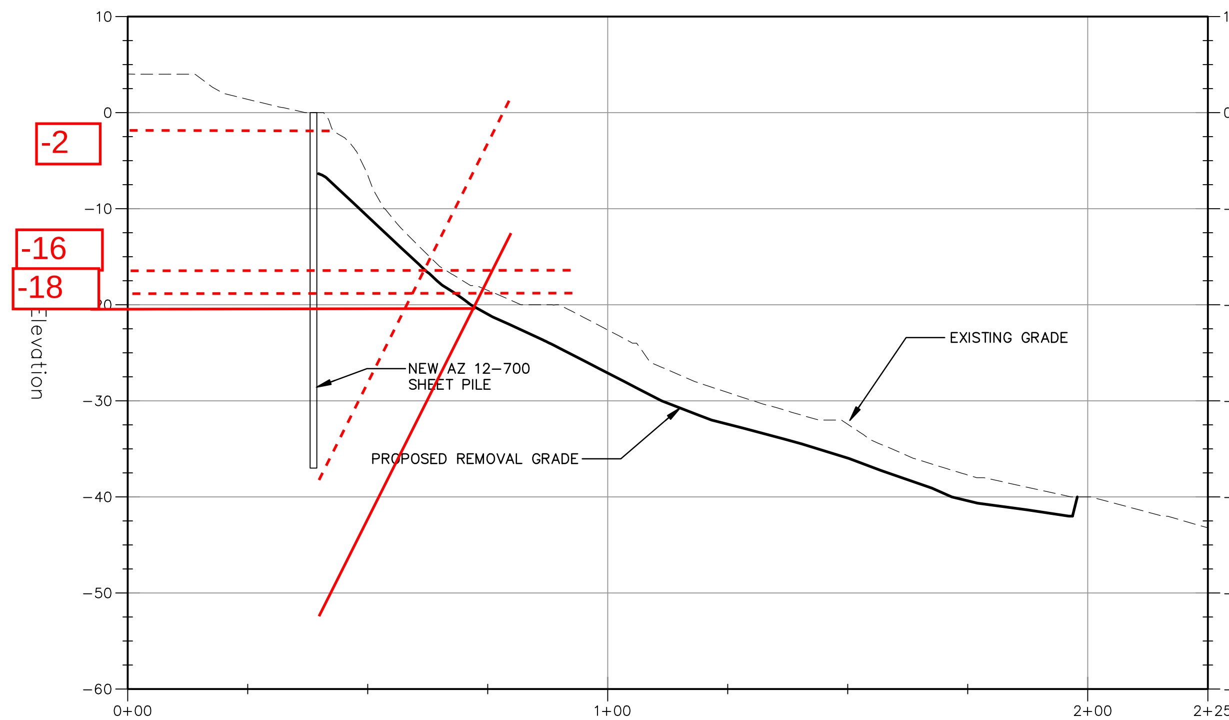
NO ALTERATIONS PERMITTED HEREON EXCEPT AS PROVIDED UNDER SECTION 7209 SUBDIVISION 2 OF THE NEW YORK STATE EDUCATION LAW

NATIONAL GRID • HUDSON (WATER STREET) SITE, HUDSON, NEW YORK
70□ DRAFT REMEDIAL DESIGN REPORT FOR OPERABLE UNIT 2

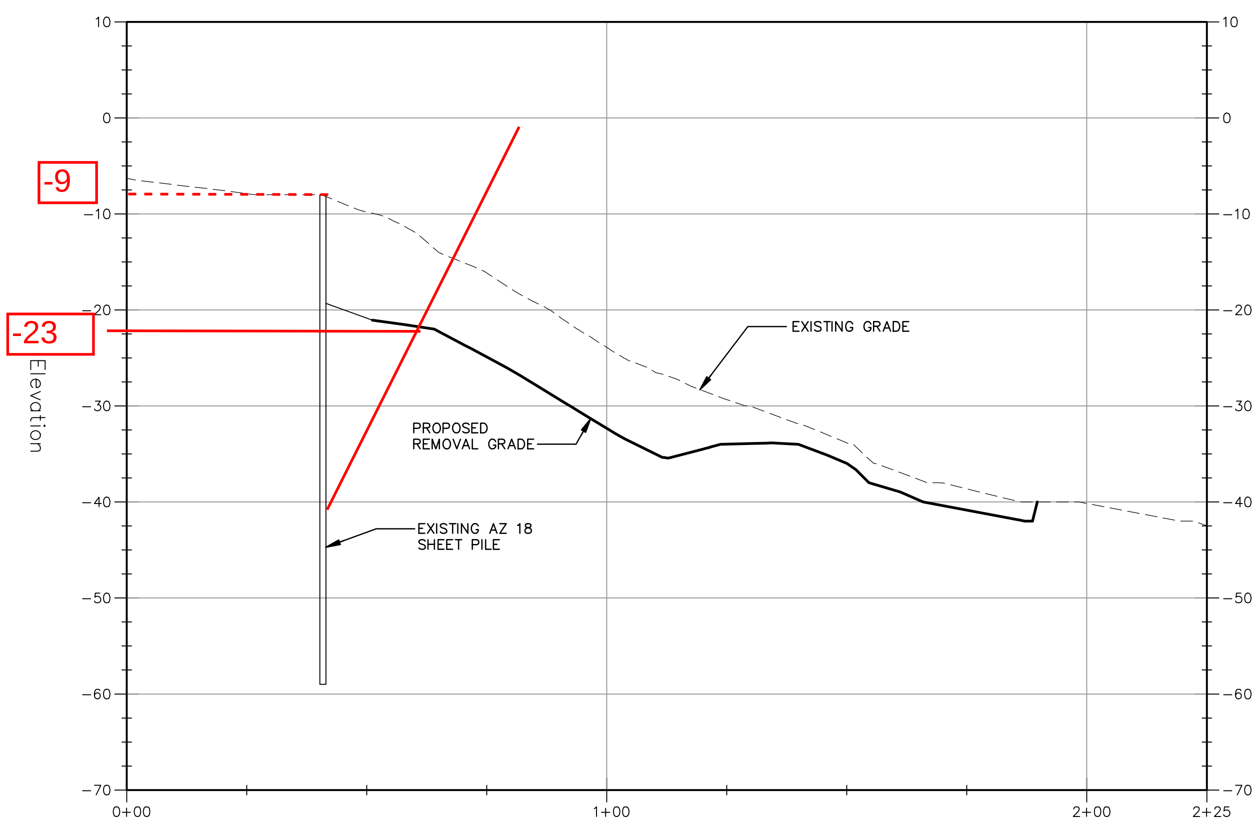
SEDIMENT REMOVAL PROFILES

ARCADIS Project No. B0036702.0002.00005
Date SEPTEMBER 2016
ARCADIS
6723 TOWPATH ROAD
P.O. BOX 66
SYRACUSE, NY 13214
TEL: 315.466.9120

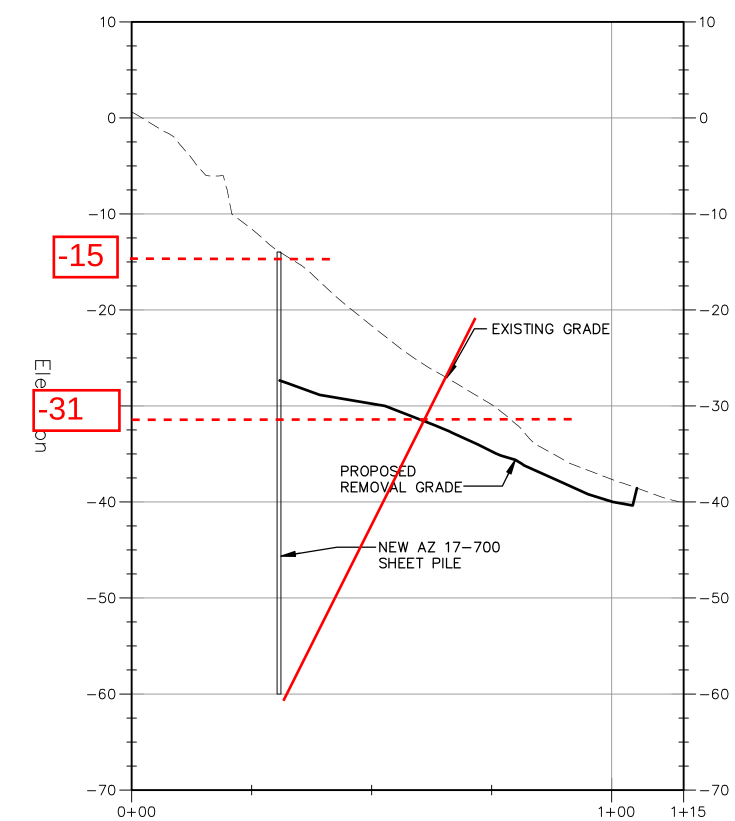
G-301



PROFILE D



PROFILE E



PROFILE F

NOT FOR CONSTRUCTION

1"=20' HORIZONTAL SCALE: 1"=20'

1"=10' HORIZONTAL SCALE: 1"=10'

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name: MARK GRAVELDING
Professional Engineer's No.: 0699□5-1
State: NY | Date Signed: | Project Mgr.: HMV
Designed by: ESD | Drawn by: KLS | Checked by: (CHK)

DRAFT

ARCADIS Design & Consultancy for natural and built assets
ARCADIS OF NEW YORK, INC.

NATIONAL GRID • HUDSON (WATER STREET) SITE, HUDSON, NEW YORK
70□ DRAFT REMEDIAL DESIGN REPORT FOR OPERABLE UNIT 2

SEDIMENT REMOVAL PROFILES

ARCADIS Project No. B0036702.0002.00005
Date SEPTEMBER 2016
ARCADIS
6723 TOWPATH ROAD
P.O. BOX 66
SYRACUSE, NY 13214
TEL: 315.466.9120

G-302

CITY: SYRACUSE, NY DIV/GROUP: IMDV/CAD DB/LD: L.POSENAUER, K.SARTORI PM/TM: C.GUEST LYR:ON=*;OFF=*REF* LAYOUT: G-302 SAVED: □/19/2016 5:35 PM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: □/19/2016 5:36 PM BY: WASILEWSKI, MATT

XREFS: 36702X00 36702X02-CIV IMAGES:

ATTACHMENT B

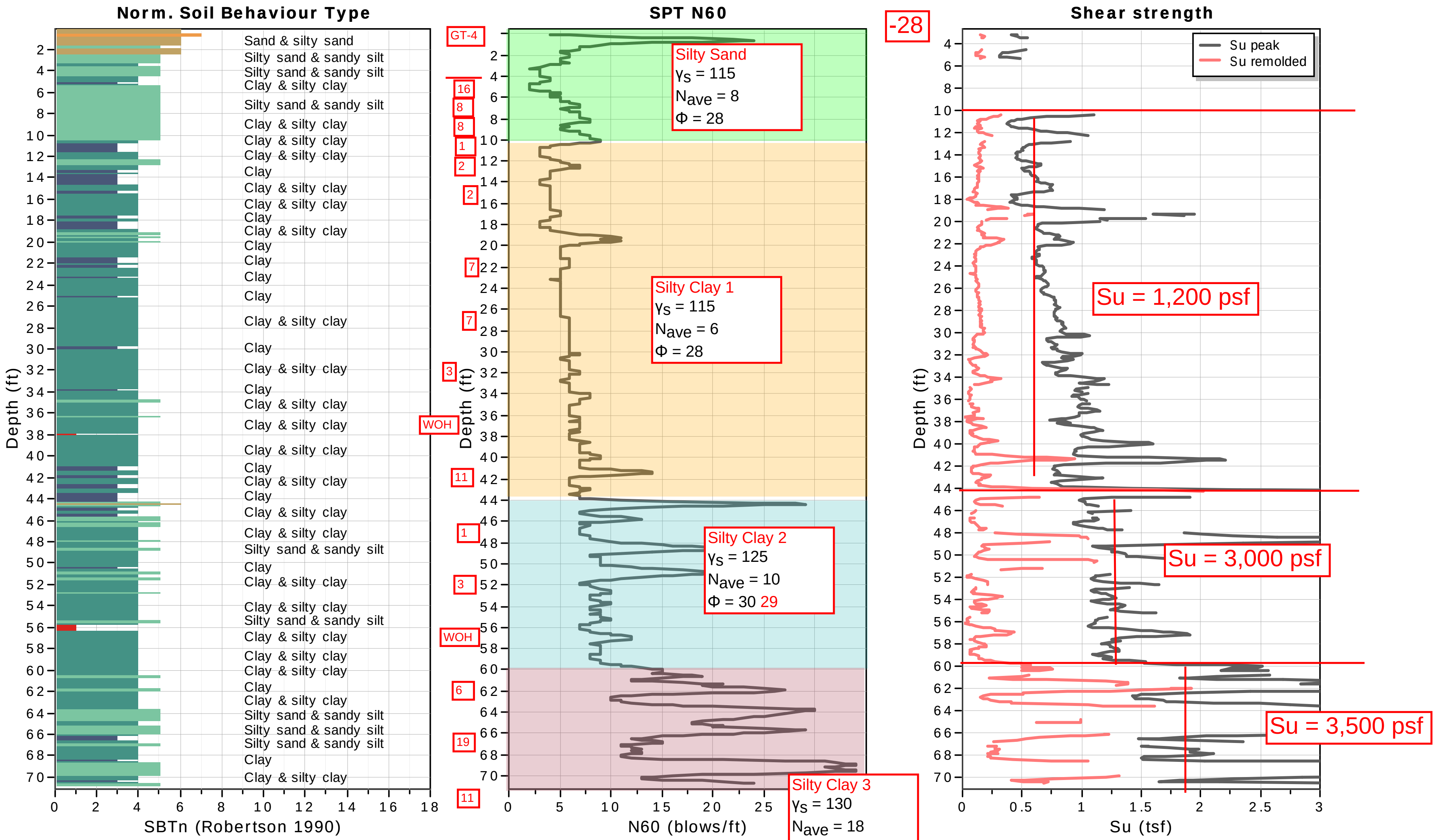
Boring and CPT Logs (ARCADIS 2013, 2014) and Lab Results

Section 01

ARCADIS
Geotechnical Engineers

CPT: CPT-4
Total depth: 71.13 ft, Date: 12/17/2014
Surface Elevation: 0.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Uknown

Project: HWS
Location: Hudson NY



21 @ -104 ft (77 ft bgs)
Glacial Till

85 @ -109 ft (82 ft bgs)
Weathered Rock

Drilling Company: Atlantic Testing Laboratories, Inc.
Driller's Name: M. Childs, T. Weston
Drilling Method: Casing
Casing Size: 4.0" ID
Rig Type: CME-850X
Sampling Method: 2 1/4" NX Core Barrel
3"x2' Split Spoon

Easting: 681654.24
Casing Elevation: NA

Borehole Depth: 92.8' bss
Water Surface: 4.4' MLW
Sediment Surface Elev.: -29.0 ft NAVD88
Descriptions By: K. Warren

Well/Boring ID: GT-4
Client: National Grid
Project: Hudson Water Street-OU2
Location: Water Street
Hudson, NY

Sample Run Number	Sample/Int/Type	Recovery (feet)	Blow Counts	N - Value	P. Penetrometer (tsf)	Stratigraphic Description
1	0-2	2.0	8 8 8 8	16		Medium to fine SAND, subrounded, trace silt, nonplastic, poorly graded, wet, medium dense, olive brown (2.5Y-6/4).
2	2-4	0.8	7 4 4 3	8		(1.2-1.5) Apparent WOOD layer, highly organic (no impacts - no odor, no coal tar). (1.5) SAA, saturated
3	4-6	2.0	5 4 4 4	8		(2.0) SAA, trace Silt, trace Organics, loose. [MC = 21.6%, OC = 0.7%, GS: #4 = 100%, #200 = 7.3%]
4	6-8	NR	WOH WOH 1 3	1		NO RECOVERY.
5	8-10	1.7	1 WOH 2 2	2		Clayey fine SAND, medium plasticity, trace gravel, subangular, saturated, very loose, olive gray (5Y-4/2).
6	13-15	1.5	1 1 1 2	2		SAA, Clayey fine SAND, some Gravel, subrounded, trace silt, gray (gley 1-6/N).
7	18-20	1.3	7 6 1 3	7		SILT and Lean CLAY, medium plasticity, trace very fine sand, wet, soft, gray (gley 1-6/N). [LL = 28, PL = 19, MC = 35.1%, GS: #4 = 100%, #200 = 99%]
8	23-25	2.0	3 3 4 5	7		Lean CLAY, medium plasticity, trace gravel, saturated, soft to firm, gray (gley 1-6/N).
9	25-27	1.9		-		SAA.
10	28-30	2.0	WOR WOH 3 3	3		Silty Lean CLAY, medium plasticity, saturated, soft to firm, gray (gley 1-6/N). [LL = 29, PL = 20, MC = 38.9%, GS: #200 = 100%, Silt = 46%, Clay = 54%] Vane shear test: Tmax = 290 lbf; t = 5:00 mins Rate of remoulding = 1 min; Max. torque remold = 49 lbf
11	33-35	2.0	WOR WOH WOH 3	WOH		
12	38-40	2.0	3 5 6 8	11		Lean CLAY, little silt, medium plasticity, saturated, firm, gray (gley 1-6/N). Vane shear test: Tmax = 220 lbf; t = 5:40 mins Rate of remoulding = -- min; Max. torque remold = -- lbf
13	43-45	2.0	WOH 1 WOH 2	1		Lean CLAY, some Silt, medium plasticity, saturated, very soft, gray (gley 1-6/N). [LL = 30, PL = 22, MC = 24.5%, GS: #4 = 100%, #200 = 100%]
14	48-50	1.6	1 1 2 5	3	0.14	SAA, soft.

Remarks:
SAA = same as above; bss = below sediment surface; NA = Not Applicable/Available; MLW = Mean Low Water; NAVD88 = North American Vertical Datum of 1988; NR = No Recovery; LL = Liquid Limit; PL = Plastic Limit; MC = Moisture Content; OC = Organic Content; GS = Grain Size, #4 and #200 refer to percent of soil finer than the #4 and #200 sieves during laboratory testing; UWd = Dry Unit Weight; Su = Undrained Shear Strength; SG = Specific Gravity; pcf = pounds per cubic foot; psi = pounds per square inch; HW = Highly Weathered, HF = Highly Fractured.
Top of Deck to Top of Water Surface: 5.5 ft.
Top of Deck to Top of Mudline: 41 ft.

ARCADIS
Infrastructure, environment, buildings

Water Level Data

Date	Water Depth	MLW
9/16/13	35.5'	4.4'

Depth measured from top of deck

Date Start/Finish: 9/16/2013 - 9/17/2013
Drilling Company: Atlantic Testing Laboratories, Inc.
Driller's Name: M. Childs, T. Weston
Drilling Method: Casing
Casing Size: 4.0" ID
Rig Type: CME-850X
Sampling Method: 2 1/4" NX Core Barrel
3"x2' Split Spoon

Northing: 1247223.80
Easting: 681654.24
Casing Elevation: NA

Borehole Depth: 92.8' bss
Water Surface: 4.4' MLW
Sediment Surface Elev.: -29.0 ft NAVD88
Descriptions By: K. Warren

Well/Boring ID: GT-4

Client: National Grid

Project: Hudson Water Street-OU2

Location: Water Street
Hudson, NY

DEPTH	ELEVATION (NAVD88)	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blow Counts	N - Value	P. Penetrometer (tsf)	Analytical Sample	Geologic Column	Stratigraphic Description
55	-85	15	53-55	2.0	WOH WOH WOH 4	WOH	0.25			SAA, very soft. SAA, soft to firm.
60	-90	16	58-60	2.0	WOH WOH 6 10	6	0.19 0.23			SILT, some Clay, medium plasticity, wet, soft to firm, gray (gley 1-6/N). [LL = 25, PL = 18, MC = 23.2%, GS: #200 = 100%, Silt = 68%, Clay = 32%]
65	-95	17	63-65	2.0	8 9 10 11	19	1.5-2.5			Silty Lean CLAY, medium plasticity, wet, firm to hard, gray (gley 1-6/N).
70	-100	18	68-70	2.0	8 6 5 6	11				SILT, little clay, trace very fine sand, wet, firm, gray (gley 1-6N). SAA, soft
75	-105	19	73-75	2.0	6 9 13 26	21				(Glacial Till) GRAVEL, some Sand, angular, little silt, poorly graded, saturated, dense, greenish black (gley 1-2.5/5GY). [MC = 30.0%, GS: #200 = 96%, Silt = 75%, Clay = 21%] SAA, very dense
80	-110	20	78-80	1.4	55 35 50 56	85				(Apparent weathered ROCK). Rollerbit apparent weathered ROCK, alternating hard and soft zones.
85	-115									Apparent weathered ROCK, in hard rock, begin rock core at 88 ft bss.
90	-120	R-1	88-93	16"/ 46"						LIMESTONE, HW, HF, thinly bedded, reacts with HCL, gray (gley 1-6/N). 88-89 = 3:22 min RQD = 10.8% Strength = RO-RI 89-90 = 10:56 min 90-91 = 19:51 min 91-92.8 = 34:48 min
95	-125									Barrel was not advancing, driller believes it is clogged, stopped run at 3.8 ft. End of Boring at 92.8 ft bss. Borehole backfilled with grout on 9/17/13.
	-130									

ARCADIS
Infrastructure, environment, buildings

Remarks:

SAA = same as above; bss = below sediment surface; NA = Not Applicable/Available; MLW = Mean Low Water; NAVD88 = North American Vertical Datum of 1988; NR = No Recovery; LL = Liquid Limit; PL = Plastic Limit; MC = Moisture Content; OC = Organic Content; GS = Grain Size, #4 and #200 refer to percent of soil finer than the #4 and #200 sieves during laboratory testing; UWd = Dry Unit Weight; Su = Undrained Shear Strength; SG = Specific Gravity; pcf = pounds per cubic foot; psi = pounds per square inch; HW = Highly Weathered, HF = Highly Fractured.
Top of Deck to Top of Water Surface: 5.5 ft.
Top of Deck to Top of Mudline: 41 ft.

Water Level Data

Date	Water Depth	MLW
9/16/13	35.5'	4.4'

Depth measured from top of deck

Section 01 and 02

Drilling Company: Atlantic Testing Laboratories, Inc.
Driller's Name: M. Childs, T. Weston
Drilling Method: Casing
Casing Size: 4.0" ID
Rig Type: CME-850X
Sampling Method: 2 1/4" NX Core Barrel
3"x2' Split Spoon

Easting: 681489.56
Casing Elevation: NA
Borehole Depth: 75' bss
Water Surface: 4.0' MLW
Sediment Surface Elev.: -36.3 ft NAVD88
Descriptions By: K. Warren

Well/Boring ID: GT-3
Client: National Grid
Project: Hudson Water Street-OU2
Location: Water Street
Hudson, NY

DEPTH	ELEVATION (NAVD88)	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blow Counts	N - Value	P. Penetrometer (tsf)	Analytical Sample	Geologic Column	Stratigraphic Description
0		1	0-2	0.2	1 8 11 11	19				Shells and GRAVEL, angular, poorly graded, little sand, wet, medium dense, olive gray (5Y-4/2).
	-40	2	2-4	0.1	10 8 7 7	15				Fine SAND, little silt, subrounded to subangular, poorly graded, trace silt, wet, medium dense, olive gray (5Y-4/2).
5		3	4-6	1.5	11 9 7 5	16				SAA, little silt, organics present, dark reddish brown (2.5YR-3/3). [MC = 23.2%, OC = 3.1%, GS: #4 = 100%, #200 = 18%]
	-45	4	6-8	1.2	6 1 1 1	2				SAA, some Silt, trace gravel, very loose, dark brown (7.5YR-3/4).
		5	8-10	2.0	6 4 4 4	8				SAA, little silt, shells, loose.
10	-50									
15	-55	6	15-17	1.2	8 10 12 15	22				Lean CLAY, trace sand, medium plasticity, wet, firm, greenish black (gley 1-2.5/5GY). [LL = 28, PL = 19, MC = 23.4%, GS: #4 = 100%, #200 = 96%]
20	-60	7	20-22	2.0	2 9 12 15	21	1.75 3.75			Lean CLAY, some Silt, medium plasticity, wet, firm, gray (gley 1-6/N).
25	-65	8	25-27	2.0	8 8 10 12	18	1.5 1.5			SAA.
30	-70	9	30-32	1.4	21 11 13 13	24	1.25			Clayey SILT, nonplastic to low plasticity, some very fine Sand, wet, firm, greenish black (gley 1-2.5/5GY).
35	-75	10	35-37	2.0	11 5 WOH 2	5	0.5 0.0			SAA, trace sand, firm to soft.
40	-80	11	40-42	2.0	WOH 1 1 3	2	0.11			Lean CLAY, little silt, low to medium plasticity, wet/saturated, soft, greenish black (gley 1-2.5/5GY). [MC = 28.6%]
45	-85	12	45-47	2.0	WOH WOH WOH 3	WOH				SILT and Lean CLAY, low to medium plasticity, wet/saturated, soft, greenish black (gley 1-2.5/5GY). [LL = 24, PL = 20, MC = 21.6%, GS: #200 = 100%, Silt = 75%, Clay = 25%]
		13	47-49	2.0		NA				SAA. [LL = 28, PL = 20, MC = 28.3%, UWd = 85.2 pcf, SG = 2.77, Su = 6.0 psi]
50										

ARCADIS
Infrastructure, environment, buildings

Remarks:
SAA = same as above; bss = below sediment surface; NA = Not Applicable/Available; MLW = Mean Low Water; NAVD88 = North American Vertical Datum of 1988; NR = No Recovery; LL = Liquid Limit; PL = Plastic Limit; MC = Moisture Content; OC = Organic Content; GS = Grain Size, #4 and #200 refer to percent of soil finer than the #4 and #200 sieves during laboratory testing; UWd = Dry Unit Weight; Su = Undrained Shear Strength; SG = Specific Gravity; pcf = pounds per cubic foot; psi = pounds per square inch.
Top of Deck to Top of Water Surface: 5.5 ft.
Top of Deck to Top of Mudline: 48 ft.

Water Level Data

Date	Water Depth	MLW
9/11/13	42.5'	4.0'

Depth measured from top of deck

Date Start/Finish: 9/11/2013 **Drilling Company:** Atlantic Testing Laboratories, Inc. **Driller's Name:** M. Childs, T. Weston **Drilling Method:** Casing **Casing Size:** 4.0" ID **Rig Type:** CME-850X **Sampling Method:** 2 1/4" NX Core Barrel 3"x2' Split Spoon	**Northing:** 1247129.64 **Easting:** 681489.56 **Casing Elevation:** NA **Borehole Depth:** 75' bss **Water Surface:** 4.0' MLW **Sediment Surface Elev.:** -36.3 ft NAVD88 **Descriptions By:** K. Warren	**Well/Boring ID: GT-3** **Client:** National Grid **Project:** Hudson Water Street-OU2 **Location:** Water Street Hudson, NY

DEPTH	ELEVATION (NAVD88)	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blow Counts	N - Value	P. Penetrometer (tsf)	Analytical Sample	Geologic Column	Stratigraphic Description
50	-90	14	50-52	2.0	7 10 12 12	22	1.75 2.25			Silty lean CLAY, low plasticity, wet/saturated, firm, greenish black (1-2.5/5GY).
55	-95	15	55-57	2.0	WOR 3 3 14	6	0.11			Lean CLAY, little silt, medium plasticity, wet/saturated, soft, greenish black (1-2.5/5GY).
										SILT, some Clay, nonplastic to low plasticity, little very fine sand, wet, firm, gray (gley 1-6/N). [MC = 5.9%, GS: #4 = 68%, #200 = 27%]
60	-100	16	60-62	2.0	12 12 25 50	37				(Glacial Till) SAND, some Gravel, angular, little silt and clay, nonplastic, poorly graded, SATURATED, very dense, gray (gley 1-6/N).
										Weathered rock encountered (rollerbit down to competent rock).
65	-105	R-1	65-70	12"/60"						LIMESTONE, highly fractured, moderate weathering, thinly bedded, dark gray, reacts with HCL, RI 65-66 = 4:00 min RQD = 0% Strength = RI 66-68 = 8:42 min 68-69 = 8:10 min 69-70 = 6:18 min
70	-110	R-2	70-75	0"/60"						NO RECOVERY, driller believes rock is highly fractured in barrel because of moving casing in current, rods move and barrel drops recovery on way up. 70-71 = 3:21 min RQD = 0% Strength = RI 71-72 = 4:33 min 72-74 = 5:38 min 74-75 = 5:07 min
75	-115									End of Boring at 75 ft bss. Borehole backfilled with grout on 9/11/13.
80	-120									
85	-125									
90	-130									
95	-135									
100										

ARCADIS
Infrastructure, environment, buildings

Remarks:
SAA = same as above; bss = below sediment surface; NA = Not Applicable/Available; MLW = Mean Low Water; NAVD88 = North American Vertical Datum of 1988; NR = No Recovery; LL = Liquid Limit; PL = Plastic Limit; MC = Moisture Content; OC = Organic Content; GS = Grain Size, #4 and #200 refer to percent of soil finer than the #4 and #200 sieves during laboratory testing; UWd = Dry Unit Weight; Su = Undrained Shear Strength; SG = Specific Gravity; pcf = pounds per cubic foot; psi = pounds per square inch.
Top of Deck to Top of Water Surface: 5.5 ft.
Top of Deck to Top of Mudline: 48 ft.

Water Level Data

Date	Water Depth	MLW
9/11/13	42.5'	4.0'

Depth measured from top of deck

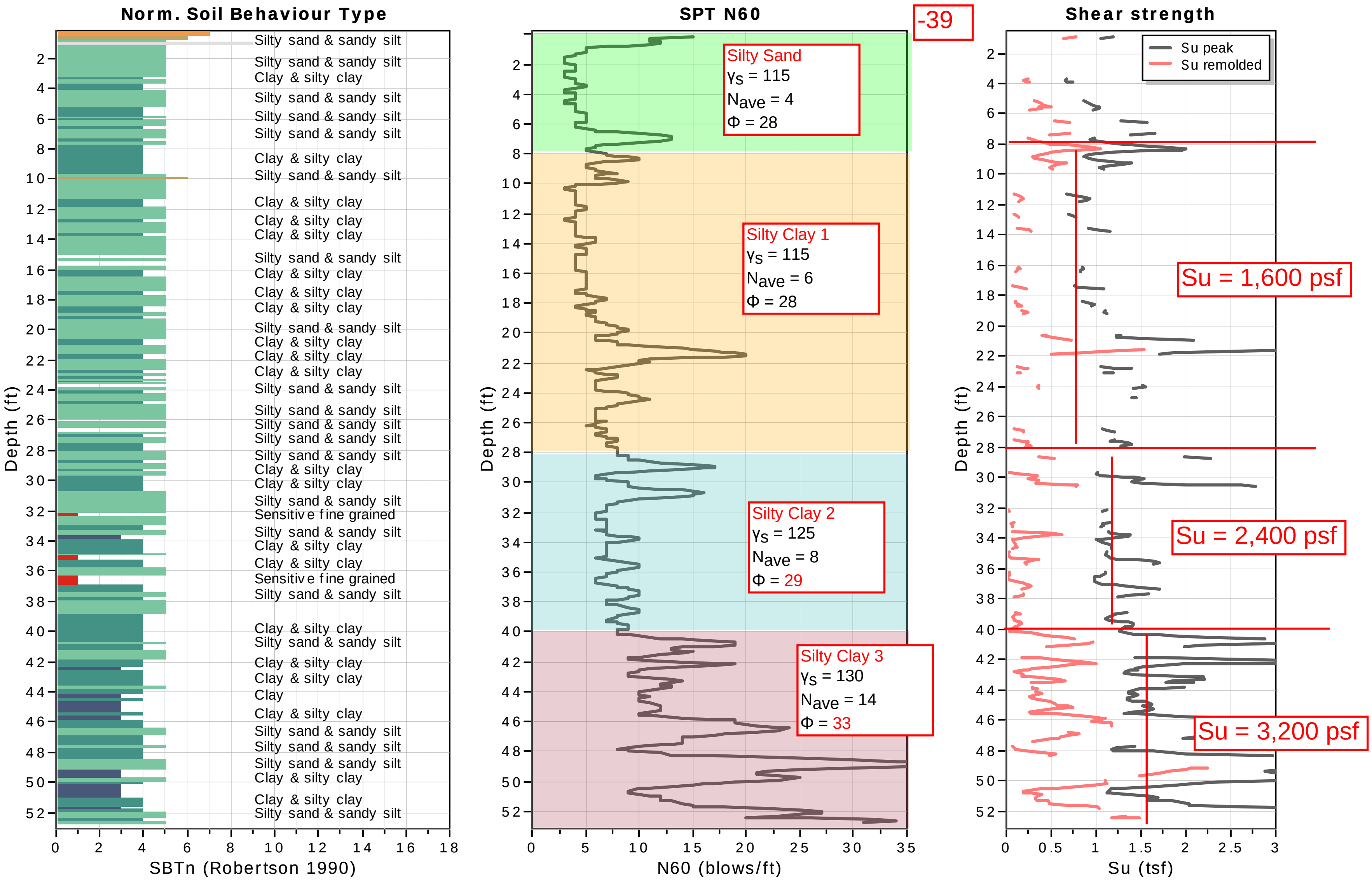
Section 01 and 02

ARCADIS
Geotechnical Engineers

CPT: CPT-3

Total depth: 53.08 ft, Date: 12/17/2014
Surface Elevation: 0.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Uknown

Project: HWS
Location: Hudson NY



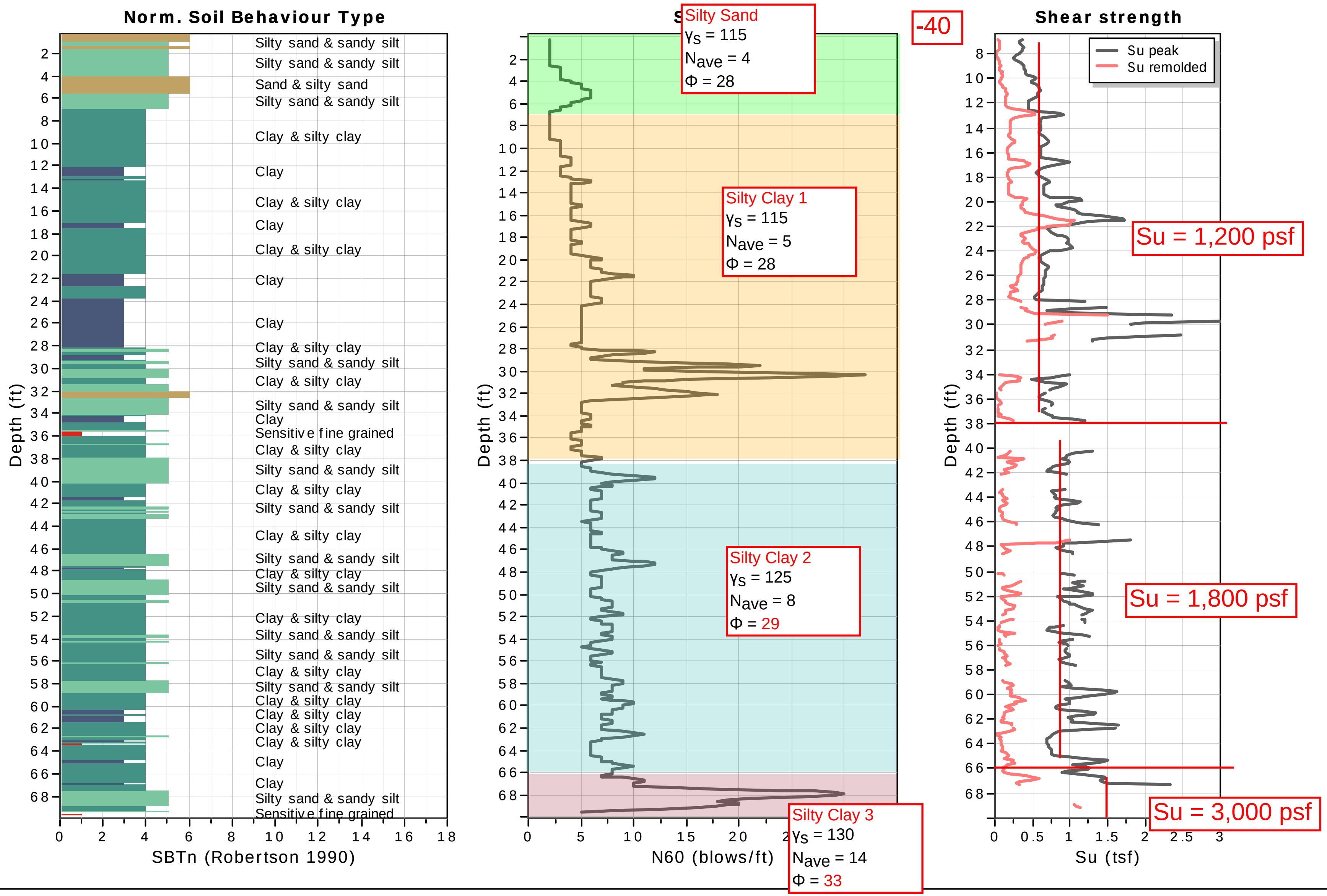
Section 02

ARCADIS
Geotechnical Engineers

CPT: CPT-2 B

Total depth: 69.95 ft, Date: 12/17/2014
Surface Elevation: -34.10 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Uknown

Project: **HWS**
Location: **Hudson NY**



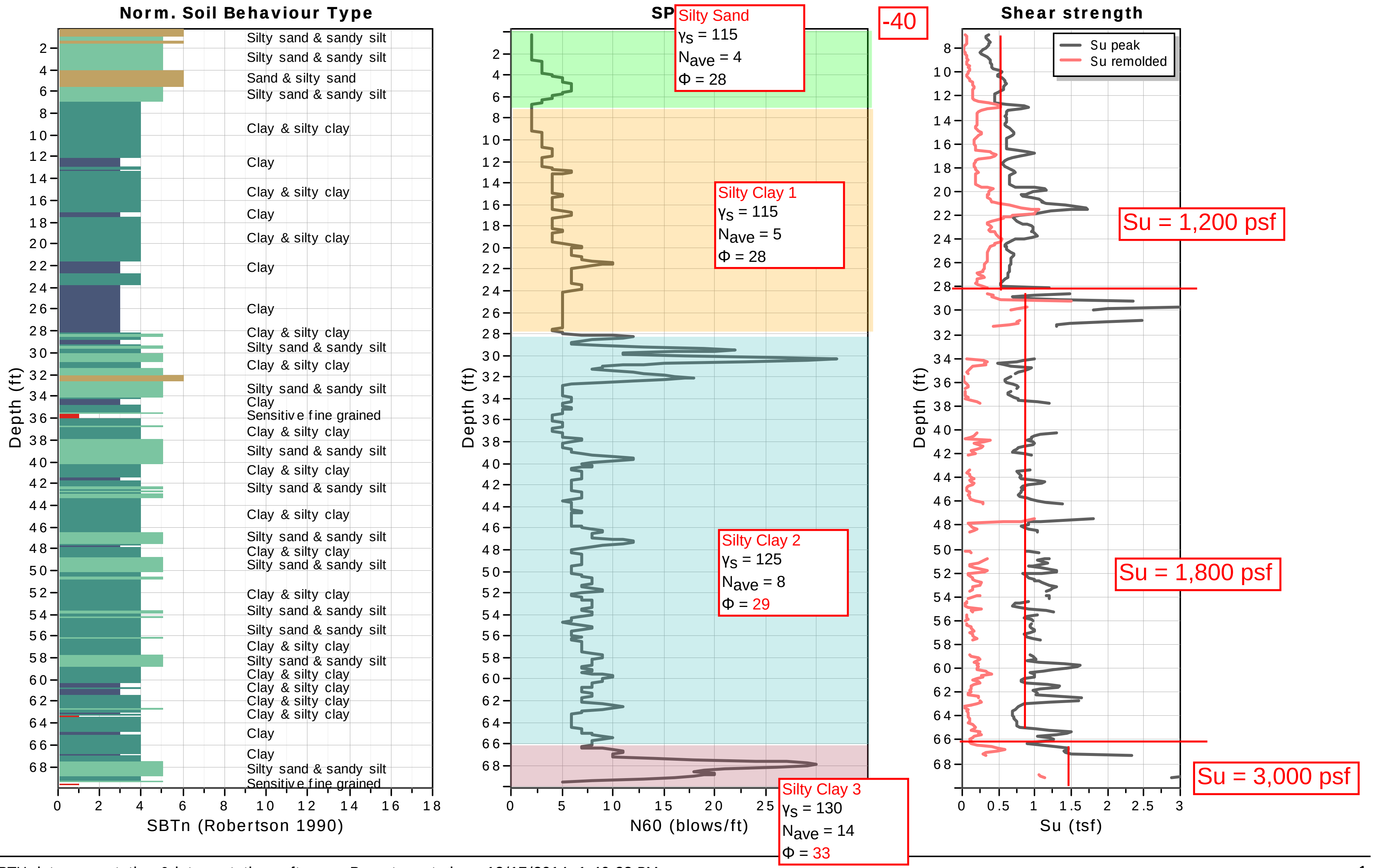
Section 03 and 04

ARCADIS
Geotechnical Engineers

CPT: CPT- 2

Total depth: 56.76 ft, Date: 12/17/2014
Surface Elevation: -32.10 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Uknown

Project: **HWS**
Location: **Hudson NY**



Section 03 and 04 3 - 9/4/2013

Drilling Company: Atlantic Testing Laboratories, Inc.
Driller's Name: M. Childs, T. Weston
Drilling Method: Casing
Casing Size: 4.0" ID
Rig Type: CME-850X
Sampling Method: 2 1/4" NX Core Barrel
3"x2' Split Spoon

Northing: 1246957.97
Easting: 681531.21
Casing Elevation: NA

Borehole Depth: 93' bss
Water Surface: 3.0' MLW
Sediment Surface Elev.: -8.9 ft NAVD88
Descriptions By: K. Warren

Well/Boring ID: GT-5

Client: National Grid
Project: Hudson Water Street-OU2
Location: Water Street
Hudson, NY

DEPTH	ELEVATION (NAVD88)	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blow Counts	N - Value	P. Penetrometer (tsf)	Analytical Sample	Geologic Column	Stratigraphic Description
0		1	0-2	1.5	1 WOH WOH WOH	WOH				Fat CLAY, some Silt, high plasticity, little fine sand, wet, very soft, grayish black (1-2.5/5GY), petroleum color, sheen on top 2" of sample.
		2	2-4	1.5	WOH WOH WOH WOH	WOH				Silty Fat CLAY, high plasticity, some Sand, wet, very soft, gray black (1-2.5/5GY), odor.
5	-15	3	4-6	1.2	WOH WOH WOH WOH	WOH				(3-3.2 ft bss) NAPL stained CLAY and poorly graded GRAVEL, wet, black. Lean CLAY, low to medium plasticity, little sand, trace gravel, trace organics, wet, very soft, grayish black (1-2.5/5GY), NAPL staining
		4	6-8	1.8	WOH 1 1 1	2				Silty Lean CLAY, medium plasticity, little sand, trace gravel, wet, very soft, grayish black (1-2.5/5GY), odor, NAPL stain.
10	-20	5	8-10	2.0	WOH WOH WOH WOH	WOH				SAA, some sand, trace gravel, trace organics.
15	-25	6	15-17	0.9	WR WR WR WR	WR				SILT, medium plasticity, little clay, little sand, wet, very soft, gray black (1-2.5/5GY), odor, NAPL stain. [LL = 55, PL = 33, MC = 55.7%]
		7	17-19	2.0		NA				SAA. [MC = 48.7%, UWd = 70.2 pcf, Su = 1.0 psi]
20	-30	8	20-22	NR	WR WR WR WR	WR				
25	-35	9	25-27	2.0	3 WOH WR WR	WOH				Poorly graded SAND, some Clay, medium plasticity, trace silt, trace gravel, wet, soft, grayish black (1-2.5/5GY). Lean CLAY, low plasticity, some Sand, little silt, wet, soft, grayish black (1-2.5/5GY).
30	-40	10	30-32	2.0	WOH WOH WOH WOH	WOH				SAA, very soft. [LL = 35, PL = 22, MC = 47.8%]
35	-45	11	35-37	0.7	9 7 5 4	12				Sandy SILT, little clay, nonplastic, gravel, saturated, very soft, grayish black (1-2.5/5GY), trace wood debris.
40	-50	12	40-42	1.6	14 6 8 9	14				Silty Lean CLAY, medium plasticity, trace sand, wet, soft to firm, grayish black (1-2.5/5GY). [MC = 23.3%, GS: #4 = 100%, #200 = 100%]
45	-55	13	45-47	2.0	7 5 3 2	8				
50	-60									

ARCADIS
Infrastructure, environment, buildings

Remarks:
SAA = same as above; bss = below sediment surface; NA = Not Applicable/Available; MLW = Mean Low Water; NAVD88 = North American Vertical Datum of 1988; NR = No Recovery; LL = Liquid Limit; PL = Plastic Limit; MC = Moisture Content; OC = Organic Content; GS = Grain Size, #4 and #200 refer to percent of soil finer than the #4 and #200 sieves during laboratory testing; UWd = Dry Unit Weight; Su = Undrained Shear Strength; SG = Specific Gravity; pcf = pounds per cubic foot; psi = pounds per square inch; HW = Highly Weathered; HF = Highly Fractured.
Top of Deck to Top of Water Surface: 27 ft.
Top of Deck to Top of Mudline: 41 ft.

Water Level Data

Date	Water Depth	MLW
9/3/13	14'	3.0'

Depth measured from top of deck

Date Start/Finish: 9/3/2013 - 9/4/2013 **Drilling Company:** Atlantic Testing Laboratories, Inc. **Driller's Name:** M. Childs, T. Weston **Drilling Method:** Casing **Casing Size:** 4.0" ID **Rig Type:** CME-850X **Sampling Method:** 2 1/4" NX Core Barrel 3"x2' Split Spoon	**Northing:** 1246957.97 **Easting:** 681531.21 **Casing Elevation:** NA **Borehole Depth:** 93' bss **Water Surface:** 3.0' MLW **Sediment Surface Elev.:** -8.9 ft NAVD88 **Descriptions By:** K. Warren	**Well/Boring ID: GT-5** **Client:** National Grid **Project:** Hudson Water Street-OU2 **Location:** Water Street Hudson, NY

DEPTH	ELEVATION (NAVD88)	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blow Counts	N - Value	P. Penetrometer (tsf)	Analytical Sample	Geologic Column	Stratigraphic Description
50		14	50-52	2.0	WOH WOH WOH 5	WOH				SAA.
55	-65	15	55-57	2.0	6 9 6 12	15				SAA, low plasticity, firm.
60	-70	16	60-62	2.0	13 9 4 3	13				SILT, some Lean CLAY, nonplastic to low plasticity, wet, firm, grayish black (1-2.5/5GY).
65	-75	17	65-67	2.0	6 1 1 3	2				SAA. [LL = NP, PL = NP, MC = 23.9%, GS: #200 = 100%, Silt = 79%, Clay = 21%]
		18	67-69	1.9		NA				SAA. [LL = NP, PL = NP, MC = 29.7%, UWd = 81.2 pcf, Su = 18.5 psi]
70	-80	19	70-72	2.0	2 3 3 16	6				SAA, soft to firm, gray (Gley 1-6/N).
75	-85	20	75-77	2.0	3 5 2 8	7				
80	-90	21	80-82	2.0	37 32 36 48	68				(Glacial Till) Poorly graded GRAVEL and SAND, angular, some Clay, nonplastic to low plasticity, wet, very dense, gray (Gley 1-6/N).
85	-95	R-1	83-88	10"/60"		NA				LIMESTONE, HF, HW, gray, reacts with HCL - calcite strings. 83-84 = 2:04 min RQD = 0% Strength = RO-RI 84-85 = 1:37 min 85-86 = 5:07 min 86-88 = 10:13 min Rock frag broken off, jammed barrel.
90	-100	R-2	88-93	10"/60"		NA				SAA. 88-93 = 23:00 min RQD = 0% Strength = RO Apparent Artesian encountered at 91.5 ft bss.
95	-105									End of Boring at 93 ft bss. Borehole backfilled with grout on 9/4/13.
100	-110									

ARCADIS
Infrastructure, environment, buildings

Remarks:
SAA = same as above; bss = below sediment surface; NA = Not Applicable/Available; MLW = Mean Low Water; NAVD88 = North American Vertical Datum of 1988; NR = No Recovery; LL = Liquid Limit; PL = Plastic Limit; MC = Moisture Content; OC = Organic Content; GS = Grain Size, #4 and #200 refer to percent of soil finer than the #4 and #200 sieves during laboratory testing; UWd = Dry Unit Weight; Su = Undrained Shear Strength; SG = Specific Gravity; pcf = pounds per cubic foot; psi = pounds per square inch; HW = Highly Weathered; HF = Highly Fractured.
Top of Deck to Top of Water Surface: 27 ft.
Top of Deck to Top of Mudline: 41 ft.

Water Level Data

Date	Water Depth	MLW
9/3/13	14'	3.0'

Depth measured from top of deck

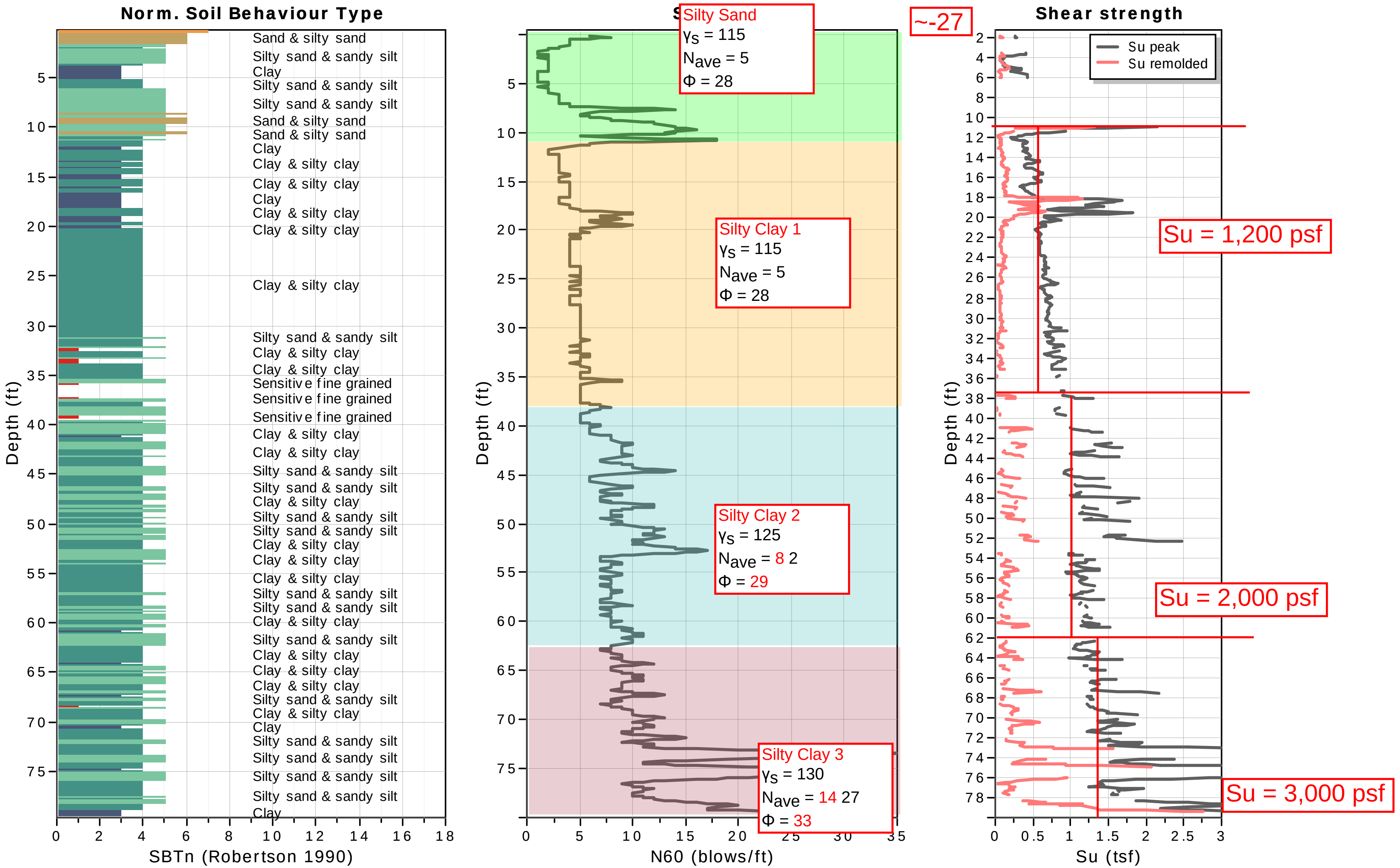
Section 04

ARCADIS
Geotechnical Engineers

CPT: CPT-1

Total depth: 79.66 ft, Date: 12/17/2014
Surface Elevation: 0.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Uknown

Project: **HWS**
Location: **Hudson NY**



Drilling Company: Atlantic Testing Laboratories, Inc.
Driller's Name: M. Childs, T. Weston
Drilling Method: Casing
Casing Size: 4.0" ID
Rig Type: CME-850X
Sampling Method: 3" x 2' Split Spoon

Northing: 1246874.65
Easting: 681446.60
Casing Elevation: NA

Borehole Depth: 89.1' bss
Water Surface: 3.7' MLW
Sediment Surface Elev.: -6.4 ft NAVD88
Descriptions By: K. Warren

Well/Boring ID: GT-1

Client: National Grid
Project: Hudson Water Street-OU2
Location: Water Street
Hudson, NY

DEPTH	ELEVATION (NAVD88)	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blow Counts	N - Value	P. Penetrometer (tsf)	Analytical Sample	Geologic Column	Stratigraphic Description
	-10									Pushed casing 3 feet into mudline for stability - very soft muck.
		1	3-5	0.8	8 5 4 3	9				Silty GRAVEL, angular, poorly graded, nonplastic, saturated, loose, olive gray (5Y-4/2).
5	-15	2	5-7	0.7	2 3 1 1	4				SAND and GRAVEL, angular, poorly graded, saturated, very loose, dark brown (7.5YR-3/4), olive gray (5Y-4/2).
		3	7-9	1.0	4 3 2 2	5				Medium SAND, some Gravel, trace Silt, well graded, angular, nonplastic, saturated, loose, greenish black (1-2.5/5GY), trace sheen.
10	-20	4	9-11	1.2	1 1 2 1	3				SAA, very loose. [MC = 28.8%, GS: #4 = 73%, #200 = 5.8%]
15	-25									
20	-30	5	19-21	1.4	7 2 2 2	4				Medium fine SAND, some GRAVEL, angular, poorly graded, little clay, low plasticity, saturated, loose, greenish black (1-2.5/5GY), trace sheen.
25	-35	6	24-26	1.0	4 2 1 1	3	0.188			Clayey very fine SAND, subrounded to subangular, poorly graded, low plasticity, wet, very loose, greenish black (1-2.5/5GY).
30	-40	7	29-31	1.4	15 10 9 9	19	3.75			Silty Lean CLAY, medium plasticity, trace sand, wet, firm, greenish black (1-2.5/5GY). [LL = 35, PL = 21, MC = 40.7%, GS: #200 = 100%, Silt = 26%, Clay = 74%]
35		8	34-36	2.0	WOH WOH WOH WOH	WOH	0.11			Lean CLAY, medium plasticity, wet, soft, greenish black (1-2.5/5GY).
	-45	9	36-38	1.8		NA				SAA. [LL = 28, PL = 16, MC = 28.1%, GS: #4 = 100%, #200 = 99%, UWd = 86.8 pcf, SG = 2.77, Su = 3.5 psi]
40		10	39-41	2.0	WOR WOH 1 3	1	0.17			SAA, olive gray (5Y-4/2).
	-50		42							Vane shear test; Tmax = 175 lbf; time to failure = 2.15 min rate of remould = 1 min; tmax = 45; H = 4 in D = 3 in, non-tapered
45	-55	11	44-46	2.0	2 1 1 1	2	0.14 0			SAA, saturated, grades to very soft.
		12	49-51	1.0	1 1	2				SAA

Remarks:

SAA = same as above; bss = below sediment surface; NA = Not Applicable/Available; MLW = Mean Low Water; NAVD88 = North American Vertical Datum of 1988; NR = No Recovery; LL = Liquid Limit; PL = Plastic Limit; MC = Moisture Content; OC = Organic Content; GS = Grain Size, #4 and #200 refer to percent of soil finer than the #4 and #200 sieves during laboratory testing; UWd = Dry Unit Weight; Su = Undrained Shear Strength; SG = Specific Gravity; pcf = pounds per cubic foot; psi = pounds per square inch.
Top of Deck to Top of Water Surface: 11.7 ft.
Top of Deck to Top of Mudline: 24 ft.
Vane Shear dimensions: H = 4 in. D = 3 in., non-tapered.

Water Level Data

Date	Water Depth	MLW
9/9/13	12.3'	3.7'

Depth measured from top of deck

ARCADIS
Infrastructure, environment, buildings

Date Start/Finish: 9/9/2013 - 9/10/2013 **Drilling Company:** Atlantic Testing Laboratories, Inc. **Driller's Name:** M. Childs, T. Weston **Drilling Method:** Casing **Casing Size:** 4.0" ID **Rig Type:** CME-850X **Sampling Method:** 3" x 2' Split Spoon	**Northing:** 1246874.65 **Easting:** 681446.60 **Casing Elevation:** NA **Borehole Depth:** 89.1' bss **Water Surface:** 3.7' MLW **Sediment Surface Elev.:** -6.4 ft NAVD88 **Descriptions By:** K. Warren	**Well/Boring ID: GT-1** **Client:** National Grid **Project:** Hudson Water Street-OU2 **Location:** Water Street Hudson, NY

DEPTH	ELEVATION (NAVD88)	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blow Counts	N - Value	P. Penetrometer (tsf)	Analytical Sample	Geologic Column	Stratigraphic Description
	-60				1 WOH					Lean CLAY, medium plasticity, wet, soft, greenish black (1-2.5/5GY).
55	-65	13	54-56	2.0	WOH WOH 3 5	3				SAA, grades from very soft to firm.
60	-70	14	59-61	2.0	1 WOH WOH 3	WOH	0.11			SAA, grades from very soft to soft.
			62							Vane shear test; Tmax = 80 lbf; time to failure = 1.26 min rate of remould = 2.39 min; tmax = 60; H = 4 in D = 3 in, non-tapered
65		15	64-66	2.0	7 1 1 2	2				SILT and Lean CLAY, medium to high plasticity, saturated, very soft, greenish black (1-2.5/5GY)
	-75	16	66-68	1.8		NA				SAA. [LL = 24, PL = 18, MC = 28.3%, UWd = 85.2 pcf, SG = 2.77, Su = 6.0 psi]
70	-80	17	69-71	1.2	1 1 1 2	2				SAA, firm to very soft.
75	-85	18	74-76	1.8	WOH WOH 2 6	2	0.22 0.14			SAA, firm.
80	-90	19	79-81	2.0	8 5 4 5	9	0.16			Lean CLAY, medium plasticity, wet, firm, greenish black (1-2.5/5GY).
85	-95	20	84-86	1.4	17 25 47 39	72				(Glacial Till) Clayey medium SAND, low plasticity, angular, some Gravel, trace silt, saturated, very dense, greenish black (1-2.5/5GY).
		21	89-89.1	NR	50/1"	50+				Apparent weathered ROCK encountered at 87' bss. Rollerbit from 87' to 89' bss. Apparent competent ROCK at 89.1' bss.
90	-100									End of Boring at 89.1 ft bss. Borehole backfilled with grout on 9/10/13.
95	-105									

ARCADIS
Infrastructure, environment, buildings

Remarks:
SAA = same as above; bss = below sediment surface; NA = Not Applicable/Available; MLW = Mean Low Water; NAVD88 = North American Vertical Datum of 1988; NR = No Recovery; LL = Liquid Limit; PL = Plastic Limit; MC = Moisture Content; OC = Organic Content; GS = Grain Size, #4 and #200 refer to percent of soil finer than the #4 and #200 sieves during laboratory testing; UWd = Dry Unit Weight; Su = Undrained Shear Strength; SG = Specific Gravity; pcf = pounds per cubic foot; psi = pounds per square inch.
Top of Deck to Top of Water Surface: 11.7 ft.
Top of Deck to Top of Mudline: 24 ft.
Vane Shear dimensions: H = 4 in. D = 3 in., non-tapered.

Water Level Data

Date	Water Depth	MLW
9/9/13	12.3'	3.7'

Depth measured from top of deck

ATLANTIC TESTING LABORATORIES
Canton
6431 U.S. Highway 11
P.O. Box 29
Canton, NY 13617
315-386-4578 (T)
315-386-1012 (F)

January 20, 2014

ARCADIS
6723 Towpath Road
PO Box 66
Syracuse, New York 13214-0066

Attn: Mr. Adam Chwalibog, PE
Geotechnical Engineer

Re: **Laboratory Analysis Services**
Hudson Water Street – Operable Unit 2
Hudson, Columbia County, New York
ATL No. CD3574D-02-12-13 Rev. 1

Ladies and Gentleman:

At the request of Mr. Adam Chwalibog, PE, representing ARCADIS, and in accordance with our proposal (ATL No. CD998-376XX-10-12 dated December 21, 2012), Atlantic Testing Laboratories, Limited (ATL) performed a subsurface investigation and laboratory analysis services for the referenced project.

Select soil samples were submitted to ATL's laboratory for geotechnical analysis. Twelve samples were analyzed in accordance with ASTM D 422 Particle Size Analysis of Soil without Hydrometer. Seven samples were analyzed in accordance with ASTM D 422 Particle Size Analysis of Soil with Hydrometer. The **Particle Size Analysis Results** are included in **Attachment A**.

Twenty-four soil samples were analyzed in accordance with ASTM D 2216 Moisture Content Test. The **Moisture Content Results** are included are included in **Attachment B**.

Seventeen soil samples were analyzed in accordance with ASTM D 4318 Liquid Limit, Plastic Limit, and Plasticity Index of Soils. The **Atterberg Limit Test Results** are included in **Attachment C**.

Three soil samples were analyzed in accordance with ASTM D 2974 Percent Organics Test. The Percent Organics test results are included on the Particle Size Analysis Results in Attachment A.

Two soil samples were analyzed in accordance with ASTM D 4767 Consolidated-Undrained Triaxial Compression Test. The **Consolidated-Undrained Triaxial Compression Test Results** are included in **Attachment D**.

Four soil samples were analyzed in accordance with ASTM D 2859 Unconsolidated-Undrained Triaxial Compression Test. The **Unconsolidated-Undrained Triaxial Compression Test Results** are included in **Attachment E**.

Two soil samples were analyzed in accordance with ASTM D 2435 One-Dimensional Consolidation Properties of Soils Using Incremental Loading. The **One-Dimensional Consolidation Test Results** are included in **Attachment F**.

Five soil samples were analyzed in accordance with ASTM D 854 Specific Gravity of Soil Solids by Water Pycnometer. The Specific Gravity test results are included on the Consolidated-Undrained Triaxial Compression Test Results in Attachment D and the Unconsolidated-Undrained Triaxial Compression Test Results in Attachment E.

The soil samples obtained during this investigation will be retained for a period of 6 months and subsequently discarded, unless otherwise instructed.

Please contact our office should you have any questions, or if we may be of further service. We look forward to our continued association to obtain a successful completion of the project.

Sincerely,
ATLANTIC TESTING LABORATORIES, Limited

Adrienne E. Mackey

Adrienne E. Mackey
Project Manager

AEM/AJS/aem
Enclosures

ATTACHMENT A

PARTICLE SIZE ANALYSIS RESULTS

Particle Size Distribution Report

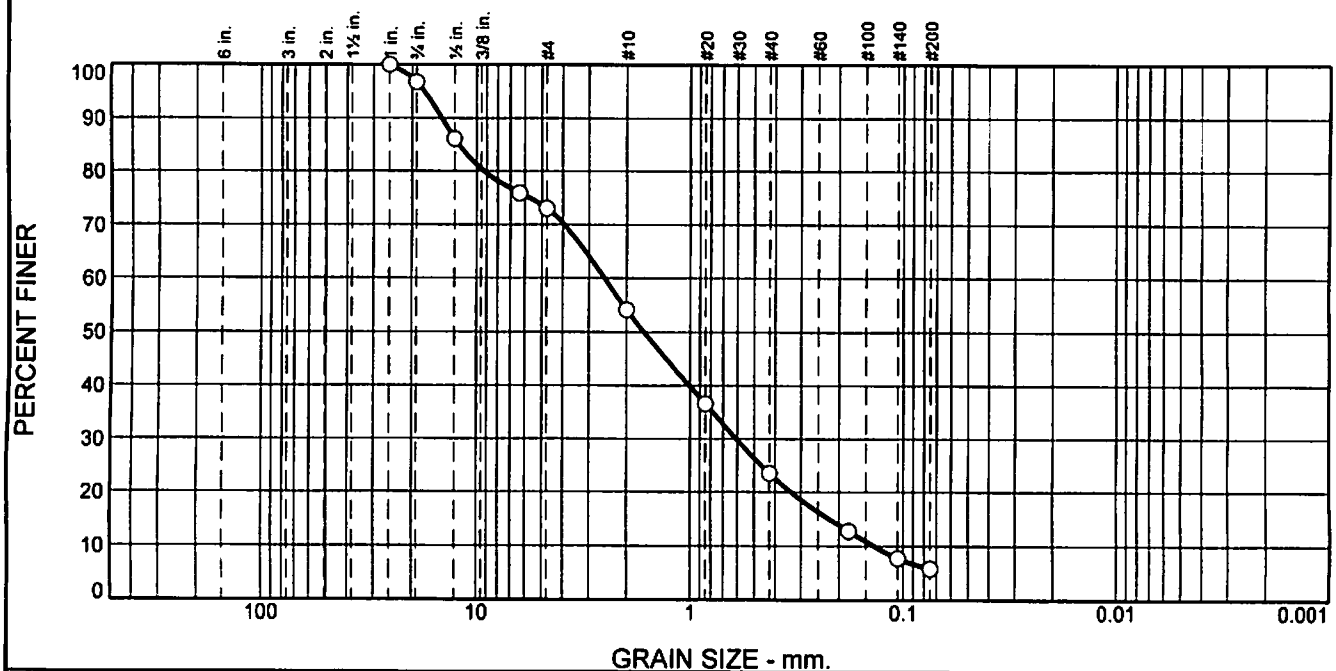
Project: Hudson Water Street - Operable Unit 2 Hudson, NY **Report No.:** CD3574SL-01-11-13

Client: ARCADIS US, Inc. **Date:** 11/1/2013

Sample No: GT-1; S-4 **Source of Sample:** Boring Sample

Location:

Elev./Depth: 9.0 - 11.0'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	3	24	19	30	18	6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
1"	100		
3/4"	97		
1/2"	86		
1/4"	76		
#4	73		
#10	54		
#20	37		
#40	24		
#80	13		
#140	8		
#200	5.8		

Soil Description

Grey cm+f SAND; some mf+ GRAVEL; trace SILT

Atterberg Limits

PL= -- LL= -- PI= --

Coefficients

D_{85}= 12.1409 D_{60}= 2.5413 D_{50}= 1.6648
D_{30}= 0.6081 D_{15}= 0.2218 D_{10}= 0.1376
C_u= 18.47 C_c= 1.06

Classification

USCS= SW-SM AASHTO=

Remarks

Moisture content 28.8%

* (no specification provided)

ATLANTIC TESTING LABORATORIES, LIMITED **Figure**

Reviewed by: [signature]

Date: 12/3/13

Particle Size Distribution Report

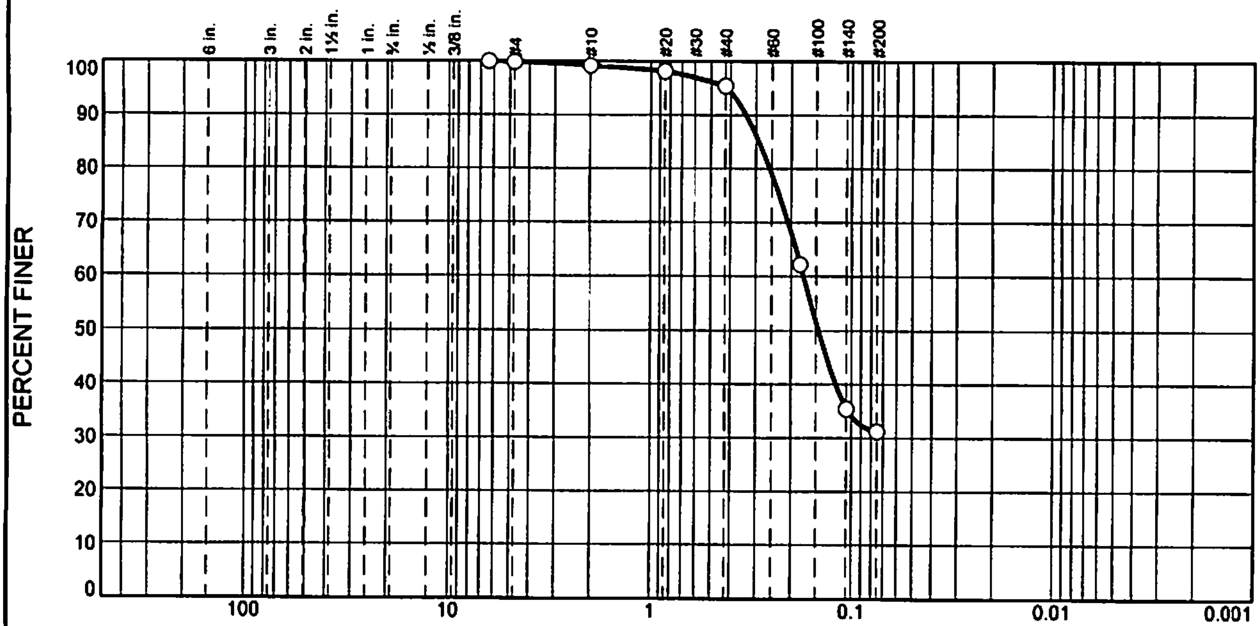
Project: Hudson Water Street - Operable Unit 2 Hudson, NY **Report No.:** CD3574SL-05-11-13

Client: ARCADIS US, Inc. **Date:** 11/01/2013

Sample No: GT-2; S-3 **Source of Sample:** Boring Sample

Location:

Elev./Depth: 4.0 - 6.0'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	1	4	64	31	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
1/4"	100		
#4	100		
#10	99		
#20	98		
#40	95		
#80	62		
#140	35		
#200	31		

Soil Description

Grey cmf- SAND; some SILT; trace ORGANIC MATERIAL

Atterberg Limits

PL= -- LL= -- PI= --

Coefficients

D_{85}= 0.2906 D_{60}= 0.1734 D_{50}= 0.1460
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Moisture content 29.4%
Organic content 2.3%

* (no specification provided)

Figure

ATLANTIC TESTING LABORATORIES, LIMITED

Reviewed by: [signature]

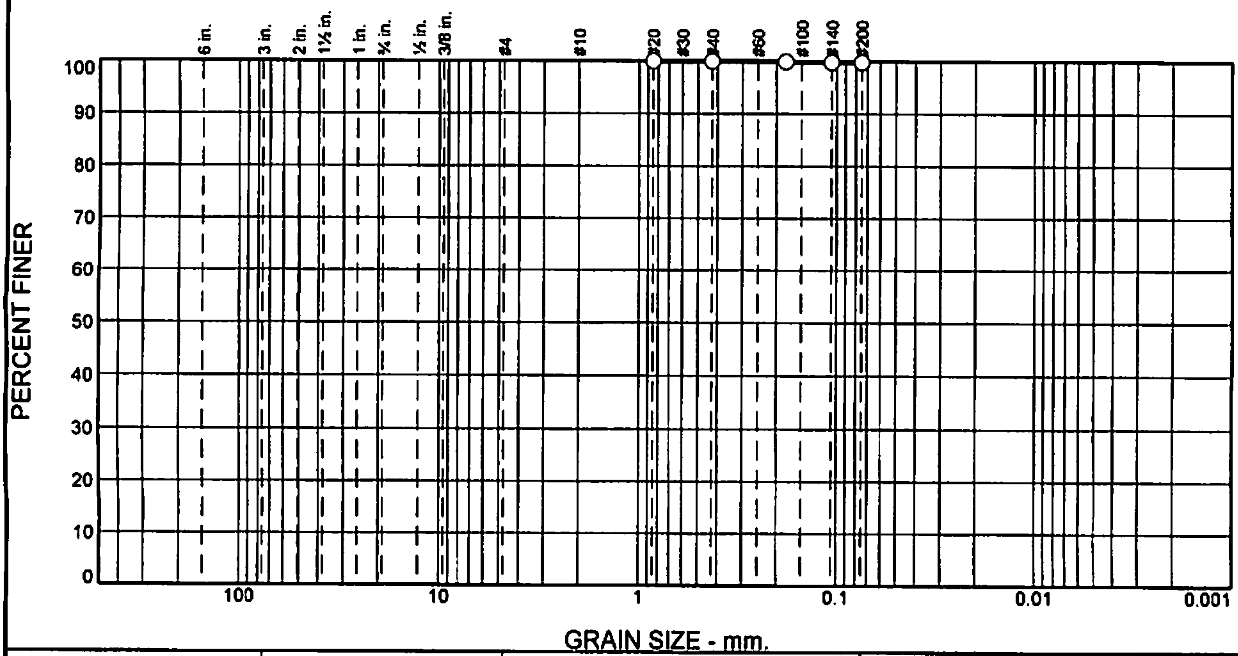
Date: 12/3/13

Particle Size Distribution Report

Project: Hudson Water Street - Operable Unit 2 Hudson, NY **Report No.:** CD3574-SL-06-11-13

Client: ARCADIS US, Inc. **Date:** 11/01/2013

Sample No: GT-2; S-7 **Source of Sample:** Boring Sample
Location: **Elev./Depth:** 20.0 - 22.0'



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	0	0	0	100	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
#20	100		
#40	100		
#80	100		
#140	100		
#200	100		

Soil Description

Grey CLAY; and SILT

Atterberg Limits

PL= 20 LL= 33 PI= 13

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL AASHTO=

Remarks

Moisture content 26.3%

* (no specification provided)

Figure

ATLANTIC TESTING LABORATORIES, LIMITED

Reviewed by: [signature]

Date: 1/20/14

Particle Size Distribution Report

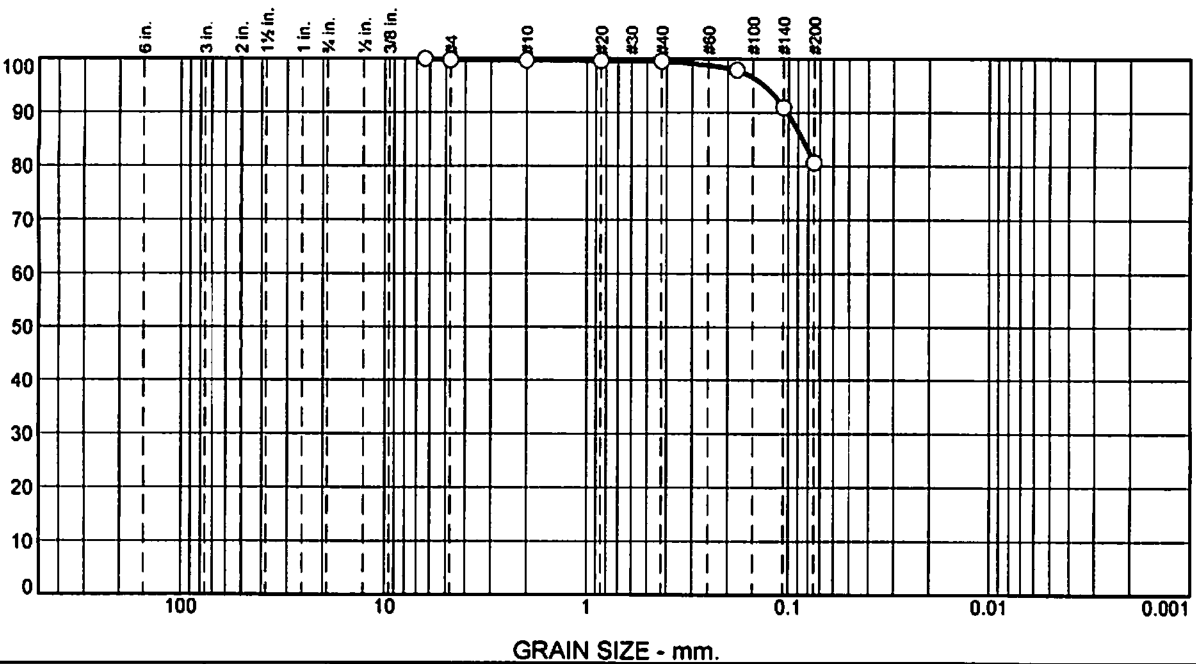
Project: Hudson Water Street - Operable Unit 2 Hudson, NY **Report No.:** CD3574SL-09-11-13

Client: ARCADIS US, Inc. **Date:** 11/01/2013

Sample No: GT-2; S-18 **Source of Sample:** Boring Sample

Location:

Elev./Depth: 65.0 - 67.0'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	0	0	19	81	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
1/4"	100		
#4	100		
#10	100		
#20	100		
#40	100		
#80	98		
#140	91		
#200	81		

Soil Description

Grey SILT; some CLAY; little f SAND

Atterberg Limits

PL= -- LL= -- PI= --

Coefficients

D_{85}= 0.0859 D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL AASHTO=

Remarks

Moisture content 17.4%

* (no specification provided)

Figure

ATLANTIC TESTING LABORATORIES, LIMITED

Reviewed by: [signature]

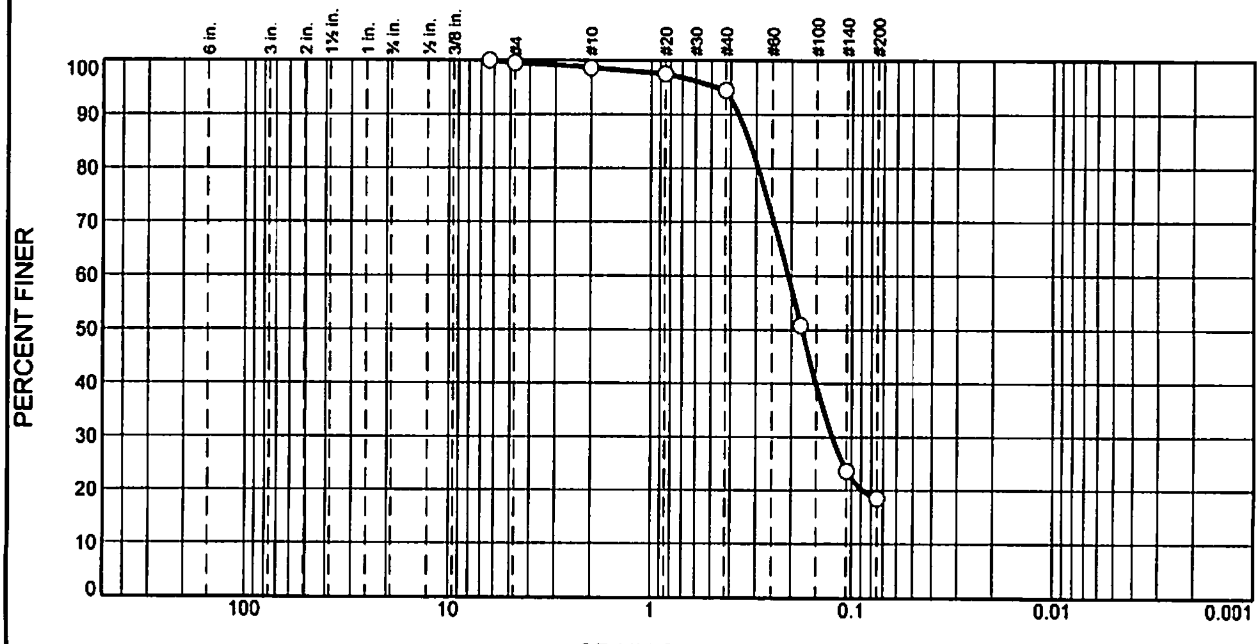
Date: 12/3/13

Particle Size Distribution Report

Project: Hudson Water Street - Operable Unit 2 Hudson, NY **Report No.:** CD3574SL-10-11-13

Client: ARCADIS US, Inc. **Date:** 11/01/2013

Sample No: GT-3; S-3 **Source of Sample:** Boring Sample
Location: **Elev./Depth:** 4.0 - 6.0'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	1	5	76	18	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
1/4"	100		
#4	100		
#10	99		
#20	98		
#40	94		
#80	51		
#140	24		
#200	18		

Soil Description

Grey cmf+ SAND; little SILT; trace ORGANIC MATERIAL

Atterberg Limits

PL= -- LL= -- PI= --

Coefficients

D_{85}= 0.3255 D_{60}= 0.2082 D_{50}= 0.1777
D_{30}= 0.1252 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO=

Remarks

Moisture content 23.2%
Organic content 3.1%

* (no specification provided)

Figure

ATLANTIC TESTING LABORATORIES, LIMITED

Reviewed by: ______

Date: 12/3/13

Particle Size Distribution Report

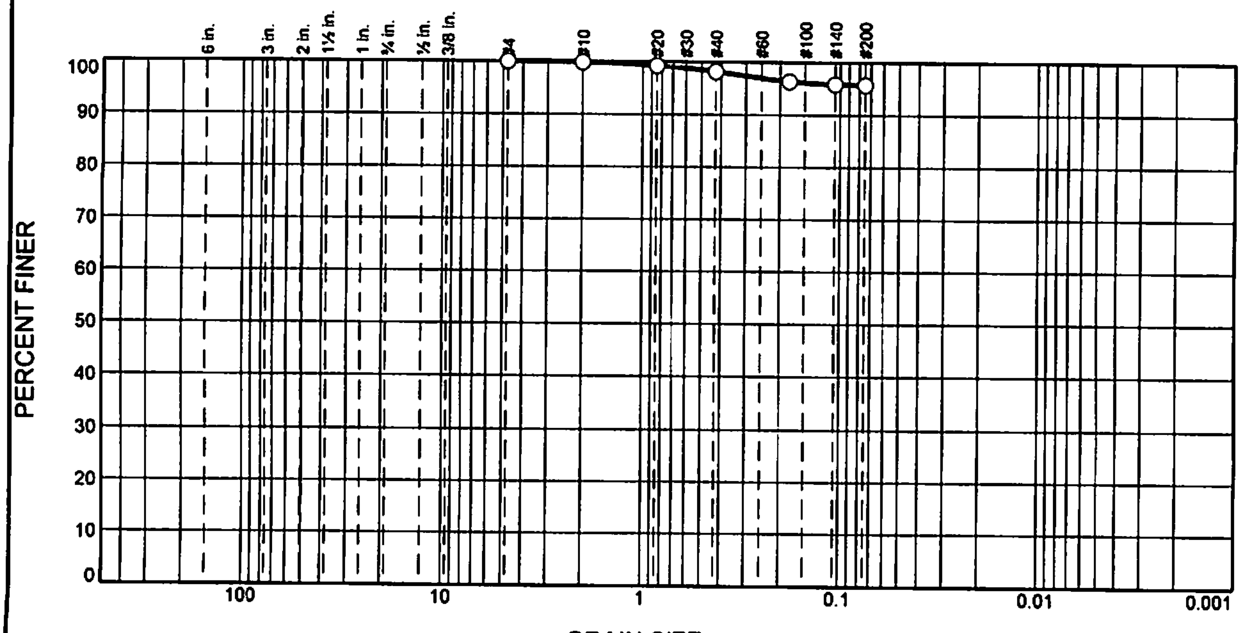
Project: Hudson Water Street - Operable Unit 2 Hudson, NY **Report No.:** CD3574SL-11-11-13

Client: ARCADIS US, Inc. **Date:** 11/01/2013

Sample No: GT-3; S-6 **Source of Sample:** Boring Sample

Location:

Elev./Depth: 15.0 - 17.0'



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	0	2	2	96	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
#4	100		
#10	100		
#20	99		
#40	98		
#80	96		
#140	96		
#200	96		

Soil Description

Grey CLAY; trace mf SAND

Atterberg Limits

PL= 19 LL= 28 PI= 9

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL AASHTO=

Remarks

Moisture content 23.4%

* (no specification provided)

ATLANTIC TESTING LABORATORIES, LIMITED

Figure

Reviewed by: [signature]

Date: 1/20/14

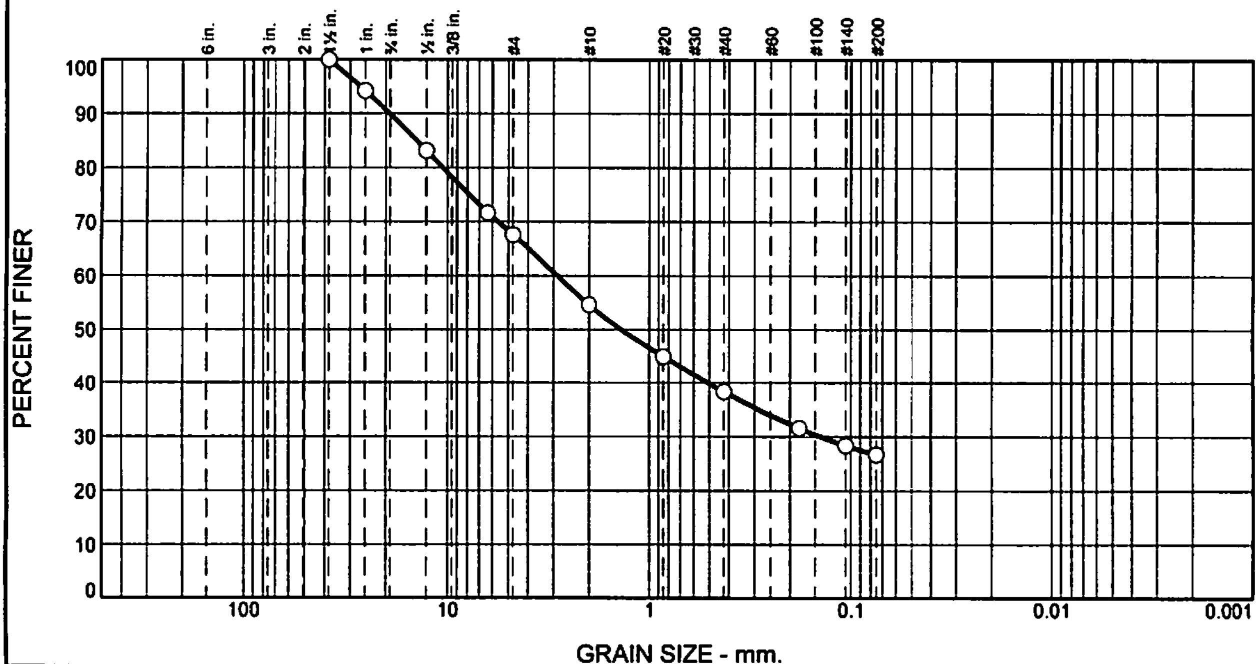
Particle Size Distribution Report

Project: Hudson Water Street - Operable Unit 2 Hudson, NY **Report No.:** CD3574SL-14-11-13

Client: ARCADIS US, Inc. **Date:** 11/01/2013

Sample No: GT-3; S-16 **Source of Sample:** Boring Sample

Location: **Elev./Depth:** 60.0 - 62.0'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	10	22	13	17	11	27	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
1-1/2"	100		
1"	94		
1/2"	83		
1/4"	72		
#4	68		
#10	55		
#20	45		
#40	38		
#80	32		
#140	28		
#200	27		

Soil Description

Grey cmf SAND; some cmf GRAVEL; some SILT

Atterberg Limits

PL= -- LL= -- PI= --

Coefficients

D_{85}= 14.1820 D_{60}= 2.8763 D_{50}= 1.3800
D_{30}= 0.1414 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Moisture content 5.9%

* (no specification provided)

Figure

ATLANTIC TESTING LABORATORIES, LIMITED

Reviewed by: [signature] Date: 12/3/13

Particle Size Distribution Report

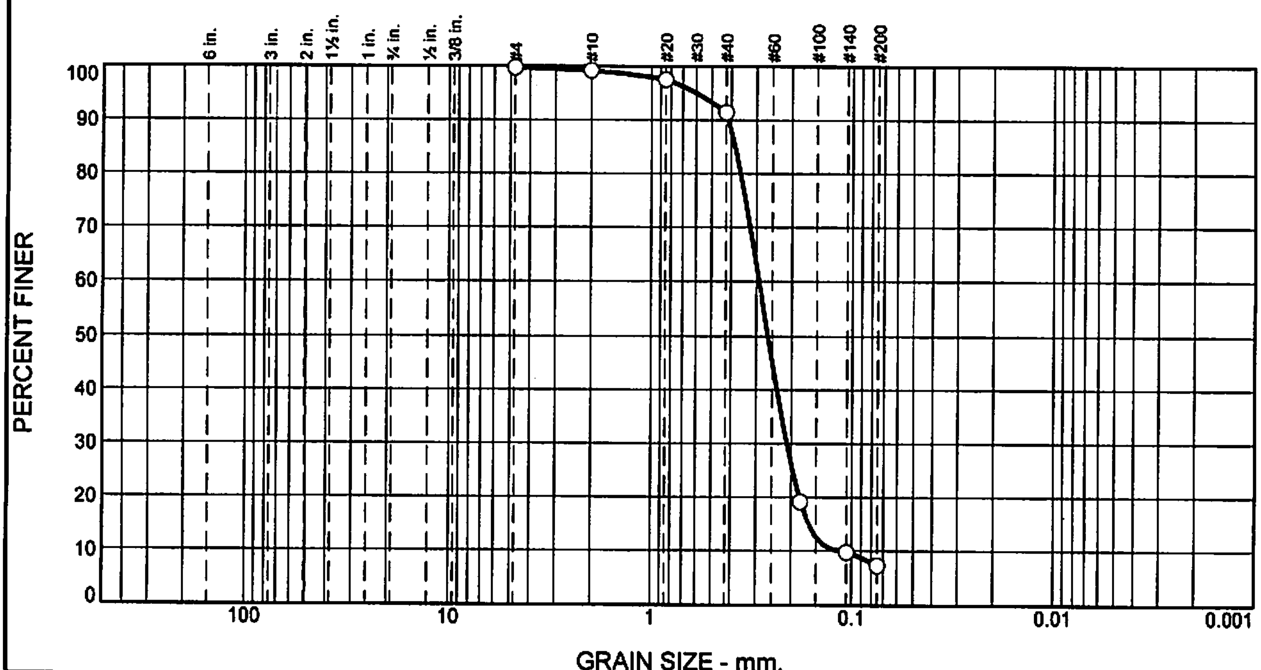
Project: Hudson Water Street - Operable Unit 2 Hudson, NY **Report No.:** CD3574SL-15-11-13

Client: ARCADIS US, Inc. **Date:** 11/01/2013

Sample No: GT-4; S-3 **Source of Sample:** Boring Sample

Location:

Elev./Depth: 4.0 - 6.0'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
			1	8	84	7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
#4	100		
#10	99		
#20	98		
#40	91		
#80	19		
#140	10		
#200	7.3		

* (no specification provided)

Soil Description

Grey cmf+ SAND; trace SILT; trace ORGANIC MATERIAL

Atterberg Limits

PL= -- LL= -- PI= --

Coefficients

D_{85}= 0.3841 D_{60}= 0.2902 D_{50}= 0.2624
D_{30}= 0.2111 D_{15}= 0.1637 D_{10}= 0.1143
C_u= 2.54 C_c= 1.34

Classification

USCS= SP AASHTO=

Remarks

Moisture content 21.6%
Organic content 0.7%

Figure

ATLANTIC TESTING LABORATORIES, LIMITED

Reviewed by: [signature]

Date: 12/3/13

Particle Size Distribution Report

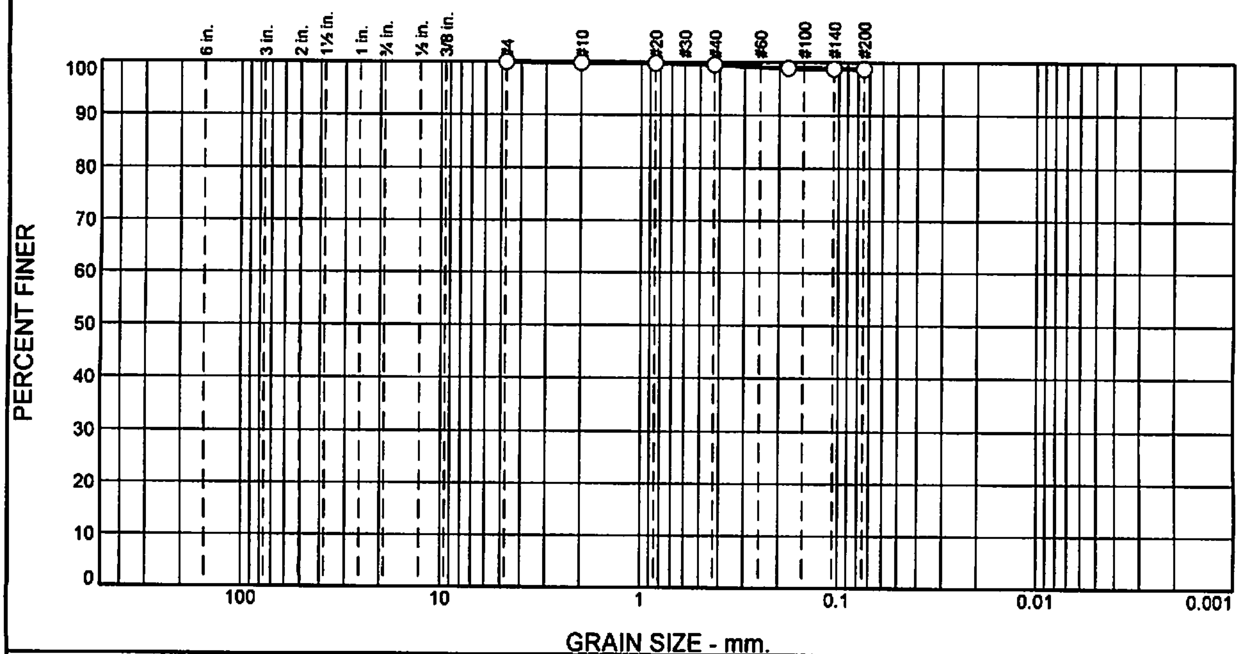
Project: Hudson Water Street - Operable Unit 2 Hudson, NY **Report No.:** CD3574SL-16-11-13

Client: ARCADIS US, Inc. **Date:** 11/01/2013

Sample No: GT-4; S-7 **Source of Sample:** Boring Sample

Location:

Elev./Depth: 18.0 - 20.0'



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	0	0	1	99	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
#4	100		
#10	100		
#20	100		
#40	100		
#80	99		
#140	99		
#200	99		

Soil Description

Grey CLAY; and SILT; trace f SAND

Atterberg Limits

PL= 19 LL= 28 PI= 9

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO=

Remarks

Moisture content 35.1%

* (no specification provided)

ATLANTIC TESTING LABORATORIES, LIMITED

Figure

Reviewed by: [signature]

Date: 1/20/14

Particle Size Distribution Report

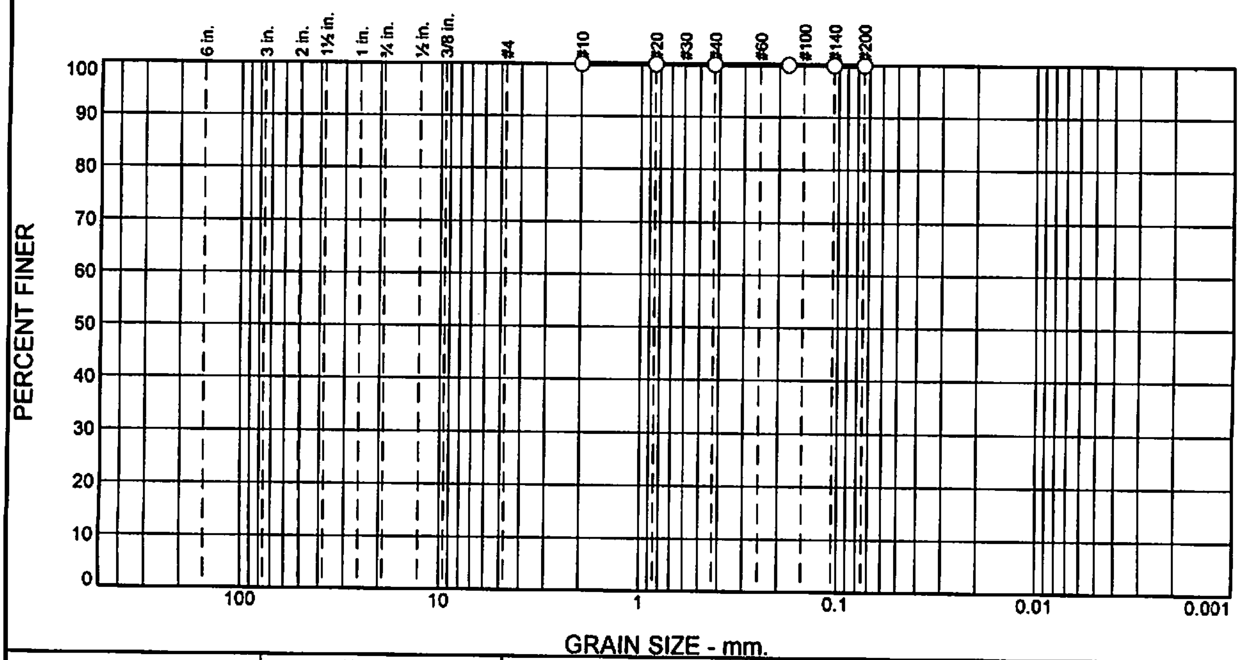
Project: Hudson Water Street - Operable Unit 2 Hudson, NY **Report No.:** CD3574SL-18-11-13

Client: ARCADIS US, Inc. **Date:** 11/01/2013

Sample No: GT-4; S-13 **Source of Sample:** Boring Sample

Location:

Elev./Depth: 38.0 - 40.0'



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	0	0	0	100	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
#10	100		
#20	100		
#40	100		
#80	100		
#140	100		
#200	100		

* (no specification provided)

Soil Description

Grey CLAY; and SILT

Atterberg Limits

PL= 22 LL= 30 PI= 8

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO=

Remarks

Moisture content 24.5%

Figure

ATLANTIC TESTING LABORATORIES, LIMITED

Reviewed by: [signature]

Date: 1/20/14

Particle Size Distribution Report

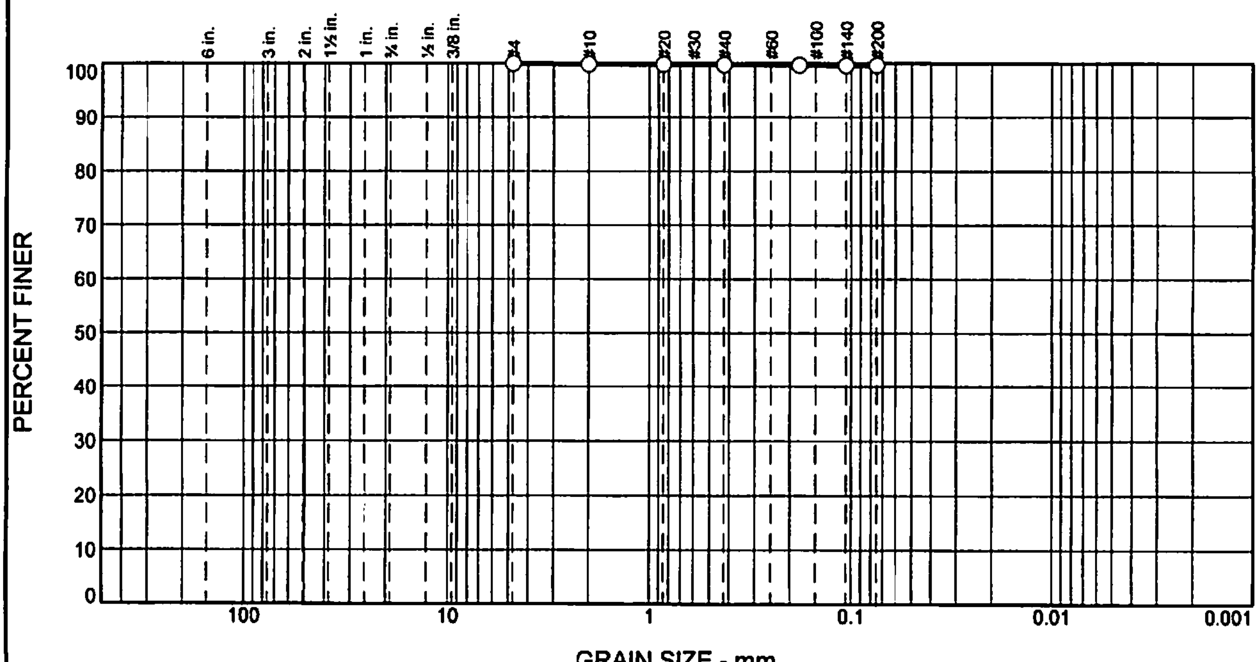
Project: Hudson Water Street - Operable Unit 2 Hudson, NY **Report No.:** CD3574SL-22-11-13

Client: ARCADIS US, Inc. **Date:** 11/01/2013

Sample No: GT-5; S-12 **Source of Sample:** Boring Sample

Location:

Elev./Depth: 40.0 - 42.0'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	0	0	0	100	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
#4	100		
#10	100		
#20	100		
#40	100		
#80	100		
#140	100		
#200	100		

Soil Description

Grey CLAY; and SILT

Atterberg Limits

PL= -- LL= -- PI= --

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL AASHTO=

Remarks

Moisture content 23.3%

* (no specification provided)

ATLANTIC TESTING LABORATORIES, LIMITED

Figure

Reviewed by: [signature]

Date: 12/3/13

Particle Size Distribution Report

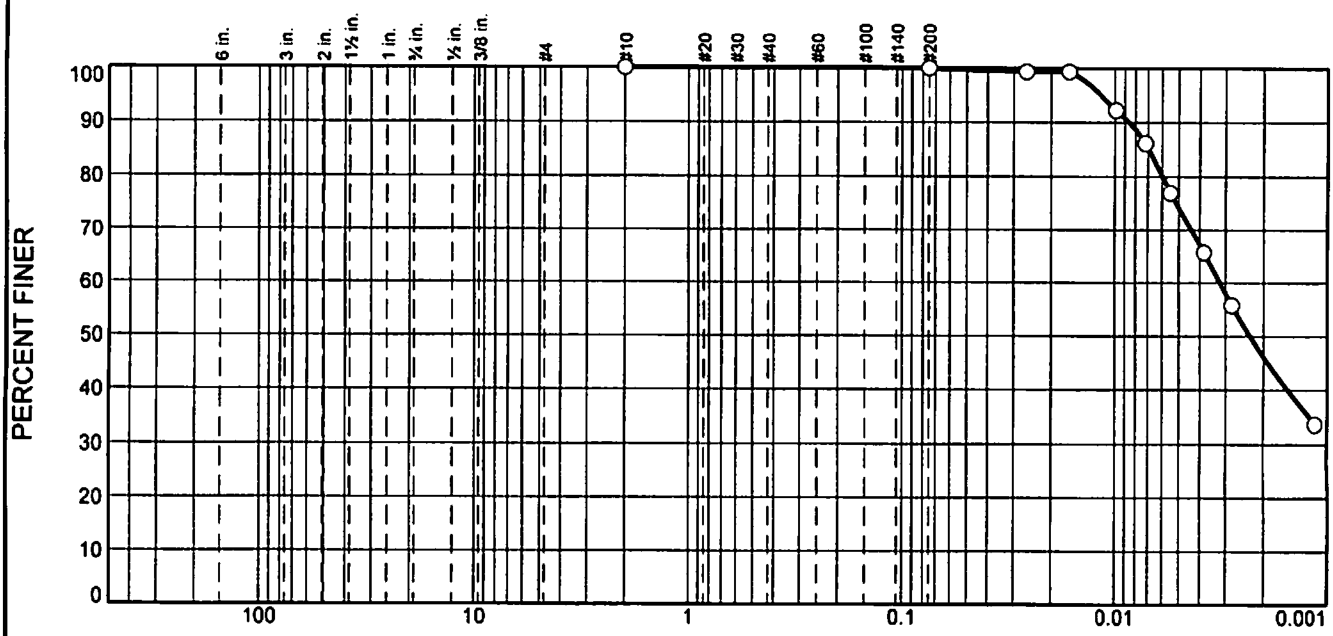
Project: Hudson Water Street - Operable Unit 2 Hudson, NY **Report No.:** CD3574SL-02-11-13

Client: ARCADIS US, Inc. **Date:** 11/1/2013

Sample No: GT-1; S-7 **Source of Sample:** Boring Sample

Location:

Elev./Depth: 29.0 - 31.0'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	0	0	0	26	74

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
#10	100		
#200	100		

Soil Description

Grey CLAY; some SILT

Atterberg Limits

PL= 21 LL= 35 PI= 14

Coefficients

D_{85}= 0.0069 D_{60}= 0.0032 D_{50}= 0.0023
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL AASHTO=

Remarks

Moisture content 40.7%

* (no specification provided)

Figure

ATLANTIC TESTING LABORATORIES, LIMITED

Reviewed by:

Date: 12/3/13

Particle Size Distribution Report

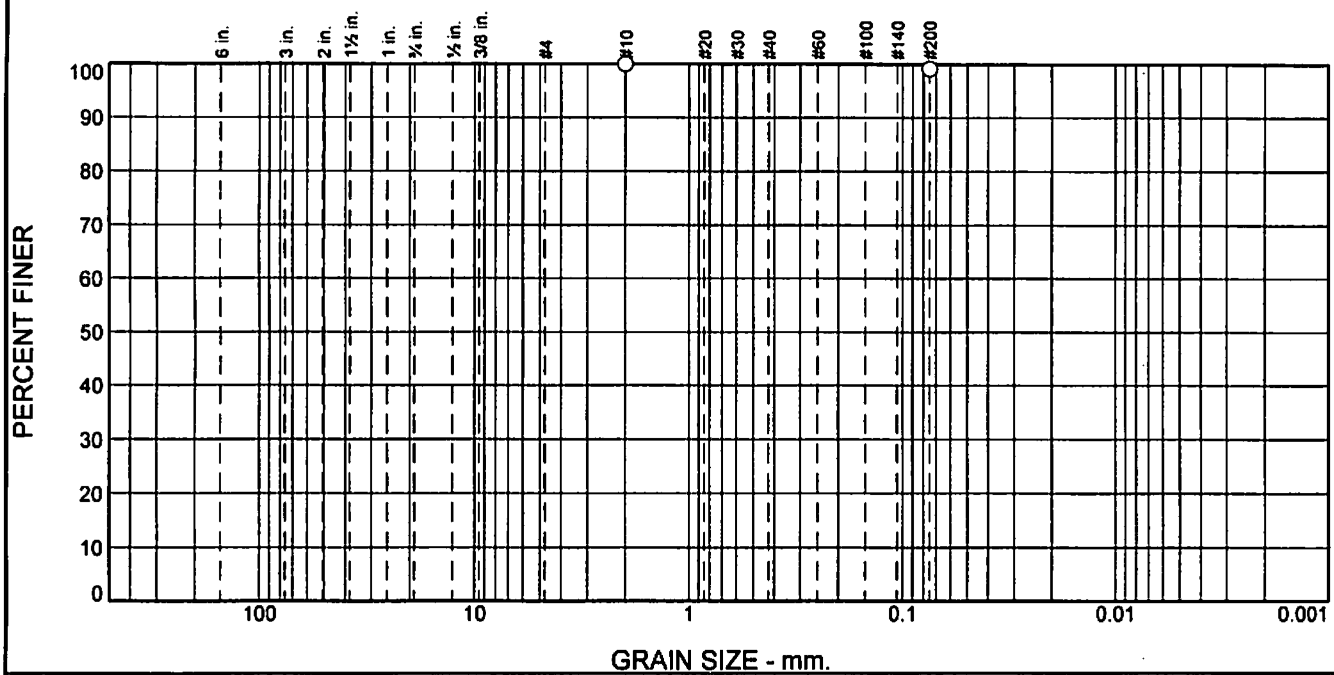
Project: Hudson Water Street - Operable Unit 2 Hudson, NY **Report No.:** CD3574SL-03-11-13

Client: ARCADIS US, Inc. **Date:** 11/22/13

Sample No: GT-1; S-9 **Source of Sample:** Boring Sample

Location:

Elev./Depth: 36.0 - 38.0'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	0	0	1	99	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
#10	100		
#200	99		

Soil Description

Grey CLAY; and SILT

Atterberg Limits

PL= 16 LL= 28 PI= 12

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL AASHTO=

Remarks

Moisture content 28.1%

* (no specification provided)

Figure

ATLANTIC TESTING LABORATORIES, LIMITED

Reviewed by: [signature]

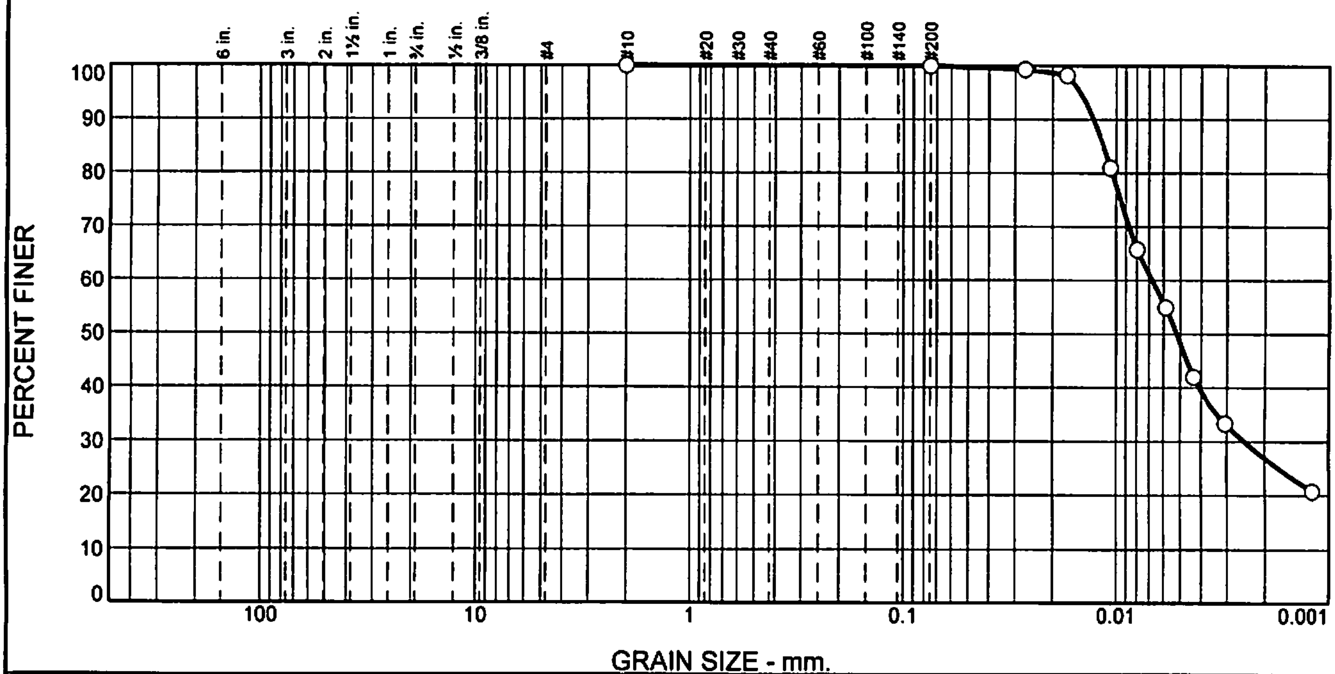
Date: 12/3/13

Particle Size Distribution Report

Project: Hudson Water Street - Operable Unit 2 Hudson, NY **Report No.:** CD3574SL-08-11-13

Client: ARCADIS US, Inc. **Date:** 11/1/13

Sample No: GT-2; S-14 **Source of Sample:** Boring Sample
Location: **Elev./Depth:** 45.0 - 47.0'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	0	0	0	52	48

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
#10	100		
#200	100		

Soil Description

Grey SILT; and CLAY

Atterberg Limits

PL= 18 LL= 27 PI= 9

Coefficients

D_{85}= 0.0115 D_{60}= 0.0068 D_{50}= 0.0052
D_{30}= 0.0025 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL AASHTO=

Remarks

Moisture content 25.2%

* (no specification provided)

Figure

ATLANTIC TESTING LABORATORIES, LIMITED

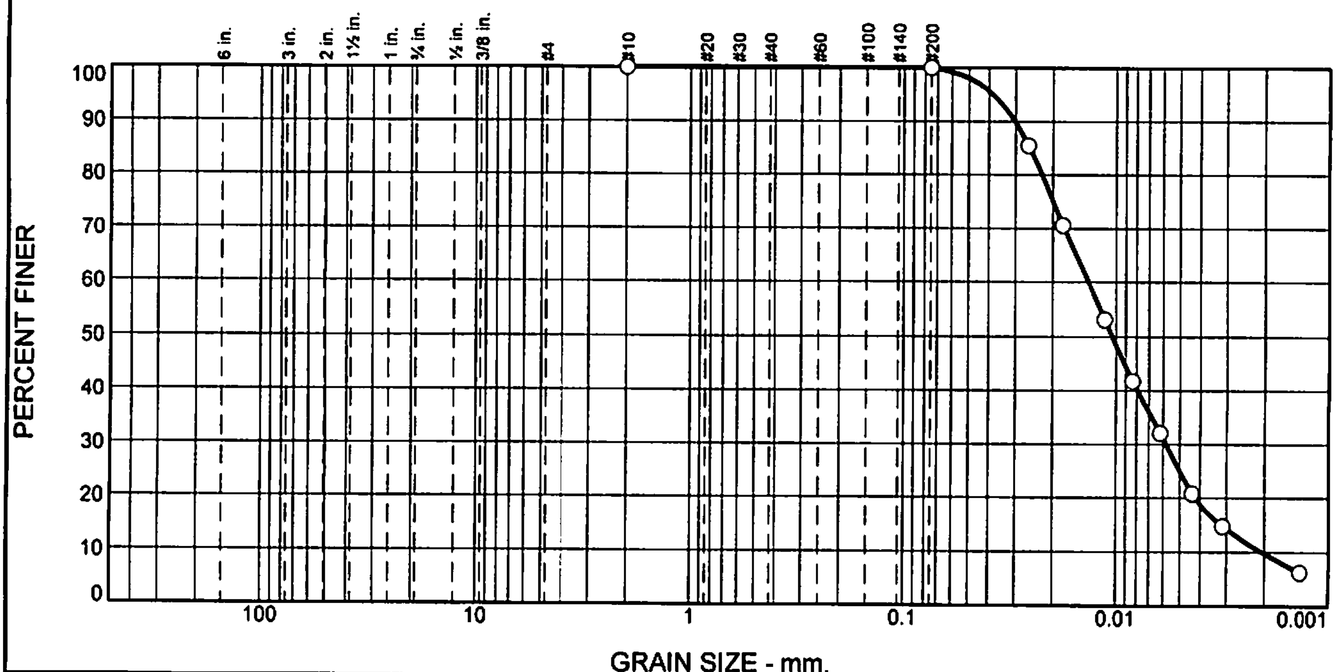
Reviewed by: [signature] Date: 12/3/13

Particle Size Distribution Report

Project: Hudson Water Street - Operable Unit 2 Hudson, NY **Report No.:** CD3574SL-12-11-13

Client: ARCADIS US, Inc. **Date:** 11/1/2013

Sample No: GT-3; S-12 **Source of Sample:** Boring Sample
Location:
Elev./Depth: 45.0 - 47.0'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	0	0	0	75	25

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
#10	100		
#200	100		

Soil Description
Grey SILT; some CLAY

Atterberg Limits
PL= 20 LL= 24 PI= 4

Coefficients
D_{85}= 0.0258 D_{60}= 0.0136 D_{50}= 0.0104
D_{30}= 0.0058 D_{15}= 0.0032 D_{10}= 0.0021
C_u= 6.60 C_c= 1.21

Classification
USCS= CL-ML AASHTO=

Remarks
Moisture content 21.6%

* (no specification provided)

Figure

ATLANTIC TESTING LABORATORIES, LIMITED

Reviewed by: [signature]

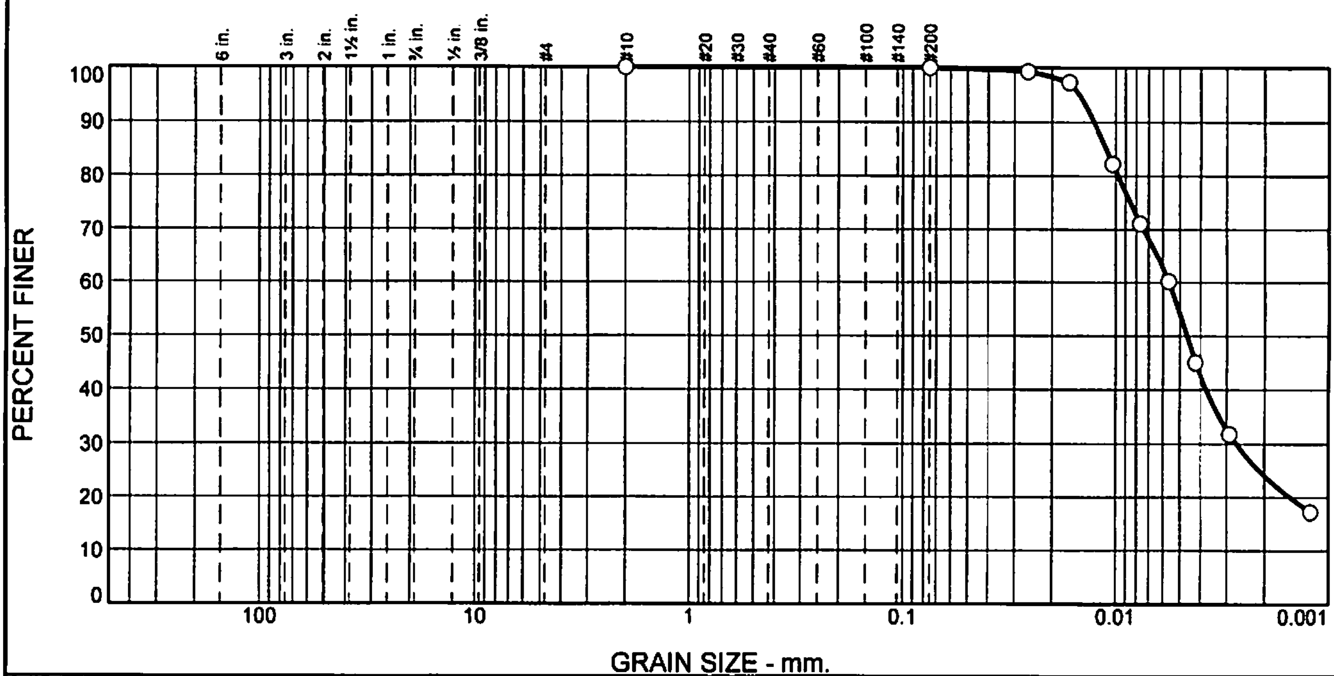
Date: 12/3/13

Particle Size Distribution Report

Project: Hudson Water Street - Operable Unit 2 Hudson, NY **Report No.:** CD3574SL-17-11-13

Client: ARCADIS US, Inc. **Date:** 11/1/2013

Sample No: GT-4; S-10 **Source of Sample:** Boring Sample
Location:
Elev./Depth: 28.0 - 30.0'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	0	0	0	46	54

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
#10	100		
#200	100		

Soil Description

Grey CLAY; and SILT

Atterberg Limits

PL= 20 LL= 29 PI= 9

Coefficients

D_{85}= 0.0111 D_{60}= 0.0056 D_{50}= 0.0047
D_{30}= 0.0027 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL AASHTO=

Remarks

Moisture content 38.9%

* (no specification provided)

Figure

ATLANTIC TESTING LABORATORIES, LIMITED

Reviewed by: [signature]

Date: 12/3/13

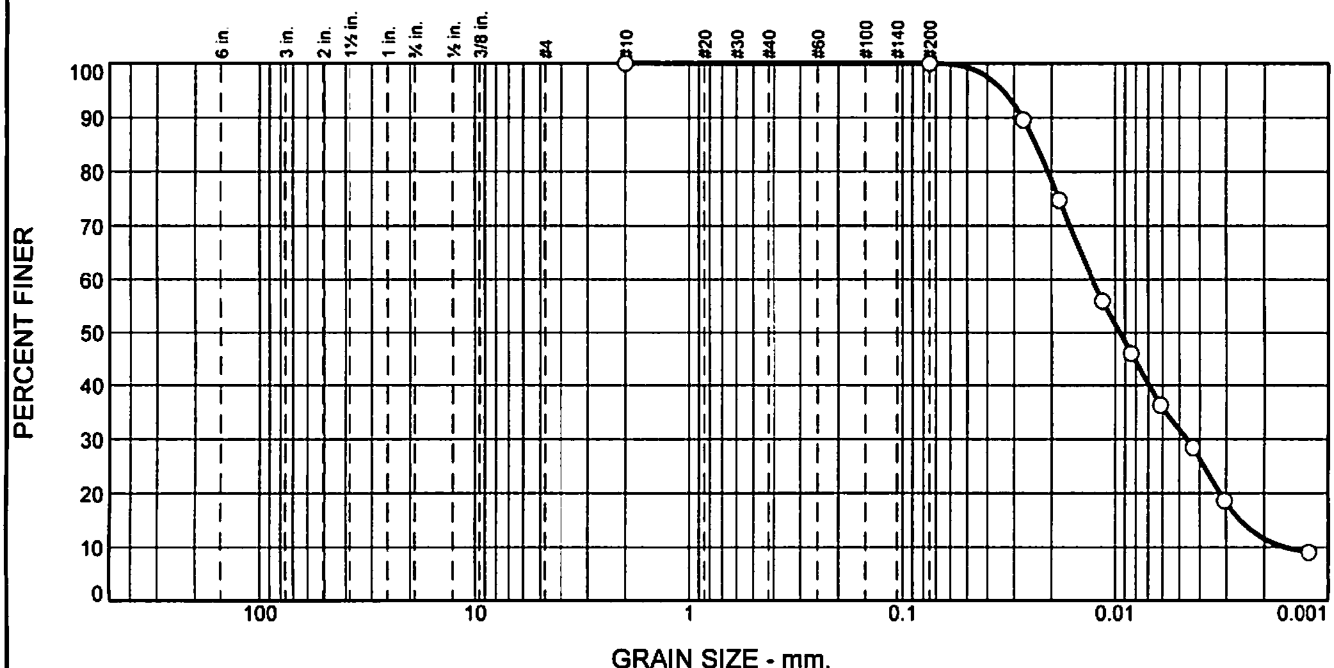
Particle Size Distribution Report

Project: Hudson Water Street - Operable Unit 2 Hudson, NY **Report No.:** CD3574SL-19-11-13

Client: ARCADIS US, Inc. **Date:** 11/01/2013

Sample No: GT-4; S-16 **Source of Sample:** Boring Sample

Location: **Elev./Depth:** 53.0 - 55.0'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	0	0	0	68	32

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
#10	100		
#200	100		

Soil Description

Grey SILT; some CLAY

Atterberg Limits

PL= 18 LL= 25 PI= 7

Coefficients

D_{85}= 0.0237 D_{60}= 0.0128 D_{50}= 0.0095
D_{30}= 0.0046 D_{15}= 0.0026 D_{10}= 0.0016
C_u= 8.00 C_c= 1.04

Classification

USCS= CL-ML AASHTO=

Remarks

Moisture content 23.2%

* (no specification provided)

Figure

ATLANTIC TESTING LABORATORIES, LIMITED

Reviewed by: [signature]

Date: 12/3/13

Particle Size Distribution Report

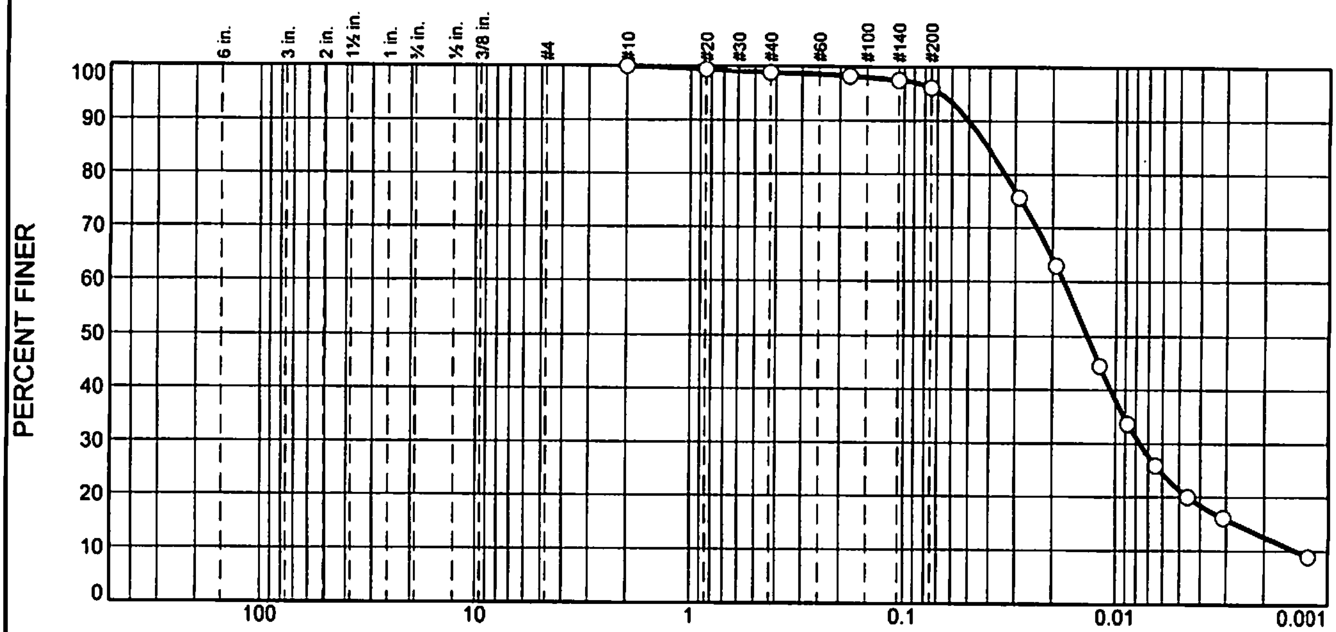
Project: Hudson Water Street - Operable Unit 2 Hudson, NY **Report No.:** CD3574SL-20-11-13

Client: ARCADIS US, Inc. **Date:** 11/01/2013

Sample No: GT-4; S-19 **Source of Sample:** Boring Sample

Location:

Elev./Depth: 68.0 - 70.0'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	0	1	3	75	21

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
#10	100		
#20	99		
#40	99		
#80	98		
#140	97		
#200	96		

Soil Description

Grey SILT; some CLAY; trace mf SAND

Atterberg Limits

PL= -- LL= -- PI= --

Coefficients

D_{85}= 0.0406 D_{60}= 0.0178 D_{50}= 0.0138
D_{30}= 0.0077 D_{15}= 0.0027 D_{10}= 0.0014
C_u= 12.37 C_c= 2.32

Classification

USCS= CL-ML AASHTO=

Remarks

Moisture content 30.0%

* (no specification provided)

Figure

ATLANTIC TESTING LABORATORIES, LIMITED

Reviewed by: [signature]

Date: 12/3/13

Particle Size Distribution Report

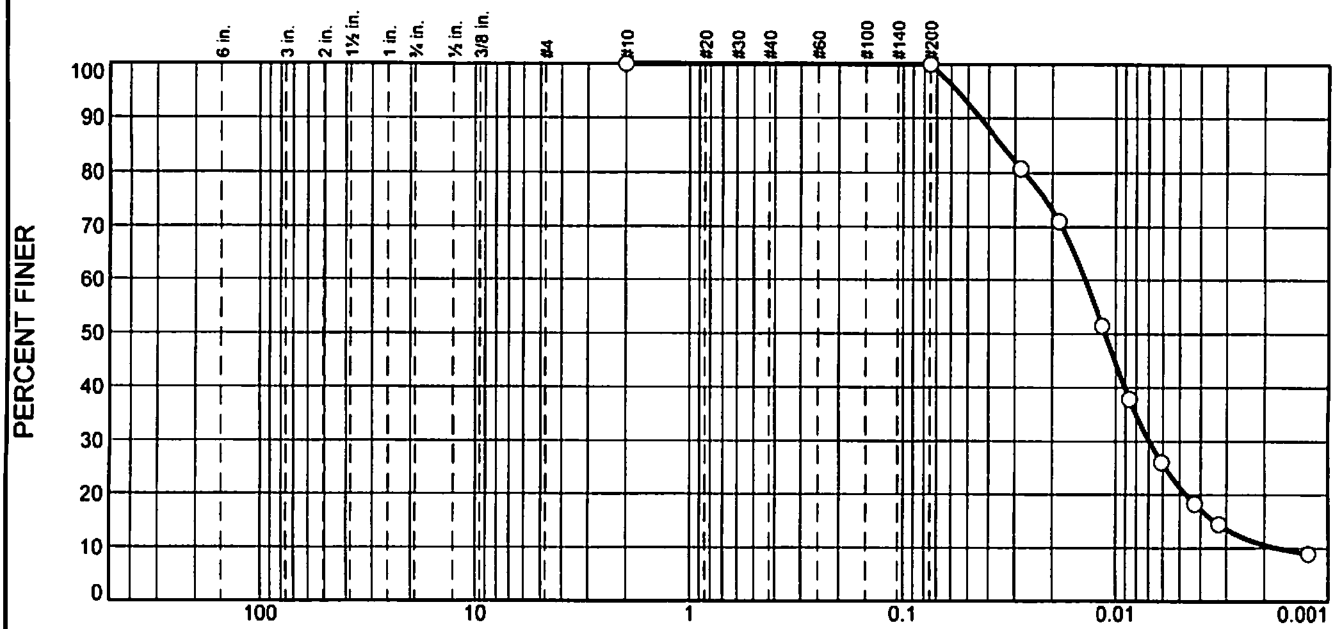
Project: Hudson Water Street - Operable Unit 2 Hudson, NY **Report No.:** CD3574SL-23-11-13

Client: ARCADIS US, Inc. **Date:** 11/01/2013

Sample No: GT-5; S-17 **Source of Sample:** Boring Sample

Location:

Elev./Depth: 65.0 - 67.0'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	0	0	0	79	21

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
#10	100		
#200	100		

* (no specification provided)

Soil Description

Grey SILT; some CLAY

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{85}= 0.0346 D_{60}= 0.0140 D_{50}= 0.0113
D_{30}= 0.0070 D_{15}= 0.0034 D_{10}= 0.0018
C_u= 7.92 C_c= 1.97

Classification

USCS= ML AASHTO=

Remarks

Moisture content 23.9%

Figure

ATLANTIC TESTING LABORATORIES, LIMITED

Reviewed by: [signature]

Date: 12/13/13

ATTACHMENT B

MOISTURE CONTENT RESULTS

ATLANTIC TESTING LABORATORIES

Hudson Water Street – Operable Unit 2
Hudson, New York
ARCADIS
ATL Report No. CD3574D-02-12-13

ASTM D 2216 Moisture Content

Boring No.	Sample No.	Depth (ft)	Water Content (%)
GT-1	S-4	9.0 – 11.0	28.8
GT-1	S-7	29.0 – 31.0	40.7
GT-1	S-9	36.0 – 38.0	28.1
GT-1	S-16	66.0 – 68.0	28.3
GT-2	S-3	4.0 – 6.0	29.4
GT-2	S-7	20.0 – 22.0	26.3
GT-2	S-8	22-0 - 24.0	25.9
GT-2	S-14	45.0 – 47.0	25.2
GT-2	S-18	65.0 – 67.0	17.4
GT-3	S-3	4.0 – 6.0	23.2
GT-3	S-6	15.0 – 17.0	23.4
GT-3	S-11	40.0 – 42.0	28.6
GT-3	S-12	45.0 – 47.0	21.6
GT-3	S-13	47.0 – 49.0	28.3
GT-3	S-16	60.0 – 62.0	5.9
GT-4	S-3	4.0 – 6.0	21.6
GT-4	S-7	18.0 – 20.0	35.1
GT-4	S-10	28.0 – 30.0	38.9
GT-4	S-13	38.0 – 40.0	24.5
GT-4	S-16	53.0 – 55.0	23.2
GT-4	S-19	68.0 – 70.0	30.0
GT-5	S-6	15.0 – 17.0	55.7
GT-5	S-7	17.0 - 19.0	48.7
GT-5	S-10	30.0 – 32.0	47.8
GT-5	S-12	40.0 – 42.0	23.3
GT-5	S-17	65.0 – 67.0	23.9
GT-5	S-18	67.0 – 69.0	29.7

ATTACHMENT C

ATTERBERG LIMIT TEST RESULTS

ATLANTIC TESTING LABORATORIES

Hudson Water Street – Operable Unit 2
Hudson, New York
ARCADIS
ATL Report No. CD3574D-02-12-13

ASTM D 4318 Liquid Limit, Plastic Limit, and Plasticity Index (Atterberg Limits)

Boring No.	Sample No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index
GT-1	S-7	29.0 – 31.0	35	21	14
GT-1	S-9	36.0 – 38.0	28	16	12
GT-1	S-16	66.0 – 68.0	24	18	6
GT-2	S-7	20.0 – 22.0	33	20	13
GT-2	S-8	22.0 – 24.0	30	18	12
GT-2	S-14	45.0 – 47.0	27	18	9
GT-3	S-6	15.0 – 17.0	28	19	9
GT-3	S-12	45.0 – 47.0	24	20	4
GT-3	S-13	47.0 – 49.0	28	20	8
GT-4	S-7	18.0 – 20.0	28	19	9
GT-4	S-10	28.0 – 30.0	29	20	9
GT-4	S-13	38.0 – 40.0	30	22	8
GT-4	S-16	53.0 – 55.0	25	18	7
GT-5	S-6	15.0 – 17.0	55	33	22
GT-5	S-10	30.0 – 32.0	35	22	13
GT-5	S-17	65.0 – 67.0	NP	NP	NP
GT-5	S-18	67.0 – 69.0	NP	NP	NP

*NP = Non-plastic

ATTACHMENT D

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS

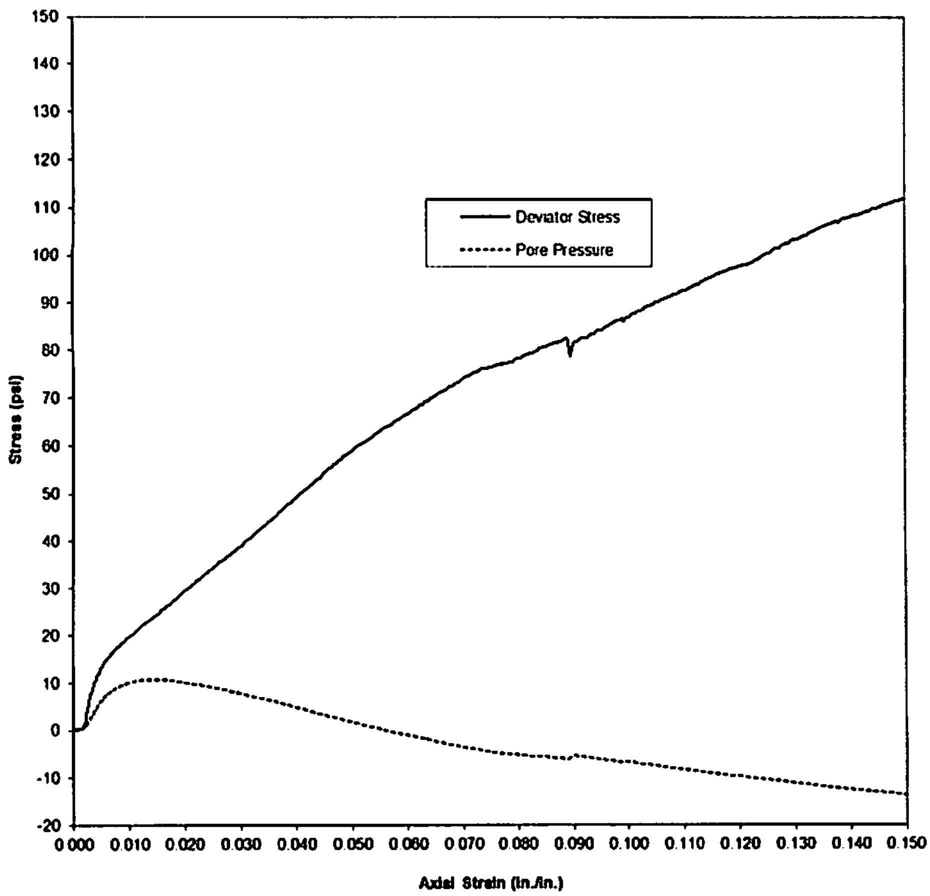
ATLANTIC TESTING LABORATORIES

Client:	ARCADIS US, Inc.	ATL Report No.:	CD3574SL-06-11-13
Project:	Hudson Water Street-Operable Unit 2	Date:	November 18, 2013
Sample ID:	GT-2; S-8	Sample Depth:	22.0 – 24.0'

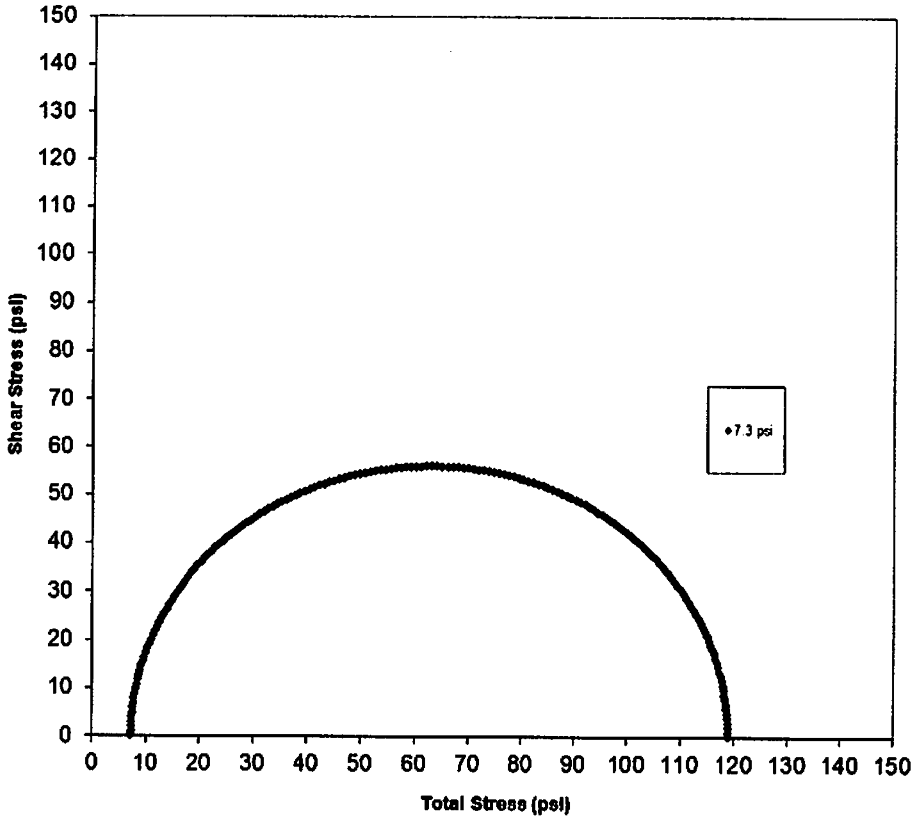
Consolidated-Undrained Triaxial Compression Test
ASTM D 4767

Parameter	Result
Confining Pressure, (psi)	7.3
Dry Unit Weight, (pcf)	86.3
Moisture Content, (%)	25.9
Height of Sample, (in)	5.987
Diameter of Sample, (in)	2.837
Height/Diameter Ratio	2.11
Deviator Stress, (psi)	111.8
Effective Minor Principal Stress, (psi)	20.9
Effective Major Principal Stress, (psi)	132.7
Axial Strain at Failure, (%)	15.0
Rate of Axial Strain, (%/min)	0.08

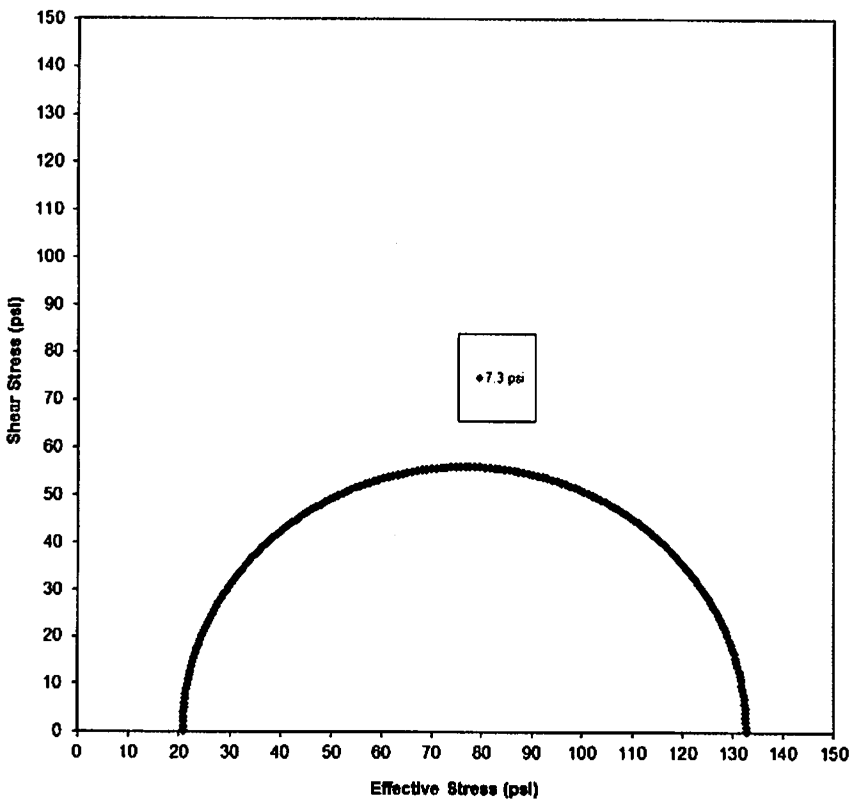
Deviator Stress and Pore Pressure
7.3 psi



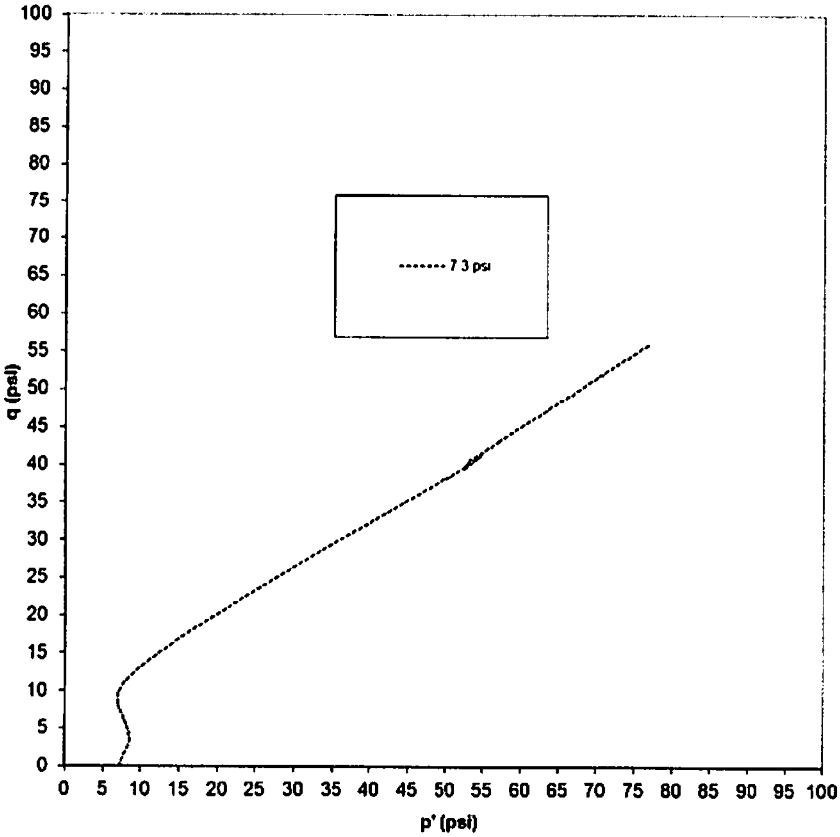
Mohr's Circle for Total Stress



Mohr's Circle for Effective Stress



p' vs. q



7.3psi Failure Photograph

Reviewed By: ____________

Date: 12/3/13

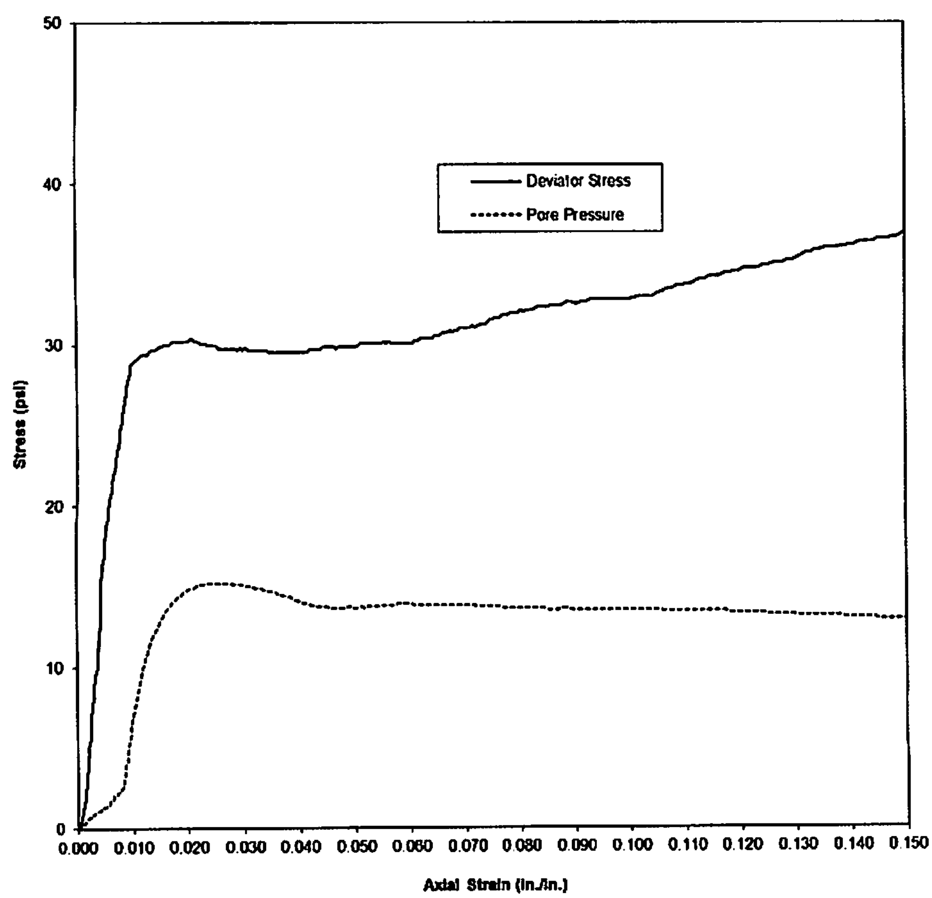
ATLANTIC TESTING LABORATORIES

Client:	ARCADIS US, Inc.		ATL Report No.:	CD3574SL-23-11-13(Revised)
Project:	Hudson Water Street-Operable Unit 2		Date:	November 18, 2013
Sample ID:	GT-5; S-18		Sample Depth:	67.0 – 69.0'

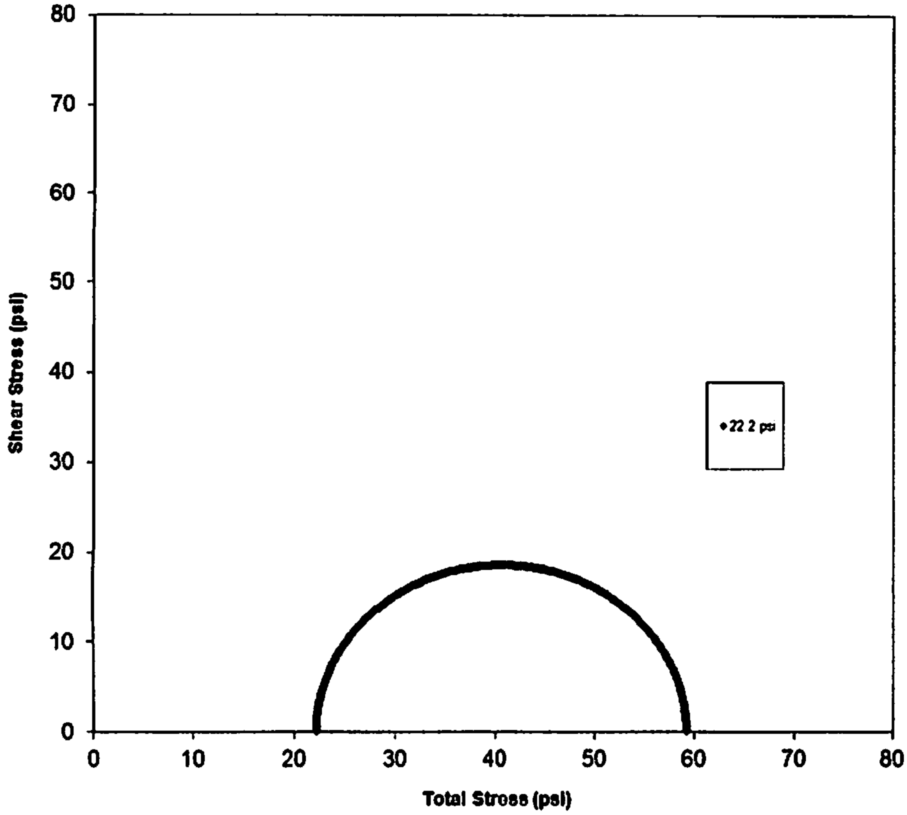
Consolidated-Undrained Triaxial Compression Test
ASTM D 4767

Parameter	Result
Confining Pressure, (psi)	22.2
Dry Unit Weight, (pcf)	81.2
Moisture Content, (%)	29.7
Height of Sample, (in)	5.876
Diameter of Sample, (in)	2.937
Height/Diameter Ratio	2.02
Deviator Stress, (psi)	37.1
Effective Minor Principal Stress, (psi)	9.4
Effective Major Principal Stress, (psi)	46.5
Axial Strain at Failure, (%)	15.0
Rate of Axial Strain, (%/min)	0.09

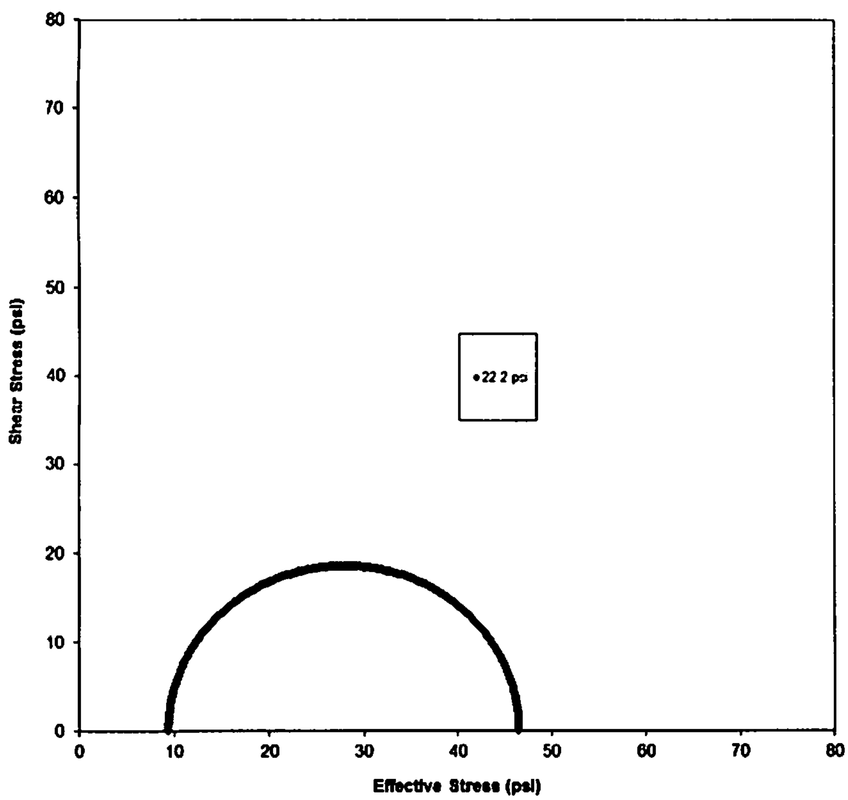
Deviator Stress and Pore Pressure
22.2 psi

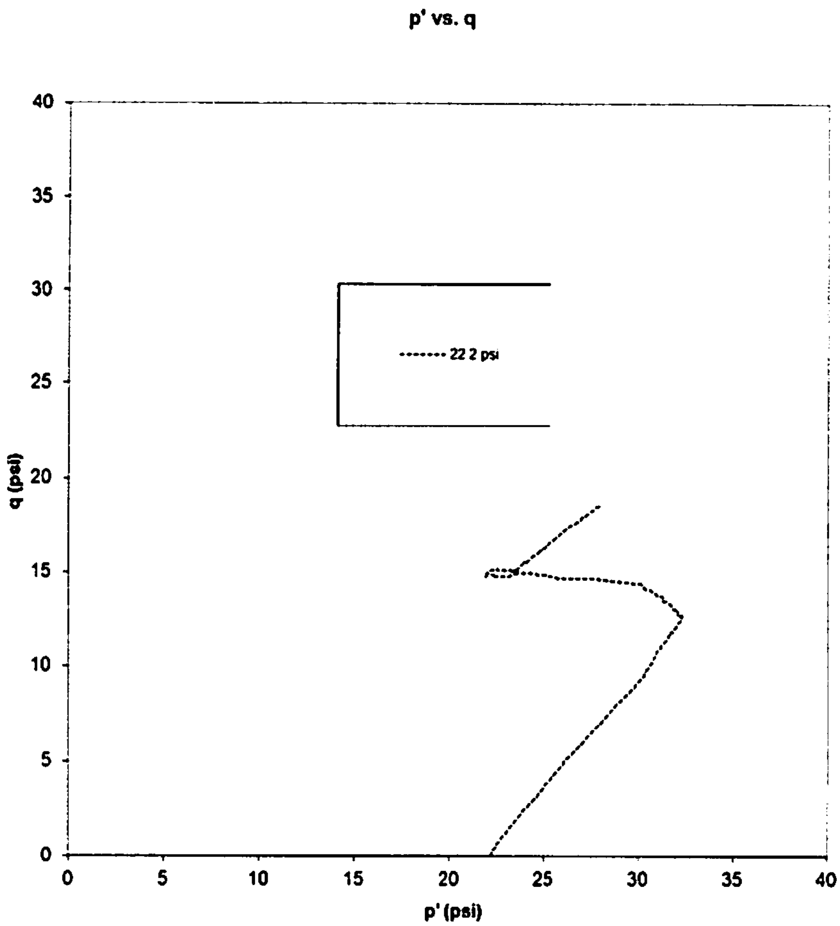


Mohr's Circle for Total Stress



Mohr's Circle for Effective Stress





22.2psi Failure Photograph

Remarks

This report was revised to correctly indicate the deviator stress at failure was 37.1psi, not 37.0psi.

Reviewed By:

Date: 1/20/14

ATTACHMENT E

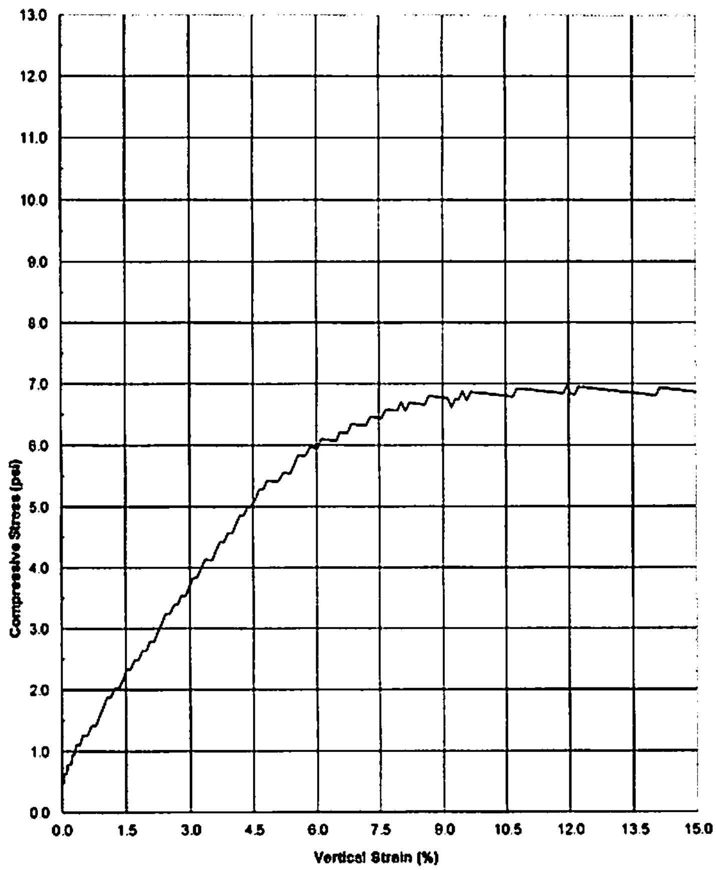
UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS

ATLANTIC TESTING LABORATORIES

Client:	ARCADIS US, Inc.	ATL Report No.:	CD3574SL-03-11-13
Project:	Hudson Water Street-Operable Unit 2	Date:	November 18, 2013
Sample ID:	GT-1; S-9	Sample Depth:	36.0 – 38.0'

Unconsolidated-Undrained Triaxial Compression Test
ASTM D 2850

Parameter	Results
Visual Soil Classification	CL (Lean Clay)
Minor Principal Stress (psi)	11.8
Initial Dry Unit Weight (pcf)	86.8
Initial Water Content, Entire Sample (%)	28.1
Specific Gravity	2.77
Void Ratio	0.992
Saturation (%)	100.7
Compressive Strength (psi)	7.0
Major Principal Stress (psi)	18.8
Initial Height (in.)	5.862
Initial Diameter (in.)	2.834
Height-to-Diameter Ratio	2.07
Axial Rate of Strain (%/min)	0.85
Axial Strain at Failure (%)	12.0



Failure Photograph

Reviewed By: ______________________

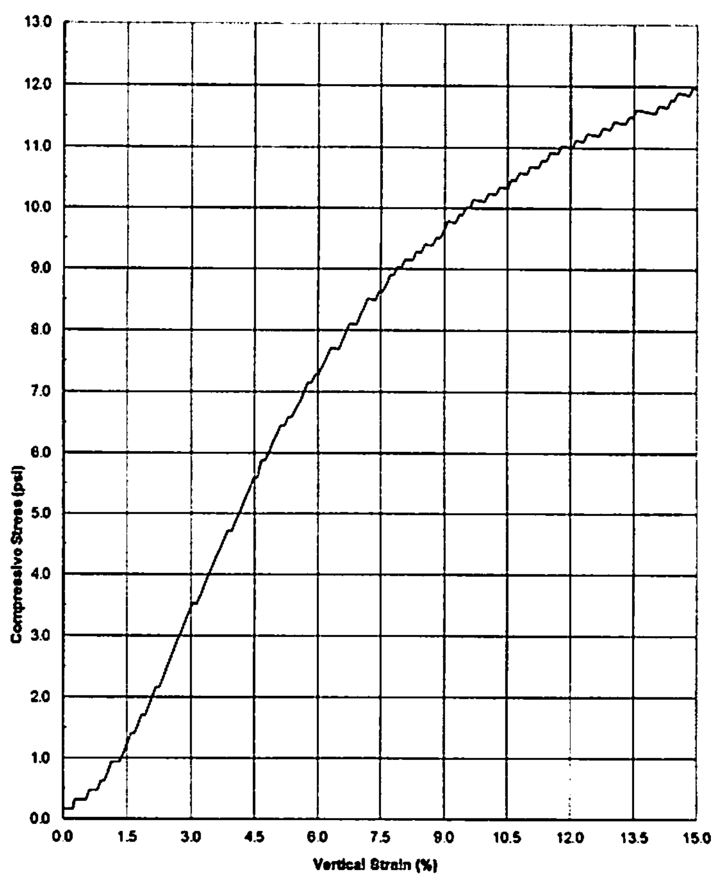
Date: 12/3/13

ATLANTIC TESTING LABORATORIES

Client:	ARCADIS US, Inc.	ATL Report No.:	CD3574SL-04-11-13
Project:	Hudson Water Street-Operable Unit 2	Date:	November 18, 2013
Sample ID:	GT-1; S-16	Sample Depth:	66.0 – 68.0'

Unconsolidated-Undrained Triaxial Compression Test
ASTM D 2850

Parameter	Results
Visual Soil Classification	CL-ML (Silty Clay)
Minor Principal Stress (psi)	21.8
Initial Dry Unit Weight (pcf)	85.2
Initial Water Content, Entire Sample (%)	28.3
Specific Gravity	2.77
Void Ratio	1.030
Saturation (%)	97.7
Compressive Strength (psi)	12.0
Major Principal Stress (psi)	33.8
Initial Height (in.)	5.981
Initial Diameter (in.)	2.836
Height-to-Diameter Ratio	2.11
Axial Rate of Strain (%/min)	0.84
Axial Strain at Failure (%)	14.9



Failure Photograph

Reviewed By:

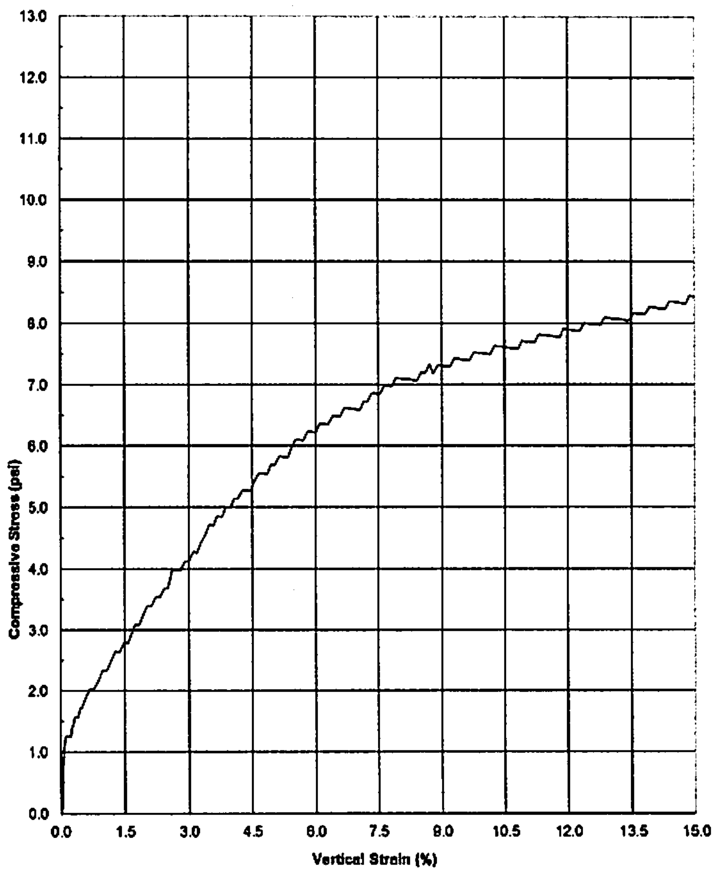
Date: 12/3/13

ATLANTIC TESTING LABORATORIES

Client:	ARCADIS US, Inc.	ATL Report No.:	CD3574SL-12-11-13
Project:	Hudson Water Street-Operable Unit 2	Date:	November 15, 2013
Sample ID:	GT-3; S-13	Sample Depth:	47.0 – 49.0'

Unconsolidated-Undrained Triaxial Compression Test
ASTM D 2850

Parameter	Results
Visual Soil Classification	CL-ML (Silty Clay)
Minor Principal Stress (psi)	21.8
Initial Dry Unit Weight (pcf)	85.2
Initial Water Content, Entire Sample (%)	28.3
Specific Gravity	2.77
Void Ratio	1.030
Saturation (%)	97.7
Compressive Strength (psi)	12.0
Major Principal Stress (psi)	33.8
Initial Height (in.)	5.981
Initial Diameter (in.)	2.836
Height-to-Diameter Ratio	2.11
Axial Rate of Strain (%/min)	0.84
Axial Strain at Failure (%)	14.9



Failure Photograph

Reviewed By:

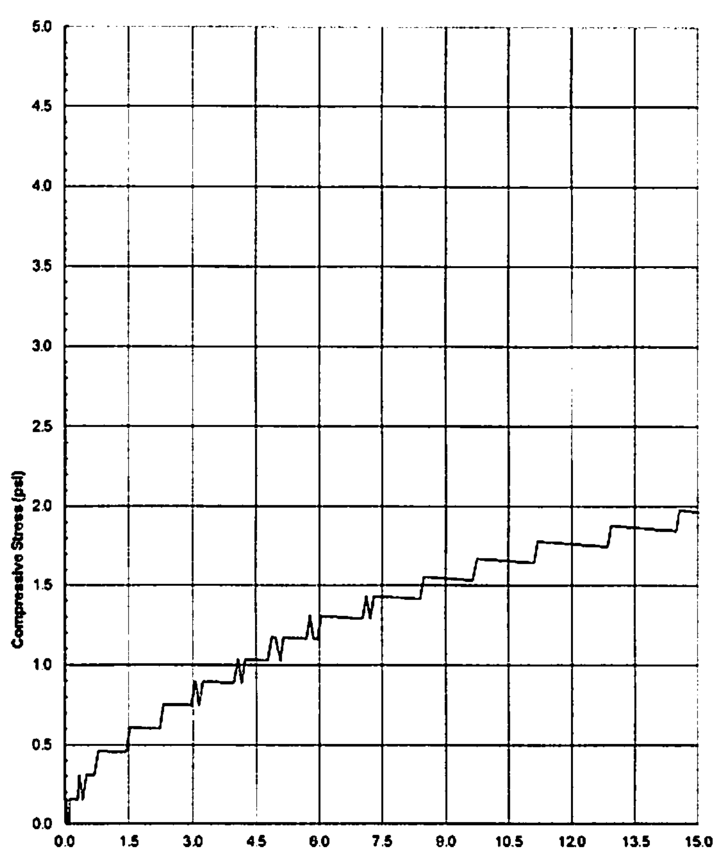
Date: 12/3/13

ATLANTIC TESTING LABORATORIES

Client:	ARCADIS US, Inc.	ATL Report No.:	CD3574SL-20-11-13
Project:	Hudson Water Street-Operable Unit 2	Date:	November 15, 2013
Sample ID:	GT-5; S-7	Sample Depth:	17.0 – 19.0'

Unconsolidated-Undrained Triaxial Compression Test
ASTM D 2850

Parameter	Results
Visual Soil Classification	CL (Lean Clay)
Minor Principal Stress (psi)	4.4
Initial Dry Unit Weight (pcf)	70.2
Initial Water Content, Entire Sample (%)	48.7
Specific Gravity, Assumed	2.77
Void Ratio	1.465
Saturation (%)	137.0
Compressive Strength (psi)	2.0
Major Principal Stress (psi)	6.4
Initial Height (in.)	5.938
Initial Diameter (in.)	2.873
Height-to-Diameter Ratio	2.07
Axial Rate of Strain (%/min)	0.84
Axial Strain at Failure (%)	14.6



Failure Photograph

Reviewed By: [signature]

Date: 12/3/13

ATTACHMENT F

ONE-DIMENSIONAL CONSOLIDATION TEST RESULTS

ATLANTIC TESTING LABORATORIES

Client: ARCADIS US, Inc. ATL Report No.: CD3574SL-06-11-13

Project: Hudson Water Street – Operable Unit 2 Date: November 18, 2013

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING
ASTM D 2435

Sample: GT-2; S-8 Sample Depth: 22.0 – 24.0'

Classification: Grey Silty Clay Specific Gravity: 2.776

Average Moisture of Trimmings (%) 30.5 Seating Pressure (psf) 50

Initial Moisture (%) 30.9 Final Moisture (%) 28.0

Initial Dry Unit Weight (pcf) 107.5 Final Dry Unit Weight (pcf) 116.3

Initial Void Ratio 0.608 Final Void Ratio 0.487

Initial Degree of Saturation 99.2 Final Degree of Saturation 100.2

Sample Trimming Method: [ ] Turntable [X] Cutting Shoe [ ] Ring Lined Sampler

Condition of Test: [ ] Natural Moisture [X] Inundated [ ] Pressure at Inundation

Test Method: [ ] A Load Increment Duration ______ [X] B

Increment No.	Load (tsf)	Final Deformation (in.)	End-of-Primary Deformation (in.)	Coefficient of Consolidation (in.^{2}/min.)
1	0.25	0.0133	0.0109	0.0446
2	0.50	0.0205	0.0147	0.0373
3	1.00	0.0285	0.0257	0.0924
4	2.00	0.0394	0.0362	0.0900
5	4.00	0.0543	0.0494	0.0955
6	1.00	0.0698	0.0658	0.1046
7	0.25	0.0933	0.0875	0.1054
8	0.50	0.0876	0.0881	0.1146
9	1.00	0.0765	0.0785	0.0810
10	2.00	0.0827	0.0823	0.1174
11	4.00	0.0769	0.0777	0.0723
12	8.00	0.0636	0.0679	0.0301
13	16.00	0.0133	0.0109	0.0446
14	4.00	0.0205	0.0147	0.0373
15	1.00	0.0285	0.0257	0.0924
16	0.25	0.0394	0.0362	0.0900

Remarks

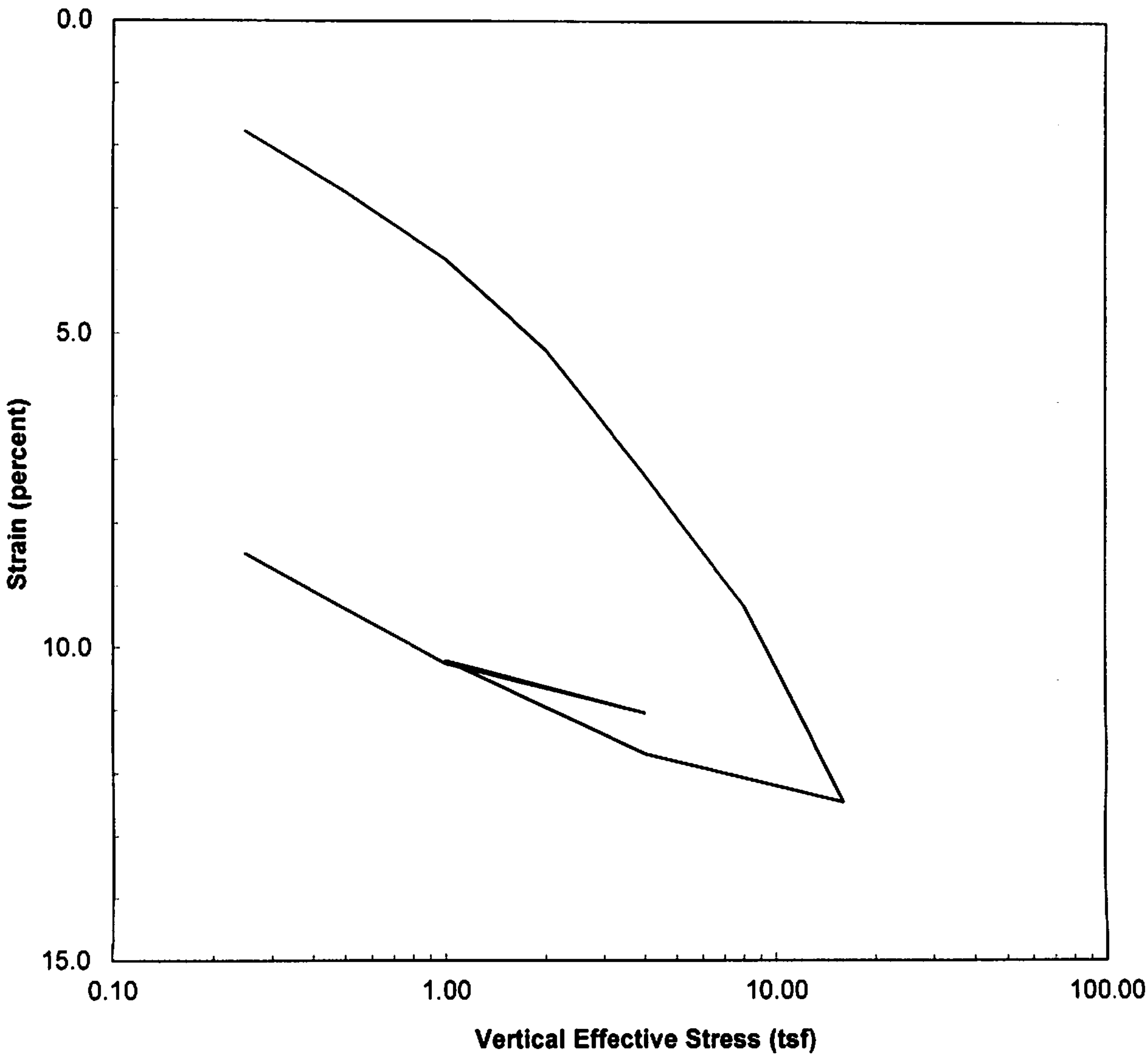
Reviewed By: [signature] Date: 12/3/13

ATLANTIC TESTING LABORATORIES

ATL Report No. CD3574SL-06-11-13
ARCADIS US, Inc.
Hudson Street - Operable Unit 2
Hudson, Columbia County, New York

One-Dimensional Consolidation of Soil
ASTM D 2435
Stress-Strain Graph

Sample No: GT-22; S-8
Depth: 22.0-24.0'

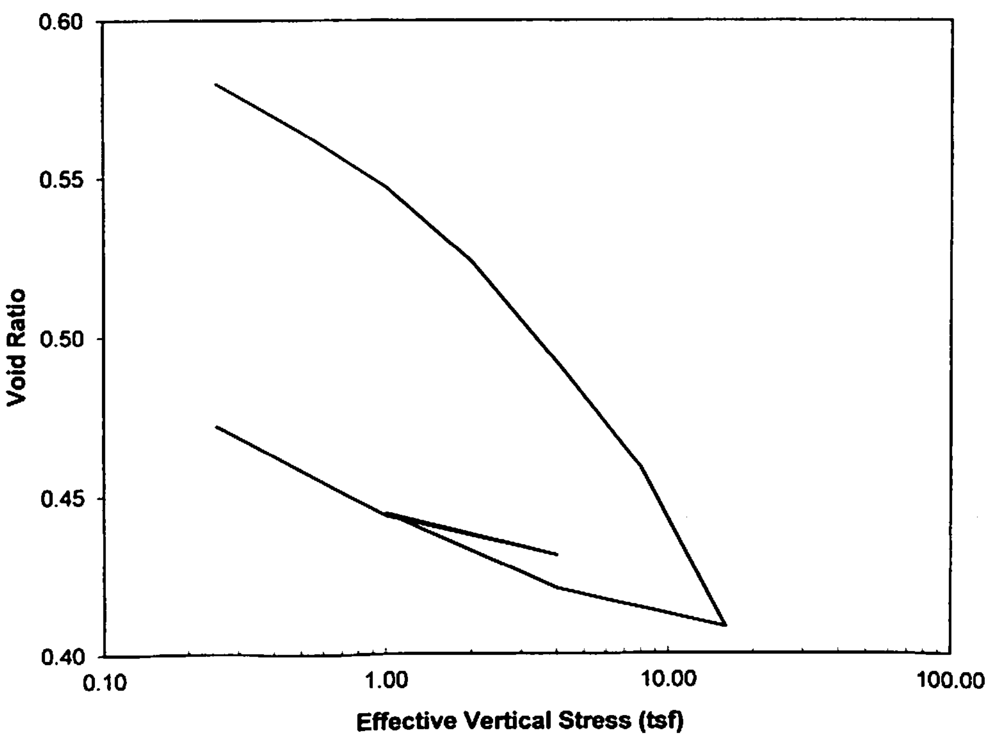


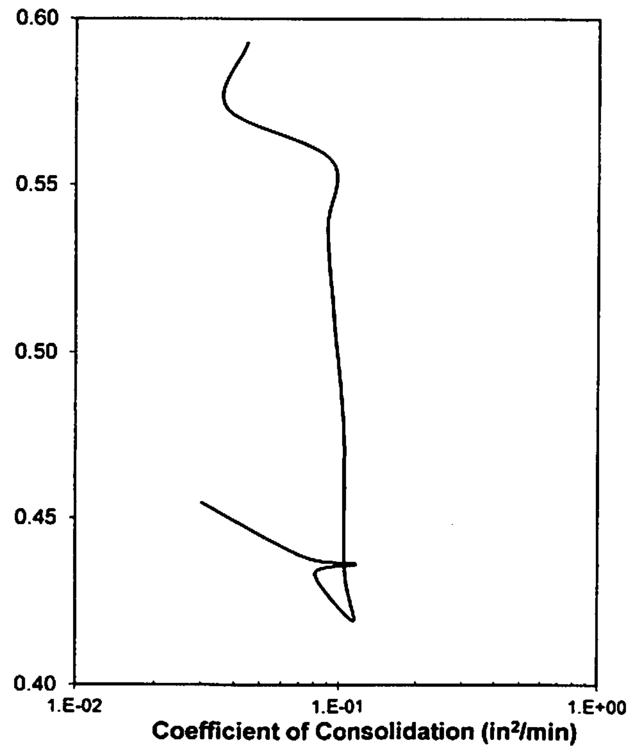
ATLANTIC TESTING LABORATORIES

ATL Report No. CD3574SL-06-11-13
ARCADIS US, Inc.
Hudson Street - Operable Unit 2
Hudson, Columbia County, New York

One-Dimensional Consolidation of Soil
ASTM D 2435
Void Ratio-Vertical Stress and Coeffcient of Consolidation

Sample No.: GT-2; S-8
Depth: 22.0-24.0'





ATLANTIC TESTING LABORATORIES

Client: ARCADIS US, Inc.

ATL Report No.: CD3574SL-23-11-13

Project: Hudson Water Street – Operable Unit 2

Date: November 18, 2013

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS USING INCREMENTAL LOADING
ASTM D 2435

Sample: GT-5; S-18

Sample Depth: 67.0 – 69.0'

Classification: Grey Silty Clay

Specific Gravity: 2.771

Average Moisture of Trimmings (%) 21.3

Seating Pressure (psf) 50

Initial Moisture (%) 22.9

Final Moisture (%) 17.8

Initial Dry Unit Weight (pcf) 108.4

Final Dry Unit Weight (pcf) 117.3

Initial Void Ratio 0.595

Final Void Ratio 0.475

Initial Degree of Saturation 106.6

Final Degree of Saturation 103.8

Sample Trimming Method: ☐ Turntable ☒ Cutting Shoe ☐ Ring Lined Sampler

Condition of Test: ☐ Natural Moisture ☒ Inundated ☐ Pressure at Inundation

Test Method: ☐ A Load Increment Duration ______ ☒ B

Increment No.	Load (tsf)	Final Deformation (in.)	End-of-Primary Deformation (in.)	Coefficient of Consolidation (in.^{2}/min.)
1	0.25	0.0073	0.0061	0.1009
2	0.50	0.0115	0.0105	0.1433
3	1.00	0.0171	0.0156	0.1416
4	2.00	0.0230	0.0219	0.1566
5	4.00	0.0303	0.0295	0.1534
6	8.00	0.0399	0.0384	0.1609
7	16.00	0.0516	0.0489	0.1474
8	4.00	0.0481	0.0483	0.2087
9	1.00	0.0436	0.0441	0.1426
10	4.00	0.0465	0.0464	0.1381
11	1.00	0.0439	0.0440	0.1320
12	0.25	0.0405	0.0411	0.1498

Remarks

Reviewed By: [signature]

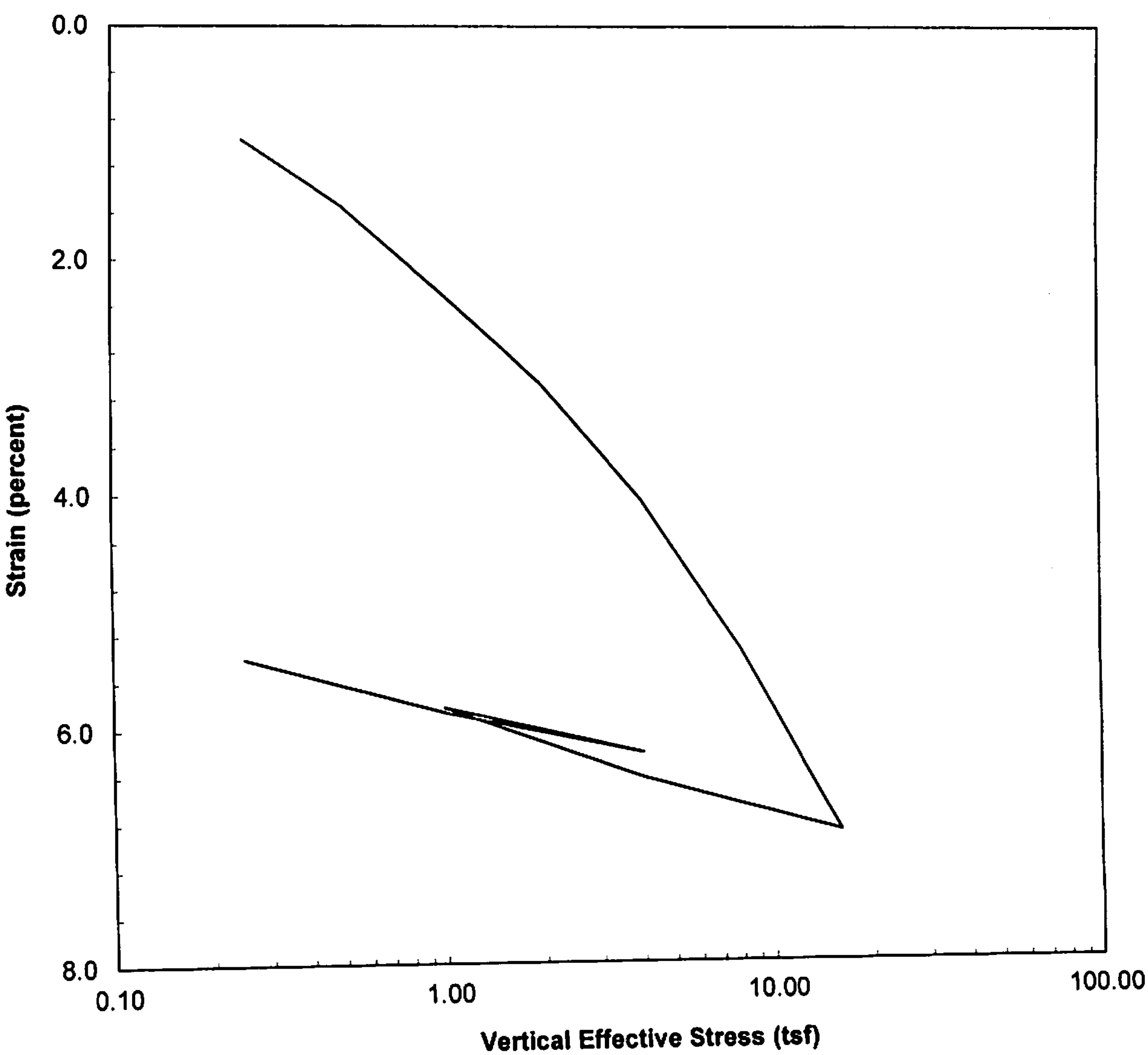
Date: 12/3/13

ATLANTIC TESTING LABORATORIES

ATL Report No. CD3574SL-23-11-13
ARCADIS US, Inc.
Hudson Street - Operable Unit 2
Hudson, Columbia County, New York

One-Dimensional Consolidation of Soil
ASTM D 2435
Stress-Strain Graph

Sample No: GT-5; S-18
Depth: 67.0-69.0'

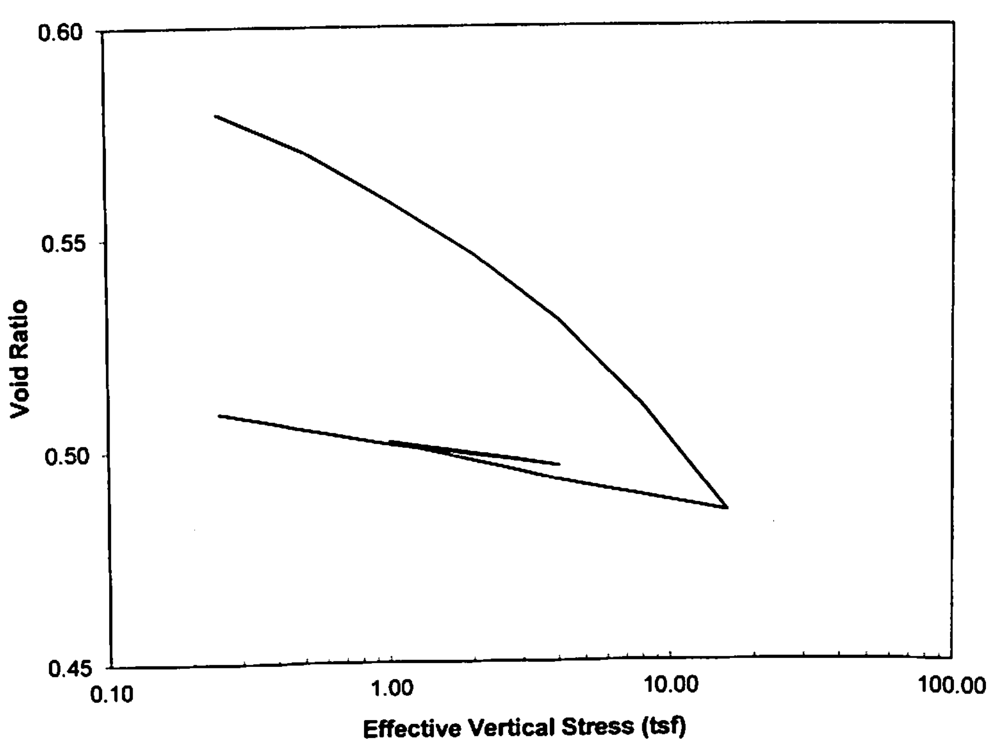


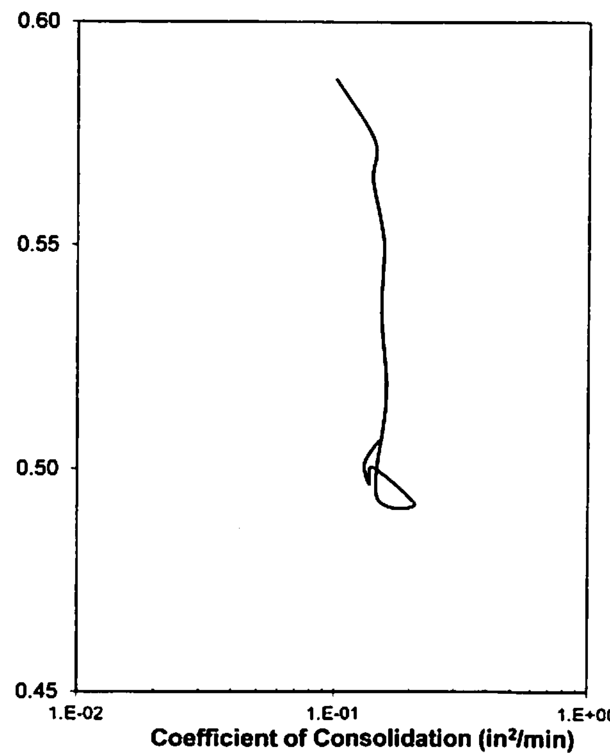
ATLANTIC TESTING LABORATORIES

ATL Report No. CD3574SL-23-11-13
ARCADIS US, Inc.
Hudson Street - Operable Unit 2
Hudson, Columbia County, New York

One-Dimensional Consolidation of Soil
ASTM D 2435
Void Ratio-Vertical Stress and Coeffcient of Consolidation

Sample No.: GT-5; S-18
Depth: 22.0-24.0'





ATTACHMENT C

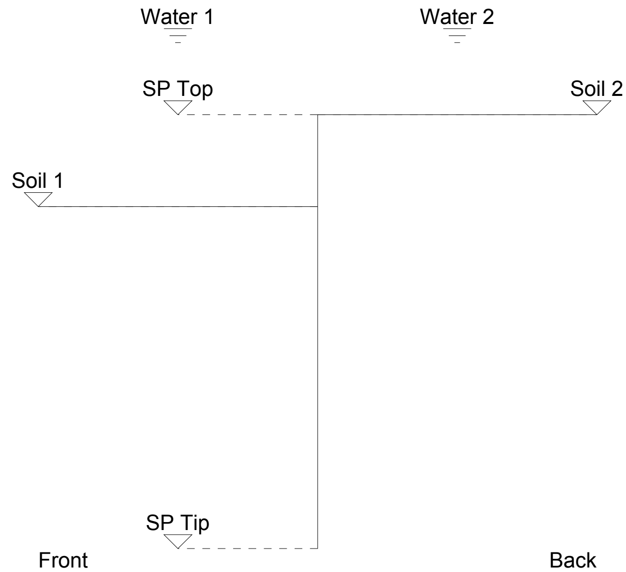
Prosheet Earth Pressure Outputs

Sheet Pile Design According to Blum-Method

Project Name:	
Date:	8/16/2016
Author:	
Company:	ARCADIS U.S., Inc.
Comment:	

Geodata

	Unit
Sheet Pile Top Level [ft]	0.000
Soil Level in Front [ft]	16.000
Soil Level behind [ft]	0.000
Anchorlevel [ft]	0.000
Water Level in Front [ft]	-15.000
Water Level behind [ft]	-15.000
Soil Surface Inclination in Front [Deg]	0.000
Soil Surface Inclination behind [Deg]	0.000
Caquot Surcharge in Front [kip/ft2]	0.000
Caquot Surcharge behind [kip/ft2]	0.000
Anchor Inclination [Deg]	0.000
Earth Support	Cantilever



Soil Layers

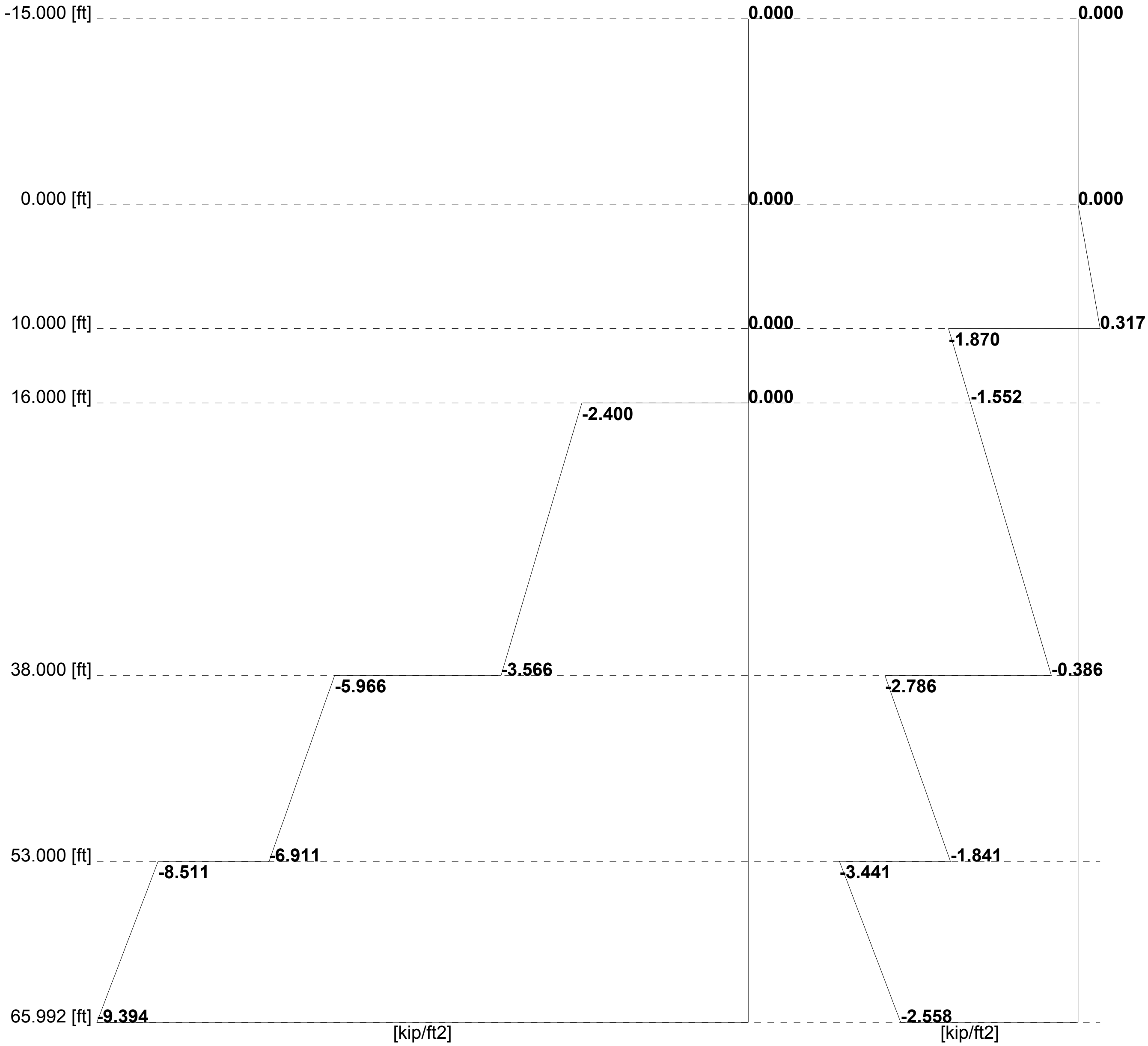
Layers in Front

	Layer Tip [ft]	Density Moist [kip/ft3]	Density Submerged [kip/ft3]	Kph	Phi [Deg]	Delta [Deg]	Cohesion [kip/ft2]
Layer 1	10.000	0.115	0.053	4.348	28.000	-15.120	0.000
Layer 2	38.000	0.115	0.053	1.000	0.000	0.000	1.200
Layer 3	53.000	0.125	0.063	1.000	0.000	0.000	2.400
Layer 4	100.000	0.130	0.068	1.000	0.000	0.000	3.200

Layers behind

	Layer Tip [ft]	Density Moist [kip/ft3]	Density Submerged [kip/ft3]	Kph	Phi [Deg]	Delta [Deg]	Cohesion [kip/ft2]
Layer 1	10.000	0.115	0.053	0.599	28.000	15.120	0.000
Layer 2	38.000	0.115	0.053	1.000	0.000	0.000	1.200
Layer 3	53.000	0.125	0.063	1.000	0.000	0.000	2.400
Layer 4	100.000	0.130	0.068	1.000	0.000	0.000	3.200

Earth Pressure Diagram

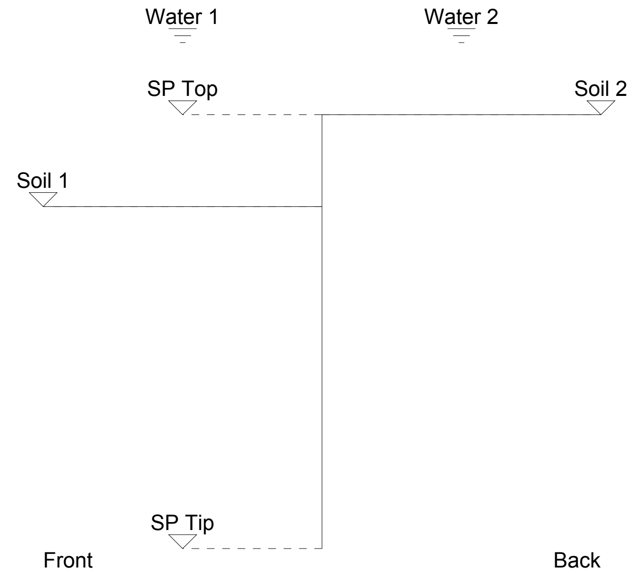


Sheet Pile Design According to Blum-Method

Project Name:	
Date:	8/16/2016
Author:	
Company:	ARCADIS U.S., Inc.
Comment:	

Geodata

	Unit
Sheet Pile Top Level [ft]	0.000
Soil Level in Front [ft]	16.000
Soil Level behind [ft]	0.000
Anchorlevel [ft]	0.000
Water Level in Front [ft]	-15.000
Water Level behind [ft]	-15.000
Soil Surface Inclination in Front [Deg]	0.000
Soil Surface Inclination behind [Deg]	0.000
Caquot Surcharge in Front [kip/ft2]	0.000
Caquot Surcharge behind [kip/ft2]	0.000
Anchor Inclination [Deg]	0.000
Earth Support	Cantilever



Soil Layers

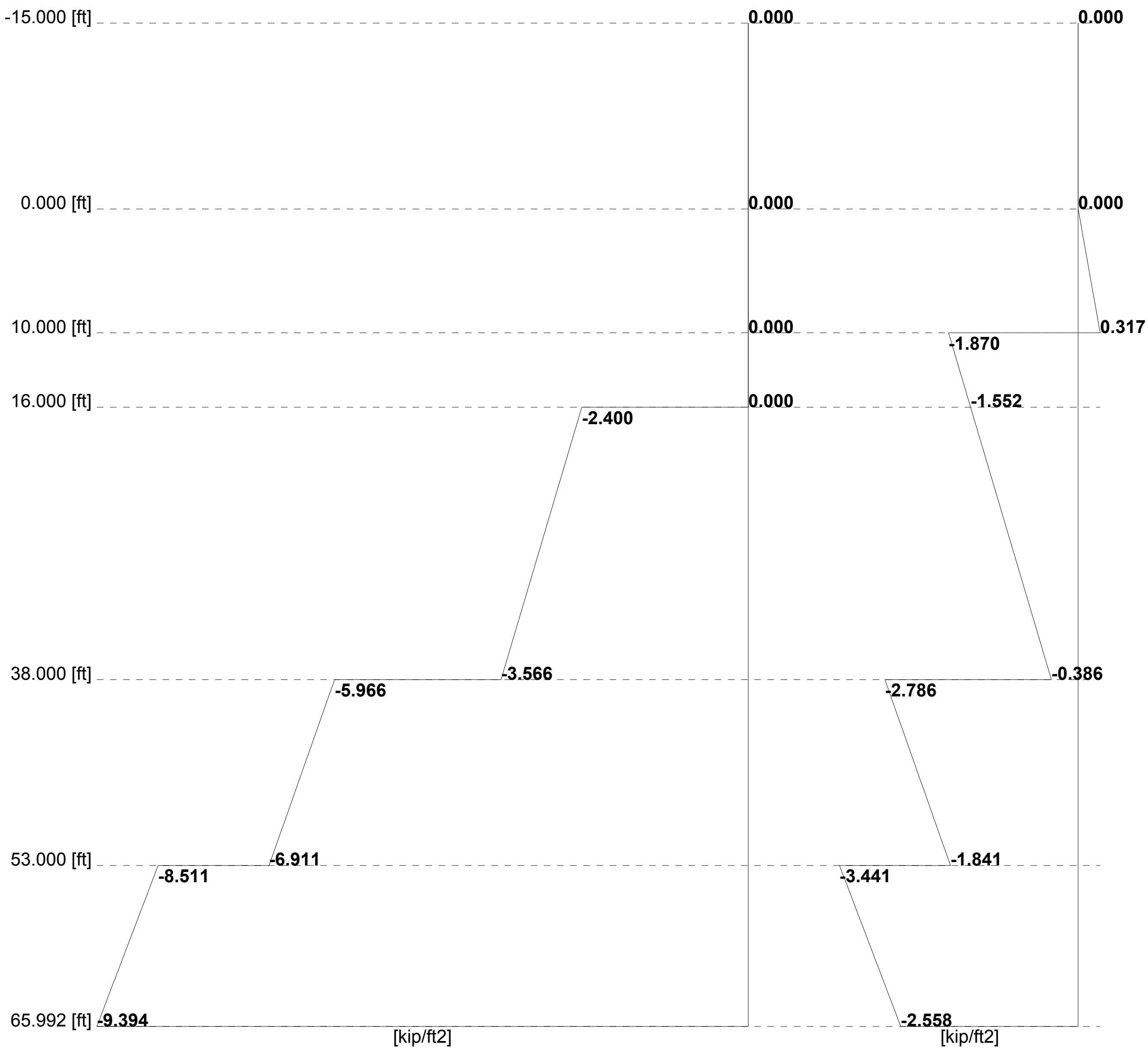
Layers in Front

	Layer Tip [ft]	Density Moist [kip/ft3]	Density Submerged [kip/ft3]	Kph	Phi [Deg]	Delta [Deg]	Cohesion [kip/ft2]
Layer 1	10.000	0.115	0.053	4.348	28.000	-15.120	0.000
Layer 2	38.000	0.115	0.053	1.000	0.000	0.000	1.200
Layer 3	53.000	0.125	0.063	1.000	0.000	0.000	2.400
Layer 4	100.000	0.130	0.068	1.000	0.000	0.000	3.200

Layers behind

	Layer Tip [ft]	Density Moist [kip/ft3]	Density Submerged [kip/ft3]	Kph	Phi [Deg]	Delta [Deg]	Cohesion [kip/ft2]
Layer 1	10.000	0.115	0.053	0.599	28.000	15.120	0.000
Layer 2	38.000	0.115	0.053	1.000	0.000	0.000	1.200
Layer 3	53.000	0.125	0.063	1.000	0.000	0.000	2.400
Layer 4	100.000	0.130	0.068	1.000	0.000	0.000	3.200

Earth Pressure Diagram

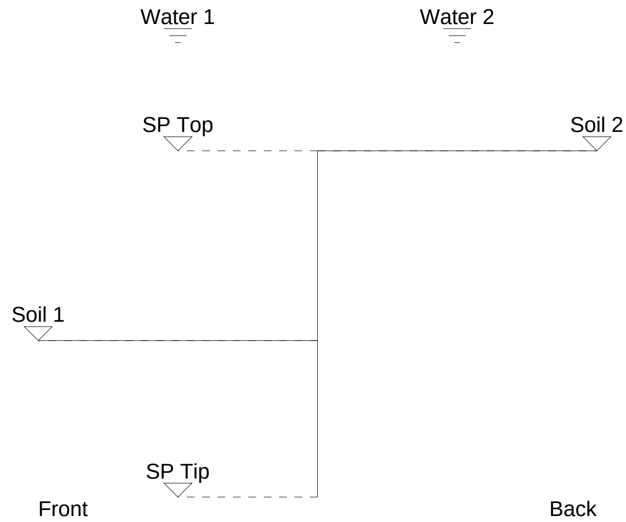


Sheet Pile Design According to Blum-Method

Project Name:	
Date:	7/7/2015
Author:	
Company:	ARCADIS U.S., Inc.
Comment:	

Geodata

	Unit
Sheet Pile Top Level [ft]	0.000
Sheet Pile Tip Level [ft]	25.535
Soil Level in Front [ft]	14.000
Soil Level behind [ft]	0.000
Anchorlevel [ft]	0.000
Water Level in Front [ft]	-9.000
Water Level behind [ft]	-9.000
Soil Surface Inclination in Front [Deg]	0.000
Soil Surface Inclination behind [Deg]	0.000
Caquot Surcharge in Front [kip/ft2]	0.000
Caquot Surcharge behind [kip/ft2]	0.000
Anchor Inclination [Deg]	0.000
Earth Support	Cantilever



Soil Layers

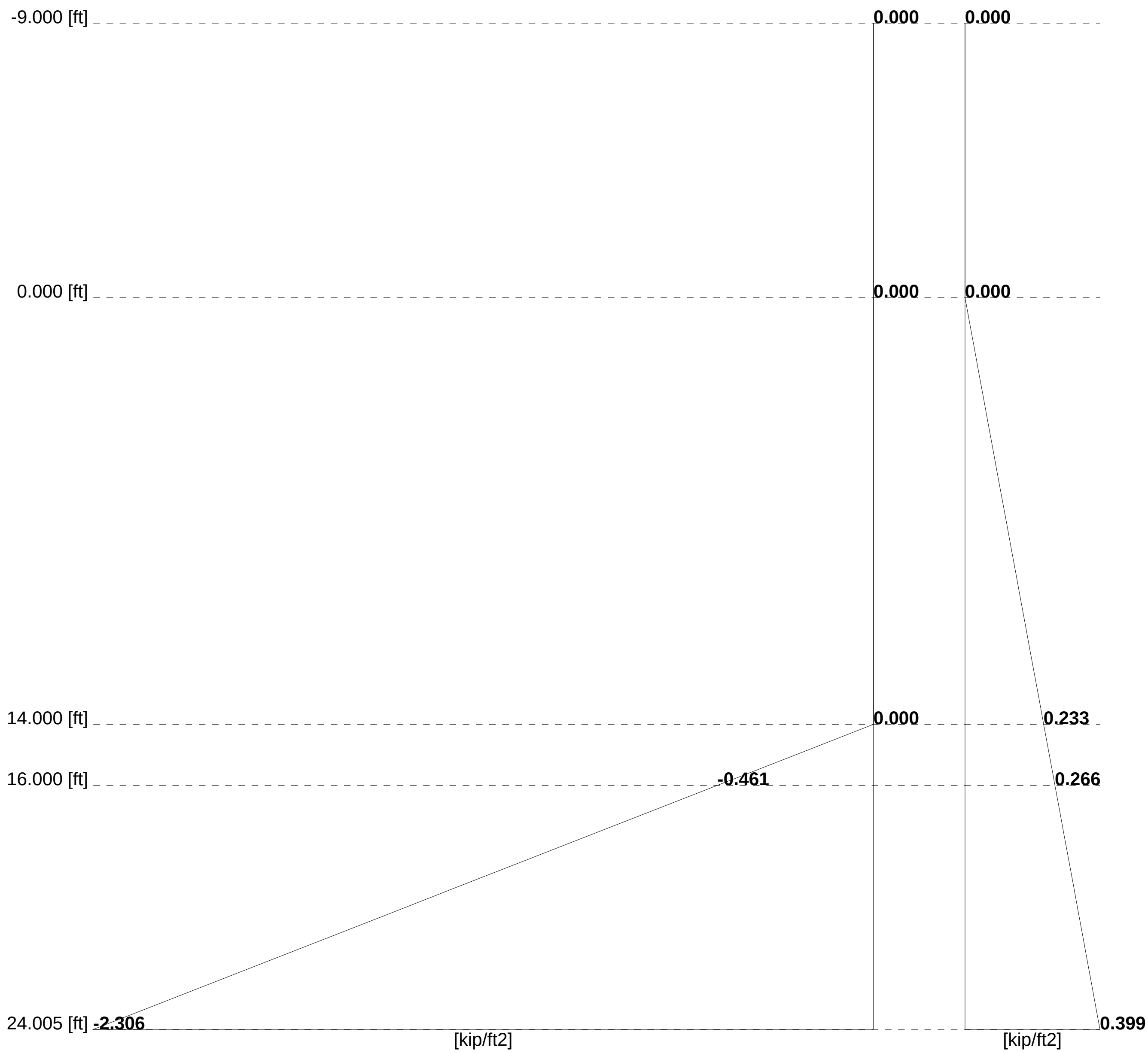
Layers in Front

	Layer Tip [ft]	Density Moist [kip/ft3]	Density Submerged [kip/ft3]	Kph	Phi [Deg]	Delta [Deg]	Cohesion [kip/ft2]
Layer 1	16.000	0.115	0.053	4.348	28.000	-15.120	0.000
Layer 2	44.000	0.115	0.053	4.348	28.000	-15.120	0.000
Layer 3	64.000	0.125	0.063	4.659	29.000	-15.660	0.000
Layer 4	100.000	0.130	0.068	6.208	33.000	-17.820	0.000

Layers behind

	Layer Tip [ft]	Density Moist [kip/ft3]	Density Submerged [kip/ft3]	Kph	Phi [Deg]	Delta [Deg]	Cohesion [kip/ft2]
Layer 1	16.000	0.115	0.053	0.314	28.000	15.120	0.000
Layer 2	44.000	0.115	0.053	0.314	28.000	15.120	0.000
Layer 3	64.000	0.125	0.063	0.301	29.000	15.660	0.000
Layer 4	100.000	0.130	0.068	0.253	33.000	17.820	0.000

Earth Pressure Diagram

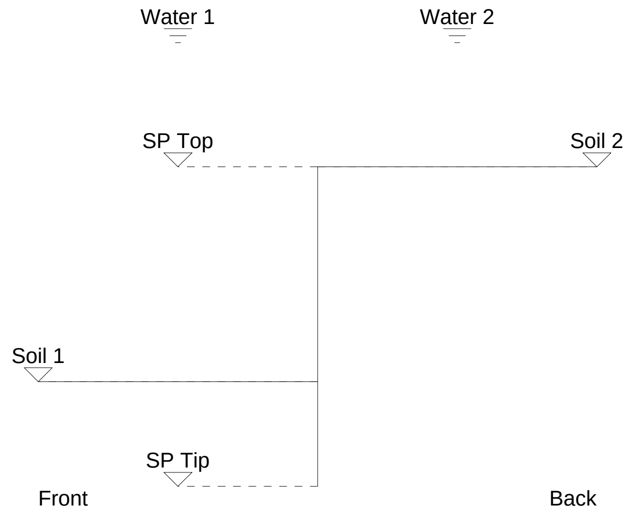


Sheet Pile Design According to Blum-Method

Project Name:	
Date:	7/7/2015
Author:	
Company:	ARCADIS U.S., Inc.
Comment:	

Geodata

	Unit
Sheet Pile Top Level [ft]	0.000
Sheet Pile Tip Level [ft]	20.822
Soil Level in Front [ft]	14.000
Soil Level behind [ft]	0.000
Anchorlevel [ft]	0.000
Water Level in Front [ft]	-9.000
Water Level behind [ft]	-9.000
Soil Surface Inclination in Front [Deg]	0.000
Soil Surface Inclination behind [Deg]	0.000
Caquot Surcharge in Front [kip/ft2]	0.000
Caquot Surcharge behind [kip/ft2]	0.000
Anchor Inclination [Deg]	0.000
Earth Support	Cantilever



Soil Layers

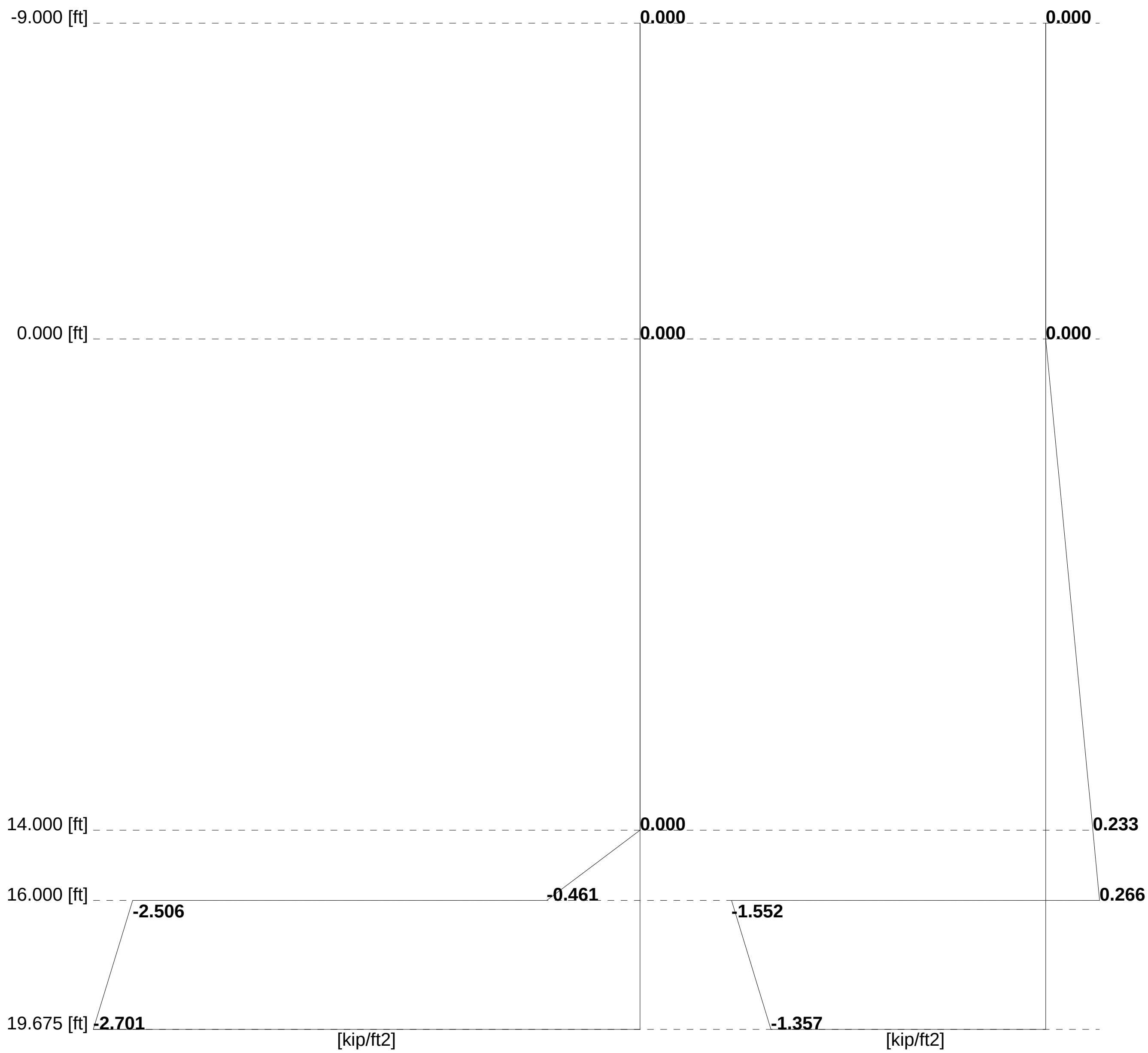
Layers in Front

	Layer Tip [ft]	Density Moist [kip/ft3]	Density Submerged [kip/ft3]	Kph	Phi [Deg]	Delta [Deg]	Cohesion [kip/ft2]
Layer 1	16.000	0.115	0.053	4.348	28.000	-15.120	0.000
Layer 2	44.000	0.115	0.053	1.000	0.000	0.000	1.200
Layer 3	64.000	0.125	0.063	1.000	0.000	0.000	1.800
Layer 4	100.000	0.130	0.068	1.000	0.000	0.000	3.000

Layers behind

	Layer Tip [ft]	Density Moist [kip/ft3]	Density Submerged [kip/ft3]	Kph	Phi [Deg]	Delta [Deg]	Cohesion [kip/ft2]
Layer 1	16.000	0.115	0.053	0.314	28.000	15.120	0.000
Layer 2	44.000	0.115	0.053	1.000	0.000	0.000	1.200
Layer 3	64.000	0.125	0.063	1.000	0.000	0.000	1.800
Layer 4	100.000	0.130	0.068	1.000	0.000	0.000	3.000

Earth Pressure Diagram

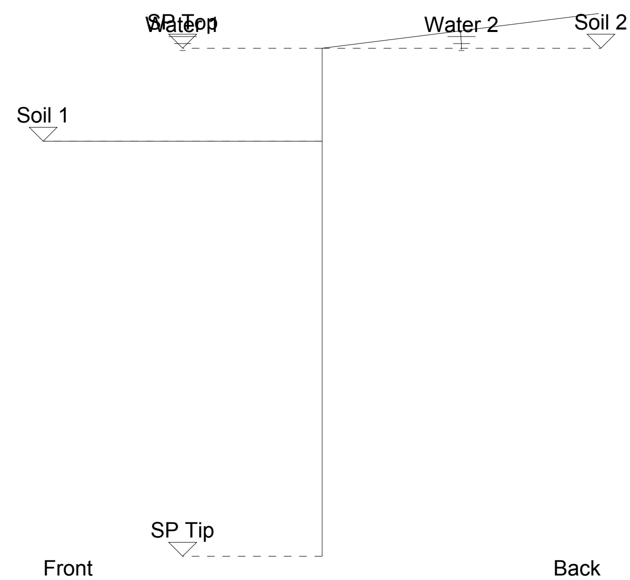


Sheet Pile Design According to Blum-Method

Project Name:	
Date:	8/16/2016
Author:	
Company:	ARCADIS U.S., Inc.
Comment:	

Geodata

	Unit
Sheet Pile Top Level [ft]	0.000
Soil Level in Front [ft]	16.000
Soil Level behind [ft]	0.000
Anchorlevel [ft]	0.000
Water Level in Front [ft]	-2.000
Water Level behind [ft]	-2.000
Soil Surface Inclination in Front [Deg]	0.000
Soil Surface Inclination behind [Deg]	7.125
Caquot Surcharge in Front [kip/ft2]	0.000
Caquot Surcharge behind [kip/ft2]	0.000
Anchor Inclination [Deg]	0.000
Earth Support	Cantilever



Soil Layers

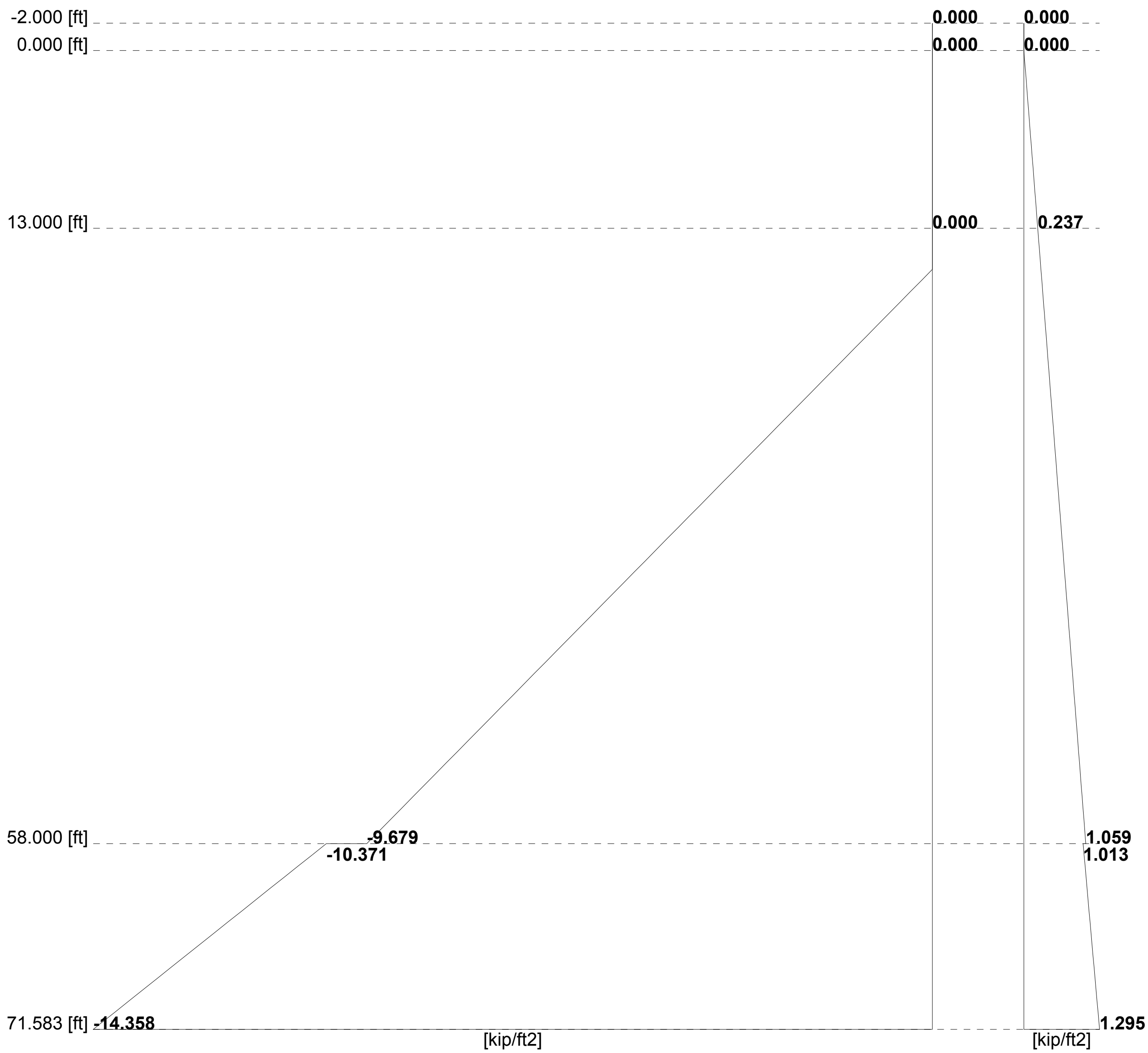
Layers in Front

	Layer Tip [ft]	Density Moist [kip/ft3]	Density Submerged [kip/ft3]	Kph	Phi [Deg]	Delta [Deg]	Cohesion [kip/ft2]
Layer 1	13.000	0.115	0.053	4.348	28.000	-15.120	0.000
Layer 2	58.000	0.115	0.053	4.348	28.000	-15.120	0.000
Layer 3	90.000	0.125	0.063	4.659	29.000	-15.660	0.000
Layer 4	100.000	0.130	0.068	6.208	33.000	-17.820	0.000

Layers behind

	Layer Tip [ft]	Density Moist [kip/ft3]	Density Submerged [kip/ft3]	Kph	Phi [Deg]	Delta [Deg]	Cohesion [kip/ft2]
Layer 1	13.000	0.115	0.053	0.345	28.000	15.120	0.000
Layer 2	58.000	0.115	0.053	0.345	28.000	15.120	0.000
Layer 3	90.000	0.125	0.063	0.330	29.000	15.660	0.000
Layer 4	100.000	0.130	0.068	0.275	33.000	17.820	0.000

Earth Pressure Diagram

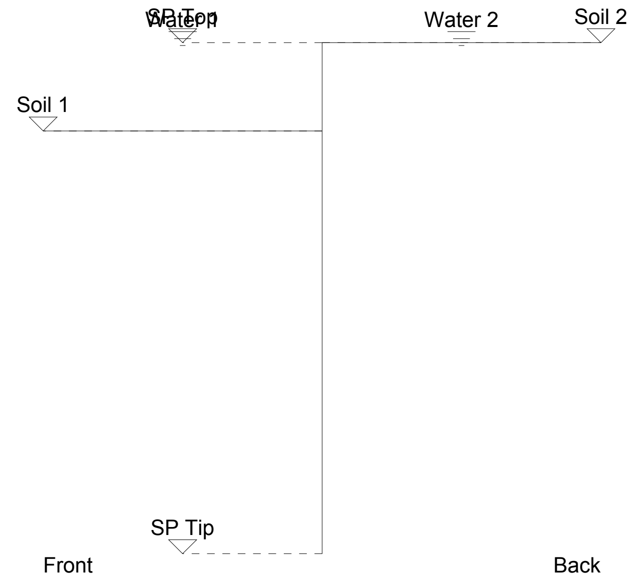


Sheet Pile Design According to Blum-Method

Project Name:	
Date:	8/16/2016
Author:	
Company:	ARCADIS U.S., Inc.
Comment:	

Geodata

	Unit
Sheet Pile Top Level [ft]	0.000
Soil Level in Front [ft]	16.000
Soil Level behind [ft]	0.000
Anchorlevel [ft]	0.000
Water Level in Front [ft]	-2.000
Water Level behind [ft]	-2.000
Soil Surface Inclination in Front [Deg]	0.000
Soil Surface Inclination behind [Deg]	0.000
Caquot Surcharge in Front [kip/ft2]	0.000
Caquot Surcharge behind [kip/ft2]	0.000
Anchor Inclination [Deg]	0.000
Earth Support	Cantilever



Soil Layers

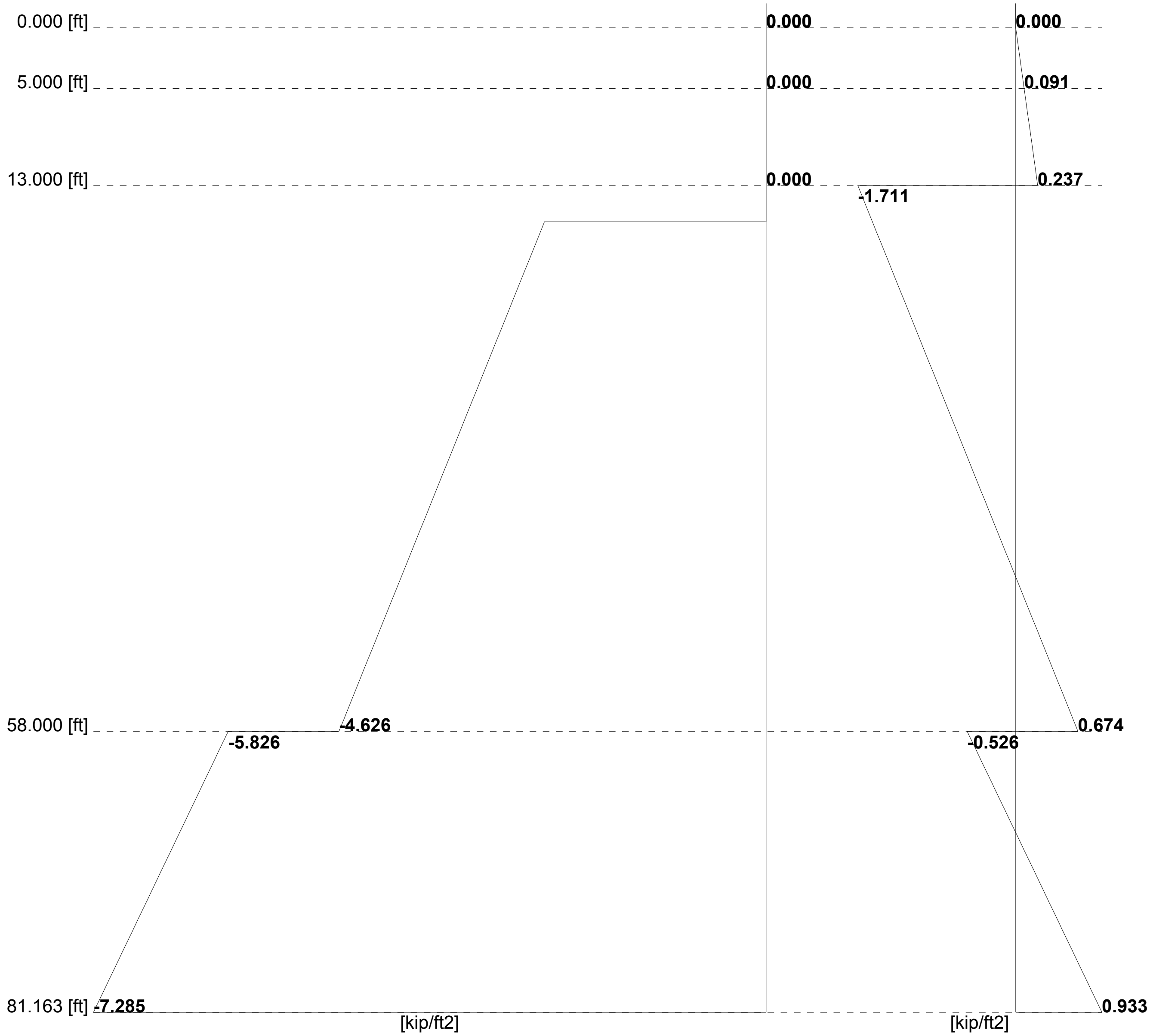
Layers in Front

	Layer Tip [ft]	Density Moist [kip/ft3]	Density Submerged [kip/ft3]	Kph	Phi [Deg]	Delta [Deg]	Cohesion [kip/ft2]
Layer 1	13.000	0.115	0.053	4.348	28.000	-15.120	0.000
Layer 2	58.000	0.115	0.053	1.000	0.000	0.000	1.200
Layer 3	90.000	0.125	0.063	1.000	0.000	0.000	1.800
Layer 4	100.000	0.130	0.068	1.000	0.000	0.000	3.000

Layers behind

	Layer Tip [ft]	Density Moist [kip/ft3]	Density Submerged [kip/ft3]	Kph	Phi [Deg]	Delta [Deg]	Cohesion [kip/ft2]
Layer 1	13.000	0.115	0.053	0.345	28.000	15.120	0.000
Layer 2	58.000	0.115	0.053	1.000	0.000	0.000	1.200
Layer 3	90.000	0.125	0.063	1.000	0.000	0.000	1.800
Layer 4	100.000	0.130	0.068	1.000	0.000	0.000	3.000

Earth Pressure Diagram

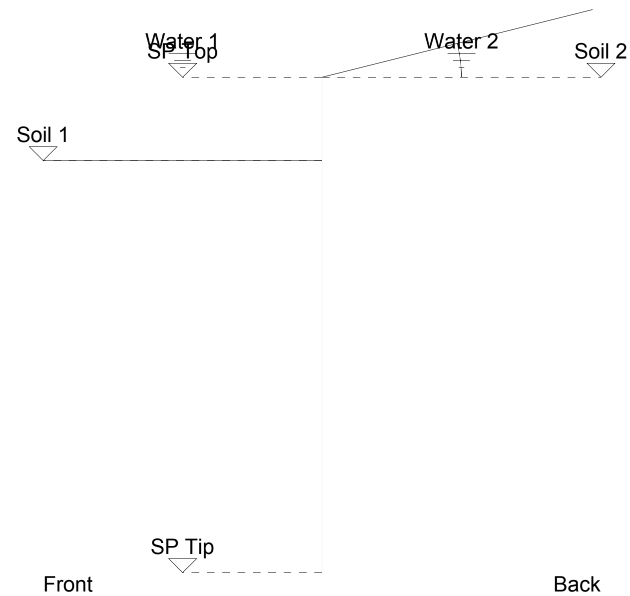


Sheet Pile Design According to Blum-Method

Project Name:	
Date:	8/16/2016
Author:	
Company:	ARCADIS U.S., Inc.
Comment:	

Geodata

	Unit
Sheet Pile Top Level [ft]	0.000
Soil Level in Front [ft]	14.000
Soil Level behind [ft]	0.000
Anchorlevel [ft]	0.000
Water Level in Front [ft]	-4.000
Water Level behind [ft]	-4.000
Soil Surface Inclination in Front [Deg]	0.000
Soil Surface Inclination behind [Deg]	14.036
Caquot Surcharge in Front [kip/ft2]	0.000
Caquot Surcharge behind [kip/ft2]	0.000
Anchor Inclination [Deg]	0.000
Earth Support	Cantilever



Soil Layers

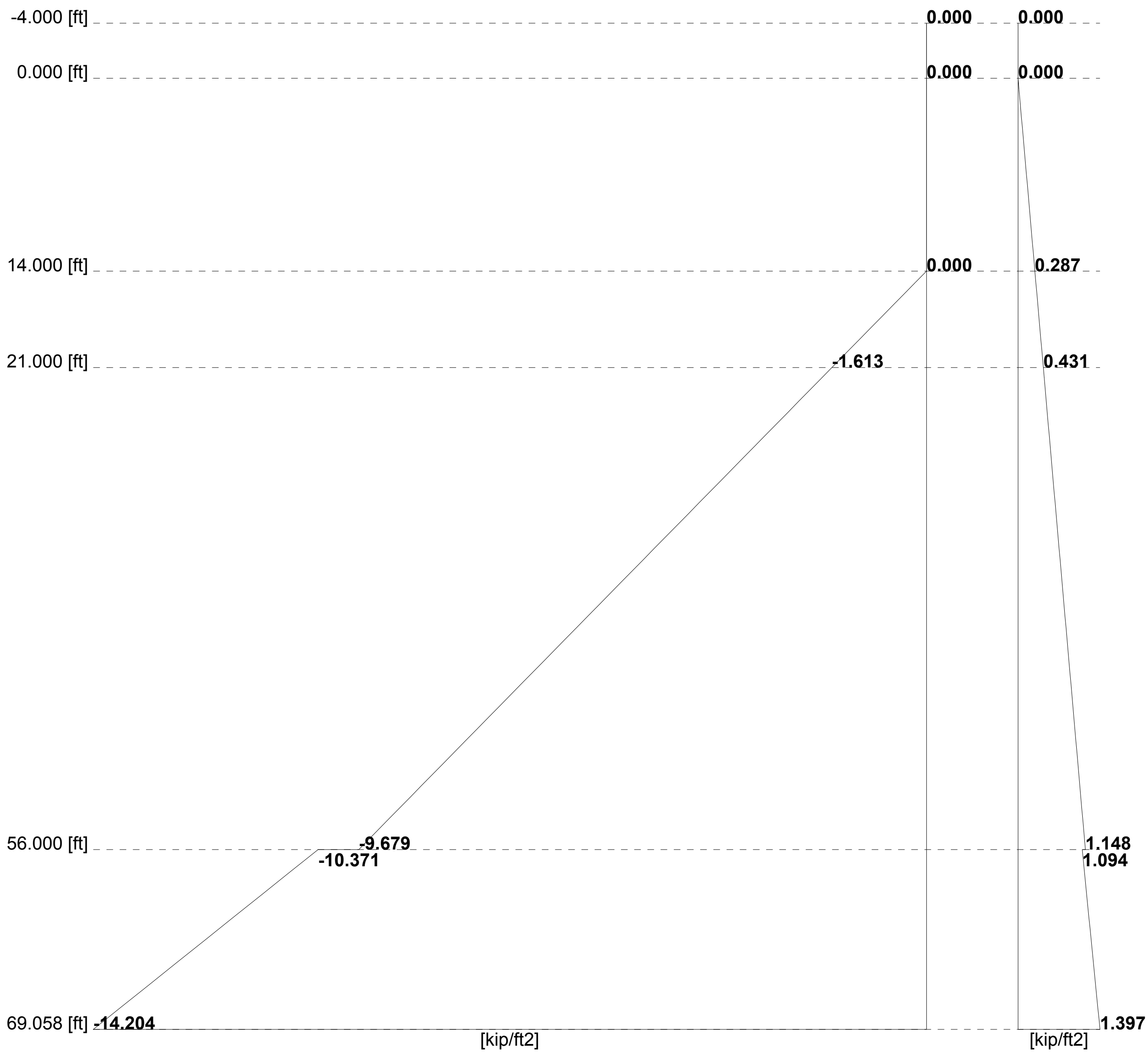
Layers in Front

	Layer Tip [ft]	Density Moist [kip/ft3]	Density Submerged [kip/ft3]	Kph	Phi [Deg]	Delta [Deg]	Cohesion [kip/ft2]
Layer 1	21.000	0.115	0.053	4.348	28.000	-15.120	0.000
Layer 2	56.000	0.115	0.053	4.348	28.000	-15.120	0.000
Layer 3	90.000	0.125	0.063	4.659	29.000	-15.660	0.000
Layer 4	150.000	0.130	0.068	6.208	33.000	-17.820	0.000

Layers behind

	Layer Tip [ft]	Density Moist [kip/ft3]	Density Submerged [kip/ft3]	Kph	Phi [Deg]	Delta [Deg]	Cohesion [kip/ft2]
Layer 1	21.000	0.115	0.053	0.387	28.000	15.120	0.000
Layer 2	56.000	0.115	0.053	0.387	28.000	15.120	0.000
Layer 3	90.000	0.125	0.063	0.369	29.000	15.660	0.000
Layer 4	150.000	0.130	0.068	0.304	33.000	17.820	0.000

Earth Pressure Diagram

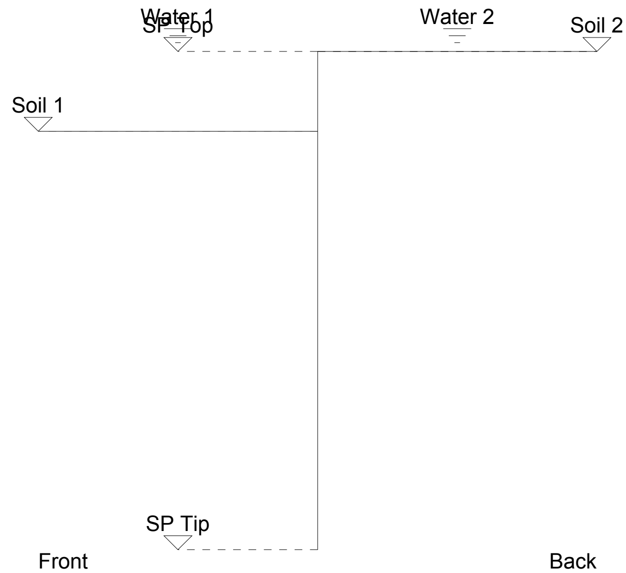


Sheet Pile Design According to Blum-Method

Project Name:	
Date:	8/16/2016
Author:	
Company:	ARCADIS U.S., Inc.
Comment:	

Geodata

	Unit
Sheet Pile Top Level [ft]	0.000
Soil Level in Front [ft]	14.000
Soil Level behind [ft]	0.000
Anchorlevel [ft]	0.000
Water Level in Front [ft]	-4.000
Water Level behind [ft]	-4.000
Soil Surface Inclination in Front [Deg]	0.000
Soil Surface Inclination behind [Deg]	0.000
Caquot Surcharge in Front [kip/ft2]	0.000
Caquot Surcharge behind [kip/ft2]	0.000
Anchor Inclination [Deg]	0.000
Earth Support	Cantilever



Soil Layers

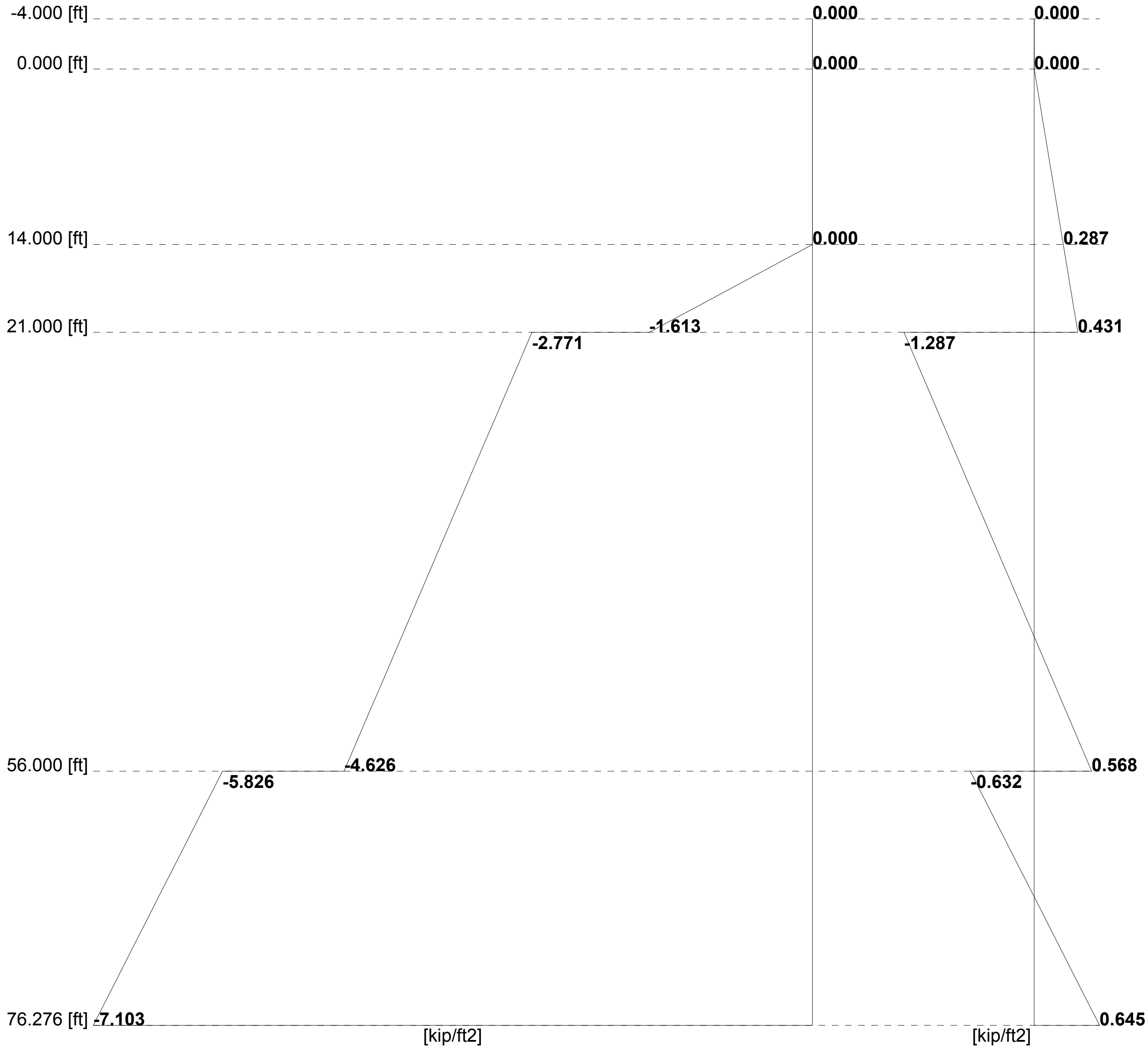
Layers in Front

	Layer Tip [ft]	Density Moist [kip/ft3]	Density Submerged [kip/ft3]	Kph	Phi [Deg]	Delta [Deg]	Cohesion [kip/ft2]
Layer 1	21.000	0.115	0.053	4.348	28.000	-15.120	0.000
Layer 2	56.000	0.115	0.053	1.000	0.000	0.000	1.200
Layer 3	90.000	0.125	0.063	1.000	0.000	0.000	1.800
Layer 4	100.000	0.130	0.068	1.000	0.000	0.000	3.000

Layers behind

	Layer Tip [ft]	Density Moist [kip/ft3]	Density Submerged [kip/ft3]	Kph	Phi [Deg]	Delta [Deg]	Cohesion [kip/ft2]
Layer 1	21.000	0.115	0.053	0.387	28.000	15.120	0.000
Layer 2	56.000	0.115	0.053	1.000	0.000	0.000	1.200
Layer 3	90.000	0.125	0.063	1.000	0.000	0.000	1.800
Layer 4	100.000	0.130	0.068	1.000	0.000	0.000	3.000

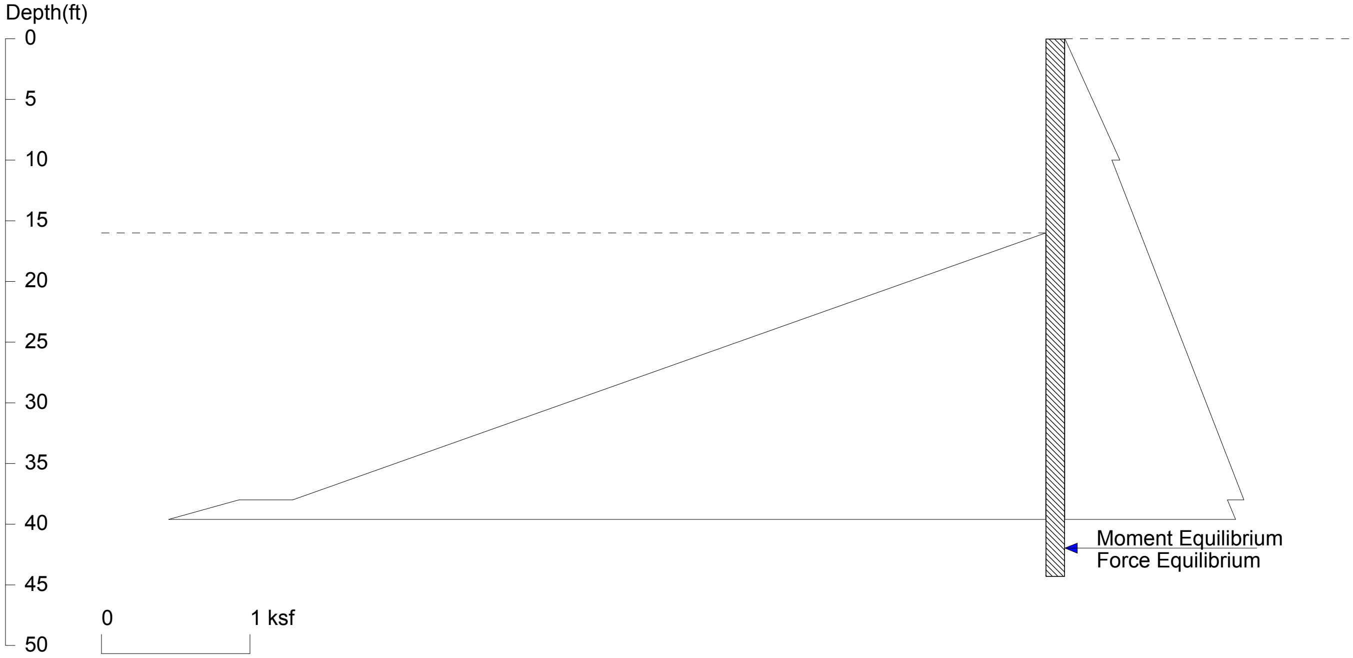
Earth Pressure Diagram



ATTACHMENT D

Shoring Suite Analysis Outputs

01_D
Embedment



<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltech.com

Licensed to Date: 8/16/2016

File: G:\COMMON\Data\Projects\National Grid\Hudson Water Street\70% Design\Calculation Sheet\Shoring Suite\01_D.sh

Wall Height=16.0 Pile Diameter=1.0 Pile Spacing=1.0 Wall Type: 1. Sheet Pile

PILE LENGTH: Min. Embedment=28.33 Min. Pile Length=44.33 (in graphics and analysis)
MOMENT IN PILE: Max. Moment=78.91 per Pile Spacing=1.0 at Depth=29.57

PILE SELECTION:
Request Min. Section Modulus = 37.9 in3/ft=2036.29 cm3/m, Fy= 50 ksi = 345 MPa, Fb/Fy=0.5
User Input I (Moment of Inertia):
Top Deflection = 2.76(in) based on E (ksi)=29000.00 and I (in4)/foot=265.3

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
* Act				
0	0	10	0.371	0.037100
10	0.317	16	0.508	0.031833
16	0.508	38	1.206	0.031727
38	1.095	53	1.608	0.034200

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =1.5

Z1	P1	Z2	P2	Slope
* Pas				
16	0	38	5.07	0.2305
38	5.433	53	9.836	0.2935

ACTIVE SPACING:

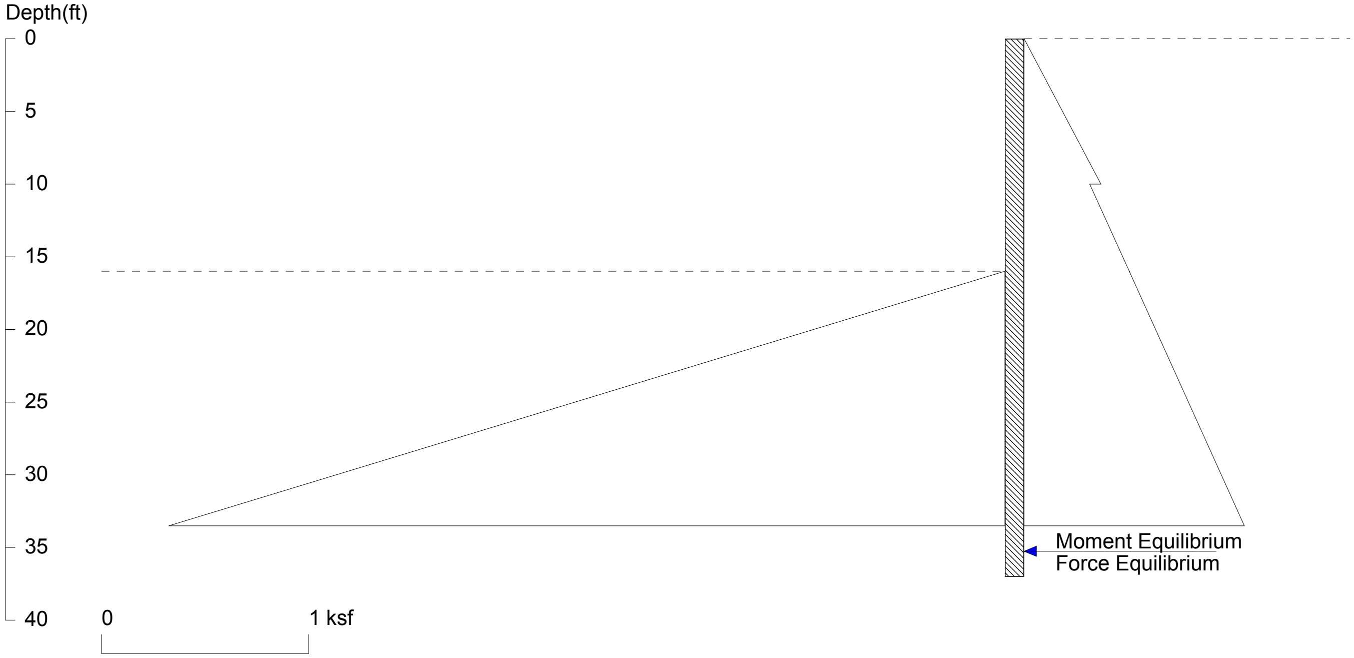
No.	Z depth	Spacing
1	0.00	1.00
2	16.00	1.00

PASSIVE SPACING:

No.	Z depth	Spacing
1	16.00	1.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

01_D
Sx and Deflection



<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltech.com

Licensed to Date: 8/16/2016

File: G:\COMMON\Data\Projects\National Grid\Hudson Water Street\70% Design\Calculation Sheet\Shoring Suite\01_D.sh

Wall Height=16.0 Pile Diameter=1.0 Pile Spacing=1.0 Wall Type: 1. Sheet Pile

PILE LENGTH: Min. Embedment=21.01 Min. Pile Length=37.01 (in graphics and analysis)
MOMENT IN PILE: Max. Moment=59.83 per Pile Spacing=1.0 at Depth=25.65

PILE SELECTION:
Request Min. Section Modulus = 28.7 in3/ft=1543.96 cm3/m, Fy= 50 ksi = 345 MPa, Fb/Fy=0.5
User Input I (Moment of Inertia):
Top Deflection = 1.71(in) based on E (ksi)=29000.00 and I (in4)/foot=265.3

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
* Act				
0	0	10	0.371	0.037100
10	0.317	16	0.508	0.031833
16	0.508	38	1.206	0.031727

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
* Pas				
16	0	38	5.07	0.2305

ACTIVE SPACING:

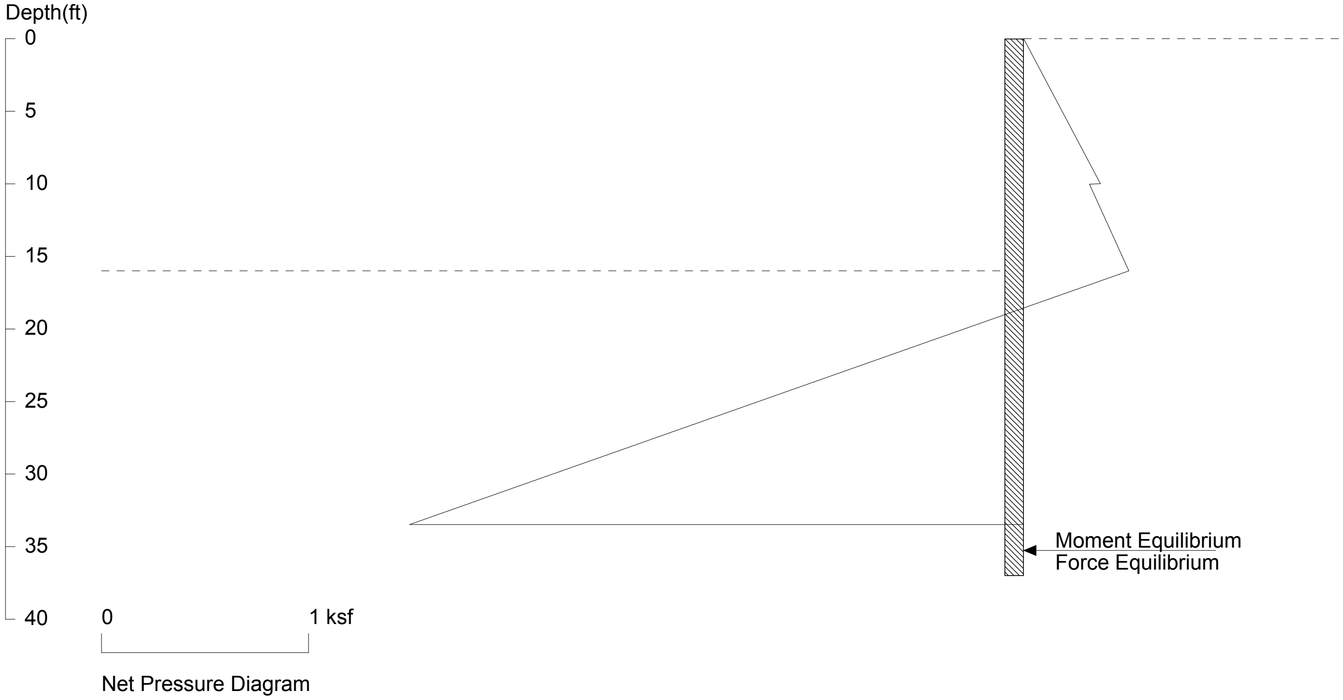
No.	Z depth	Spacing
1	0.00	1.00
2	16.00	1.00

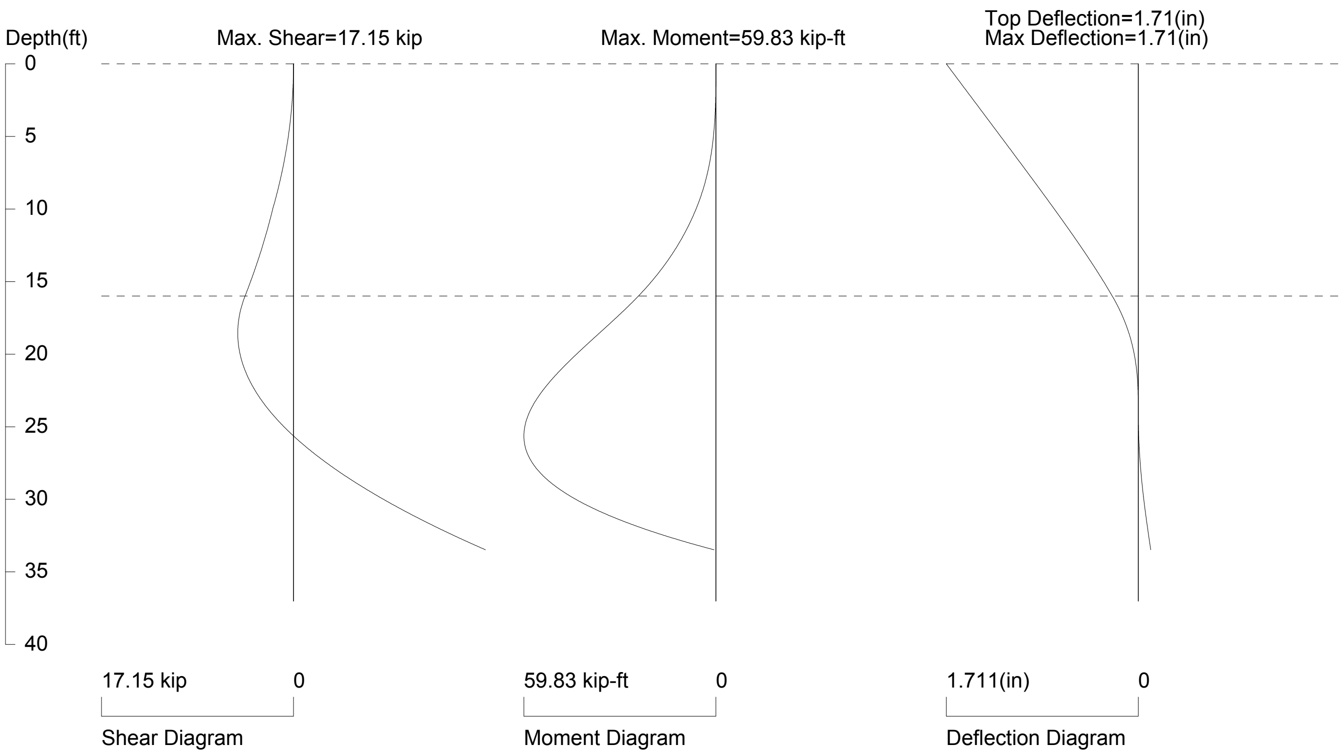
PASSIVE SPACING:

No.	Z depth	Spacing
1	16.00	1.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

01_D
Sx and Deflection





PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 1.0 foot or meter

User Input I: E (ksi)=29000.0, I (in4)/foot=265.3

File: G:\COMMON\Data\Projects\National Grid\Hudson Water Street\70% Design\Calculation Sheet\Shoring Suite\01_D.sh8

01_U
Embedment

<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltech.com

Licensed to Date: 8/16/2016
File: G:\COMMON\Data\Projects\National Grid\Hudson Water Street\70% Design\Calculation Sheet\Shoring Suite\01_U.sh

Wall Height=16.0 Pile Diameter=1.0 Pile Spacing=1.0 Wall Type: 1. Sheet Pile

PILE LENGTH: Min. Embedment=8.30 Min. Pile Length=24.30 (in graphics and analysis)
MOMENT IN PILE: Max. Moment=18.73 per Pile Spacing=1.0 at Depth=17.51

PILE SELECTION:
Request Min. Section Modulus = 9.0 in3/ft=483.35 cm3/m, Fy= 50 ksi = 345 MPa, Fb/Fy=0.5
User Input I (Moment of Inertia):
Top Deflection = 0.47(in) based on E (ksi)=29000.00 and I (in4)/foot=265.3

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
* Act				
0	0	10	0.371	0.037100

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =2

Z1	P1	Z2	P2	Slope
* Pas				
16	2.4	38	3.566	0.0530

ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00
2	16.00	1.00

PASSIVE SPACING:

No.	Z depth	Spacing
1	16.00	1.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

01_U
Sx and Deflection

<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltech.com

Licensed to Date: 8/16/2016
File: G:\COMMON\Data\Projects\National Grid\Hudson Water Street\70% Design\Calculation Sheet\Shoring Suite\01_U.sh

Wall Height=16.0 Pile Diameter=1.0 Pile Spacing=1.0 Wall Type: 1. Sheet Pile

PILE LENGTH: Min. Embedment=5.47 (8~10ft is recommended!!!) Min. Pile Length=21.47 (in graphics and analysis)
MOMENT IN PILE: Max. Moment=18.03 per Pile Spacing=1.0 at Depth=16.77

PILE SELECTION:
Request Min. Section Modulus = 8.7 in3/ft=465.16 cm3/m, Fy= 50 ksi = 345 MPa, Fb/Fy=0.5
User Input I (Moment of Inertia):
Top Deflection = 0.38(in) based on E (ksi)=29000.00 and I (in4)/foot=265.3

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
* Act				
0	0	10	0.371	0.037100

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
* Pas				
16	2.4	38	3.566	0.0530

ACTIVE SPACING:

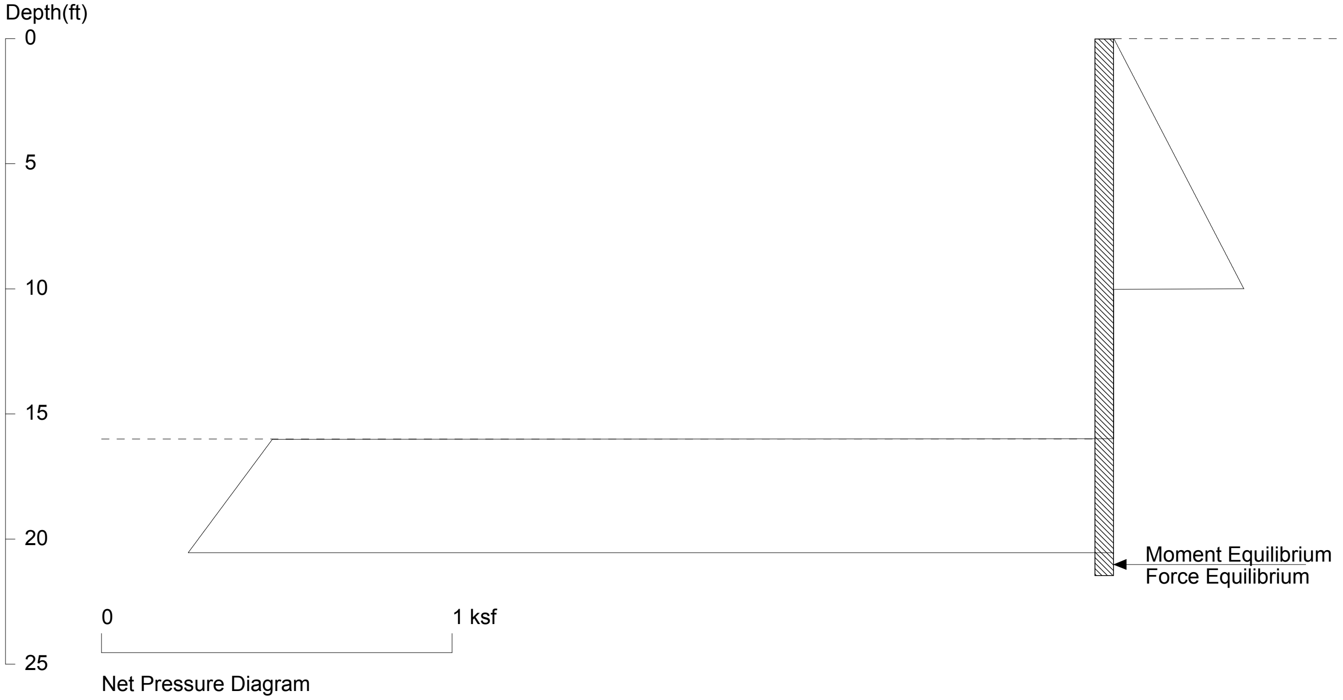
No.	Z depth	Spacing
1	0.00	1.00
2	16.00	1.00

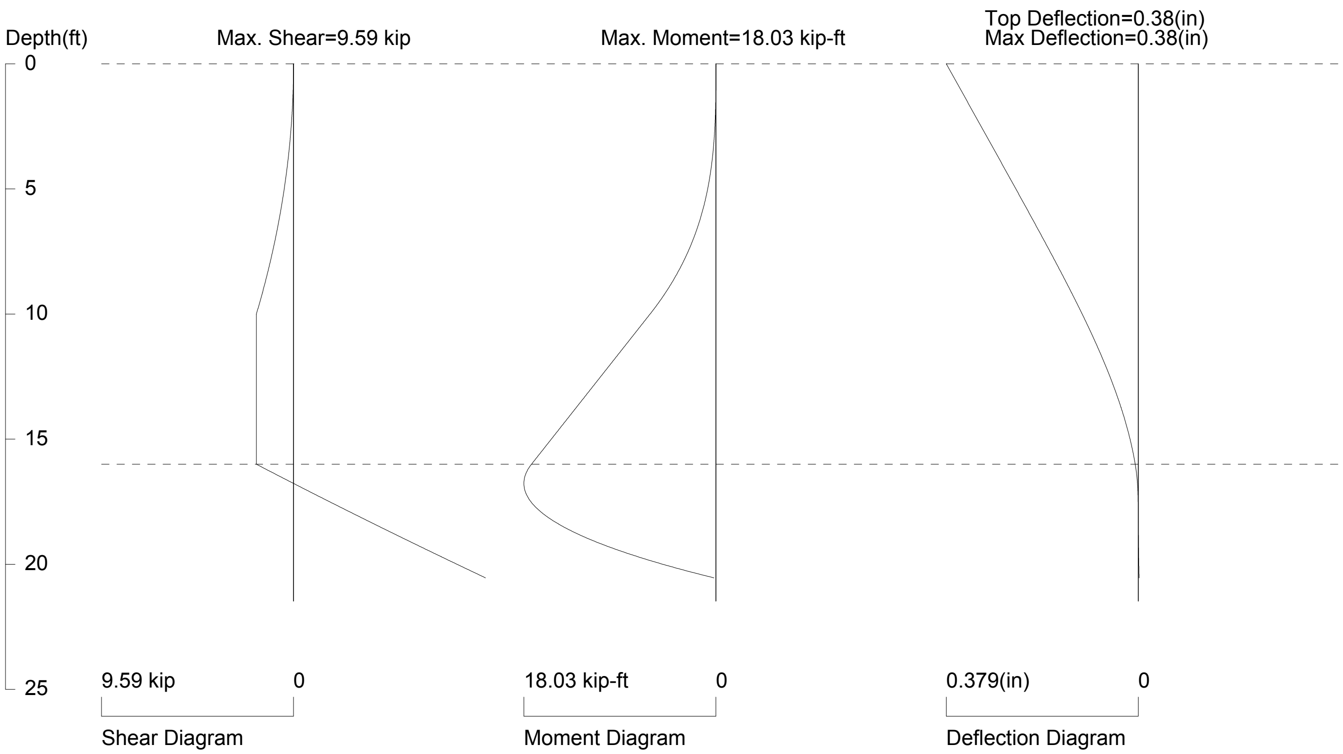
PASSIVE SPACING:

No.	Z depth	Spacing
1	16.00	1.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

01_U
Sx and Deflection





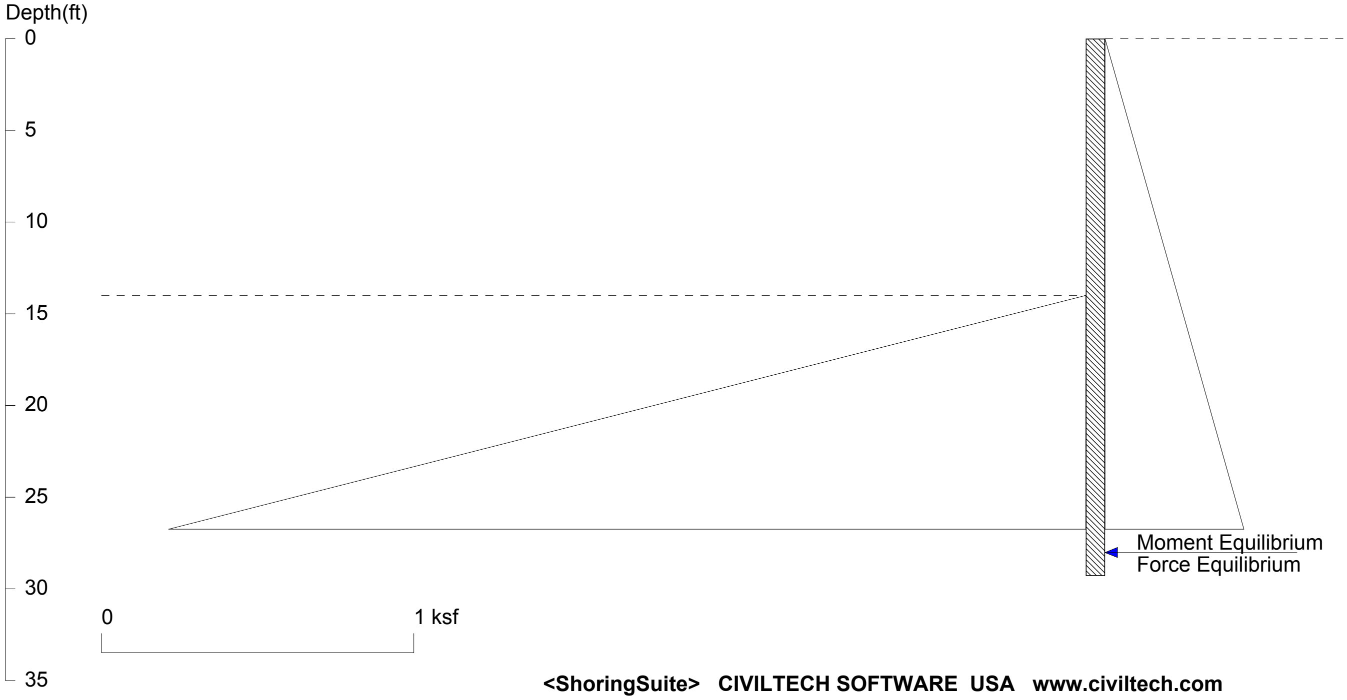
PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 1.0 foot or meter

User Input I: E (ksi)=29000.0, I (in4)/foot=265.3

File: G:\COMMON\Data\Projects\National Grid\Hudson Water Street\70% Design\Calculation Sheet\Shoring Suite\01_U.sh8

02_D
Embedment



Licensed to Date: 8/16/2016
File: G:\COMMON\Data\Projects\National Grid\Hudson Water Street\70% Design\Calculation Sheet\Shoring Suite\02_D.sh

Wall Height=14.0 Pile Diameter=1.0 Pile Spacing=1.0 Wall Type: 1. Sheet Pile

PILE LENGTH: Min. Embedment=15.29 Min. Pile Length=29.29 (in graphics and analysis)
MOMENT IN PILE: Max. Moment=16.88 per Pile Spacing=1.0 at Depth=20.86

PILE SELECTION:
Request Min. Section Modulus = 8.1 in3/ft=435.68 cm3/m, Fy= 50 ksi = 345 MPa, Fb/Fy=0.5
User Input I (Moment of Inertia):
Top Deflection = 0.57(in) based on E (ksi)=29000.00 and I (in4)/foot=250.4

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
* Act				
0	0	16	0.266	0.016625
16	0.266	44	0.731	0.016607

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =1.5

Z1	P1	Z2	P2	Slope
* Pas				
14	0	16	0.461	0.2305
16	0.461	44	6.913	0.2304

ACTIVE SPACING:

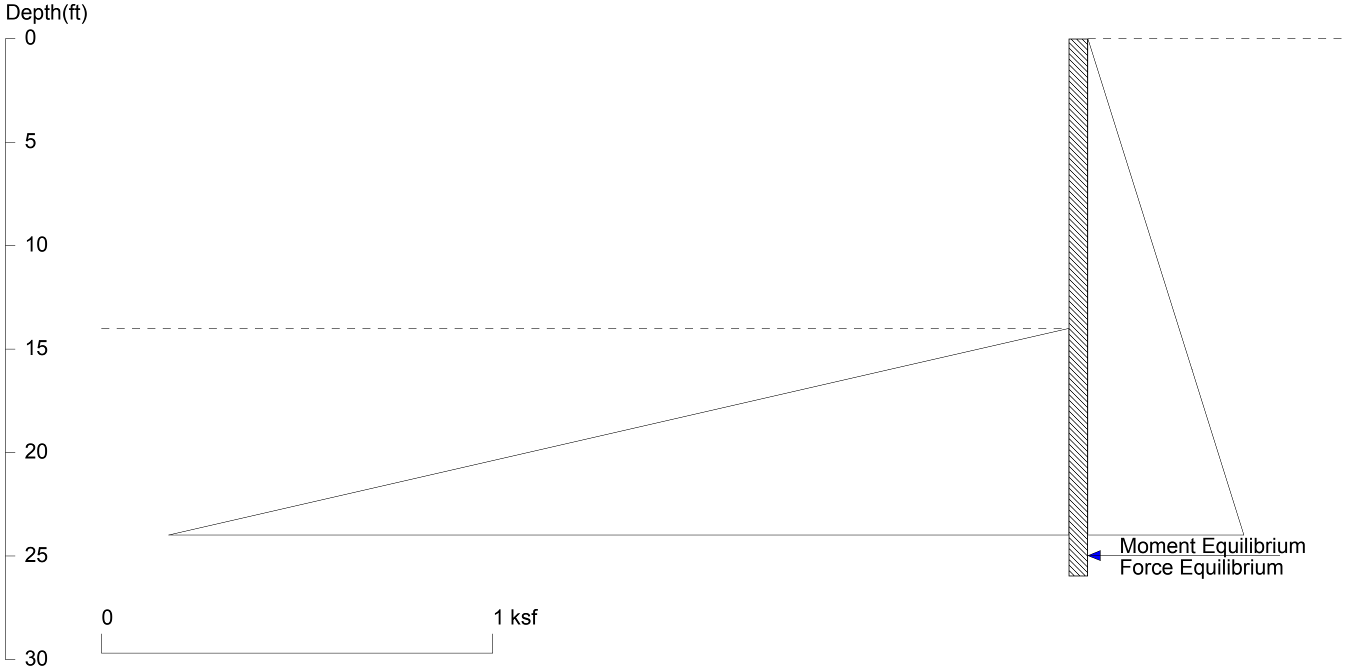
No.	Z depth	Spacing
1	0.00	1.00
2	14.00	1.00

PASSIVE SPACING:

No.	Z depth	Spacing
1	14.00	1.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

02_D
Sx and Deflection



<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltech.com

Licensed to Date: 8/16/2016
File: G:\COMMON\Data\Projects\National Grid\Hudson Water Street\70% Design\Calculation Sheet\Shoring Suite\02_D.sh

Wall Height=14.0 Pile Diameter=1.0 Pile Spacing=1.0 Wall Type: 1. Sheet Pile

PILE LENGTH: Min. Embedment=11.98 Min. Pile Length=25.98 (in graphics and analysis)
MOMENT IN PILE: Max. Moment=14.21 per Pile Spacing=1.0 at Depth=19.13

PILE SELECTION:
Request Min. Section Modulus = 6.8 in3/ft=366.74 cm3/m, Fy= 50 ksi = 345 MPa, Fb/Fy=0.5
User Input I (Moment of Inertia):
Top Deflection = 0.39(in) based on E (ksi)=29000.00 and I (in4)/foot=250.4

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
* Act				
0	0	16	0.266	0.016625
16	0.266	44	0.731	0.016607

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
* Pas				
14	0	16	0.461	0.2305
16	0.461	44	6.913	0.2304

ACTIVE SPACING:

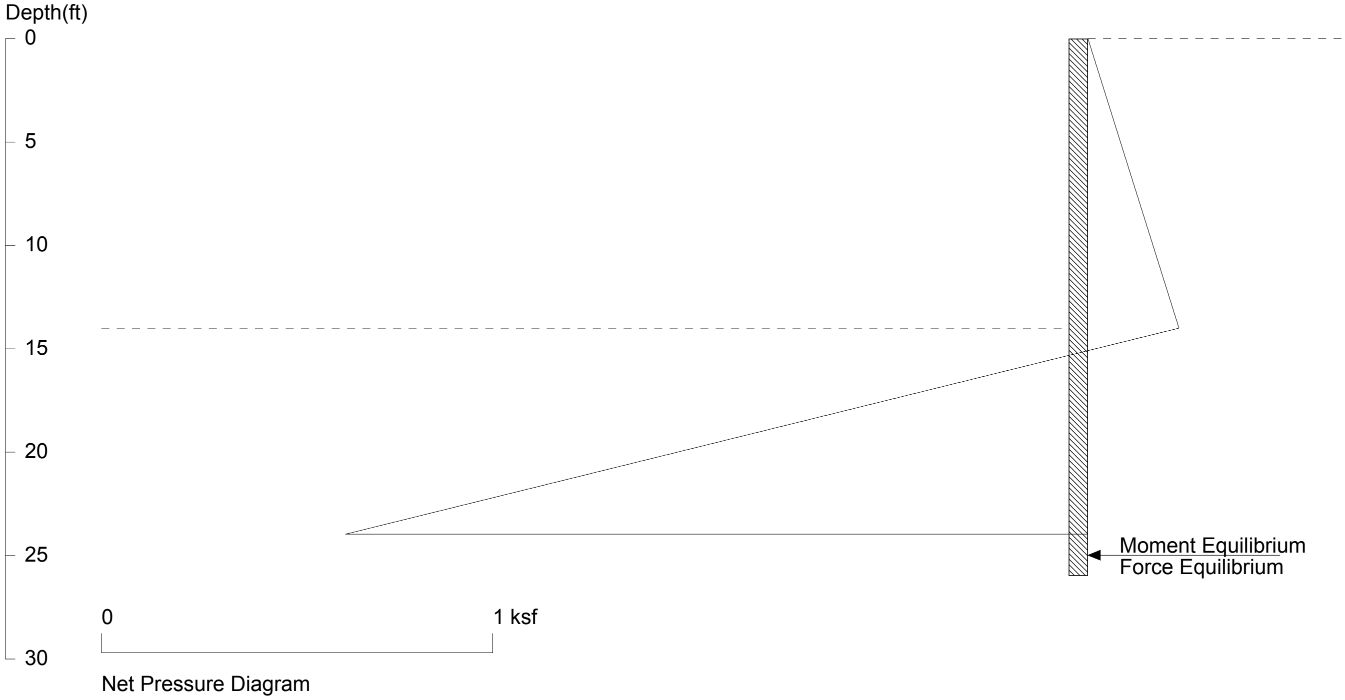
No.	Z depth	Spacing
1	0.00	1.00
2	14.00	1.00

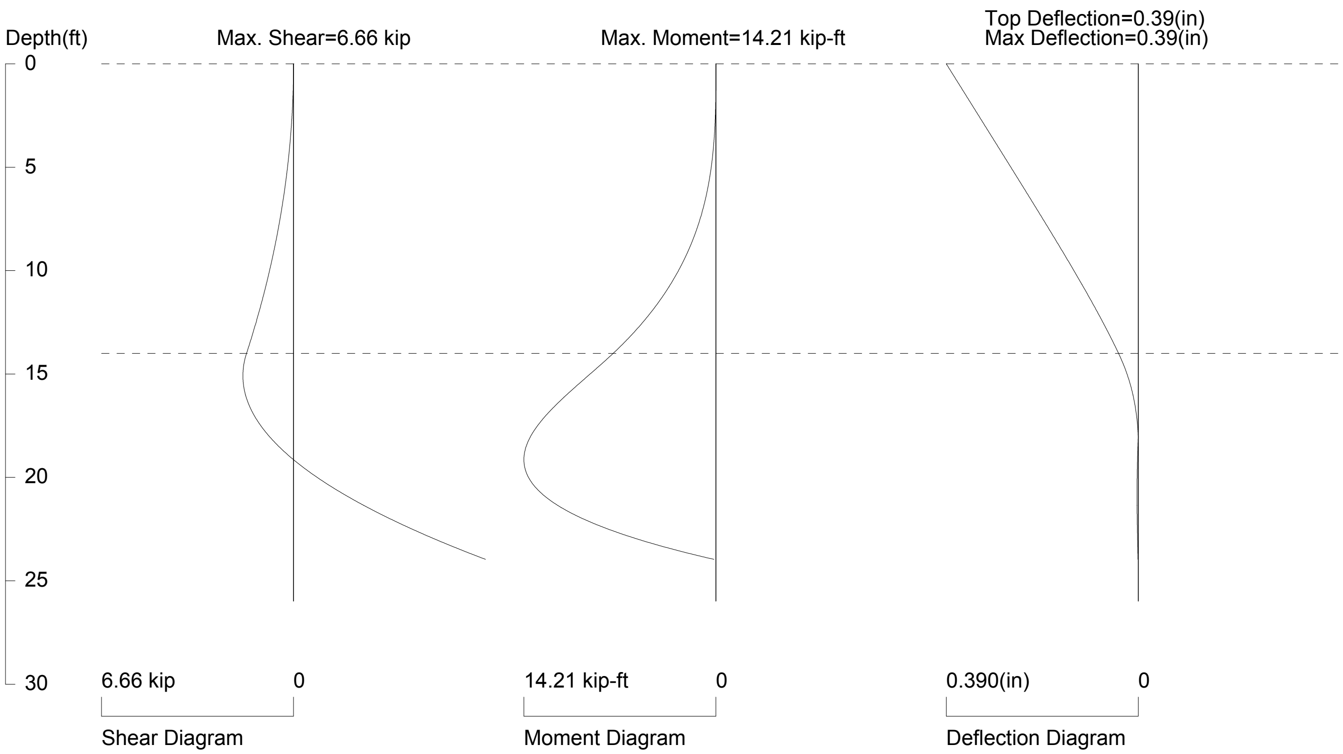
PASSIVE SPACING:

No.	Z depth	Spacing
1	14.00	1.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

02_D
Sx and Deflection





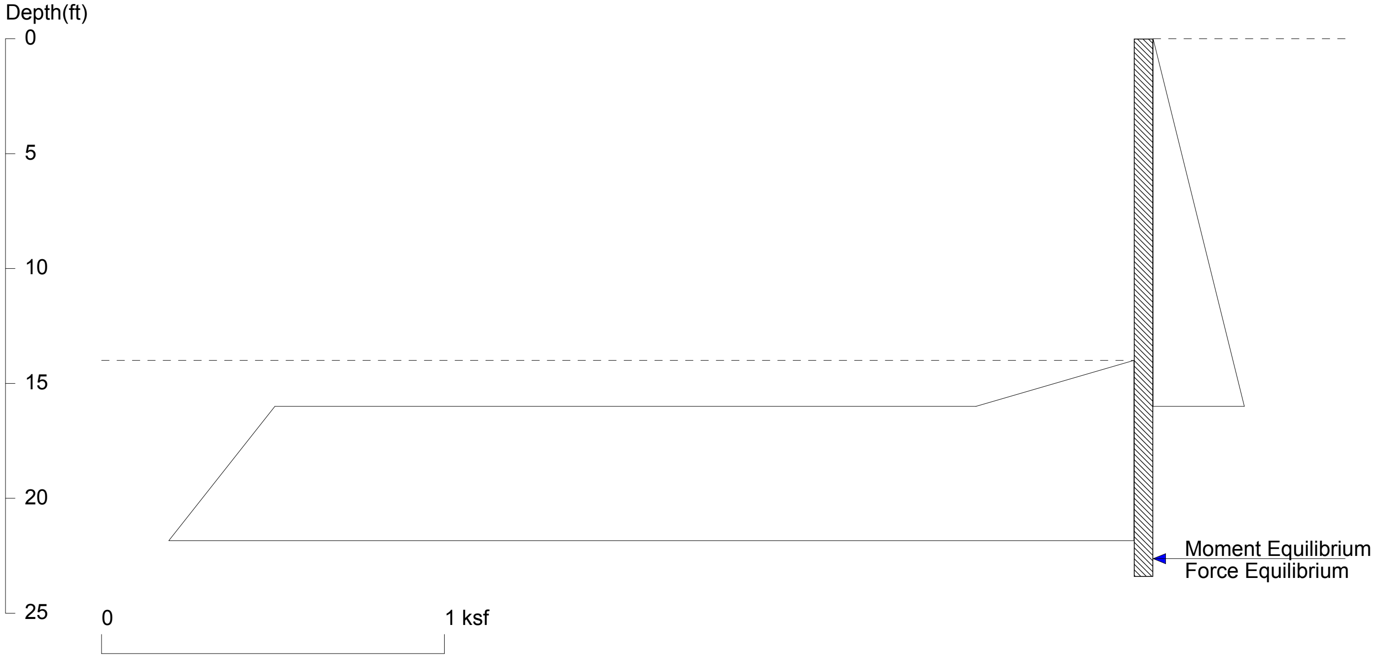
PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 1.0 foot or meter

User Input I: E (ksi)=29000.0,   I (in4)/foot=250.4

File: G:\COMMON\Data\Projects\National Grid\Hudson Water Street\70% Design\Calculation Sheet\Shoring Suite\02_D.sh8

02_U
Embedment



<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltech.com

Licensed to Date: 8/16/2016
File: G:\COMMON\Data\Projects\National Grid\Hudson Water Street\70% Design\Calculation Sheet\Shoring Suite\02_U.sh

Wall Height=14.0 Pile Diameter=1.0 Pile Spacing=1.0 Wall Type: 1. Sheet Pile

PILE LENGTH: Min. Embedment=9.41 Min. Pile Length=23.41 (in graphics and analysis)
MOMENT IN PILE: Max. Moment=12.62 per Pile Spacing=1.0 at Depth=17.50

PILE SELECTION:
Request Min. Section Modulus = 6.1 in3/ft=325.59 cm3/m, Fy= 50 ksi = 345 MPa, Fb/Fy=0.5
User Input I (Moment of Inertia):
Top Deflection = 0.28(in) based on E (ksi)=29000.00 and I (in4)/foot=250.4

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
* Act				
0	0	16	0.266	0.016625

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =2

Z1	P1	Z2	P2	Slope
* Pas				
14	0	16	0.461	0.2305
16	2.506	44	3.99	0.0530

ACTIVE SPACING:

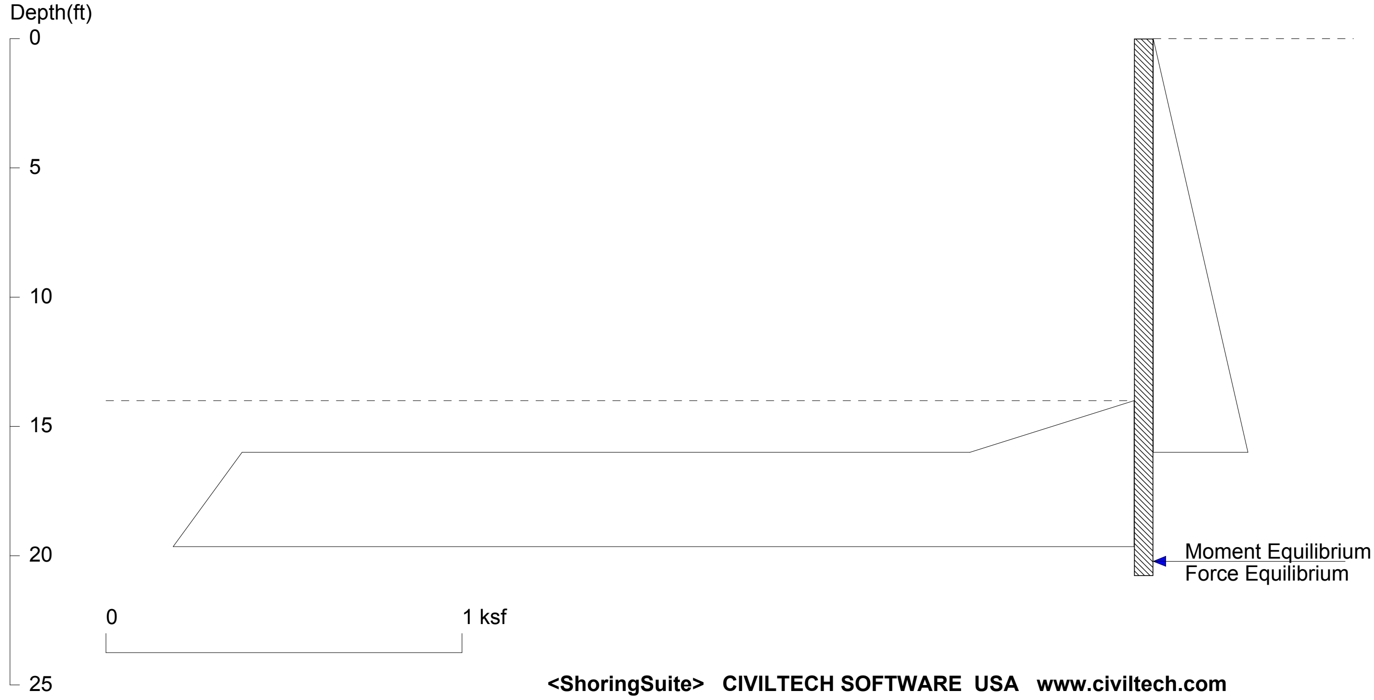
No.	Z depth	Spacing
1	0.00	1.00
2	14.00	1.00

PASSIVE SPACING:

No.	Z depth	Spacing
1	14.00	1.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

02_U
Sx and Deflection



Licensed to Date: 8/16/2016
File: G:\COMMON\Data\Projects\National Grid\Hudson Water Street\70% Design\Calculation Sheet\Shoring Suite\02_U.sh

Wall Height=14.0 Pile Diameter=1.0 Pile Spacing=1.0 Wall Type: 1. Sheet Pile

PILE LENGTH: Min. Embedment=6.78 (8~10ft is recommended!!!) Min. Pile Length=20.78 (in graphics and analysis)
MOMENT IN PILE: Max. Moment=11.59 per Pile Spacing=1.0 at Depth=16.66

PILE SELECTION:
Request Min. Section Modulus = 5.6 in3/ft=299.18 cm3/m, Fy= 50 ksi = 345 MPa, Fb/Fy=0.5
User Input I (Moment of Inertia):
Top Deflection = 0.20(in) based on E (ksi)=29000.00 and I (in4)/foot=250.4

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
* Act				
0	0	16	0.266	0.016625

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
* Pas				
14	0	16	0.461	0.2305
16	2.506	44	3.99	0.0530

ACTIVE SPACING:

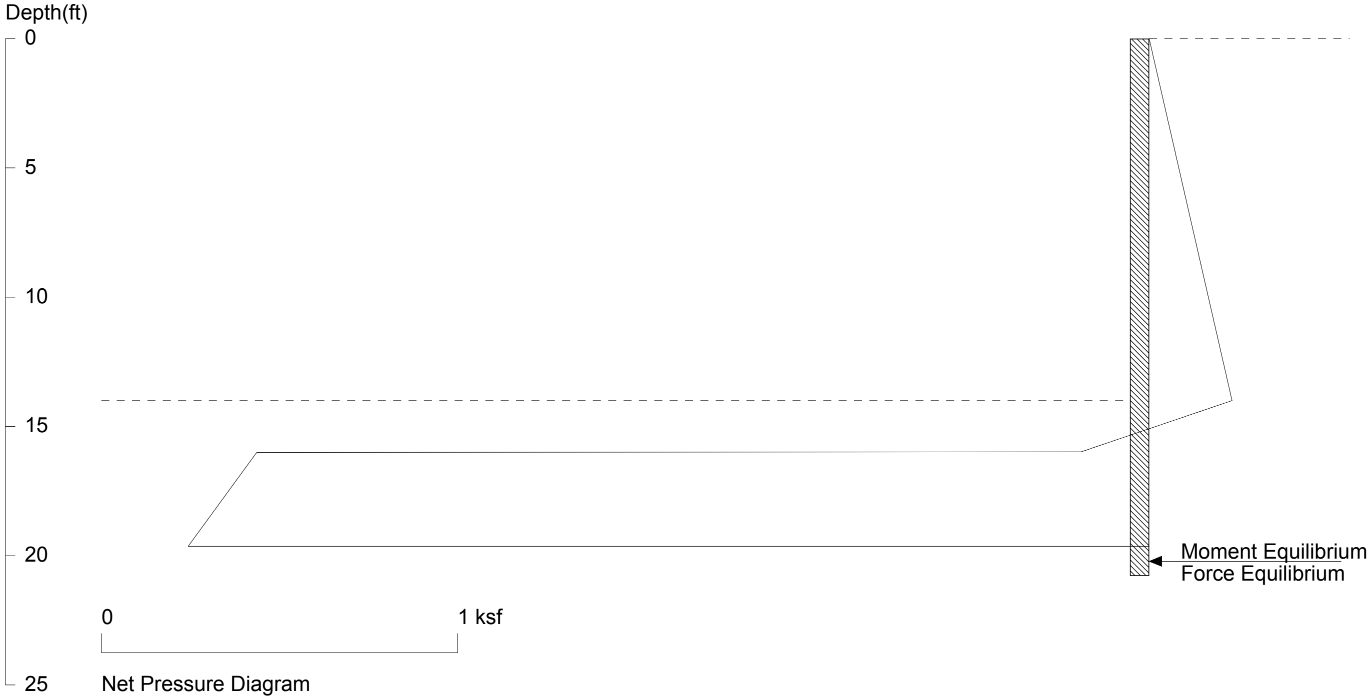
No.	Z depth	Spacing
1	0.00	1.00
2	14.00	1.00

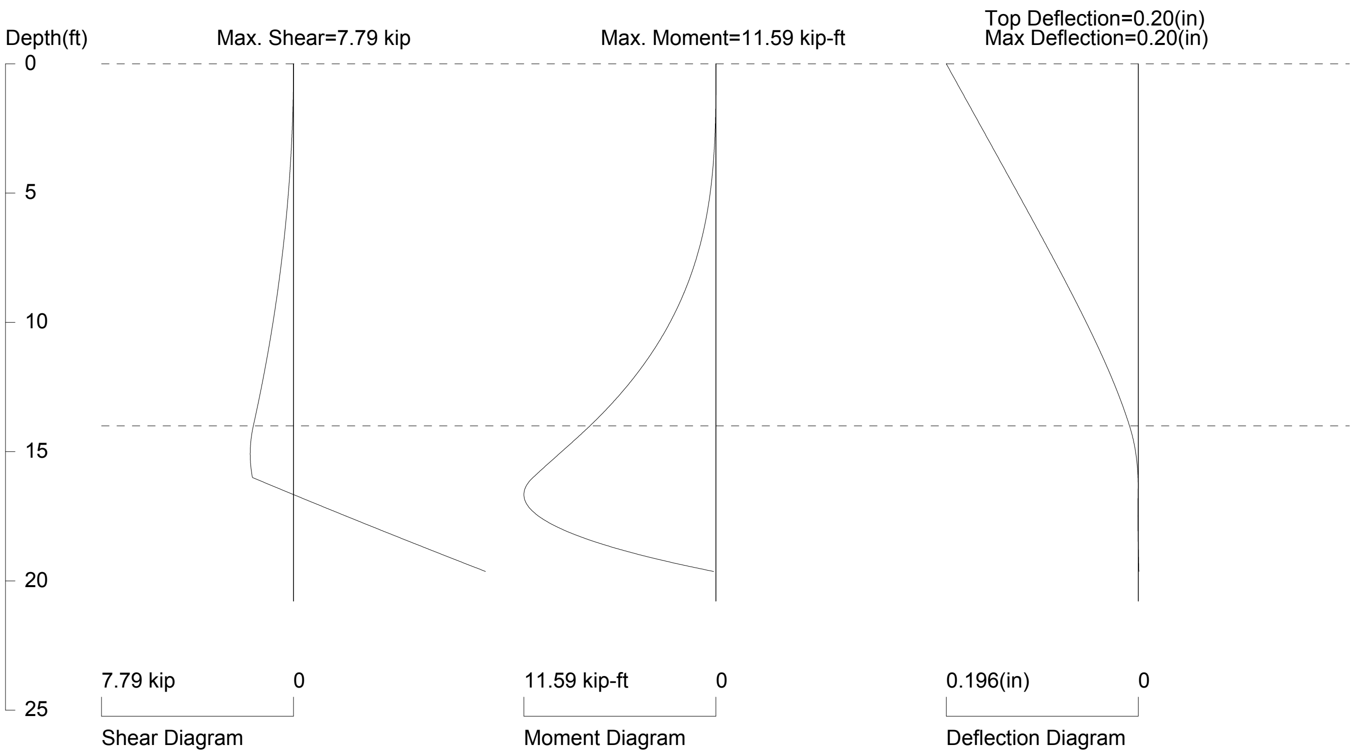
PASSIVE SPACING:

No.	Z depth	Spacing
1	14.00	1.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

02_U
Sx and Deflection





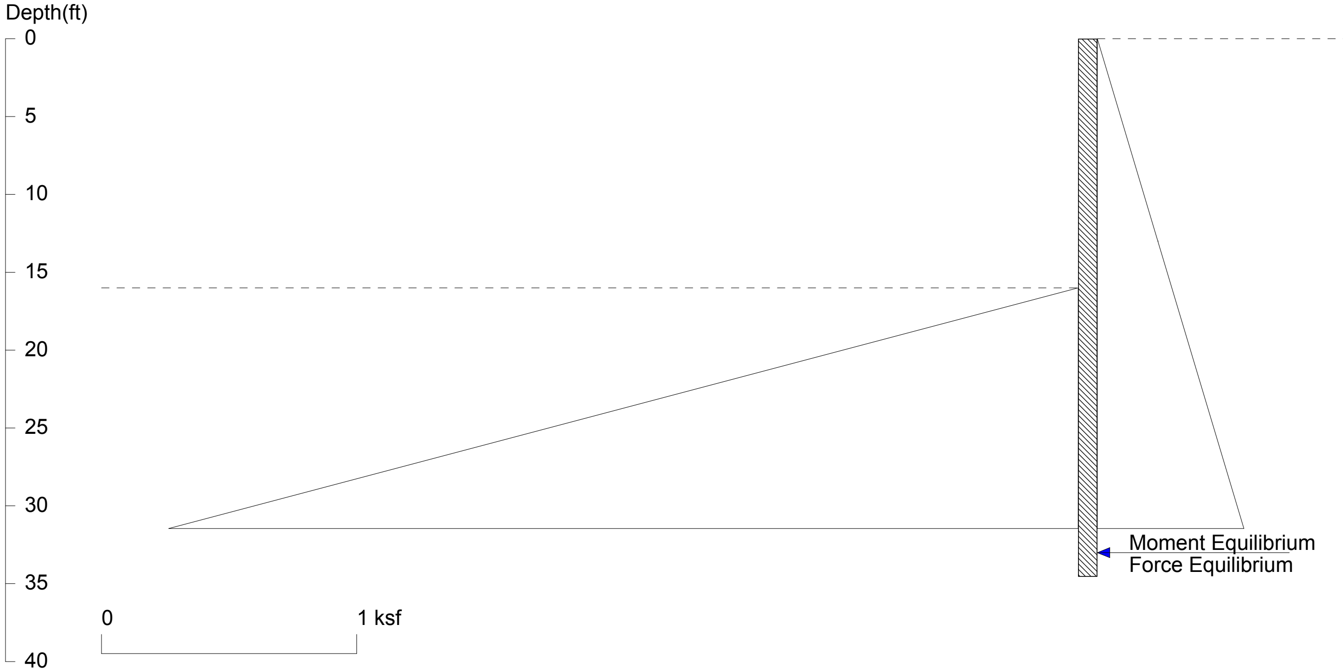
PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 1.0 foot or meter

User Input I: E (ksi)=29000.0, I (in4)/foot=250.4

File: G:\COMMON\Data\Projects\National Grid\Hudson Water Street\70% Design\Calculation Sheet\Shoring Suite\02_U.sh8

03_D
Embedment



<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltech.com

Licensed to Date: 8/16/2016

File: G:\COMMON\Data\Projects\National Grid\Hudson Water Street\70% Design\Calculation Sheet\Shoring Suite\03_D.sh

Wall Height=16.0 Pile Diameter=1.0 Pile Spacing=1.0 Wall Type: 1. Sheet Pile

PILE LENGTH: Min. Embedment=18.55 Min. Pile Length=34.55 (in graphics and analysis)
MOMENT IN PILE: Max. Moment=28.97 per Pile Spacing=1.0 at Depth=24.40

PILE SELECTION:
Request Min. Section Modulus = 13.9 in3/ft=747.53 cm3/m, Fy= 50 ksi = 345 MPa, Fb/Fy=0.5
User Input I (Moment of Inertia):
Top Deflection = 1.61(in) based on E (ksi)=29000.00 and I (in4)/foot=156.9

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
* Act				
0	0	13	0.237	0.018231
13	0.237	58	1.059	0.018267

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =1.5

Z1	P1	Z2	P2	Slope
* Pas				
16	0	58	9.679	0.2305

ACTIVE SPACING:

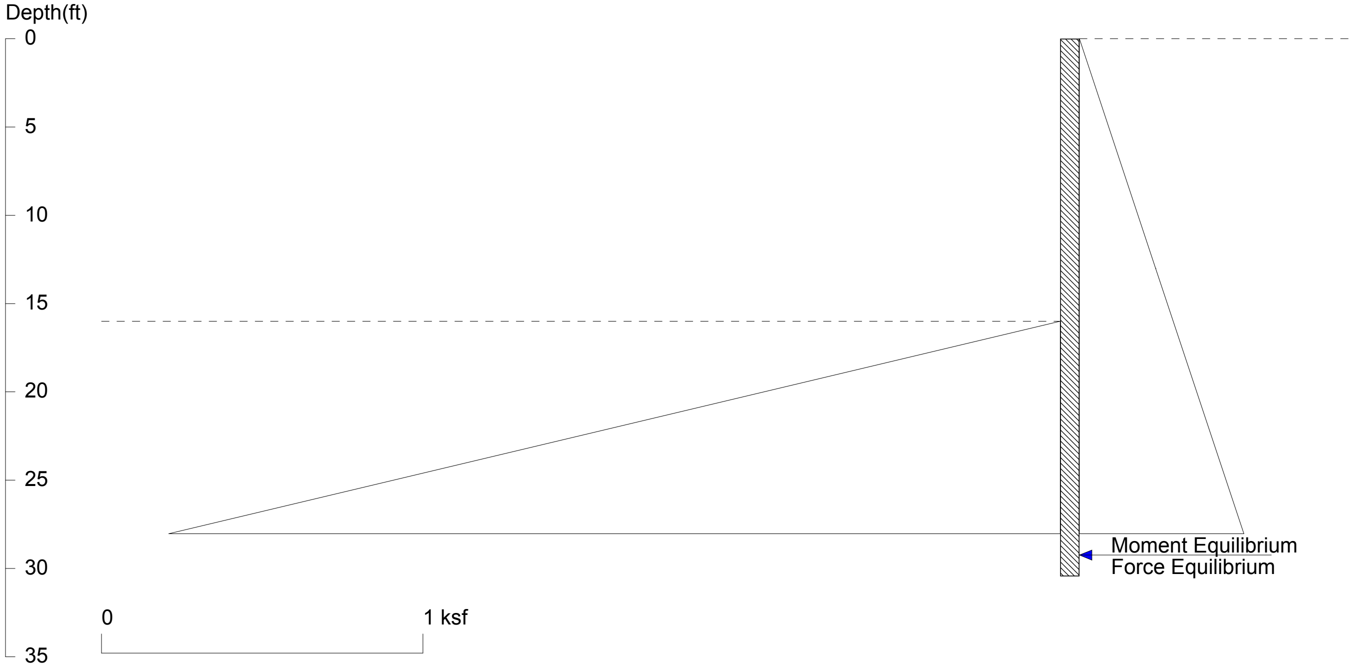
No.	Z depth	Spacing
1	0.00	1.00
2	16.00	1.00

PASSIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

03_D
Sx and Deflection



<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltech.com

Licensed to Date: 8/16/2016
File: G:\COMMON\Data\Projects\National Grid\Hudson Water Street\70% Design\Calculation Sheet\Shoring Suite\03_D.sh

Wall Height=16.0 Pile Diameter=1.0 Pile Spacing=1.0 Wall Type: 1. Sheet Pile

PILE LENGTH: Min. Embedment=14.44 Min. Pile Length=30.44 (in graphics and analysis)
MOMENT IN PILE: Max. Moment=24.10 per Pile Spacing=1.0 at Depth=22.27

PILE SELECTION:
Request Min. Section Modulus = 11.6 in3/ft=621.77 cm3/m, Fy= 50 ksi = 345 MPa, Fb/Fy=0.5
User Input I (Moment of Inertia):
Top Deflection = 1.12(in) based on E (ksi)=29000.00 and I (in4)/foot=156.9

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
* Act				
0	0	13	0.237	0.018231
13	0.237	58	1.059	0.018267

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
* Pas				
16	0	58	9.679	0.2305

ACTIVE SPACING:

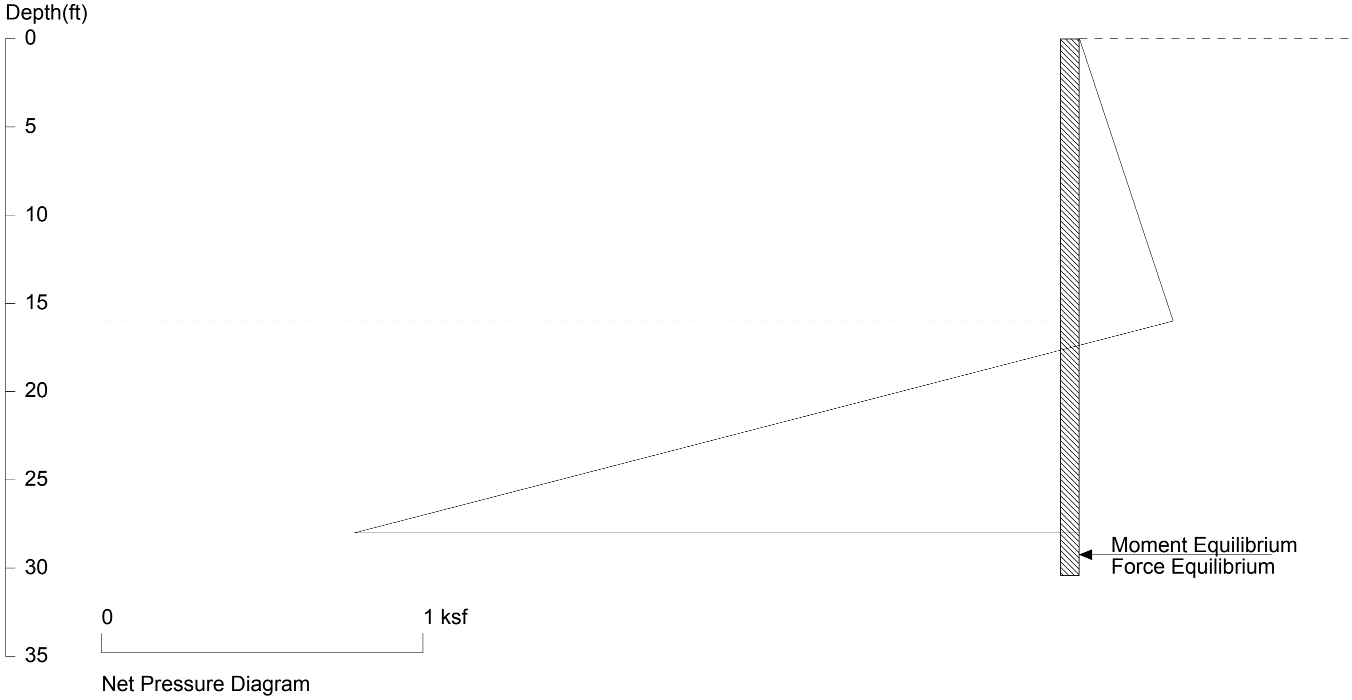
No.	Z depth	Spacing
1	0.00	1.00
2	16.00	1.00

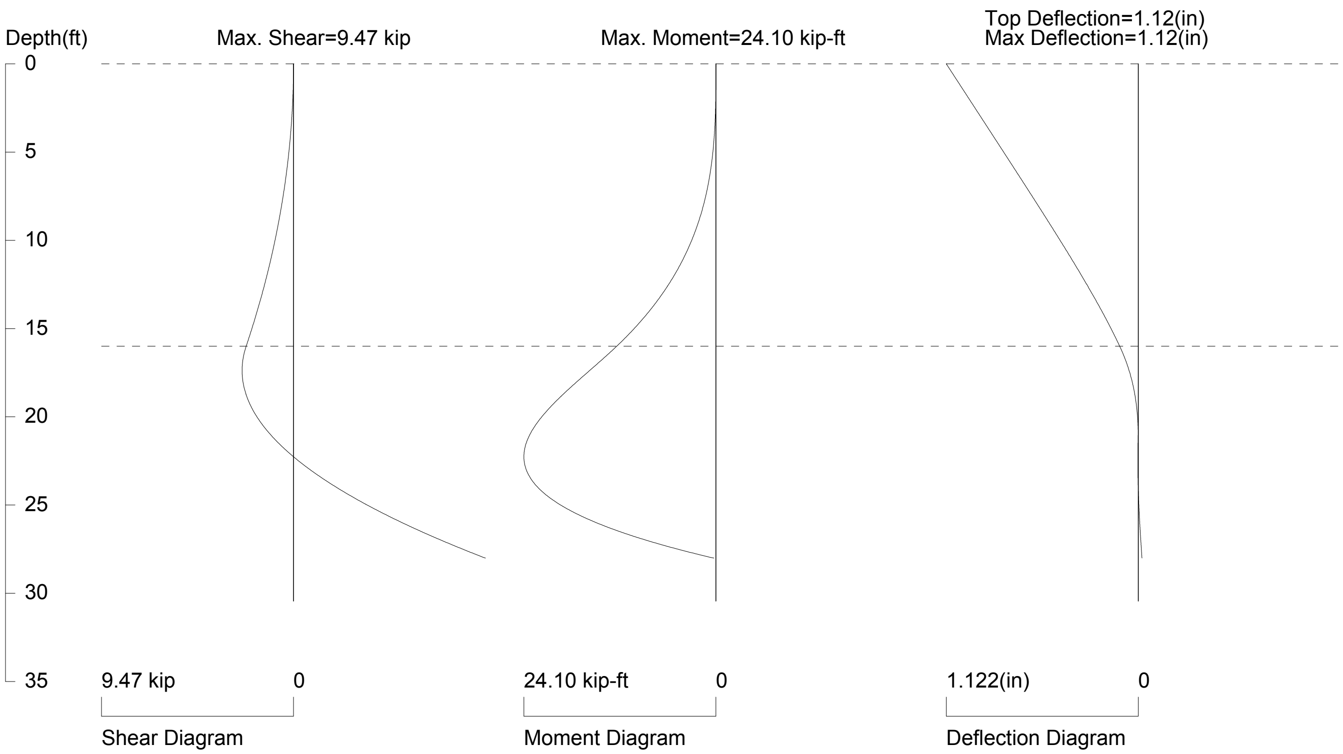
PASSIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

03_D
Sx and Deflection





PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 1.0 foot or meter

User Input I: E (ksi)=29000.0,   I (in4)/foot=156.9

File: G:\COMMON\Data\Projects\National Grid\Hudson Water Street\70% Design\Calculation Sheet\Shoring Suite\03_D.sh8

03_U
Embedment

<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltech.com

Licensed to Date: 8/16/2016

File: G:\COMMON\Data\Projects\National Grid\Hudson Water Street\70% Design\Calculation Sheet\Shoring Suite\03_U.sh

Wall Height=16.0 Pile Diameter=1.0 Pile Spacing=1.0 Wall Type: 1. Sheet Pile

PILE LENGTH: Min. Embedment=6.79 (8~10ft is recommended!!!) Min. Pile Length=22.79 (in graphics and analysis)
MOMENT IN PILE: Max. Moment=12.28 per Pile Spacing=1.0 at Depth=17.28

PILE SELECTION:
Request Min. Section Modulus = 5.9 in3/ft=316.80 cm3/m, Fy= 50 ksi = 345 MPa, Fb/Fy=0.5
User Input I (Moment of Inertia):
Top Deflection = 0.48(in) based on E (ksi)=29000.00 and I (in4)/foot=156.9

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
* Act				
0	0	13	0.237	0.018231

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =2

Z1	P1	Z2	P2	Slope
* Pas				
16	2.4	58	4.626	0.0530

ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00
2	16.00	1.00

PASSIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

03_U
Sx and Deflection

<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltech.com

Licensed to Date: 8/16/2016

File: G:\COMMON\Data\Projects\National Grid\Hudson Water Street\70% Design\Calculation Sheet\Shoring Suite\03_U.sh

Wall Height=16.0 Pile Diameter=1.0 Pile Spacing=1.0 Wall Type: 1. Sheet Pile

PILE LENGTH: Min. Embedment=4.46 (8~10ft is recommended!!!) Min. Pile Length=20.46 (in graphics and analysis)
MOMENT IN PILE: Max. Moment=11.79 per Pile Spacing=1.0 at Depth=16.63

PILE SELECTION:
Request Min. Section Modulus = 5.7 in3/ft=304.22 cm3/m, Fy= 50 ksi = 345 MPa, Fb/Fy=0.5
User Input I (Moment of Inertia):
Top Deflection = 0.37(in) based on E (ksi)=29000.00 and I (in4)/foot=156.9

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
* Act				
0	0	13	0.237	0.018231

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
* Pas				
16	2.4	58	4.626	0.0530

ACTIVE SPACING:

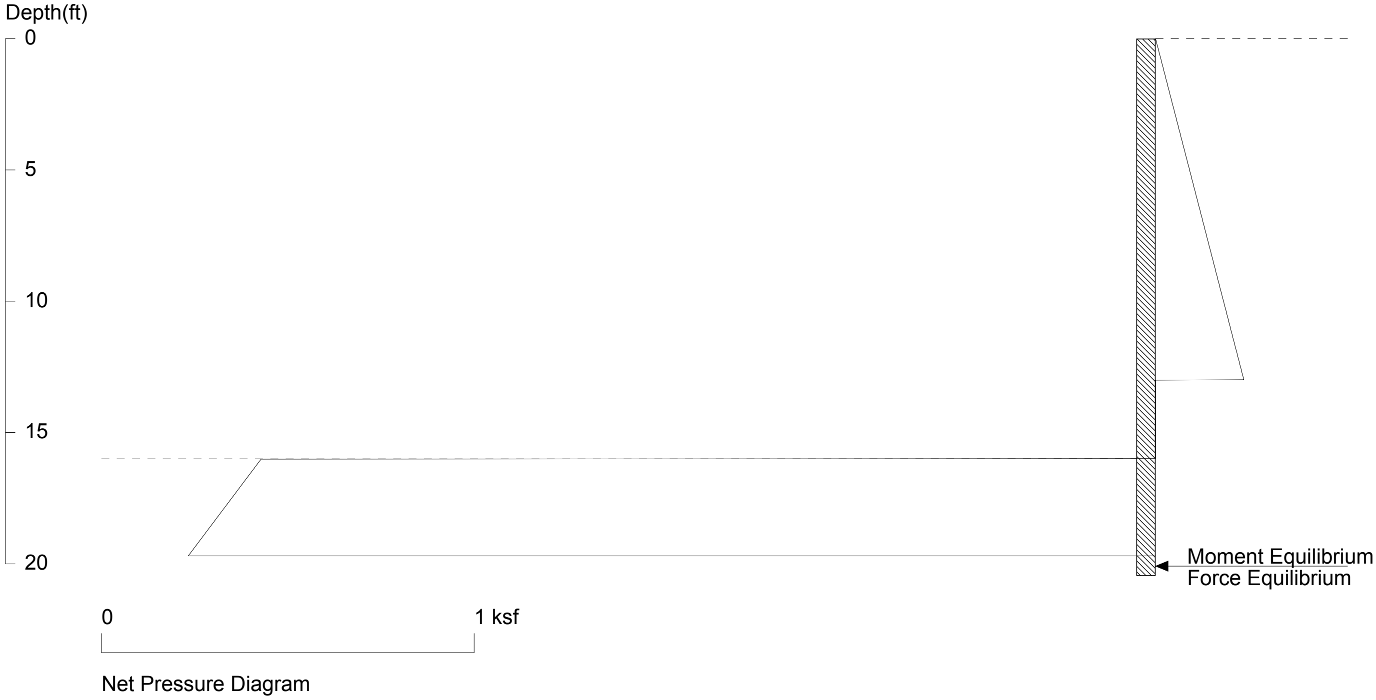
No.	Z depth	Spacing
1	0.00	1.00
2	16.00	1.00

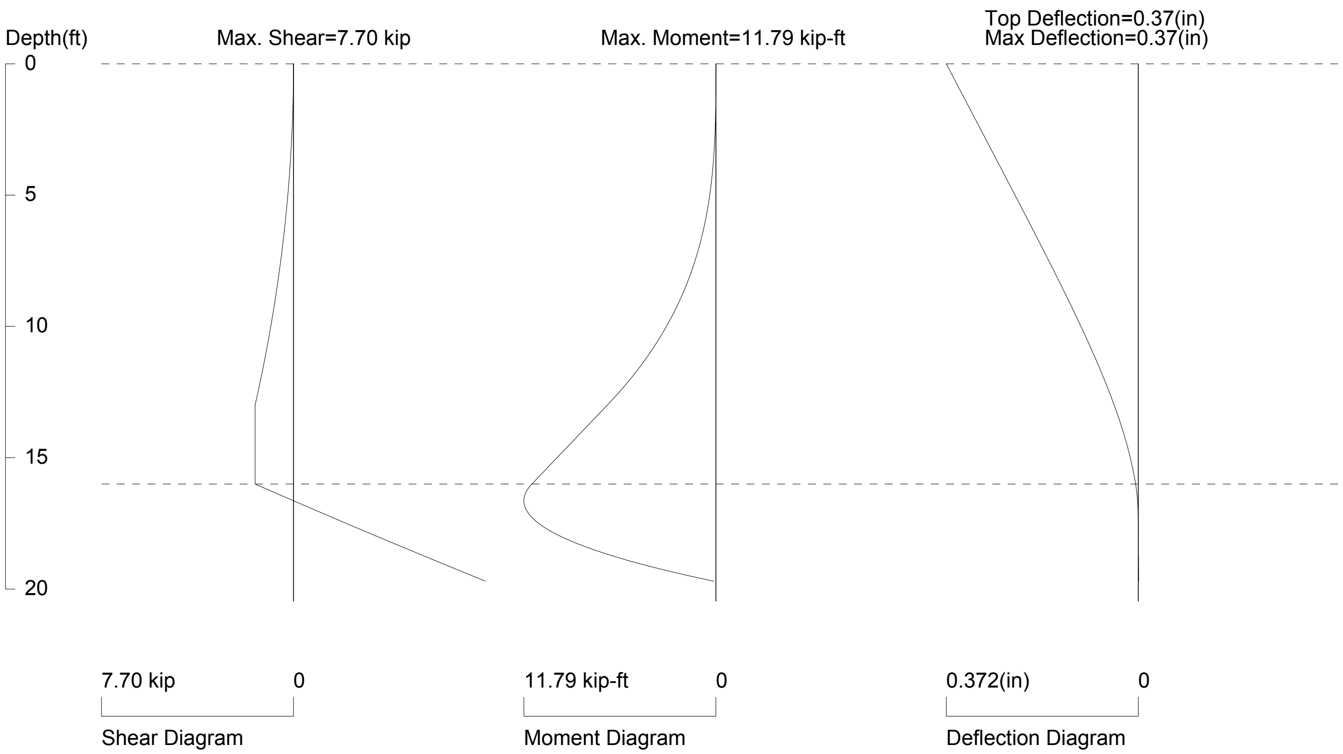
PASSIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

03_U
Sx and Deflection





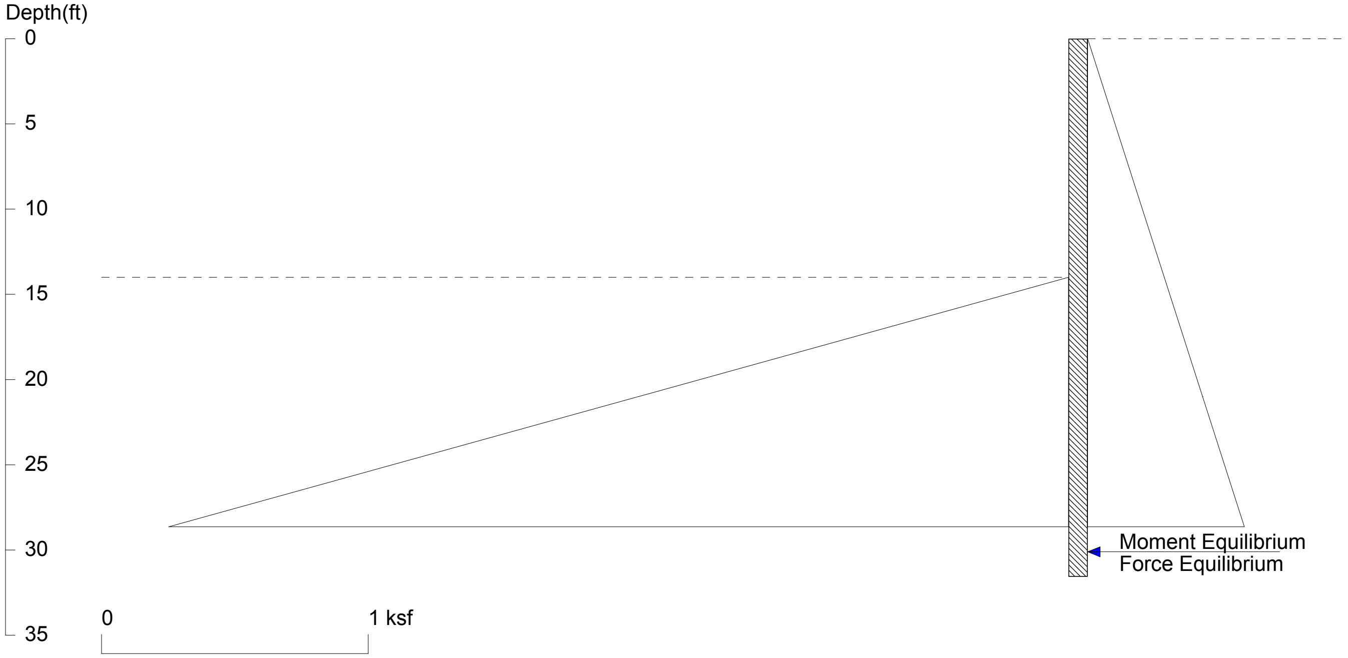
PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 1.0 foot or meter

User Input I: E (ksi)=29000.0, I (in4)/foot=156.9

File: G:\COMMON\Data\Projects\National Grid\Hudson Water Street\70% Design\Calculation Sheet\Shoring Suite\03_U.sh8

04_D
Embedment



<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltech.com

Licensed to Date: 8/16/2016

File: G:\COMMON\Data\Projects\National Grid\Hudson Water Street\70% Design\Calculation Sheet\Shoring Suite\04_D.sh

Wall Height=14.0 Pile Diameter=1.0 Pile Spacing=1.0 Wall Type: 1. Sheet Pile

PILE LENGTH: Min. Embedment=17.57 Min. Pile Length=31.57 (in graphics and analysis)
MOMENT IN PILE: Max. Moment=23.32 per Pile Spacing=1.0 at Depth=22.05

PILE SELECTION:
Request Min. Section Modulus = 11.2 in3/ft=601.71 cm3/m, Fy= 50 ksi = 345 MPa, Fb/Fy=0.5
User Input I (Moment of Inertia):
Top Deflection = 1.20(in) based on E (ksi)=29000.00 and I (in4)/foot=156.9

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
* Act				
0	0	21	0.431	0.020524
21	0.431	56	1.148	0.020486

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =1.5

Z1	P1	Z2	P2	Slope
* Pas				
14	0	21	1.613	0.2304
21	1.613	56	9.679	0.2305

ACTIVE SPACING:

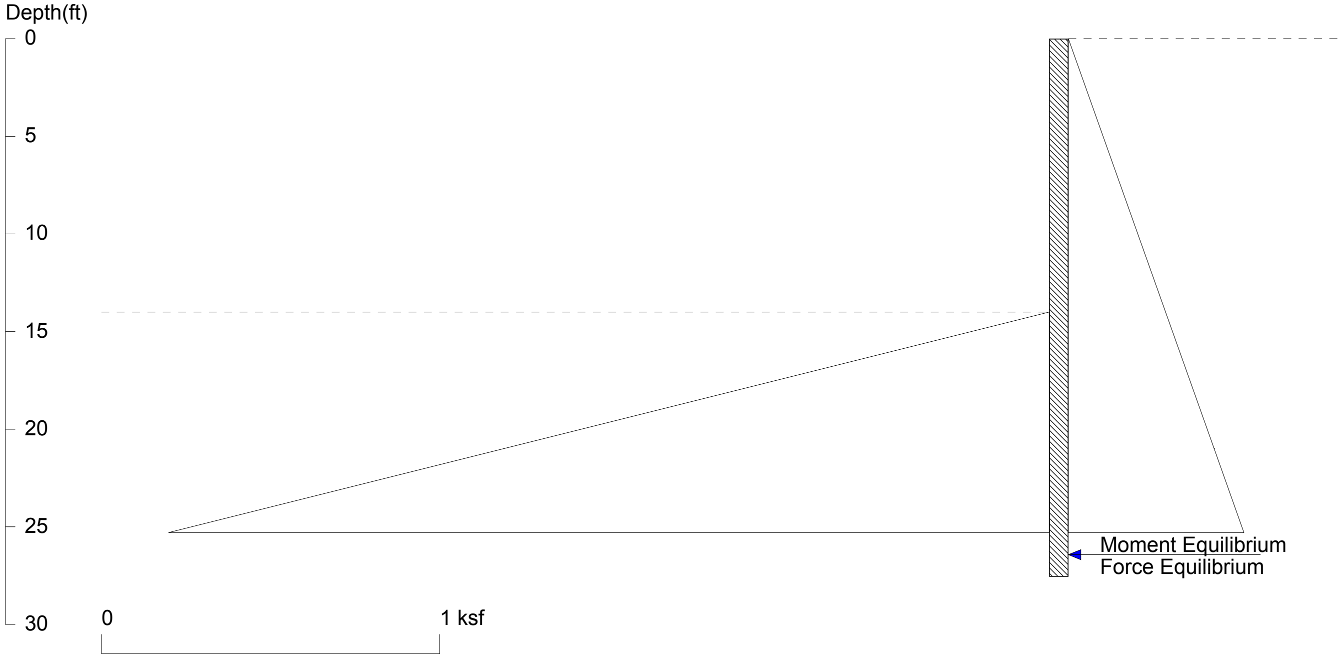
No.	Z depth	Spacing
1	0.00	1.00
2	14.00	1.00

PASSIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

04_D
Sx and Deflection



<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltech.com

Licensed to Date: 8/16/2016

File: G:\COMMON\Data\Projects\National Grid\Hudson Water Street\70% Design\Calculation Sheet\Shoring Suite\04_D.sh

Wall Height=14.0 Pile Diameter=1.0 Pile Spacing=1.0 Wall Type: 1. Sheet Pile

PILE LENGTH: Min. Embedment=13.56 Min. Pile Length=27.56 (in graphics and analysis)
MOMENT IN PILE: Max. Moment=19.07 per Pile Spacing=1.0 at Depth=19.96

PILE SELECTION:
Request Min. Section Modulus = 9.2 in3/ft=492.15 cm3/m, Fy= 50 ksi = 345 MPa, Fb/Fy=0.5
User Input I (Moment of Inertia):
Top Deflection = 0.79(in) based on E (ksi)=29000.00 and I (in4)/foot=156.9

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
* Act				
0	0	21	0.431	0.020524
21	0.431	56	1.148	0.020486

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
* Pas				
14	0	21	1.613	0.2304
21	1.613	56	9.679	0.2305

ACTIVE SPACING:

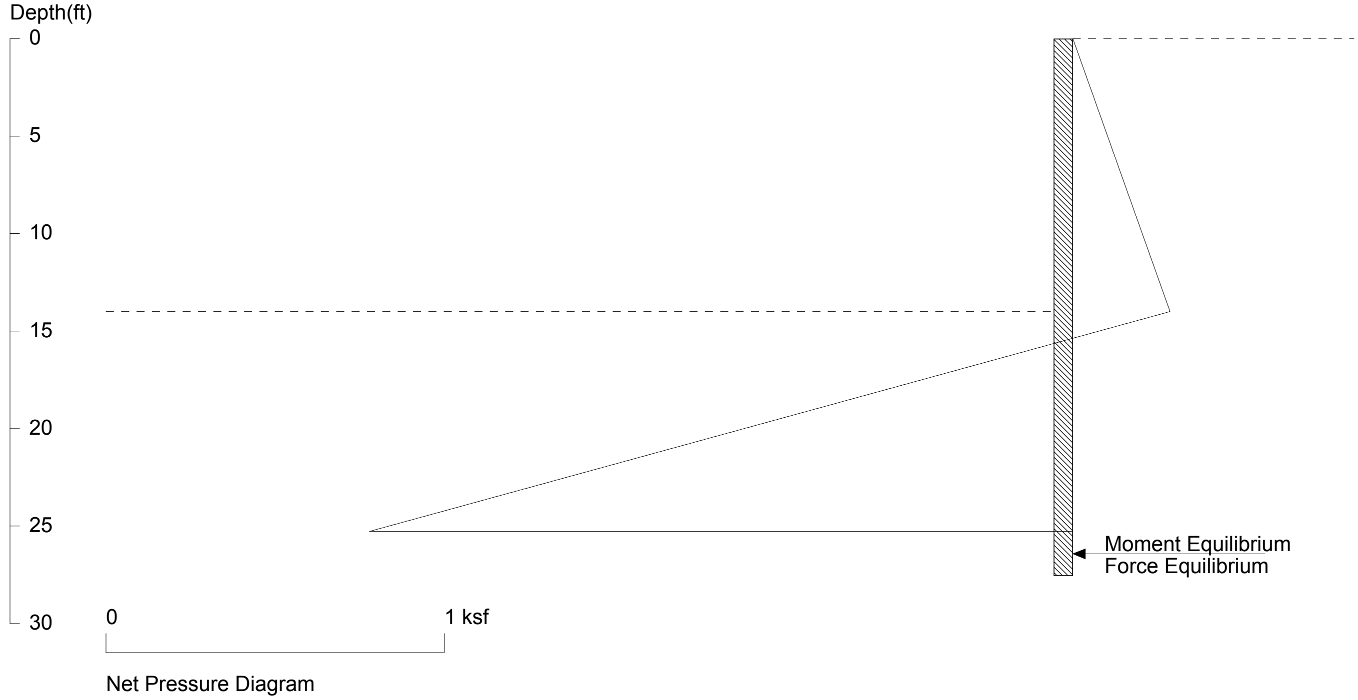
No.	Z depth	Spacing
1	0.00	1.00
2	14.00	1.00

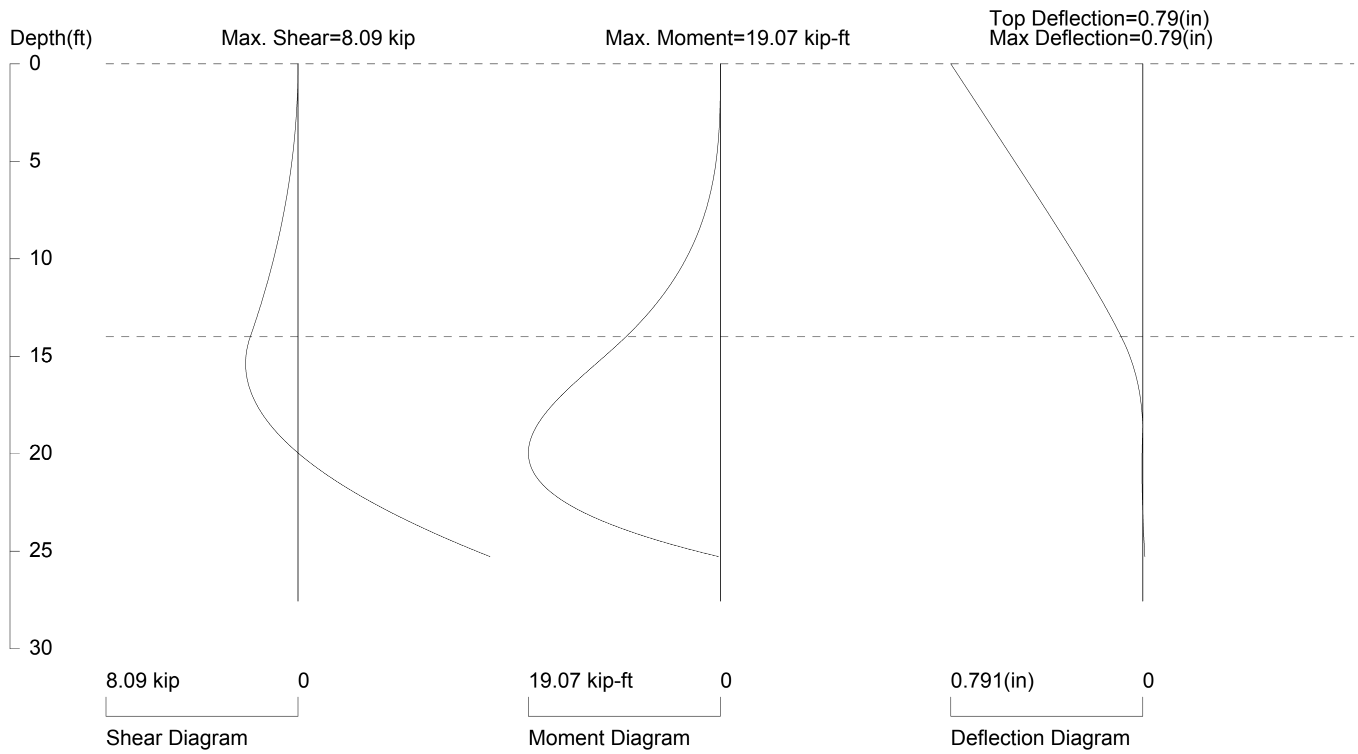
PASSIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

04_D
Sx and Deflection





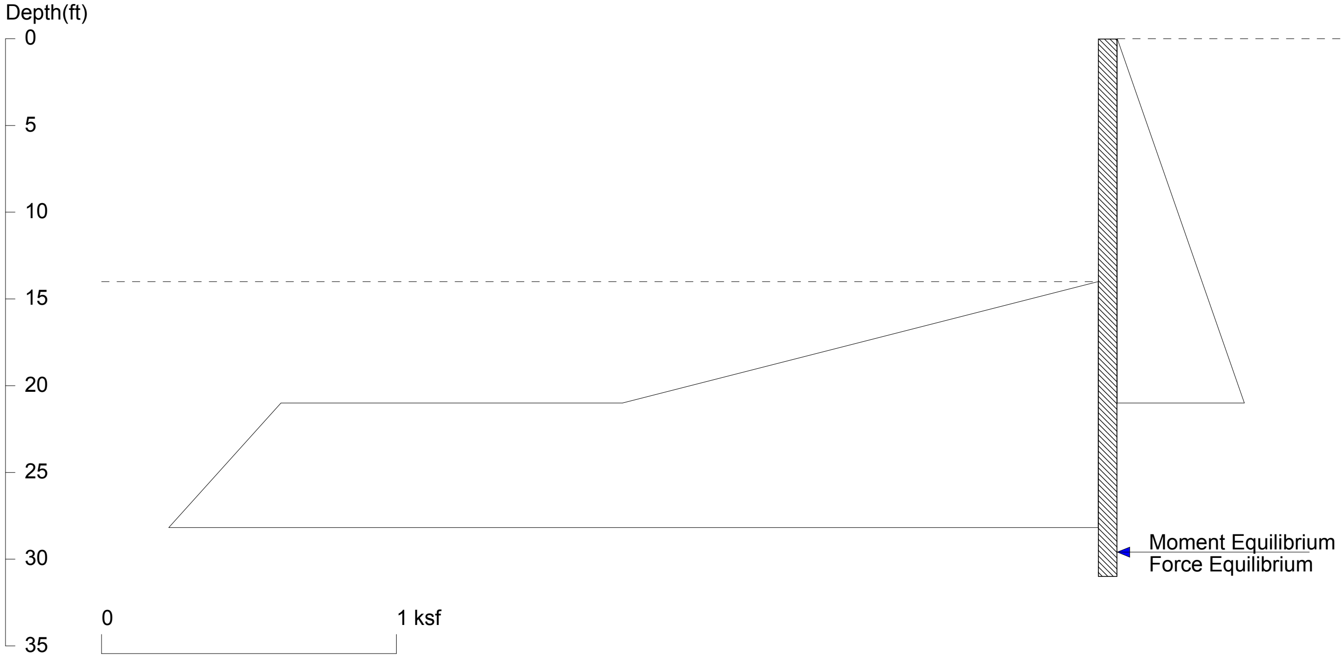
PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 1.0 foot or meter

User Input I: E (ksi)=29000.0, I (in4)/foot=156.9

File: G:\COMMON\Data\Projects\National Grid\Hudson Water Street\70% Design\Calculation Sheet\Shoring Suite\04_D.sh8

04_U
Embedment



<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltech.com

Licensed to Date: 8/16/2016
File: G:\COMMON\Data\Projects\National Grid\Hudson Water Street\70% Design\Calculation Sheet\Shoring Suite\04_U.sh

Wall Height=14.0 Pile Diameter=1.0 Pile Spacing=1.0 Wall Type: 1. Sheet Pile

PILE LENGTH: Min. Embedment=17.01 Min. Pile Length=31.01 (in graphics and analysis)
MOMENT IN PILE: Max. Moment=26.13 per Pile Spacing=1.0 at Depth=22.23

PILE SELECTION:
Request Min. Section Modulus = 12.5 in3/ft=674.33 cm3/m, Fy= 50 ksi = 345 MPa, Fb/Fy=0.5
User Input I (Moment of Inertia):
Top Deflection = 1.15(in) based on E (ksi)=29000.00 and I (in4)/foot=156.9

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
* Act				
0	0	21	0.431	0.020524

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =2

Z1	P1	Z2	P2	Slope
* Pas				
14	0	21	1.613	0.2304
21	2.771	56	4.626	0.0530

ACTIVE SPACING:

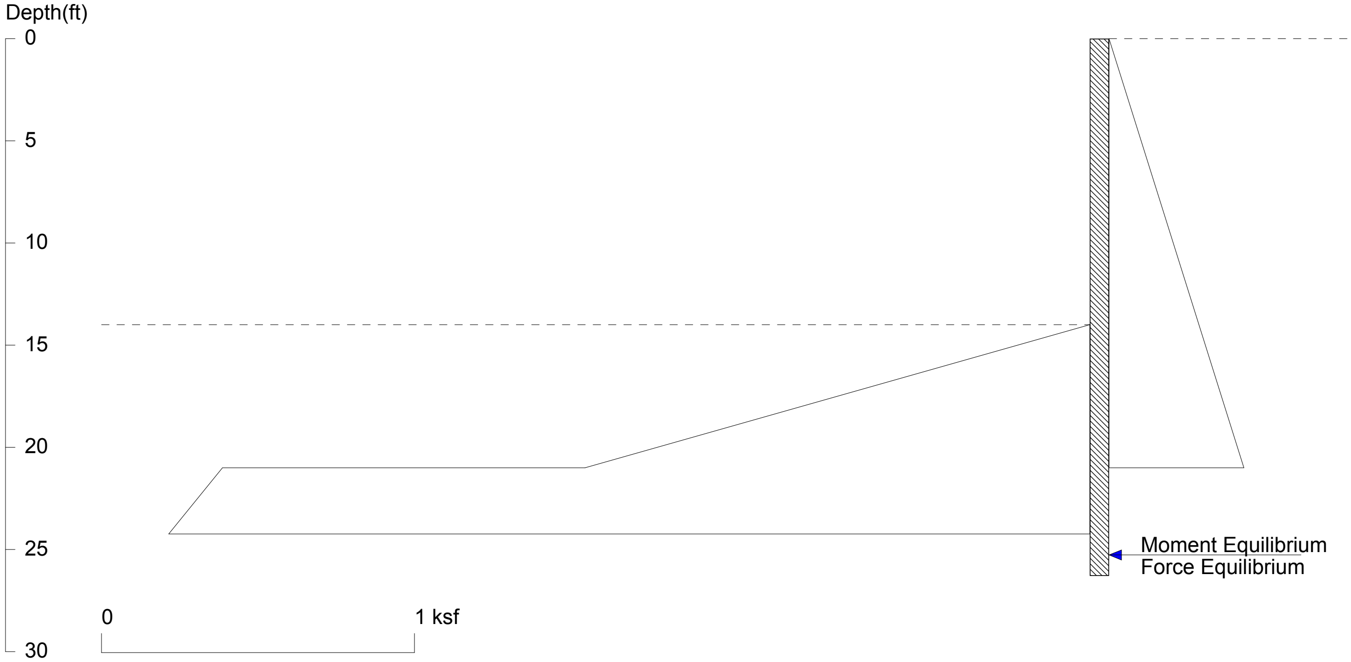
No.	Z depth	Spacing
1	0.00	1.00
2	14.00	1.00

PASSIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

04_U
Sx and Deflection



<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltech.com

Licensed to Date: 8/16/2016

File: G:\COMMON\Data\Projects\National Grid\Hudson Water Street\70% Design\Calculation Sheet\Shoring Suite\04_U.sh

Wall Height=14.0 Pile Diameter=1.0 Pile Spacing=1.0 Wall Type: 1. Sheet Pile

PILE LENGTH: Min. Embedment=12.29 Min. Pile Length=26.29 (in graphics and analysis)
MOMENT IN PILE: Max. Moment=19.07 per Pile Spacing=1.0 at Depth=19.96

PILE SELECTION:
Request Min. Section Modulus = 9.2 in3/ft=492.15 cm3/m, Fy= 50 ksi = 345 MPa, Fb/Fy=0.5
User Input I (Moment of Inertia):
Top Deflection = 0.69(in) based on E (ksi)=29000.00 and I (in4)/foot=156.9

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
* Act				
0	0	21	0.431	0.020524

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
* Pas				
14	0	21	1.613	0.2304
21	2.771	56	4.626	0.0530

ACTIVE SPACING:

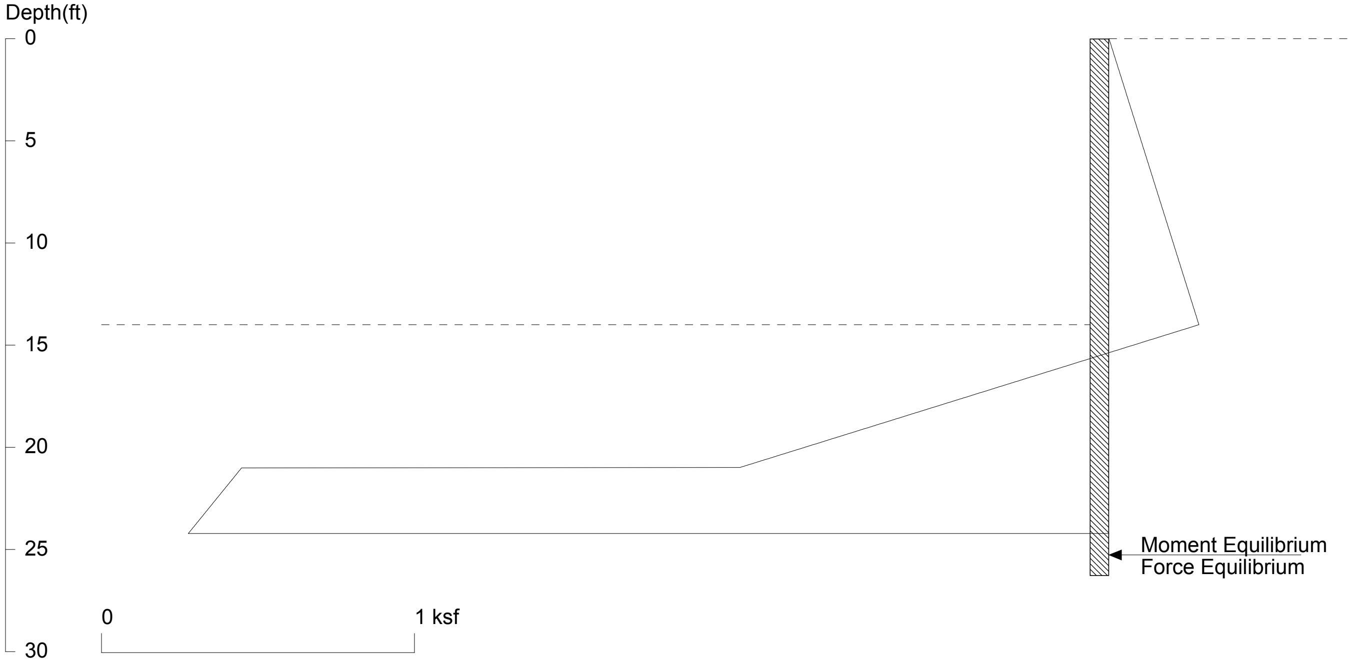
No.	Z depth	Spacing
1	0.00	1.00
2	14.00	1.00

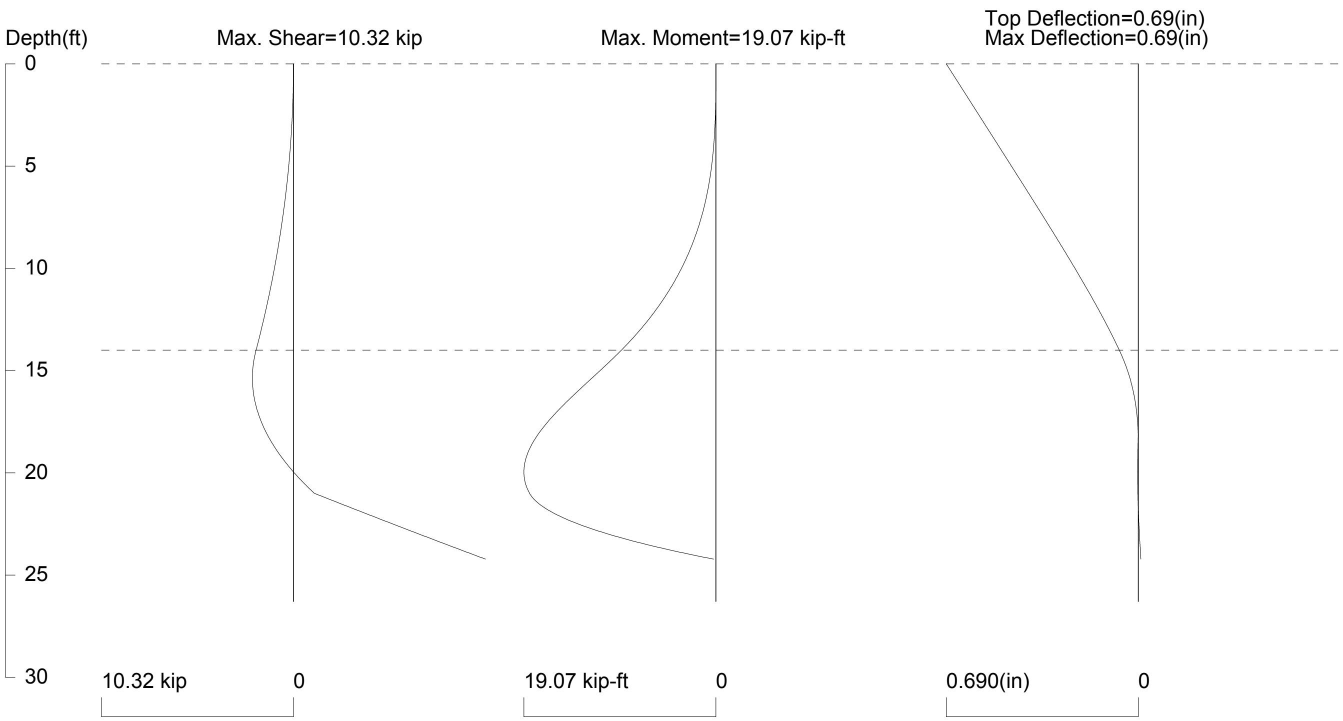
PASSIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

04_U
Sx and Deflection





PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 1.0 foot or meter

User Input I: E (ksi)=29000.0, I (in4)/foot=156.9

File: G:\COMMON\Data\Projects\National Grid\Hudson Water Street\70% Design\Calculation Sheet\Shoring Suite\04_U.sh8

ATTACHMENT E

Existing Sheet Pile Data

Item #85, 86, 96

Permanent Steel Sheetpile Wall (Embayment #1) –Records of Each Sheetpile Installed and Interlock Seal Installation Records

Temporary Watertight Steel Sheetpile Wall (East Bank Area and Embayment #1) – Records of Each Sheetpile Installed

BBL®
an ARCADIS company

1. Pile Identification number – on attached drawing and spreadsheet

2. Model of Hammer & Energy Rating - APE 150 Vibro - rated @ 2,200 In-LBS -- Centrifugal Force -- 50 to 102 US tons suspended weight -- 8,500 lbs

3. See Attached Sheet for elevations

4. Length in the ground – See Attached spread sheet

5. Rate of penetration – Rate varied depending on area and whether obstructions were encountered. The area is heavily laden with timbers which slowed the rate of penetration. Sheets driven in the mouth of the embayment away from the timbers were driven at a rate of 10-15 feet/minute to areas that were 1 ft/minute or less.

6. Detailed remarks on alignment and obstructions – Alignment was closely monitored to insure interlocks were straight. The alignment was checked with a level on each sheet driven. If the alignment was found to be off the sheet would be lifted and redriven or if an obstruction was encountered, that obstruction would be excavated or an attempt would be made to drive through the obstruction.

7. See 6 above.

Sealant:

1. Joint Identification number – See attached spreadsheet
2. Date and time of sealing – Sealing would normally take place two days prior to sheets being installed. Sheets that were found to have been exposed to the elements were resealed. Sheets were covered to protect from precipitation events.
3. Type of Sealant – Adeka

SD-54

Station / Sheetpile No	Top Elevation	Bottom Elev	Orginal Length of Sheet	Length of Sheet Cut	Notes
SD-54	(AMSL)	(AMSL)	(Feet)	(Feet)	Sheetpile No start at the south corner and increase to the west corner to the north corner and along the east bank shoreline back to the south corner
1	6.3	-53.7	60	0	
2	6.51	-53.49	60	0	
3	6.42	-53.58	60	0	
4	6.44	-53.56	60	0	
5	6.36	-53.64	60	0	
6	6.06	-53.94	60	0	
7	5.96	-54.04	60	0	
8	5.69	-54.31	60	0	
9	5.87	-54.13	60	0	
10	5.89	-54.11	60	0	
11	6.04	-53.96	60	0	
12	6.03	-53.97	60	0	
13	7.01	-52.99	60	0	
14	7.12	-52.88	60	0	
15	5.87	-54.13	60	0	
16	5.88	-54.12	60	0	
17	5.88	-54.12	60	0	
18	5.91	-54.09	60	0	
19	5.8	-54.2	60	0	
20	5.89	-54.11	60	0	
21	7.2	-52.8	60	0	
22	5.25	-54.75	60	0	
23	5.97	-39.03	60	15	cut sheet SD-1
24	6.01	-53.99	60	0	
25	6.43	-53.57	60	0	
26	6.31	-53.69	60	0	
27	6.23	-53.77	60	0	
28	5.83	-54.17	60	0	
29	5.85	-54.15	60	0	
30	5.96	-54.04	60	0	
31	6.36	-32.72	60	20.92	cut sheet SD-3
32	6.31	-53.69	60	0	
33	6.41	-53.59	60	0	
34	6.39	-53.61	60	0	
35	5.99	-54.01	60	0	
36	6.02	-53.98	60	0	
37	5.95	-54.05	60	0	
38	5.97	-54.03	60	0	
39	7.21	-52.79	60	0	
40	7.25	-52.75	60	0	
41	6.59	-53.41	60	0	
42	6.6	-53.4	60	0	
43	6.42	-53.58	60	0	
44	5.78	-54.22	60	0	
45	6.28	-53.72	60	0	
46	8.83	-51.17	60	0	
47	8.94	-51.06	60	0	
48	5.84	-54.16	60	0	
49	5.07	-54.93	60	0	
50	5.77	-54.23	60	0	
51	5.71	-54.29	60	0	
52	5.75	-54.25	60	0	
53	5.82	-54.18	60	0	
54	6.22	-53.78	60	0	
55	6.19	-53.81	60	0	
56	6.32	-53.68	60	0	
57	6.14	-53.86	60	0	
58	5.71	-54.29	60	0	
59	5.79	-54.21	60	0	
60	5.76	-54.24	60	0	
61	5.29	-54.71	60	0	
62	4.16	-55.84	60	0	
63	8.33	-51.67	60	0	
64	9.19	-50.81	60	0	
65	3.02	-56.98	60	0	
66	5.04	-45.56	60	9.4	cut sheet SD-4
67	6.09	-52.41	60	1.5	cut sheet SD-4
68	6.08	-53.92	60	0	
69	5.88	-54.12	60	0	
70	5.84	-54.16	60	0	
71	5.77	-54.23	60	0	
72	5.61	-54.39	60	0	
73	5.93	-54.07	60	0	
74	5.97	-54.03	60	0	
75	6.02	-53.98	60	0	
76	6.06	-53.94	60	0	
77	6.17	-53.83	60	0	
78	6.15	-43.35	60	10.5	cut sheet SD-2
79	5.24	-54.76	60	0	
80	5.24	-54.76	60	0	

Northwall

Station / Sheetpile No North Wall	Top Elevation (AMSL)	Bottom Elev (AMSL)	Orginal Length of Sheet (Feet)	Length of Sheet Cut (Feet)	Notes Sheetpile No start at the Mouth of the embayment and increase to the east
1	6.58	-38.42	45	0	
2	6.45	-38.55	45	0	
3	7.53	-37.47	45	0	
4	6.35	-38.65	45	0	
5	6.23	-38.77	45	0	
6	6.12	-38.88	45	0	
7	4.85	-40.15	45	0	
8	4.73	-40.27	45	0	
9	4.74	-40.26	45	0	
10	4.73	-40.27	45	0	
11	5.08	-39.92	45	0	
12	4.73	-40.27	45	0	
13	5.9	-39.1	45	0	
14	5.9	-39.1	45	0	
15	5.85	-39.15	45	0	
16	5.85	-39.15	45	0	
17	5.8	-39.2	45	0	
18	5.76	-39.24	45	0	
19	5.52	-39.48	45	0	
20	5.28	-39.72	45	0	
21	5.58	-39.42	45	0	
22	5.58	-39.42	45	0	
23	5.54	-39.46	45	0	
24	5.63	-39.37	45	0	
25	5.62	-39.38	45	0	
26	5.65	-39.35	45	0	
27	5.59	-39.41	45	0	
28	5.48	-39.52	45	0	
29	5.6	-39.4	45	0	
30	5.28	-39.72	45	0	
31	5.64	-39.36	45	0	
32	5.44	-39.56	45	0	
33	5.53	-39.47	45	0	
34	5.2	-39.8	45	0	
35	5.68	-39.32	45	0	
36	5.67	-39.33	45	0	
37	5.6	-39.4	45	0	
38	5.28	-39.72	45	0	
39	5.42	-39.58	45	0	
40	5.15	-39.85	45	0	
41	5.2	-39.8	45	0	
42	4.89	-40.11	45	0	
43	6.18	-34.24	45	4.58	
44	6.23	-38.77	45	0	
45	6.21	-38.79	45	0	
46	6.1	-38.9	45	0	
47	7.42	-37.58	45	0	
48	6.48	-38.52	45	0	
49	6.52	-38.48	45	0	
50	6.52	-38.48	45	0	
51	6.01	-38.99	45	0	
52	6	-39	45	0	
53	5.61	-39.39	45	0	
54	6.24	-38.76	45	0	
55	6.45	-38.55	45	0	
56	6.45	-38.55	45	0	
57	6.07	-38.93	45	0	
58	6.13	-38.87	45	0	
59	6.15	-38.85	45	0	
60	6.15	-28.85	35	0	
61	6.09	-28.91	35	0	
62	5.25	-29.75	35	0	
63	6.25	-28.75	35	0	
64	5.19	-29.81	35	0	
65	7.09	-27.91	35	0	
66	7.07	-37.93	45	0	
67	6.98	-32.86	45	5.16	
68	6.98	-18.02	25	0	
69	6.8	-18.2	25	0	
70	6.61	-18.39	25	0	
71	6.51	-18.49	25	0	
72	6.33	-18.67	25	0	
73	6.4	-18.6	25	0	
74	6.37	-18.63	25	0	
75	6.08	-18.92	25	0	
76	6.08	-18.92	25	0	
77	6.8	-18.2	25	0	
78	6.19	-18.81	25	0	
79	6.84	-18.16	25	0	
80	6.7	-18.3	25	0	
81	6.7	-18.3	25	0	
82	6.76	-18.24	25	0	
83	6.75	-18.25	25	0	
84	7.08	-17.92	25	0	
85	7.1	-17.9	25	0	
86	7.11	-17.89	25	0	
87	7.1	-17.9	25	0	
88	7.08	-17.92	25	0	
89	7.02	-17.98	25	0	
90	6.82	-18.18	25	0	
91	6.71	-18.29	25	0	
92	6.6	-18.4	25	0	
93	6.5	-18.5	25	0	
94	6.62	-18.38	25	0	
95	6.6	-18.4	25	0	
96	6.5	-18.5	25	0	
97	8.06	-16.94	25	0	
98	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
99	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
100	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
101	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
102	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'

Mouth West Wall

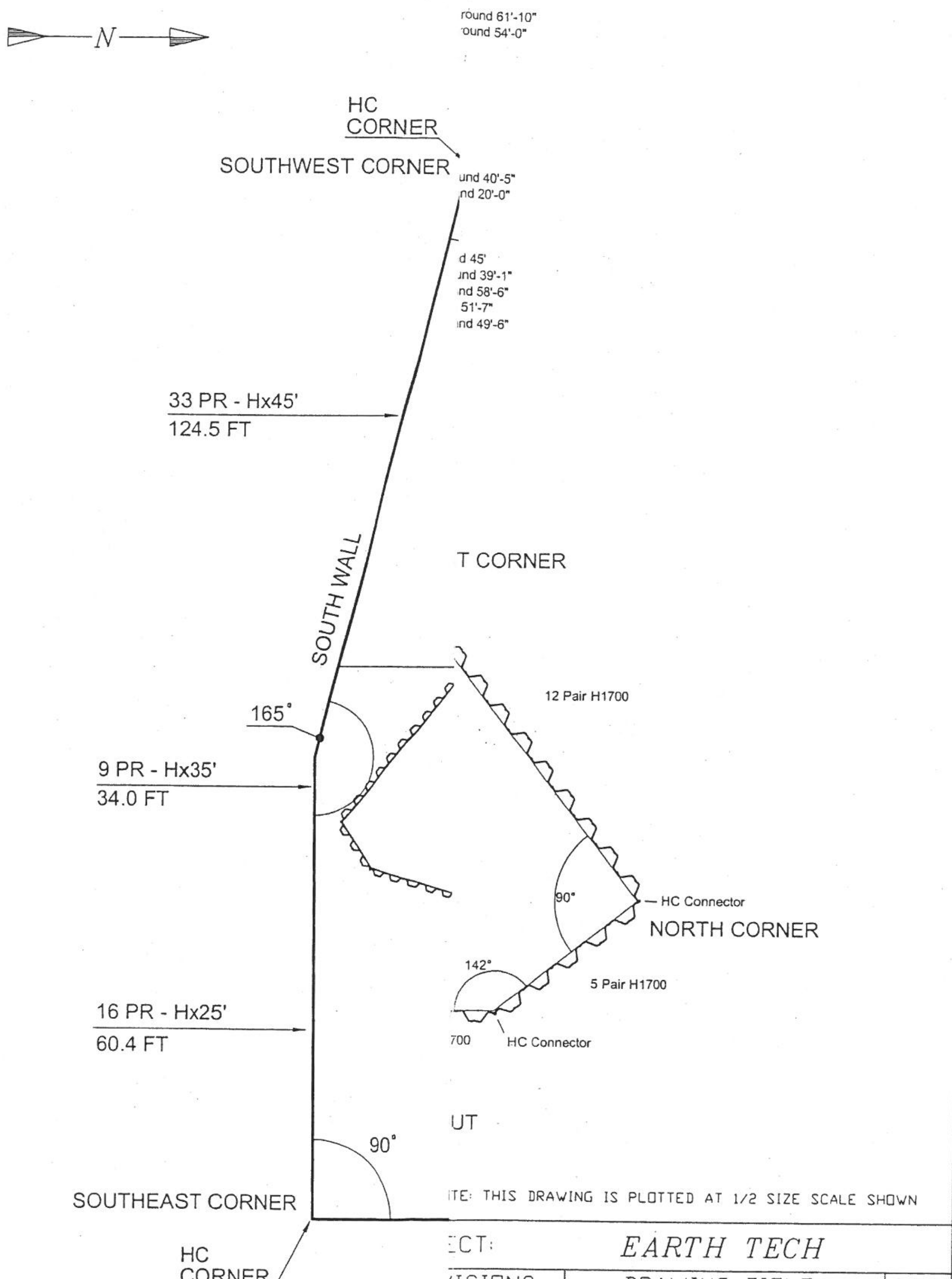
Station / Sheetpile No Mouth / West Wall	Top Elevation (AMSL)	Bottom Elev (AMSL)	Orginal Length of Sheet (Feet)	Length of Sheet Cut (Feet)	Notes Sheetpile No start at the North of the embayment and increase to the south
1	5.66	-59.34	65	0	
2	5.64	-59.36	65	0	
3	5.55	-59.45	65	0	
4	5.76	-59.24	65	0	
5	5.89	-59.11	65	0	
6	5.93	-48.07	65	11	cut sheet RW 1
7	5.4	-59.6	65	0	
8	5.92	-55.92	65	3.16	cut sheet RW 2
9	4.95	-60.05	65	0	
10	6	-59	65	0	
11	5.41	-59.59	65	0	
12	6.2	-58.8	65	0	
13	6.85	-58.15	65	0	
14	6.86	-58.14	65	0	
15	5.94	-59.06	65	0	
16	6.3	-58.7	65	0	
17	5.89	-59.11	65	0	
18	5.89	-59.11	65	0	
19	5.58	-59.42	65	0	
20	6.06	-58.94	65	0	
21	6.18	-58.82	65	0	
22	7.29	-57.71	65	0	
23	5.9	-59.1	65	0	
24	5.94	-59.06	65	0	
25	5.92	-59.08	65	0	
26	6.08	-58.92	65	0	
27	5.95	-59.05	65	0	
28	6.05	-58.95	65	0	
29	6.34	-58.66	65	0	
30	6.48	-58.52	65	0	
31	6.37	-58.63	65	0	
32	6.18	-58.82	65	0	
33	6.2	-58.8	65	0	
34	6.25	-58.75	65	0	
35	6.27	-58.73	65	0	
36	5.93	-59.07	65	0	

Southwall

Station / Sheetpile No South Wall	Top Elevation (AMSL)	Bottom Elev (AMSL)	Orginal Length of Sheet (Feet)	Length of Sheet Cut (Feet)	Notes Sheetpile No start at the Mouth of the embayment and increase to the east
1	6.78	-38.22	45	0	
2	6.6	-38.4	45	0	
3	6.08	-38.92	45	0	
4	6.29	-38.71	45	0	
5	6.55	-38.45	45	0	
6	6.41	-38.59	45	0	
7	5.57	-39.43	45	0	
8	5.32	-39.68	45	0	
9	5.95	-39.05	45	0	
10	5.92	-39.08	45	0	
11	5.5	-39.5	45	0	
12	5.6	-39.4	45	0	
13	6.2	-38.8	45	0	
14	5.7	-39.3	45	0	
15	6.3	-38.7	45	0	
16	6.3	-38.7	45	0	
17	5.9	-39.1	45	0	
18	6.1	-38.9	45	0	
19	6.07	-38.93	45	0	
20	5.78	-39.22	45	0	
21	4.64	-40.36	45	0	
22	4.15	-40.85	45	0	
23	7.37	-37.63	45	0	
24	6.38	-38.62	45	0	
25	6.32	-38.68	45	0	
26	6.44	-38.56	45	0	
27	6.42	-38.58	45	0	
28	6.42	-38.58	45	0	
29	6.31	-38.69	45	0	
30	6.57	-38.43	45	0	
31	6.48	-38.52	45	0	
32	7.36	-37.64	45	0	
33	6.53	-38.47	45	0	
34	6.49	-38.51	45	0	
35	5.6	-39.4	45	0	
36	6.42	-38.58	45	0	
37	6.34	-38.66	45	0	
38	6.28	-38.72	45	0	
39	6.87	-38.13	45	0	
40	7	-38	45	0	
41	6.92	-38.08	45	0	
42	6.87	-38.13	45	0	
43	6.67	-38.33	45	0	
44	6.81	-38.19	45	0	
45	6.59	-38.41	45	0	
46	6.14	-38.86	45	0	
47	6.1	-38.9	45	0	
48	6.07	-38.93	45	0	
49	5.9	-39.1	45	0	
50	5.2	-39.8	45	0	
51	5.75	-39.25	45	0	
52	5.39	-39.61	45	0	
53	5.56	-39.44	45	0	
54	5.32	-39.68	45	0	
55	5.35	-39.65	45	0	
56	5.43	-39.57	45	0	
57	7.31	-37.69	45	0	
58	5.8	-39.2	45	0	
59	6.19	-38.81	45	0	
60	6.29	-38.71	45	0	
61	5.3	-39.7	45	0	
62	5.78	-39.22	45	0	
63	5.47	-39.53	45	0	
64	5.82	-39.18	45	0	
65	5.8	-39.2	45	0	
66	5.9	-39.1	45	0	
67	5.82	-29.18	35	0	
68	5.81	-29.19	35	0	
69	6.37	-28.63	35	0	
70	5.8	-29.2	35	0	
71	5.93	-29.07	35	0	
72	5.97	-29.03	35	0	
73	6.21	-28.79	35	0	
74	6.25	-28.75	35	0	
75	6.25	-28.75	35	0	
76	6.29	-28.71	35	0	
77	6.28	-28.72	35	0	
78	5.85	-29.15	35	0	
79	5.74	-29.26	35	0	
80	6.25	-28.75	35	0	
81	6.03	-28.97	35	0	
82	6.03	-28.97	35	0	
83	5.92	-29.08	35	0	
84	5.92	-29.08	35	0	
85	5.39	-19.61	25	0	
86	5.93	-19.07	25	0	
87	5.75	-19.25	25	0	
88	5.66	-19.34	25	0	
89	5.94	-19.06	25	0	
90	5.84	-19.16	25	0	
91	5.93	-19.07	25	0	
92	5.93	-19.07	25	0	
93	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
94	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
95	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
96	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
97	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
98	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
99	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
100	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
101	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
102	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
103	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
104	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
105	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
106	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
107	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
108	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
109	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
110	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
111	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
112	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
113	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
114	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
115	6.1	-18.9	25	0	
116	6.06	-18.94	25	0	

Eastwall

Station / Sheetpile No Eastwall	Top Elevation (AMSL)	Bottom Elev (AMSL)	Orginal Length of Sheet (Feet)	Length of Sheet Cut (Feet)	Notes Sheetpile No start at the south corner and increase to the north
1	6.44	-18.56	25	0	
2	6.5	-18.5	25	0	
3	6.53	-18.47	25	0	
4	6.91	-18.09	25	0	
5	6.19	-18.81	25	0	
6	6.27	-18.73	25	0	
7	6.27	-18.73	25	0	
8	6.25	-18.75	25	0	
9	6.3	-18.7	25	0	
10	6.29	-18.71	25	0	
11	6.04	-18.96	25	0	
12	6	-19	25	0	
13	5.89	-19.11	25	0	
14	5.95	-19.05	25	0	
15	6.81	-18.19	25	0	
16	7.05	-17.95	25	0	
17	6.4	-18.6	25	0	
18	6.25	-18.75	25	0	
19	6.25	-18.75	25	0	
20	6.24	-18.76	25	0	
21	6.3	-18.7	25	0	
22	6.21	-18.79	25	0	
23	6.31	-18.69	25	0	
24	6.25	-18.75	25	0	
25	6.03	-18.97	25	0	
26	5.71	-19.29	25	0	
27	4.96	-20.04	25	0	
28	5.28	-19.72	25	0	
29	6.37	-18.63	25	0	
30	6.21	-18.79	25	0	
31	3.66	-21.34	25	0	
32	3.62	-21.38	25	0	
33	7.06	-17.94	25	0	
34	6.12	-18.88	25	0	
35	4.86	-20.14	25	0	
36	6.21	-18.79	25	0	
37	5.7	-19.3	25	0	
38	6.66	-18.34	25	0	
39	6.8	-18.2	25	0	
40	6.79	-18.21	25	0	
41	6.83	-18.17	25	0	
42	6.8	-18.2	25	0	
43	7.34	-17.66	25	0	
44	7.32	-17.68	25	0	
45	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
46	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
47	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
48	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
49	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
50	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
51	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
52	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
53	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'
54	6	-19	25	0	sheets were covered at time of survey for access into the cell, assume top elev = 6'



TE: THIS DRAWING IS PLOTTED AT 1/2 SIZE SCALE SHOWN

ECT:		EARTH TECH	
VISIONS		DRAWING TITLE	REF.
		AS– BUILT EMBAYMENT No.1	
E	DATE	M.A. BONGIOVANNI, INC.	DWG.
0'	05/14/04	1400 JAMESVILLE AVE. SYRACUSE, N.Y. 13205	141 A-B

APPENDICES

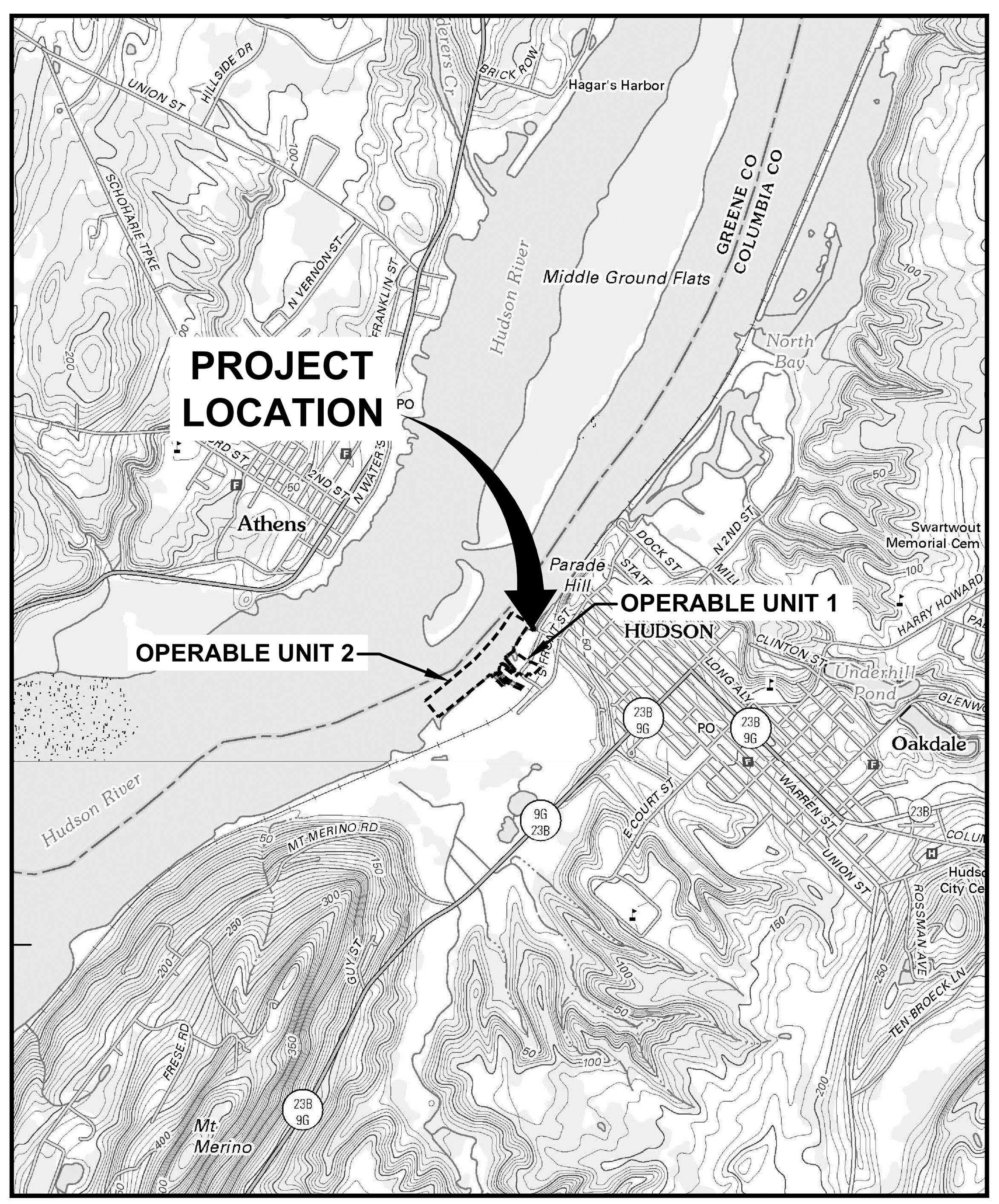
APPENDIX A

Design Drawings

CITY: SYRACUSE, NY DIV/GROUP: IMDV/CAD DB/LD: L.POSENAUER PM/TM: C.GUEST LYR:ON=*;OFF=*REF*
C:\Users\jlharris\BIM 360\Arcadis\ANA - National Grid\Project Files\Hudson (Water Street) Site OU2\2020\30003986\01-DWG\36702G000.dwg LAYOUT: COVER SAVED: 5/20/2020 7:23 AM ACADVER: 23.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTCONT.CTB PLOTTED: 7/16/2020 7:01 AM
BY: HARRIS, JESS
XREFS: IMAGES: 36702X01.jpg 36702X02.jpg MOG NY (from CHGE Eltings).bmp

DESIGN DRAWINGS

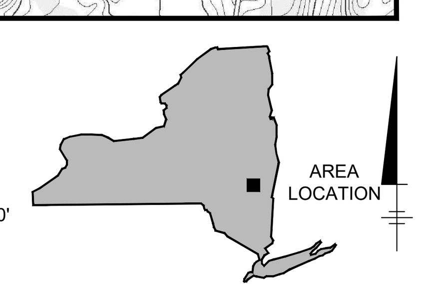
FINAL REMEDIAL DESIGN REPORT FOR OPERABLE UNIT 2



REFERENCE: BASE MAP USGS 7.5 MINUTE QUADRANGLE., HUDSON NORTH, NY, AND HUDSON SOUTH, NY, 2013.

LOCATION MAP

0 2000' 4000'
GRAPHIC SCALE



DATE ISSUED
JULY 2020

NATIONAL GRID
HUDSON (WATER STREET) SITE,
HUDSON, NEW YORK

ARCADIS
Design & Consultancy for natural and built assets

ARCADIS OF NEW YORK, INC.

NO ALTERATIONS PERMITTED HEREON EXCEPT AS PROVIDED UNDER SECTION 7209 SUBDIVISION 2 OF THE NEW YORK STATE EDUCATION LAW

INDEX TO DRAWINGS

GENERAL NOTES AND ABBREVIATIONS

GENERAL NOTES:

1. THE TECHNICAL WORK AND THE CONTRACTOR REQUIREMENTS ARE DESCRIBED IN SEVERAL DOCUMENTS THAT COLLECTIVELY REPRESENT THE REMEDIAL DESIGN. THESE DOCUMENTS INCLUDE THE REMEDIAL DESIGN NARRATIVE, DESIGN DRAWINGS, TECHNICAL SPECIFICATIONS, CAMP, CQAP, RACP, SWPPP, AND RESTORATION PLAN. THESE DOCUMENTS SHOULD BE THOROUGHLY REVIEWED BY THE CONTRACTOR. ANY DIFFERENCES IDENTIFIED BY THE CONTRACTOR BETWEEN THE INFORMATION PRESENTED IN THE ABOVE-LISTED DOCUMENTS SHALL BE SUBMITTED TO THE ENGINEER (IN WRITING) FOR CLARIFICATION.

2. BASE MAP FROM TOPOGRAPHIC SURVEY BY BOSK ASSOCIATES, DRAWING FILE HUDSONDL.DWG, DATED 3/24/95. THE RIVER SHORELINE WAS SURVEYED BY ARCADIS USING SURVEY-GRADE GPS EQUIPMENT IN DECEMBER 1995, AUGUST 1996, MARCH 1998, SPRING 2002, AND OCTOBER 2009. GRID SYSTEM FOR SURVEY IS IN U.S. SURVEY FEET RELATIVE TO THE NEW YORK STATE PLANE COORDINATE SYSTEM, EAST ZONE (3101), NAD83. ALL ELEVATIONS ARE IN FEET AND ARE REFERENCED TO NAVD88.

3. BATHYMETRIC SURVEY AND DEBRIS SURVEY CONDUCTED BY AQUA SURVEY, INC. ON APRIL 23-29, 2015. GRID SYSTEM FOR SURVEY IS IN U.S. SURVEY FEET RELATIVE TO THE NEW YORK STATE PLANE COORDINATE SYSTEM, EAST ZONE (3101), NAD83. ALL ELEVATIONS ARE IN FEET AND ARE REFERENCED TO NAVD88.

4. PROPERTY BOUNDARIES AND ADDITIONAL SHORELINE INFORMATION WERE OBTAINED FROM CITY OF HUDSON TAX MAP, 1009.11, DATED SEPTEMBER 2016. THE HUDSON RIVER, INCLUDING THE BED OF THE HUDSON RIVER, IS OWNED BY THE STATE OF NEW YORK.

5. THE CONTRACTOR SHALL PERFORM SURVEY ACTIVITIES IN ACCORDANCE WITH SPECIFICATION SECTION 022100 - SURVEYS.

6. DIFFERENCES IDENTIFIED BY THE CONTRACTOR BETWEEN THE REMEDIAL DESIGN AND ACTUAL SITE CONDITIONS, WHICH MAY AFFECT CONSTRUCTION, SHALL BE SUBMITTED TO THE ENGINEER IN WRITING FOR CLARIFICATION.

7. THE CONTRACTOR MUST MEET THE REQUIREMENTS OF APPLICABLE ENVIRONMENTAL PERMITS AND/OR REGULATIONS, AND ALL OTHER PERMITS THAT MAY BE REQUIRED UNDER LOCAL JURISDICTIONS. NATIONAL GRID SHALL PROVIDE THE NECESSARY PERMITS ASSOCIATED WITH STATE AND FEDERAL ENVIRONMENTAL REQUIREMENTS AND REGULATIONS. THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING ALL PERTINENT AND APPLICABLE LOCAL AND STATE PERMITS ASSOCIATED WITH THE PERFORMANCE OF THE REMEDIAL CONSTRUCTION ACTIVITIES. REFER TO SPECIFICATION SECTION 014100 - REGULATORY REQUIREMENTS FOR A SUMMARY OF PERMIT RESPONSIBILITIES.

8. OU2 IS IDENTIFIED BY NYSDEC AS A PORTION OF THE HUDSON RIVER ADJACENT TO THE SITE INCLUDING SEDIMENTS IN EMBAYMENTS #2, #3, AND #4.

9. LOCATIONS OF SITE FEATURES, INCLUDING EXISTING BUILDINGS, ROADS, AND UTILITIES, REFLECT AVAILABLE INFORMATION AND ARE APPROXIMATE, PROVIDED FOR REFERENCE ONLY, AND SUBJECT TO FIELD VERIFICATION BY THE CONTRACTOR.

10. THE CONTRACTOR IS RESPONSIBLE FOR ALL COSTS FOR DAMAGE TO EXISTING STRUCTURES, UTILITIES, AND/OR FEATURES CAUSED BY THE CONTRACTOR'S ACTIONS, INCLUDING, BUT NOT LIMITED TO, REPAIR- AND SCHEDULE-RELATED COSTS.

11. IF THE PROPERTY OWNER(S) REQUIRE USE OF THE SITE DURING REMEDIAL ACTIVITIES, THE CONTRACTOR SHALL YIELD TO THE PROPERTY OWNER(S).

12. NATIONAL GRID SHALL BE RESPONSIBLE FOR SECURING ACCESS AGREEMENTS.

13. THE POSITIONING OF SELECT EXISTING FEATURES (E.G., OFFSITE HAUL ROAD) HAVE BEEN TAKEN FROM AERIAL IMAGERY, AND THEREFORE, LIMITED IN ACCURACY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THE FEATURE POSITION AND NOTIFYING THE ENGINEER OF ANY DISCREPANCIES AS PRESENTED IN THE DESIGN DOCUMENTS.

UTILITY NOTES:

1. LOCATIONS OF KNOWN UTILITIES ARE APPROXIMATE. THE CONTRACTOR IS RESPONSIBLE FOR LOCATING ALL UTILITIES BEFORE COMMENCING CONSTRUCTION.

2. THE CONTRACTOR SHALL COORDINATE WITH THE APPROPRIATE UTILITY COMPANIES FOR THE TEMPORARY BRACING, REMOVAL, RELOCATION, AND REPLACEMENT OF ANY UTILITY POLES, GUY WIRES, UNDERGROUND UTILITIES, AND/OR OVERHEAD WIRES THAT ARE NEAR OR WITHIN THE PROJECT WORK LIMITS OF CONSTRUCTION, OR THAT MAY INTERFERE WITH THE PROJECT.

3. THE CONTRACTOR IS RESPONSIBLE FOR THE LOCATION, PROTECTION, RELOCATION, AND/OR MAINTENANCE OF UNDERGROUND AND OVERHEAD UTILITIES THAT MAY BE IMPACTED DURING CONSTRUCTION. ALL UTILITIES, UNLESS STATED OTHERWISE, SHALL REMAIN FUNCTIONAL DURING THE PROGRESSION OF THIS PROJECT.

4. FOR INFORMATION, THE DIG SAFELY NEW YORK NUMBER IS 811. THEIR WEBSITE IS WWW.DIGSAFELYNEWYORK.COM. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING/COORDINATING WITH DIG SAFELY NEW YORK.

5. APPROXIMATE LOCATION OF BURIED FIBER OPTIC CABLES SCANNED FROM SHEET 2 OF 2 "PLAN & PROFILE HUDSON RIVER CROSSING BETWEEN HUDSON AND ATHENS, COLUMBIA AND GREEN COUNTIES, NEW YORK" BARRETT, BONACCI, HYMAN AND VANWEELE, P.C., 175 A COMMERCE DRIVE, HAUPPAUGE, NEW YORK, OCTOBER 13, 1993. RECEIVED FROM DAVID FINGER, CHIEF ENGINEER, MID-HUDSON CABLE, CATSKILL, NEW YORK.

6. APPROXIMATE LOCATION OF UNBURIED COPPER CABLE POINTED OUT BY GERALD DALY, CONTRACT INSPECTOR, VERIZON SOUTH CAIRO, NEW YORK ON APRIL 17, 2002.

SITE MANAGEMENT NOTES:

1. LOCATIONS OF ALL PHYSICAL OBSTRUCTIONS AND DEBRIS ARE APPROXIMATE. ONLY KNOWN OBSTRUCTIONS ARE SHOWN. THE CONTRACTOR IS RESPONSIBLE FOR REMOVAL OF OBSTRUCTIONS WITHIN THE WORK AREA AS NECESSARY TO COMPLETE THE REQUIRED WORK. THE CONTRACTOR SHALL NOTIFY THE CM AND ENGINEER IMMEDIATELY IF AN OBSTRUCTION CANNOT BE REMOVED.

2. ALL WORK SHALL BE PERFORMED WITHIN THE PROJECT WORK LIMITS (REFER TO G-103). ANY WORK NECESSARY TO BE PERFORMED OUTSIDE THE PROJECT WORK LIMITS, SHALL BE APPROVED BY THE OWNER BEFORE THE COMMENCEMENT OF SUCH WORK.

3. THE CONTRACTOR SHALL PERFORM ALL DREDGING AND IN-WATER SHEET PILE INSTALLATION WORK WITHIN THE PHYSICAL BARRIER CONTROL (I.E., MOON POOL TURBIDITY CURTAIN) AND IN ACCORDANCE WITH SPECIFICATION SECTION 013543 - ENVIRONMENTAL PROTECTION PROCEDURES.

4. THE CONTRACTOR SHALL PERFORM ALL WORK IN A NEAT MANNER IN CONFORMANCE WITH BEST MODERN TRADE PRACTICE BY COMPETENT, EXPERIENCED PERSONNEL. ALL MATERIALS AND INSTALLATION SHALL BE IN ACCORDANCE WITH ALL CODES, REGULATIONS, AND REQUIREMENTS OF ALL APPLICABLE MUNICIPAL, STATE, FEDERAL, AND OTHER PUBLIC OR PRIVATE AUTHORITIES.

5. THE CONTRACTOR SHALL CLEAN/DECONTAMINATE ANY EQUIPMENT THAT HAS COME INTO CONTACT WITH IMPACTED MATERIALS, IN ACCORDANCE WITH THE CONTRACTOR'S HEALTH AND SAFETY PLAN, BEFORE HANDLING NON-IMPACTED MATERIALS AND BEFORE DEMOBILIZATION.

6. THE CONTRACTOR SHALL ESTABLISH, MAINTAIN, AND PROTECT THE PROJECT WORK LIMITS.

7. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO ESTABLISH AND MAINTAIN CONSTRUCTION SURVEY CONTROL AND VERIFY GRADES DURING THE PERFORMANCE OF WORK.

8. THE CONTRACTOR SHALL RESTORE ALL AREAS THAT ARE IMPACTED BY THE PROJECT, INCLUDING BUT NOT LIMITED TO, EQUIPMENT AND MATERIAL STORAGE AREAS, MATERIAL LOADING AND STAGING AREAS, PARKING AREAS, AND LOCATIONS OF SITE TRAILERS, EXCEPT AS NOTED OTHERWISE IN THE REMEDIAL DESIGN.

9. ALL SURFACES DAMAGED AS A RESULT OF WORK PERFORMED SHALL BE RESTORED TO PRE-CONSTRUCTION CONDITIONS AND/OR AS INDICATED ON THE REMEDIAL DESIGN IN A TIMELY MANNER AND BEFORE THE CONTRACTOR DEMOBILIZATION.

10. THE CONTRACTOR SHALL CONTROL ODORS, DUST, AND VAPORS THAT RESULT FROM THE CONSTRUCTION ACTIVITIES IN ACCORDANCE WITH THE CONTRACTOR'S HEALTH AND SAFETY PLAN, THE COMMUNITY AIR MONITORING PLAN, THE REMEDIAL DESIGN, AND APPLICABLE FEDERAL, STATE, AND LOCAL REGULATIONS.

11. THE CONTRACTOR MAY UTILIZE A QUALIFIED SUBCONTRACTOR TO PROVIDE ALL LABOR, MATERIALS AND EQUIPMENT NECESSARY TO IMPLEMENT THE COMMUNITY AIR MONITORING PROGRAM SPECIFIED IN THE REMEDIAL DESIGN. IT IS THE CONTRACTOR'S RESPONSIBILITY TO ENSURE THAT ALL ACTIVITIES ASSOCIATED WITH THE COMMUNITY AIR MONITORING PROGRAM ARE PERFORMED IN ACCORDANCE WITH THE REMEDIAL DESIGN.

12. THE CONTRACTOR SHALL NOT INITIATE ANY INTRUSIVE ACTIVITIES WITHOUT FIRST CONFIRMING THAT THE COMMUNITY AIR MONITORING PROGRAM IS IN OPERATION.

13. THE CONTRACTOR SHALL MAINTAIN SUITABLE TRAFFIC SAFETY SIGNS, EQUIPMENT, AND MANPOWER TO PROVIDE TRAFFIC CONTROL WITHIN THE PROJECT WORK LIMITS AND OBTAIN ANY NECESSARY PERMITS THAT MAY BE REQUIRED IN CONJUNCTION WITH VEHICLE USE ON PUBLIC ROADS/WATERWAYS (FOR BOTH LAND AND WATER OPERATIONS). THE CONTRACTOR SHALL PROVIDE ALL LABOR AND EQUIPMENT NECESSARY TO MAINTAIN THE ROADWAYS FREE OF DIRT AND/OR DEBRIS RESULTING FROM PROJECT OPERATIONS.

14. THE CONTRACTOR IS RESPONSIBLE FOR ANY SEDIMENT AND EROSION CONTROL MEASURES REQUIRED BY REGULATORY AUTHORITY REGARDLESS OF WHETHER OR NOT THEY ARE EXPLICITLY STATED IN THE CONTRACT DOCUMENTS.

15. THE EXISTING FENCE MAY BE REMOVED AS NECESSARY TO ACCESS THE WORK AREA. ANY FENCE REMOVED SHALL BE REPLACED DURING RESTORATION ACTIVITIES.

16. THE CONTRACTOR SHALL TAKE DAILY PRECAUTIONS TO MINIMIZE SHEEN DURING CONSTRUCTION. THE CONTRACTOR SHALL NOT BE PERMITTED TO USE SURFACTANTS, OF ANY TYPE, TO CONTROL ACCUMULATED OIL AND/OR SHEENS IN THE HUDSON RIVER. REFER TO SPECIFICATION SECTION 013543 - ENVIRONMENTAL PROTECTION PROCEDURES FOR REQUIREMENTS.

17. DESIGN DREDGING CONTOURS ARE SHOWN WITHIN THE DREDGING FOOTPRINT ON DRAWING G-300.

18. RIPRAP IS PRESENT ALONG THE RIVER BANK. THE CONTRACTOR SHALL REMOVE AND STOCKPILE EXISTING RIPRAP FROM SHORELINE AS NECESSARY TO ACCESS THE WORK AREA AND COMPLETE WORK AS APPROPRIATE. THE CONTRACTOR SHALL CLEAN RIPRAP IN A CONTAINED AREA TO REMOVE REMEDIATION-RELATED VISUAL IMPACTS, IF ANY, AS DETERMINED BY THE ENGINEER AND CM. THE CONTRACTOR SHALL REPLACE RIPRAP AFTER CONSTRUCTION IS COMPLETE. DEBRIS AND OTHER MATERIAL (E.G., LOGS, RUBBISH) SHALL BE REMOVED AND DISPOSED OF OFFSITE.

19. CLEANING OF RIPRAP AND/OR DEBRIS SHALL OCCUR WITHIN A CONTAINED AREA. WASH WATER SHALL BE COLLECTED FOR ONSITE TREATMENT.

WASTE MANAGEMENT NOTES:

1. THE CONTRACTOR SHALL REMOVE AND PROPERLY CHARACTERIZE/DISPOSE OF ALL ABOVEGROUND AND BELOWGROUND NON-EARTHEN MATERIALS ENCOUNTERED DURING PERFORMANCE OF THIS PROJECT, INCLUDING, BUT NOT LIMITED TO, DEBRIS, BRUSH, LOGS, TREES, STUMPS, REFUSE, AND RUBBISH FROM WITHIN THE PROJECT WORK LIMITS, AS REQUIRED TO PERFORM THE WORK. THE CONTRACTOR SHALL COLLECT CHARACTERIZATION SAMPLES, IF REQUIRED, IN ACCORDANCE WITH THE NUMBER OF SAMPLES AND ANALYSES REQUIRED BY THE TREATMENT/DISPOSAL FACILITY(IES).

2. ALL NECESSARY PRECAUTIONS SHALL BE TAKEN TO PREVENT THE MIGRATION OF SITE AND CONSTRUCTION-RELATED DEBRIS, FUELS, SOLVENTS, LUBRICANTS, CONCRETE, OR ANY OTHER POLLUTANT INTO THE RIVER AND BEYOND THE WORK AREA. IN PARTICULAR, THE CONTRACTOR SHALL PREVENT SUCH POLLUTANTS FROM ENTERING ANY AND ALL CATCH BASINS, OR OTHER DRAINAGE FEATURES.

3. BEFORE CONSTRUCTION, THE CONTRACTOR SHALL CONDUCT A GENERAL CLEANUP OF THE SITE TO INCLUDE FLOATING DEBRIS, DEBRIS WASHED ASHORE, REFUSE, AND OTHER ITEMS AND SHALL PROPERLY DISPOSE OF ALL DEBRIS OFF-SITE. A SURVEY OF KNOWN OBSTRUCTIONS IS PROVIDED IN THE REMEDIAL DESIGN; HOWEVER, THIS SURVEY DOES NOT NECESSARILY INCLUDE ALL OBSTRUCTIONS PRESENT.

4. DREDGED MATERIAL PLACEMENT: OWNER SHALL NOT APPROVE DEPOSITION OF DREDGED MATERIAL IN PLACES OTHER THAN THOSE DESIGNATED ON THE DRAWINGS OR OTHERWISE PREVIOUSLY APPROVED BY OWNER, AND MAY REQUIRE THE CONTRACTOR TO MOVE SUCH MISPLACED DREDGED MATERIAL AT HIS OWN EXPENSE. WHEN NOTIFIED BY OWNER, OF ANY VIOLATION OF THE FOREGOING PROVISIONS, THE CONTRACTOR SHALL TAKE IMMEDIATE CORRECTIVE ACTION. SHOULD THE CONTRACTOR REFUSE OR FAIL TO PROMPTLY CORRECT SUCH VIOLATION, OWNER MAY ORDER ALL OR PART OF THE WORK STOPPED PENDING CORRECTION. THE CONTRACTOR SHALL NOT CLAIM OR BE ENTITLED TO AN EXTENSION OF CONTRACT COMPLETION TIME, EXCESS COSTS OR DAMAGES DUE TO TIME LOST BY SUCH A STOP WORK ORDER.

HEALTH AND SAFETY NOTES:

1. THE CONTRACTOR SHALL PROVIDE EVIDENCE OF ALL ONSITE PERSONNEL COMPLETING OSHA 40-HOUR TRAINING AND 8-HOUR REFRESHER TRAINING BEFORE INITIATING REMEDIAL CONSTRUCTION ACTIVITIES.

2. THE CONTRACTOR IS RESPONSIBLE FOR IMPLEMENTING, MAINTAINING, AND SUPERVISING ALL SAFETY MEASURES AND PROGRAMS IN CONNECTION WITH THE PROJECT. THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS FOR THE SAFETY OF, AND SHALL PROVIDE THE NECESSARY PRECAUTIONS TO PROTECT, SITE WORKERS, ENGINEER, CM, AND SITE VISITORS.

3. THE CONTRACTOR SHALL COMPLY WITH ALL APPLICABLE LAWS, ORDINANCES, RULES, REGULATIONS, AND ORDERS OF PUBLIC BODIES HAVING JURISDICTION FOR THE SAFETY OF PERSONS OR PROPERTY OR TO PROTECT THEM FROM DAMAGE, INJURY, OR LOSS, INCLUDING, WITHOUT LIMITATION, THE DEPARTMENT OF LABOR SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION PROMULGATED UNDER THE OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970 (PL 91-596) AND UNDER SECTION 107 OF THE CONTRACT WORK HOURS AND SAFETY STANDARDS ACT (PL 91-54) AND AMENDMENTS THERETO. THE CONTRACTOR SHALL COMPLY WITH THE REQUIREMENTS SET FORTH UNDER 29 CFR 1910 AND 29 CFR 1926. THE CONTRACTOR SHALL ERECT AND MAINTAIN, AS REQUIRED BY THE CONDITIONS AND THE PROGRESS OF THE WORK, ALL NECESSARY SAFEGUARDS FOR THE SAFETY AND PROTECTION OF PERSONS AND PROPERTY AND SHALL COMPLY WITH ALL APPLICABLE RECOMMENDATIONS OF THE MANUAL OF ACCIDENT PREVENTION IN CONSTRUCTION OF THE ASSOCIATED GENERAL THE CONTRACTORS OF AMERICA, INC.

4. THE CONTRACTOR SHALL FURNISH AND PLACE PROPER GUARDS FOR PREVENTION OF ACCIDENTS, AND PROVIDE ALL EXCAVATION SHORING/BACKING, SCAFFOLDING, SHIELDING, DUST/VAPOR/ODOR PROTECTION, MECHANICAL/ELECTRICAL PROTECTION, SPECIAL GROUNDING, SAFETY RAILINGS, BARRIERS, PROPER WORKING EQUIPMENT WITH FUNCTIONING SAFETY MECHANISMS (E.G., LIFT GATE WARNING SIGNALS), ALL SITE SAFETY SIGNAGE, OR OTHER SAFETY FEATURES REQUIRED. AS NEEDED, THE CONTRACTOR SHALL PROVIDE AND MAINTAIN SUFFICIENT LIGHT DURING NIGHT HOURS TO SECURE SUCH PROTECTION.

5. THE MATERIALS SUBJECT TO HANDLING AS PART OF THE PROJECT MAY CONTAIN HAZARDOUS CONSTITUENTS OR CHEMICALS AND SHOULD BE HANDLED IN ACCORDANCE WITH APPLICABLE REGULATIONS. THE CONTRACTOR SHALL DEVELOP AND IMPLEMENT APPROPRIATE HEALTH AND SAFETY MEASURES FOR ITS EMPLOYEES, SUBTHE CONTRACTORS, AND SITE VISITORS, AND FOR THE PROTECTION OF THE ENVIRONMENT AND SURROUNDING COMMUNITY. THE CONTRACTOR'S HASP SHALL BE DEVELOPED IN ACCORDANCE WITH APPLICABLE OSHA, FEDERAL, STATE, AND LOCAL REGULATIONS.

6. THE CONTRACTOR SHALL PROVIDE A LIST OF ALL CHEMICAL PRODUCTS AND AN SDS FOR ALL CHEMICAL PRODUCTS TO BE USED ONSITE. THE LIST MUST BE APPROVED BY THE OWNER BEFORE BEING BROUGHT ONSITE.

7. PERSONNEL SHALL WEAR U.S. COAST GUARD-APPROVED (TYPE I OR II) PFD (E.G., LIFE JACKET) WHEN WORKING WITHIN 15 FEET OF WATER. ADDITIONALLY, LIFELINES MAY BE REQUIRED.

8. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR ALL SAFETY PROGRAMS FOR THEIR EMPLOYEES, SUBTHE CONTRACTORS, AND ANY OTHER PERSONS WHO MAY BE AFFECTED THEREBY. THE CONTRACTOR SHALL PREPARE A SITE-SPECIFIC HASP THAT SHALL BE REVIEWED BY THE ENGINEER AND THE OWNER BEFORE THE START OF ANY WORK.

9. THE CONTRACTOR SHALL ASSIST NATIONAL GRID WITH PHAs AS REQUESTED

ABBREVIATIONS:

CAMP	–	COMMUNITY AIR MONITORING PLAN	NYS	–	NEW YORK STATE
CFR	–	CODE OF FEDERAL REGULATIONS	NYSDEC	–	NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
CM	–	CONSTRUCTION MANAGER	O.D.	–	OUTSIDE DIAMETER
CQAP	–	CONSTRUCTION QUALITY ASSURANCE PLAN	OSHA	–	OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
EL	–	ELEVATION	OU1	–	OPERABLE UNIT 1
FT	–	FEET	OU2	–	OPERABLE UNIT 2
GAC	–	GRANULAR ACTIVATED CARBON	PFD	–	PERSONAL FLOTATION DEVICE
GALV	–	GALVANIZED	PHA	–	PROCESS HAZARD ANALYSIS
GPS	–	GLOBAL POSITIONING SYSTEM	PVC	–	POLYVINYL CHLORIDE
HASP	–	HEALTH AND SAFETY PLAN	RA	–	REMEDIAL ACTION
HDPE	–	HIGH DENSITY POLYETHYLENE	RACP	–	REMEDIAL ACTION CONTINGENCY PLAN
MAX	–	MAXIMUM	RECM	–	ROLLED EROSION CONTROL MATERIAL
MHW	–	MEAN HIGH WATER	REQ'D	–	REQUIRED
MIN	–	MINIMUM	SCH	–	SCHEDULE
MLW	–	MEAN LOW WATER	SDS	–	SAFETY DATA SHEET
MGP	–	MANUFACTURED GAS PLANT	SWPPP	–	STORM WATER POLLUTION PREVENTION PLAN
NAD83	–	NORTH AMERICAN DATUM OF 1983	TBD	–	TO BE DETERMINED
NAPL	–	NON-AQUEOUS PHASE LIQUID	TYP.	–	TYPICAL
NAVD88	–	NORTH AMERICAN VERTICAL DATUM OF 1988			

No.	Date	Revisions	By	Ckd

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

Professional Engineer's Name: MARK GRAVELDING
Professional Engineer's No.: 069985-1
State: NY | Date Signed: | Project Mgr.: HMV
Designed by: ESD | Drawn by: KLS | Checked by:

STATE OF NEW YORK · MARK OWEN GRAVELDING · 069985 · LICENSED PROFESSIONAL ENGINEER

ARCADIS Design & Consultancy for natural and built assets

ARCADIS OF NEW YORK, INC.

NO ALTERATIONS PERMITTED HEREON EXCEPT AS PROVIDED UNDER SECTION 7209 SUBDIVISION 2 OF THE NEW YORK STATE EDUCATION LAW

NATIONAL GRID • HUDSON (WATER STREET) SITE, HUDSON, NEW YORK
FINAL REMEDIAL DESIGN REPORT FOR OPERABLE UNIT 2

GENERAL NOTES AND ABBREVIATIONS

ARCADIS Project No. 30003986
Date JULY 2020

ARCADIS
ONE LINCOLN CENTER
110W FAYETTE STREET
SYRACUSE, NY 13202
TEL: 315.446.9120

G-100

80' 0 80' 160'
1"=80'

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

THIS DRAWING IS THE PROPERTY OF THE ARCADIS ENTITY IDENTIFIED IN THE TITLE BLOCK AND MAY NOT BE REUSED OR ALTERED IN WHOLE OR IN PART WITHOUT THE EXPRESS WRITTEN PERMISSION OF SAME.

Professional Engineer's Name
MARK GRAVELDING
Professional Engineer's No.
069985-1

State	Date Signed	Project Mgr.
NY		HMV
Designed by	Drawn by	Checked by
ESD	KLS	

STATE OF NEW YORK · MARK OWEN GRAVELDING · LICENSED PROFESSIONAL ENGINEER

ARCADIS Design & Consultancy for natural and built assets
ARCADIS OF NEW YORK, INC.

NO ALTERATIONS PERMITTED HEREON EXCEPT AS PROVIDED UNDER SECTION 7209 SUBDIVISION 2 OF THE NEW YORK STATE EDUCATION LAW

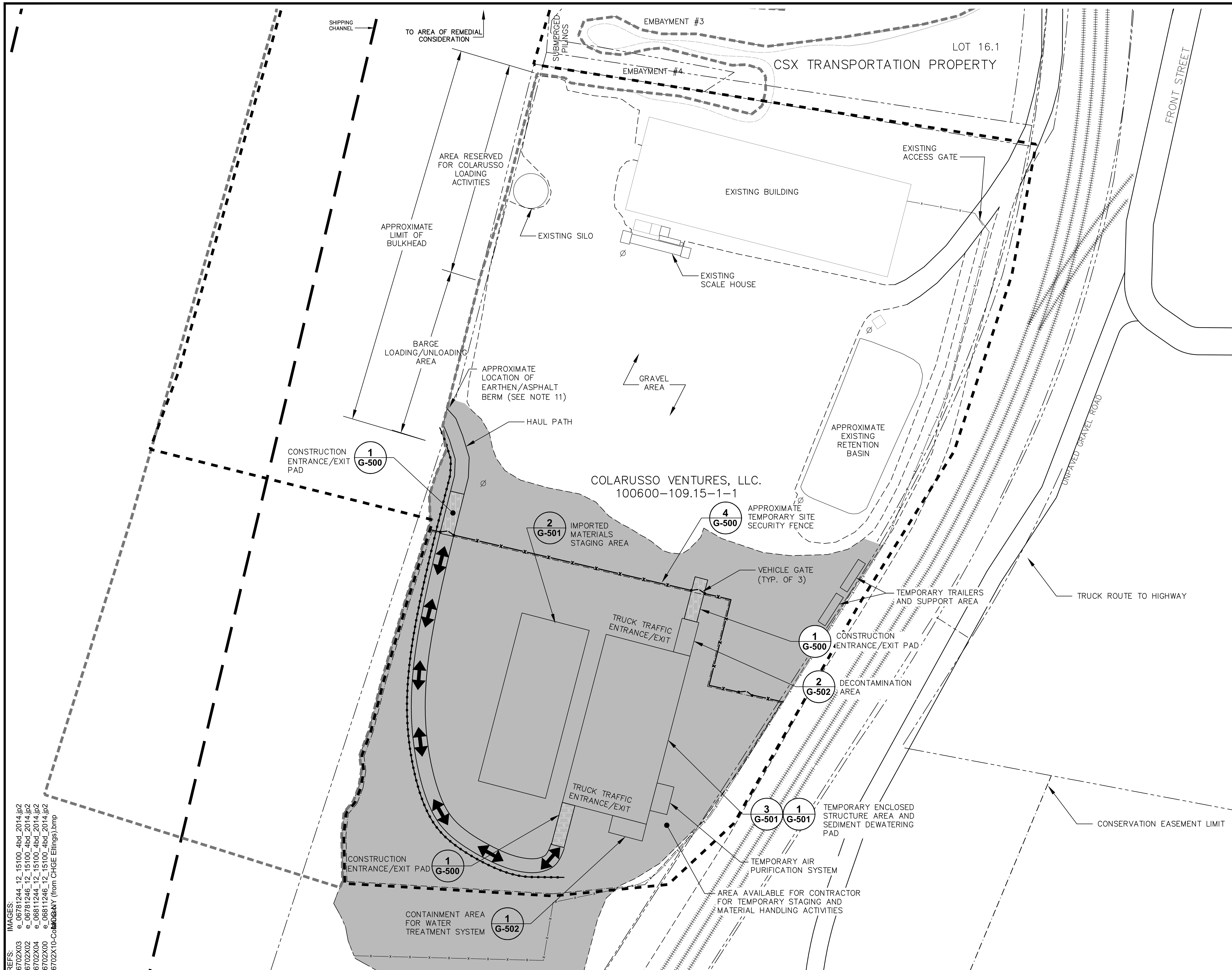
NATIONAL GRID • HUDSON (WATER STREET) SITE, HUDSON, NEW YORK
FINAL REMEDIAL DESIGN REPORT FOR OPERABLE UNIT 2

SITE PLAN AND EXISTING CONDITIONS

ARCADIS Project No.
30003986
Date
JULY 2020
ARCADIS
ONE LINCOLN CENTER
110W FAYETTE STREET
SYRACUSE, NY 13202
TEL: 315.446.9120

G-101

CITY: SYRACUSE, NY DIV/GROUP: IMDV/CAD DB/LD: L.POSENAUER, K.SARTORI PM/TM: C.GUEST LYR:ON=*;OFF=*REF*
C:\Users\jharris\BIM 360\Arcadis\ANA - National Grid\Project Files\Hudson (Water Street) Site OU2\2020\30003986\01-DWG\36702G101.dwg LAYOUT: G-101 SAVED: 5/20/2020 7:24 AM ACADVER: 23.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 7/16/2020 7:03 AM BY: HARRIS, JESS
XREFS: 36702X03 36702X02 36702X04 36702X00
IMAGES: MOG NY (from CHGE Eltings).bmp



LEGEND:

- PROJECT WORK LIMIT
- APPROXIMATE EXTENT OF OPERABLE UNIT 2
- APPROXIMATE TAX PARCEL LINE
- EXISTING CHAIN-LINK FENCE
- PROPOSED SECURITY FENCE
- RAIL LINES
- APPROXIMATE BOUNDARY OF THE SHIPPING CHANNEL
- AREA AVAILABLE FOR TEMPORARY STAGING
- EROSION CONTROL MATERIAL
- APPROXIMATE LOCATION OF LIGHT POLE
- UNPAVED ROAD/GRAVEL AREA
- UNIMPROVED AREA
- PROPERTY LINE
- CONSERVATION EASEMENT

NOTES:

1. THE LAYOUT OF THE AREA AVAILABLE FOR TEMPORARY STAGING WILL BE DETERMINED BY THE CONTRACTOR AND, AS SUCH, LOCATIONS SHOWN ARE SUBJECT TO CHANGE. ANY ALTERNATE LAYOUT SHALL BE APPROVED BY THE OWNER AND THE ENGINEER PRIOR TO USE.
2. NECESSARY PRECAUTIONS SHALL BE TAKEN TO PREVENT MIGRATION OF CONSTRUCTION–RELATED SOILS, DEBRIS, FUELS, SOLVENTS, LUBRICANTS, CONCRETE, LEACHATE, OR ANY OTHER POLLUTANT BEYOND THE AREA AVAILABLE FOR TEMPORARY STAGING.
3. THE CONTRACTOR SHALL INSTALL EROSION AND SEDIMENT CONTROL MEASURES PRIOR TO DISTURBING EXISTING SITE SOILS AND VEGETATION. ACTUAL LOCATION OF EROSION AND SEDIMENT CONTROL MEASURES MAY VARY BASED ON ACTUAL SITE CONDITIONS ENCOUNTERED AT THE TIME OF CONSTRUCTION.
4. INSTALL TEMPORARY FENCING AROUND TEMPORARY STAGING AREA AS NEEDED FOR SITE SECURITY IN ACCORDANCE WITH DETAIL 4 ON DRAWING G–500.
5. ADDITIONAL EROSION AND SEDIMENT CONTROL MEASURES MAY BE REQUIRED AT TIME OF CONSTRUCTION TO CONTROL EROSION AND SEDIMENTATION.
6. TEMPORARY EROSION AND SEDIMENT CONTROL DURING CONSTRUCTION, INCLUDING, BUT NOT LIMITED TO, INSPECTION, MAINTENANCE, AND INSTALLATION OF ADDITIONAL CONTROLS (AS NEEDED, AND IN COORDINATION WITH THE ENGINEER), SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. ALL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSTALLED AND MAINTAINED IN ACCORDANCE WITH THE LATEST EDITION OF THE NEW YORK STATE STANDARDS AND SPECIFICATIONS FOR EROSION AND SEDIMENT CONTROL.
7. ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSPECTED, AT A MINIMUM, ONCE EVERY SEVEN CALENDAR DAYS BY THE CONTRACTOR AND THE ENGINEER. REFER TO THE CQAP FOR INSPECTION REPORT REQUIREMENTS.
8. THE CONTRACTOR SHALL EQUIP SITE SECURITY FENCING WITH 'DANGER, CONSTRUCTION AREA, AUTHORIZED PERSONNEL ONLY' SIGNS AND HANG GEOTEXTILE (OR EQUIVALENT) FROM FENCING TO PROVIDE A VISUAL BARRIER.
9. TREE REMOVAL AND GRUBBING ON OR NEAR THE BANKS OF THE HUDSON RIVER WILL BE LIMITED TO ONLY WHAT IS NECESSARY FOR ACCESS OR REMEDIATION.
10. THE CONTRACTOR SHALL PROMOTE POSITIVE DRAINAGE AND INSTALL ADDITIONAL CONTROLS AS NECESSARY TO MINIMIZE SURFACE WATER RUNOFF INTO EXCAVATION AND SOLIDIFICATION AREAS.
11. AN EARTHEN/ASPHALT BERM EXISTS BETWEEN THE IMPROVED AND UNIMPROVED UPLAND AREAS. THE CONTRACTOR SHALL CONSTRUCT RAMPS USING TYPE 2 STONE AS NEEDED TO ALLOW TRAFFIC ACROSS THE BERM.
12. IF NAPL–IMPACTED MATERIALS ARE ENCOUNTERED DURING SITE PREPARATION, SUCH MATERIALS SHALL BE HANDLED AND DISPOSED OF ALONG WITH THE NAPL–IMPACTED SEDIMENTS. SUCH DETERMINATION SHALL BE MADE BY THE ENGINEER.
13. AFTER CONSTRUCTION IS COMPLETE AND PRIOR TO DEMOBILIZATION, REMOVE CONSTRUCTED FEATURES FOR THE TEMPORARY STAGING AREAS AND RESTORE DISTURBED AREAS TO PRE–CONSTRUCTION CONDITIONS. IMPORTED SOIL USED TO RESTORE DISTURBED AREAS LYING OUTSIDE OF THE APRIL 6, 2004 DEED RESTRICTION SHALL SATISFY UNRESTRICTED USE CONDITIONS IN ACCORDANCE WITH 6 NYCRR PART 375 UNRESTRICTED USE SOIL CLEANUP OBJECTIVES.
14. CONSERVATION EASEMENT BOUNDARY SURVEYED BY PLASS, ROCKEFELLER & NUCCI, LLC PROFESSIONAL LAND SURVEYORS ON OCTOBER 23, 2014. REFERENCE DEED: BOOK 640 PAGE 811 AND TAX MAP: #109.15–01–01 & 02.

XREFS: 36702X03 36702X02 36702X04 36702X00 36702X10-COLOR
IMAGES: e_06781244_12_15100_4bd_2014.jp2 e_06781246_12_15100_4bd_2014.jp2 e_06811244_12_15100_4bd_2014.jp2 e_06811246_12_15100_4bd_2014.jp2 NY (from CHGE Eltings).bmp

CITY: SYRACUSE, NY DIV/GROUP: IMDV/CAD DB/LD: L.POSENAUER, K.SARTORI PM/TM: C.GUEST LYR:ON=*;OFF=*REF*
C:\Users\jharris\BIM 360\Arcadis\ANA - National Grid\Project Files\Hudson (Water Street) Site OU2\2020\30003986\01-DWG\36702G102.dwg LAYOUT: G-102 SAVED: 5/20/2020 7:26 AM ACADVER: 23.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 7/16/2020 7:05 AM BY: HARRIS, JESS

60' 0 60' 120'
1"=60'

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

THIS DRAWING IS THE PROPERTY OF THE ARCADIS ENTITY IDENTIFIED IN THE TITLE BLOCK AND MAY NOT BE REUSED OR ALTERED IN WHOLE OR IN PART WITHOUT THE EXPRESS WRITTEN PERMISSION OF SAME.

Professional Engineer's Name		
MARK GRAVELDING		
Professional Engineer's No. 069985-1		
State: NY	Date Signed	Project Mgr.: HMV
Designed by: ESD	Drawn by: KLS	Checked by

STATE OF NEW YORK · MARK OWEN GRAVELDING · LICENSED PROFESSIONAL ENGINEER

ARCADIS Design & Consultancy for natural and built assets

ARCADIS OF NEW YORK, INC.

NO ALTERATIONS PERMITTED HEREON EXCEPT AS PROVIDED UNDER SECTION 7209 SUBDIVISION 2 OF THE NEW YORK STATE EDUCATION LAW

NATIONAL GRID • HUDSON (WATER STREET) SITE, HUDSON, NEW YORK
FINAL REMEDIAL DESIGN REPORT FOR OPERABLE UNIT 2

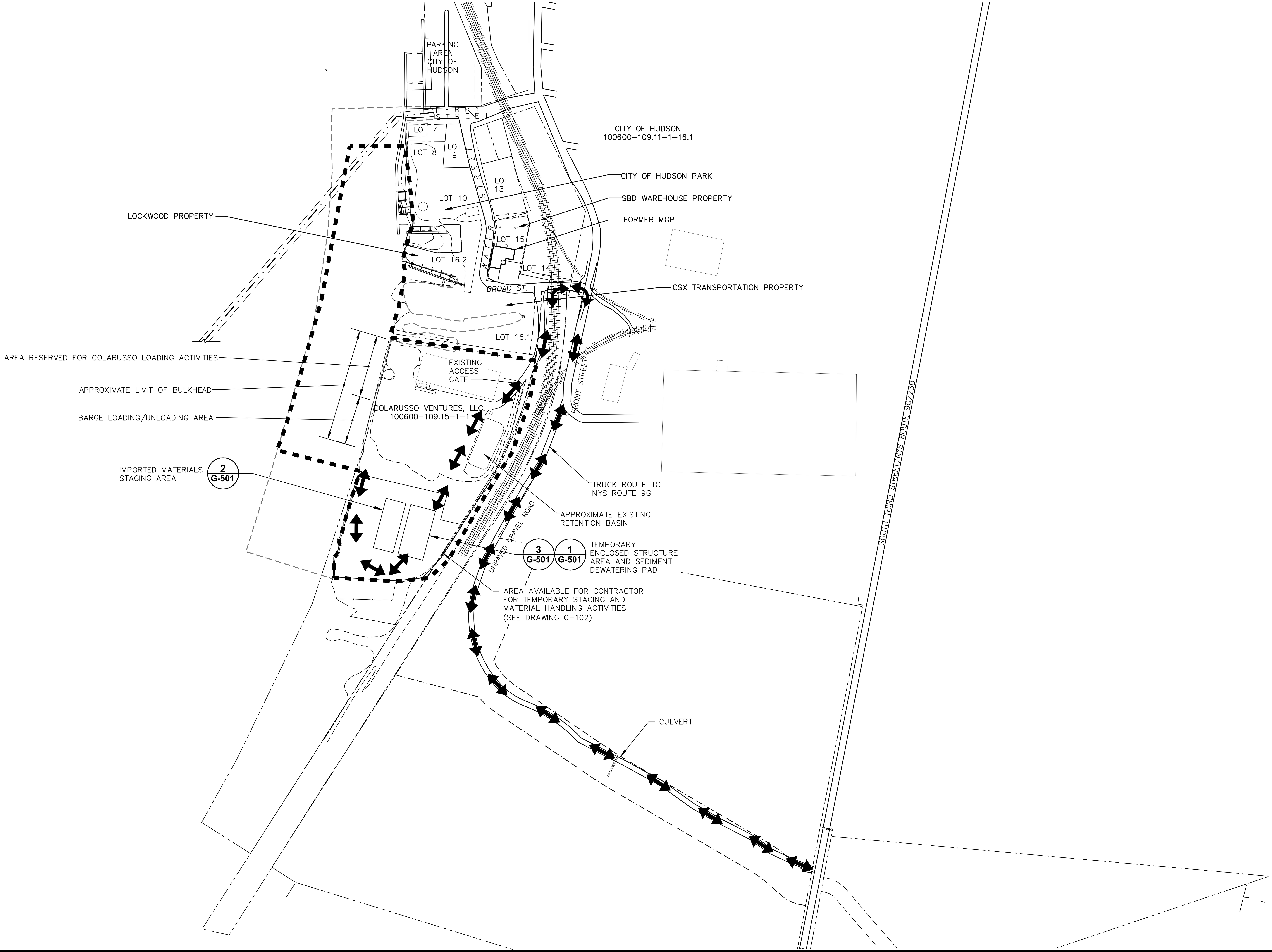
SITE PREPARATION AND ENVIRONMENTAL CONTROLS PLAN

ARCADIS Project No. 30003986

Date JULY 2020

ARCADIS
ONE LINCOLN CENTER
110W FAYETTE STREET
SYRACUSE, NY 13202
TEL: 315.446.9120

G-102



LEGEND:

- TRAFFIC ROUTE
- APPROXIMATE EXTENT OF OPERABLE UNIT 2
- PROJECT WORK LIMIT
- APPROXIMATE TAX PARCEL LINE
- EXISTING CHAIN–LINK FENCE
- RAIL LINES
- APPROXIMATE FIBER OPTIC CABLE EASEMENT
- APPROXIMATE FIBER OPTIC CABLE LOCATION
- PROPERTY LINE
- CONSERVATION EASEMENT

NOTES:

1. THE LAYOUT OF THE TEMPORARY STAGING AREA WILL BE DETERMINED BY THE CONTRACTOR, AND AS SUCH, THE LOCATION OF AREAS SHOWN HEREIN ARE SUBJECT TO CHANGE.
2. IMPROVEMENTS TO THE OFFSITE HAUL ROAD, INCLUDING TURNOFFS, MAY BE REQUIRED AND WILL BE COORDINATED WITH THE PROPERTY OWNER.

XREFS: 36702X03 36702X04 36702X00 36702X10-Colarusso
IMAGES: MOG NY (from CHGE Eltings).bmp

200' 0 200' 400'
1"=200'

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

THIS DRAWING IS THE PROPERTY OF THE ARCADIS ENTITY IDENTIFIED IN THE TITLE BLOCK AND MAY NOT BE REUSED OR ALTERED IN WHOLE OR IN PART WITHOUT THE EXPRESS WRITTEN PERMISSION OF SAME.

Professional Engineer's Name: **MARK GRAVELDING**
Professional Engineer's No.: 069985-1

State	Date Signed	Project Mgr.
NY		HMV
Designed by	Drawn by	Checked by
ESD	KLS	

STATE OF NEW YORK · MARK OWEN GRAVELDING · LICENSED PROFESSIONAL ENGINEER

ARCADIS Design & Consultancy for natural and built assets

ARCADIS OF NEW YORK, INC.

NO ALTERATIONS PERMITTED HEREON EXCEPT AS PROVIDED UNDER SECTION 7209 SUBDIVISION 2 OF THE NEW YORK STATE EDUCATION LAW

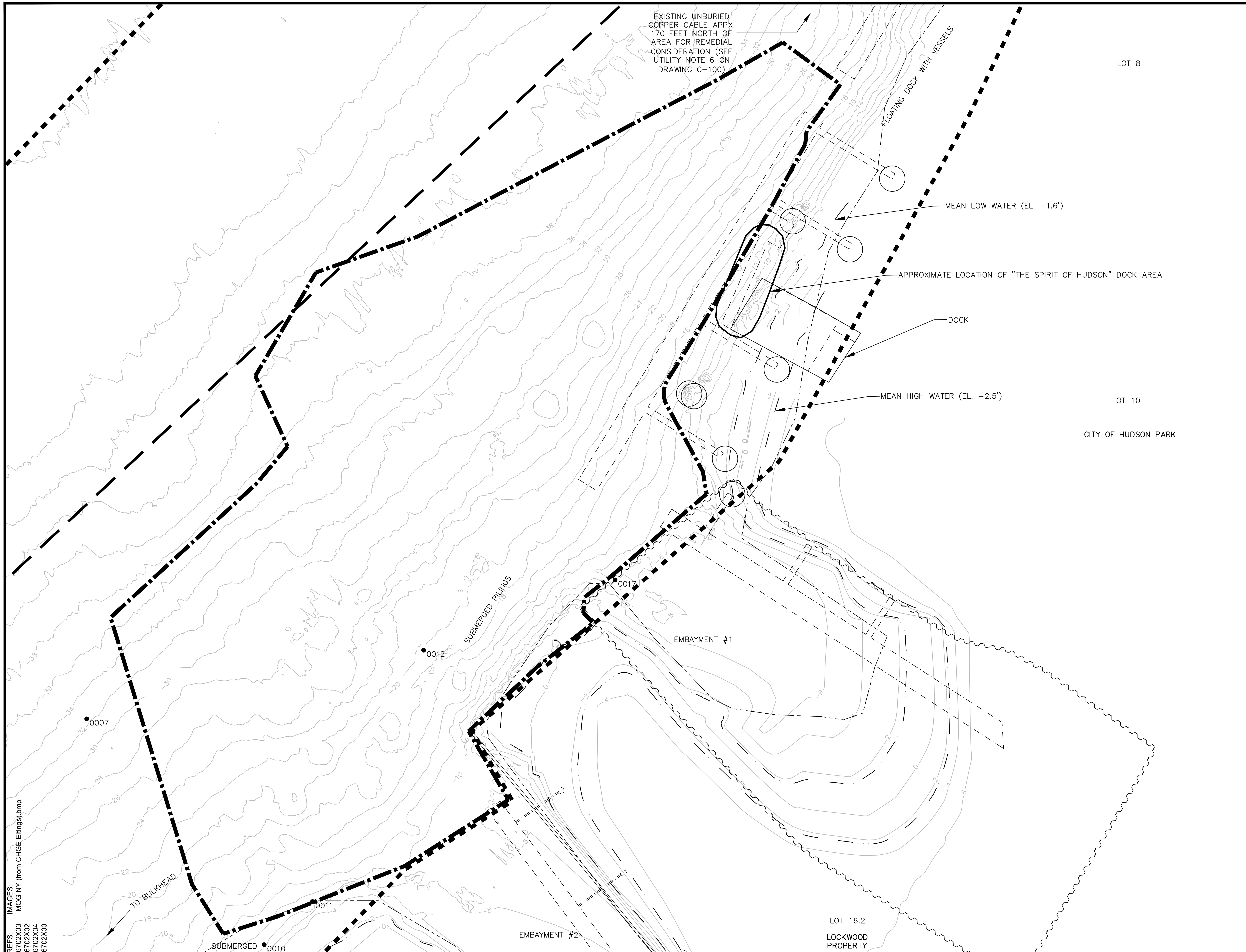
NATIONAL GRID • HUDSON (WATER STREET) SITE, HUDSON, NEW YORK
FINAL REMEDIAL DESIGN REPORT FOR OPERABLE UNIT 2

PRELIMINARY TRUCK ROUTES PLAN

ARCADIS Project No. 30003986
Date JULY 2020
ARCADIS ONE LINCOLN CENTER 110W FAYETTE STREET SYRACUSE, NY 13202 TEL: 315.446.9120

G-103

CITY: SYRACUSE, NY DIV/GROUP: IMDV/CAD DB/LD: L.POSENAUER, K.SARTORI PM/TM: C.GUEST LYR:ON=*;OFF=*REF* C:\Users\jharris\BIM 360\Arcadis\ANA - National Grid\Project Files\Hudson (Water Street) Site OU2\2020\30003986\01-DWG\36702G103.dwg LAYOUT: G-103 SAVED: 5/20/2020 7:27 AM ACADVER: 23.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 7/16/2020 7:06 AM BY: HARRIS, JESS



LEGEND:

- APPROXIMATE TAX PARCEL LINE
- EXISTING CHAIN-LINK FENCE
- BATHYMETRIC CONTOUR (2-FOOT INTERVAL)
- MEAN LOW WATER / MEAN HIGH WATER
- EXISTING SHEET PILE (SEE NOTE 1)
- DREDGE AREA LIMIT
- APPROXIMATE BOUNDARY OF THE SHIPPING CHANNEL
- UTILITY POLE
- EXISTING PERMANENT DOCK
- EXISTING TEMPORARY DOCK
- EXISTING DOLPHIN
- PROJECT WORK LIMIT

ELEVATION OR DESCRIPTION	EASTING	NORTHING
PILINGS	681632.92	1247080.82
VERTICAL I BEAM	681634.79	1247079.79
MOORING	681649.76	1247041.4
MOORING	681646.93	1247055.28
MOORING	681667.2	1247090.2
MOORING	681695.8	1247137.24
VERTICAL I BEAM	681673.38	1247148.22
MOORING	681712.33	1247164.88

2015 DEBRIS AND OBSTRUCTION SURVEY

TARGET #	DESCRIPTION	LENGTH	WIDTH	HEIGHT
0007	PROBABLE TREE	20.46	1.22	1.48
0010	PILING	0	0	0
0011	DOCK REMAINS – PILING AREA	18.95	25.44	0
0012	PROBABLE TREE	25.76	1.05	0
0017	SHEET PILING EMERGING FORM ROCKS AND DISAPPEARING UNDER THE SEDIMENT	14.41	0	0

NOTES:

1. AS DESCRIBED IN THE FINAL ENGINEERING REPORT – REMEDIAL ACTION IMPLEMENTATION OF OPERABLE UNIT 1, A PERMANENT SHEET PILE WALL WAS INSTALLED AROUND THE SEDIMENT REMOVAL AREA AND ALONG THE WESTERN ALIGNMENT OF EMBAYMENT #1. THIS STEEL SHEET PILE WALL WAS LEFT IN PLACE TO PROVIDE ADDITIONAL PROTECTION AGAINST THE POTENTIAL LATERAL SUBSURFACE MIGRATION OF IMPACTED MATERIAL FROM SURROUNDING PROPERTIES INTO EMBAYMENT #1. THE SHEET PILE WALL AT THE MOUTH OF EMBAYMENT #1 WAS CUT OFF AT THE MUDLINE FOLLOWING COMPLETION OF THE OU1 REMEDIATION.

2. A REMNANT BULKHEAD FEATURE WAS IDENTIFIED BY DIVERS ALONG THE LENGTH OF THE WATERFRONT IMMEDIATELY OFFSHORE OF THE PENINSULA BETWEEN EMBAYMENTS # 1 AND #2 AND CONTINUING ALONG THE SHORE-SIDE OF THE HUDSON RIVER CRUISE BOAT DOCKS. THE CONFIGURATION OF THE STRUCTURE IS UNKNOWN, BUT THERE APPEARED TO BE TWO PARALLEL TIMBER-PILE WALLS WITH 3 TO 4 FEET OF VOID SPACE BETWEEN THEM. VARIOUS PIECES OF TIMBER-PILES AND DRIFTWOOD/LOGS WERE CAUGHT IN THE VOID SPACE. THE FEATURE APPEARED TO BE CONSISTENT OVER THE ENTIRE LENGTH OF THE SITE WATERFRONT EXCEPT IN FRONT OF EMBAYMENT #1, AND APPEARED TO BE IN VARIOUS STATES OF DEGRADATION.

XREFS: 36702X03 36702X02 36702X04 36702X00
IMAGES: MOG NY (from CHGE Eltings).bmp

CITY: SYRACUSE, NY DIV/GROUP: IMDV/CAD DB/LD: L.POSENAUER, K.SARTORI PM/TM: C.GUEST LYR:ON=*;OFF=*REF*
C:\Users\jharris\BIM 360\Arcadis\ANA - National Grid\Project Files\Hudson (Water Street) Site OU2\2020\30003986\01-DWG\36702G200.dwg LAYOUT: G-200 SAVED: 5/20/2020 7:29 AM ACADVER: 23.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 7/16/2020 7:08 AM BY: HARRIS, JESS

20' 0 20' 40'
1"=20'

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name: MARK GRAVELDING
Professional Engineer's No.: 069985-1
State: NY | Date Signed: | Project Mgr.: HMV
Designed by: ESD | Drawn by: KLS | Checked by:

STATE OF NEW YORK – MARK OWEN GRAVELDING – LICENSED PROFESSIONAL ENGINEER

ARCADIS Design & Consultancy for natural and built assets

ARCADIS OF NEW YORK, INC.

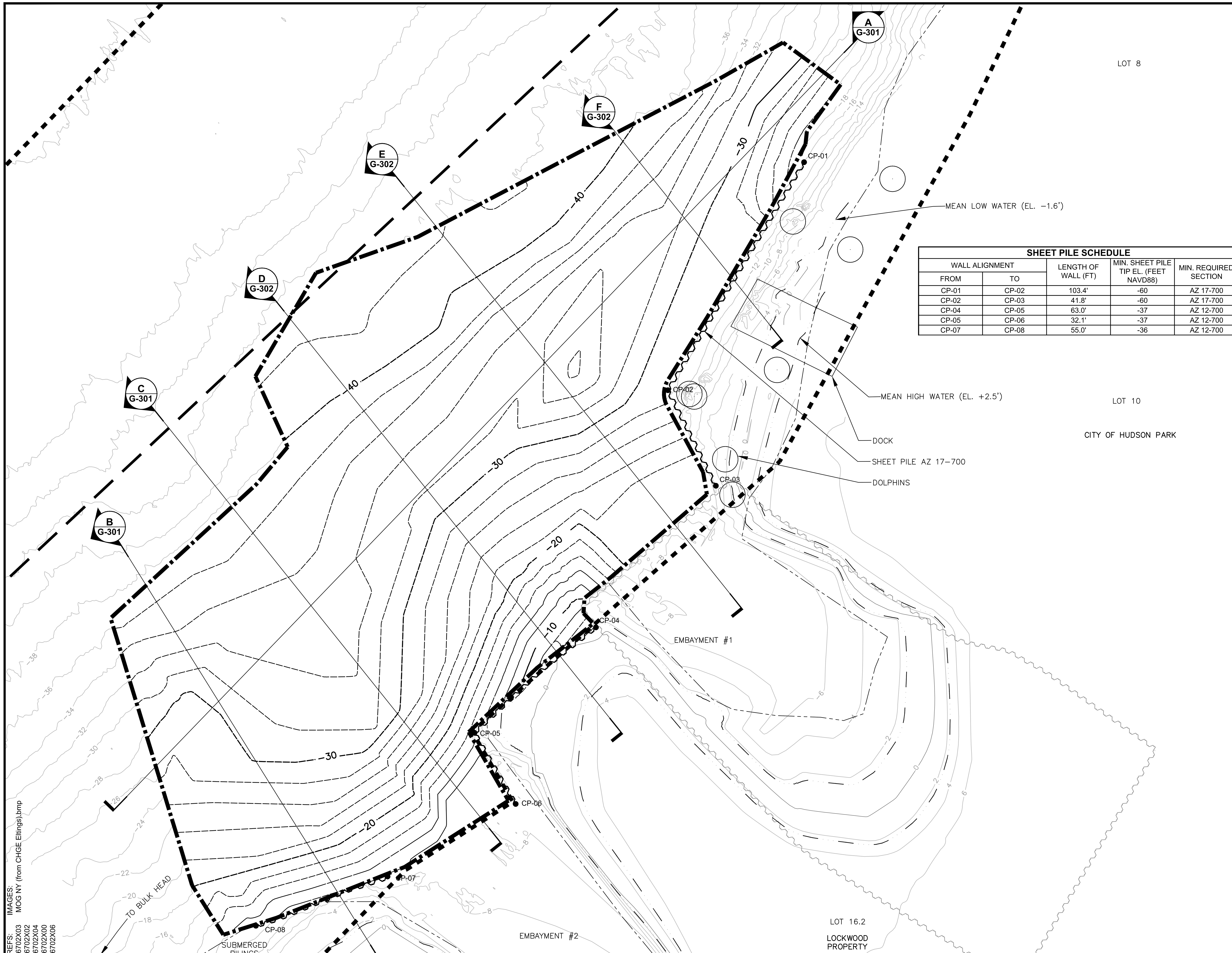
NATIONAL GRID • HUDSON (WATER STREET) SITE, HUDSON, NEW YORK
FINAL REMEDIAL DESIGN REPORT FOR OPERABLE UNIT 2

KNOWN OBSTRUCTIONS, DEBRIS, AND SITE UTILITY PLAN

ARCADIS Project No. 30003986
Date: JULY 2020

ARCADIS
ONE LINCOLN CENTER
110W FAYETTE STREET
SYRACUSE, NY 13202
TEL: 315.446.9120

G-200



SHEET PILE SCHEDULE				
WALL ALIGNMENT		LENGTH OF WALL (FT)	MIN. SHEET PILE TIP EL. (FEET NAVD88)	MIN. REQUIRED SECTION
FROM	TO			
CP-01	CP-02	103.4'	-60	AZ 17-700
CP-02	CP-03	41.8'	-60	AZ 17-700
CP-04	CP-05	63.0'	-37	AZ 12-700
CP-05	CP-06	32.1'	-37	AZ 12-700
CP-07	CP-08	55.0'	-36	AZ 12-700

LEGEND:

- APPROXIMATE TAX PARCEL LINE
- PROJECT WORK LIMIT
- EXISTING CHAIN-LINK FENCE
- EXISTING BATHYMETRIC CONTOUR (2-FOOT INTERVAL)
- MEAN LOW WATER / MEAN HIGH WATER
- EXISTING SHEET PILE WALL
- DREDGE AREA LIMIT
- APPROXIMATE BOUNDARY OF THE SHIPPING CHANNEL
- PROPOSED REMOVAL CONTOUR (MAJOR)
- PROPOSED REMOVAL CONTOUR (MINOR)
- EXISTING PERMANENT DOCK
- EXISTING DOLPHIN
- APPROXIMATE PROPOSED SHEET PILE WALL

NOTES:

1. IF RIPRAP REQUIRES REMOVAL, STOCKPILE FOR REUSE DURING RESTORATION.
2. SHEET PILE WALL SHALL BE INSTALLED TO PROVIDE EXCAVATION SUPPORT DURING DREDGING ACTIVITIES. FOLLOWING SEDIMENT BACKFILL ACTIVITIES, THE SHEET PILE SHALL BE CUT AT POST-RESTORATION GRADE AS REQUIRED BY THE CONTRACT DOCUMENTS.
3. THE CONTRACTOR SHALL INSTALL TWO FLOATING BOUNDARY/PERIMETER CONTAINMENT BOOMS EQUIPPED WITH SKIRTS AND ABSORBENT BOOMS, ONE EACH NOMINALLY UPSTREAM AND DOWNSTREAM OF THE DREDGE AREA LIMIT.

CITY: SYRACUSE, NY DIV/GROUP: IMDV/CAD DB/LD: L.POSENAUER, K.SARTORI PM/TM: C.GUEST LYR:ON=*;OFF=*REF*
C:\Users\jharris\BIM 360\Arcadis\ANA - National Grid\Project Files\Hudson (Water Street) Site OU2\2020\30003986\01-DWG\36702G300.dwg LAYOUT: G-300 SAVED: 5/20/2020 7:31 AM ACADVER: 23.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 7/16/2020 7:09 AM BY: HARRIS, JESS

XREFS: 36702X03 36702X02 36702X04 36702X00 36702X06
IMAGES: MOG NY (from CHGE Eltings).bmp

1"=20' — 20' 0 20' 40'

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

THIS DRAWING IS THE PROPERTY OF THE ARCADIS ENTITY IDENTIFIED IN THE TITLE BLOCK AND MAY NOT BE REUSED OR ALTERED IN WHOLE OR IN PART WITHOUT THE EXPRESS WRITTEN PERMISSION OF SAME.

Professional Engineer's Name: **MARK GRAVELDING**
Professional Engineer's No.: 069985-1
State: NY | Date Signed: | Project Mgr.: HMV
Designed by: ESD | Drawn by: KLS | Checked by:

STATE OF NEW YORK · MARK OWEN GRAVELDING · 069985-1 · LICENSED PROFESSIONAL ENGINEER

ARCADIS Design & Consultancy for natural and built assets

ARCADIS OF NEW YORK, INC.

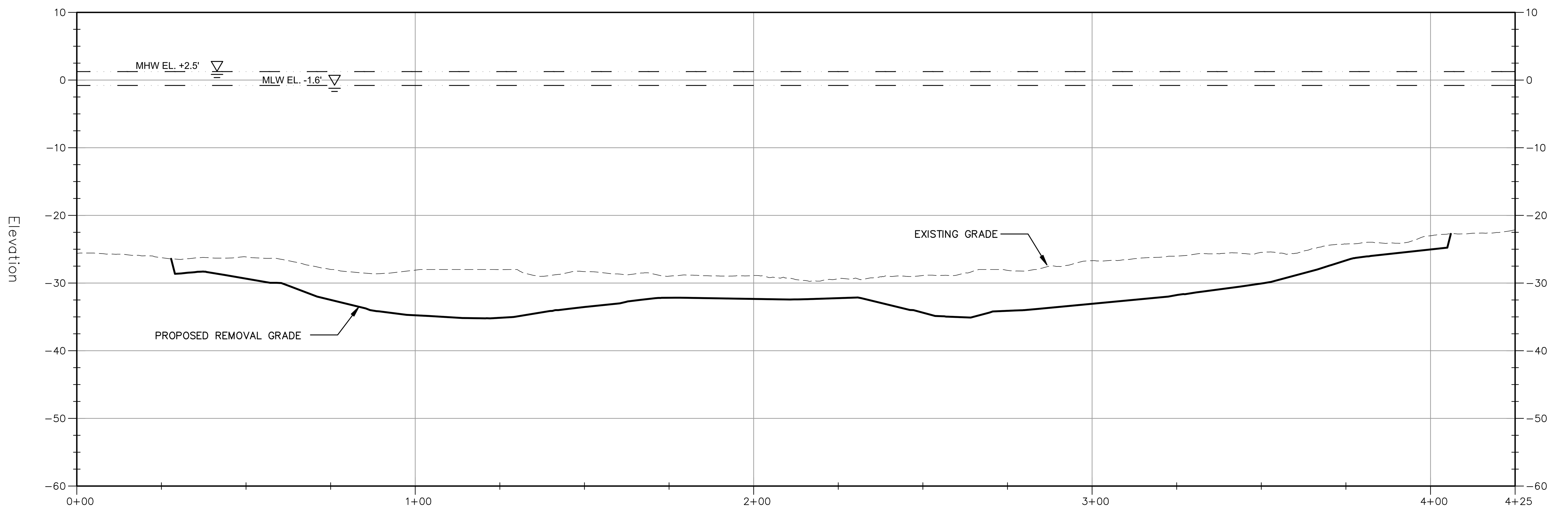
NO ALTERATIONS PERMITTED HEREON EXCEPT AS PROVIDED UNDER SECTION 7209 SUBDIVISION 2 OF THE NEW YORK STATE EDUCATION LAW

NATIONAL GRID ● HUDSON (WATER STREET) SITE, HUDSON, NEW YORK
FINAL REMEDIAL DESIGN REPORT FOR OPERABLE UNIT 2

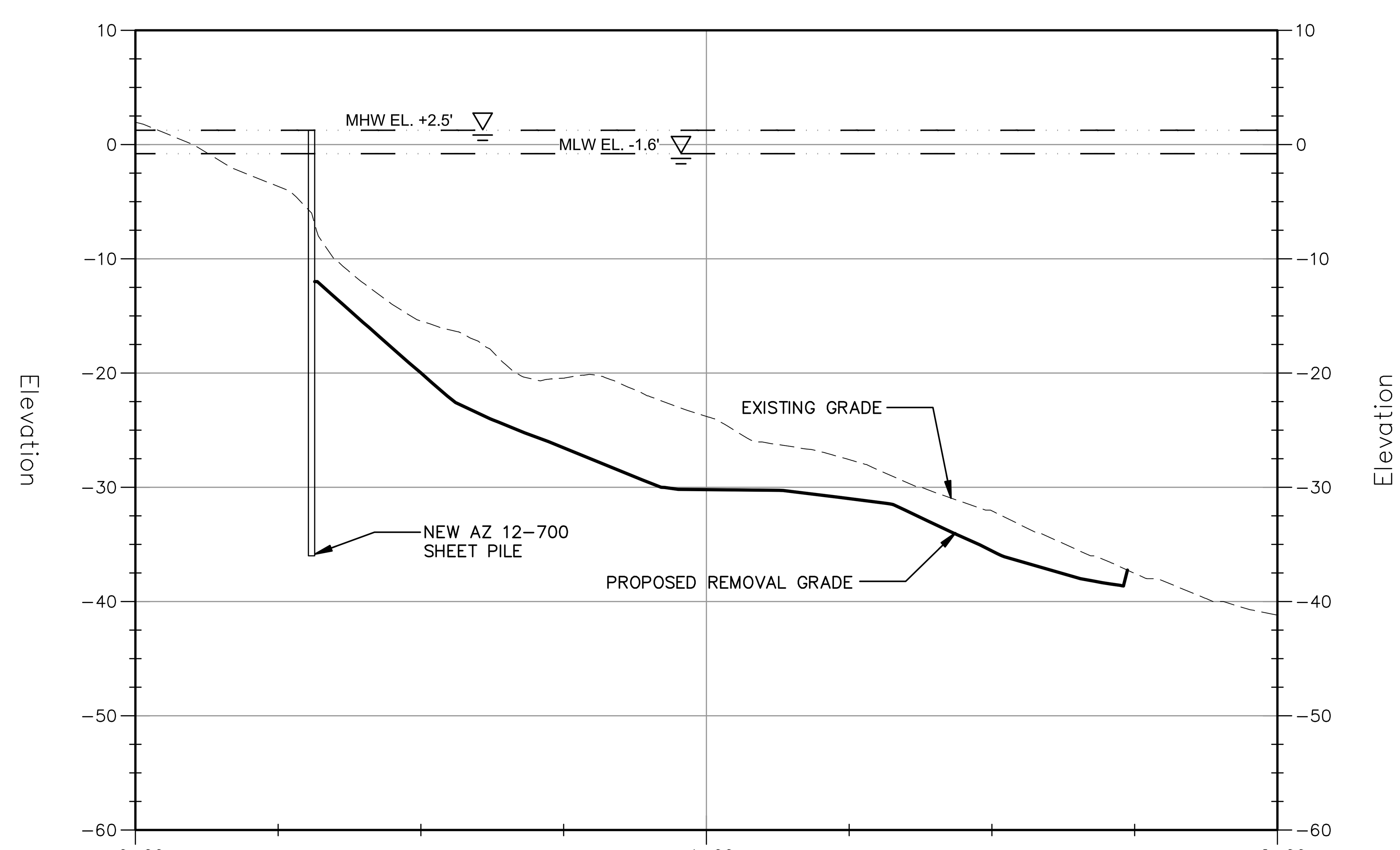
SEDIMENT REMOVAL PLAN

ARCADIS Project No. 30003986
Date JULY 2020
ARCADIS
ONE LINCOLN CENTER
110W FAYETTE STREET
SYRACUSE, NY 13202
TEL: 315.446.9120

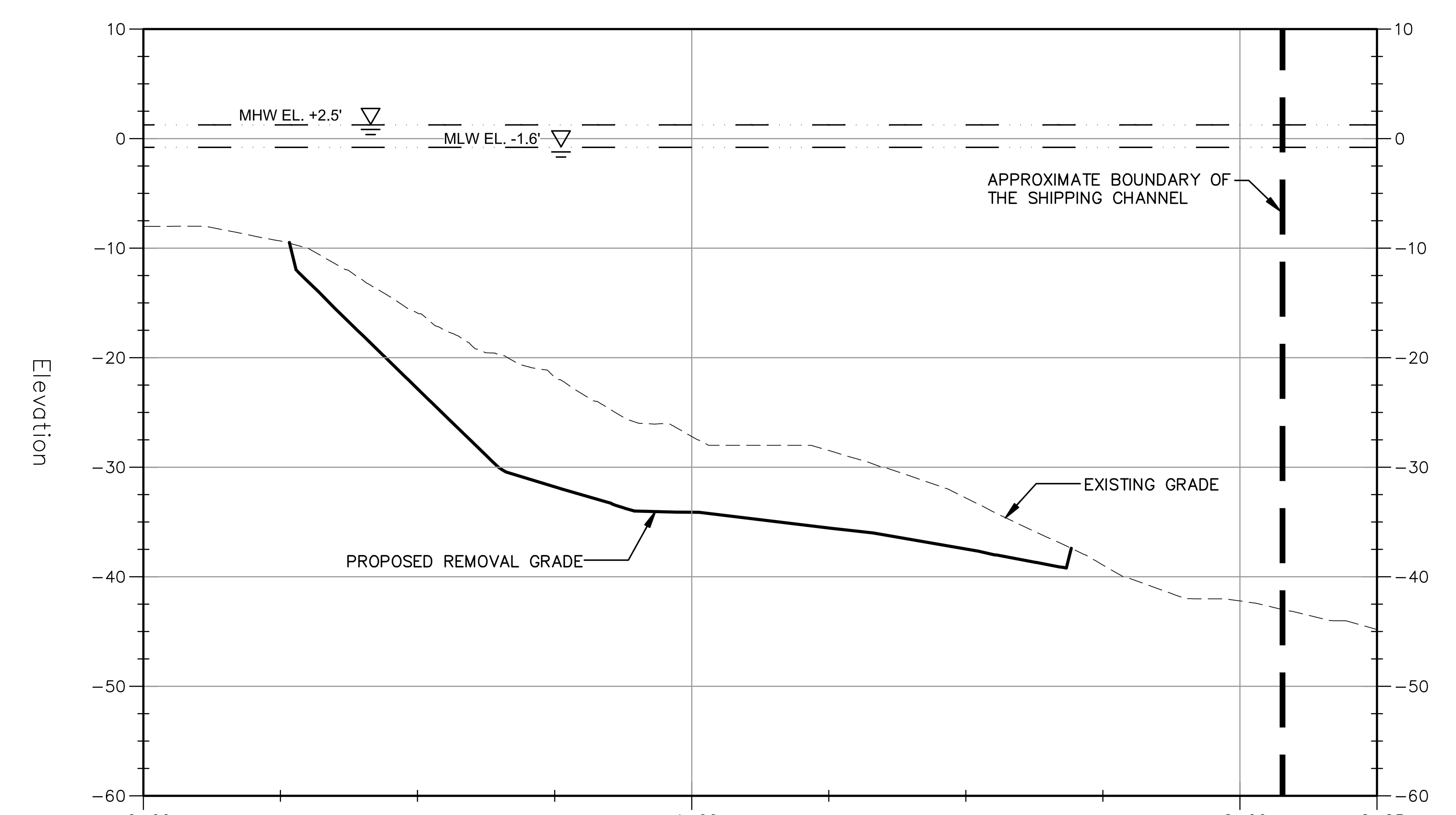
G-300



PROFILE A



PROFILE B



PROFILE C

CITY: SYRACUSE, NY DIV/GROUP: IMDV/CAD DB/LD: L.POSENAUER, K.SARTORI PM/TM: C.GUEST LYR:ON=*;OFF=*REF* C:\Users\jharris\BIM 360\Arcadis\ANA - National Grid\Project Files\Hudson (Water Street) Site OU2\2020\30003986\01-DWG\36702G301.dwg LAYOUT: G-301 SAVED: 5/20/2020 7:32 AM ACADVER: 23.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 7/16/2020 7:11 AM BY: HARRIS, JESS

XREFS: 36702X00 36702X02-CIV IMAGES: MOG NY (from CHGE Ellings).bmp

HORIZONTAL SCALE: 1"=20'
VERTICAL SCALE: 1"=10'

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

THIS DRAWING IS THE PROPERTY OF THE ARCADIS ENTITY IDENTIFIED IN THE TITLE BLOCK AND MAY NOT BE REUSED OR ALTERED IN WHOLE OR IN PART WITHOUT THE EXPRESS WRITTEN PERMISSION OF SAME.

Professional Engineer's Name: MARK GRAVELDING
Professional Engineer's No.: 069985-1
State: NY | Date Signed: | Project Mgr.: HMV
Designed by: ESD | Drawn by: KLS | Checked by:

ARCADIS Design & Consultancy for natural and built assets

ARCADIS OF NEW YORK, INC.

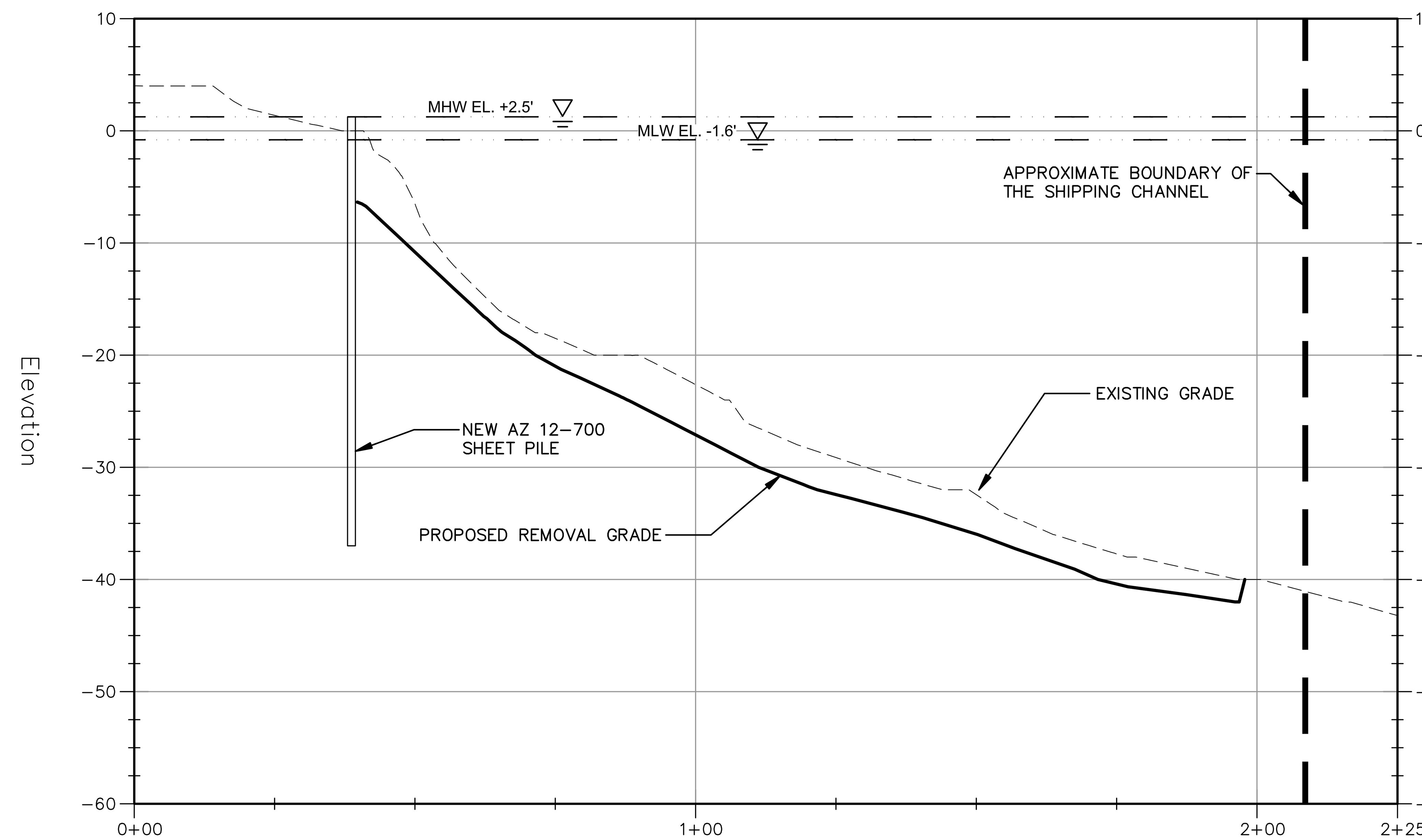
NO ALTERATIONS PERMITTED HEREON EXCEPT AS PROVIDED UNDER SECTION 7209 SUBDIVISION 2 OF THE NEW YORK STATE EDUCATION LAW

NATIONAL GRID • HUDSON (WATER STREET) SITE, HUDSON, NEW YORK
FINAL REMEDIAL DESIGN REPORT FOR OPERABLE UNIT 2

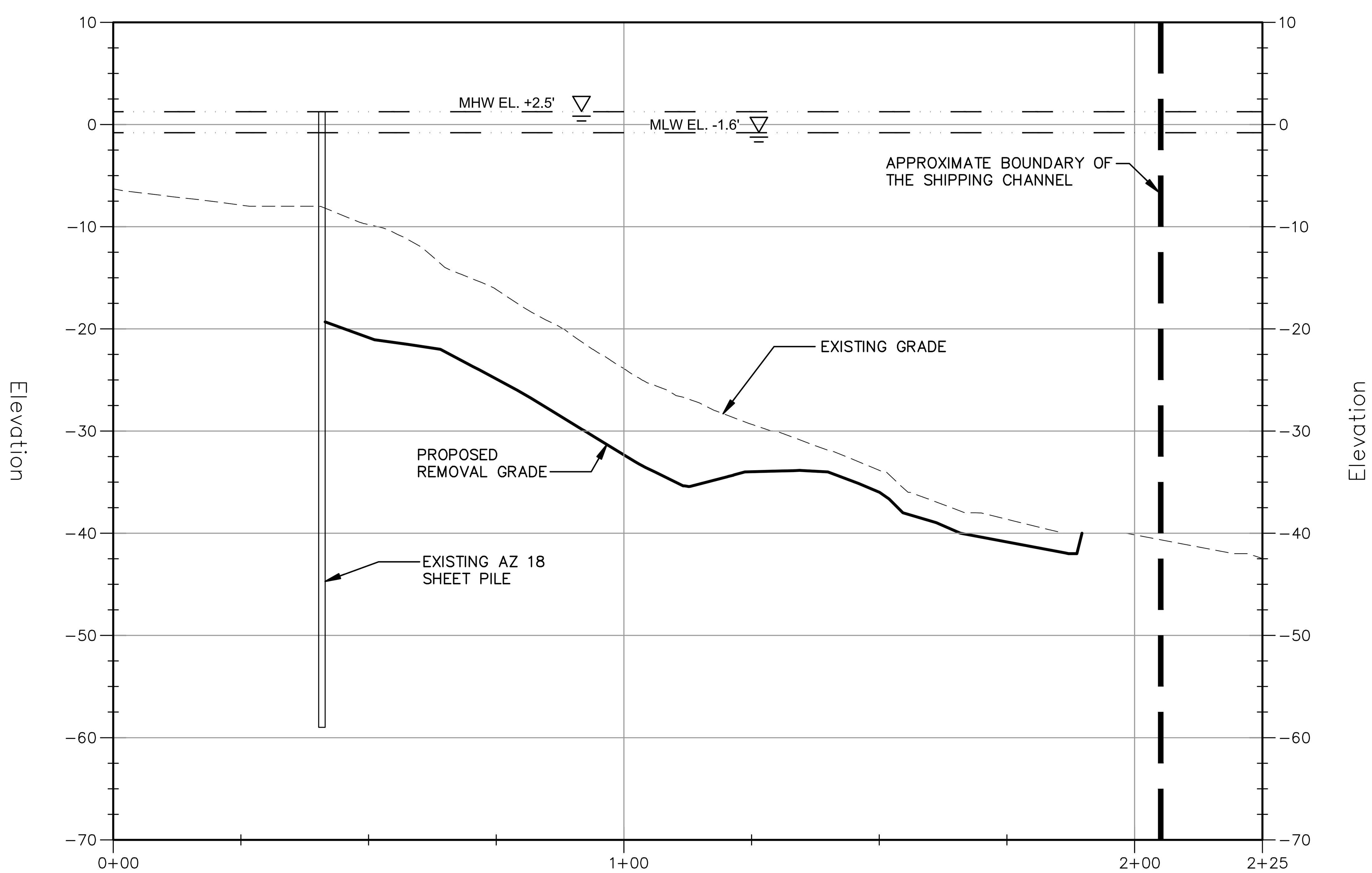
SEDIMENT REMOVAL PROFILES

ARCADIS Project No. 30003986
Date JULY 2020
ARCADIS
ONE LINCOLN CENTER
110W FAYETTE STREET
SYRACUSE, NY 13202
TEL: 315.446.9120

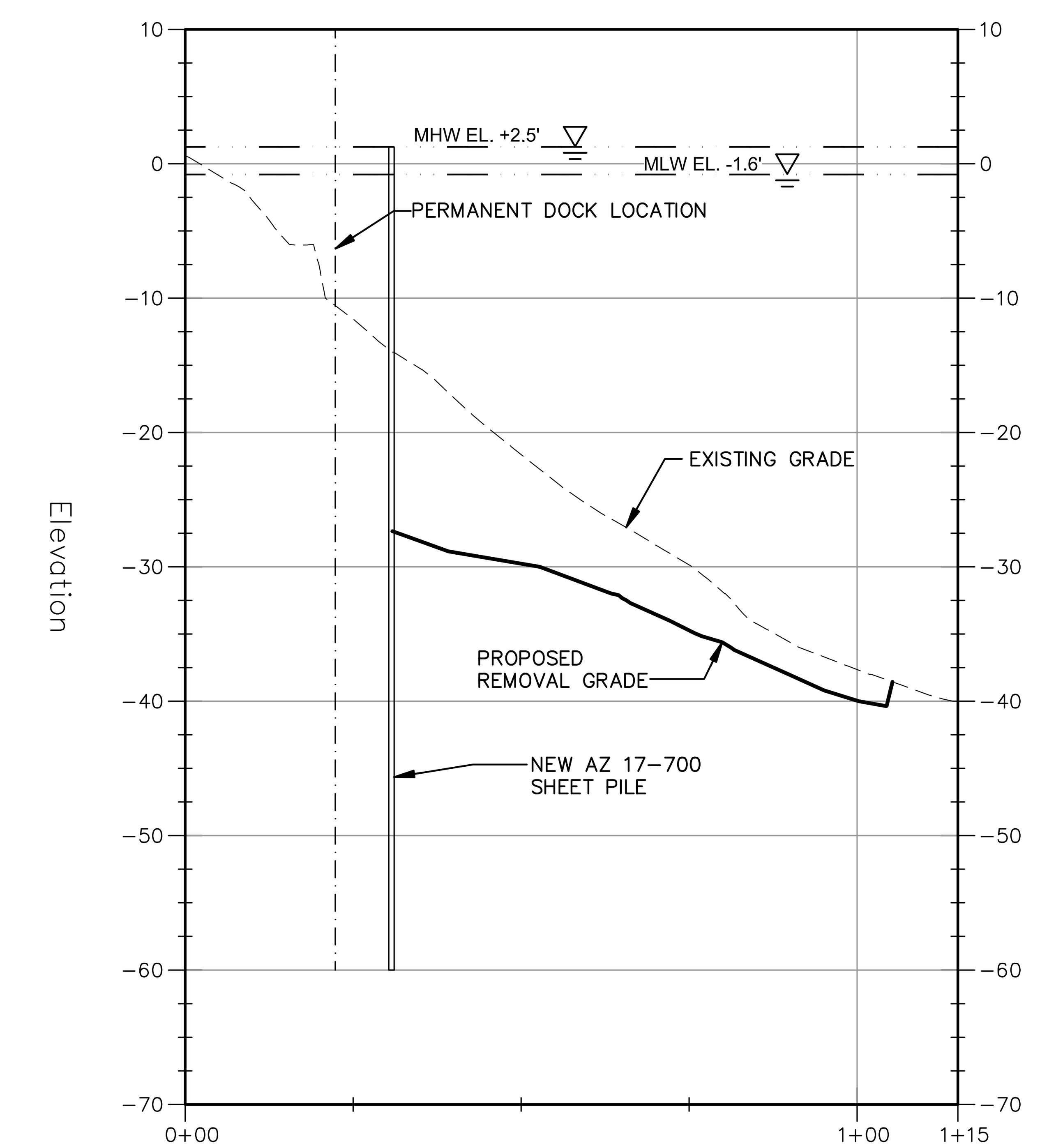
G-301



PROFILE D



PROFILE E



PROFILE F

XREFS: 36702X00 36702X02-CIV
IMAGES: MOG NY (from CHGE Elings).bmp

CITY: SYRACUSE, NY DIV/GROUP: IMDV/CAD DB/LD: L.POSENAUER, K.SARTORI PM/TM: C.GUEST LYR:ON=*;OFF=*REF*
C:\Users\jharris\BIM 360\Arcadis\ANA - National Grid\Project Files\Hudson (Water Street) Site OU2\2020\30003986\01-DWG\36702G301.dwg LAYOUT: G-302 SAVED: 5/20/2020 7:32 AM ACADVER: 23.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 7/16/2020 7:11 AM BY: HARRIS, JESS

HORIZONTAL SCALE: 1"=20'
VERTICAL SCALE: 1"=10'

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

THIS DRAWING IS THE PROPERTY OF THE ARCADIS ENTITY IDENTIFIED IN THE TITLE BLOCK AND MAY NOT BE REUSED OR ALTERED IN WHOLE OR IN PART WITHOUT THE EXPRESS WRITTEN PERMISSION OF SAME.

Professional Engineer's Name: MARK GRAVELDING
Professional Engineer's No.: 069985-1

State	Date Signed	Project Mgr.
NY		HMV
Designed by	Drawn by	Checked by
ESD	KLS	

ARCADIS Design & Consultancy for natural and built assets

ARCADIS OF NEW YORK, INC.

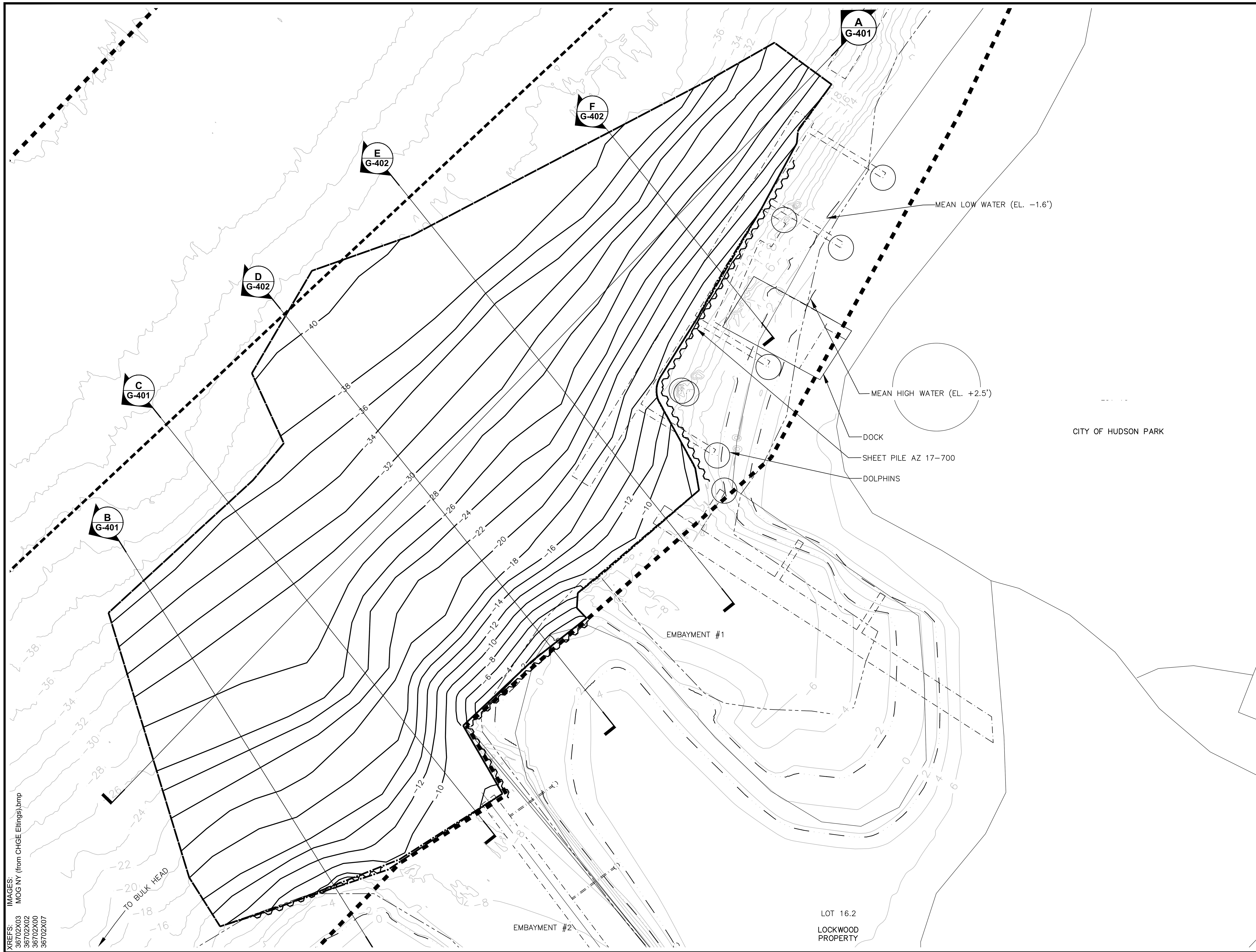
NO ALTERATIONS PERMITTED HEREON EXCEPT AS PROVIDED UNDER SECTION 7209 SUBDIVISION 2 OF THE NEW YORK STATE EDUCATION LAW

NATIONAL GRID • HUDSON (WATER STREET) SITE, HUDSON, NEW YORK
FINAL REMEDIAL DESIGN REPORT FOR OPERABLE UNIT 2

SEDIMENT REMOVAL PROFILES

ARCADIS Project No. 30003986
Date JULY 2020
ARCADIS
ONE LINCOLN CENTER
110W FAYETTE STREET
SYRACUSE, NY 13202
TEL: 315.446.9120

G-302



LEGEND:

- APPROXIMATE PROPERTY LINE
- PROJECT WORK LIMIT
- EXISTING CHAIN LINK FENCE
- BATHYMETRIC CONTOUR (2-FOOT INTERVAL)
- PROPOSED FINISHED GRADE (-20)
- MEAN LOW WATER / MEAN HIGH WATER
- APPROXIMATE BOUNDARY OF THE SHIPPING CHANNEL
- EXISTING SHEET PILE WALL
- RESTORED DREDGED AREA
- EXISTING PERMANENT DOCK
- EXISTING TEMPORARY DOCK
- EXISTING DOLPHIN
- APPROXIMATE PROPOSED SHEET PILE WALL

NOTES:

1. RESTORE DISTURBED SHORELINE AND NEARSHORE AREAS WITH CLASS 3 RIPRAP. REUSE STOCKPILED RIPRAP WHERE POSSIBLE.
2. SHEET PILE WALL SHALL BE INSTALLED TO PROVIDE EXCAVATION SUPPORT DURING DREDGING ACTIVITIES. FOLLOWING SEDIMENT BACKFILL ACTIVITIES, THE SHEET PILE SHALL BE CUT AT POST-RESTORATION GRADE AS REQUIRED BY THE CONTRACT DOCUMENTS.

XREFS: 36702X03 36702X02 36702X00 36702X07
IMAGES: MOG NY (from CHGE Eltings).bmp

CITY: SYRACUSE, NY DIV/GROUP: IMDV/CAD DB/LD: L.POSENAUER, K.SARTORI PM/TM: C.GUEST LYR:ON=*;OFF=*REF*
C:\Users\jharris\BIM 360\Arcadis\ANA - National Grid\Project Files\Hudson (Water Street) Site OU2\2020\30003986\01-DWG\36702G400.dwg LAYOUT: G-400 SAVED: 5/20/2020 7:34 AM ACADVER: 23.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 7/16/2020 7:12 AM BY: HARRIS, JESS

20' 0 20' 40'
1"=20'

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name: MARK GRAVELDING
Professional Engineer's No.: 069985-1
State: NY | Date Signed: | Project Mgr.: HMV
Designed by: ESD | Drawn by: KLS | Checked by:

STATE OF NEW YORK — MARK OWEN GRAVELDING — LICENSED PROFESSIONAL ENGINEER

ARCADIS Design & Consultancy for natural and built assets

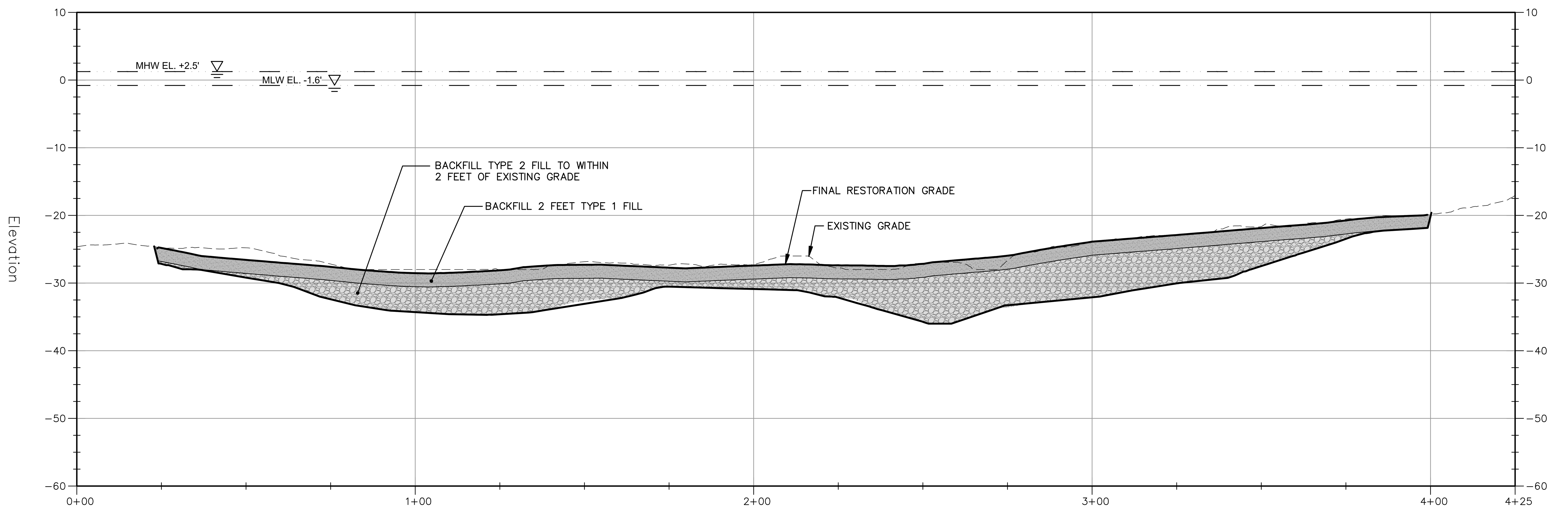
ARCADIS OF NEW YORK, INC.

NATIONAL GRID • HUDSON (WATER STREET) SITE, HUDSON, NEW YORK
FINAL REMEDIAL DESIGN REPORT FOR OPERABLE UNIT 2

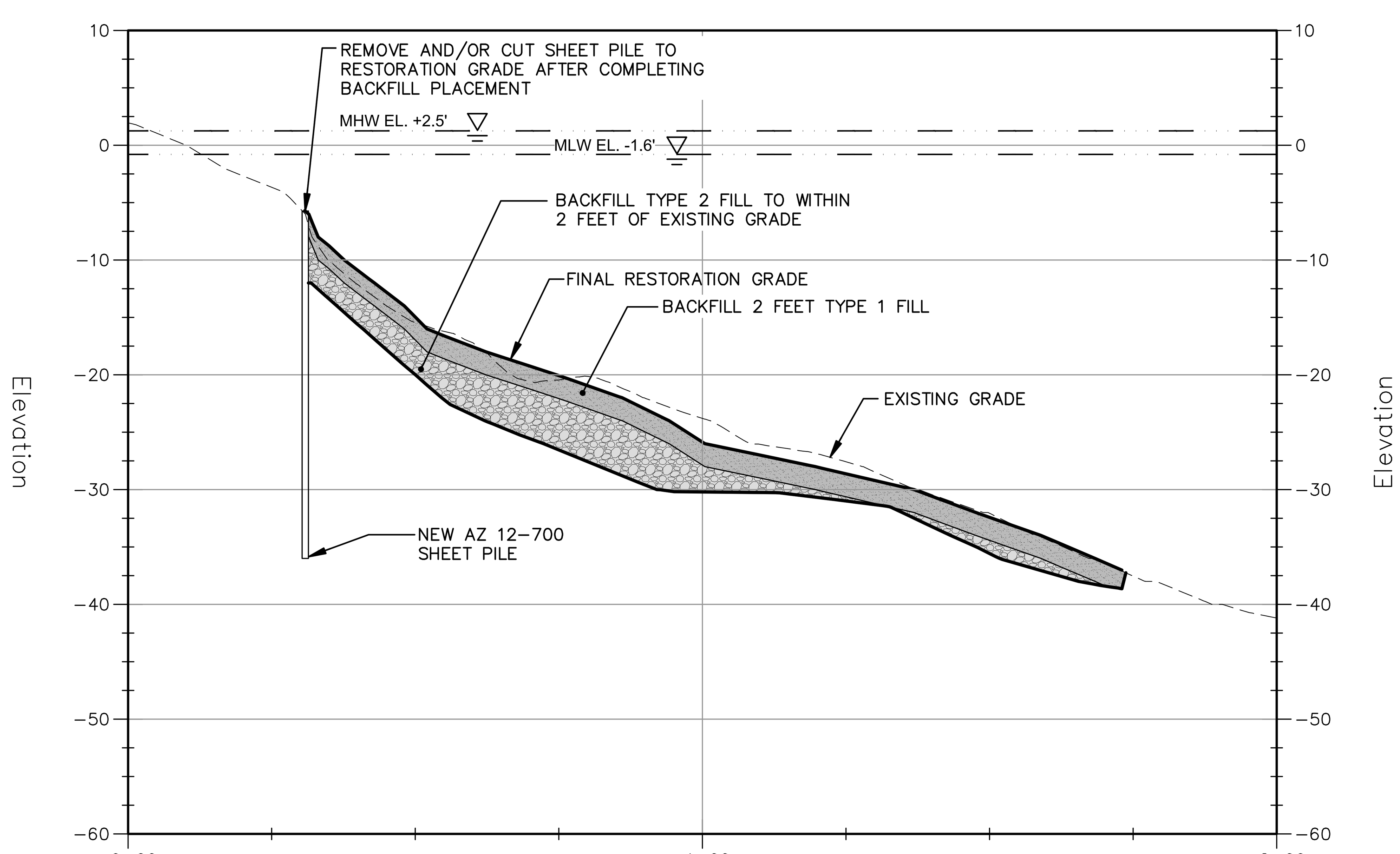
SITE RESTORATION PLAN

ARCADIS Project No. 30003986
Date JULY 2020
ARCADIS
ONE LINCOLN CENTER
110W FAYETTE STREET
SYRACUSE, NY 13202
TEL: 315.446.9120

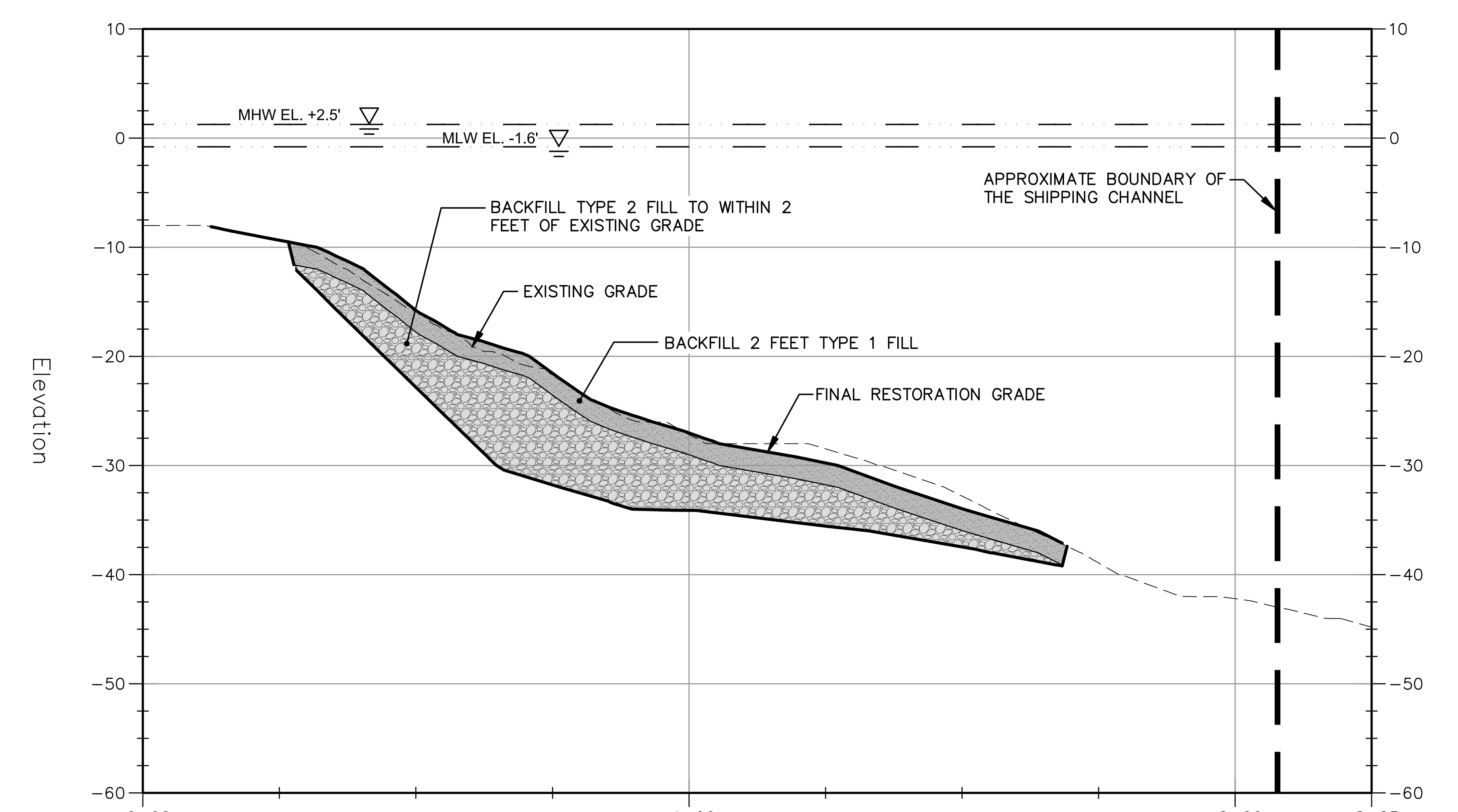
G-400



PROFILE A



PROFILE B



PROFILE C

CITY: SYRACUSE, NY DIV/GROUP: IMDV/CAD DB/LD: L.POSENAUER, K.SARTORI PM/TM: C.GUEST LYR:ON=*;OFF=*REF* LAYOUT: G-401 SAVED: 5/20/2020 7:35 AM ACADVER: 23.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 7/16/2020 7:14 AM BY: HARRIS, JESS

C:\Users\jharris\BIM 360\Arcadis\ANA - National Grid\Project Files\Hudson (Water Street) Site OU2\2020\30003986\01-DWG\36702G401.dwg

XREFS: 36702X00 36702X02-CIV IMAGES: MOG NY (from CHGE Ellings).bmp

1"=20' HORIZONTAL SCALE: 1"=20'

1"=10' VERTICAL SCALE: 1"=10'

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

THIS DRAWING IS THE PROPERTY OF THE ARCADIS ENTITY IDENTIFIED IN THE TITLE BLOCK AND MAY NOT BE REUSED OR ALTERED IN WHOLE OR IN PART WITHOUT THE EXPRESS WRITTEN PERMISSION OF SAME.

Professional Engineer's Name: MARK GRAVELDING
Professional Engineer's No.: 069985-1

State	Date Signed	Project Mgr.
NY		HMV
Designed by	Drawn by	Checked by
ESD	KLS	

ARCADIS Design & Consultancy for natural and built assets

ARCADIS OF NEW YORK, INC.

NO ALTERATIONS PERMITTED HEREON EXCEPT AS PROVIDED UNDER SECTION 7209 SUBDIVISION 2 OF THE NEW YORK STATE EDUCATION LAW

NATIONAL GRID • HUDSON (WATER STREET) SITE, HUDSON, NEW YORK
FINAL REMEDIAL DESIGN REPORT FOR OPERABLE UNIT 2

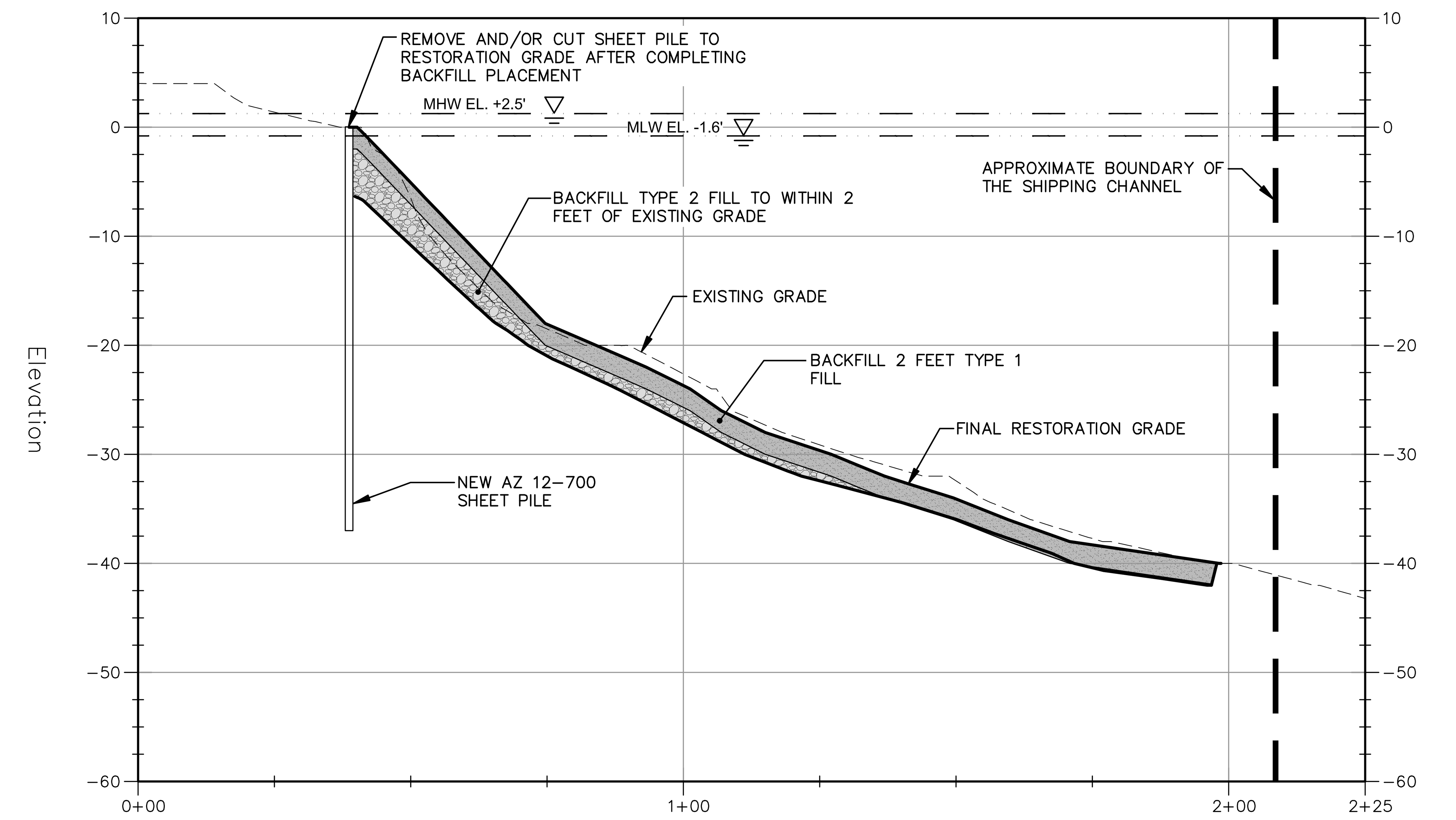
SEDIMENT RESTORATION PROFILES

ARCADIS Project No. 30003986

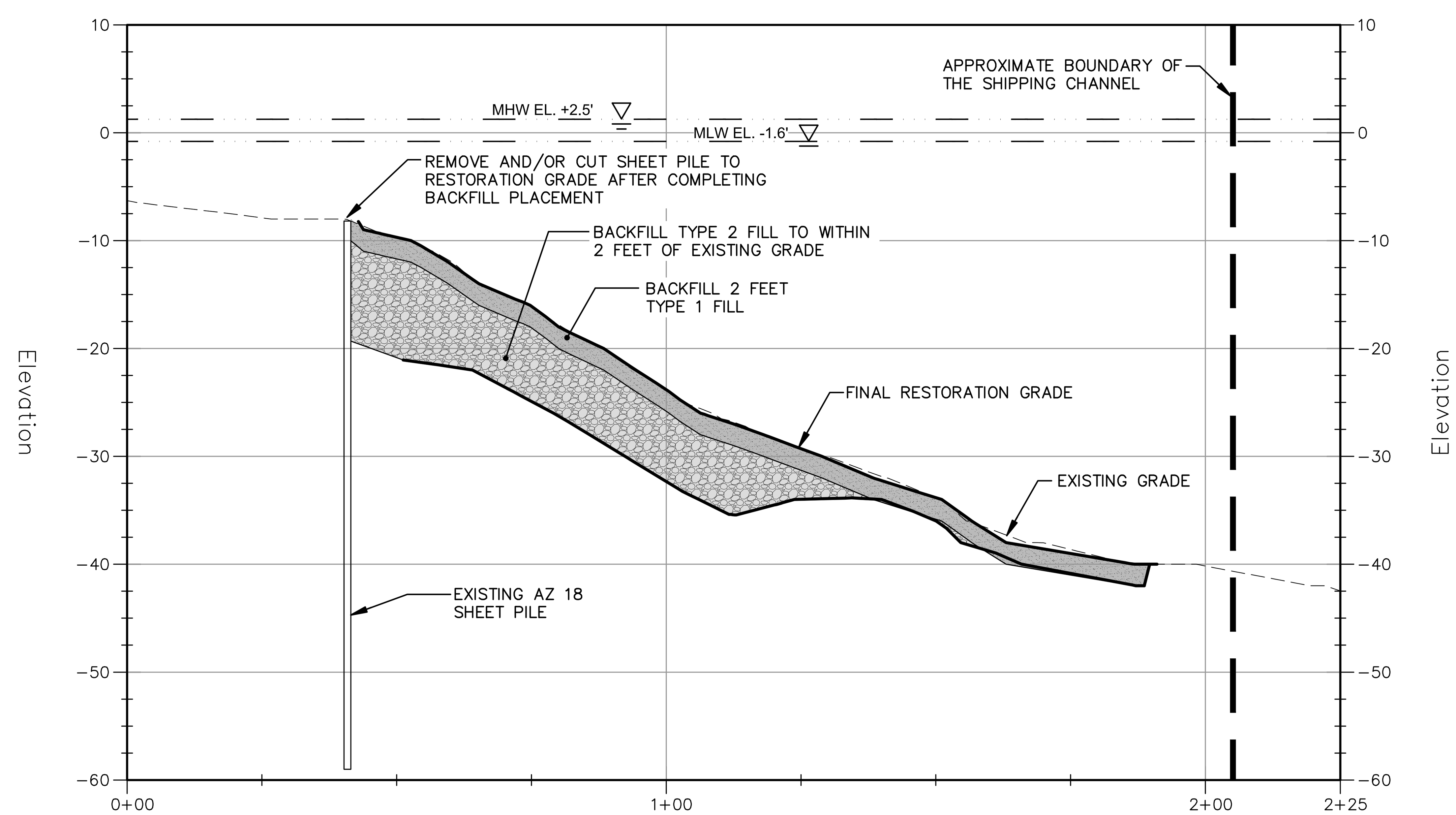
Date JULY 2020

ARCADIS ONE LINCOLN CENTER 110W FAYETTE STREET SYRACUSE, NY 13202 TEL: 315.446.9120

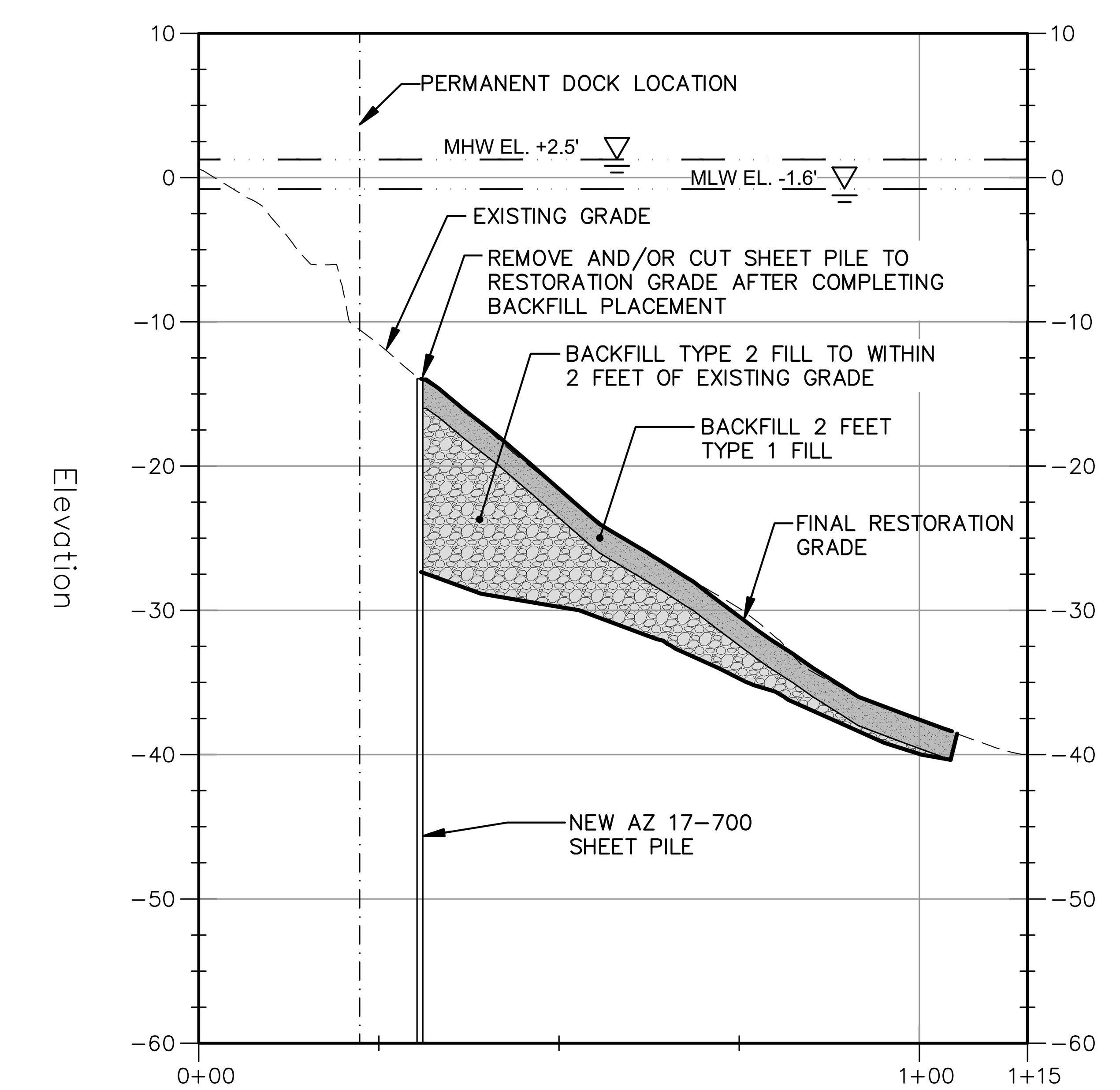
G-401



PROFILE D



PROFILE E



PROFILE F

CITY: SYRACUSE, NY DIV/GROUP: IMDV/CAD DB/LD: L.POSENAUER, K.SARTORI PM/TM: C.GUEST LYR:ON=*;OFF=*REF* C:\Users\jharris\BIM 360\Arcadis\ANA - National Grid\Project Files\Hudson (Water Street) Site OU2\2020\30003986\01-DWG\36702G401.dwg LAYOUT: G-402 SAVED: 5/20/2020 7:35 AM ACADVER: 23.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 7/16/2020 7:14 AM BY: HARRIS, JESS

XREFS: 36702X00 36702X02-CIV IMAGES: MOG NY (from CHGE Ellings).bmp

HORIZONTAL SCALE: 1"=20' (20' 0 20' 40')
VERTICAL SCALE: 1"=10' (10' 0 10' 20')

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

THIS DRAWING IS THE PROPERTY OF THE ARCADIS ENTITY IDENTIFIED IN THE TITLE BLOCK AND MAY NOT BE REUSED OR ALTERED IN WHOLE OR IN PART WITHOUT THE EXPRESS WRITTEN PERMISSION OF SAME.

Professional Engineer's Name: MARK GRAVELDING
Professional Engineer's No.: 069985-1

State	Date Signed	Project Mgr.
NY		HMV
Designed by	Drawn by	Checked by
ESD	KLS	

ARCADIS Design & Consultancy for natural and built assets

ARCADIS OF NEW YORK, INC.

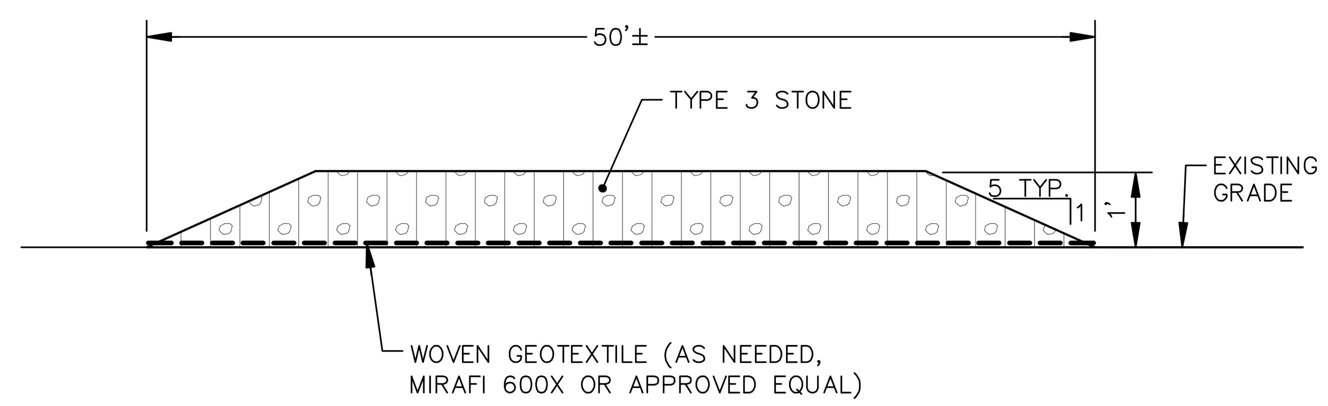
NO ALTERATIONS PERMITTED HEREON EXCEPT AS PROVIDED UNDER SECTION 7209 SUBDIVISION 2 OF THE NEW YORK STATE EDUCATION LAW

NATIONAL GRID • HUDSON (WATER STREET) SITE, HUDSON, NEW YORK
FINAL REMEDIAL DESIGN REPORT FOR OPERABLE UNIT 2

SEDIMENT RESTORATION PROFILES

ARCADIS Project No. 30003986
Date JULY 2020
ARCADIS ONE LINCOLN CENTER 110W FAYETTE STREET SYRACUSE, NY 13202 TEL: 315.446.9120

G-402



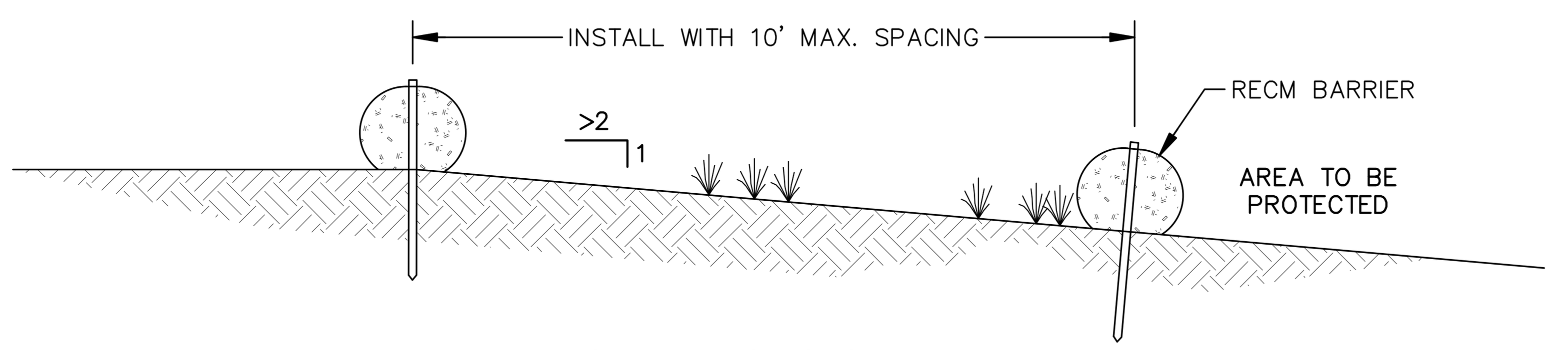
PROFILE

NOTES:

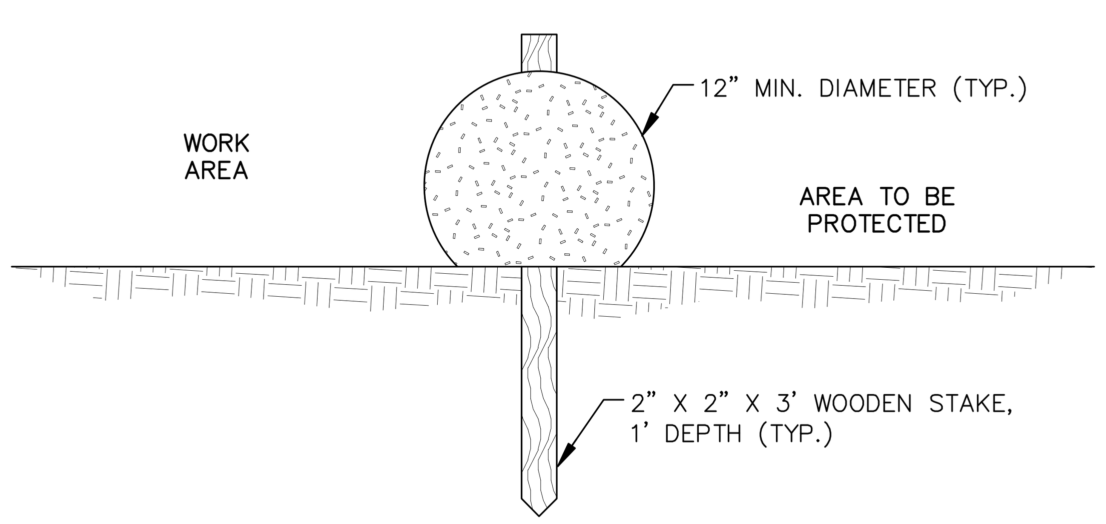
1. CONSTRUCTION ENTRANCE/EXIT PAD WILL BE APPROXIMATELY 50' LONG, 15' WIDE, AND 1' THICK.

CONSTRUCTION ENTRANCE/EXIT PAD (1)

NOT TO SCALE



INSTALLED ON SLOPE >2:1



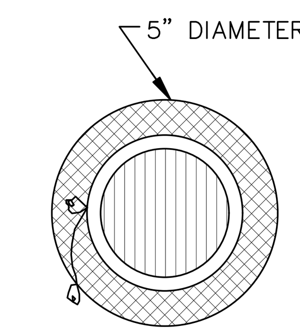
INSTALLED ON SOIL

NOTES:

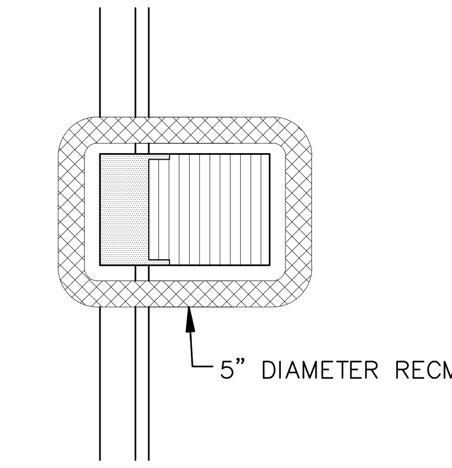
1. RECM SHALL ONLY BE USED AS REQUIRED.
2. RECM SHALL BE PLACED TIGHTLY TOGETHER, END TO END, TO FORM A CONTINUOUS BARRIER IN SELECTED AREAS.
3. THE INTEGRITY OF THE RECM SHALL BE MAINTAINED FOR THE PROJECT DURATION AND UNTIL ADEQUATE VEGETATIVE GROWTH IS ESTABLISHED.
4. STOCKPILE ANY EXCAVATED MATERIAL ONSITE FOR USE AS BACKFILL UPON COMPLETION.
5. IF SLOPE IS GREATER THAN 2:1 HORIZONTAL:VERTICAL INSTALL SECOND RECM BARRIER AT TOP OF SLOPE.

ROLLED EROSION CONTROL MATERIAL DETAILS (2)

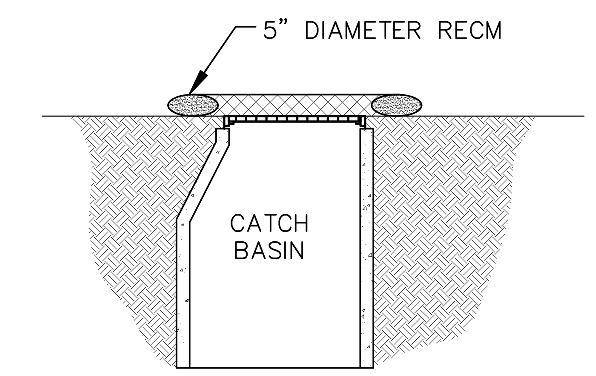
NOT TO SCALE



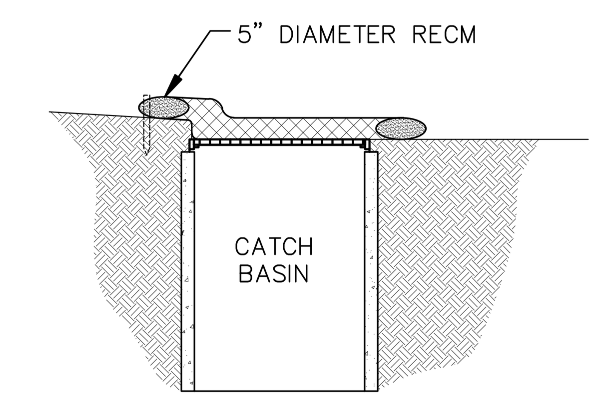
DRAIN INLET PLAN



CURBSIDE OPTION PLAN



DRAIN INLET SECTION



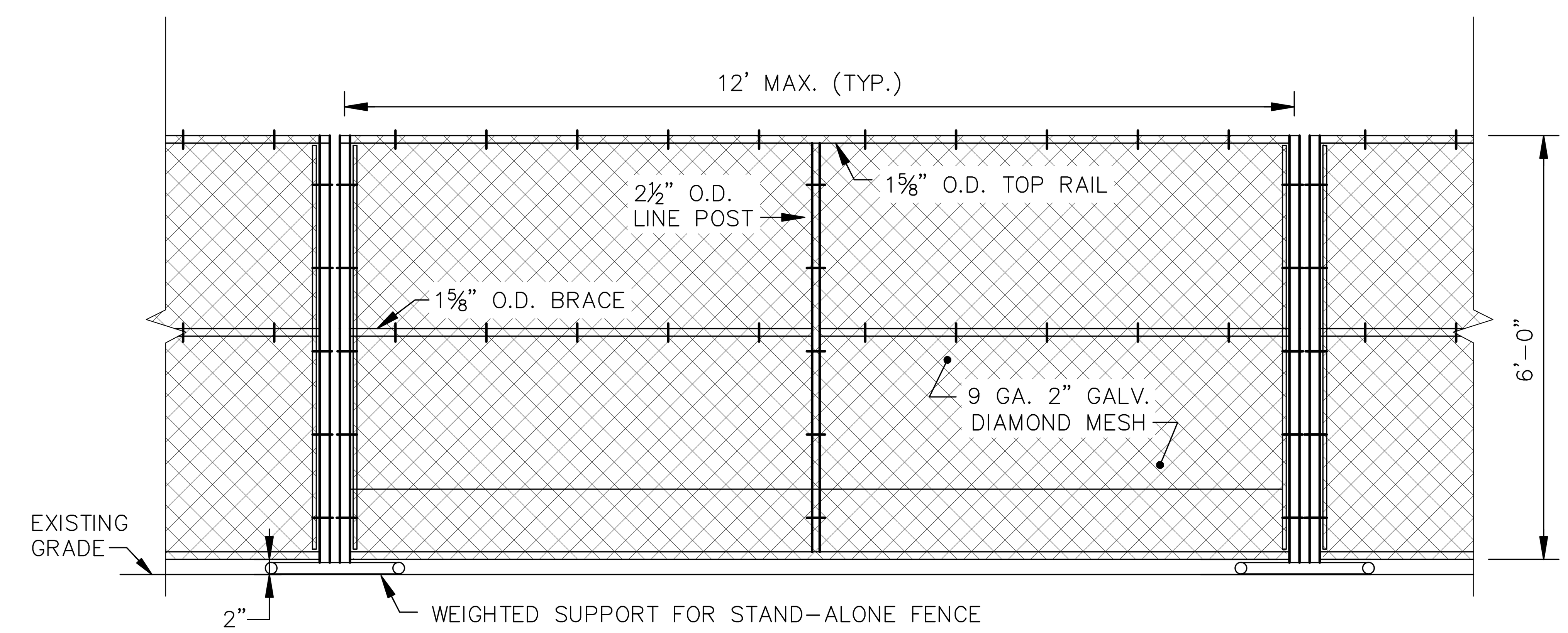
CURBSIDE SECTION

NOTES:

1. NO KNOWN STORMWATER INLETS EXIST AT SITE. IF ENCOUNTERED IN WORK AREA, APPLY PROTECTION AS SHOWN.

ROLLED EROSION CONTROL MATERIAL INLET PROTECTION (3)

NOT TO SCALE



NOTES:

1. FENCE PANELS SHALL HAVE HORIZONTAL AND VERTICAL CROSS BARS FOR ADDED SUPPORT.
2. THE CONTRACTOR SHALL PROVIDE SAND BAGS FOR ADDITIONAL SUPPORT FOR STAND-ALONE FENCE PANELS.

TEMPORARY SITE SECURITY FENCE (4)

NOT TO SCALE

XREFS: 36702X00 IMAGES: MOG NY (from CHGE Eltings).bmp

CITY: SYRACUSE, NY DIV/GROUP: IMDV/CAD DB/LD: L.POSENAUER, K.SARTORI PM/TM: C.GUEST LYR:ON=*;OFF=*REF*
C:\Users\jharris\BIM 360\Arcadis\ANA - National Grid\Project Files\Hudson (Water Street) Site OU2\2020\30003986\01-DWG\36702G500.dwg LAYOUT: G-500 SAVED: 5/20/2020 7:36 AM ACADVER: 23.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 7/16/2020 7:15 AM BY: HARRIS, JESS

NOT TO SCALE					
THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE					
No.	Date	Revisions	By	Ckd	

THIS DRAWING IS THE PROPERTY OF THE ARCADIS ENTITY IDENTIFIED IN THE TITLE BLOCK AND MAY NOT BE REUSED OR ALTERED IN WHOLE OR IN PART WITHOUT THE EXPRESS WRITTEN PERMISSION OF SAME.

Professional Engineer's Name		
MARK GRAVELDING		
Professional Engineer's No. 069985-1		
State: NY	Date Signed	Project Mgr.: HMV
Designed by: ESD	Drawn by: KLS	Checked by

STATE OF NEW YORK · MARK OWEN GRAVELDING · LICENSED PROFESSIONAL ENGINEER

ARCADIS Design & Consultancy for natural and built assets

ARCADIS OF NEW YORK, INC.

NO ALTERATIONS PERMITTED HEREON EXCEPT AS PROVIDED UNDER SECTION 7209 SUBDIVISION 2 OF THE NEW YORK STATE EDUCATION LAW

NATIONAL GRID • HUDSON (WATER STREET) SITE, HUDSON, NEW YORK
FINAL REMEDIAL DESIGN REPORT FOR OPERABLE UNIT 2

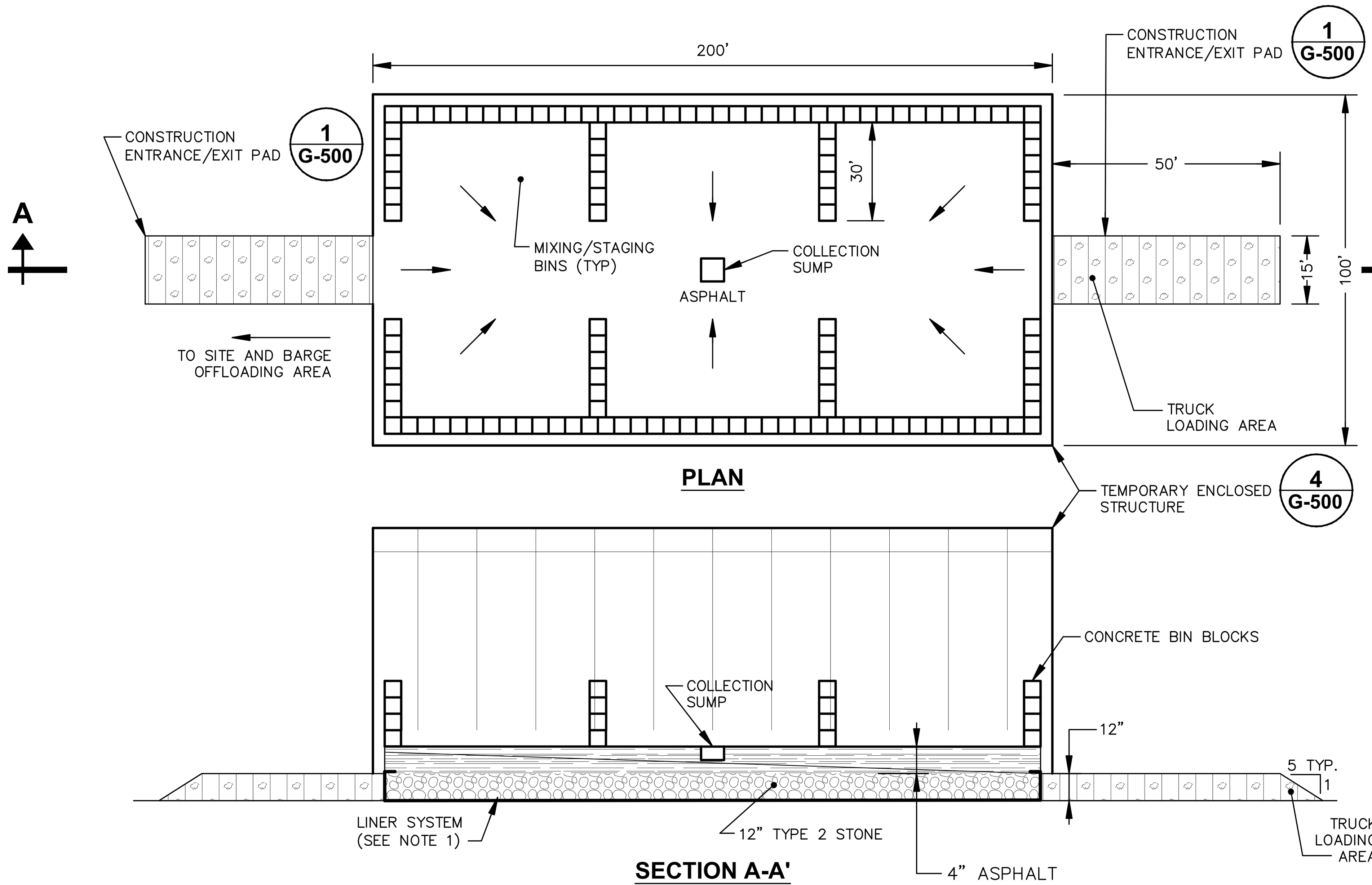
MISCELLANEOUS DETAILS

ARCADIS Project No. 30003986

Date JULY 2020

ARCADIS
ONE LINCOLN CENTER
110W FAYETTE STREET
SYRACUSE, NY 13202
TEL: 315.446.9120

G-500

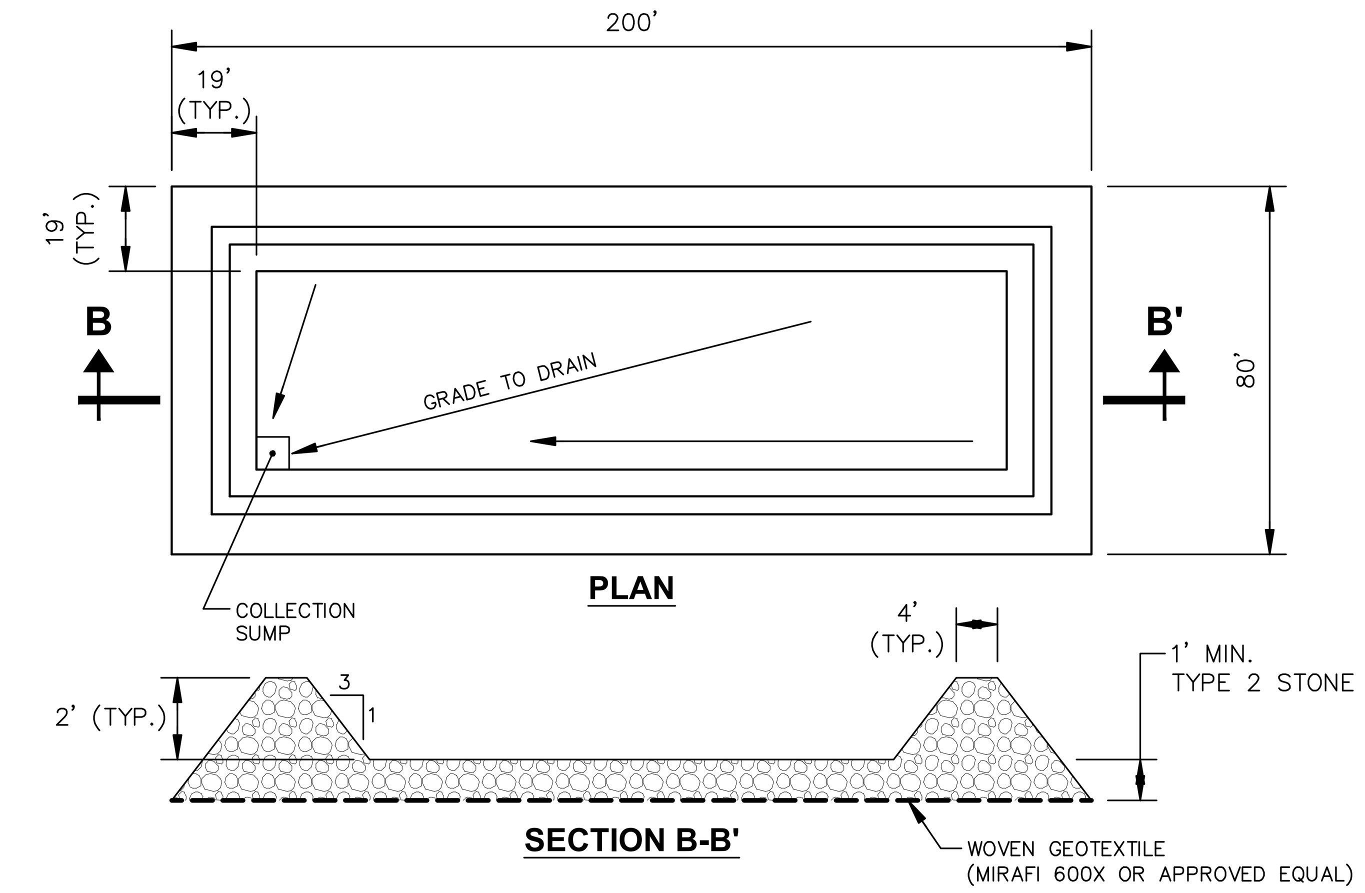


NOTES:

1. LINER SYSTEM TO CONSIST OF A GEOTEXTILE FABRIC OVER A 40 MIL HDPE LINER AND GEOTEXTILE FABRIC OVER THE GROUND SURFACE.
2. SLOPE THE SEDIMENT DEWATERING PAD TO A SUMP LOCATED IN THE CENTER OF THE PAD.
3. USE CONCRETE BIN BLOCKS TO SEPARATE SEDIMENT STOCKPILES.
4. CONSTRUCT WITHIN THE TEMPORARY ENCLOSED STRUCTURE AS SHOWN IN DETAIL 3 ON DRAWING G-501.
5. REFER TO TECHNICAL SPECIFICATION SECTION 321216 FOR ASPHALT MATERIAL SPECIFICATIONS.

SEDIMENT DEWATERING PAD (1)

NOT TO SCALE

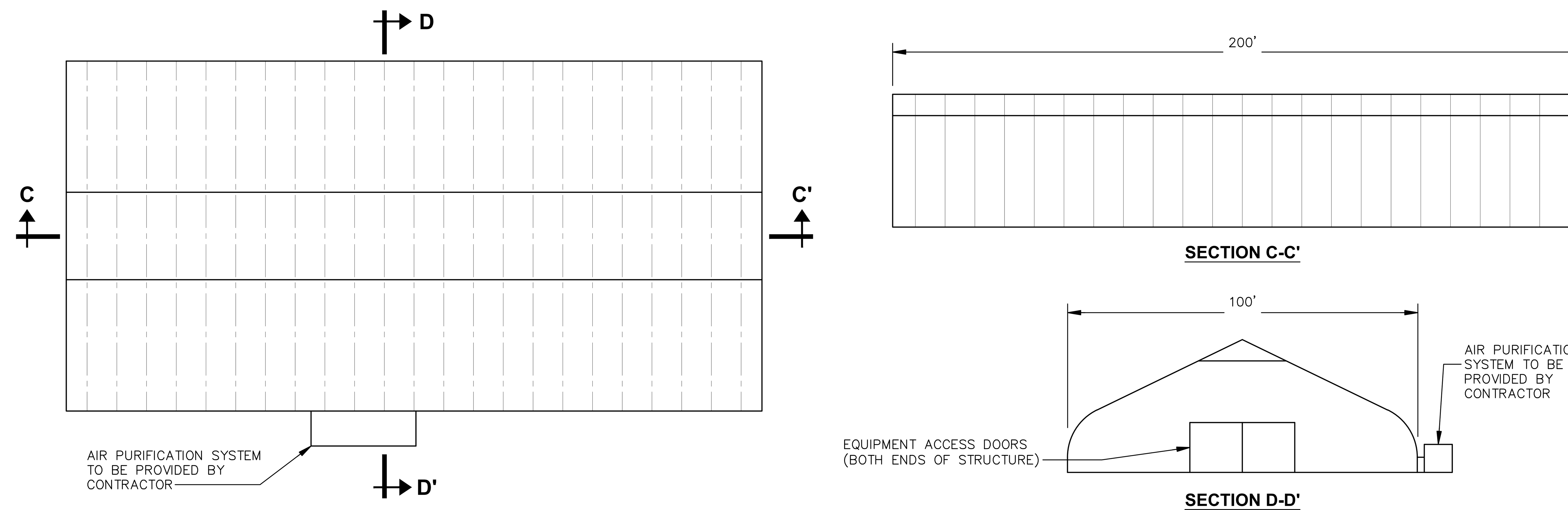


NOTE:

1. DIMENSIONS OF IMPORT STAGING AREA SHALL BE A MINIMUM OF 200' X 80'

IMPORTED MATERIALS STAGING AREA (2)

NOT TO SCALE



NOTE:

1. BUILDING TO BE DESIGNED BY CONTRACTOR, INCLUDING FOUNDATIONS, ELECTRICAL SUPPLY, DOORS, ETC. REFER TO TECHNICAL SPECIFICATIONS SECTION 015000.

TEMPORARY ENCLOSED STRUCTURE DETAIL (3)

NOT TO SCALE

NOT TO SCALE

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name		
MARK GRAVELDING		
Professional Engineer's No. 069985-1		
State NY	Date Signed	Project Mgr. HMV
Designed by ESD	Drawn by KLS	Checked by

ARCADIS Design & Consultancy for natural and built assets

ARCADIS OF NEW YORK, INC.

NATIONAL GRID • HUDSON (WATER STREET) SITE, HUDSON, NEW YORK
FINAL REMEDIAL DESIGN REPORT FOR OPERABLE UNIT 2

MISCELLANEOUS DETAILS

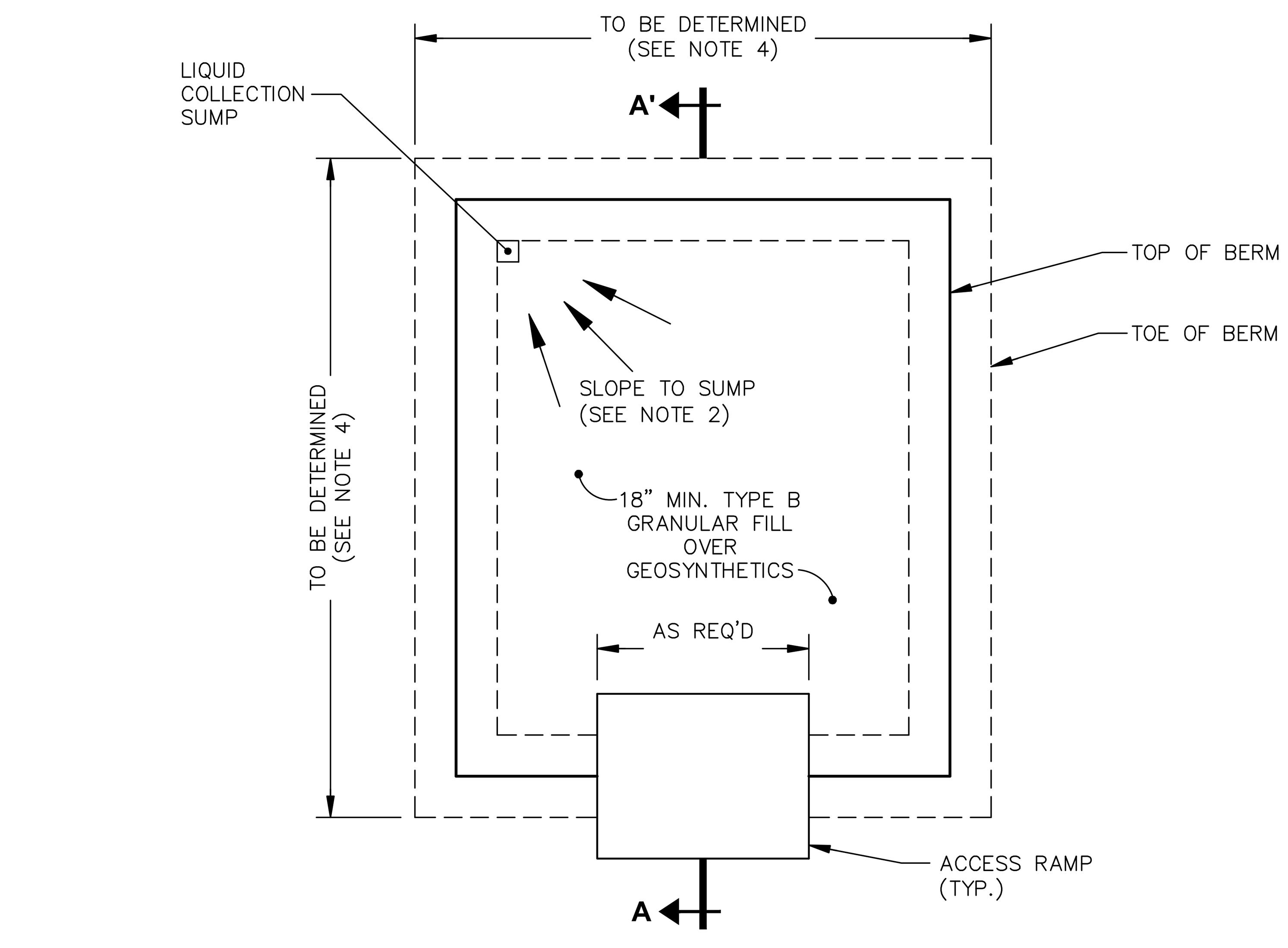
GENERAL

ARCADIS Project No. 30003986

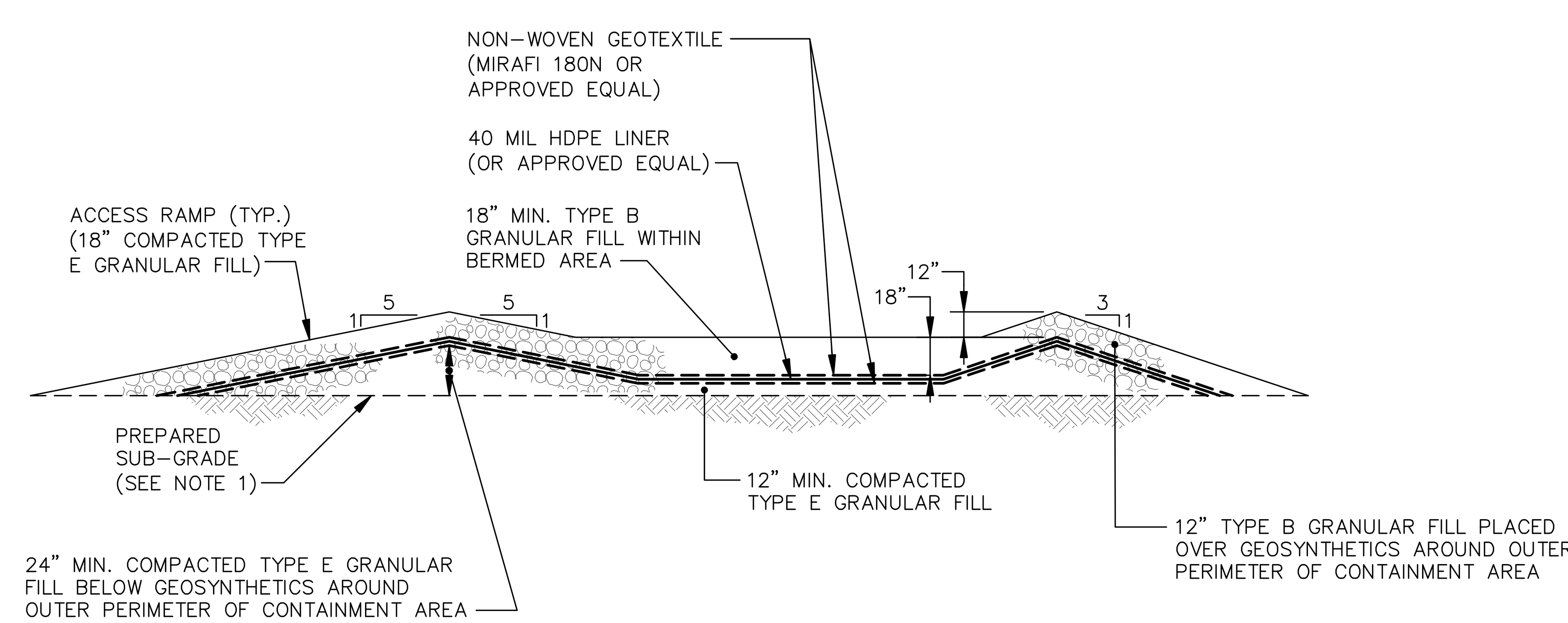
Date JULY 2020

ARCADIS
ONE LINCOLN CENTER
110W FAYETTE STREET
SYRACUSE, NY 13202
TEL: 315.446.9120

G-501



PLAN



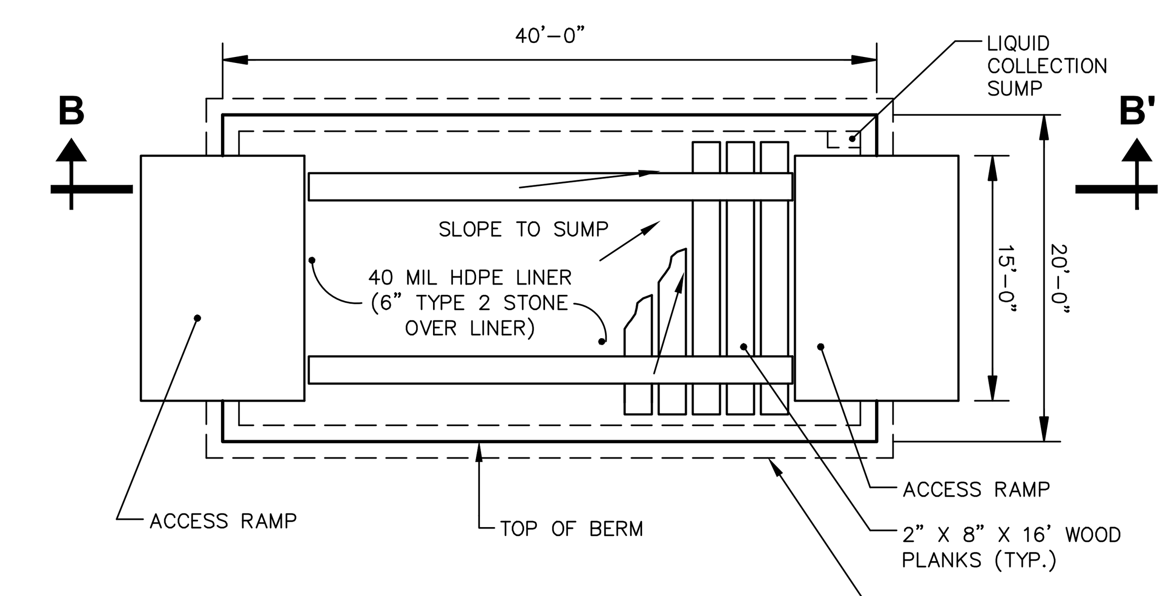
SECTION A-A'

NOTES:

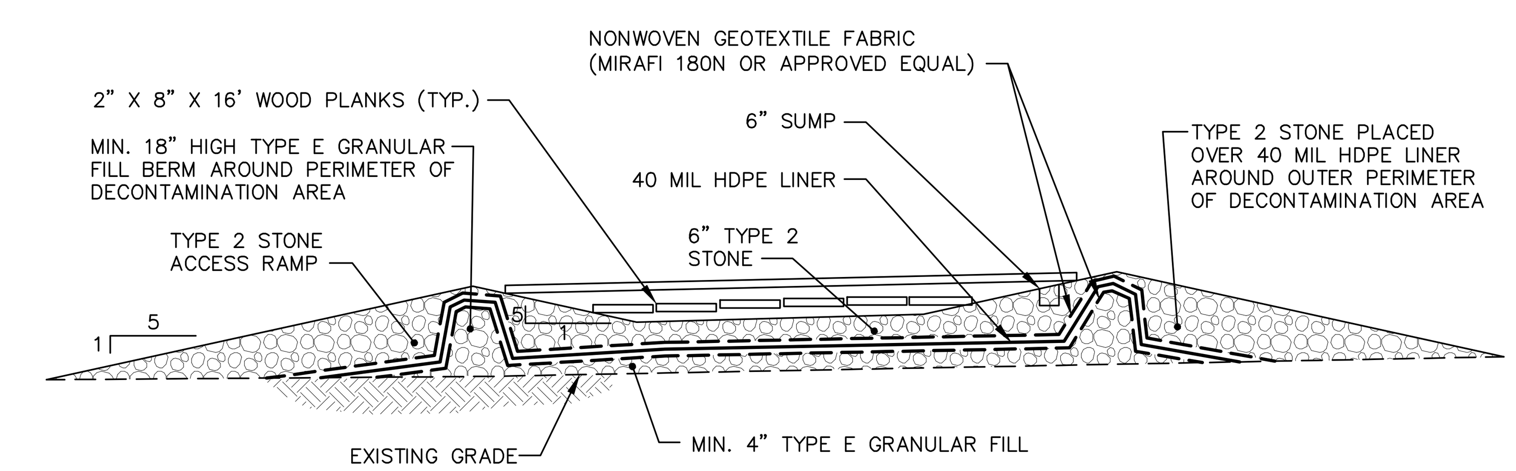
1. THE SUBGRADE SURFACE SHALL BE UNIFORM AND FREE OF DELETERIOUS MATERIALS (E.G., SHARP STONES, WOODY DEBRIS) THAT COULD DAMAGE THE HDPE LINER.
2. CONTAINMENT AREAS (INCLUDING HDPE LINER) SHALL BE SLOPED TOWARD A COLLECTION SUMP TO FACILITATE THE REMOVAL OF LIQUIDS. LIQUIDS SHALL BE PUMPED FROM THE COLLECTION SUMP TO THE WATER TREATMENT SYSTEM.
3. COMPACTION OF TYPE E GRANULAR FILL MATERIAL SHALL BE SUFFICIENT DENSITY TO PROVIDE A FIRM AND UNIFORM SURFACE. PLACEMENT AND COMPACTION OF FILL MATERIAL ABOVE GEOSYNTHETICS SHALL BE PERFORMED IN A MANNER AND USING APPROPRIATE EQUIPMENT THAT AVOIDS DAMAGING THE GEOSYNTHETICS.
4. SIZE CONTAINMENT AREA TO ACCOMMODATE THE TEMPORARY WATER TREATMENT SYSTEM.
5. UPON COMPLETION OF CONSTRUCTION ACTIVITIES, CONTAINMENT AREA (INCLUDING GEOSYNTHETICS AND FILL MATERIALS) SHALL BE REMOVED BY THE CONTRACTOR AND TRANSPORTED OFFSITE FOR DISPOSAL.
6. PROVIDE ENCLOSURE FOR WATER TREATMENT SYSTEM TO PROTECT FROM COLD WEATHER CONDITIONS.

CONTAINMENT AREA 1

NOT TO SCALE



PLAN



SECTION B-B'

NOTES:

1. THE SUBGRADE SURFACE SHALL BE UNIFORM AND FREE OF DELETERIOUS MATERIALS (E.G., SHARP STONES, WOODY DEBRIS) THAT COULD DAMAGE THE HDPE LINER.
2. CONTAINMENT AREAS (INCLUDING HDPE LINER) SHALL BE SLOPED TOWARD A COLLECTION SUMP TO FACILITATE THE REMOVAL OF LIQUIDS. LIQUIDS SHALL BE PUMPED FROM THE COLLECTION SUMP TO THE WATER TREATMENT SYSTEM.
3. COMPACTION OF TYPE E GRANULAR FILL MATERIAL SHALL BE SUFFICIENT DENSITY TO PROVIDE A FIRM AND UNIFORM SURFACE. PLACEMENT AND COMPACTION OF FILL MATERIAL ABOVE GEOSYNTHETICS SHALL BE PERFORMED IN A MANNER AND USING APPROPRIATE EQUIPMENT THAT AVOIDS DAMAGING THE GEOSYNTHETICS.
4. DECONTAMINATION AREA WILL HAVE A GENERAL SLOPE TOWARD A COLLECTION SUMP TO FACILITATE THE COLLECTION OF WASH FLUIDS.
5. UPON COMPLETION OF CONSTRUCTION ACTIVITIES, CONTAINMENT AREA (INCLUDING GEOTEXTILE, HDPE LINER, AND WOOD PLANKS) SHALL BE REMOVED BY THE CONTRACTOR AND TRANSPORTED OFF-SITE FOR DISPOSAL.
6. WOOD PLANKS WILL BE PLACED ABOVE THE GRAVEL DRAINAGE LAYER THROUGHOUT THE WORKING SURFACE OF THE DECONTAMINATION AREA TO PROVIDE A STABLE SURFACE FOR VEHICLES AND EQUIPMENT TO BE DECONTAMINATED.
7. THE CONTRACTOR WILL TAKE PRECAUTIONS TO CONTAIN SPRAYED FLUIDS WITHIN THE DECONTAMINATION AREA.
8. PREFABRICATED STEEL PADS MAY BE USED IN LIEU OF CONSTRUCTING STONE PADS.

DECONTAMINATION AREA 2

NOT TO SCALE

XREFS: 36702X00 IMAGES: MOG NY (from CHGE Ellings).bmp

CITY: SYRACUSE, NY DIV/GROUP: IMDV/CAD DB/LD: L.POSENAUER, K.SARTORI PM/TM: C.GUEST LYR:ON=*;OFF=*REF* C:\Users\jharris\BIM 360\Arcadis\ANA - National Grid\Project Files\Hudson (Water Street) Site OU2\2020\30003986\01-DWG\36702G501_2.dwg LAYOUT: G-502 SAVED: 5/20/2020 7:37 AM ACADVER: 23.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 7/16/2020 7:16 AM BY: HARRIS, JESS

NOT TO SCALE

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

THIS DRAWING IS THE PROPERTY OF THE ARCADIS ENTITY IDENTIFIED IN THE TITLE BLOCK AND MAY NOT BE REUSED OR ALTERED IN WHOLE OR IN PART WITHOUT THE EXPRESS WRITTEN PERMISSION OF SAME.

Professional Engineer's Name: MARK GRAVELDING
Professional Engineer's No.: 069985-1
State: NY | Date Signed: | Project Mgr.: HMV
Designed by: ESD | Drawn by: KLS | Checked by:

STATE OF NEW YORK · MARK OWEN GRAVELDING · 069985 · LICENSED PROFESSIONAL ENGINEER

ARCADIS Design & Consultancy for natural and built assets

ARCADIS OF NEW YORK, INC.

NO ALTERATIONS PERMITTED HEREON EXCEPT AS PROVIDED UNDER SECTION 7209 SUBDIVISION 2 OF THE NEW YORK STATE EDUCATION LAW

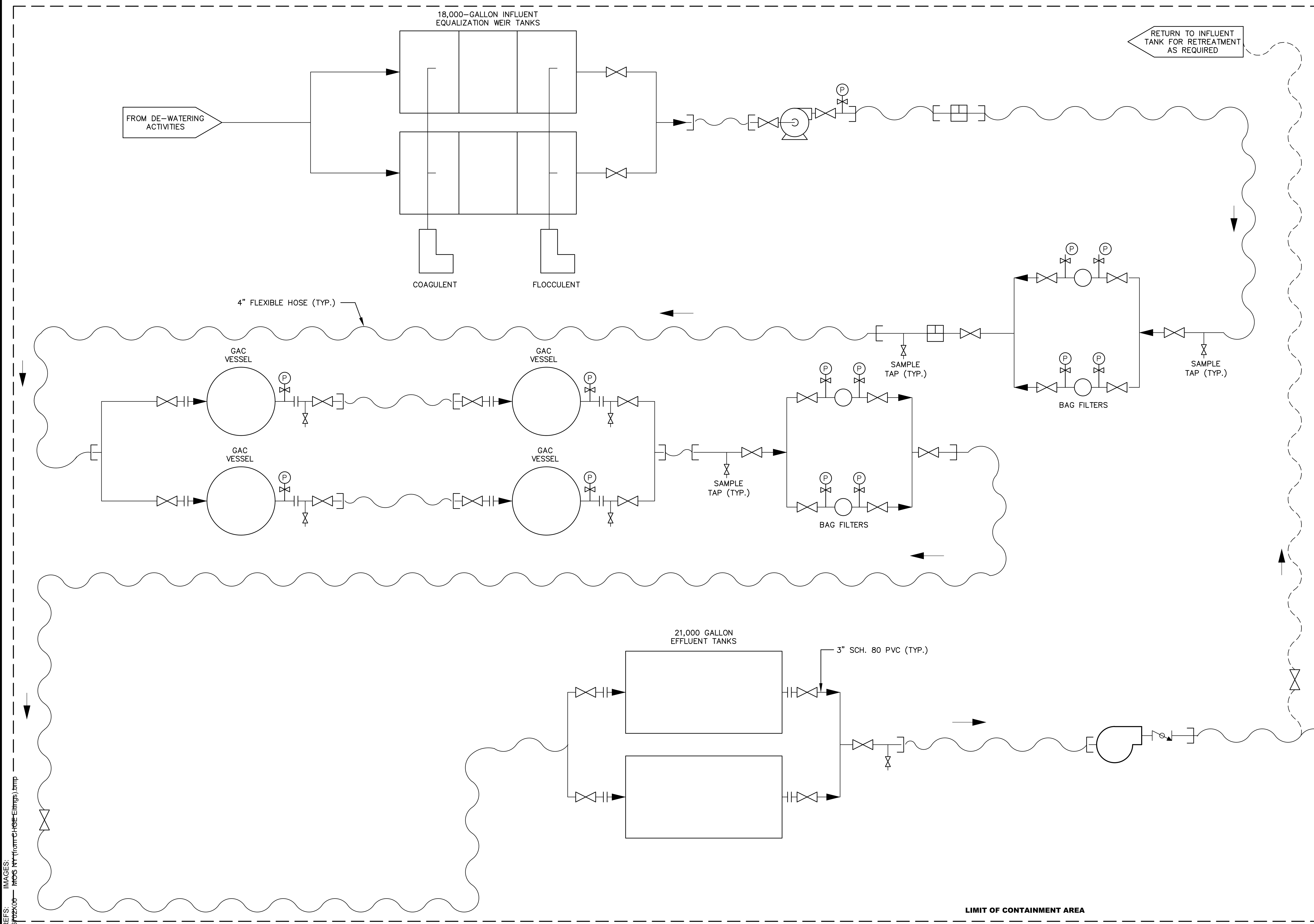
NATIONAL GRID • HUDSON (WATER STREET) SITE, HUDSON, NEW YORK
FINAL REMEDIAL DESIGN REPORT FOR OPERABLE UNIT 2

MISCELLANEOUS DETAILS

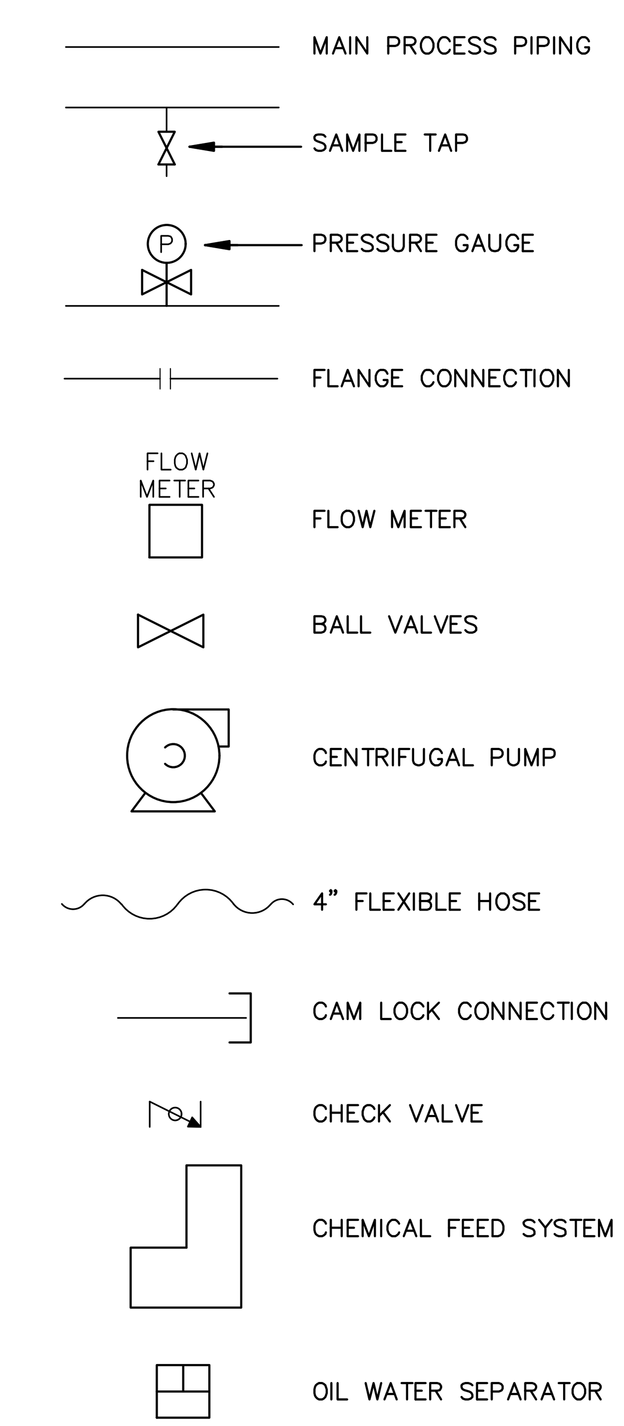
GENERAL

ARCADIS Project No. 30003986
Date JULY 2020
ARCADIS ONE LINCOLN CENTER 110W FAYETTE STREET SYRACUSE, NY 13202 TEL: 315.446.9120

G-502



LEGEND:



NOTES:

1. TYPICAL PIPING AND INSTRUMENTATION DIAGRAM OF TEMPORARY WATER TREATMENT SYSTEM SHOWN. CONTRACTOR TO PROVIDE A TEMPORARY WATER TREATMENT SYSTEM THAT MEETS SPECIFICATION 444000 – TEMPORARY WATER TREATMENT AND MANAGEMENT.
2. CONTRACTOR SHALL INCLUDE CONTINGENCY PROVISIONS TO WINTERIZE THE WATER TREATMENT SYSTEM IF NECESSARY.

NOT TO SCALE

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name: MARK GRAVELDING
Professional Engineer's No.: 069985-1
State: NY | Date Signed: | Project Mgr.: HMV
Designed by: ESD | Drawn by: KLS | Checked by:

ARCADIS Design & Consultancy for natural and built assets
ARCADIS OF NEW YORK, INC.

NATIONAL GRID • HUDSON (WATER STREET) SITE, HUDSON, NEW YORK
FINAL REMEDIAL DESIGN REPORT FOR OPERABLE UNIT 2

WATER TREATMENT SYSTEM TYPICAL PIPING AND INSTRUMENTATION DIAGRAM

ARCADIS Project No. 30003986
Date JULY 2020
ARCADIS
ONE LINCOLN CENTER
110W FAYETTE STREET
SYRACUSE, NY 13202
TEL: 315.446.9120

G-503

APPENDIX B

Technical Specifications

Appendix B
List of Technical Specifications
Remedial Design Report for Operable Unit 2
National Grid - Hudson (Water Street) Site, Hudson, New York

TABLE OF CONTENTS

SECTION 011100

SUMMARY OF WORK

PART 1 - GENERAL

1.01 INTRODUCTION

A. The Hudson (Water Street) Site (the Site) is located in the City of Hudson, Columbia County, New York. The Site is located in and along the east bank of the Hudson River. It includes property where the former manufactured gas plant (MGP) was located on Water Street and sediments within a portion of the Hudson River. To facilitate the development of a remedy for the Site, it was divided into two Operable Units (OUs). This Section describes the Summary of Work for excavating sediments as part of the remedial action (RA) activities for the OU-2 portion of the Site. This RA generally includes the removal of up to approximately 9,000 cubic yards (cy) of sediment from within the Hudson River.

B. The remedial construction (the Project) will be performed by National Grid (Owner); the Remedial Design (RD) has been prepared by Arcadis (Engineer). A summary of the Contractor's overall responsibilities is provided herein.

1.02 REGULATORY BASIS AND OBJECTIVES

A. The New York State Department of Environmental Conservation's (NYSDEC's) March 28, 2012 OU-2 Record of Decision (ROD) outlines the remedy selected for the Site, which was later described in the April 14, 2014 Remedial Design Work Plan. Based on the requirements specified in those documents, as well as a June 24, 2014 letter from NYSDEC approving the April 2014 Remedial Design Work Plan, the November 2016 70% Draft Remedial Design Report (Draft RD Report) has been prepared to address removal of sediments within OU-2. The contents of the Draft RD Report satisfy several components identified in the ROD, while certain submittals to be prepared by the Contractor shall address remaining components not otherwise presented in the Draft RD Report. Certain Contractor submittals will be provided to the NYSDEC, as detail in Article 2.01 of this Section.

B. The following Remedial Action Objectives (RAOs) were identified in the ROD:
   1. Prevent direct contact with contaminated sediments.
   2. Prevent surface water contamination which may result in fish advisories.
   3. Prevent releases of contaminant(s) from sediments that would result in surface water levels in excess of ambient water quality criteria.
   4. Prevent impacts to biota from ingestion/direct contact with sediments causing toxicity or impacts from bioaccumulation through the marine or aquatic food chain.
   5. Restore sediments to pre-release/background conditions to the extent feasible.

1.03 SUBMITTALS

A. Pre-construction Submittals:
   1. Operations Plan: Refer to Article 2.02 of this Section for requirements.
   2. Health and Safety Plan: Refer to Article 2.03 of this Section for requirements.
   3. Contingency Plan: Refer to Article 2.04 of this Section for requirements.
   4. Schedule: The Contractor must prepare and submit a proposed Construction Schedule as part of his/her Operations Plan for review. The Construction Schedule shall include all

elements of the Project, be neatly prepared and labeled as a bar graph indicating all anticipated start and completion dates and adhere to the requirements and restrictions noted in the Specifications and Drawings.

a. Submit a horizontal bar chart with separate lines for each section of work.
b. At a minimum, the following major work items shall be included, with appropriate subtasks included as necessary:
    1) Technical submittals.
    2) Mobilization.
    3) Site preparation.
    4) Utility location and protection.
    5) Installation and maintenance of erosion and sedimentation control measures.
    6) Debris and riprap removal.
    7) Installation of excavation support (sheet pile).
    8) Sediment removal, material handling, and offsite disposal of waste materials.
    9) Water handling, treatment, and discharge.
    10) Backfilling.
    11) Site restoration.
    12) Demobilization/recordkeeping.
c. Show complete sequence of construction by activity (including work by subcontractors, if any). Indicate the early and late start, early and late finish, float dates, and duration. The Construction Schedule provided by the Contractor shall show seasonal considerations and planned shutdown durations (if any).
d. At a minimum, the Contractor shall update and re-submit its Construction Schedule to the Construction Manager and Engineer on a weekly basis during the Project. As updated, the schedule shall identify the projected and actual durations for each work activity.

1.04 SCOPE OF WORK

A. The Contractor shall perform all activities and furnish all labor, materials, equipment, subcontractor services, and incidentals necessary to implement the RD in accordance with the Contract between the Owner and the Contractor. In general, the Project involves preparing sediment handling and project support areas, removing existing obstructions that interfere with the completion of the Work, installing excavation support, excavating sediments to depths ranging from approximately 2 to 15 feet below sediment surface (bss), offsite transportation for low-temperature thermal desorption (LTTD) treatment (as necessary) and disposal of removed sediments, backfilling of the excavated area, and restoring the areas impacted by the Project.

   The work shall also include all activities required of the Contractor to plan, organize, monitor, and coordinate the logical and timely sequence of project activities, in accordance with all applicable regulatory requirements. This includes (but is not limited to) activities such as preparing technical and operational submittals, obtaining construction-related permits, attending project meetings, incurring incidental expenses, and performing administrative activities.

B. The Project scope includes, but is not limited to, the following:
   1. General
      a. General activities include mobilizing and setting up field offices for the Contractor, Construction Manager, and Engineer, staff, and construction/sanitary facilities; mobilizing and demobilizing all equipment, materials, and labor; performing site monitoring and protection; implementing health and safety equipment and practices;

implementing quality control and quality assurance activities; providing site security during the Project; and implementing a community air monitoring program.

b. Preparing technical/Project submittals and performing ancillary support services and activities throughout the performance of site activities (e.g., photographic and survey documentation).

2. Site Preparation
   a. Site preparation generally includes: obtaining all necessary construction-related permits; performing pre-construction survey(s), including bathymetric survey; providing erosion and environmental controls; clearing and grubbing; providing traffic controls (as necessary); setting up work zones (including staging, material handling, and decontamination areas); installation of construction entrance/exit pads; removing existing site structures (as necessary) that may impede performance of construction activities; fence and barrier installation/relocation activities; protection/deactivation of active utilities (as necessary); and installing environmental controls. Refer to Design Drawing G-102 for additional site preparation requirements.
3. Debris and Riprap Removal
   a. Excavation support (sheet pile) installation shall require the removal of debris and riprap along the sheet pile alignment. Debris and riprap removal generally includes: removing existing riprap and debris along the shoreline; temporarily stockpiling of riprap in a designated staging area; and characterizing/cleaning staged riprap for possible onsite re-use during site restoration activities.
   b. Sediment removal shall require the removal of debris and riprap (if present) from the dredging area. Debris and riprap removal shall include removing existing debris and riprap (if present); temporarily stockpiling of riprap in a designated staging area; and characterizing/cleaning staged riprap for possible onsite re-use during site restoration activities.
4. Excavation Support Installation
   a. Excavation support installation generally includes installing sheet piling, from within a physical barrier control system, in the locations shown on Design Drawing G-300 and as detailed in Specification Section 315000 – Excavation Support and Protection.
5. Sediment Removal and Material Handling and Disposition
   a. Sediment removal generally includes: excavating sediment, from within a physical barrier control system , to the limits shown on the Design Drawings; onsite handling and temporary staging within a temporary enclosure structure; processing excavated sediment; water handling and treatment; additional waste characterization of processed sediment, if required by the disposal facility; and offsite disposal.
6. Site Restoration and Demobilization Activities
   a. Site restoration and demobilization activities generally include: importing and placing select fill materials to restore the river bed and banks to the pre-dredge bathymetry; cutting and/or removal of sheet piling; importing, placing, and compacting select fill materials to disturbed upland areas to the pre-construction topography; restoring shorelines affected due to debris and riprap removal or other construction-related activities; onsite reuse of riprap (as appropriate); restoring areas disturbed, damaged, or destroyed as the result of RA activities; properly disposing excess project materials, supplies, and work-derived waste materials; disconnecting any temporary utilities; removing erosion and sedimentation control measures; decontamination of equipment and other project materials associated with RA activities; preparation and submittal of final documentation (e.g., record drawings, final field reports, photographs); and demobilizing equipment and personnel from the Site.

C. The technical work and Contractor requirements are described in several components that collectively represent the Final RD. These components include the following:

1. Final RD Report text.
2. Design Drawings.
3. Technical Specifications.
4. Work Plans:
    a. Construction Quality Assurance Plan (CQAP).
    b. Community Air Monitoring Plan (CAMP).
    c. Storm Water Pollution Prevention Plan (SWPPP).
    d. Remedial Action Contingency Plan (RACP).
    e. Restoration Plan.
5. Remedial Design Calculations.

The above components should be thoroughly reviewed by the Contractor. Nothing presented in one of the above documents should relieve the Contractor's obligations to satisfy the components specified in the other documents. In addition, in the event that there are discrepancies in the information contained in the above-listed documents, the Contractor shall identify such discrepancies in writing for Engineer review.

1.05 WORK SEQUENCE/WORK HOURS

A. The Owner anticipates that work activities can be conducted between the hours of 7:00 a.m. and 7:00 p.m. (on non-holiday) Monday through Friday except in cases of emergency or unless prior approval has been obtained from the Owner and the City of Hudson. See Section 011400 – Work Restrictions for more information on allowable workdays/hours.

B. Project implementation shall be in accordance with the schedule submitted by the Contractor and approved by Owner with input from the Engineer.

C. In-water work may only be conducted between the dates of September 1 and November 30.

1.06 CONTRACTOR'S USE OF PREMISES

A. Contractor shall limit its activities to the Project Work Limits shown on the Design Drawings. All conflicts over use of the premises shall be resolved without additional cost to the Owner. Costs related to the Contractor's use of the property (e.g., telephone, electric, etc.) shall be borne by the Contractor.

B. Contractor shall assume full responsibility for security of all of its and its subcontractors' materials and equipment stored within the Project Work Limits.

C. At all times, Contractor shall maintain the Work Areas in a neat, orderly, and safe manner. In addition, safe and clean access shall be available to other areas of the Site that are not specifically part of the Project.

D. See Section 011400 – Work Restrictions for more information on the use of Premises.

1.07 CARE AND PROTECTION OF WORK

A. The Contractor shall be responsible for the care and protection of materials, supplies and equipment delivered at the Site intended to be used for the Project (whether provided by the Contractor or the Owner); and all injury or damage to the same from whatever cause, shall be the responsibility of the Contractor. The Contractor shall provide suitable means of protection for and shall protect all materials intended to be used. The Contractor shall take all necessary precautions to prevent injury or damage by flood, fire, freezing, or from other inclemency of weather. The Contractor shall provide 24-hour continuous site security measures for the duration of the Project. This includes all non-working hours (e.g., overnight, weekends, holidays, etc.).

1.08 MONITORING OF WORK

A. Access to Work

All parties contracted to do work for the Owner at the Site shall, for all purposes that may be required by their contracts, and representatives of State and Federal regulatory agencies shall, for any purpose, have access to the Work Area and the premises used by the Contractor, and the Contractor shall provide safe and proper facilities.

1.09 MATERIALS AND EQUIPMENT

A. Quality and Workmanship

1. All materials furnished or incorporated in the Project shall be of the best quality, and especially adapted for the service required; whenever the characteristics of any material are not particularly specified, such material shall be utilized as is customary in first class work of a nature for which the material is employed.
2. All materials and workmanship shall be subject to inspection, examination, and tests by the Owner and Engineer at any and all times during manufacture or construction and at any and all places where such manufacture or construction are carried on.
3. The Contractor’s selection and use of organizations for the inspection and tests of supplies, materials, and equipment shall be subject to the approval of the Owner with input from the Engineer. Satisfactory documentary evidence that the material has passed the required inspection and tests shall be furnished by the Contractor prior to the incorporation of the material in the Project.
4. The costs for all laboratory and field testing shall be borne by the Contractor unless specifically stated otherwise in the RD.

B. Equivalent Products and Changes to RD

1. The words "similar and equal to," "or equal," "equivalent," and such other words of similar content and meaning (hereinafter, “or equal”) shall, for the purposes of this work, be deemed to mean similar and equivalent to one of the named products or remedial design elements.
2. Whenever any product/design element is specified in the RD by a reference to the name, trade name, make or catalog number of any manufacturer or supplier, the intent shall not be to limit competition, but to establish a standard of quality which the Engineer has determined is necessary for the Project. If any product/design element other than that specified is proposed for use by the Contractor, it shall submit to the Owner and Engineer either its certification that the “or equal” strictly conforms to the RD, or a statement specifically identifying all differences between the “or equal” and the RD.
3. Any variation of a proposed “or equal” from the RD which is not specifically noted in the Contractor’s submittal shall be at the sole risk and expense of the Contractor. In addition, the Contractor shall provide all the information that the Owner and Engineer request concerning the product/design element. The proposed product shall not be used until it is accepted by the Owner with input from the Engineer. Any “or equal” product incorporated into the Project without the Owner’s written acceptance shall be at the Contractor’s sole risk, and the Owner may require the removal and replacement of any unaccepted “or equal” product.

4. In all cases, the Owner and Engineer will determine whether a proposed “or equal” is acceptable, and the Contractor shall have the burden of proving, at its expense, to the satisfaction of the Owner and Engineer that the proposed “or equal” is similar and equal to the named product/design element. In making such determination the Owner or Engineer may establish such criteria as it deems proper for acceptance of the “or equal.”
5. Any requested change in the RD not pertaining to an “or equal” must be submitted to the Owner and Engineer in writing and must be stated with sufficient clarity and detail to permit proper consideration by the Owner and Engineer. Unless accepted by the Owner (with input from the Engineer) after submission as herein provided, any deviation from the RD, or the use of any product/design element which varies from the RD, shall be at the Contractor’s sole risk and expense.
6. The Contractor’s use of “or equal” products or design elements is at their own risk. Such “or equals” shall be clearly identified in the Contractor’s submittals. In the event that the Owner or Engineer subsequently determines that the “or equal” is not suitable, the Contractor shall utilize products/design elements established in the RD without any adjustment to the Contract price.

C. Suppliers
1. All supplies and equipment shall be furnished by manufacturers who shall have at least three years of experience in the design, production, assembly, and field service of equipment of like type, size, and capacity. Where required by the Engineer, the Contractor shall supply a list of at last three successful installations.

PART 2 - PROCEDURE

2.01 GENERAL SUBMITTAL AND SUBMITTAL REVIEW REQUIREMENTS

A. Notwithstanding the required submittals related to the technical aspects of the Project, the Contractor shall prepare three (3) Project-specific documents related to the overall implementation of the Project: Operations Plan, Health and Safety Plan (HASP), and Contingency Plan. The information to be addressed in these submittals is provided below.

B. Once reviewed by the Engineer and/or approved by the Owner, select submittals will be provided to the NYSDEC. These submittals are anticipated to include, but not be limited to: Operations Plan; HASP; Contingency Plan; Construction Schedule (to be included in the Operations Plan); proposed backfill source(s); and analytical data associated with the proposed source(s). The specific submittals will be identified in consultation with NYSDEC.

2.02 OPERATIONS PLAN

A. To gauge the Contractor’s understanding of the RD, work to be performed, and its construction, objectives, procedures, and outcomes, and to address misunderstandings, clarifications, or modifications prior to Project implementation, the Contractor shall prepare and submit an Operations Plan for review by the Owner and Engineer. The plan shall address, but not be limited to, the following items:
1. List/schedule of equipment.
2. Identification of key personnel that will be onsite for the duration of the Project.
3. Site security/property protection procedures.
4. Construction Schedule.
5. List of subcontractors with proof of qualifications and licensing requirements.
6. Vehicular and pedestrian traffic plan.

7. Onsite traffic plan, including truck routes to and from various points in the site (e.g., imported materials staging areas, decontamination areas, etc.).
8. Erosion and sediment control plan.
9. Site preparation plan, including location and layout of the following:
    a. Field offices and sheds, sanitary facilities, and first-aid facilities.
    b. Temporary access roads and parking areas.
    c. Equipment storage and fueling area(s).
    d. Sediment handling area and temporary enclosure. Clearly identify location and size of each.
    e. Temporary imported materials staging area(s). Clearly identify location and size of each.
    f. Temporary decontamination area(s). Clearly identify location and size of each.
    g. Temporary water treatment containment area(s). Clearly identify location and size of each.
10. Storm water management plan.
11. Survey control plan.
12. Debris removal and management plan.
13. Dredging plan, including dredging and backfill sequence/technique, including sheet piling installation and removal.
14. Material staging and handling approach.
15. List of treatment and/or disposal facilities for offsite disposition (note that the Contractor shall provide and coordinate with a minimum of two Owner-approved facilities).
16. Resuspension control plan.
17. Sheen control and response plan.
18. Water handling, treatment, and discharge plan, including treatment system design.
19. Air monitoring plan, including dust and odor controls, including equipment cut sheets.
20. Noise control/suppression plan.
21. Equipment decontamination and cleaning procedures.
22. Environmental protection plan.
23. Construction Schedule (refer to Paragraph 1.03.A.4 of this Section).

2.03 HEALTH AND SAFETY PLAN

A. The Contractor shall prepare a Health and Safety Plan in accordance with Section 013529 – Contractor's Health and Safety Plan.

2.04 CONTINGENCY PLAN

A. The Contractor must prepare, submit, and implement a Contingency Plan that includes, at a minimum, the following items:
    1. A pollution prevention plan for all materials brought to the Site. This plan shall also include methods to address spills (should they occur).
    2. Emergency vehicular access/egress.
    3. Evacuation procedures of personnel from the Site.
    4. A weather response plan with measures to protect on-water personnel and equipment from impacts in the event of high flow or adverse weather conditions. The Contractor's weather response plan shall demonstrate the Contractor's understanding of the Project and consider the following:
        a. Monitoring river flows and/or weather reports (at least daily) to identify potential conditions that may result in high flow or adverse weather conditions.
        b. Adjusting onsite activities in response to high-river flows or adverse weather conditions (e.g., temporarily reducing or suspending operations).

   c. Securing water-based vessels from high-river flow or adverse weather conditions.
5. A flood event contingency plan with measures to protect the Site and waterways from impacts in the event of high water and/or flood conditions. In the event of a flood/high water condition (i.e., where storm water overtops the banks and/or rises to a level that prevents continuing the remedial activities in a safe manner), the Contractor's flood event contingency plan shall be implemented. The Contractor's flood event contingency plan shall demonstrate the Contractor's understanding of the Project and consider the following:
   a. Monitoring storm water flows and/or weather reports (at least daily) to identify potential conditions that may result in a flood event.
   b. Adjusting onsite activities in response to monitored storm water flows and weather reports.
   c. Providing pump system(s) to remove/handle ponded water at the support areas. These pumps would be used to handle non-contact storm water (if necessary).
   d. Securing water-based vessels from flooding conditions.
   e. Securing or removing, if possible, all chemicals and materials in flood prone areas, including impacted materials within staging areas.
   f. Relocating equipment to areas of the Site that are not as prone to flooding.
   g. Monitoring the flood conditions to determine when remedial activities could resume (if the activities are discontinued due to a flood event). The determination to discontinue remedial activities due to a flood event shall be agreed to in the field between the Contractor, Construction Manager, and Owner.
6. The Contractor may identify additional or other contingencies in the plan based on his/her experience. Such provisions shall be subject to approval by the Owner.
7. A list of all contact personnel with phone numbers, including: the Contractor; the City of Hudson fire official(s); ambulance service; local, county, and State Police; and local hospitals, including routes to local hospitals and procedures for notifying each.
8. Identification of responsible personnel who will be in a position at all times to receive incoming phone calls and to dispatch Contractor personnel and equipment in the event of an emergency situation.

PART 3 - EXECUTION (NOT USED)

- END OF SECTION –

SECTION 011400

WORK RESTRICTIONS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified
   1. Furnish and provide all labor, tools, materials, equipment, and services, and complete all work, installed, tested, and ready for use, as described in the RD.
   2. Adhere to the administrative, contractual, and procedural requirements for the proper conduct of the work including, but not limited to:
      a. Allowable workdays/hours
      b. Access and containment
      c. Public roads
      d. Work limits
      e. Protection of existing structures and facilities
      f. Existing and subsurface structures
      g. Replacement of property
      h. Housekeeping

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 ALLOWABLE WORKDAYS/HOURS

A. In-water work may only be conducted between September 1 and November 30.

B. Work activities can be conducted between 7:00 a.m. and 7:00 p.m. (on non-holiday) Monday through Friday except in cases of emergency or unless prior approval has been obtained from the Owner and the City of Hudson. If the Contractor needs to modify the regular work hours following the start of the work, the Contractor must notify Construction Manager in writing at least 48 hours in advance of the initiation of such work. The Construction Manager will notify the Owner and Engineer of the modification. The Contractor must obtain prior written approval from the Owner before work is scheduled to be performed beyond the regular work hours, during a second shift, on the weekends, or at night.

C. The Contractor is responsible for adhering to any local and state noise laws or ordinances that may govern or restrict the performance of the work during the regular or extra work hours.

D. The Contractor is responsible for providing and maintaining adequate lighting and other facilities required for carrying out and inspecting the work during regular and extra work hours.

3.02 ACCESS AND CONTAINMENT

A. The Contractor shall provide any necessary traffic controls and shall comply with posted speed limits on public roads and in work areas. Construction trucks entering and exiting the Site shall use established site access roads.

B. Personally owned vehicles are allowed on site only in areas designated by the Contractor for employee parking. These areas shall be located within the Temporary Staging Area illustrated on the associated Design Drawings, however, if necessary, the Contractor may propose for Owner approval an alternate offsite employee parking area. The Contractor shall be responsible for transporting personnel to the Work Area within the Site, if required.

C. The Contractor may place Type 2 stone as needed to improve the existing site surface for access.

D. All vehicle and equipment fueling and maintenance operations must be confined to designated areas identified in the Contractor's Operations Plan prepared in accordance with Section 011100 – Summary of Work. These designated areas must have appropriate measures that prevent the contamination of stormwater runoff. Measures may include, but are not limited to, covered or roofed areas, drip pans, using spill and overflow equipment, constructing berms, cleaning pavement surfaces to remove oil and grease from leaks, and draining all parts of fluids.

E. The upland staging area, existing haul road, and bulkhead available to the Contractor are owned by Colarusso Ventures, LLC. (Colarusso). With exception of the upland staging area, the property must remain available for use by Colarusso at all times. Colarusso will have priority for use of the existing bulkhead for loading and offloading. The Contractor shall coordinate with and accommodate Colarusso's use of the property and bulkhead at no additional cost to the Owner. Final terms of the negotiated access agreement will be provided to the Contractor. The Contractor's operations must not interfere with any Colarusso's ongoing operations at the property.

F. Work will be required in the active navigation channel within the Hudson River. The Contractor shall follow all United States Coast Guard (USCG) regulations and requirements for operations within the channel.

3.03 PUBLIC ROADS

A. The use and protection of public roads shall be in accordance with all applicable state, county, and local requirements.

B. The Contractor shall be responsible for obtaining all required permits and paying for any fees associated with use of public roads.

C. The Contractor shall be responsible for repairing any project-related damages to existing roads or bridges to their original condition or better, at no additional cost to the Owner.

3.04 WORK LIMITS

A. Where applicable, Project Work Limits have been depicted on the Design Drawings. The Contractor shall restrict all work activities including, but not limited to, storage of materials to be incorporated in the project, as well as parking of vehicles, heavy equipment, project trailers, etc., to the Project Work Limits designated on the Design Drawings. Where appropriate, and following Owner approval, the Contractor may provide offsite storage of construction materials or equipment, as necessary.

B. The Owner will arrange for/coordinate access to privately-owned properties within the Project Work Limits. The Contractor is responsible for coordinating access to privately-owned properties beyond the Project Work Limits.

C. All work shall be conducted (to the extent practicable) in such a manner as will cause the minimum inconvenience and disturbance to the surrounding community.

D. Contaminated materials, if any, and equipment that has not been decontaminated may not be transported outside of the limits of the Site without prior approval from the Owner.

E. The work limits or health and safety requirements may change following the finalization of access agreements between the Owner and affected property owners.

3.05 PROTECTION OF EXISTING STRUCTURES AND FACILITIES

A. Except where noted or as otherwise indicated in the RD, the Contractor shall protect from damage any and all pavements, sidewalks, curbs, buildings, trees, poles, docks, bulkheads, drainage features, utilities, and other property in and around the Project Work Limits. Any damage caused by the Contractor shall be repaired by the Contractor at no additional cost to the Owner.

B. The Contractor is responsible for the repair/restoration of damage sustained by any structure during or as a result of the work.

C. The Contractor shall have available on site all necessary equipment and material for sustaining and supporting any and all existing structures that are uncovered, undermined, weakened, endangered, threatened, or otherwise materially affected during the work.

D. If damage occurs to any portion of an existing structure, or to the material surrounding or supporting the same, the Contractor shall immediately notify the Construction Manager and the Construction Manager will notify the Owner, Engineer, and other parties as applicable. The Contractor shall also immediately proceed with appropriate and safe response actions to (as necessary): 1) collect, containerize, characterize, and appropriately dispose of any materials released from the damaged structure; 2) provide provisions for alternate/temporary service; and 3) furnish necessary materials and repair or replace the damaged structure. In the case of utilities, the Contractor shall immediately notify the appropriate utility company and provide assistance to the utility company during repairs unless authorized by the utility company to undertake such repairs directly. Any damage to existing structures shall be promptly and completely repaired by the Contractor to the satisfaction of the Owner, Construction Manager, utility company, and property owner.

3.06 EXISTING SUBSURFACE STRUCTURES

A. General
   1. Subsurface structures may be present that are either not identified or not accurately shown on the Design Drawings. The Contractor is responsible for verifying the accuracy and completeness of the information shown on the Design Drawings (as necessary to perform the work). The Contractor agrees that it shall neither have nor assert against the

Owner, Construction Manager, or Engineer any claim for damages by reason of the inaccuracy, inadequacy, incompleteness, or other deficiency of the information given, or the failure to furnish additional or further information in the possession of the Owner, Construction Manager, or Engineer.

2. The Contractor shall use due care to avoid damage to existing subsurface structures identified, not identified, or inaccurately depicted on the Design Drawings.
3. In certain instances, it may be beneficial to assess the potential presence of existing subsurface structures or obstructions in advance of the specific work activities that may encounter such structures or obstructions (e.g., test trenching to confirm the locations of utilities, foundations, or other subsurface structures). Such activities shall be performed in a safe manner, consistent with all applicable provisions of the RD. The Contractor shall immediately backfill any such exploratory excavations, unless otherwise directed by the Construction Manager or Engineer.
4. Where the size, location, or depth of an existing subsurface structure has been anticipated and the RD specifies removal, realignment, or change, all work shall be performed in mutual cooperation with the utility company or other parties concerned.
5. Where an existing subsurface structure (e.g., utility, foundation, etc.) is encountered that is not anticipated or is found to be materially different in size, location, or depth from that shown on the Design Drawings, the Contractor shall immediately notify the Construction Manager. Any work required by the Contractor to remove, realign, or change the structure shall be performed as mutually agreed upon by the Owner, Engineer, Contractor, and utility company or property owner.

B. Utilities

1. Certain existing subsurface utilities (e.g., communication cables, natural gas lines, sanitary/storm sewers, water mains, etc.), which may be encountered during the work or are located in close proximity to the Project Work Limits, shall require special precautions and methods for their protection. Subsurface utilities that are known to the Owner and Engineer, together with appurtenances, are shown on the Design Drawings. The sizes, locations, alignments, and depths shown (if any) are approximate.
2. Contractor shall coordinate with Dig Safely New York to determine utility locations prior to the start of work. Contractor shall identify and mark out utility locations and relocate, protect, or abandon utilities, as required. The Contractor shall also secure the services of a private utility locator as necessary to identify and verify the location of utilities on private property wherever subsurface disturbance will occur.
3. All utilities whose facilities may be affected by the work shall be notified at least 72 hours in advance of the start of any operations that might affect such facilities.
4. The removal, replacement, support, or other handling of private and public utilities within the Project Work Limits shall be performed by the Contractor in accordance with arrangements satisfactory to Owner, Construction Manager, or operator of the utility involved. The Contractor shall remove, replace, or support all utilities as required.
5. Where it is necessary to interrupt natural gas, sewer, water, or other utility service to remove, realign, or change a subsurface structure, the work shall: 1) be coordinated with the Owner, Construction Manager, Engineer, and appropriate utility company; 2) proceed with expedience; and 3) be continuous after interruption of service until completion of the removal, realignment, or change and return of the utility service to its normal state.
6. The Contractor shall not permit nor cause any hindrance to or interference with any individual, municipal department, public service corporation, or other company in protecting its poles, posts, or other structures, nor in shifting, removing, or replacing the same. The Contractor shall allow said individual, department, corporation, or company to take all such measures as they may deem prudent to protect their structures.

C. Submerged Piles
   1. Submerged piles, which may be encountered during the work or are located in close proximity to the Project Work Limits, shall require special precautions and methods for their protection. Submerged pile areas that are known to the Owner and Engineer are shown on the Design Drawings. The sizes, locations, and depths shown (if any) are approximate.
   2. If submerged piles require removal to allow for access or completion of dredging, the Contractor shall remove the submerged pile as necessary to facilitate dredging. The Contractor shall submit means and methods to the Owner and Engineer for review. Portions of submerged piles below the final dredged sediment surface may be left in place.

D. Existing Subsurface Structures Requiring Changes to the Remedial Design
   1. The Owner and Engineer (in consultation with the NYSDEC) will determine if: 1) changes should be made to the RD to avoid a subsurface structure; 2) the work can proceed without changes to the RD; or 3) the structure should be removed, realigned, or changed.

3.07 REPLACEMENT OF PROPERTY

A. The Contractor shall replace all pavements, driveways, sidewalks, fences, shrubs, lawns, trees, and any other public or private property damaged during the work. In all cases, said replacement shall be new and to the satisfaction of the Owner, Construction Manager, property owner, and other affected party.

3.08 HOUSEKEEPING

A. As work progresses, the Contractor shall remove all unused tools and equipment, surplus materials, waste materials, rubbish, refuse, and other debris from the site in a timely manner and ensure that the site is at all times maintained in a neat and orderly condition.

B. At the completion of the Project, the Contractor shall promptly remove all construction tools and equipment, surplus materials, waste materials, rubbish, refuse, and other debris from the site and leave the site in a neat and orderly condition.

C. If it is observed that the Contractor neglects his responsibilities as set forth above, or neglects the repairing of streets, sidewalks, fences, or other damages, the Owner, Construction Manager, or Engineer will notify the Contractor to that effect. The Contractor shall take reasonable steps after notification to correct the neglected situation in a timely manner.

- END OF SECTION -

SECTION 013100

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Contractor shall coordinate the Work, including testing agencies whether hired by the Contractor, owner or others; Subcontractors, Suppliers, and others with whom coordination is necessary, in accordance with this Section, to complete the Work within the schedule restrictions noted in Section 011100 – Summary of Work, Section 011400 – Work Restrictions, and in accordance with the RD.

B. The Contractor shall cooperate with and coordinate the Work with other contractors, utility service companies, the Owners' employees working at the Site, and other entities working at the Site (if any).

C. Attend and participate in all project coordination and progress meetings, and report on the progress of the Work and compliance with the Construction Schedule.

1.02 SUBMITTALS

A. Progress Reports: Submit field progress reports in accordance with this Section.
   1. Daily field reports shall be submitted by 10:00 a.m. the following business day.
   2. Weekly field reports shall be submitted by close of business the day before the following week's progress and coordination meeting.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PROJECT MEETINGS

A. General
   1. Project meetings will be held on a regular basis.
   2. Representatives present for each entity attending the Project Meetings shall be qualified and authorized to act on that entity's behalf.
   3. Contractor attendance is mandatory at all Project Meetings.

B. Pre-Construction Meeting
   1. The Owner will schedule a pre-construction meeting no later than 15 days after date of Notice to Proceed.
   2. The pre-construction meeting will be held at the Site or an alternate location designated by the Owner.
   3. Attendance will likely include:
      a. Owner.
      b. NYSDEC.
      c. City of Hudson.

d. Engineer.
e. Construction Manager.
f. Contractor.
   1) Project manager.
   2) Site superintendent.
   3) Safety representative.
   4) Major Subcontractors.
g. Others (as deemed appropriate by the Owner or Construction Manager).

4. For the conference, the Construction Manager will:
   a. Prepare the meeting agenda.
   b. Preside at the meeting.
   c. Record the minutes and include significant proceedings and decisions.
   d. Distribute copies of minutes after the meeting to attendees and other parties affected by the decisions made at the meeting.
5. Contractor shall bring to the conference the following, with sufficient number of copies for each attendee:
   a. Preliminary Construction Schedule.
   b. Preliminary Schedule of Submittals.
6. Anticipated Agenda Items:
   a. Safety/safe work practices.
   b. Review of work scope.
   c. Distribution and discussion of major subcontractors and suppliers
   d. Construction Schedule.
   e. Contractor submittals.
   f. Major equipment deliveries and priorities.
   g. Project coordination/chain-of-communication
   h. Procedures and processing of field decisions, proposal requests, submittals, change orders, applications for payment.
   i. Procedures for maintaining Record Documents.
   j. Use of premises (office, work, storage areas).
   k. Construction facilities, controls, and construction aids.
   l. Temporary utilities.
   m. Housekeeping procedures.

C. Progress and Coordination Meetings
   1. The Construction Manager will schedule regular progress meetings every week on a day and time agreeable to Owner, Construction Manager, Engineer, and Contractor. Additional coordination meetings will be scheduled as necessary and appropriate. Progress and coordination meetings will be held at the Site.
   2. Attendance will likely include:
      a. Owner.
      b. NYSDEC.
      c. Engineer.
      d. Construction Manager.
      e. Contractor.
         1) Project manager.
         2) Site superintendent.
         3) Safety representative.
         4) Air monitoring technician.
         5) Representatives of other Subcontractors and Suppliers when needed for the discussion of a particular agenda item.
      f. Others (as deemed appropriate by the Owner or Construction Manager).

3. For each meeting, the Construction Manager will:
    a. Prepare the meeting agenda.
    b. Preside at the meeting.
    c. Record the minutes and include significant proceedings and decisions.
    d. Distribute copies of minutes after the meeting to attendees and other parties affected by the decisions made at the meeting.
4. Contractor shall bring to each meeting the following, with sufficient number of copies for each attendee:
    a. List of Work accomplished since the previous progress meeting.
    b. Up-to-date Construction Schedule.
    c. Up-to-date Schedule of Submittals.
    d. Detailed “look-ahead” schedule of Work planned for the next two weeks, with specific starting and ending dates for each activity, including shutdowns, deliveries of important materials and equipment, Milestones (if any), and important activities affecting Owner, the Project, and the Site.
5. Anticipated Agenda Items:
    a. Safety/safe work practices.
    b. Review/approval of prior meeting minutes.
    c. Air monitoring/Community Air Monitoring Plan update.
    d. Review of work progress since previous meeting.
    e. Field observations, problems, and conflicts.
    f. Review of upcoming work activities.
    g. Problems that potentially impede Construction Schedule.
    h. Corrective measures and procedures to regain projected schedules.
    i. Revisions to Construction Schedule.
    j. Submittal status and schedules.
    k. Maintenance of quality standards.
    l. Pending changes and substitutions.
6. Representatives of the Contractor who have decision-making authority shall be attendance at all progress and coordination meetings.

D. Daily Work Meetings
1. Daily work meetings will be held at the beginning of each workday at the Site. Contractor shall coordinate and lead the daily work meetings.
2. Attendance will likely include:
    a. Owner (as necessary).
    b. Engineer.
    c. Construction Manager.
    d. Contractor.
    e. Other parties to be onsite during the day.
3. Topics may include:
    a. Health and safety-related requirements/issues.
    b. Environmental, operational, or maintenance issues, incidents, or concerns.
    c. Quality control activities and results.
    d. Review of the previous day’s activities.
    e. Review activities planned for the current day.

3.02 PROGRESS REPORTING

A. Daily Field Reports: Prepare and maintain daily reports of site activities including the following information, at minimum:
1. Number of employees at the Site.

2. Number employees at the Site for each Subcontractor.
3. Major equipment and materials installed as part of the Work.
4. Major construction equipment utilized.
5. Location of areas in which construction was performed.
6. Materials and equipment received.
7. Work performed, including, but not limited to:
    a. Sediment removal summary as required by Section 352023.
    b. Waste disposal summary sheet as required by Section 028100.
    c. Field quality control measures and testing.
8. Weather conditions.
9. Safety concerns, events, and precautions taken. Include results of any personnel monitoring performed in accordance with the Contractor's HASP, documentation of instrument calibration, new hazards encountered, and additional PPE utilized.
10. Delays encountered, amount of delay incurred, reasons for the delay, and corrective measure(s) implemented to maintain the Construction Schedule.
11. Instructions received from Owner, Construction Manager, or Engineer.

B. Weekly Reports: Prepare and maintain weekly summary reports including the following information, at minimum:
    1. Location of areas in which construction was performed.
    2. Work performed (and dredged material volumes), including field quality control measures and testing.
    3. Quantities of material transported offsite for disposal (include completed manifests received).
    4. Material stabilization information as required by Section 313200.
    5. Water treatment system operation and maintenance information as required by Section 444000.
    6. Safety concerns, events, and precautions taken.
    7. Delays encountered, amount of delay incurred, reasons for the delay, and corrective measure(s) implemented to maintain the Construction Schedule.
    8. Updates to the Construction Schedule.

- END OF SECTION -

SECTION 013300

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

A. This Section specifies the general methods and requirements of submissions applicable to Contractor submittals, including various plans, shop drawings, product data, samples, mock-ups, and construction or submittal schedules. Detailed and specific submittal requirements are specified elsewhere within the Remedial Design (RD).

B. All submittals shall be clearly identified by reference to Section Number, Paragraph, Drawing Number, or Detail as applicable. Submittals shall be clear and legible and of sufficient size for presentation of data.

C. Each submittal shall be prepared and transmitted to the Engineer at minimum of two weeks in advance of the Contractor's intended performance of the related work or other applicable activities, or within the time specified in the individual work of other related sections, so that work will not be delayed by processing times (including rejections and resubmittals, if required), coordination with other submittals, testing, purchasing, fabrication, delivery, and similar sequenced activities. The Owner, Construction Manager, and Engineer will not be liable for any project costs or schedule delays resulting from the Contractor's failure to provide submittals in a timely manner.

1.02 SHOP DRAWINGS, PRODUCT DATA, SAMPLES

A. Shop Drawings
1. Shop drawings as specified in individual sections include work plans, samples, supporting vendor information, calculations, test reports, custom-prepared data such as fabrication and erection/installation (working) drawings, schedules for carrying out the Project, setting diagrams, actual shop work manufacturing instructions, custom templates, coordination drawings, individual system or equipment inspection and test reports including performance curves and certifications, as applicable to the Project.
2. Shop drawings shall not be provided by subcontractors and shall only be forwarded to the Engineer once the Contractor has verified that they are complete. The Contractor shall be responsible for checking all subcontractor shop drawings regarding measurements, size of members, materials, and details to make sure that they conform to the intent of the shop drawings and related sections. The Contractor shall be responsible for their submission at the proper time so as to prevent work delays.
3. All details on shop drawings shall show clearly the relation of the various parts to the main members and lines of the structure and where correct fabrication of the work depends upon field measurements, such measurements shall be made and noted on the shop drawings before being submitted.

B. Product Data
1. Product data as specified in individual sections include standard prepared data for manufactured products (sometimes referred to as catalog data), such as the manufacturer's product specification and installation instructions, manufacturer's printed statements of compliances and applicability, roughing-in diagrams and templates, catalog

cuts, product photographs, standard wiring diagrams, printed performance curves and operational-range diagrams, production or quality control inspection and test reports and certifications, mill reports, product operating and maintenance instructions and recommended spare-parts listing and printed product warranties, as applicable to the work.

C. Samples
   1. Samples specified in individual sections include physical examples of the work such as sections of manufactured or fabricated work, small cuts or containers of materials, complete units of repetitively-used products and units of work to be used by the Engineer for independent inspection and testing, as applicable to the work.

1.03 SUBMITTALS REQUIRED IN THIS SECTION

A. Schedule of Submittals:
   1. Timing:
      a. Provide submittal within time frames specified in the Contract Documents.
      b. Provide updated Schedule of Submittals with each submittal of the updated Construction Schedule.
   2. Content: In accordance with the General Conditions, as may be modified by the Supplementary Conditions, and this Section. Requirements for content of preliminary Schedule of Submittals and subsequent submittals of the Schedule of Submittals are identical. Identify on Schedule of Submittals all submittals required in the RD. Updates of Schedule of Submittals shall show scheduled dates and actual dates for completed tasks. Indicate submittals that are on the Project’s critical path. Indicate the following for each submittal:
      a. Date by which submittal will be provided to Engineer.
      b. Whether submittal will be for a substitution or “equal”. Procedures for substitutions and “or equals” are specified in the General Conditions, as may be modified by the Supplementary Conditions, and the General Requirements.
      c. Date by which Engineer’s response is required. At least 14 days shall be allowed from Engineer’s receipt of each submittal. Allow increased time, upwards of 28 days, for large or complex submittals.
      d. For submittals for materials or equipment, date by which material or equipment must be at the Site to avoid delaying the Work and to avoid delaying the work of other contractors.
   3. Prepare Schedule of Submittals using same software, and in same format, specified for Construction Schedules.
   4. Coordinate Schedule of Submittals with the Construction Schedule.
   5. Schedule of Submittals that is not compatible with the Construction Schedule, or that does not indicate submittals on the Project’s critical path, or that that places extraordinary demands on Engineer for time and resources, is unacceptable. Do not include submittals not required by the RD.
   6. In preparing Schedule of Submittals:
      a. Considering the nature and complexity of each submittal, allow sufficient time for review and revision.
      b. Reasonable time shall be allowed for Engineer’s review and processing of submittals, for submittals to be revised and resubmitted, and for returning submittals to Contractor.
      c. Identify and accordingly schedule submittals that are expected to have long anticipated review times and submittals that may be subject to review by authorities having jurisdiction.

1.04 CONTRACTOR'S RESPONSIBILITIES

A. Review shop drawings, product data, and samples, including those by subcontractors, prior to submission to determine and verify the following:
   1. Field measurements;
   2. Field construction criteria;
   3. Catalog numbers and similar data; and
   4. Conformance with related sections.

B. Each shop drawing, sample, and product data submitted by the Contractor shall have affixed to it the following Certification Statement including the Contractor's Company name and signed by the Contractor: "Certification Statement: by this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data and I have checked and coordinated each item with other applicable shop drawings and all Project requirements." The above Certification Statement shall be written on the cover sheet. The cover sheet shall fully describe the packaged data and include a listing of all items within the package. The Contractor shall provide to the Engineer a copy of each transmittal sheet for shop drawings, product data, and samples at the time of submittal to the Engineer.

C. The Contractor shall utilize an 11-character submittal identification numbering system in the following manner:
   1. The first character shall be a D, S, or P, which represents shop/working drawing and other product data (D), sample (S), or preliminary submittal (P).
   2. The next six digits shall be the applicable Section Number.
   3. The next three digits shall be the numbers 001 to 999 to sequentially number each initial separate item or drawing submitted under each specific Section Number.
   4. The last character shall be a letter, A to Z, indicating the submission, or resubmission of the same Drawing, i.e., A=1st submission, B=2nd submission, C=3rd submission, etc. A typical submittal number would be as follows: D-310519-008-B

D	=	Shop Drawing
310519	=	Section for Geosynthetics
008	=	The eighth initial submittal under this section
B	=	The second submission (first resubmission) of that particular shop drawing

D. Notify the Engineer in writing, at the time of submittal, of any deviations in the submittals from the requirements of the RD.

E. The Engineer shall review shop drawings, samples, and product data for conformance with the RD. The Engineer’s review shall not relieve the Contractor from the responsibility for the fulfillment of the terms of the RD. All risks of error and omission are assumed by the Contractor and the Engineer will have no responsibility, therefore.

F. Work started, or materials fabricated or installed, prior to review of the applicable submittal items by the Engineer shall be at the sole risk of the Contractor. Fabrication performed, materials purchased, or onsite construction accomplished that does not conform to the RD shall be at the Contractor's risk. Neither the Owner nor Engineer will not be liable for any expense or delay due to corrections or remedies required to accomplish conformity.

G. Project work, materials, fabrication, and installation shall conform to the RD.

1.05 SUBMISSION REQUIREMENTS

A. Make submittals promptly in accordance with Schedule of Submittals and in such sequence as to cause no delay in the Project.

B. Each submittal, appropriately coded, will be returned following review of submittal by the Engineer.

C. Except where noted or as otherwise indicated in the RD, all submittals shall be provided electronically (in Adobe® PDF or other mutually agreeable format) to the Engineer. Where hard copies are required, the following shall be provided:
1. Shop Drawings and Product Data – two copies. Shop drawings and product data sheets shall be bound together in an orderly fashion.
2. Samples – number and/or size stated in the respective sections.

D. Submittals shall contain:
1. The date of submission and the dates of any previous submissions.
2. The project title and number.
3. Contractor submittal identification number.
4. Identification of any subcontractors, suppliers, or manufacturers.
5. Identification of the product, with the section number, page and paragraph(s).
6. Field dimensions clearly identified as such.
7. Relation to adjacent or critical features of the work or materials.
8. Applicable standards, such as ASTM International (ASTM) or Federal Standards numbers.
9. Identification of deviations from the RD.
10. Identification of revisions on resubmittals.
11. Contractor's certification statement per Paragraph 1.04.B of this Section.
12. Where calculations are required to be submitted by the Contractor or subcontractor, the calculations shall have been checked by a qualified individual other than the preparer. The submitted calculations shall clearly show the names of the preparer and of the checker.

1.06 REVIEW OF SUBMITTALS

A. The review of submittals will be for general conformance with the design concept and RD. All risks of error and omission are assumed by the Contractor and the Engineer will have no responsibility, therefore. Engineer corrections/comments to the Contractor submittals shall not be construed:
1. As permitting any departure from the RD;
2. As relieving the Contractor of responsibility for any errors, including details, dimensions, and materials; or
3. As approving departures from details furnished by the Owner, except as otherwise provided herein.

B. The Contractor shall remain responsible for details and accuracy, coordinating the work with all other associated work and trades, selecting fabrication processes, techniques of assembly, and performing work in a safe manner.

C. If the shop drawings, data, or samples as submitted describe variations and show a departure from the RD which the Engineer finds to be in the interest of the Owner and to be so minor as not to involve a change in Project Price or Project Time, the Engineer may return the reviewed shop drawings without noting an exception.

D. Submittals will be returned to the Contractor under one of the following codes.

“R” - "REVIEWED" is assigned when there are no notations or comments on the submittal. When returned under this code the Contractor may release the equipment and/or material for manufacture.

“N” - "REVIEWED AND NOTED" is assigned when a confirmation of the notations and comments IS NOT required by the Contractor. The Contractor may release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product.

“S” - "RESUBMIT" is assigned when notations and comments are extensive enough to require a resubmittal of the package. This resubmittal is to address all comments, omissions and non-conforming items that were noted. Resubmittal is to be received by the Engineer within 15 calendar days of the date of the Engineer’s transmittal requiring the resubmittal.

“J” - "REJECTED" is assigned when the submittal does not meet the intent of the RD. The Contractor must resubmit the entire package revised to bring the submittal into conformance. It may be necessary to resubmit using a different manufacturer/vendor to meet the intent of the RD.

“I” - "FOR YOUR INFORMATION" is assigned to acknowledge receipt of a submittal that does not require the Engineer’s review and is being filed for informational purposes only. This code is generally used in acknowledging receipt of field conformance test reports and *Health and Safety Plans*.

E. Resubmittals shall be handled in the same manner as first submittals. On resubmittals, the Contractor shall identify all revisions made to the submittals, either in writing on the letter of transmittal or on the shop drawings by use of revision triangles or other similar methods. The resubmittal shall clearly respond to each comment made by the Engineer on the previous submission. Additionally, the Contractor shall direct specific attention to any revisions made other than the corrections requested by the Engineer on previous submissions.

F. Partial submittals may not be reviewed. Submittals not complete shall be returned to the Contractor and considered "Rejected" until resubmitted as a complete submittal. The Engineer may at its option provide a list or mark the submittal directing the Contractor to the areas that are incomplete.

G. If the Contractor considers any correction indicated on the shop drawings to constitute a change to the RD, the Contractor shall give written notice thereof to the Engineer at least seven working days prior to release for manufacture.

H. When the shop drawings have been completed to the satisfaction of the Engineer, the Contractor shall carry out the construction in accordance therewith and shall make no further changes therein except upon written instructions from the Engineer.

I. Work started, or materials fabricated or installed, prior to review of the applicable submittal items by the Engineer shall be at the sole risk of the Contractor. Fabrication performed, materials purchased, or onsite construction accomplished that does not conform to the RD shall be corrected at the Contractor’s expense. The Owner will not be liable for any expense or delay to corrections or remedies required to accomplish conformity with the RD.

J. Certain submittals may be subject to review/approval by the NYSDEC, City of Hudson, or other Agencies or interested parties. Refer to Article 2.01 of Section 011100 – Summary of Work for a list of such submittals.

1.07 SUBMITTAL LOG

A. The Engineer will maintain the submittal log and distribute the updated log with reviewed submittals, ahead of progress meetings, and otherwise as requested. A template of the Engineer's submittal log form is attached to this Section.

1.08 DISTRIBUTION

A. Distribute hard copy of reproductions of reviewed submittals, where required, to the job site file and elsewhere as directed by the Engineer. Number of copies shall be as directed by the Engineer but shall not exceed four.

1.09 SCHEDULES

A. Provide all schedules as required in the RD and in accordance with Section 011100. Schedules shall be updated as needed (minimum of weekly) and resubmitted to the Engineer.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 ATTACHMENTS

A. The attachments listed below, which follow the "End of Section" designation, are part of this Section:
   1. Engineer's submittal log form (1 page).

- END OF SECTION -

ENGINEER’S SUBMITTAL LOG

Item No.	Specification Section No.	Description	Submittal ID		Date Submitted	Reviewed By	Status and Date				Comments
			Submittal No.	Review Cycle			Interim		Final		

- END OF SUBMITTAL LOG -

SECTION 013529

CONTRACTOR'S HEALTH AND SAFETY PLAN

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope:
   1. Contractor shall prepare and maintain a written, Site-specific Health and Safety Plan (HASP), and conduct all construction activities in a safe manner that avoids:
      a. Injuries to employees, Subcontractors, and other persons with an interest at or near the Site.
      b. Employee exposures to health hazards above occupational limits established respectively by OSHA, the American Conference of Governmental Industrial Hygienists (ACGIH), and the Nuclear Regulatory Commission (NRC), as applicable.
      c. Exposure of the public and Owner's employees to air contaminants above levels established for public exposure by USEPA, NRC, NYSDEC, NYSDOH, and other authorities having jurisdiction at the Site.
      d. Significant increases in concentrations of contaminants in soil, water, or sediment near the Site.
      e. Violations of the Occupational Safety and Health Act, or other Laws or Regulations.

B. Related Sections:
   1. Section 011100, Summary of Work.
   2. Section 013543, Environmental Protection Procedures.

1.02 QUALITY ASSURANCE

A. Qualifications:
   1. HASP Preparer:
      a. Engage a certified industrial hygienist, accredited by the American Board of Industrial Hygiene, or safety professional certified by the Board of Certified Safety Professionals, to prepare or supervise preparation of Contractor's HASP.
   2. Safety Representative:
      a. Retain the services of an independent, safety industry professional to manage, oversee, and enforce Contractor's health and safety program at the Site, and ensure compliance with Contractor's HASP and applicable Laws and Regulations during the Project. Contractor's safety representative shall have a minimum of five years direct construction safety experience on projects with construction activities substantively similar to those to be performed as part of the Project, and appropriate training to supervise Hazardous Waste operations and emergency response (HAZWOPER) activities.
      b. Contractor's safety representative shall be present at the Site at all times when Work is being performed and shall be dedicated solely to the supervision of Contractor's health and safety program.
      c. Responsibilities include, but are not necessarily limited to, the following:
         1) Supervising the implementation of Contractor's HASP.
         2) Providing health and safety orientation training to Contractor's employees, Subcontractors, and Site visitors.

3) Attending pre-construction conference, progress meetings, and other Project meetings, as required.
4) Preparing and maintaining health and safety records and statistics.
5) Leading and documenting daily job safety briefings.
6) Preparing and submitting accident reports in accordance with Article 1.05 of this Section.
7) Leading accident investigations on Contractor's behalf.
8) Preparing and submitting daily health and safety field reports in accordance with Article 1.06 of this Section.

3. Vessel Operators:
   a. Tug boat operators:
      1) Captains shall demonstrate at least 10 years of relevant experience
      2) First mates shall demonstrate at least 5 years of relevant experience.
      3) Any tug boat operator shall be in possession of at least a current Master, 100 Tons Merchant Mariner Credential.
   b. Small craft operators:
      1) Operators of small craft supporting dredging operations Contractor shall be in possession of at least a current Operator of Uninspected Passenger Vessel Merchant Mariner Credential.

B. Regulatory Requirements:
1. Laws and Regulations applying to the Work under this Section include, but are not limited to, the following:
   a. 29 CFR 1904, Recording and Reporting Occupational Injuries and Illnesses.
   b. 29 CFR 1910, Occupational Safety and Health Standards.
   c. 29 CFR 1926, Safety and Health Regulations for Construction.
   d. 33 CFR Part 26, Vessel Bridge-to-Bridge Radiotelephone Regulations.
   e. 33 CFR Part 62 through 76, Aids to Navigation.
   f. 33 CFR Parts 83 through 90, Inland Navigation Rules.
   g. 40 CFR 261.3, 264, and 265, Resource Conservation and Recovery Act (RCRA).
   h. 49 CFR 171.8, Transportation, Definitions and Abbreviations.
   i. 6 NYCRR 371, Identification and Listing of Hazardous Wastes.
   j. 6 NYCRR 375, Environmental Remediation Programs.
   k. 12 NYCRR 23, Protection in Construction, Demolition, and Excavation Operations.
   l. 12 NYCRR 57, High Voltage Proximity.
   m. 12 NYCRR 61, Occupational Licensing and Certification.
   n. 16 NYCRR 753, Protection of Underground Facilities.
   o. 17 NYCRR 32, Oil Spill Prevention and Control – Actions to be Taken in Case of Discharge.
   p. USCG, Navigation Rules and Regulations Handbook.

1.03 SUBMITTALS

A. Contractor's HASP: Submit in accordance with Article 1.04 of this Section. Once reviewed by the Engineer, HASP will be provided to the NYSDEC.

B. Qualifications Statements:
1. HASP Preparer: Submit name and qualifications of certified industrial hygienist or safety professional, including summary of experience and copy of valid certifications.
2. Safety Representative: Submit name and qualifications of safety representative, including summary of experience, training received, and copy of valid certifications applicable to the Project.

3. Vessel Operators: Submit name and qualifications of vessel operators, including summary of experience and copy of valid credentials.

C. Reports:
1. Accident Reports: Submit in accordance with Article 1.05 of this Section.
2. Daily Health and Safety Field Reports: Submit in accordance with Article 1.06 of this Section.

1.04 HASP SUBMITTAL

A. General:
1. The Site is currently classified as a Hazardous Waste site, as defined in the General Conditions, which includes, but is not limited to, Hazardous Waste as defined in any of the following: 29 CFR 1926.65(a)(3), RCRA, 49 CFR 171.8, 6 NYCRR 371.1(d), and 6 NYCRR 375-1.2(w).
2. Each employer working at the Site shall develop and implement a written HASP for its employees involved in Hazardous Waste operations. HASP shall include procedures that will be used to ensure the safe handling of Hazardous Waste during excavating, loading, and transporting activities.
3. Comply with 29 CFR 1904, 29 CFR 1910, 29 CFR 1926, 12 NYCRR 23, 12 NYCRR 57, 12 NYCRR 61, 16 NYCRR 753, 17 NYCRR 32, and other Laws and Regulations.
4. Include in HASP requirements for complying with Owner’s health and safety requirements, as set forth in the General Conditions and Supplementary Conditions, and Site-specific hazard/emergency response plans, if any.
5. HASP shall be kept at the Site, shall address safety and health hazards of each phase of operations at the Site, and shall include requirements and procedures for employee protection.

B. HASP Contents: HASP shall address and include the following:
1. Organizational Structure:
   a. Specific chain of command and overall responsibilities of supervisors and employees. Include the following:
      1) Designation of general supervisor who has responsibility and authority to direct all Hazardous Waste operations.
      2) Name of Site safety representative who has responsibility and authority to implement and modify the HASP and verify compliance.
      3) Other personnel required for Hazardous Waste operations at the Site and emergency response, and general functions and responsibilities of each.
      4) Lines of authority, responsibility, and communication.
   b. Review and update organizational structure as necessary to reflect current status of Site operations and personnel.
2. Site description, background, and scope of Work.
3. Safety and health risk or hazard analysis, and planned hazard controls, for each task and operation required to complete the Project.
4. Site control measures, including:
   a. Coordinating with property owner operations.
   b. Preventing trespassing.
   c. Preventing unqualified or unprotected workers from entering restricted areas.
   d. Preventing the “tracking” of impacted materials out of the Site.
   e. Maintaining a log of employees at the Site and visitors to the Site.
   f. Delineating exclusion, contamination reduction, and support zones.
   g. Locating personnel and equipment decontamination zones.

   h. Communicating routes of escape and gathering points.
5. Training Program:
   a. Initial training requirements for Site workers and supervisors.
   b. Exceptions to initial training requirements.
   c. Site briefings for visitors and workers.
   d. Refresher training requirements.
   e. Certification of training for all Contractor and Subcontractor employees assigned to the Project.
6. Medical Surveillance Program:
   a. Provisions of the Site medical surveillance program.
   b. Communication protocols between the Site, physicians, and workers.
   c. Medical recordkeeping procedures.
   d. Certification of medical clearance for all Contractor and Subcontractor employees assigned to the Project.
7. Personal Protective Equipment (PPE):
   a. PPE selection criteria.
   b. Site- and task-specific PPE ensembles.
   c. Training in the use of PPE.
   d. Respiratory protection.
   e. Hearing conservation.
   f. PPE maintenance and storage.
8. Exposure Monitoring Program:
   a. Monitoring procedures to detect the presence of hazardous substances.
   b. Monitoring procedures to determine worker exposures to hazardous substances and physical hazards.
   c. Action levels and required responses for known and expected hazardous substances and physical hazards.
   d. Calibration and maintenance procedures for monitoring equipment.
9. Heat stress prevention program.
10. Cold stress prevention program.
11. Man overboard plan:
   a. Emergency response procedures for a man overboard situation.
   b. Personnel responsibilities and training.
   c. Frequency and scope of man overboard drills.
12. Abandon ship plan:
   a. Potential scenarios that may require an abandon ship situation.
   b. Emergency response procedures for an abandon ship situation.
   c. Personnel responsibilities and training.
   d. Frequency and scope of abandon ship drills.
13. Safe lifting program.
14. Spill containment program. Comply with Section 013543- Environmental Protection Procedures.
15. Decontamination Program:
   a. Location and type of temporary decontamination facilities.
   b. General and specific decontamination procedures for personnel and PPE.
   c. General and specific decontamination procedures for equipment and vehicles.
   d. Disposal of residual waste from decontamination.
   e. Decontamination equipment and materials.
   f. Monitoring procedures used to evaluate the effectiveness of decontamination.
16. Emergency Response Plan:
   a. Potential emergencies that may occur at the Site.
   b. Pre-emergency planning.

c. Onsite emergency response equipment, materials, and PPE.
d. Emergency Maps: Evacuation routes, gathering points, and route to nearest hospital.
e. Emergency roles and responsibilities.
f. Emergency alerting and evacuation procedures for Site personnel.
g. Procedures for notifying, and list of emergency contact information for:
    1) Emergency responders, including fire officials, ambulance service, poison control, police, and local hospitals.
    2) Authorities having jurisdiction.
    3) Owner, Construction Manager, and Engineer.
    4) Contractor's project manager, Site superintendent, safety representative, and foreman.
    5) Other entities, as required.
h. Emergency response procedures.
i. Emergency decontamination, medical treatment, and first-aid.
j. Emergency response training.

17. Confined space entry program. Describe procedures for confined space entry in accordance with OSHA's Confined Space Standard.
18. Other standard operating procedures applicable to the Work.

C. Submittal Procedure:
1. Submit HASP to Engineer the sooner of: seven days prior to pre-construction conference, or 30 days prior to Contractor's scheduled mobilization to the Site.
2. Engineer's review and acceptance of HASP will be only to determine if the topics covered in HASP comply with the Contract Documents. Engineer's review and acceptance will not extend to safety measures, means, methods, techniques, procedures of construction, or whether representations made in the HASP comply with Laws and Regulations, or standards of good practice.
3. Do not perform Work at the Site until written HASP has been accepted by Engineer.
4. Notwithstanding other provisions of the Contract Documents, changes in the Contract Price or Contract Times will not be authorized due to delay by Contractor in developing, submitting, or revising the HASP.

1.05 ACCIDENT REPORTING AND INVESTIGATION

A. Immediately notify Construction Manager and Engineer of all accidents that:
1. Result in bodily injury, illness, or property damage.
2. Affect the environment.
3. Involve the public.

B. Submit accident report to Construction Manager and Engineer within 24 hours after accident occurs. Include in each report the following:
1. Date, time, and location of accident.
2. Names of all Site personnel involved in or affected by accident.
3. Description of accident and activities being performed when accident occurred.
4. Medical treatment administered, if any.
5. Nature and seriousness of injury or damage.
6. Other information requested by Owner to complete Owner's incident analysis.

C. Comply with 29 CFR 1904.29, including using OSHA 300, 300-A, and 301 forms (or equivalent) to document all accidents that result in bodily injury.

D. Based upon results of accident investigation, modify HASP as required by changing tasks or procedures to prevent reoccurrence of accident.

E. Post current copy of Contractor's OSHA 300-A report at conspicuous place at the Site from February 1 through April 30 of each year.

1.06 DAILY HEALTH AND SAFETY FIELD REPORTS

A. Prepare daily health and safety field reports throughout the Project. Include in each report, at a minimum, the following:
   1. Contractor's name.
   2. Owner's name.
   3. Project name.
   4. Site name and location.
   5. Date and day of the week.
   6. Weather conditions.
   7. Delays encountered in construction.
   8. Copy of daily job safety briefing form.
   9. Acknowledgment of deficiencies noted along with corrective actions taken on current and previous deficiencies.
   10. Daily health and safety exposure monitoring results, documentation of instrument calibration, new hazards encountered, and PPE utilized.
   11. Problems, real or anticipated, encountered during the Work that must be brought to the attention of Construction Manager and Engineer.
   12. Deviations from planned Work described in previously submitted daily health and safety field report(s).

B. Submit daily health and safety field reports to Construction Manager and Engineer by 10:00 a.m. the next working day after the day covered in the associated report. Daily reports shall be signed by Contractor's safety representative.

1.07 RECORDS

A. Retain at the Site complete and accurate health and safety records for all Contractor and Subcontractor employees assigned to the Project. Records shall include, at a minimum, the following:
   1. Valid Training Certificates:
      a. Initial 40-hour HAZWOPER training.
      b. Initial 24-hour HAZWOPER training.
      c. Eight-hour HAZWOPER supervisor training.
      d. Annual eight-hour HAZWOPER refresher training.
      e. 10-hour construction safety training.
      f. First-aid/cardiopulmonary resuscitation training.
      g. Other training required by Contractor's HASP.
   2. Valid Merchant Mariner Credentials.
   3. Valid medical clearance certificates.
   4. Valid respirator fit test certificates.
   5. Accident reports prepared in accordance with Article 1.05 of this Section.
   6. Daily health and safety field reports prepared in accordance with Article 1.06 of this Section.
   7. Other records required by Laws and Regulations.

B. Keep records up to date throughout the Project.

C. Contractor's safety representative shall meet at least monthly with Construction Manager and Engineer to review Contractor's health and safety records and verify compliance with this Section.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

- END OF SECTION -

SECTION 013543

ENVIRONMENTAL PROTECTION PROCEDURES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified
1. The Contractor shall manage potential environmental impacts in conformance with applicable laws and regulations, during and as the result of this Project. For the purpose of this section, environmental impacts are defined as the presence of chemical, physical, or biological elements or agents that adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to man; or degrade the utility of the environment for aesthetic and/or recreational purposes.
2. The control of environmental pollution requires consideration of air, water, and land, and involves management of noise and solid waste, as well as other pollutants.
3. Schedule and conduct all work in a manner that shall minimize the erosion of soils and sediments in the area of the work. Provide temporary erosion and sedimentation control measures as required to prevent silting and muddying of existing and new drainage systems, streams, rivers, impoundments, etc.
4. Mitigate potential disturbance to the existing ecological balance between a water resource and its surroundings.

B. Related Work Specified Elsewhere
1. Section 011100 – Summary of Work
2. Section 013100 – Project Management and Coordination
3. Section 013529 – Contractor’s Health and Safety Plan
4. Section 013549 – Community Air Monitoring Plan
5. Section 014100 – Regulatory Requirements
6. Section 312323 - Selected Fill
7. Section 329000 - Site Restoration
8. Section 352023 - Dredging and Subaqueous Backfill
9. Section 044000 - Water Handling and Disposal

1.02 APPLICABLE REGULATIONS

A. Comply with all applicable Federal, State, and local laws and regulations concerning environmental pollution control and abatement. Contractor shall also comply with all permits obtained for the project.

1.03 NOTIFICATIONS

A. The Owner will notify the Contractor of any detected non-compliance with the foregoing provisions or of any environmentally objectionable acts and corrective action to be taken. State or local agencies responsible for verification of certain aspects of the environmental protection requirements may also provide notification of any non-compliance with State or local requirements. After receipt of such notice, the Contractor shall immediately take corrective action. If the Contractor fails or refuses to comply promptly, the Owner may direct the Contractor to stop all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made the subject of a claim for extension of time or for excess costs or damages by the Contractor.

1.04 SUBMITTALS

A. The Contractor shall prepare and submit a Dust Control Methods Plan (as part of his or her Operations Plan prepared in accordance with Section 011100 – Summary of Work, or as a separate document) to detail the specific methods of dust control/suppression, and shall submit to the Engineer for review prior to mobilization.

B. The Contractor shall prepare and submit an Erosion and Sedimentation Control Plan (ESCP; as part of his or her Operations Plan prepared in accordance with Section 011100 – Summary of Work, or as a separate document), and shall submit to the Engineer for review, product information for temporary seeding, silt fencing, temporary erosion control matting, rolled erosion control material (RECM), oil absorbent booms/pads, and any other necessary erosion control material prior to mobilization. In addition to the above, the ESCP shall require the following information:
1. Planned location and alignment of the required features
2. Anticipated stormwater flow direction
3. Minimum dimensions/sizes
4. Inlet or outlet conditions

C. The Contractor shall prepare and submit a Turbidity and Sheen Control Methods Plan (as part of his or her Operations Plan prepared in accordance with Section 011100 – Summary of Work, or as a separate document) to detail the specific methods of turbidity/re-suspension and sheen control. The Turbidity and Sheen Control Methods Plan shall address proactive turbidity and sheen control measures such as work sequencing, operational procedures and work rates, and use and disposal containment booms and sorbent booms/pads, including proposed product information. Information shall include, but not be limited to, the following:
1. A description of best management practices that will be implemented to minimize the generation of suspended solids in the water column during dredging and backfilling operations.
2. A description of best management practices that will be implemented to minimize the migration of any sheens on the water surface during the in-water work activities.
3. A description of the physical barrier control system (i.e., nearshore and moon pool turbidity curtains) that will be used to manage turbidity and sheen generation during in-water work (e.g., dredging, backfilling, and sheet pile operations).
4. Boundary/perimeter containment boom installation plan, including manufacturer and vendor information, proposed alignment, method of attachment/anchoring, and inspection requirements.
5. Oil absorbent boom installation plan, including type of absorbent boom/pad, manufacturer and vendor information, proposed alignment, method of attachment/anchoring, and inspection requirements, as necessary, to meet the performance criteria.
6. Description of sheen control crew equipment and monitoring procedures.
7. Contingency measures if elevated turbidity readings are noted at the downstream monitoring location. Contingency measures may include, but are not limited to, modification to dredge operation, such as fall height, cycle time, bucket handling procedures, or use of a rinse tank.
8. Contingency measures if sheens are observed. Contingency measures may include modification of containment system and deploying additional sorbent booms and pads.
9. Type and deployment plan for sorbent booms or sorbent pads, as necessary, to meet the performance criteria in Part 3 of this Section.

D. The Contractor shall also submit the following details as part of the Operations Plan (prepared in accordance with Section 011100 – Summary of Work) before construction and maintenance of temporary erosion, sedimentation, and dust control measures:
   1. Provide a site plan for the Work Area, including all improvements; areas of disturbance; areas that will not be disturbed; existing vegetation; onsite and adjacent offsite surface water(s), wetlands and drainage patterns that could be affected by the construction activity; and location(s) of material or equipment storage areas.
   2. Provide a construction phasing plan describing the intended sequence of construction activities, including clearing and grubbing, site preparation, utility and infrastructure installation, and any other activity at the Site that results in soil disturbance.
   3. Provide a description of the pollution prevention measures that will be used to control litter, construction chemicals, and construction debris from becoming a pollutant source in potential stormwater discharges from the Site.
   4. Provide a description of construction materials expected to be stored onsite, with updates as appropriate, and a description of controls to reduce pollutants from these materials, including storage practices to minimize exposure of the materials to stormwater, and spill prevention and response.
   5. Describe the temporary and permanent structural and vegetative measures to be used for soil stabilization, runoff control, and sediment control for each stage of the work, from initial land clearing and grubbing to project closeout.
   6. Identify and show on a site map the specific location(s), size(s), and length(s) of each erosion and sediment control practice.
   7. Identify any temporary practices that will be converted to permanent control measures.
   8. Provide an implementation schedule for staging temporary erosion and sediment control practices, including the timing of initial placement and the duration that each practice must remain in place.
   9. Provide an inspection and maintenance schedule, including submittal of weekly inspections and reporting, to ensure continuous and effective operation of the erosion and sediment control practices.
   10. The inspection and maintenance schedule shall include the frequency of required inspections and the names individuals designated to perform the inspections and activities for maintenance and repair of erosion and sediment control features.

E. The Contractor shall develop, implement, and maintain an emergency/spill response plan as part of the Contractor’s Site-specific health and safety plan prepared in accordance with Section 013529 – Contractor’s Health and Safety Plan. Response plan shall include, at a minimum, the following:
   1. Description of equipment and materials available at the Site to contain a spill of, or respond to an emergency related to, the material.
   2. Procedures for notifying, and list of emergency contact information for:
      a. Authorities having jurisdiction.
      b. Emergency responders.
      c. Contractor’s project manager, Site superintendent, safety representative, and foreman.
      d. Owner, Construction Manager, and Engineer.
      e. Other entities as required.
   3. Response coordination procedures between Contractor, Owner, and others as appropriate.
   4. Site plan showing proposed location of Hazardous Materials storage area, location of fuel storage area(s), location of fueling location(s), location of spill containment/response equipment and materials, and location of storm water drainage inlets and drainage routes.

5. Description of Hazardous Material handling and spill response training provided to Contractor's and Subcontractors' employees, in accordance with 29 CFR 1926.21(b) and other Laws and Regulations.

1.05 REFERENCES

A. NYSDEC. November 2016. New York Standards and Specifications for Erosion and Sediment Control.

1.06 IMPLEMENTATION

A. Prior to commencement of the work, meet with the Construction Manager and Engineer to develop mutual understandings relative to compliance with these provisions.

PART 2 - PRODUCTS

2.01 EROSION AND SEDIMENT CONTROLS

A. Temporary Seeding
   1. If temporary seeding occurs in spring, summer, or early fall: seed shall consist of ryegrass applied at 30 lbs. per acre.
   2. If temporary seeding occurs in late fall or early winter: seed shall consist of certified Aroostook winter rye applied at 100 lbs. per acre.
   3. All temporary seeding shall be covered with straw or hay mulch at a rate of two tons/acre or hydromulched in accordance with the seed supplier's recommendations.

B. Temporary Erosion Control Mat
   1. Temporary erosion control mat shall consist of a 100% straw fiber matrix sewn between two lightweight biodegradable polypropylene nets, such as North American Green S-150BN, or equivalent, and shall be installed in accordance with the manufacturer's installation guidelines.

C. Rolled Erosion Control Materials (RECM)
   1. RECM shall be a minimum of 12 inches in diameter (Filtrexx SiltSoxx or equivalent) and meet the following requirements:
      a. Sock fabric shall be 5 mil HDPE mesh with a mesh opening of 3/8-inch and be made of HDPE (5 mil) and meet manufacturer's material recommendations.
      b. Infill shall be well decomposed (matured at least 3 months), weed-free, organic matter. Infill shall be aerobically composted, possess no objectionable odors, and contain less than 1%, by dry weight, of manmade foreign matter.
   2. RECM Support:
      a. Hardwood posts shall be at least 2.0 inches by 2.0 inches in cross section and installed in the middle of the RECM.
      b. In the event staking is not possible, concrete blocks or sand bags shall be used to stabilize the RECM.

2.02 ODOR, VAPOR, AND DUST CONTROLS

A. Vapor Mitigation Agents: Provide the following:
   1. BioSolve Pinkwater, by The BioSolve Company.
   2. AC-645 Long-Duration Foam, by Rusmar, Inc.

B. Water: Clean, potable.

C. Provide pressure washers, pneumatic foam unit, portable tanks, hoses, and other equipment required for the storage and application of vapor mitigation agents and water. Furnish and retain at the Site spare equipment to allow for uninterrupted odor, vapor, and dust control in the event of equipment damage or malfunction.

2.03 RESUSPENSION CONTROL

A. Nearshore Turbidity Curtain
1. A nearshore turbidity curtain, to be described in the Contractor's Turbidity and Sheen Control Methods Plan, including fabrication details, at a minimum shall consist of a bottom-weighted permeable fabric barrier system enclosing the active dredge zone (i.e., point of sediment removal) from the surrounding shallow water work areas.
2. The nearshore turbidity curtain design and configuration shall be reviewed and approved by the Engineer prior to use.

B. Moon Pool Turbidity Curtain
1. A moon pool turbidity curtain, to be described in the Contractor's Turbidity and Sheen Control Methods Plan, including fabrication details, at a minimum shall consist of a bottom-weighted permeable fabric barrier system enclosing the active dredge zone (i.e., point of sediment removal) from the surrounding the deep water work area.
2. The moon pool turbidity curtain design and configuration shall be reviewed and approved by the Engineer prior to use.

2.04 SHEEN CONTROLS

A. Boundary/Perimeter Containment Boom
1. Containment boom curtains shall be a pre-assembled system (ChemTex Inc. OILM097 or equivalent) comprised of the following:
   a. Float: 6-inch close cell foam float.
   b. Skirt: 12-inch PVC skirt.
   c. Tension Cable: 5/16-inch diameter galvanized top tension cable.
   d. Ballast: 5/16-inch galvanized chain ballast.
   e. Connector: Aluminum universal connector.
2. Requirements for anchor types and locations are site-specific. The number of locations is dependent on the Contractor's alignment of the ensuing containment, exterior currents, size of project, etc. Contractor shall design and install an anchoring system to properly secure the containment boom system.

B. Oil Absorbent Boom
1. The absorbent boom shall be a minimum of eight inches in diameter (ChemTex Inc. B8 or equivalent) and filled with highly sorbent polypropylene capable of absorbing up to 65 gallons of oil. Absorbent booms shall include built-in connectors to allow linking of booms together.

C. Oil Absorbent Pad
1. Oil absorbent pads shall be ChemTex Inc.SW100 or equivalent. Pads shall be composed of highly sorbent polypropylene fibers and include reinforced nylon straps to allow for towing capabilities.
2. Other commercially available absorbent materials suitable for the collection of oils/sheens may be used upon review by the Engineer and approval by Owner.

PART 3 - EXECUTION

3.01 GENERAL

A. The Contractor shall meet or exceed the requirements of all environmental legislation and regulations, including all amendments in force for the duration of the work, in accordance with Section 014100 – Regulatory Requirements.

B. At the pre-construction meeting (refer to Section 013100 – Project Management and Coordination), the Construction Manager, Engineer, and Contractor will discuss the Contractor's operations to develop mutual understandings relative to the administration of the environmental protection program.

C. During the work, all activities, including those of subcontractors, shall be supervised to ensure compliance with the intent and details of the ESCP. The Contractor shall instruct its employees and subcontractors to assure that all personnel working at the site are able to recognize the environmental protection provisions as they pertain to the Site. All equipment and materials for environmental protection shall be inspected before use and after use to ensure that they are in proper order and have not deteriorated.

3.02 EROSION AND SEDIMENTATION CONTROLS

A. Land-based erosion controls shall be installed during site preparation activities and shall be completed prior to any land disturbance or clearing activities.
   1. RECMs shall be installed onsite at locations downgradient of Work Areas and as shown on the Design Drawings or modified by the Construction Manager in the field, or as otherwise deemed necessary by the Contractor. The RECMs shall be installed in accordance with manufacturer’s instructions. These erosion and sediment control measures shall be used as appropriate, and as specified herein and in the Design Drawings, or as modified as necessary by the Contractor or Construction Manager.

B. Contractor shall inspect and maintain all erosion and sedimentation controls in accordance with the Project’s Storm Water Pollution Prevention Plan, provided as Appendix E of the RD.
   1. Periodic inspections shall be performed by Contractor’s qualified inspector at a minimum of once every seven calendar days and after wet weather events to verify effectiveness and integrity of erosion and sedimentation controls.
   2. Any deficiencies observed during the inspection, and any maintenance activities or corrective actions required to address those deficiencies, shall be communicated to the Construction Manager within one working day after the inspection.
   3. Maintenance activities and corrective actions shall be initiated within two working days of the inspection and completed before the next scheduled inspection. If site conditions prevent the maintenance activities or corrective actions from being completed before the next scheduled inspection, the maintenance activities/corrective actions shall be completed as soon as site conditions permit.

C. The Owner, Construction Manager, or Engineer may order additional sediment and erosion controls to be installed. The Contractor shall comply with the request and immediately install the required controls.

3.03 PROTECTION OF SURFACE WATERS

A. Take all precautions to prevent, or reduce to a minimum, any damage to surface water from pollution by debris, sediment, or other material, or from the manipulation of equipment and/or materials within/adjacent to such channels/streams or other water bodies.

B. The Contractor shall store sorbent booms, pads or skimmers, and other absorbent materials onsite for regular use to collect and retain oils, grease, and other potentially hazardous substances that accumulate on the water surface during dredging. Refer to Article 3.09 of this Section for additional details.

C. Do not discharge water from operations directly into any live or intermittent stream, channel, wetlands, surface water or any sanitary or storm sewer. All water generated during the course of and as a result of construction and demobilization activities shall be handled and treated in accordance with Section 444000 and all applicable local and State regulations.

D. The application of any type of surfactants to the river to control accumulated oil and/or sheen is not permitted.

3.04 PROTECTION OF LAND RESOURCES

A. Restore affected land resources within/adjacent to the Project Work Limits to a condition that shall appear to be natural and not detract from the appearance of the Project, unless otherwise indicated herein. Confine all activities to the Project Work Limits or other areas authorized by the Owner or Construction Manager.

B. All scars made on trees by equipment, construction operations, or by the removal of limbs larger than one inch in diameter shall be coated as soon as possible with an acceptable tree wound dressing. All trimming or pruning shall be performed by experienced workmen.

C. The Contractor shall remove all evidence of temporary construction facilities such as work areas, structures, stockpiles of excess or materials, or any other vestiges of construction as directed by the Owner, Construction Manager, or Engineer. The disturbed areas shall be restored as described in Section 329000 – Site Restoration, or as approved by the Owner. Final payment will not be made until the environmental protection requirements have been met.

D. All debris and excess material shall be disposed of in an environmentally sound manner.

3.05 PROTECTION OF AIR QUALITY

A. General:
   1. The Contractor shall implement and adhere to the requirements of the Section 013549 - Community Air Monitoring Plan and recognize that precautions may be required for dust/vapor/odor control. The Contractor shall summarize the air monitoring data in the daily and weekly progress reports, and shall make all data available to the Owner, Construction Manager, and Engineer upon request.

B. Dust Control
   1. Maintain all disturbed areas, embankments, stockpiles, access roads, and all other work areas within or outside the Project Work Limits free from dust that could cause action level exceedances.

2. Dust control methods consisting of wetting or other similar methods will be permitted. The use of petroleum products is prohibited.
3. Wetting must be repeated at such intervals as to keep all parts of the disturbed areas at least damp at all times, and the Contractor shall have sufficient competent equipment on the job to accomplish this. Dust control shall be performed as the work proceeds, based on site conditions, work activities, and/or as directed by the Owner, Construction Manager, or Engineer.
4. Appropriate dust control measures include the following:
   a. Excavating, loading, handling, and backfilling materials in a manner that minimizes dust generation;
   b. Periodic removal of dirt/debris from active vehicle transportation routes;
   c. Spraying water on access roads and surfaces;
   d. Spraying water on disturbed areas, material stockpiles, buckets during materials handling and capping activities, and sediments when loading transport vehicles and/or barges;
   e. Spraying water on stockpiles;
   f. Hauling excavated materials and clean backfill materials in properly tarped vehicles;
   g. Restricting vehicle speeds; and
   h. Covering disturbed areas and stockpiles with a layer of polyethylene sheeting (anchored appropriately to resist wind forces) after work activities cease for the day and when not actively using the stockpiles.
5. The Contractor shall make a source of water (e.g., water tank truck) available at the Site. The Contractor shall be responsible for maintaining, in the immediate vicinity of the work, a supply of water and means of dispersion (e.g., a water tank and sprayer) such that water may be applied for dust control immediately as required. If the dust control measures being utilized by the Contractor do not reduce particulate concentrations to acceptable levels, based on visual observations or the results of airborne particulate monitoring, all dust generating activities must be suspended until the Contractor develops appropriate corrective measure(s) to remedy the situation. Under no circumstances shall treated water or river water be used for dust suppression.
6. If the Contractor’s methods of controlling dust do not reduce particulate concentrations to acceptable levels, based on visual observations and/or the results of airborne particulate monitoring, all dust generating activities shall be suspended until appropriate corrective actions are taken by Contractor to remedy the situation to Construction Manager’s and Engineer’s satisfaction. Owner will not be liable for any expense or delay resulting from Contractor’s failure to control dust in accordance with this Section.

C. Odor Control
1. Odors shall be controlled to the satisfaction of the Owner, Construction Manager, Engineer, and the NYSDEC.
2. Mobilize vapor mitigation agents and means of storage and dispersion at the Site before initiating any ground-intrusive Work, dust-generating Work, or dredging Work.
3. Application of vapor mitigation agents shall be as follows when required to control odors:
   a. BioSolve Pinkwater:
      1) Prepare three-percent solution of BioSolve Pinkwater concentrate and water. Apply to exposed dredged material (e.g., in transport barges) using backpack sprayers, power washers, or misters.
      2) Apply when actively handling dredged materials, and as directed by Owner, Construction Manager, or Engineer.
   b. AC-645 Long-Duration Foam:
      1) Prepare 13-percent solution of AC-645 Long-Duration Foam concentrate and water. Apply to uncovered stockpiles of dredged materials outside the temporary

enclosure using pneumatic foam unit. Completely and uniformly cover exposed soil surfaces with minimum three inches of foam.

2) Apply before each work break, at the end of each workday, and as directed by Owner, Construction Manager, or Engineer.

4. The Contractor shall have a minimum of one spare photoionization detector (PID) available to use in response to odor complaints, if any.

3.06 NOISE CONTROL

A. The Contractor shall make every effort to minimize noises caused by the construction operations. Equipment shall be equipped with silencers or mufflers designed to operate with the least possible noise in compliance with Federal, State, and local noise ordinance regulations.

B. The Contractor shall provide and use devices that will minimize noise levels in construction areas to safe and tolerable limits as set forth by the Occupational Safety and Health Administration, the United States Environmental Protection Agency, and the New York State Industrial Code Guidelines and Ordinances.

C. In the event of a noise complaint, the noise level will be monitored by the Construction Manager and mitigation contingencies shall be implemented by the Contractor.

3.07 SPILLS

A. The Contractor shall be prepared at all times to control, contain, intercept, clean up, and dispose of any spillage that may occur whether on land or water.

B. The Contractor shall exercise care in handling of fuels to minimize the potential for fuel spills.
   1. Equipment shall not be fueled while operating.
   2. The Contractor shall use secondary containment whenever possible to prevent or control spills of fuels, lubricants, or other materials from entering the waterway. The Contractor shall conduct refueling and maintenance of land-based equipment in the staging area.

C. The Contractor shall keep all material required for cleanup of spillages readily accessible onsite at a minimum near each of the following locations:
   1. On-water sediment removal activities
   2. At locations where sheet pile installation occurs
   3. On-shore near material handling operations
   4. At locations where refueling and maintenance occurs (water- and land-based)
   5. With spill response crew

D. The Contractor shall immediately contain and cleanup spills including but not limited to fuel, hydraulic fluids, and contaminated water, in accordance with regulatory requirements.

E. The Contractor shall report immediately any and all spills to the Construction Manager. The Construction Manager will notify the Engineer, Owner, and, as necessary, the appropriate state and federal agencies.

F. The Contractor is responsible for any cleanup or repair resulting from any spills at no additional cost to the Owner.

3.08 HANDLING OF DREDGED MATERIALS

A. Excavation, filling, pumping, towing, hauling, disposal, and dumping operations for dredging shall employ such methods and equipment to ensure minimum loss of materials into waterways, in accordance with Section 028100 – Transport and Disposal of Impacted Materials and Section 352023 – Dredging and Subaqueous Backfill.

3.09 TURBIDITY AND SHEEN CONTROL

A. Resuspension Control Measures
   1. The Contractor shall perform intrusive in-water work within the confines either a nearshore and moon pool turbidity curtain systems to control resuspension, depending on position within the river (i.e., shallow or deep water). Intrusive in-water work includes installation of sheet piles and sediment dredging. Debris removal operations will be excluded from in-water work requiring the use of the turbidity curtain system due to the irregular shape and nature of submerged debris and subsequent potential for entanglement. The turbidity curtain system shall be inspected at minimum once per shift or once daily, whichever is more frequent, and repaired as necessary.

B. Sheen Control Measures
   1. Contractor shall have sufficient sheen response personnel, absorbents, booms, boats and all other necessary equipment onsite to implement the sheen control measures described herein and respond to observed sheens.
   2. Prior to the start of any intrusive in-water work activities (e.g., debris removal, sheet pile installation, or dredging), the Contractor shall install two floating boundary/perimeter containment booms with skirts, one each nominally upstream and downstream of the in-water work area. In addition, an oil absorbent boom shall be installed on the interior side of the containment boom to capture any contained sheen.These booms shall be inspected at minimum once per shift or once daily, whichever is more frequent, and replaced as necessary. Increase inspection frequency may be necessary based on site conditions and observations made of the booms during previous inspections.
      a. The initial set up of areas for dredging and debris removal operations shall include deployment of a containment boom, oil absorbent boom, and absorbent materials. Containment booms, absorbent booms, and absorbent materials shall be deployed in proximity to each operation unless otherwise approved by the Construction Manager. The absorbent boom and absorbent material shall extend for the same length as the containment boom and shall be located on the side of the containment boom closest to the operation.
      b. Sheet pile installation, debris removal, and dredging operations shall not be allowed until booms and absorbent materials have been deployed.
      c. Containment booms and absorbent booms shall be maintained in proper position for the duration of in-water work, except as necessary to allow vessels access. Prior to opening the booms and absorbent materials, the Contractor shall visually inspect the opening for the presence of sheens. If sheens are observed, sweep and/or actively collect the sheens in accordance with this Section. If the materials must be moved to facilitate access, the time when the booms and absorbent materials are open shall be kept to an absolute minimum and be closed immediately after the vessel(s) passes.
   3. Contractor shall provide a boat and crew dedicated to performing sheen inspection and control measures onsite during intrusive in-water activities (e.g., sheet piling installation, dredging). The sheen control crew shall:
      a. Inspect in-water work areas and surrounding waters at least every two hours during intrusive activities.

b. Immediately notify the Construction Manager when oil/sheens are observed on the water surface. Document the date; time; operations being conducted; control and absorbent materials in place and their condition; and the location, extent, and visual characteristics of the observed sheen.
c. Immediately respond to sheens reported by site personnel.
d. Visually inspect booms and absorbent materials currently deployed to confirm that the materials are in a position that will intercept and control the sheen. If the booms and absorbent materials are not in position to intercept or control the sheen, the sheen response team shall immediately reposition the materials or deploy additional boom and/or absorbent materials.
e. Immediately deploy additional oil containment booms, oil absorbent booms, and oil absorbent pads as necessary to contain all sheens observed in areas where booms and absorbent materials have not been deployed.
f. Adjust the booms and absorbent materials so as to maximize the potential to control the sheens.
g. Review areas downstream for evidence of sheens. If additional sheens are found, additional measures shall be implemented in an effort to control those sheens.
h. Sweep areas where sheens are observed with absorbent material if necessary, to minimize escape of sheens downstream.

4. Oil absorbent booms shall be attached to the operating barge prior to beginning intrusive water work and replaced as necessary to control sheens.
   a. The oil absorbent boom shall be placed such that there are no gaps to allow the potential migration of oil/sheens outside the boom. The oil absorbent boom shall be maintained and changed out, as appropriate, to ensure no release of oil/sheens outside the boom.
   b. The Contractor shall maintain and replace oil absorbent booms/pads as necessary to prevent the potential migration of oils/sheens beyond the boom.
5. If sheens are observed to have collected behind containment boom or other stationary locations, the Contractor shall actively collect the sheens and any other floating debris in contact with the sheens. The Contractor shall proceed with the active collection of sheens promptly after observation. Active collection shall be conducted within the Work Areas and areas downstream based on flow direction. The active collection shall be deemed complete at an active collection location when the observed sheen and other associated floating debris in contact with the sheen have been removed from that location.
6. Spent sorbent media shall be collected, containerized, and disposed of in accordance with Section 028100 – Transport and Disposal of Impacted Materials.

C. Turbidity Control and Contingency Measures

1. The Contractor shall implement the following practices and operational controls intended to minimize resuspension of sediment during all in-river operations (i.e., dredging; sheet pile installation; transport of dredged material; vessel movement; and backfill placement):
   a. Minimizing the number of bucket bites in any given dredge location.
   b. To the extent possible, complete closing of the dredge bucket before it is lifted from the river bottom, unless prohibited by debris.
   c. Moving buckets continuously and in the most efficient path to the scow once the bucket breaks the water surface.
   d. Not re-handling or stockpiling of material on the river bottom.
   e. Not using the dredge bucket to drag sediment on the river bottom.
   f. Minimizing the number of attempts to remove debris.
   g. Prohibiting raking for debris removal.
   h. Not grounding barges or other project vessels. Allowing water levels to rise before attempting to free grounded vessels.

i. Conducting tow boat operations in a location or manner to minimize resuspension due to prop-wash.
j. Not misplacing dredged materials.
k. Limiting tugboat or push boat engine revolutions per minute (RPMs) (except in emergency situations) in shallow water areas to minimize resuspension due to prop-wash.

2. The Contractor shall implement additional controls as necessary based on results of turbidity monitoring as discussed in Paragraph 3.09.D.3 of this section.

D. Quality Assurance

1. The Contractor shall be responsible for coordinating construction efforts with any monitoring that occurs within and outside of the dredging areas.
2. Sheen monitoring shall be performed by Contractor as required by Paragraph 3.09.B of this section.
3. Turbidity monitoring equipment will be supplied by the Engineer. The Contractor shall assist the Engineer with deploying and installing the turbidity monitoring equipment. Data collected by the Engineer will be provided to the Contractor so that they are aware of these results. Maintaining operations within the specified water quality requirements is the sole responsibility of the Contractor. Turbidity monitoring will be performed by the Engineer as follows:
   a. At each monitoring location, turbidity will be monitored in real time using a turbidity monitoring system, consisting of the following main components: data station, turbidity sensor, submersible data-logging system, and computer software. Turbidity levels will be measured using International Organization for Standardization 7027 method and reported in nephelometric turbidity units (NTUs).
   b. Turbidity levels will be logged a minimum of every 15 minutes and transmitted a minimum of every 30 minutes. The Engineer will inform the Contractor of any exceedances of target turbidity levels and discuss the ensuing actions including (but not limited to): review of the ongoing activities, modification of methods and/or rates, modification of the condition or performance of the existing control measures, temporarily suspending work.
   c. The evaluation of turbidity control criteria will consider the state of the tidal cycle. The performance criterion for turbidity is to limit turbidity below target levels at the monitoring station(s) located in the Hudson River upstream and downstream of the Project Work Limits. Turbidity action levels to be monitored and recorded by the Engineer are as follows:

$$\text{Turbidity}_{\text{Downstream}} \geq \text{Turbidity}_{\text{Upstream}} + 50 \text{ NTUs.}$$

   d. Continued exceedance of the turbidity criteria (4 or more consecutive readings) will require modifications to the Contractor’s operations, such as slowing bucket movement and/or only dredging at slack tide. Such determinations will be made by the Construction Manager in cooperation with the Contractor.

E. Visual Turbidity Monitoring

1. The intrusive in-water work will be visually monitored for distinct turbid plumes outside the limits of the turbidity curtain system. The visual monitoring of turbidity will be based on substantial visual contrast to natural conditions (6 CRR-NY 703.2) and performed over the course of the workday.
2. The Contractor shall implement corrective measures as necessary based on the observation of distinct turbid plumes outside the limits of the turbidity curtain system as discussed in Paragraph 3.09.C.1 of this section.

F. Maintenance and Inspections
   1. If deployed, oil absorbent booms shall be visually inspected from a boat during installation and at least daily during construction activities. Additional inspections shall be conducted at the Contractor's discretion and/or at the request of the Owner, Construction Manager, or Engineer following high-wave/flow periods, noticeable turbidity increases, unexpected absorbent boom position/behavior, contact of the boom by equipment or debris, icing conditions, or other abnormal events.
   2. Oil absorbent booms shall be maintained in proper working order during construction activities. Any torn, damaged, or otherwise ineffectively functioning sections of the oil absorbent booms identified during routine inspections shall be promptly repaired or replaced by the Contractor, as necessary, to maintain the performance objectives.

3.10 CLEANING EQUIPMENT AND COMPLETION

A. The Contractor shall decontaminate equipment in accordance with Section 028100 – Transport and Disposal of Impacted Materials.

B. The Contractor shall not clean equipment in streams, harbors, or any other water body.

C. The Contractor shall clean all construction equipment prior to entering public roadways.

D. The Contractor shall clean all equipment in the designated staging area and not in locations where debris can enter sewers, watercourses, or any other water body.

3.11 PROHIBITED CONSTRUCTION PROCEDURES

A. Prohibited construction procedures include, but are not limited to, the following:
   1. Burning of waste materials, rubbish, or other debris shall not be permitted on or adjacent to the Site.
   2. Dumping of spoil material into any drainage way, any surface waters, or at unspecified locations.
   3. Pumping of silt-laden water from staging areas into any drainage way or any stream corridors.
   4. Damaging vegetation beyond the extent necessary for construction.
   5. Disposal of trees, brush, and other debris in any stream corridors, drainage ways, or at unspecified locations.

3.12 GREEN REMEDIATION PRACTICES

A. The following specific procedures and protocols shall be adopted during implementation, where feasible:
   1. Use of solar powered monitoring equipment and/or battery chargers.
   2. Substitute recycled materials (e.g., paper, lubrication oil) for virgin materials.
   3. Recycle all non-contaminated debris and construction waste at a site (asphalt, metals, etc.).

B. The Contractor shall execute remediation activities to minimize the potential for negative impacts on the environment through implementation of best management practices (BMPs). Examples of such BMPs include:
   1. Minimizing access routes into the work areas and maintaining designated vehicular traffic routes onsite to protect ecosystems.

2. Limiting, where practical, the "footprint" of equipment staging material processing areas, remediation areas, and field offices. The footprint shall be restored to original condition upon completion of the project.
3. Collection and onsite treatment of all potentially impacted wastewaters encountered during operations.
4. Maintaining pollution prevention and waste minimization programs from initiation of mobilization activities to project close out.
5. Inspecting onsite equipment on a daily basis for clean operation.
6. Maintaining good site housekeeping practices.
7. Utilization of low emission diesel equipment and fuel.
8. Reducing project emissions by minimizing idle time for equipment by shutting down equipment not being actively used.
9. Using environmentally acceptable lubricants for oil-water interfaces, to the extent practicable.

- END OF SECTION -

SECTION 013549

COMMUNITY AIR MONITORING PLAN

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope:
1. Contractor shall provide all labor, materials, equipment, services, and incidentals as specified and required to implement and comply with the Project's Community Air Monitoring Plan (CAMP). The CAMP included as Appendix D to the RD is part of the Contract Documents.
2. Perform community air monitoring on a continuous basis during all ground-intrusive Work or dust-generating Work. Community air monitoring includes:
    a. Real-time air monitoring for volatile organic compounds (VOCs) and particulate matter less than 10 micrometers in diameter (PM10).
    b. Periodic monitoring for project related odors.
3. Perform community air monitoring within areas shown or indicated.
4. Owner will coordinate with property owners and provide access for community air monitoring on private properties.

B. Coordination:
1. Coordinate requirements of this Section with requirements for odor, vapor, and dust control in the Contract Documents.

C. Related Sections:
1. Section 013543 – Environmental Protection Procedures.

1.02 TERMINOLOGY

A. "Dust-generating Work" means any Work with the potential to generate dust. Examples of dust-generating Work include, but are not limited to, the following:
1. Handling dredged material and fill material.
2. Ground-intrusive Work.

B. "Ground-intrusive Work" means any Work performed below the existing level of the ground, or that involves the disturbance of existing earth, regardless of quantity. Examples of ground-intrusive Work include, but are not limited to, the following:
1. Grubbing.
2. Sheet pile installation and removal.
3. Dredging and backfilling.

C. "Perimeter of work area" means the limits of Work, or half the distance to the nearest potential receptor or occupied residential/commercial structure, whichever is less, but in no case less than 20 feet.

D. "Work Area" means any area where ground-intrusive Work or dust-generating Work is being performed.

1.03 QUALITY ASSURANCE

A. Qualifications:
   1. Air Monitoring Technician:
      a. Contractor's air monitoring technician shall have a minimum of five years of direct construction safety or environmental monitoring experience, and appropriate health and safety training in accordance with Laws and Regulations.
      b. Contractor's air monitoring technician shall be present at the Site at all times when Work is being performed and shall be dedicated solely to the implementation of the CAMP.
      c. Responsibilities include, but are not necessarily limited to, the following:
         1) Selecting upwind and downwind monitoring locations and setting up air monitoring stations on a daily basis.
         2) Calibrating air monitoring equipment at frequency recommended by the manufacturer.
         3) Coordinating equipment maintenance and repairs.
         4) Performing hourly or more frequent inspections of air monitoring stations to verify proper function.
         5) Performing regular perimeter checks of the work area to monitor for odors.
         6) Removing air monitoring stations and downloading VOC and PM10 data from monitoring equipment at the end of each workday.
         7) Managing a database of VOC and PM10 data at the Site.
         8) Preparing and submitting weekly air monitoring reports in accordance with Article 1.05 of this Section.
         9) Preparing and submitting exceedance reports in accordance with Article 1.06 of this Section.
         10) Preparing and submitting daily odor monitoring logs in accordance with Article 1.07 of this Section.
         11) Notifying Construction Manager, Engineer, and appropriate Contractor personnel when alert or action levels are exceeded at downwind monitoring locations, and when odors are noted at the perimeter of the work area.

B. Regulatory Requirements:
   1. Comply with applicable provisions and recommendations of the NYSDEC Technical Guidance for Site Investigation and Remediation (DER-10).

C. Equipment Calibration:
   1. Calibrate air monitoring equipment at frequency recommended by the manufacturer, in accordance with manufacturer's calibration and quality assurance requirements. Document all instrument readings, field reference checks, and calibrations in a dedicated log.
   2. Preventative maintenance and repair of monitoring equipment, if required, shall only be performed by qualified personnel, or authorized representatives of the manufacturer.
   3. Prepare and retain at the Site electronic or written records of all equipment calibrations, preventative maintenance, and repairs. Submit to Construction Manager and Engineer upon request.

1.04 SUBMITTALS

A. Air Monitoring Plan: Submit acceptable plan for implementing the CAMP not less than 21 days before initiating any dust-generating Work or ground-intrusive Work at the Site. Include the following:

1. List of proposed equipment for community air monitoring.
2. Manufacturer's product data, specifications, and installation or operating instructions for community air monitoring equipment, including the following:
   a. Real-time VOC and PM10 monitoring equipment and accessories.
   b. Environmental enclosures and mounting tripods.
   c. Alarms and wireless telemetry system.
3. Manufacturer’s calibration and field quality assurance requirements for real-time VOC and PM10 monitoring equipment.
4. Proposed weekly air monitoring report form.
5. Proposed exceedance report form.
6. Proposed daily odor monitoring log form.

B. Qualification Statements: Submit name and summary of relevant experience for air monitoring technician.

C. Reports:
1. Weekly Air Monitoring Reports: Submit in accordance with Article 1.05 of this Section.
2. Exceedance Reports: Submit in accordance with Article 1.06 of this Section.

D. Data Files: Submit in accordance with Article 1.08 of this Section.

1.05 WEEKLY MONITORING REPORTS

A. Prepare weekly air monitoring reports throughout the Project. Include in each report, at a minimum, the following:
1. Contractor’s name.
2. Owner’s name.
3. Project name.
4. Site name and location.
5. The following for each day that community air monitoring is performed:
   a. Date and day of the week.
   b. General location and brief description of Work performed at the Site.
   c. Daily average concentration of VOCs and PM10 for each air monitoring station.
   d. Daily maximum 15-minute time-weighted average (TWA) concentration of VOCs and PM10 for each air monitoring station.
   e. Exceedances (if any) of the action levels specified in Paragraph 3.01.C of this Section. Provide the following:
      1) Time, location, and 15-minute TWA concentration of exceedance.
      2) Copy of exceedance report, prepared in accordance with Article 1.06 of this Section.
   f. Site plan showing approximate locations of upwind and downwind air monitoring stations at the Site and prevailing wind direction for the day. Note if air monitoring stations were relocated during the day.
   g. Copy of daily odor monitoring log, prepared in accordance with Article 1.07 of this Section.

B. Submit weekly air monitoring reports to Construction Manager and Engineer by 12:00 p.m. the Monday after the week covered in the associated report. Construction Manager will distribute weekly air monitoring reports to:
1. Owner.
2. Construction Manager.
3. Engineer.

4. Contractor.
5. NYSDEC.
6. NYSDOH.
7. Others as appropriate.

1.06 EXCEEDANCE REPORTS

A. Prepare an exceedance report whenever the action levels specified in Paragraph 3.01.C of this Section are exceeded. Include in each report the following:
   1. Contractor's name.
   2. Owner's name.
   3. Project name.
   4. Site name and location.
   5. Date, day of the week, and time of exceedance.
   6. General location and brief description of work being performed at time of exceedance.
   7. Weather conditions at time of exceedance.
   8. For each air monitoring station, 15-minute TWA concentration of VOCs and PM10 at time of exceedance.
   9. Source or cause of exceedance.
   10. Corrective actions taken or to be taken in response to exceedance.
   11. Date and time verbal or written notification was provided to NYSDEC.

B. Submit exceedance reports to Construction Manager and Engineer within 12 hours after an action level exceedance. Construction Manager will distribute exceedance reports within 24 hours after exceedance to:
   1. Owner.
   2. Construction Manager.
   3. Engineer.
   4. Contractor.
   5. NYSDEC.
   6. NYSDOH.
   7. Others as appropriate.

1.07 DAILY ODOR MONITORING LOG

A. Prepare daily odor monitoring logs throughout the Project. Include in each daily log, at a minimum, the following:
   1. Contractor's name.
   2. Owner's name.
   3. Project name.
   4. Site name and location.
   5. Date and day of the week.
   6. Weather conditions.
   7. Time and outcome of each perimeter check.
      a. Note the presence or absence of MGP-related odors at the perimeter of the work area.
      b. Identify the general location(s) along the work area perimeter where MGP-related odors are noticed.
   8. Time and outcome of any odor complaints from the public.

B. Submit daily odor monitoring logs to Construction Manager and Engineer in weekly air monitoring report submittal in accordance with Article 1.05 of this Section.

1.08 DATA MANAGEMENT

A. Maintain a database of VOC and PM10 data files at the Site.
   1. Index VOC and PM10 data files by date, station number, station location (upwind or downwind), and data type (VOC or PM10).

B. Back up data files to disc or portable hard drive on a weekly or more frequent basis.

C. Submit VOC and PM10 data files on a monthly basis throughout the Project. Provide data files electronically in format acceptable to Engineer. Label electronic file with the following information:
   1. Dates covered.
   2. Owner's name.
   3. Project name.
   4. Site name and location.

PART 2 - PRODUCTS

2.01 PERIMETER AIR MONITORING SYSTEM

A. System Description:
   1. Provide complete, integrated perimeter air monitoring system consisting of the following:
      a. Three portable air monitoring stations, each capable of measuring real-time ambient air concentrations of VOCs and PM10, logging air monitoring data, and notifying Site personnel if alert levels or action levels are exceeded.

B. Air Monitoring Stations:
   1. Photoionization Detectors: Direct-reading, data-logging photoionization detector with 10.6 eV lamp. Provide one of the following for each air monitoring station:
      a. MiniRAE 2000.
      b. Or equal.
   2. Aerosol Photometers: Direct-reading, data-logging aerosol monitor. Provide one of the following for each air monitoring station:
      a. MIE DataRAM PDR1000.
      b. Or equal.
   3. Spare Equipment: Provide and retain at the Site the following:
      a. Spare photoionization detectors and aerosol photometers to allow for uninterrupted monitoring in the event of equipment damage or malfunction.
      b. Spare batteries for each photoionization detector and aerosol photometer to allow for continuous real-time monitoring and data-logging for a period of not less than 12 hours.
   4. Environmental Enclosures and Mounting Tripods: Provide portable, weather-tight enclosure and compatible mounting (survey) tripod for each air monitoring station. Environmental enclosures shall provide proper operating conditions for photoionization detectors and aerosol photometers.
   5. Alarms and Wireless Telemetry System: Provide for each air monitoring station audible and visible alarms and wireless telemetry system capable of notifying air monitoring technician in real-time (via handheld radio) if alert levels or action levels are exceeded.
   6. Accessories: Provide equipment calibration kits, sampling inlets, data management software, and other accessories recommended by the equipment manufacturers for the intended application.

PART 3 - EXECUTION

3.01 REAL-TIME AIR MONITORING FOR VOCS AND PM10

A. Air Monitoring Stations
1. Installation:
    a. Deploy air monitoring stations at the start of each workday before any ground-intrusive Work or dust-generating Work is initiated.
        1) Position one air monitoring station at the upwind perimeter of the work area and two air monitoring stations at the downwind perimeter of the work area. Determine and designate upwind and downwind air monitoring stations based on prevailing wind direction and nature and location of Work to be performed.
        2) Set alarm levels on real-time VOC and PM10 monitoring equipment to respond to 15-minute TWA concentrations at or below the action levels specified in Paragraph 3.01.C of this Section.
        3) Ensure that community air monitoring is being performed before initiating ground-intrusive Work or dust-generating Work.
    b. Monitor wind direction throughout the day and adjust locations of air monitoring stations if wind direction shifts more than 60 degrees from original upwind direction. Document original upwind and downwind air monitoring stations, and any changes made to monitoring locations during the day.
2. Protection:
    a. Protect air monitoring stations from damage due to construction operations, weather, and vandalism.
    b. Immediately remove from service, and replace at Contractor’s expense, damaged equipment.
3. Removal:
    a. Remove air monitoring stations at the end of each workday, and only after all ground-intrusive Work or dust-generating Work has been completed for the day.
    b. Download VOC and PM10 data from air monitoring stations at the end of each day.

B. Alert Levels and Response:
1. Alert Levels:
    a. VOCs: 15-minute TWA concentration at downwind air monitoring station of three parts per million (ppm) above background (upwind) 15-minute TWA concentration.
    b. PM10: 15-minute TWA concentration at downwind air monitoring station of 100 micrograms per cubic meter (ug/m3) above background (upwind) 15-minute TWA concentration, or visible dust observed leaving the work area.
2. Response: Implement the following if alert levels are exceeded:
    a. Notify Construction Manager, Engineer, and appropriate Contractor personnel.
    b. Continue Work and employ additional odor, vapor, and dust controls to abate emissions in accordance with Section 013549 – Environmental Protection Procedures.
    c. Evaluate and, if necessary and appropriate, modify construction techniques.

C. Action Levels and Response:
1. Action Levels:
    a. VOCs: 15-minute TWA concentration at downwind air monitoring station of five ppm above background (upwind) 15-minute TWA concentration.
    b. PM10: 15-minute TWA concentration at downwind air monitoring station of 150 ug/m3 above background (upwind) 15-minute TWA concentration.
2. Response: Implement the following if action levels are exceeded:

a. Stop all Work and immediately notify Construction Manager, Engineer, and appropriate Contractor personnel. Construction Manager will notify the NYSDEC project manager by telephone or e-mail within two hours after the exceedance.
b. Continue monitoring and employ additional odor, vapor, and dust controls to abate emissions in accordance with Section 013549 – Environmental Protection Procedures.
c. Identify the source or cause of the exceedance.
d. Evaluate and, if necessary and appropriate, modify construction techniques.
e. Prepare exceedance report in accordance with Article 1.06 of this Section.
f. Work shall not resume until 15-minute TWA concentrations are below action levels. If the 15-minute TWA concentration of VOCs exceeds 25 ppm above the background (upwind) 15-minute TWA concentration, Work shall not resume until authorized by Owner.

3.02 PERIODIC MONITORING FOR ODORS

A. Perimeter Checks:
1. During work hours, perform routine walks around the entire perimeter of the work area to monitor for odors.
2. Document the time and outcome of each perimeter check in daily odor monitoring log in accordance with Article 1.07 of this Section.
3. Implement the following if odors are noticed at the perimeter of the work area:
   a. Notify Construction Manager, Engineer, and appropriate Contractor personnel.
   b. Continue Work and employ additional odor, vapor, and dust controls to abate emissions in accordance with Section 013549 – Environmental Protection Procedures.
   c. Evaluate and, if necessary and appropriate, modify construction techniques.
   d. Perform more frequent perimeter checks.
   e. If odors persist at the perimeter of the work area, stop Work and notify Construction Manager, Engineer, and appropriate Contractor personnel.
   f. Identify the source or cause of odors.
   g. Evaluate and, if necessary and appropriate, further modify construction techniques and employ additional odor, vapor, and dust controls to abate emissions in accordance with 013549 – Environmental Protection Procedures.
   h. Work shall not resume until authorized by Owner.

B. Odor Complaints:
1. Immediately notify Construction Manager and Engineer of any odor complaints from the public. Construction Manager will notify the NYSDEC project manager by telephone or e-mail within two hours after a complaint.
2. Implement the following in response to an odor complaint:
   a. As appropriate, verify with Construction Manager and Engineer the legitimacy of the complaint based on the Work being performed at the Site, the prevailing wind direction, and other climatological factors.
   b. Continue monitoring and employ additional odor, vapor, and dust controls to abate emissions in accordance with Section 013549 – Environmental Protection Procedures.
   c. Evaluate and, if necessary and appropriate, modify construction techniques.
3. Document the time and outcome of any odor complaints in daily odor monitoring log in accordance with Article 1.07 of this Section.

3.03 FIELD QUALITY CONTROL

A. Site Inspections:
1. During the workday, perform routine field checks of monitoring equipment to verify proper function. Document the date, day of the week, time, and outcome of each field check in a dedicated log.
2. Immediately remove from service, and replace at Contractor’s expense, damaged or malfunctioning equipment.
3. Prepare and retain at the Site electronic or written records of all field checks. Submit to Engineer upon request.

- END OF SECTION -

SECTION 014100

REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified
1. Conform to federal, state, and local regulations governing execution of the work.
2. Meet the requirements of applicable environmental permits and regulation. Permits to be obtained by Owner are noted in Table 014100-1. The Contractor shall obtain all other permits that may be required under local jurisdictions as noted Table 014100-1. These permits include, but are not necessarily limited to, those related to work within public roadways, zoning regulations, building permits, etc.

Table 014100-1. Summary of Required Permits

Required Permit	Timeline	Requirement Satisfied
Permits to be obtained by the Owner or Engineer		
Joint Permit Application	75-120 days	• Clean Water Act (CWA) Section 401, Water Quality Certification (WQC) • CWA Section 404 • Section 10 of the Rivers and Harbors Act • New York State Department of State, Coastal Management Program • Public Lands Law, Article 6, Section 75 • New York State Protection of Waters Program, Environmental Conservation Law (ECL) Article 15, Title 5/6 the New York Codes, Rules and Regulations (5/6 NYCRR) Part 608
Consultation with the U.S. Fish and Wildlife Service and the National Marine Service (NMFS)	60-90 days	Section 7 of the Endangered Species Act (ESA) and Fish and Wildlife Coordination Act of 2002
National Historic Preservation Act (NHPA)– Assessment of Adverse Effects	60-90 days	Section 106 of the NHPA
State Historic Preservation Office (SHPO) – Assessment of Adverse Effects	60-90 days	Section 106 of the NHPA New York State Historic Preservation Act of 1980, Section 14.09
State Pollutant Discharge Elimination System (SPDES) General Permit for Stormwater Discharges from Construction Activity	75-120 days	SPDES, ECL Article 17, Titles 7 and 8 Clean Water Act, 33 USC Part 1250 et seq.
SPDES Equivalency Permit (see Note 3)	75-120 days	SPDES, ECL Article 17, Titles 7 and 8 Clean Water Act, 33 USC Part 1250 et seq.
Permits to be obtained by Contractor		
City of Hudson Permits	30 days	Hudson Code of Ordinances

3. All appropriate permits must be maintained, and a copy must be at the Site throughout the duration of the project.

1.02 REFERENCES

REGULATION/GUIDANCE	SOURCE
40 CFR 302, 350, 355, 370	Emergency Planning & Community Right-to-Know Act
40 CFR 260-267	Hazardous Waste Management Regulations (Resource Conservation and Recovery Act)
40 CFR 268.48	Universal Treatment Standards/Land Disposal Restrictions (UTS/LDRs)
29 CFR 1910 and 1926	Occupational Safety and Health Administration Standards
49 CFR 107, 171 and 172	United States Department of Transportation, Transportation Requirements
6 NYCRR 364	New York State Department of Transportation, Transportation Requirements
6 NYCRR 360, 370, 371, and 372	New York Hazardous Waste Requirements
6 NYCRR 375	New York Environmental Remediation Programs
6 NYCRR 750 - 758	New York Surface Water and Discharge Standards
DER-10	New York State Department of Environmental Conservation (NYSDEC) Technical Guidance for Site Investigation and Remediation
Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1	NYSDEC Ambient Water Quality Standards and Guidance Values
Sections 401 and 404	Federal Water Pollution Control Act (Clean Water Act) (33 USC 1341-1344)
Section 10	Rivers and Harbors Act (330 USC 401 et seq)
DER-31	Technical Guidance for Green Remediation
TAGM 4031	Program at Inactive Hazardous Waste Sites (NYSDEC)
TAGM 4061	Management of Coal Tar Waste and Coal Tar Contaminated Soils and Sediment From Former MGPs (NYSDEC)
Technical Guidance	Technical Guidance for Screening and Assessment of Contaminated Sediment (NYSDEC)
Community Air Monitoring	Generic Community Air Monitoring Plan (New York State Department of Health)

USCG Regulations	Marine Safety (33 CFR Part 26, 33 CFR Part 62 through 76, 33 CFR Parts 83 through 90)D 3740 and E 329 ASTM International
ISO 9000 Quality Management Systems	International Organization for Standardization
ANSI/ASQC E4-1994	American National Standards Institute
Erosion and Sediment Control	New York State Standards and Specifications for Erosion and Sediment Control (NYSDEC)

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

- END OF SECTION -

SECTION 015000

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified
1. The Contractor shall provide and maintain temporary enclosures as required by this Section and the Design Drawings.
2. The Contractor shall provide and maintain temporary facilities, utilities, and office-related equipment for the Owner, Construction Manager, Engineer and the NYSDEC for the duration of the Project.
    a. Offices shall be ready for occupancy within 10 days of mobilization and shall be provided and maintained until final acceptance of the work conducted under this Project.
3. The Contractor shall provide and maintain temporary support areas, including imported materials staging area(s), decontamination area(s), and water treatment containment area.
4. The Contractor shall maintain the site in a neat and orderly condition throughout the remedial construction activities.

B. Related Specifications
1. Section 011100 – Summary of Work

1.02 SUBMITTALS

A. Temporary Enclosure Design: Submit the following related to the temporary enclosure:
1. Shop drawings of the proposed temporary enclosed structure and anchoring system prepared and sealed by a New York State licensed professional engineer qualified for the temporary enclosure design.
2. If applicable, results of geotechnical data collected by the Contractor to support anchoring system design.
3. Manufacture's installation and testing requirements.
4. Shop drawings of air handling and ventilation system, including calculations showing the number of air changes per hour.

PART 2 - PRODUCTS

2.01 TEMPORARY ENCLOSURES

A. An open span temporary structure shall serve as a staging area for impacted sediments, as specified on the Design Drawings. The temporary structure shall help to minimize the release of dust, odors, water, or other materials during the staging and stabilization of dredged sediment. The structure shall be sufficiently sized to enclose the dredged material handling area. The temporary structure shall also include the following:
1. Pre-engineered air handling/filtration system shall include activated carbon filters capable of at least six air changes per hour and the necessary ventilation/fan system. The temporary enclosure shall be equipped with inlet louvers and outlet transitions for the

ductwork of the air handling/filtration system. The Contractor shall be required to provide noise controls to minimize noises caused by the ventilation/fan system.

2. The structure's components must be designed to withstand climatic conditions without requiring major repair, refinishing or replacement. Minor repairs of the membrane due to normal wear shall be permitted with a 5 percent maximum replacement membrane over the 20-year service life of the membrane. Climatic conditions include (but are not limited to):
   a. Snow and ice load
   b. Wind load
   c. Rainfall and precipitation
3. The architectural membrane panels, when installed and tensioned, must be wrinkle free, and must remain so indefinitely in temperature normal for the area.
4. The anchor system shall be provided by the structure manufacturer. Installed anchors shall be tested in accordance with the manufacturer's recommendations.
5. No interior or exterior guy ropes or cables shall be used for anchoring the system.
6. Provide adequate lighting to meet OSHA requirements. Translucent membrane panels may be used to provide ambient light.

2.02 FIELD OFFICES

A. The Contractor shall provide and maintain, in accordance with all applicable codes and regulations, the fire extinguishers and electric, heating (as appropriate), and cooling (as appropriate) services for the temporary facilities.

B. Contractor shall supply two office trailers, one for the Contractor and one for the Owner/Construction Manager/Engineer/NYSDEC. Each trailer shall have the following items:
1. Three office desks (each measuring a minimum of 44 inches long by 30 inches wide) and three office chairs.
2. Two combination printer/scanner/copier/facsimile machines.
3. Two cordless telephones, each with hands-free speaker, speed dialing with minimum of 16 programmable numbers, volume control, LCD display, and buttons for hold and mute.
4. Two digital telephone answering machines.
5. Two filing cabinets with locks.
6. Three folding tables (each measuring 60 inches long by 30 inches wide) and 15 folding or stacking chairs.
7. One large waste basket.
8. One first aid kit meeting the minimum requirements of ANSI/ISEA Z308.1 (10 Person ANSI First Aid Kit by Genuine First Aid® or equivalent).
9. One refrigerator (minimum 5 cubic-foot capacity).

C. Field office shall include the fire protection system, adequate heating, cooling, electric, internet, and telephone services, lighting, portable sanitary facilities (may be a stand-alone and temporary portable facility), snow removal as required, and janitorial services not less than weekly. All garbage, dust, and miscellaneous material collected during clean-up of the facilities shall be disposed of at a sanitary landfill.

2.03 TEMPORARY FACILITIES

A. Upon mobilization to the Site and initiation of construction activities, the Contractor shall provide (at a minimum) the following temporary facilities for the duration of the Project:
1. Internet Service: The Contractor shall provide and maintain high-speed wireless internet service capable of supporting a minimum of 10 users simultaneously.

2. Telephone Service: The Contractor shall provide and maintain private telephone service, including payment of installation, monthly, and service costs for four telephone lines (two for voice and two for fax service), each with separate telephone number assigned by the telephone company.
3. Temporary Water Service: The Contractor shall provide and maintain suitable bottled drinking water service including a 5-gallon capacity bottled drinking water cooler. The Contractor shall provide temporary water service as deemed necessary for construction activities.
4. Temporary Sanitary Facilities: The Contractor shall provide and maintain temporary sanitary facilities and enclosures as required by the Occupational Safety and Health Administration (OSHA).
5. Portable Toilets: The Contractor shall provide a minimum of two portable sanitary toilets. The Contractor shall be responsible for the removal and disposal/treatment of sanitary wastes offsite on a periodic basis as required and in accordance with applicable laws and regulations.
6. Portable Hand Wash Stations: The Contractor shall provide a minimum of one portable hand wash station. The Contractor shall be responsible for the removal and disposal/treatment of wastewater offsite on a periodic basis as required and in accordance with applicable laws and regulations.
7. Temporary Lighting for Construction Purposes: The Contractor shall provide and maintain lighting for construction operations.
8. Temporary Fencing: The Contractor shall provide and maintain temporary fencing in accordance with the Design Drawings.
9. Health and Safety Equipment (including equipment and personnel).
10. Eye Wash Station and Other First-Aid Equipment.

2.04 SUPPORT AREA MATERIALS

A. Fill materials required to accomplish or be incorporated into the work of this Section shall meet the requirements of Section 312323 - Selected Fill.

B. Geosynthetic materials required to accomplish or be incorporated into the work of this Section shall meet the requirements of Section 310519 - Geosynthetics.

2.05 TEMPORARY FENCE

A. Provide temporary fence as required by Design Drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install facilities and offices in neat, orderly, manner, and make structurally, mechanically, and electrically sound throughout. Install in accordance with manufacturer’s instructions and Laws and Regulations.

B. Support Areas:
1. Construct the following support areas in the “Area Available for Temporary Staging” shown on Design Drawings G-102 and in accordance with the Contractor’s Operation Plan prepared in accordance with Section 011100 – Summary of Work:

a. Temporary Enclosed Structure and Sediment Dewatering Pad in accordance with Design Drawing G-501.
b. Imported Materials Staging Area in accordance with Design Drawing G-501.
c. Decontamination Area in accordance with Design Drawing G-502.
d. Water Treatment Containment Area in accordance with Design Drawing G-502.

C. Temporary Fence:
1. Contractor must entirely enclose upland support area(s) by means of woven wire fence.
2. Contractor shall restrict access along shoreline as required to perform the Work and protect public.
3. Gates must be provided at all points of access. Gates must be closed and secured in place at all times when work is not in progress.

3.02 REMOVAL

A. Do not remove temporary facilities or controls until after Substantial Completion, unless otherwise directed by Construction Manager or Engineer.

B. Remove temporary facilities and controls and restore areas prior to final inspection.

- END OF SECTION -

SECTION 022100

SURVEYS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Contractor shall provide survey control sufficient to support the overall Project and document the performance of the RD.

B. The Contractor shall employ a New York State-licensed Surveyor to provide the upland/onshore surveying functions necessary for the proper construction and documentation of the work. All upland/onshore survey-related work products shall be sealed and signed by a registered New York State Professional Engineer or Licensed Surveyor. In-river/bathymetric survey shall be performed by a National Society of Professional Surveyors (NSPS)/ The Hydrographic Society of America (THSOA) Certified Hydrographer.

C. Survey control for construction and documentation purposes shall be the responsibility of the Contractor. The Contractor shall safeguard all survey points and benchmarks. Should any of these points be destroyed, the replacement cost shall be borne by the Contractor. The Contractor shall assume the entire expense of rectifying work improperly constructed due to failure to maintain and protect such established survey points and benchmarks.

D. Contractor shall furnish and/or provide all supervision, labor, tools, materials, equipment, services and appurtenances necessary for, or incidental to, completing all work necessary for performing the surveying activities described herein and preparing required as-built survey drawings of pre-construction, post-removal, and post-backfill grades.

1. The Contractor shall perform bathymetric and topographic surveys to determine sediment bed elevations and shore elevations. Bathymetric surveys shall be performed as a way of accurately monitoring the completed dredging project. Topographic surveys shall be performed to tie in the bathymetric survey to the top of the slope, provide verification of the bathymetric survey data, and document upland support area conditions.
2. The Contractor shall perform bathymetric and topographic surveys to verify the grades of the final dredged surface for use as acceptance of completed work for progress payments. The Contractor shall prepare bathymetric drawings and confirm that work is performed according to specifications including, but not limited to, the confirmation that dredging and backfill elevations are met.
3. Additional bathymetric surveys, contingent on the results of the post-construction survey shall be conducted by the Contractor if the required removal or fill extents and thickness have not been met. If these requirements have not been met, additional in-water construction activities must be conducted and surveyed in order to verify the final design requirements specified in the RD have been achieved. All contingency surveying shall be conducted at the Contractor’s sole expense with no additional cost to the Owner.

1.02 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

A. Hydrographic Surveying Engineering Manual, EM 1110-2-1003 prepared by United States Army Corps of Engineers (USACE) in 2013. The most recent version of this reference applies.

1.03 SUBMITTALS

A. Survey Plan: The Contractor shall submit a Survey Plan for review at least 3 weeks prior to the start of any survey work. The Plan shall include the following:
   1. Survey Schedules and Drawings Depicting Track-lines
      a. The Survey Plan shall include a schedule for all survey work and Drawings that show the track-lines for each survey.
   2. Bathymetric Survey Instrument Calibration Certificates and Specifications
      a. The Contractor shall submit bathymetric survey instrument calibration certificates to the Engineer for the project records.
      b. The Contractor shall submit specifications for all proposed bathymetric survey equipment for review by the Engineer.
   3. Topographic Survey Instrument Calibration Certificates and Specifications
   4. Survey Crew Qualifications
      a. The Plan shall include name, address, telephone number, and qualifications, including licensure and/or certification, of the surveyor, crew chief, superintendent, and all other persons who are proposed to perform surveys or survey related duties.

B. Data Records
   1. The Contractor shall furnish copies of all field notes, computations, any records relating to the layout of the work and any computer software required to interpret the finished data and records for review and approval prior to the final progress payment. The Engineer will use them as necessary to verify completion of the project activities prior to submittal of the final payment by the Owner. The Contractor shall retain copies of all such material furnished to the Owner and Engineer.
   2. Survey data shall be provided in x, y, z (easting, northing, elevation) format. Each data file must include a descriptive header including, but not limited to software and equipment information, project name and client, horizontal and vertical datum, units, survey type, alignment, and stations surveyed.
   3. The Contractor shall maintain a complete, accurate log of survey work as it progresses at the Site.
   4. The accuracy of the Contractor's survey and other furnishing of data to the Engineer do not constitute a transfer of responsibility for verifying accuracy.

C. As-Built Drawings. Upon completion of major phases of Work, Contractor shall submit a copy of the associated survey drawings with contour data in a format compatible with AutoCAD Civil 3D 2014 and in PDF.
   1. Drawings for surveys performed as required in Part 3 shall include the sediment elevation contours (1-foot resolution) and upland elevation contours (1-foot resolution).
   2. Drawings showing bathymetry data shall be shown at scale not to exceed 1-inch equals 20 feet.
   3. Volume tables shall be included on post-dredge and post-backfill survey drawings documenting the actual removal and backfill volumes, respectively.
   4. Drawings showing locations where sheet pile installed as part of the Work remains at the completion of the Work.
   5. Drawings showing post-construction conditions shall include location and elevation of sheet pile remaining in place.

1.04 PERFORMANCE CRITERIA/QUALITY ASSURANCE

A. The Contractor must have a minimum of 5 years of experience completing the type of work specified herein.

B. All upland/on shore survey, layout, and related work shall be performed and signed by a New York State-licensed Surveyor. All in-river/bathymetric survey, layout, and related work shall be performed and signed by a NSPS/THSOA Certified Hydrographer. The surveyor/hydrographer shall have actively engaged in survey operations during the past 3 years.

C. The Contractor shall conduct and document the quality control procedures recommended by the equipment manufacturer.

D. The survey shall be conducted to meet the requirements specified herein; including, but not limited to confirming removal and backfill operations have met the required vertical and horizontal extent.

E. When applicable, the Contractor shall regularly resurvey benchmarks for comparison with original elevations and positions. Where the laser is used for control, the Contractor shall periodically check the grade and alignment during each day's operation. The Contractor shall promptly notify the Engineer and Construction Manager if changes in elevations or positions occur to be reviewed for consistency with Design Drawings.

F. Bathymetric surveying tools and techniques shall follow USACE Hydrographic Manual guidance.

G. All bathymetric surveys will meet the following repeatable accuracy:
   1. Horizontal accuracy will be plus or minus 0.1 foot.
   2. Vertical accuracy will be plus or minus 0.1 foot.

PART 2 - PRODUCTS

2.01 QUALITY OF MATERIALS AND EQUIPMENT

A. Bathymetric survey instruments shall be calibrated as specified by the manufacturer.

B. The Contractor shall conduct surveys using a Differential Global Positioning System (DGPS), a multi-beam echosounder system, and a single beam echosounder system (for supplemental coverage in shallow areas) to obtain soundings. The survey vessel shall be equipped with the DGPS for determining the horizontal and vertical location of the soundings.

C. The system shall be capable of sub-meter horizontal positioning accuracy.

D. The Contractor shall use sounding equipment with the capability to produce a high-resolution, permanent record that accurately depicts bottom profiles.

PART 3 - EXECUTION

3.01 GENERAL

A. The Contractor shall exercise care during the execution of the work activities specified herein to minimize any disturbance to existing property and to the landscape and waters in the areas surrounding the work areas. Survey crews shall not traverse into controlled areas or private property without first obtaining approval from the Owner.

B. The Contractor shall reference survey points to the provided survey control points and record all survey locations, with horizontal and vertical data, on project record documents.

C. To the extent practicable, the Contractor shall perform each survey activity at the same locations and along the same lines as used in previous surveys.

D. Perform contingency bathymetric survey at the sole expense of the Contractor if post-dredge and/or post-construction surveys indicates that final removal elevation/extent and/or backfill elevation/extent, as specified within the RD, has not been met.

E. Bathymetric surveys shall be multi-beam bathymetric surveys, with closely spaced single-beam surveys used to supplement coverage in shallow areas where multi-beam coverage may be inadequate. Track lines shall be spaced to achieve 100% overlap of the multi-beam survey data. Bathymetric survey data shall be reported on a 1-foot by 1-foot grid.

F. Topographic surveys shall be collected on a 25- by 25-foot grid or wherever the elevation changes more than 1 foot. Survey shall document location of grade breaks and edges of construction areas as appropriate.

3.02 PRE-CONSTRUCTION SURVEY

A. Contractor shall photograph and perform pre-construction survey of upland support and staging areas to document existing area conditions.

B. Contractor shall perform pre-construction survey of the existing shoreline areas and existing riprap areas using a combination of bathymetric and topographic survey as necessary.

C. Contractor shall perform pre-construction bathymetric survey. Bathymetric survey shall be a combination of multi-beam survey with single-beam survey for near-shore and shallow water areas, as noted in Paragraph 3.01.E of this Section.

D. Pre-construction debris survey has been completed and the results are presented on the Design Drawings. If the Contractor elects to, they may perform an additional pre-construction debris survey at no additional cost to the Owner. If the Contractor elects to perform an additional pre-construction debris survey of dredge limits and surrounding area, the Contractor shall submit the results of the survey to the Engineer for review and to document conditions at the time of mobilization to the site. Additional pre-construction debris survey, if performed, should indicate location of significant debris, structures, or other features within and/or adjacent to the dredge area; however, the scope of this survey will be determined by the Contractor.

E. Pre-construction survey drawings shall be submitted to the Engineer at least 2 weeks prior to the start of dredging.

3.03 EXCAVATION SUPPORT SURVEY

A. Contractor shall perform a layout and grade survey of the top of sheet piles following installation. Survey shall include locations and elevation where sheet pile was installed for excavation support during construction activities as required by Section 315000.

3.04 INTERIM DREDGE SURFACE MONITORING

A. Interim dredge surface data shall be collected by the Contractor during dredging. A Global Positioning System (GPS) attached to dredging equipment (as required by Section 352023) shall document that all dredging depths are being obtained as specified along the completed areas.

B. Interim monitoring results shall be included in the Contractor's daily progress reports and shall be made available to the Owner, Construction Manager, and Engineer upon request.

3.05 POST-DREDGE SURVEY

A. The Contractor shall perform a post-dredge multi-beam bathymetric survey to confirm that the required design dredge elevations have been met and required terms of Contract completed. The post-dredge survey shall be completed on the same sounding lines as the pre-construction survey.

B. Post-dredging survey drawings shall be submitted to the Owner and Engineer prior to the start of backfilling operations and not more than 2 days after completion of the survey.

3.06 INTERIM BACKFILL SURFACE MONITORING

A. Interim backfill surface data shall be collected by the Contractor during backfill and shall differentiate between types of backfill material being placed. Interim backfill monitoring shall be performed similar to the interim dredge surface monitoring described in Article 3.04 of this Section.

B. The GPS-generated data shall be used to document the placement of the first backfill layer and the Contractor shall submit this data to the Engineer prior to starting placement of the second backfill layer.

C. Interim monitoring results shall be included in the Contractor's daily progress reports and shall be made available to the Owner, Construction Manager, and Engineer upon request.

3.07 POST-CONSTRUCTION SURVEY

A. The Contractor shall photograph and perform post-construction survey of upland support and staging areas to confirm restoration to pre-construction conditions.

B. Post-construction survey shall also include:
   1. Location and elevation of restored riprap areas.
   2. Locations and elevation where sheet pile remains at the completion of construction.

C. The Contractor shall perform a post-construction bathymetric survey to confirm that the required restoration elevations have been met for the upper fill material placement and required terms of Contract completed. The post-construction survey shall be completed on the same sounding lines as the pre-construction survey.

D. Post-construction survey drawings shall be submitted to the Engineer not more than 2 days after completion of the survey.

3.08 CONDUCT OF WORK

A. Reference Points:
1. Established reference points damaged or destroyed by Contractor shall be re-established by Contractor at no cost to Owner.
2. From established reference points, establish lines, grades, and elevations necessary to control the Work. Obtain measurements required for executing the Work to tolerances specified.
3. Establish, place, and replace as required, such additional stakes, markers, and other reference points necessary for control, intermediate checks, and guidance of construction operations.
4. For all surveys, use and report data in using the following:
   a. Horizontal datum: North American Datum of 1983 (NAD 83), New York State Plane Coordinate System, East Zone (3101).
   b. Vertical Datum: National America Vertical Datum of 1988 (NAVD88).

B. Procedures
1. Bathymetric survey procedures (positioning modes, EPS calibration, data reduction, adjustment, processing and plotting) shall conform to industry standards. Horizontal location observations shall compensate for errors, geodetic corrections and atmospheric variations. Data recording, annotation and processing procedures must be consistent with recognized bathymetric standards. Failure to perform and process such surveys in accordance with recognized standards shall result in a rejection and nonpayment for work performed.
2. Accuracy:
   a. For topographic land surveys:
      1) Horizontal accuracy shall be plus or minus 0.1 feet.
      2) Vertical accuracy shall be plus or minus 0.05 feet for general site grading and 0.02 feet for structural features (e.g. pipes, manholes) unless otherwise specified or agreed to by Owner and Engineer.
   b. Bathymetric survey accuracy shall be in accordance with the Hydrographic Surveying Engineering Manual.
   c. Survey calculations shall include an error analysis sufficient to demonstrate required accuracy.

C. Soundings
1. Sounding and survey lines shall be established such that intervals between sounds on each line shall not exceed 1 foot.
2. Within the field notes maintained by the Contractor, the location of each sounding line and the date and time (hour and minutes) each sounding line is taken shall be recorded, at a minimum.

D. Prohibited Construction Procedures
1. Prohibited construction procedures include, but are not limited to:
   a. Indiscriminate, arbitrary or capricious operation of equipment.

- END OF SECTION -

SECTION 028100

TRANSPORT AND DISPOSAL OF IMPACTED MATERIALS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified
   1. This specification identifies the method for the transport and disposal of impacted materials.
   2. Furnish and/or provide all labor, tools, materials, equipment, and services, and complete all work, installed, tested, and ready for use, as described in the RD, as necessary, for handling of impacted materials to be properly managed during work performed under this contract.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 011100 – Summary of Work

B. Section 014100 – Regulatory Requirements

C. Section 015000 – Temporary Facilities and Controls

D. Section 313200 – Material Stabilization

E. Section 352023 – Dredging and Subaqueous Backfill

F. Section 444000 – Water Handling and Disposal

1.03 SUBMITTALS

A. Transport and Disposal of Impacted Materials Section of Operations Plan
   1. As part of the Operations Plan (prepared in accordance with Section 011100 – Summary of Work), prepare and submit a Transport and Disposal of Impacted Materials Plan to the Engineer for review prior to commencing sediment removal operations. This Plan shall identify the proposed transport and disposal procedures of impacted materials. Such items include, but are not limited to the following:
      a. Sediment and other materials (e.g. debris) removed during implementation of the remedial activities
      b. Absorbent boom material (if any)
      c. Decontamination materials
      d. Other wastes and refuse from implementation of remedial activities (e.g., personal protective equipment [PPE])
   2. The plan shall also include a description of and requirements for the following waste-related activities:
      a. Staging/containerization of waste materials and material stabilization (see Section 313200 – Material Stabilization)
      b. Sampling and analysis activities for waste characterization (if any, including characterization for disposal facility acceptance)
      c. Waste stream characterization and profiling

d. Manifesting and packing/shipping requirements for waste streams
e. Identifying New York State Department of Environmental Conservation-permitted and Owner approved transporters and disposal facilities for the wastes
   1) Contractor shall provide and coordinate with a minimum of two Owner-approved facilities
f. Truck haul routes

B. Shop drawing submittal for mixing/bulking and pretreatment procedures, if necessary, of sediment to develop a homogeneous mixture to render the materials suitable for offsite treatment at a low-temperature thermal desorption (LTTD) facility or offsite disposal at a Resource Conservation and Recovery Act Subtitle D landfill. Pretreatment procedures shall include provisions/equipment that is capable of rendering materials to a size as required to facilitate offsite disposal or treatment (if necessary) and stabilization in accordance with Section 313200 – Material Stabilization.

C. For the Owner's records, for all materials that require offsite disposal or offsite treatment/disposal, all waste transporters shall submit a copy of their current Waste Transportation Permit, obtained in accordance with 6 NYCRR Part 364.

D. Draft waste transportation documents

E. Waste Profiles:
   1. In preparing waste profiles, Contractor shall determine if the waste material can be transported/disposed of under an existing National Grid waste profile (if one exists) or if a new waste profile is required.
   2. Contractor shall submit the preliminary waste profile, listing Owner's name and address of the Site as generator of waste, for each treatment facility, landfill, and incinerator facility. Owner will sign and return each acceptable preliminary waste profile to Contractor. Contractor shall return the counter-signed waste profile and proof of acceptance of waste for each treatment facility, landfill, and incinerator facility.

F. The Contractor shall provide two copies of the following items as they relate to the offsite transport and disposal of waste materials:
   1. Counter-signed Bills of lading, hazardous waste manifests, and certificates of disposal/destruction
   2. Chain of custody records
   3. Contracts
   4. Trucking logs
   5. Waste characterization analytical results, if any

1.04 REFERENCES

A. Comply with applicable federal, state, municipal, and local regulations including, but not limited to, those listed in Section 014100 – Regulatory Requirements.
   1. United States Environmental Protection Agency, including Title 40, Code of Federal Regulations.
   2. Occupational Safety and Health Administration (OSHA), including Title 29, Code of Federal Regulations, and Parts 1910 and 1926, OSHA, United States Department of Labor.
   3. State of New York Rules and Regulations, including 6 NYCRR Parts 360, 364, and 370 regarding disposal, transportation, and management of hazardous waste.
   4. Recommendations of the National Institute of Occupational Safety and Health.

5. Transportation regulations, including U.S. Department of Transportation regulations, including Title 49 Parts 171 and 172 and New York State Department of Transportation rules and regulations.

B. Whenever there is a conflict or overlap of the applicable federal, state, and local government regulations, the most stringent provision shall be applicable. In the event that any requirement of this Technical Specification contradicts any such regulatory requirement, immediately notify the Owner/Engineer of such conflict or contradiction. In such cases, the regulation or law shall apply.

C. New York State Department of Transportation Standard Specifications.

D. ASTM International (ASTM) D6913 - Standard Test Method for Particle-Size Analysis of Soils

E. Post all applicable regulations in a conspicuous place at the site. Assure that the regulations are not altered, defaced, or covered by other materials.

F. The components of the RD, including the associated Appendices.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 MATERIAL SEGREGATION DEBRIS PROCESSING

A. In accordance with Section 352023 – Dredging and Subaqueous Backfill, the Contractor shall segregate materials as necessary during the removal of debris and/or sediments for material handling activities including (if necessary): gravity dewatering, mixing, stabilizing, and characterizing as required to render the materials suitable for, offsite disposal, or offsite treatment/disposal at the Owner-approved facility.
   1. Sediment impacted with visible NAPL as determined by visual observation of the staged material by the Construction Manager and/or containing total PAHs at concentrations greater than or equal to 1,000 mg/kg, or that is characteristically hazardous for benzene, shall be treated by low-temperature thermal desorption.
   2. Non-visually impacted materials shall be transported and disposed at an Owner-approved solid waste landfill.

3.02 SEDIMENT TESTING AND VERIFICATION SAMPLING

A. It is anticipated that existing data will be suitable for waste characterization for offsite disposal. Any additional required analytical sampling necessary to determine if the material is prepared for offsite disposal shall be performed by the Contractor as required by the disposal facility(ies). All sample results must be provided to the Construction Manager and Engineer for review prior to shipment of waste.

3.03 SEDIMENT TRANSPORTATION AND DISPOSAL

A. The Contractor shall be responsible for the offsite transportation of waste material generated as a result of the removal activities to an appropriate offsite treatment and/or disposal facility as determined based on the matrix of the waste material and the results of characterization sampling. Waste material shall be stabilized for transportation in accordance with Section 313200 – Material Stabilization.

B. The Contractor shall load pretreated sediment (deemed suitable for offsite disposal or disposal) into lined roll-off containers and/or lined dump trailers for offsite transportation. The loading activities shall be conducted in accordance with the Contractor's Operations Plan prepared in accordance with Section 011100 – Summary of Work.

C. The Contractor is responsible for properly containerizing, staging, and preparing waste material for offsite disposal. Each waste medium (e.g., sediment, decontamination water, waste debris, PPE) shall be properly containerized via Department of Transportation-approved 55-gallon drums, temporary tanks, lined and covered roll-off containers, lined and covered dump trailers, or lined and covered staging areas and properly labeled and staged with like materials.

D. The Contractor shall provide coordination of offsite transportation and, at a minimum, shall be responsible for the following:
1. Provision/preparation of a uniform Hazardous Waste Manifest or Bill of Lading, to be signed by the Owner or an authorized representative and the truck driver.
2. Preparation and submittal as part of the daily progress report of a daily summary sheet that indicates the temporary stockpile area, analytical data, and at a minimum, the following information regarding each truck load:
    a. Load number (sequential)
    b. Uniform Hazardous Waste Manifest number or Bill of Lading Number
    c. Truck ID number (license plate number of the truck and/or trailer used)
    d. Time of departure from the site
    e. Gross weight
    f. Tare weight
    g. Net load weight
    h. Material type (nonhazardous or hazardous)
    i. Final destination

3.04 DECONTAMINATION OF EQUIPMENT

A. Provide all supervision, labor materials, tools, equipment, accessories, and appurtenances necessary to decontaminate all of the Contractor's equipment that has come in contact with impacted materials.

B. Decontaminate equipment in accordance with applicable state and federal regulations before being used with non-impacted materials or demobilizing from the Site. Impacted sediment and decontamination fluids shall not be disposed of in the River during decontamination procedures.

C. The equipment decontamination procedure shall, at a minimum, include the following:
1. Remove remaining sediment from equipment surfaces using shovels, brooms, and other hand tools as necessary.
2. Wash equipment surfaces using pressure washers and related supplies (e.g., equipment for scrubbing, plastic sheeting), where appropriate, to remove any additional sediment that may remain.
3. Collect and transport all decontamination liquids and solids to the Equipment and Material Staging Area for proper unloading and disposal.

D. The decontamination standard for equipment that will no longer be used on the Project is the removal of visible material and power washing of surfaces.

E. Surfactants shall not be used to decontaminate equipment.

F. All decontamination fluids must be managed as wastewater under Section 444000 – Water Handling and Disposal.

- END OF SECTION -

SECTION 101400

SIGNAGE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified
1. The Contractor shall furnish, install, and maintain temporary signage for Project identification and construction site information.
2. Temporary signs required are indicated in Part 2 of this Section.
3. Do not display any other temporary signs, other than those specified, without prior approval of the Owner.
4. Maintain temporary signs until Substantial Completion, or as otherwise directed by Owner.

1.02 SUBMITTALS

A. Layout of each temporary sign, indicating layout, text, font, character size, graphics if any, materials type and grade, including sign board, trim, supports, and bracing.

B. Specifications and product data for finishes proposed for use, when requested by the Engineer. Provide color samples when requested by the Engineer.

C. Sketch of sign location and orientation.

PART 2 - PRODUCTS

2.01 GENERAL

A. Temporary signs, including supports and bracing, shall withstand sustained winds of 75 miles per hour. All lumber shall be structural quality and exterior grade (pressure treated). All bolts, nuts, and washers shall be plated or galvanized steel, or equal.

B. Paint sign with exterior gloss-finish enamel, suitable for long-term exposure to sunlight without fading for the duration of the Project.

2.02 PROJECT SIGN

A. Project Identification Signs:
1. Project identification signs, including layout, fonts, logos, and colors, shall be as specified in the NYSDEC guidance specification included with this Section.
2. Location: Site entrances
3. Text Inserts: Text inserts shall be centered horizontally on sign board in the specified locations and shall read as included in the attached example sign.

B. Background Color: White.

C. Font: Calson 540.

D. Printing: Digital or screen printing with ultraviolet-resistant inks.

E. Sign Board:
1. Material: Aluminum composite, minimum thickness of three millimeters.
2. Minimum Dimensions: As shown in attached example sign.

F. Distance from Ground to Center of Sign: Six feet.

G. Supports and Bracing: Provide supports and bracing as required to adequately support and brace signs for the duration of the Project.

H. Obtain Engineer consent before releasing for manufacture.

2.03 ADDITIONAL SIGNS

A. Signs stating “Danger, Construction Area, Authorized Personnel Only” shall be installed along the site perimeter at a spacing of no more than 50 feet between signs.

PART 3 - EXECUTION

3.01 INSTALLATION, MAINTENANCE, AND REMOVAL

A. Proposed location of signs shall be at the entrance to the site from public roads. Prior to site mobilization, the Contractor shall submit a sketch detailing proposed sign location and orientation for review by the Construction Manager and Engineer.

B. After the sign location is approved and prior to excavation for the footings, the Contractor shall verify with all appropriate utility authorities that no interferences exist, and satisfactory clearances will be met.

C. The project sign shall be constructed, painted, and installed, in accordance with the Design Drawings, within 21 days following the notice to proceed.

D. Maintenance:
1. Maintain temporary signage so that signs are clean, legible, and upright. Cut grass, weeds, and other plants so that temporary signs are not covered or obscured.
2. Repair and repaint damaged temporary signs. Relocate signs as required by progress of the Project.

E. Remove temporary signage upon Substantial Completion of the entire Project, or when directed by the Owner.

3.02 ATTACHMENTS

A. The documents listed below, which falls after the “End of Section” designation, is part of this Section.
1. Example Project Identification Sign (1 page)

-END OF SECTION-

8'-0"

4'-8"

(1)

(2) NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation — 6"

(3)

(4) STATE SUPERFUND PROGRAM — 4"

(5)

(6) HUDSON MGP SITE — 4"

(7)

(8) SITE NO. 411005

(9)

(10) nationalgrid

(11)

(12) GOVERNOR ANDREW M. CUOMO

(13)

(14) COMMISSIONER BASIL SEGGOS

(15)

(16) MAYOR KAMAL JOHNSON

(17)

(18) TRANSFORM THE PAST... BUILD FOR THE FUTURE — 4"

(19)

(20) FOR INFORMATION CALL [Phone number To Be Determined]

(21)

(22) [Website To Be Determined]

(23)

ELEVATION
NOT TO SCALE

NOTES:
1. (1), DENOTES LINE NUMBER.
2. FONT IS CALSON 540.
3. CENTER EACH LINE OF TEXT IN ALL CAPS.
4. TEXT COLORS ARE AS FOLLOWS:
   BLUE: PANTONE MATCHING SYSTEM 301 (LINE NOS. 4, 12, 14, 16, 20, AND 22).
   GREEN: PANTONE MATCHING SYSTEM 355 (LINE NOS. 6, 8, AND 18).
5. LOGOS WILL BE FURNISHED BY ENGINEER.
6. ROW/TEXT HEIGHT IS TWO INCHES, EXCEPT WHERE SHOWN OR INDICATED OTHERWISE.
7. INCLUDE BLANK LINE, TWO INCHES IN HEIGHT, AT TOP AND BOTTOM OF SIGN (LINE NOS. 1 AND 23) AND BETWEEN EACH LOGO OR LINE OF TEXT (LINE NOS. 3, 5, 7, 9, 11, 13, 15, 17, 19, AND 21).

EXAMPLE PROJECT SIGN

SECTION 310519

GEOSYNTHETICS

PART 1 - GENERAL

1.01 DESCRIPTION

A. All labor, materials, equipment, and services necessary for furnishing and geosynthetics required for completion of the Project.

B. B. Related Work Specified Elsewhere
1. Section 015000 – Temporary Facilities and Controls
2. Section 352023 – Dredging and Subaqueous Backfill
3. Section 312323 – Selected Fill
4. Section 329000 – Site Restoration

1.02 TERMINOLOGY

A. For these Technical Specifications, the term "geosynthetics" is used to encompass both geotextile and geomembrane materials.

1.03 SUBMITTALS

A. Certification: Provide to the Engineer a certificate stating the name of the manufacturer, product name, style number, chemical composition of the filaments or yarns, and other pertinent information to fully describe the geotextile. The certification shall state that the furnished geotextile meets the minimum Average Roll Value (MARV) requirements of the Specification as evaluated under the manufacturer's Quality Control (QC) Program. Certification shall be attested to by a person having legal authority to bind the manufacturer.

B. Manufacturer's standard warranty provided for the geosynthetics.

PART 2 - PRODUCTS

2.01 MATERIALS

A. High-density Polyethylene (HDPE) Geomembrane: For use as non-permeable layer shall be 40 mil GSE HD Smooth, or equivalent.

B. Non-woven Geotextile: For use as an erosion control filter layer or as a separation layer underneath stone fill materials (e.g., washed gravel, riprap) shall meet the AASHTO M 288-05 requirements for Class 1 permanent erosion control geotextile, such as Mirafi 180N, or equivalent.

C. Woven Geotextile: For use as a stabilization layer underneath roadways or structures shall meet the AASHTO M 288-05 requirements for a Class 1 stabilization geotextile, such as Mirafi 600X, or equivalent.

2.02 DELIVERY, STORAGE, AND HANDLING

A. Geosynthetics shall be furnished in a protective wrapping labeled with the following information: Manufacturer's name, product identification, lot number, roll number, and dimensions.

B. Geosynthetics shall be protected from ultraviolet light, precipitation, mud, soil, excessive dust, puncture, cutting, and/or other damaging conditions prior to and during delivery and onsite storage. Geosynthetics shall be shipped and stored in relatively opaque and watertight wrappings. The geotextile shall be stored onsite at a location subject to review and acceptance by the Construction Manager and Engineer.

C. Materials shall be deployed only after the required submittals have been received and reviewed by the Engineer.

PART 3 - EXECUTION

3.01 GEOTEXTILE INSTALLATION

A. Site Preparation
1. Sub-grade shall be cleared of all sharp objects, tree stumps, and large stones.
2. Sub-grade shall be graded and compacted as required to provide a uniform and stable surface.

B. Material Placement
1. Placement of the geotextile shall not be conducted during adverse weather conditions. The geotextile shall be kept dry during storage and up to the time of deployment. During windy conditions all geotextiles shall be secured with sandbags or an equivalent anchoring system. Removal of the sandbags or equal shall only occur upon placement of an overlying soil layer.
2. Proper cutting tools shall be used to cut and size the geotextile materials. The proper PPE, as defined in the Contractor’s HASP, shall be worn by Contractor’s employees. Care shall be exercised while cutting geotextiles.
3. During the placement of geotextiles, all dirt, dust, sand, and mud shall be kept off to prevent clogging. If excessive amounts of such materials are present on the geotextile, the geotextile shall be cleaned or replaced to the satisfaction of the Construction Manager and Engineer.
4. Geotextile material shall be placed (rolled out) in the direction of most frequent vehicular travel.
5. Adjoining edges shall have a two- to three-foot overlap and shingled in a manner that prevents material rollup during aggregate placement.
6. In general, seams on slopes shall be parallel to the line of slope.
7. Aggregate shall be as specified Section 312323 – Selected Fill and placed in a manner which prevents damage to or dislodgement of underlying geosynthetics.

C. Seaming and Repair
1. On slopes: A patch made from the same geotextile shall be double seamed into place; with each seam ¼-inch to ¾-inch apart and no closer than 1 inch from any edge. Should any tear exceed 10 percent of the width of the roll, that roll shall be removed from the slope and replaced.

2. Non-slopes: A patch made from the same geotextile shall be spot-seamed in place with a minimum 24-inch overlap in all directions.

3.02 GEOMEMBRANE INSTALLATION

A. General Requirements
1. The liner shall be placed, seamed, and tested in accordance with the manufacturer's recommendations/specifications.
2. The installation of geomembrane liner shall be performed on geotextile-covered surfaces free from stones or other protruding objects.
3. No liner shall be placed onto an area that has become softened by precipitation. Appropriate methods of moisture control are the responsibility of the Contractor.
4. The liner shall not be installed on frozen soil material. Such material shall be removed and replaced with acceptable material.
5. All surfaces on which the liner is to be installed shall be acceptable to the Construction Manager and Engineer at the time of installation.

B. Placement
1. The placement of geomembrane panels shall follow all instructions on the boxes or wrapping containing the material that describe the proper methods of unrolling the panels.
2. Liner deployment shall not be undertaken if weather conditions will preclude material seaming following deployment.
3. During placement, geomembrane shall be visually inspected for uniformity, tears, punctures, blisters, or other damage or imperfections. Any such damage or imperfections shall be immediately repaired and re-inspected at the Contractor's expense.
4. No equipment used shall damage the liner by handling, trafficking, leakage of hydrocarbons, or other means.
5. No personnel working on the liner shall smoke, wear damaging shoes, or engage in other activities that could damage the liner.
6. The prepared surface underlying the liner shall not be allowed to deteriorate after acceptance and shall remain acceptable up to the time of liner installation and until completion of the project.
7. Adequate temporary loading and/or anchoring (e.g., sand bags), not likely to damage the liner, shall be placed to prevent uplift by wind (in case of high winds, continuous loading is recommended along edges of panels to minimize risk of wind flow under the panels).
8. Direct contact with the liner shall be minimized. In high-traffic areas, the liner shall be protected by geotextiles, extra geomembrane, or other suitable materials.
9. The method used to unroll or adjust the panels shall not cause excessive scratches or crimps in the liner and shall not damage the supporting soil or underlying geotextile (where applicable).
10. The method used to place the panels shall minimize the potential for wrinkles (especially differential wrinkles between adjacent panels).
11. Any damage to the geomembrane panels or portions of the panels as a result of placement shall be replaced or repaired at the Contractor's expense. The decision to replace or repair any panel or portions of panels shall be made by the Construction Manager and Engineer.

C. Seaming
1. All personnel performing seaming operations shall be qualified by experience or by successfully passing seaming tests.

2. Generally, all seams whether field or factory, shall be oriented parallel to the line of slope, not across slope. At liner penetrations and corners, the number of seams shall be minimized.
3. The area of the liner to be seamed shall be cleaned and prepared in accordance with the manufacturer’s specified procedures. Any abrading of the liner shall not extend more than 0.5 inch on either side of the weld. Care shall be taken to eliminate or minimize the number of wrinkles and "fish-mouths" resulting from seam orientation.
4. Field seaming is prohibited when either the air or sheet temperature is below 32ºF, when the sheet temperature exceeds 122ºF, or when the air temperature is above 104ºF. At air or sheet temperatures between 32ºF and 40ºF, seaming shall be conducted directly behind a preheating device. In addition, seaming shall not be conducted when the liner material is wet from precipitation, dew, fog, etc., or when winds are in excess of 20 miles per hour.
5. Seaming shall not be performed on frozen or excessively wet underlying surfaces.
6. Seams shall have an overlap beyond the weld large enough to perform destructive peel tests, but shall not exceed 5 inches.
7. The Contractor shall perform trial seams on excess liner material. A 1-foot by 3-foot seamed liner sample shall be fabricated with the seam running down the 3-foot length in the center of the sample. Such trial seaming shall be conducted prior to the start of each seaming succession for each seaming crew, every 4 hours, after any significant change in weather conditions or liner temperature, or after any change in seaming equipment. From each trial seam, four field test specimens shall be taken. The test specimens shall be 1-inch by 12-inch strips cut perpendicular to the trial seam. Two of these specimens shall be shear tested and two shall be peel tested using a field tensiometer and recorded as pass (failure of liner material) or fail (failure of seam). Upon initial failure, a second trial seam shall be made; if both trial seams fail, then the seaming device and its operator shall not perform any seaming operations until the deficiencies are corrected and two successive passing trial seams are produced. Completed trial seam samples cannot be used as portions of a second sample and must be discarded.
8. Where “fish-mouths” occur, the material shall be cut, overlapped, and an overlap weld shall be applied. Where necessary, patching using the same liner material shall be welded to the geomembrane.
9. Acceptable seaming methods include:
   a. Extrusion welding using extrudate with identical physical, chemical, and environmental properties.
   b. Hot-wedge welding using a proven fusion welder and master seamer.
10. The seaming device shall not have any sharp edges that might damage the liner. Where self-propelled seaming devices are used, it shall be necessary to prevent "bulldozing" of the device into the underlying soil.
11. The Contractor shall perform non-destructive seam testing on all field seams.
    a. Non-destructive seam testing shall be conducted under the direct observation of the Construction Manager and Engineer.
    b. Air pressure testing may be used if double-track hot-wedge welding has been used to seam the liner. Using approved pressure testing equipment, the following procedures shall be followed:
       1) Seal both ends of the air channel separating the double-track hot-wedge welds.
       2) Insert pressure needle into air channel and pressurize the air channel to 27 psi.
       3) Monitor pressure gauge for 3 minutes and determine whether pressure is maintained without a loss of more than 2 psi.
       4) If the pressure test fails, then localize the leak and mark the area for repair.
    c. Vacuum testing shall be used on all seams not tested using air pressure testing. Using an approved vacuum box, the following procedures shall be followed:

1) Apply a soapy water mixture over the seam.
2) Place vacuum box over soapy seam and form a tight seal.
3) Create a vacuum by reducing the vacuum box pressure to 5 psi for 10 seconds.
4) Observe through the vacuum box window any bubbles.
5) Where bubbles are observed, mark seam for repair.
6) Move vacuum box further down seam, overlapping tested seam by 3 inches.
7) Where hot-wedge seaming has been performed, the overlap shall be cut back to the weld.

D. Liner Repair

1. All imperfections, flaws, construction damage, and seam failures shall be repaired by the Contractor at no additional cost to the Owner.
2. Acceptable repair methods include:
3. Patching, used to repair holes, tears, undispersed raw materials, and contamination by foreign matter.
4. Grinding and re-welding used to repair small sections of extruded seams.
5. Spot Welding or Seaming, used to repair pinholes or other minor, localized flaws.
6. Capping used to repair large lengths of failed seams.
7. Topping used to repair areas of inadequate seams which have an exposed edge.
8. Removing bad seams and replacing with a strip of new material welded into place.

- END OF SECTION -

SECTION 311000

SITE CLEARING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified
1. Clearing and grubbing, within the area available for temporary staging indicated on Design Drawing G-102, or as directed by the Contraction Manager or Engineer, of the following:
   a. Topsoil.
   b. Pieces of rock up to ½-cubic yard in volume.
   c. Trees and bushes.
   d. Pavements.
   e. Brush.
   f. Logs and stumps.
   g. Riprap.
   h. Refuse and Rubbish (on top of ground surface).
   i. Decayed and growing organic matter.
   j. Snow and ice.
2. All material shall be appropriately staged onsite for disposal or potential reuse at locations approved by Construction Manager and Engineer.
3. The Contractor shall remove, replace, support, and protect all power and telephone poles and posts as required.

B. Related Work Specified Elsewhere
1. Section 011100 – Summary of Work
2. Section 013543 – Environmental Protection Procedures
3. Section 352023 – Dredging and Subaqueous Backfill
4. Section 329000 – Site Restoration

1.02 SUBMITTALS

A. The Contractor shall submit for review by the Engineer, an Operations Plan (prepared in accordance with Section 011100 – Summary of Work), including a Site Clearing Section. The Site Clearing Section shall describe clearing methods that will be employed at the Site. Components of the site clearing which shall be specified include, but are not limited to, the following:
1. Site plan showing locations of clearing to be performed.
2. Copies of any permits required for clearing and disposal of materials.
3. Facility to be utilized for disposal of cleared material, including disposal site name, operating license, and validation of the permitted types of waste that can be received

PART 2 - PRODUCTS

2.01 QUALITY OF MATERIALS

A. New power and utility poles and posts and the supporting and protecting of all poles and posts shall be in accordance with the requirements of the local power and telephone companies.

PART 3 - EXECUTION

3.01 GENERAL

A. Tree Protection
   1. Any tree within or in the immediate vicinity of the work area that will not, in the opinion of the Owner, Construction Manager, and Engineer, hinder construction or landscaping shall be protected by stakes placed in a circle having a radius of not less than 5 feet, as measured from the base of the trunk around the tree. The stakes shall extend at least 4 feet above the existing ground. Each circle shall consist of at least six stakes. Landscaping within the circle shall be accomplished by hand, unless otherwise permitted by the Construction Manager and Engineer.
   2. All trees damaged beyond repair by the Contractor, as determined by Owner, shall be removed and replaced by the Contractor at his own expense. Replacement shall be with equivalent caliber size and species.
   3. Roots or branches beyond the limit of tree protection that interfere with the work or present an immediate safety hazard shall be pruned. Trees that must be pruned shall be cut cleanly at an angle to not retain rainfall. If the tree is damaged, the wood shall be repaired. The repair primarily shall involve cutting the cracked or split limb or root at a clean, straight angle. Painting is not ecologically necessary, but if desired, a Latex-based tree paint (to be reviewed by the Engineer) can be used.

B. Removal and Disposal of Cleared Materials/Debris
   1. All materials cleared from at or below grade (i.e., tree stumps/roots, surface debris, riprap, etc.) not suitable for reuse must be disposed of based on the planned removal actions for the soil or sediment from which the material was removed. For example, if a tree stump is removed from an area where underlying soils are not subject to excavation and disposal as impacted material, the tree stump may be disposed of at a local permitted resource recovery facility, as approved by the Owner.
   2. All cleared materials subject to offsite disposal with the associated dredged materials shall be broken into sufficiently small pieces, as required by the selected disposal facility.
   3. Vegetative materials cleared from above grade (e.g., trees/brush/branches, etc.) shall be disposed of at a local permitted resource recovery facility, as appropriate, unless otherwise requested by the Owner. These materials must be removed and handled in a manner that will prevent contact with materials subject to excavation and disposal as impacted material.
   4. Materials that are visually impacted with NAPL shall be handled and disposed of along with sediment in accordance with Section 028100 – Transport and Disposal of Impacted Materials.
   5. Foreign materials and other surface debris must be disposed of, as regulated materials (i.e., hazardous, nonhazardous), unless otherwise requested by the Owner.
   6. Onsite burning of cleared materials is strictly prohibited.

C. Site and Access Clearing
   1. To the extent practicable, existing vegetation and topsoil shall be left in place in areas that will not immediately (i.e., within 24 hours) undergo construction activities.

D. Sediment and Erosion Control
   1. Sediment and erosion control procedures shall be the responsibility of the Contractor. Erosion control procedures, inclusive of mulching, shall be used on the Site. Erosion control shall occur as required, and immediately before and following (weather permitting) completion of Site and access clearing in accordance with Section 013543 – Environmental Protection Procedures.

- END OF SECTION -

SECTION 312323

SELECTED FILL

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified
1. Selected fill materials shall be used as shown on the Design Drawings, as specified herein, or as directed by the Engineer.

B. Related Work Specified Elsewhere
1. Section 028100 – Transportation and Disposal of Impacted Materials
2. Section 329000 – Site Restoration
3. Section 352023 – Dredging and Subaqueous Backfill

1.02 APPLICABLE CODES, STANDARDS, AND SPECS

A. New York State Department of Transportation (NYSDOT) Standard Specifications

B. ASTM International (ASTM). The following ASTM specifications are referred to in this Section and are to be considered a part of this Section:

D6913	Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
D5519	Standard Test Method for Particle Size Analysis of Natural and Man-Made Riprap Materials

C. The following U.S. EPA Methods are referred to in this Section and are to be considered a part of this Section:

6010B/7000A, 9010B, and 9030B	Inorganics
8270C	Semi-Volatile Organic Carbons (SVOCs)
8260B	Volatile Organic Carbons (VOCs)
8081/8151	Pesticides/Herbicides
8082	Polychlorinated Biphenyls (PCBs)

D. New York State Department of Environmental Conservation (NYSDEC) Title 6 of the Official Compilation of Codes, Rules, and Regulations (6 NYCRR) Part 375 (Environmental Remediation Programs)

E. NYSDEC. 2014. Technical Guidance Screening and Assessment of Contaminated Sediment.

1.03 QUALITY ASSURANCE

A. Contractor’s Testing Laboratory:
1. The laboratory used to analyze offsite fill materials shall be certified by the New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) for the parameters being analyzed.
2. The laboratory shall be capable of providing detection limits at or below NYSDEC Technical Guidance for Screening Contaminated Sediments (River Fill Materials) or 6 NYCRR Part 375 unrestricted use soil cleanup objectives (other fill and stone) to allow for comparison of the analytical results to those objectives.

B. Required Quality Assurance Material Testing:
   1. Gradation in accordance with ASTM D6913 and D5519 (as appropriate). Perform one test for each type and source of material. Test one sample per 2,000 cubic yards of imported material.
   2. Analytical testing shall be performed at a frequency consistent with DER-10 Table 5.4(e)10.
      a. Analytical testing shall demonstrate that offsite materials meet the following requirements:
         1) Non-detect for polychlorinated biphenyls (PCBs) and pesticides/herbicides.
         2) Meet Class A criteria in NYSDEC Technical Guidance Screening and Assessment of Contaminated Sediment for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and inorganics.
         3) Conform with DER-10, Section 5.4(e) for 1,4-dioxane and PFAS contamination in using EPA Method 8270, and EPA Method 537.1 (modified) (full list of PFAS compounds), respectively.
         4) For 1,4-dioxane, soil exceeding 0.1 ppm will be rejected per DER 10: Appendix 5 - Allowable Constituent Levels for Imported Fill or Soil, Subdivision 5.4(e).
         5) If PFOA or PFOS is detected in any sample at or above 1 ppb, then a soil sample will be tested by the Synthetic Precipitation Leaching Procedure (SPLP) and the leachate analyzed. If the SPLP results exceed 70 ppt combined PFOA/S, then the source of backfill will be rejected. National Grid will retain the option of analyzing samples concurrently for both PFAS in soil and in the SPLP leachate to minimize project delays.
         6) Category B deliverables will be required for PFAS analysis.
      b. Gravel, rock or stone backfill, consisting of virgin material from a permitted mine or quarry, will be exempt from pre-characterization analytical sampling requirements provided that it contains less than 10% (by weight) material that would pass through a size 80 sieve.

1.04 SUBMITTALS

A. At least three weeks prior to bringing fill materials onsite the Contractor shall submit the following:
   1. The name and location of the source of the selected fill material.
   2. Laboratory test report for each material type that indicates the grain-size profile of the material in accordance with ASTM D6913 and D5519, as appropriate.
   3. Analytical test results as required by Article 1.03 of this Section.

B. Source Quality Control Submittals: Submit Supplier name, source address, copy of NYSDEC mining permit, and proof of NYSDOT approval, as required, for each proposed source of fill material.

C. Delivery Tickets: Submit copy of the delivery ticket for each load of imported fill material, delivered to the Site. Each delivery ticket shall indicate Supplier name and source address, project name, contract number, date, material type, NYSDOT item number when applicable, and quantity delivered.

PART 2 - PRODUCTS

2.01 GENERAL

A. Any offsite materials brought onsite for use as fill must be from a NYSDOT-certified source and meet the requirements of this Section.

B. If quality assurance testing shows that the material does not meet the requirements of this Section, the Contractor must identify a new source for the material and provide the required data report for the new source of material prior to the use of such material onsite.

2.02 LISTING OF MATERIALS

A. Stone/Stone Fill

1. Type 2 Stone
   a. Type 2 Stone shall conform to NYSDOT Standard Specification 304-2.02 or similar, having the following gradation by weight:

Percent Passing by Weight	Sieve Size
100%	2 inch
25 – 60	1/4 inch
5 – 40	No. 40
0 – 10	No. 200

2. Type 3 Stone
   a. Run-of-crusher hard durable limestone, or equal, having the following gradation by weight:

Percent Passing by Weight	Sieve Size
100%	4 inch
30 - 70	1/4 inch
5 - 40	#40 sieve
0 - 10	#200 sieve

3. Type B Granular Fill
   a. Thoroughly washed clean, sound, tough, hard crushed limestone or equal free from coatings. Gradation for crushed stone shall have the following gradation by weight:

Percent Passing by Weight	Sieve Size
100%	1 1/2 inch
0 - 25	3/4 inch
0 - 5	1/2 inch

4. Type E Granular Fill
   a. Run-of-bank gravel or other acceptable granular material, free from organic matter, having the following gradation by weight:

Percent Passing by Weight	Sieve Size
100%	1 1/2 inch
30 - 65	1/4 inch
0 - 10	#200 sieve

5. Riprap
   a. Riprap removed during debris removal shall be cleaned of visual impacts and stockpiled onsite for reuse during restoration activities.
   b. If additional riprap material is necessary, imported riprap for shoreline armor protection shall conform to NYSDOT specifications for stone filling (heavy) and consist of hard, durable, angular rock, having the following gradation:

Percent Passing by Weight	Weight/Size
80-100%	2,000 pounds
0-50%	600 pounds
0-10%	6 inch

   c. Riprap shall have a relatively uniform gradation throughout the full range of stone sizes. Contractor shall submit the required material information for all riprap sizes to be used for construction (if multiple riprap sizes are required).

B. River Fill Materials

1. Type 1 Fill

a. Material to replace the top 2 feet of the dredged areas in the Hudson River. This shall consist of materials conforming to fine sand or silt:

Percent Passing by Weight	Sieve Size
100%	3 in
80 – 100	1 in
70 – 95	No. 4
55 – 80	No. 40
10 – 30	No. 200

2. Type 2 Fill

a. Clean soil for use, as shown on the Design Drawings, must be free of loam, organic matter, very soft clays, swelling clays, and fine uniform sands. This shall consist of materials conforming to the following size characteristics:

Percent Passing by Weight	Sieve Size
100%	3 in
80 – 100	1 in
65 – 90	No. 4
50 – 75	No. 40
0 – 20	No. 200

PART 3 - EXECUTION

3.01 GENERAL

A. Selected fill materials shall be placed in accordance with the Design Drawings and Section 329000 – Site Restoration.

B. Materials displaced through the use of the above materials shall be disposed of by the Contractor in accordance with Section 028100 – Transportation and Disposal of Impacted Materials.

3.02 RIPRAP AND OTHER ARMOR PROTECTION MATERIALS

A. Riprap and other armor protection materials shall be carefully placed to avoid damage or displacement of the underlying materials, particularly River Fill. Placement of riprap by dumping into chutes shall not be permitted.

B. Riprap and other armor protection materials shall be placed in a single lift, to the full required thickness, to avoid segregation of stone sizes during placement.

C. Riprap and other armor protection materials shall be placed such that the completed top surface of the riprap meets the lines and grades from pre-construction survey, unless otherwise directed by the Owner or Engineer.

D. Some hand placement or rearrangement of stones by mechanical equipment may be required to the extent necessary to achieve the results specified.

E. Riprap and other armor protection materials do not require compaction.

- END OF SECTION -

SECTION 313200

MATERIAL STABILIZATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified
1. Furnish and/or provide all labor, tools, materials, equipment, and services, and complete all work, installed, tested, and ready for use, as described in the RD for the stabilization of the dredged material as described in this Technical Specification.

B. Related Specifications
1. Section 011100 – Summary of Work
2. Section 015000 – Temporary Facilities and Controls
3. Section 028100 – Transport and Disposal of Impacted Materials
4. Section 352023 – Dredging and Subaqueous Backfill

1.02 REFERENCES

A. Reference Standards:
1. USEPA SW-846 Method 9095, Paint Filter Liquids Test.

1.03 SUBMITTALS

A. The Contractor shall prepare and submit, as part of the Operations Plan (prepared in accordance with Section 011100 – Summary of Work), a Material Stabilization Plan to the Engineer for review prior to commencing sediment removal operations. At a minimum, the Material Stabilization Plan shall include:
1. Equipment, methods, and location for mixing stabilization additive with dredged material prior to final disposal.
2. Manufacturer’s product data for proposed stabilization additive.
3. Storage location for stabilization additive.
4. Proposed location of mixing and description of mixing vessel(s).
5. Proposed method(s) for determining and tracking amounts of stabilization additive utilized and quantity of material stabilized/solidified.
6. Procedures for completing Paint Filter testing.
7. Summary of Contractor’s qualifications and experience performing stabilization activities.

B. The Contractor shall provide the following in the weekly progress report:
1. Total quantity of dredged material stabilized/solidified, total quantity of stabilization additive utilized, and the results of Paint Filter testing.
2. Summary of material deliveries for the week

1.04 QUALITY ASSURANCE

A. Qualifications:
1. The Contractor must be able to demonstrate that they have a minimum five years of experience in ex-situ stabilization projects of similar scope and size.

PART 2 - PRODUCTS

2.01 STABILIZATION ADDITIVE

A. The Contractor shall provide all required stabilization additive in sufficient quantities to complete the ex-situ stabilization activities as specified, without delay. Stabilization additives may include:
   1. Portland cement shall be Type 1.
   2. Super absorbent Polymer such as M2 Polymer Technologies Inc. Waste Lock 770 or A-100 or equivalent.
   3. Other materials acceptable to Engineer.

B. Any stabilizing agents greater than 50 percent calcium and/or magnesium oxide (e.g. quick lime and lime kiln dust) are prohibited from use on the Site.

PART 3 - EXECUTION

3.01 ADDITION OF STABILIZATION ADDITIVE

A. The Contractor shall add stabilization additive to each batch of dredged material to be stabilized, as necessary, to allow for transportation of the waste materials and acceptance by the selected disposal facility. The Contractor shall determine the actual ratio and actual amounts of stabilization additive to be used in the field.

B. The Contractor must provide a means for accurate measurement and documentation for verifying that the appropriate quantities of stabilization additive are maintained. The Contractor shall determine the actual amount of stabilization additive needed for the stabilization application.

C. The Contractor shall place and mix the appropriate quantities of stabilization additive in such a manner as to achieve thorough mixing with dredged material.

3.02 STABILIZATION

A. Sediment processing stabilization activities performed onsite shall be performed within an open-span enclosed structure, as described in Specification Section 015000 – Temporary Facilities and Controls and as shown on the Design Drawings.

B. The Contractor shall mix the material until a homogeneous mixture is achieved throughout.

C. The stabilized mixture must pass Paint Filter testing procedures (USEPA SW-846 Method 9095) prior to transport or otherwise meet the acceptance criteria of the selected disposal facility. Transportation and disposal shall be performed in accordance with Section 028100 – Transport and Disposal of Impacted Materials.

- END OF SECTION -

SECTION 315000

EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified
1. The following section describes the installation of steel sheet piling for shoreline stabilization during dredging and backfill, as shown or indicated on the Design Drawings.
2. Contractor shall provide all supervision, labor, materials, tools, equipment, accessories, and incidentals as shown, specified, and required to furnish, install, monitor, and maintain dredge support and protection systems capable of supporting dredge depths and sidewalls, and resisting soil pressures and superimposed and construction loads.
3. All labor, materials, equipment, surveys and services necessary for or incidental to the following:
    a. Furnishing of shoring/support systems consisting of, but not limited to steel sheet piles.
    b. Underwater torch cutting of sheet piling near the existing mudline.
    c. Remove and decontaminate/clean remainder of shoring system above the mudline.
4. The Contractor shall install support systems without damaging existing buildings, structures, utilities, and site improvements adjacent to Work.
5. It is the Contractor’s responsibility to review the dredge area configuration and the available information concerning subsurface conditions in order to anticipate subsurface conditions that may be encountered during installation.

B. Related Specifications
    a. Section 011400 – Work Restrictions
    b. Section 013543 – Environmental Protection Procedures
    c. Section 014100 – Regulatory Requirements
    d. Section 022100 – Surveys

1.02 QUALITY ASSURANCE

A. Qualifications:
1. Surveyor:
    a. Surveyor shall meet requirements of Section 022100.
    b. Responsibilities include, but are not necessarily limited to, the following:
        1) Performing or supervising performance of field survey work to check lines and elevations of steel sheet piling.
        2) Preparing field survey reports.
2. Installer:
    a. Engage an experienced pile installer possessing a minimum of five years of experience installing piles substantively similar to those specified, to perform all pile driving indicated in the RD.
    b. The Contractor (or subcontractor) shall retain a field engineer with at least three years of experience in the design and construction of earth retaining support/shoring systems.
    c. Operators and foreman shall have a minimum of three years of experience installing earth retaining support and protection systems.

d. Divers and underwater support personnel shall have a minimum of three years of experience in underwater welding/torching.

B. Regulatory Requirements:
1. Laws and Regulations applying to the Work under this Section include, but are not limited to, the following:
   a. 29 CFR 1926.750 through 29 CFR 1926.761, Subpart R – Steel Erection.
   b. 12 NYCRR 23-2.3, Structural Steel Assembly.

1.03 SUBMITTALS

A. Pile Driving Plan: Submit acceptable plan for pile driving and related Work not less than 21 days prior to starting pile driving work. Include the following:
1. Proposed procedures for storing, handling, preparing, driving, and removing piles during pile driving operations.
2. Proposed procedures for pre-clearing the sheet pile alignment and removing obstructions encountered during pile driving operations.
3. Other proposed procedures as applicable.
4. List of proposed equipment for pile driving Work.
5. Complete data on hammer and other driving equipment to be used.
6. Planned sequence of pile driving operations, including coordination with dredging Work.
7. Quality control procedures to ensure piles are driven within the tolerances specified in this Section.
8. Detailed schedule of pile driving Work in accordance with the accepted Construction Schedule.

B. Sheet Pile Removal Plan: Submit acceptable plan for torch cutting of sheet pile walls at the mudline for removal and related work not less than 21 days prior to starting sheet pile removal. Include the following:
1. Proposed procedure for cutting of sheet piles underwater at water depths ranging from 2 to 15 ft.
2. Proposed procedure for securing and lifting of cut portions of sheeting during removal activities.
3. Proposed procedure for decontaminating the sections of cut sheet piles that are removed.
4. Other proposed procedures as applicable.
5. List of proposed equipment for cutting of sheet piles.
6. Planned sequence of operations.
7. Injury protocol and emergency plan.

C. Certificates: Submit copies of certified mill test reports covering chemical and physical properties of structural steel of each type furnished under this Section.

D. Driving Records: Within two days of driving, submit copies of driving record of each pile including the following information:
1. Project name, Contractor number, report date, and date of pile driving.
2. Contractor and subcontractor names.
3. Pile location and number.
4. Pile section designation.
5. Total length of pile.
6. Type, size, and energy rating of hammer.
7. Starting and finishing driving times.

8. Rate of penetration in feet per minute, as well as changes in rate of penetration and depth at which change occurred.
9. Ground, tip, and butt elevation of pile.
10. Total length of pile in ground.
11. Data on and description of unusual occurrences or obstructions, if any, during pile driving.

E. Pile Cutting and Removal Plan: submit a plan for removing piles as required by this Section not less than 21 days prior to starting pile removal work. Include the following:
   1. Proposed procedures for cutting, removing, handling, decontaminating, and demobilizing piles during removal operations.
   2. List of proposed equipment for pile cutting and removal Work.
   3. Complete data on equipment to be used.
   4. Planned sequence of pile cutting and removal operations, including coordination with dredging and backfill Work.
   5. Detailed schedule of pile cutting and removal Work in accordance with the accepted Construction Schedule.

F. Qualifications Statements
   1. Provide resumes for key Contractor/subcontractor personnel, including project manager, onsite superintendent/foreman, onsite health and safety officer, and equipment operators.
   2. Installer: Provide documentation of agreement with licensed installer for provisions of quality control service for the shoring installation, including but not limited to sheet piles.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
   1. Deliver materials to the Site in such quantities and at such times to ensure continuity of pile driving operations in accordance with the accepted Construction Schedule.

B. Storage:
   1. Store piles in orderly groups above ground on level blocks or racks to minimize potential for permanent deflection, distortion, or damage to interlocks. Structural steel and miscellaneous metal shall be stored on blocking so that no metal touches the ground and water cannot collect thereon. The material shall be protected against bending under its own weight or under superimposed loads. Materials shall not be permitted to sag more than 0.25 inch maximum.
   2. Protect steel members and packaged materials from corrosion and deterioration

C. Handling:
   1. Handle piling with care using only handling holes or lifting devices to prevent permanent deflection, distortion, or damage to interlocks.
   2. Do not drag piles across the ground.
   3. Before assembly, surfaces that shall contact each other will be thoroughly cleaned. All parts shall be assembled accurately as shown on the Drawings. Light drifting will be permitted to draw parts together, but drifting to match unfair holes shall not be permitted. Any enlargement of holes necessary to make connections in the field shall be done by reaming with twist drills. Enlarging holes by burning is prohibited.

1.05 SITE CONDITIONS

A. Subsurface Information

1. The Supplementary Conditions indicate information available relative to subsurface conditions at the Site. Such information and data are not intended as a representation or warranty of continuity of conditions between soil borings or test pits, nor of groundwater levels at dates and times other than date and time when measured, nor that purpose of obtaining the information and data were appropriate for use by Contractor. Owner and Engineer will not be responsible for interpretations or conclusions drawn therefrom by Contractor.

B. Existing Structures:
1. The RD shows or indicates certain structures adjacent to or within the limits of the Work. Such information was obtained from existing records and is not guaranteed to be correct or complete. Contractor shall explore ahead of dredging, or other subsurface work to determine the exact location of all existing structures.
2. Coordinate with utility owners for shut off of services in active piping and conduits, as needed. When required by utility owner, Owner will assist Contractor with utility owner notifications.

C. Line and Level:
1. Using reference points and engineering surveys provided by Owner, Contractor shall establish and locate all other lines and levels, and is responsible for the correct location and deviation of all piles.
2. Install piles at the proper locations and orientation shown or indicated in the RD.
3. Survey shall conform to the requirements of Section 022100.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General
1. Provide materials that are either new or in serviceable (like-new) condition.

B. Steel Sheet Piles
1. Hot-rolled steel sections of continuous interlocking type complying with ASTM A572/A572M, Grade 50. Provide sheet pile sections of the minimum lengths and specifications shown or indicated on the Design Drawings.

C. Steel Corner Piles:
1. Provide steel corner piles of continuous interlocking type, and of the types and lengths shown or indicated on the Design Drawings.

D. Source Quality Control Inspection and Testing at the Mill or Shop
1. Perform fabricator’s standard procedures for source quality control, including inspections and testing.
2. Materials and fabrication procedures shall be subject to inspection and tests in mill and shop, conducted by a qualified inspection laboratory. Such inspections and tests do not relieve Contractor of responsibility for providing the Work in accordance with the RD.

2.02 EQUIPMENT

A. Driving Hammer: Drive piles with variable-moment vibratory hammer or impact hammer (if necessary). Use hammer with sufficient energy to drive piling to required tip elevations without damaging piles. Size or capacity of hammer shall be as recommended by hammer manufacturer for the total pile mass weight and character of soil formation to be penetrated. Submit complete descriptions of the proposed equipment as part of the Pile Driving Plan. Final approval of the proposed equipment is subject to review by the Engineer. Changes in the selected pile driving equipment shall not be allowed after the equipment has been agreed to by the Engineer, except as specified and directed. No schedule accommodation shall be made for Contractor-proposed changes to the equipment. If piling sheet pile section must be increased based on pile drivability analysis, the Contractor shall alert the Engineer and provide price adjustment for Engineer and Owner review, and only price adjustment for materials increase will be made. Upon approval, the Contractor shall make arrangements to procure and delivery the appropriate sheet piling to the Site according to a schedule acceptable to the Engineer.

1. Pile driving hammers shall be of the vibratory or impact type.
    a. Contractor shall use vibratory pile driving to extent practical, and this shall be supplemented by impact pile driving as needed to achieve the requirements of design.
    b. Vibratory pile driving hammers shall be sized appropriately by the pile driving Contractor based on available subsurface information and specifications of piling to be driven. Proposed vibratory hammer type shall be submitted as required as part of the Pile Driving Plan.
    c. For impact hammers, a pile cushion block shall be required to protect the piling integrity.
    d. Submit the following information as part of the Pile Driving Plan for each impact hammer proposed:
        1) Make and model
        2) Ram mass weight (pounds)
        3) Anvil mass weight (pounds)
        4) Rated stroke (inches)
        5) Rate energy range (foot pounds)
        6) Rate speed (blows per minute)
        7) Steam or air pressure, hammer, and boiler and/or compressor (pounds per square inch [psi])
        8) Rated bounce chamber pressure curves or charts, including pressure correction chart for type and length of hose used with pressure gage (psi)
        9) Pile driving cap, make, and mass weight (pounds)
        10) Cushion block dimensions and material type
        11) Power pack description

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine the areas and conditions under which the Work will be performed and notify Construction Manager and Engineer in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected in a manner acceptable to the Construction Manager and Engineer.

3.02 PREPARATION

A. Notification:

1. At least seven days prior to commencing pile driving Work, notify Construction Manager in writing of planned start of pile driving Work; the Construction Manager will notify the Engineer, Owner, and other parties as appropriate. Do not start pile driving operations without permission of Construction Manager.

B. Protection of Surrounding Areas and Facilities:
   1. Protect structures, utilities, and other facilities indicated to remain from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during dredging support and protection system operations. Repair damage at Contractor's expense.
   2. Implement turbidity and sheen control measures as required by Section 013543.

C. Demolition:
   1. Before proceeding with pile driving operations, locate, identify, and remove or relocate obstructing structures.

D. Pile Preparation:
   1. Pile Markings: Label each pile using a waterproof marking device with its total length and a unique identification number. Identification number shall be clearly visible and located within two feet of the top of each pile.
   2. Splices: Use of splices is prohibited.

3.03 PILE DRIVING

A. Drive piles in plumb position to lines and grades shown or indicated, and tightly interlock along entire length of each pile to form a continuous wall.

B. Prevent damage due to excessive bending or twisting when lifting and positioning piles for driving. Bent or twisted piles may be rejected by Contraction Manager or Engineer.

C. Provide temporary wales, templates, or guide structures to ensure that piles are placed and driven to the correct alignment. Use a system of structural framing sufficiently rigid to resist lateral and driving forces and to adequately support sheet piling until design tip elevation is achieved. Templates shall not move when supporting sheet piling. Fit templates with wood blocking to bear against the web of each alternate sheet pile and hold the sheet pile at the design location alignment. Provide outer template straps or other restraints as necessary to prevent sheets from warping or wandering from design alignment.

D. Carefully plumb piles before driving. During driving, monitor, prevent, and correct tendency of piles to bend, twist, rotate, or pull out of their interlocks. Remove and re-drive piles known or suspected to have pulled out of their interlocks. Integrity of each sheet pile, including interlock, shall be maintained during driving.

E. Driving Tolerances:
   1. Drive piles within the following maximum tolerances:
      a. Horizontal: Three inches from location indicated for center of gravity of each pile.
      b. Plumbness: One inch in ten feet from vertical, or a maximum of four inches.
   2. Remove and re-drive sheet piles damaged or driven outside the above tolerances at no additional cost to Owner.

F. Obstructions:

1. Should an obstruction including, but not limited to, boulders, rock, rubble, fill, or existing foundations be encountered that prevents driving of pile to its required tip elevation, threatens pile damage, or causes pile to drift from required location, cease driving operations and immediately notify the Construction Manager, who will notify the Engineer. Construction Manager and Engineer will determine corrective measures, including, but not necessarily limited to, pre-spudding, pre-drilling, and pile relocation, required to accommodate or remove obstruction.
2. Pre-Spudding:
   a. Drive small diameter steel spud or steel H-pile at locations and to depths as required for satisfactory driving results.
   b. Pre-spudding equipment and method shall be reviewed by Engineer prior to commencing pre-spudding operation.
3. Pre-Drilling:
   a. Drill holes with six-inch diameter auger at locations and to depths as required for satisfactory driving results.
   b. Pre-drilling equipment and method shall be reviewed by Engineer prior to commencing pre-drilling operation.
4. The Contractor shall make the above available contingencies within 24 hours of the need for such contingency being identified.

3.04 MONITORING

A. Monitor dredging support and protection systems and surrounding conditions daily during dredging progress and until backfill of dredge area is completed.

B. Immediately notify Construction Manager of any movement, cracking, or settlement of the ground surface surrounding the dredge area, or of any visual damage to or movement of adjacent structures, utilities, or other facilities. The Construction Manager will notify the Engineer, Owner, and other appropriate parties.

C. Promptly correct bulges, breakage, leaks, or other evidence of movement to ensure that dredge support and protection systems remain stable.

3.05 FIELD QUALITY CONTROL

A. Site Tests and Inspections: Materials and erection procedures shall be subject to inspection and tests at the Site conducted by qualified inspection laboratory. Such inspections and tests do not relieve Contractor of responsibility for providing the Work in accordance with the RD.

3.06 CUTTING AND REMOVAL

A. Sheet piles shall be torch cut underwater using oxy-arc cutting equipment at the existing mudline after completion of backfill. The cutting diver shall be a licensed commercial diver and have current training certifications in oxy-arc cutting. Proper lifting equipment shall be attached to sheet pile while cutting in order to safely facilitate removal of the portion of the pile above the mudline.
   1. The Contractor may propose alternate methods in their removal plan, such as extraction of the sheet pile, for the Engineer's review.

B. Removed sheet piles shall be cleaned/decontaminated prior to demobilization from the site.

- END OF SECTION -

SECTION 321216

ASPHALT PAVING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified
1. Furnish and/or provide all labor, tools, materials, equipment, and services, and complete all work, installed, tested, and ready for use, as described in the RD.
2. Construction of bituminous concrete as pavement on a prepared base laid to the required grade, thickness, and cross section, as shown on the Design Drawings and/or as specified in this Technical Specification.
3. The quality of materials and performance of the work shall be in accordance with the Standard Specifications of the New York State Department of Transportation (NYSDOT), unless otherwise specified in this Technical Specification.

B. Related Work Specified Elsewhere
1. 312323 - Selected Fill

PART 2 - PRODUCTS

2.01 MATERIALS OF CONSTRUCTION

A. Bituminous Concrete Products
1. Base courses shall be NYSDOT Type 1, Base Course.
2. The wear course shall be NYSDOT Type 6, Top Course.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Subgrade
1. The subgrade shall be shaped to line and grade and compacted with self-propelled rollers. A minimum of 3 passes with the roller shall be performed.
2. All depressions which develop under rolling shall be filled with acceptable material and the area re-rolled.
3. Soft areas shall be removed and re-filled with acceptable materials and the areas re-rolled.
4. Should the subgrade become rutted or displaced prior to the placing of the subbase, it shall be reworked to bring to line and grade.

B. Subbase
1. The subbase shall consist of 12 inches of Type 2 stone.
2. Rolling shall begin at the sides and continue toward the center and shall continue until there is no movement ahead of the roller. Compaction shall be to 95 percent compaction throughout the subbase.

3. After completion of the subbase rolling there shall be no hauling over the subbase other that the delivery of material for the top course.

C. Bituminous Material
   1. The bituminous base course shall be a 2 ½ -inch compacted depth.
   2. The bituminous top course shall be a 1 ½ -inch compacted depth.

D. Testing
   1. The finish pavement shall be to the grades and cross-section, as described in the RD.
      a. The surface tolerance shall not exceed ¼ -inch in 10 feet.
      b. There shall be no depressions which will retain standing water.
   2. Variations exceeding ¼ -inch (or depressions) shall be satisfactorily corrected.

- END OF SECTION -

SECTION 329000

SITE RESTORATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified
   1. All types of surfaces disturbed, damaged, or destroyed during the performance of the Project, shall be restored as specified herein.
   2. The quality of materials and the performance of work used in the restoration shall produce a surface or feature equal to or better than the condition of each before the Project began, as reviewed by the Owner and acceptable to the property owner.

1.02 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

A. New York State Department of Transportation (NYSDOT) Standard Specifications

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Section 321216 – Asphalt Paving

B. Section 312323 – Selected Fill

1.04 SUBMITTALS

A. The Contractor shall submit a schedule of restoration operations for review. Any changes to the agreed upon restoration schedule must be reviewed by the Engineer and accepted by the Owner. The replacement of surfaces at any time, as scheduled or as directed, shall not relieve the Contractor of the responsibility to repair damages by settlement or other failures.

B. The Contractor shall prepare a support area restoration plan documenting the locations and types of restoration to be performed to restore upland support areas to pre-construction conditions.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Stone/Gravel – See Section 312323 – Selected Fill

B. Asphalt Pavement – See Section 321216 – Asphalt Paving.

PART 3 - EXECUTION

3.01 STONE OR GRAVEL SURFACES

A. All areas surfaced with stone or gravel shall be replaced with material to match the existing surface unless otherwise specified.

1. The depth of the stone or gravel shall be at least equal to the existing.
2. After compaction, the surface shall conform to the slope and grade of the area being replaced.

3.02 OTHER TYPES OF RESTORATION

A. Upland areas disturbed by construction work shall be restored to pre-construction conditions as documented in the pre-construction survey, or in an alternate manner that is agreeable to the property owner. Final restoration details shall be coordinated with the property owner prior to implementation.

B. Fences destroyed or removed as a result of the construction operations shall be replaced in like size and material and shall be replaced at the original or new location, as shown on the Design Drawings, or as directed by the Owner.

C. All bituminous concrete pavement or other paved driveways shall be replaced with material to match the existing surface condition unless otherwise specified.

D. Other site features removed or damaged as a result of the construction operations shall be restored in-kind to their original location and condition unless otherwise indicated in the RD, or as directed by the Owner.

E. Existing riprap-lined shoreline areas shall be restored by placing riprap along the riverbank and in near-shore areas, as necessary, to match pre-construction locations, elevations, and grades in accordance with the RD and Section 312323 – Selected Fill.

- END OF SECTION -

SECTION 352023

DREDGING AND SUBAQUEOUS BACKFILL

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified
   1. Provide all supervision, labor, materials, tools, equipment, accessories, and appurtenances necessary to perform sediment removal and related Work.

B. Related Specifications
   1. Section 011100 – Summary of Work
   2. Section 011400 – Work Restrictions
   3. Section 013543 – Environmental Protection Procedures
   4. Section 014100 – Regulatory Requirements
   5. Section 022100 – Surveys
   6. Section 028100 – Transport and Disposal of Impacted Materials
   7. Section 312323 – Selected Fill
   8. Section 313200 – Material Stabilization
   9. Section 315000 – Excavation Support and Protection
   10. Section 329000 – Site Restoration
   11. Section 444000 – Water Handling and Disposal

1.02 SUBMITTALS

A. Pre-Construction
   1. As part of the Operations Plan (prepared in accordance with Section 011100 – Summary of Work), prepare and submit a Sediment Removal and Backfill Plan to the Engineer for review prior to commencing sediment removal operations. The Sediment Removal and Backfill Plan shall include details for the Work planned for the upcoming construction season. At a minimum, the Sediment Removal and Backfill Plan shall include:
      a. Proposed methods, procedures, and equipment for debris removal during dredging, including the segmentation and transport of debris that may be encountered during dredging.
      b. Description, dimensions, capacity, and drawings or photographs of the equipment to be used for removal of river sediments and subaqueous backfill placement.
      c. Description of dredging and/or excavation equipment to be utilized, including number and type of dredges or excavators including bucket types, dredge platforms, etc.
      d. Description of real-time kinematics differential global positioning system (RTK DGPS) to be utilized and the qualifications and experience of the positioning equipment technical support personnel to be onsite during dredging.
      e. Description, number and type of ancillary equipment (e.g., barges, trucks, pumps) to be used for material transport, including debris.
      f. Anticipated production rates and sequencing.
      g. Proposed inspection procedure to verify dredging equipment is clean and functioning prior to mobilization and demobilization.
      h. Delineation of the Work Areas to be used by the Contractor, including the areas to be used for material transfers (e.g., sediment offloading, backfill loading), dredged material stabilization, temporary stockpiling of debris, and de-watering. Additionally

the sequencing of dredging and backfill placement must be described (order of areas that will be dredged and sequencing with other vessels utilizing the bulkhead area and/or other vehicles using the access road).

i. Description and location of navigation aids to be used as required by Article 3.06 of this section.
j. Description of dredging equipment positioning and visualization software to be utilized for sediment removal and backfill in addition to the planned work progression.
k. Description of land-based and/or water-based removal operations, and what materials will be removed with land-based removal equipment, if any.
l. Description of land-based and/or water-based backfill placement operations, and what materials will be placed with land-based removal equipment, if any.
m. Proposed methods for avoiding, protecting, or removing and replacing public and private utilities. Include the procedures for locating and protecting and utilities that could be encountered and impacted by dredging operations.
n. Proposed methods and procedures for sediment removal and backfill placement within tolerances and to minimize generation of turbidity or sheens.
o. Proposed equipment and methods for unloading/loading the material transport barges.
p. Identify designated location for temporary sediment staging including description of all necessary containment systems for temporary sediment staging area.

2. Third-party Inspection Reports
   a. Provide independent third-party inspection reports prior to mobilization that certify that each vessel to be used in conducting the work (for water based operations) is seaworthy and includes all the required safety gear, equipment, lighting, and markings. The Construction Manager and Engineer shall have full access to examine and inspect all equipment for hull integrity, mooring lines, and lights prior to equipment arrival onsite and on a regular basis throughout conduct of the work. Testing may be conducted to certify that the material barges are watertight. Barges will also be clearly numbered and labeled for identification purposes to help with reporting requirements.

B. During Construction
1. Submit any proposed significant changes to operating procedures or equipment, such as use of an entirely different dredging technology, to the Engineer for review and Owner approval prior to implementation.
2. Submit updates to the Sediment Removal and Backfill Plan as requested by the Engineer or, as necessary, to account for different methods, procedures, or conditions to those presented in the approved Sediment Removal and Backfill Plan.
3. Submit dredging status summary in daily progress reports. Such reports shall include the following information, at a minimum:
   a. Weather conditions
   b. Hudson River tidal elevations
   c. Volume of material removed/placed that day
   d. Total volume removed/placed to date
   e. Daily production rate (sediment removed and backfill placed)
   f. Overall production rate to date (sediment removed and backfill placed)
   g. Debris encountered during dredging
   h. Unusual conditions encountered during dredging
   i. Visual output from positioning software (such as RTK DGPS positioning software) showing dredging and backfill completed to date
   j. Results of progress bathymetry surveys
   k. Summary of debris offloading activities for that day, including quantity

l. Results of RTK-DGPS system verification

1.03 DEFINITIONS

A. Refusal Areas: Refusal areas are areas where the dredge encounters the top of a hard surface (e.g., bedrock, boulders) that it is unable to penetrate.

B. Debris: Debris includes, but is not limited to, wood, vegetation, and manmade objects. Debris also includes potentially significant cultural resources, and floating or submerged aquatic vegetation that is present in the dredge area.

C. Design Dredge Prism XYZ File: The Design Dredge Prism XYZ File is an electronic data file that specifies the horizontal (X and Y) and Vertical (Z) extent of design cut material to be removed as part of the sediment removal. The electronic data file contains X, Y, and Z values on a 1-foot by 1-foot basis within the footprint of the dredge area and the adjoining side slope areas.

D. Dredging: Dredging includes the removal of all sediment and debris necessary to achieve the Required Elevations shown in the Design Dredge Prism XYZ File, including design cut material and target materials that may be necessary to achieve the Required Elevations in the Design Dredge Prism XYZ File.

E. Required Elevations: The Required Elevations include the following within the dredge area boundaries:
   a. The elevations in the Design Dredge Prism XYZ File.
   b. The elevations of Refusal Areas, if encountered prior to achieving the Required Elevations shown in the Design Dredge Prism XYZ File.

   Required Elevations do not include areas where a specific setback, offset, or exclusion area is directed in writing by the Engineer with Owner approval.

F. Target Material: Target Material is sediment and debris located inside the dredge area limits and above the Required Elevations.

1.04 MATERIAL TO BE REMOVED

A. Character of Material to be Removed
   1. Information regarding the physical and chemical properties of material to be removed from the River is provided in the RD. The information is based on field investigation and laboratory testing of the materials from the River. Although the results of such explorations are considered generally representative of the subsurface conditions at their respective locations, local variations in the subsurface materials are to be expected and, if encountered, shall not be considered materially difference within the purview of the Contract.
   2. The Contractor is encouraged to assess the geotechnical characteristics of the sediments at the Site through their own exploratory methods as dredging progresses and to use that information to supplement the information provided in the RD for planning purposes if material characteristics differ from what is indicated by available data. Any additional work of this nature shall be at no additional cost to the Owner.

1.05 CONTRACT WORK AREA

A. Access

1. Access is available to the Contractor at a portion of an existing bulkhead as shown on Design Drawing G-102. Provide and maintain in-river access to dredges, barges, tow boats, and other related equipment. Ascertain conditions that can affect the access such as climate, winds, currents, waves, depths, shoaling, and scouring tendencies.
2. If the Contractor desires to access the shoreline near the site for personnel or equipment loading and offloading, at locations other than the property for which the Owner is seeking an access agreement, these locations must be identified in the Contractor's Operations Plan (prepared in accordance with Section 011100 – Summary of Work). Access to these locations must be accepted by the Owner and secured by the Contractor. Any costs for access or use of such sites for these purposes shall be at the Contractor's expense.

B. Protection of Adjacent Property and Structures

1. Conduct Work in such a manner that no removed material (i.e., sediment or debris) is placed or otherwise deposited outside of dredging limits (e.g., existing side channels, basins, docking areas, or other areas).
2. The Contractor shall review and verify the condition of existing structures adjacent to the Contract Work Area prior to beginning Work to ascertain existing conditions, including photographic documentation. Work shall be conducted in a manner to protect the stability of structures on or adjacent to the Contract Work Area.
3. The Contractor shall protect the existing dock and marina structures adjacent to the dredging area, as shown on the Design Drawings.

C. Shoreline

1. Work shall be conducted such that shoreline materials adjacent to and upland of the dredge areas are not destabilized and do not enter the dredge areas, as shown on the drawings. Sloughing or erosion of these shoreline areas into the dredge cut is not acceptable either during or immediately following dredging. Any consequence of the Contractor's actions shall solely be borne by the Contractor.

D. Relocation of Navigation Aids

1. Do not remove, change the location of, obstruct, willfully damage, make fast to, or interfere with any Aid to Navigation except with approval of the USCG.
2. Navigation buoys shall be geolocated so that they can be replaced if damaged.

1.06 BARGE LOADING

A. Load barges using methods that do not create an unsafe situation or a situation causing spillage or submergence (tipping) of the barge. Load barges evenly to maintain stability of the barge. Once movement of the dredge bucket toward the barge begins, the dredge shall maintain continuous movement of the bucket toward the barge until the dredged material is loaded in the barge; except where barge stability is a concern, where otherwise noted, or where otherwise directed in writing by the Engineer and approved by the Owner.

B. Conduct dredging and barge loading operations in a manner to optimize the quantity of sediment in the barges while maintaining barge stability and integrity.

C. Implement odor controls as necessary in accordance with Section 013543 – Environmental Protection Procedures to control odors during barge transport of dredged materials.

1.07 SEDIMENT OIL SHEEN RESPONSE

A. Implement measures to control sediment oil sheens on the river water surface resulting from dredging and debris removal operations in accordance with Section 013543 – Environmental Protection Procedures.

1.08 SEDIMENT TURBIDITY PLUME RESPONSE

A. Implement measures to control sediment turbidity plumes outside the turbidity curtain system resulting from dredging operations in accordance with Section 013543 – Environmental Protection Procedures.

PART 2 - PRODUCTS

2.01 GENERAL

A. All vessel to be used in conducting the work (for water based operations) shall be seaworthy and include all the required safety gear, equipment, lighting, and markings.

B. The Construction Manager and Engineer shall have full access to examine and inspect all equipment for hull integrity, mooring lines, and lights prior to equipment arrival onsite and on a regular basis throughout conduct of the work.

2.02 DREDGING PLANT AND EQUIPMENT

A. Dredging Plant and Equipment
   1. Dredging equipment shall be capable of making a flat cut to minimize the amount of non-target materials removed during dredging. In addition, the dredging equipment shall be designed to remove sediments at near in situ densities and minimize the amount of water requiring management.
   2. Dredging equipment shall be designed and operated to minimize generation of suspended sediments during dredging.
   3. Dredge equipment of various sizes, types, and configurations shall be provided as necessary to maximize effectiveness based on the dredge cut thicknesses and different substrate conditions anticipated to be encountered.
   4. Dredge buckets shall be:
      a. Equipped with monitoring capabilities to inform the dredge operator if the bucket is not completely closed. Separate logs of closed and partially closed (i.e., held open by debris or other obstruction) buckets shall be reported by the RTK DGPS.
      b. Designed to maintain enclosure of sediments when the bucket is being raised through the water column; minimize, to the maximum extent practical, the generation of suspended sediments during bucket lowering, closing, and raising in the water column; and minimize the amount of water contained in the dredge bucket as it is closed.
      c. Equipped with features designed by the buckets’ manufacturer that allow free water overlying the sediment in the bucket to drain once the dredge bucket has been raised above the water surface.

B. Dredge Positioning Equipment
   1. The dredge shall be equipped RTK DGPS with the necessary sensors, to enable accurate positioning of the dredge bucket. The dredge bucket shall have a positioning

tolerance of plus or minus 2 inches vertically and plus or minus 3 inches horizontally. The information generated by the RTK DGPS shall be provided to the Owner, Construction Manager, and Engineer upon request.

2. The Contractor shall have a qualified positioning equipment technical support personnel on the Project Site whenever dredging activities take place.
3. The RTK DGPS shall be capable of:
   a. Inputting and presenting a dredge prism file (an x, y, z file on a gridded interval of 1 foot by 1 foot).
   b. Recording all dredge bucket sensor information in standard ASCII format (or other format requested by the Engineer) to a hard disc so that the position and movements of the dredge bucket can be reviewed at a later date (playback capability).
   c. Producing plots showing the location where each dredge bucket closing (x,y,z) was attempted and if the bucket was closed.
   d. Showing the dredge operator, in real-time, the depth of material removed in relation to the dredge prism.
   e. Using a true 3-dimensional computational system to calculate the position of the dredge bucket taking into account the tilt and list of dredge platform as well as standard positioning sensors.
   f. Show that the dredge positioning system's error budget allows it to with within the stated vertical and horizontal accuracies. The error budget must include all errors associated with measuring the positioning of the bucket.
4. Hypack, Inc.'s Dredgepack System is an acceptable version of such a RTK DGPS. If the Contractor chooses to use an alternate positioning system, it must be reviewed by the Engineer and approved by the Owner.
5. The RTK DGPS for the dredge shall be verified to demonstrate the ability to achieve, monitor, and report project tolerances. Procedures for verification shall be submitted to the Engineer for review and for written approval by Owner at least 30 days in advance of verification. The Contractor must calibrate positioning system and verify its error budget (i.e., quality control check of all positioning sensors to verify that individually and together they operate within an error range that satisfies the error budget requirement) at least two times per day.
6. If GPS downtime is greater than 10 hours per week for work in the dredge area, alternate positioning equipment systems must be used subject to review by Engineer and approval of Owner.

C. Tow Boats
   1. All contractor-furnished tow boats utilized for propelling barges and other equipment shall be of size adequate for pushing the anticipated load and shall have necessary reserve power for maneuvering with material barges under emergency conditions as well as for control of material barges at the offloading point.

D. Dredged Material Transport Barges
   1. Provide material barges sized as necessary to access the dredge area as shown on the Drawings. Provide sufficient quantities to minimize downtime associated with barge changeout.
   2. Barges shall be clearly numbered and labeled for identification purposes to help with reporting requirements.
   3. Material barges used to transport impacted dredged materials shall be decontaminated prior to transporting backfill or being demobilized from the site.

E. Navigation aids (e.g., buoys) as required by Article 3.06 of this section.

2.03 RIVER BACKFILL

A. River backfill shall meet the requirements of Section 312323.

PART 3 - EXECUTION

3.01 SEQUENCE OF SEDIMENT REMOVAL WORK

A. Prior to the start of dredging, Contractor shall perform the pre-construction bathymetric survey in accordance with Section 022100. If Contractor elects to perform pre-construction debris survey as discussed in Section 022100, the debris survey shall be completed before start of dredging.

B. Prior to the start of dredging within the dredge area, complete pruning of vegetation along the shorelines as necessary to complete the Work in accordance with Section 311000 – Site Clearing. Clearing operations shall be completed sufficiently in advance of the dredge such that it does not interfere or conflict with dredging production.

C. Implement procedures that minimize sediment resuspension during dredging. Implement turbidity control measures in accordance with Section 013543.

D. Implement procedures that minimize sheen generation during dredging and debris removal. Implement sheen control measures in accordance with Section 013543.

E. Prior to the start of dredging, remove large debris from the river bottom surface and shoreline as necessary to facilitate dredging. Debris removal operations shall proceed in advance of dredging such that these operations do not interfere with dredging and to minimize the potential for debris interference with the dredge.
   1. Existing riprap from the shoreline and dredge area shall be removed and staged onsite for cleaning of visual impacts, characterization, and potential reuse in accordance with Section 312323.

F. Install sheet pile in accordance with Section 315000 and as shown on the Drawings.

G. Conduct dredging to the Required Elevations.
   1. In preparation for dredging activities, Contractor shall assess the site-specific conditions presented in the RD. Following their assessment of site conditions, Contractor shall determine the appropriate dredging equipment for completion of the Work, and shall choose such equipment and any associated features to minimize, to the extent practical, generation of suspended sediments.
   2. The Contractor shall follow the method presented in the Operations Plan (prepared in accordance with Section 011100 – Summary of Work) for dredging progression. Any deviations from this plan must be reviewed by the Engineer and approved by the Owner. The dredging progression is expected to be conducted from shallow water areas to deep water areas to avoid recontamination of previous removal areas. There shall be a minimum of 1-foot overlap of consecutive cuts based on the accuracy of the positioning equipment to account for sediment sloughing during dredging activities. Cut thickness shall be no more than 2 feet of material in any dredge pass as a precaution to limit sloughing.

H. Conduct post-dredging bathymetric survey in accordance with Section 022100 following completion of dredging and prior to backfill placement.

I. Conduct equipment decontamination prior to backfill placement.

J. Conduct backfill placement as discussed in Article 3.08 of this Section.
   1. Documentation of the interface between backfill types shall be documented using the RTK DGPS.

K. Conduct post-construction bathymetric survey in accordance with Section 022100 following completion of backfill placement.

L. Conduct equipment decontamination prior to demobilization.

3.02 DREDGING PROCEDURES

A. The Contractor shall remove debris from within the dredge area as part of dredging as necessary to facilitate dredging to the Required Elevations.
   1. The amount, type, and location of debris in the Contract Work Area may differ from that shown on the Drawings; therefore, it shall be necessary for the Contractor to determine the extent of debris present at any given time and location.
   2. If debris cannot be removed using the dredge equipment, the Contractor shall be prepared to use and implement alternate procedures and equipment to remove debris as necessary to facilitate dredging to the Required Elevations.
   3. Grabbing and removing debris shall be limited to three attempts. If removal is not successful after three attempts, notify the Construction Manager immediately.
   4. The Contractor shall notify the Construction Manager immediately if debris encountered during debris removal or dredging extends into the riverbank beyond the shoreline. The Contractor shall not remove debris that extends into the riverbank beyond the shoreline unless directed by the Engineer or Construction Manager.
   5. Debris shall be transported within a barge or scow approved for such use. Debris shall not be loaded, stored, or transported in/on deck barges or on the decking of hopper barges without containment measures.
   6. (If appropriate based on selected dredging method.) Debris may be transported in the same barge as dredged sediment, but must be segregated within the hold of the barge such that it may be offloaded separately and before the dredged sediment is offloaded.
   7. (If appropriate based on selected dredging method.) Dredge materials may be temporarily stored in barges if necessary to allow for coordination of offloading with the property owner operations. Contractor shall implement odor controls as necessary in accordance with Section 013543 – Environmental Protection Procedures to control odors during such storage.

B. During dredging, the use of multiple attempts to achieve a full bucket or stockpiling of material within the river or on shoreline is not permitted. Design the equipment and methods to minimize the release of resuspended sediments during dredging and entrainment of surface water in dredged material.

C. It is acceptable to dredge with sediment adhering to the bucket provided that this does not prevent the Contractor from complying with the project resuspension standards. If at any point during the dredging process, the turbidity monitoring data indicates turbidity levels above the turbidity action level, or distinct turbidity plumes are visible the Contractor shall implement response actions as described in Section 013543 and the Contractor's Turbidity and Sheen Control Methods Plan.

1. The dredge bucket shall be placed in a manner as to provide complete horizontal coverage of the area targeted for sediment removal during each dredge pass. Bucket placement shall not allow for gaps between the bucket placement or skipping planned bucket or heat bite locations. Horizontal coverage shall be documented with output from the RTK DGPS.

D. Implement procedures that minimize sediment resuspension during dredging in accordance with Section 013543.

E. Implement sediment oil sheen control and response measures in accordance with Section 013543.

F. Dredging Procedures in Areas where Bucket Refusal is Encountered

1. The following procedure shall be followed in areas where bucket refusal is encountered:
   a. The Contractor shall dig to the Required Elevations of the dredge prism or to bucket refusal, whichever is encountered first.
   b. If bucket refusal is encountered at a location, mark the location using the RTK DGPS positioning software and notify the Engineer and Construction Manager. The Construction Manager will notify the NYSDEC.
   c. The Contractor shall then continue to dredge the area, but rather than dig at each and every bucket station, the dredge operator shall attempt to dig the port, center, and starboard stations in that bucket set. If sediment is not present at these locations, the dredge operator shall move ahead to the next bucket station and repeat the process. If sediment is encountered at any of the three bucket stations, the dredge operator shall continue to dig at that location until either the Required Elevations are reached or refusal is encountered, whichever is encountered first, and the dredge operator shall then dig the adjacent stations in that set in a similar manner until the dredge pass is completed for that set.
   d. The Engineer will confirm the areas designated as refusal. The Contractor shall provide means acceptable to the Engineer for the Engineer to visually inspect the Refusal Areas.
   e. Provide information to the Engineer documenting the locations and elevations where Refusal Areas are encountered. Provide the Engineer with a target file with XYZ locations of all buckets that encountered refusal.

G. Dredging Procedures in Areas Where Subsurface Debris is Encountered

1. The following procedures shall be followed in areas where subsurface debris is encountered:
   a. Immediately notify the Construction Manager and Engineer. The Construction Manager will notify the NYSDEC.
   b. The Contractor shall attempt to remove the debris in accordance with Paragraph 3.02.A of this Section and continue to dredge the area to the Required Elevations within the specified tolerance.
   c. If submerged debris appears to be present at the Required Elevations, the Contractor shall mark that location using the RTK DGPS.
   d. Provide information to the Engineer documenting the locations and elevations where submerged debris appears to be present in the sediment at the Required Elevations. Provide the Engineer with a target file with XYZ locations of encountered submerged debris at the Required Elevations. This target file shall be limited to data related to submerged debris encountered at the Required Elevations.

e. The Engineer will provide direction to the Contractor whether additional dredging is necessary in areas where submerged debris appears to be present at the Required Elevations.

3.03 DREDGE TOLERANCES

A. Dredging shall achieve the Required Elevations in 95 percent or more of the total area dredged. If the Contractor elects to perform the work using smaller dredge management units, surveys will confirm completion as specified within 95 percent or more of each individual unit.

1. Preliminary screening of dredging tolerances shall be made by comparing the RTK DGPS XYZ file with the Design Dredge Prism XYZ File to verify that at least 95 percent of the total area dredged, or of each individual dredge management unit, is at or below the corresponding Required Elevations, subject to the following clarifications:
   a. The comparison shall be performed by comparing the surface generated from the RTK DGPS XYZ file with the dredge surface in the Design Dredge Prism XYZ using TIN subtraction. The allowable over dredge shall be -6 inches from the dredge surface shown in the Design Dredge Prism XYZ.
   b. Field identified Refusal Areas, as accepted by the Engineer, are considered to have achieved the Required Elevations in those areas.
2. Once preliminary screening indicates dredging tolerances have been met, the Contractor shall perform Confirmation Survey in accordance with Article 3.04 of this Section.

B. It is expected that the Contractor will provide target cut elevations to the dredge operators that differ in elevation form the Design Dredge Prism XYZ file to assist in achieving Required Elevations. The Contractor shall review daily and iteratively adjust their target cut elevations provided to the dredge operator as the work progresses to ensure that the dredging pass in any given location is consistently achieving the Required Elevations and that consistent improvement in the accuracy of dredging equipment is being demonstrated.

3.04 CONFIRMATION SURVEY

A. Contractor shall perform post-dredge bathymetric survey in accordance with Section 022100 and submit the results of the survey to the Engineer for confirmation that the dredging limits have been met within the specified tolerances.

B. The Engineer will identify if removal of additional sediment is required to achieve specified tolerances. It is generally expected that the Engineer will provide direction on any re-dredging to achieve specified tolerances within approximately 2 days of the Contractor providing bathymetric survey data.

3.05 MISPLACED MATERIAL

A. Material that is deposited elsewhere than at the stockpile area is considered misplaced material. If materials are misplaced by the Contractor, the Contractor shall be required to remove such misplaced material and deposit it where directed by the Owner at the Contractor’s expense.

3.06 INTERFERENCE WITH NAVIGATION

A. The Contractor shall plan construction activities to minimize conflict with other vessels within the waterway (navigation channel) and all privately operated facilities. Contractor shall be responsible for submitting appropriate Notice to Mariners. The shifting or moving of dredges or the interruption of dredging and backfilling operations may be required to accommodate the movement of other vessels and floating equipment not associated with the Contractor's activities. Where such conflicts cannot be avoided, required coordination by the Contractor and those impacted by the work must be arranged, and the Owner must be informed of such conflicts and plans to prevent future conflicts. Non-project vessels will not be permitted in the dredge area during conduct of work without the acceptance of the Owner. At a minimum, the Contractor shall provide lighted buoys to be placed upstream, downstream, and out from the dredge area. Navigation buoys shall be located so that they can be replaced if disturbed. All lighting activities and requirements shall be in compliance with all applicable USCG standards and regulations.

3.07 DREDGED MATERIAL DEWATERING

A. Decanting of water from the transport barges back to the river will not be allowed.

B. After the vessel has been filled, and prior to offloading or adding any stabilization agents, any standing water accumulated in the vessel (due to settling and self-weight consolidation of the dredged material) shall be transferred to the onsite temporary water treatment plant for treatment in accordance with Section 444000.

3.08 BACKFILL

A. Backfill shall not be placed until all dredging activities have been completed and post-dredging survey has been completed and confirmed by the Engineer in accordance with Article 3.04 of this Section.

B. If dredging equipment is used for cover placement, the equipment shall be decontaminated prior to handling backfill.

C. Contractor shall choose an appropriate placement method to minimize resuspension of residual bottom sediments to prevent mixing with the backfill. The placement method shall be selected to minimize loss of fines during placement, and shall include minimizing the material fall height to the extent practicable without disturbing the in-place sediment.

D. Dredged areas shall be backfilled as shown in the Design Drawings and as follows:
1. Each fill layer shall be placed as follows:
   a. Type 2 fill shall be placed from the dredge surface to within 2 feet of the final backfill surface (± 6 inches).
   b. Type 1 fill shall be placed over the Type 2 fill to the final backfill surface shown in Design Drawings.
2. The final backfill surface shall be ± 6 inches from the final backfill surface shown on the Design Drawings in 95 percent or more of the total area, or of each individual dredge management unit, , with no net fill of the dredge area as compared to the Contractor's pre-construction bathymetric survey performed in accordance with Section 022100.
   a. To document completion of backfill, Contractor shall complete a post-backfill bathymetric survey and provide the results to the Engineer for review. The Engineer will evaluate backfill data by comparing (using TIN subtraction) the surface generated from the post-backfill bathymetric survey with the backfill surface shown in Design Drawings.
3. If the maximum tolerance for the design backfill is exceeded, the Contractor shall identify any areas of overfilling to the Construction Manager and Engineer for further discussion.

The Owner shall not be responsible for any costs associated with excess fill material, associated placement activities, and/or removal of excess fill, if required.

E. Survey control shall be maintained throughout backfill placement activities, and shall be utilized to confirm the horizontal and vertical extents of placement have been achieved in accordance with Section 022100.

- END OF SECTION -

SECTION 444000

WATER HANDLING AND DISPOSAL

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Contractor shall furnish all labor, equipment, and materials necessary to provide, construct, operate, monitor, and maintain a temporary water treatment system. The water treatment system shall treat all water collected, extracted, or otherwise accumulated during the implementation of this Project (e.g., surface water that collects in the upland work areas and staging area(s), fluids from sediment dewatering, decontamination fluids that collect in the decontamination area, and decant water that collects in the sediment transfer barge). Treated waters shall be discharged to the Hudson River under the requirements of a State Pollution Discharge Elimination System permit-equivalent to be obtained by the Owner. Under no circumstances shall treated water be used for dust suppression activities.

B. The Contractor is responsible for all costs and fees related to the operation and maintenance of the water treatment system (e.g., media change-out, system repairs, etc.).

C. The water treatment system shall be constructed within a containment area to collect miscellaneous water that may leak/leave the water treatment system prior to treatment (e.g., leaks in hose or pipe connections). The containment area shall be constructed in accordance with the Design Drawings. Accumulated water within the containment area shall be collected and subject to treatment.

D. The Contractor shall provide, operate, monitor, and maintain a treatment system that is likely to handle water containing the following constituents:
1. Suspended and dissolved solids.
2. Polycyclic Aromatic Hydrocarbons (PAHs)
3. Benzene, Toluene, Ethylbenzene, and Xylene (BTEX)
4. Light nonaqueous phase liquids (LNAPL).

E. Treatment/Discharge Requirements
1. The Contractor shall operate the water treatment system in accordance with the discharge permit anticipated to be received from NYSDEC and this section. It is anticipated that treated water must meet the following criteria prior to discharge; however, final criteria shall be determined upon receipt of the discharge permit.

Parameter	Units	Discharge Limit
Benzene	micrograms per liter (ug/L)	5.0
Ethylbenzene	ug/L	5.0
Toluene	ug/L	5.0
Xylenes (total)	ug/L	15
2-Methylnaphthalene	ug/L	10
Oil & Grease	mg/L	15
pH	Standard units	6.0-9.0

2. System monitoring shall be limited to the parameters listed in the discharge permit in order to demonstrate compliance with such permit.

F. The treatment-related components of the system described in Part 2 of this Section and all related and interconnecting piping, valves, controls, gauges, operations, etc. shall be provided as a package/modular system (capable of operating during winter months) by a single supplier/vendor with experience in similar applications.
   1. The Contractor shall coordinate with the supplier/vendor and provide ancillary services related to, but not limited to, piping; pipe sizes and connections; influent pump flow rate and delivery pressure; electrical requirements; delivery, offloading, assembly, and testing of system components; operations training and maintenance; safety; and cleaning and demobilization of system components.
   2. The Contractor shall provide electrical service connection(s) as appropriate for operation of the water treatment system. Such service shall be installed in accordance with applicable federal, state, and local regulations and requirements.
   3. The Contractor shall be responsible for inspecting all components of the water treatment system for leaks. Leaks (if observed) shall be addressed by the Contractor immediately upon observation.

G. Related Work Specified Elsewhere
   1. Section 011100 – Summary of Work
   2. Section 352023 – Dredging and Subaqueous Backfill
   3. Section 028100 – Transport and Disposal of Impacted Materials

1.02 SUBMITTALS

A. The Contractor shall submit the following information related to the water treatment system in their Operations Plan prepared in accordance with Section 011100 – Summary of Work:
   1. Overall system layout (process flow diagram).
   2. Technical details relating to the construction and maintenance of the containment area(s).
   3. Calculations showing justification for size of select system components.
   4. Cut sheets and technical details for each system component and media.
   5. Equipment size, dimensions, and materials of construction for all system components.
   6. Pumping and piping types, sizes, and connections.
   7. Electrical requirements and service connections.
   8. Monitoring and maintenance requirements for system components.
   9. Location of system components within the Site.
   10. Safety Data Sheets (SDSs).

B. The Contractor shall maintain (throughout the course of the Project) a written record of the operation and maintenance activities associated with the water treatment system. Such information shall be tabulated, updated daily, and submitted on a weekly basis to the Engineer and Construction Manager. At a minimum, the summary shall include the following information (for each day):
   1. Hours of operation.
   2. Volume of water treated and discharged.
   3. Mode of discharge (i.e., batch or continuous).
   4. Type and frequency of monitoring and maintenance activities (if any).
   5. Description of and results for any testing performed by the Contractor.
   6. Other information relevant to the operation, monitoring, and maintenance of the water treatment system.

1.03 QUALITY ASSURANCE/QUALITY CONTROL

A. Materials and methods shall comply with relevant standards, as well as any other standards, codes, or specifications applicable to the design, construction, operation, and maintenance of the water treatment system.

PART 2 - PRODUCTS

2.01 WATER TREATMENT SYSTEM

A. The water treatment system shall be constructed within a containment area and for the purposes of this Technical Specification it is assumed that the treatment system will include the following components/processes, as shown on Design Drawing G-503:
   1. Influent Holding Tanks.
   2. Solids and nonaqueous phase liquid (NAPL) separation and removal.
   3. Solids filtration/removal.
   4. Granular activated carbon (GAC) vessels.
   5. System controls.
   6. Sample collection taps.
   7. Effluent Holding Tanks.
   8. Piping, pumps, controls, gauges, re-pressurization tanks (as needed) etc. to convey all Project-related waters from various points of collection to and through the water treatment system, and to the discharge location.

   However, the Contractor shall select unit processes, as appropriate, to meet the discharge criteria. The Contractor will not be bound to the particular processes identified in this Technical Specification; however, if a deviation is proposed, it shall be provided as part of the Contractor's Operations Plan (prepared in accordance with Section 011100 – Summary of Work) for review and acceptance by the Owner/Engineer.

PART 3 - EXECUTION

3.01 MINIMIZATION OF SUSPENDED SOLIDS

A. The Contractor shall conduct project activities (including operation of the water treatment system) to minimize the presence of solids in the water subject to treatment. Such activities include, but are not limited to, the following:
   1. Maximizing the retention time of the water in the Influent Holding Tanks to allow gravity-based settling to occur within the tanks.
   2. Positioning and operating the influent pumps within the Influent Holding Tanks such that water is not drawn from either the lower or upper portion of standing water within the tanks, to minimize the potential transfer of solids or floating materials to subsequent components of the water treatment system.
   3. Operating the treatment system components in accordance with supplier's/manufacturer's recommendations, including optimization of the bag filter assembly (e.g., filter size selection, mode of operation, etc.), changing out bag filters as required to maintain sufficient flow through the system, backflushing the GAC vessels, changing out GAC, etc.
   4. Performing regular cleaning and removing solids from the Influent Holding Tanks as needed, and remove solids accumulated within various components of the system.

B. The Contractor shall review the overall operations throughout the performance of the Project with respect to the presence of solids in the water subject to treatment, and take measures as appropriate to minimize the presence of solids.

3.02 SOLIDS AND NAPL SEPARATION

A. The Contractor shall periodically inspect the Influent Holding Tank for the presence of accumulated solids and floatables and remove such accumulations if their presence represents a potential impact to the operation of the water treatment system, as determined by visual observations, operational data, or other considerations. Solids shall be collected, handled, and disposed appropriately in accordance with the requirements of Section 028100 – Transport and Disposal of Impacted Materials. Liquids (other than NAPL) which result from cleaning activities shall be transferred to the Influent Holding Tank and treated using the water treatment system. NAPL shall be removed and separately containerized.

3.03 WATER TREATMENT SYSTEM OPERATION, MONITORING, AND MAINTENANCE

A. System start-up and monitoring requirements specified below assume operation under a SPDES permit. The scope of such activities shall be provided to the Contractor following receipt of the SPDES permit.

B. Start-Up Testing / System Optimization – The Contractor shall coordinate and perform start-up testing for individual system components, portions of the system, and the overall system in accordance with the manufacturer's and supplier/vendor instructions. Start-up activities sha be described in the Contractor's Operations Plan (prepared in accordance with Section 011100 – Summary of Work) and reviewed by the Engineer prior to the actual start-up activities. In addition, the Contractor shall procure the services of the supplier/vendor of the treatment-related components of the overall system (e.g., solids filtration, GAC vessels) to assist in the performance of start-up activities at the Site and to provide instructions and training to the Contractor related to operation, monitoring, and maintenance of the system.
   1. The Engineer will collect representative samples for laboratory analysis from the Influent Holding Tank and the Effluent Holding Tank to determine the effectiveness of the water treatment system and compliance with the applicable discharge criteria.
      a. Once laboratory results are obtained, the Engineer will provide direction regarding the disposition of the treated water (e.g., discharge to the River or re-treat).
      b. The Engineer may also periodically collect samples from between the GAC vessels to monitor for breakthrough.
      c. Sampling conducted by the Engineer shall not relieve the Contractor of his/her obligation to monitor/maintain the water treatment system and perform any additional sampling the Contractor determines is necessary to ensure the water treatment system is operating in accordance with the RD and the SPDES permit.

C. System Operations and Project Coordination – The Contractor shall be responsible for operating the water treatment system in accordance with the SPDES permit, specific operating procedures related to the individual system components, the Contractor's other operations within the Site, and this RD. The Contractor shall closely coordinate and monitor the system operations with respect to potential impacts and disruptions to the overall Project implementation. Under no circumstances shall the Contractor exceed the storage capacity of the Influent Holding Tank, or discharge any treated effluent to any location without the prior consent of the Engineer. The SPDES permit will be obtained by the Owner and additional information regarding the discharge and monitoring requirements for this permit will be provided to the Contractor following Project award. Any determination regarding modifications to the discharge rate, method, and/or location will be made by the Owner/Engineer and communicated to the Contractor.

1. The Contractor shall operate the treatment system in batch mode until otherwise approved by NYSDEC. The Engineer will collect samples of the treated effluent for laboratory analysis to confirm compliance with the permit discharge requirements prior to discharge of each treated batch. Downtime related to the laboratory turnaround time (generally two to three days) shall be incorporated into the Contractor's planned operation of the system and coordination of related Project activities.
2. If continuous discharge is approved by NYSDEC, the Engineer will collect samples of treated effluent for laboratory analysis at the frequency required by NYSDEC to document compliance with the permit discharge requirements.

D. The Contractor shall continuously monitor the operation of the treatment system (especially during cold weather months) and at no time leave the system operating without qualified attending personnel present within the Project Work Limits.

E. As required, the Contractor shall perform routine maintenance of the treatment system, including, but not limited to, change-out of bag filters, backflushing of the GAC vessels, GAC change-out, etc. During such times, the Contractor shall coordinate his activities to minimize interruption to the overall Project implementation.

F. Following conclusion of the water treatment system operations, the Contractor shall clean/decontaminate all equipment in accordance with the provisions of the RD and per the vendor/supplier requirements.

- END OF SECTION -

APPENDIX C

Construction Quality Assurance Plan

CONSTRUCTION QUALITY ASSURANCE PLAN

Operable Unit 2

Hudson (Water Street) Site

Hudson, New York

July 2020

CONSTRUCTION QUALITY ASSURANCE PLAN

Operable Unit 2
Hudson (Water Street) Site
Hudson, New York

07/17/2020

Mark O. Gravelding, P.E. Date
Senior Vice President

Prepared for:

National Grid

Syracuse, New York

Prepared by:

Arcadis of New York, Inc.

One Lincoln Center

110 W Fayette Street

Suite 300

Syracuse

New York 13202

Tel 315 446 9120

Fax 315 449 0017

Our Ref.:

30003986.00012

Date:

July 2020

CONTENTS

ACRONYMS AND ABBREVIATIONS

ARC	Area for Remedial Consideration
Arcadis	Arcadis of New York, Inc.
bss	below sediment surface
CAMP	Community Air Monitoring Plan
CQA	Construction Quality Assurance
CQAP	Construction Quality Assurance Plan
cy	cubic yards
GAC	granular-activated carbon
HASP	Health and Safety Plan
MGP	manufactured gas plant
MPTP	Maintenance and Protection of Traffic Plan
NAPL	non-aqueous phase liquids
NTU	nephelometric turbidity units
NYSDEC	New York State Department of Environmental Conservation
OU	operable unit
QA	quality assurance
QC	quality control
RACP	Remedial Action Contingency Plan
RD	Remedial Design
ROD	Record of Decision
SWPPP	Storm Water Pollution Prevention Plan
TDS	total dissolved solids
TSS	total suspended solids
USACE	United States Army Corp of Engineers
VOC	volatile organic compound
WWTP	wastewater treatment plant

1 INTRODUCTION

This Construction Quality Assurance Plan (CQAP) has been prepared by Arcadis of New York, Inc. (Arcadis), on behalf of National Grid, to support the implementation of the selected remedy for the former National Grid Hudson Water Street manufactured gas plant (MGP) site (the Site) in Hudson, New York. This CQAP describes the Site-specific components of the quality assurance (QA) and quality control (QC) program, which will confirm that the completed project meets or exceeds all design criteria, Design Drawings, and Technical Specifications.

1.1 Site Description

The Site is located in, and along the east bank of, the Hudson River. It includes property where the former MGP was located on Water Street in Hudson, Columbia County, New York, and sediments within a portion of the Hudson River. The Site consists of two operable units, OU1 and OU2.

OU1 is defined as the onsite source area including Embayment #1. Remediation activities for OU1 were completed from April 2004 to September 2005 in accordance with the Final Remedial Design – Contract No. 1 – General (BBL 2003a). The OU1 remediation activities consisted of excavation and offsite disposal of approximately 8,800 cubic yards (cy) of soil from the former gas holder area and former tar tank area of the former MGP; excavation and offsite disposal of approximately 8,600 cy of sediment and soil from Embayment #1 and the surrounding shoreline; and restoration of the Embayment #2 shoreline and the north wall of a building on the City of Hudson property. As described in the Final Engineering Report for the OU1 activities, a permanent sheet pile wall was installed around the sediment removal area and along the western alignment of Embayment #1 (i.e., the mouth of the embayment; Arcadis U.S., Inc. [Arcadis] 2008b). This steel sheet pile wall was left in-place to provide additional protection against the potential lateral subsurface migration of impacted material from surrounding properties (e.g., the former oil terminal) into Embayment #1.

OU2 is defined as a portion of the Hudson River adjacent to the Site extending approximately 1,700 feet along the shoreline from the west end of Ferry Street to the Colarusso Ventures, LLC property, and approximately 300 feet offshore into the eastern edge of the shipping channel. OU2 includes Embayment #2, Embayment #3, and Embayment #4.

1.2 Overview of Remedial Action

The Remedial Action has been prepared to describe the activities necessary to complete the remedy selected in the New York State Department of Environmental Conservation’s (NYSDEC’s) Operable Unit 2 Record of Decision (ROD; NYSDEC 2012). The selected remedy for OU2 includes the following:

- A Remedial Design (RD) program to provide the details necessary for the construction, operation, maintenance, and monitoring of the remedy. Green remediation principles and techniques will be implemented to the extent feasible in the design, implementation, and management of such program, per DER-31/Green Remediation (NYSDEC 2011).

- Installation and maintenance of appropriate engineering controls around the Area for Remedial Consideration (ARC) during remediation, as feasible, to control and contain re-suspended sediments and mobile non-aqueous phase liquids (NAPL) that may be generated as a result of dredging activities.
- Removal of debris and shoreline riprap within the ARC for offsite disposal or, in the case of the riprap, reuse as feasible.
- Removal of up to 9,000 cy of NAPL-saturated and potentially toxic sediment within the ARC to depths up to 15 feet below sediment surface (bss).
- Management, including dewatering and if necessary, pre-treatment, of the dredged sediment in preparation for offsite treatment and/or disposal at a permitted facility. Installation of a temporary containment structure with an air handling and treatment system over the sediment staging and processing area.
- Installation of a temporary wastewater treatment system to treat water removed from the dredged sediment.
- Restoration of the riverbed and banks to the original bathymetry and, to the extent possible, with material similar to the existing substrate.
- Post-remediation monitoring of remedy effectiveness and restoration success.

1.3 Quality Assurance and Quality Control

In the context of this CQAP, the terms are further defined as follows:

- QA refers to the means and actions employed by the Construction Engineer(s) to confirm conformity of the systems' installation with this CQAP, the Design Drawings, and Technical Specifications. QA is provided under the oversight of the Construction Engineer.
- QC refers to those actions taken by the manufacturer, fabricator, or Contractor to provide materials and workmanship that meet the requirements of this CQAP, the Design Drawings, and Technical Specifications.
- RD refers to documents including the RD Report; Design Drawings; Technical Specifications, Community Air Monitoring Plan (CAMP); Storm Water Pollution Prevention Plan (SWPPP); Remedial Action Contingency Plan (RACP); and Restoration Plan.

1.4 Construction Quality Assurance Plan Organization

This CQAP includes the following components relevant to completion of the construction activities:

- Section 2 – Quality Assurance/Quality Control Meetings and Documentation: QA/QC-related meetings and documentation
- Section 3 – Pre-Construction and Site Preparation Activities: CQA measures that will be performed to verify methods and materials associated with mobilization and Site setup for construction

- Section 4 – Dredging and Backfilling: CQA activities that will be performed to verify methods and materials associated with sediment removal and backfill activities.
- Section 5 –Waste Handling/Management: CQA measures that will be performed to verify methods and materials associated with construction activities in the upland area
- Section 6 – Wastewater Treatment Plant Monitoring: CQA activities related to wastewater treatment
- Section 7 – Decontamination: CQA activities related to decontamination
- Section 8 – Demobilization: CQA activities related to demobilization
- Section 9 – Reporting: reporting requirements for the CQA activities
- Section 10 – References

2 QUALITY ASSURANCE/QUALITY CONTROL MEETINGS AND DOCUMENTATION

Meetings will be conducted among the Project Manager, Construction Engineer, Construction Manager, Contractor, National Grid, and NYSDEC to discuss and review construction activities, work schedule, and potential changes in construction activities or construction products. The results of these meetings and follow-up actions will be included in meeting minutes and/or daily construction reports.

2.1 Project Meetings

To maintain clear and open channels of communication through construction, specific project meetings will be held regularly. These meetings are described below.

2.1.1 Pre-Construction Construction Quality Assurance Meeting

A pre-construction CQA meeting will be held as part of a general pre-construction meeting prior to commencing construction activities. This meeting will include the Project Manager, Construction Engineer, Construction Manager, Contractor, National Grid, and NYSDEC.

The purpose of the pre-construction CQA meeting is to coordinate CQA activities, discuss potential items that might cause quality issues and delays in construction, and discuss roles and responsibilities of project staff responsible for implementing CQA activities. It is important that rules regarding testing and repair be known and accepted by each party.

Specific topics to be considered during the pre-construction CQA meeting may include the following:

- Review the responsibilities of each party.
- Review lines of authority and communication.
- Review critical design details, including the Design Drawings and Technical Specifications.
- Review the project schedule.
- Review CQA activities.
- Observe where the Site survey benchmarks are located and review methods for maintaining vertical and horizontal control.
- Review methods for documenting and reporting, and for distribution of documentation and reports.

Meeting minutes will be recorded by the Construction Manager and transmitted to the participants via email within 1 week.

2.1.2 Weekly Progress Meetings

Weekly progress meetings will be held at the Site. The purpose of the weekly progress meetings is to discuss construction activities and CQA activities. At a minimum, the weekly progress meetings will be attended by the Construction Manager, Construction Engineer, and the Contractor. National Grid may elect to participate as well. Topics to be addressed at the weekly progress meetings may include:

- Review the previous week's construction activity.
- Review the work activity planned for the coming week.
- Review the work schedule.
- Discuss weekly assignments for construction personnel and equipment.
- Discuss status of CQA activities.
- Discuss potential issues and resolution of previously discussed issues.
- Review construction documentation requirements.
- Discuss health and safety and recognize potential hazards in upcoming work.

The Construction Manager will coordinate the weekly progress meetings; develop and circulate a weekly meeting agenda; prepare weekly meeting minutes; and distribute to the Construction Manager, Project Manager, Construction Engineer, Contractor, National Grid, and NYSDEC.

2.1.3 Daily Work Meeting

A daily work meeting will be held at the beginning of each workday at the Site. The purpose of the daily work meetings is to discuss construction activities and CQA activities. The daily work meetings will be attended by the Construction Manager (as necessary), Construction Engineer, Contractor, National Grid (as necessary), and other parties to be onsite during the day. Topics to be addressed at the daily work meetings may include:

- Discuss the previous day’s construction activities.
- Review the construction activities planned for the current day.
- Review CQA activities for the current day.
- Review health and safety-related requirements/issues.

The Contractor will coordinate and lead the daily work meetings.

2.2 Pre-Construction Quality Assurance Documentation

Pre-Construction QA efforts will include verifying equipment and materials meet the requirements of the RD. Documentation and certifications for equipment and material will be submitted to the Construction Engineer prior to mobilization and/or installation.

2.3 Construction Documentation

CQA activities will be documented to confirm that the CQA requirements have been satisfied during all construction activities. The documentation process includes:

- Recognition of construction tasks that should be observed and documented as determined by the Engineer.
- Assignment of responsibilities for the observation, testing, and documentation of these tasks.
- Completion of the required documentation to provide an accurate record of the CQA activities performed during construction, including data summary reports.

The Construction Engineer will prepare completed and signed reports, forms, data sheets, data summary reports, and checklists to document that the CQAP requirements have been carried out satisfactorily. The Construction Engineer will provide the CQA documentation to the Project Manager. Data summary reports will be submitted to National Grid as they are finalized.

2.3.1 CQA Reports

The Construction Engineer will complete a summary report of CQA activities daily. This report will be separate from the Contractor's daily reports required in Specification Section 013100 – Project Management and Coordination. The CQA report will contain, at a minimum, the following information:

- Date, project name, location, and the number and names of people onsite.
- Data on weather conditions, including temperature, humidity, wind direction and speed, cloud cover, and precipitation.
- Description and results of any CQA field testing performed by the Construction Engineer or Contractor.
- Documentation of any problems/deficiencies noted during construction (e.g., when construction materials or activities are observed or tested that do not meet the requirements of the RD), and corrective actions taken by the Contractor to address or resolve the problems/deficiencies. The documentation of problems/ deficiencies and corrective actions may include the following information:
  - A description of the problem or deficiency, including reference to supplemental data or observations leading to the identification of the problem or deficiency.
  - Location of the problem or deficiency, including how and when the problem or deficiency was discovered.
  - Identification of corrective actions taken by the Contractor to address or resolve the problem/deficiency. If the corrective actions have already been taken by the Contractor, observations and documentation showing that the problem/deficiency was resolved should be included. If the problem/deficiency has not been resolved by the end of the day upon which it was discovered, the documentation will state that the deficiency was unresolved at the end of the day.

- A listing of CQA samples collected, marked, and delivered to the CQA Laboratory.
- A record of calibrations or standardizations performed on field testing equipment, including actions related to the results of re-calibrations.

2.3.2 Photographic Documentation

Photographs will be taken by the Construction Engineer to document observations, issues, deficiencies, and work-in-progress. Photographs will be in color print format and will be filed in chronological order in a permanent protective file and computer storage system.

The following information should be documented on a photo log for selected photos:

- Date and time.
- Photographer's name.
- Location where the photograph was taken, including information regarding the orientation of the photograph for proper viewing.
- Description of the subject matter.
- Unique identifying number (i.e., digital photo file number) for reference in other reports.

2.4 Project Record Documents

Project record documents include the following:

- The RD (and any addenda).
- Change Orders and other modifications to the RD.
- Engineer's Field Orders or written instructions.
- Approved Contractor submittals (e.g., shop drawings, working drawings, samples, etc.).
- Meeting minutes.
- Field test records.
- Contractor's updated work schedule.
- As-built survey drawings.

These items will be maintained at the Site (in an organized manner) and updated by the Contractor as work progresses and as items are approved. Additional information and requirements for project record documents are provided in the Specifications.

2.5 Final Engineering Report

Subsequent to the completion of construction activities, a Final Engineering Report (FER) will be prepared and submitted to the NYSDEC for review and approval. The purpose of the FER will be to document the construction activities for the OU1 and OU2 areas and note any deviations from the Final

RD Report. The FER will be prepared under the direction of, and certified by a Professional Engineer licensed in the State of New York directly involved in the construction activities, and will contain the following information:

- Background, site description, and remedial objectives;
- Description of the selected remedy;
- Summary of the activities performed;
- Record Drawings documenting the removal limits and final configuration of installed restoration
- Copies of permits, regulatory documents, and approvals, and relevant project correspondence, as appropriate;
- A description of any deviations from or modifications to the NYSDEC-approved Final RD Report;
- Copies of waste manifests, bills of lading, and/or certificates of treatment/disposal, as appropriate;
- QA/QC testing results;
- Summaries of monitoring results obtained during construction (e.g., water column, air);
- Representative project photographs taken during the RA; and
- Engineer's certification statement.

Additional requirements for the FER are set forth in Section 5.8 of DER-10 Technical Guidance for Site Investigation and Remediation (DER-10; NYSDEC 2010).

3 PRE-CONSTRUCTION AND SITE PREPARATION ACTIVITIES

This section identifies the initial activities to be performed at the Site following Contractor mobilization. In general, those activities include: 1) the performance of pre-construction surveys; 2) equipment and material specifications verification; 3) the installation of erosion and sediment controls; 4) the installation of temporary traffic control and site security measures; 5) site preparation; and 6) the construction of material staging, containment, and decontamination areas. Additional information regarding each of these activities is provided below.

3.1 Pre-Construction Surveys

An initial Site survey will be performed by the Contractor's surveyor to document existing (pre-construction) Site conditions. During these activities, the surveyor will also establish survey control for the proper construction, documentation, and testing of subsequent work activities (e.g., excavation, etc.). As part of the pre-construction survey, the Contractor will photograph upland staging areas to document existing area conditions. The Construction Engineer will document, through visual observation, that survey activities and documentation are performed in accordance with the Specifications. The Construction Engineer will also obtain photographic documentation of pre-construction conditions prior to the initiation of construction activities.

3.2 Equipment and Material Specifications Verification

The Contractor will submit required documentation to the Construction Engineer prior to mobilizing equipment and implementing construction activities. Requirements are discussed in the Technical Specifications.

Upon delivery and prior to use of any equipment and material, the Contractor will provide certifications to the Construction Engineer that the material and equipment meet the Specifications. Equipment and material delivered to the Site will be inspected by the Construction Engineer to confirm compliance with the Design Drawings and Specifications prior to installation.

3.3 Erosion and Sedimentation Controls

Prior to initiating any intrusive activities, erosion and sediment control measures will be installed by the Contractor. The Construction Engineer will document, through visual observation, that erosion and sediment control measures are installed, inspected, and maintained by the Contractor in accordance with the Design Drawings, Specifications, and the SWPPP.

3.4 Temporary Traffic Control and Site Security Measures

Temporary traffic control and site security measures (e.g., fencing, barriers, signage, etc.) will be installed by the Contractor to maintain vehicular and pedestrian traffic and preserve the safety of motorists, highway workers, and pedestrians during the project. The Construction Engineer will document, through visual observation, that temporary traffic control and site security measures are installed, inspected, and maintained by the Contractor in accordance with the Design Drawings and Specifications.

3.5 Site Preparation

The Contractor will clear debris vegetation within the work area to the extent required to allow the construction of staging areas, dewatering pads, construction support areas, and excavation of sediment. The Construction Engineer will document, through visual observation, that the Site preparation activities are performed in accordance with the Specifications.

3.6 Material Staging, Containment, and Decontamination Areas

The Contractor will construct material staging, containment, and equipment/personnel decontamination areas in the locations shown on the Design Drawings, or in alternate locations proposed by the Contractor and approved by National Grid and the Engineer. The Construction Engineer will document, through visual observation, that 1) material staging, containment, and decontamination areas are constructed in accordance with the RD and 2) geosynthetics (i.e., geomembranes and geotextiles) used in the construction of material staging, containment, and decontamination areas are not damaged during installation.

During construction, the Contractor will be responsible for the maintenance of material staging, containment, and decontamination areas. Maintenance activities may include the placement of additional stone (to maintain sufficient cover above the geosynthetics), the periodic pumping of accumulated liquids to the onsite wastewater treatment system, and the repair of any damage to the geosynthetics. In the event that the geosynthetics are damaged during the work, the Contractor will promptly notify National Grid, the Construction Manager, and the Construction Engineer and take immediate steps to repair such damage. The Construction Engineer will document that the geosynthetics are repaired by properly trained/qualified individuals in accordance with the manufacturer’s QA/QC manual and/or recommendations.

3.7 Sheet Pile Installation

The Contractor will install sheet piling in select locations along the shoreline. The required locations are shown on Design Drawing G-200 and requirements for sheeting installation are included in Specification Section 315000 – Excavation Support and Protection. The Construction Engineer will review submittals before the equipment and materials are used and document, through visual observation, that the installation activities are performed in accordance with the Specifications. Refer to Specification Section 315000 – Excavation Support and Protection for detailed QA/QC requirements for sheet pile installation.

4 DREDGING AND BACKFILLING

Dredging and backfilling activities are described in the RD. This section describes the CQA activities related to dredging and backfilling.

4.1 Dredging

4.1.1 Equipment and Material Specifications Verification

Real-time removal tracking will be performed by the Contractor using a real-time kinematic differential global positioning system (RTK-DGPS). The RTK-DGPS will be mounted on the equipment performing the dredging work. The dredging equipment will have a positioning tolerance of 3 inches horizontally and 2 inches vertically and will be calibrated based on manufacturer's recommendations prior to initial use. Twice daily, the Contractor will conduct and document a vertical and horizontal check of the RTK-DGPS. Additional calibrations will be conducted by the Contractor as needed:

- If accuracy checks are found to be outside of the manufacturer's specified tolerance limit
- If the Contractor changes, modifies, or damages the equipment during work
- After a period of 2 calendar months

4.1.2 Bathymetric Surveys

A bathymetry survey will be conducted to confirm completion of the dredge prism. Surveying will consist of a combination of single- and multi-beam methods based on water depth and proximity to active operations.

Surveys described above will be conducted using survey equipment equipped with an DGPS. Track lines will be spaced to 100% overlap of the multi-beam survey data. Bathymetric surveys will be conducted with multi-beam equipment, supplemented with single-beam equipment for near-shore and shallow water areas. Surveys will be conducted in accordance with the Specifications and the U.S. Army Corps of Engineers' (USACE) Hydrographic Survey Manual (USACE 2013). Surveys will confirm that the Contractor completed the dredging to elevations specified within 95 percent or more of the total area. If the Contractor elects to perform the work using smaller dredge management units, surveys will confirm completion as specified within 95 percent or more of each individual unit. Refer to Specification Sections 022100 – Surveys and 352023 – Dredging and Subaqueous Backfill for additional information.

4.1.3 Production Monitoring

Dredging production will be monitored by the Contractor and will consist of the following:

- In real-time using instrumentation and software on the dredging equipment and barge
- On a daily basis through daily dredge reports provided by the Contractor

4.1.3.1 Real-Time Removal Tracking

Positioning software (such as RTK-DGPS positioning software) will be used to track the dredging equipment movements during work. The software will provide a visual output for the Contractor to identify where in the work area and in the specific dredge unit the material is being removed. Output from the positioning software will be included in the daily dredge report, as discussed in the following section. Refer to Specification Sections 022100 – Surveys and 352023 – Dredging and Subaqueous Backfill for additional details.

4.2 Backfill Operations

4.2.1 Backfill Sampling Activities

Prior to placement of backfill into the Hudson River, the backfill will be sampled for physical and chemical properties as described below, in the Restoration Plan (Appendix G to the RD), and in Specification Sections 312323 – Selected Fill and 352023 – Dredging and Subaqueous Backfill (Appendix B to the RD).

4.2.1.1 Physical Properties

Prior to placement of the backfill material, the grain size of the backfill will be tested to demonstrate the conformity with the backfill design specification, and to verify that physical properties meet the requirements of Specification Section 312323 – Selected Fill.

4.2.1.2 Chemical Properties

The screening criteria for the following constituents is non-detect, except as noted:

- Pesticides/herbicides
- Polychlorinated biphenyls
- Metals (below standards in NYSDEC Technical Guidance Screening and Assessment of Contaminated Sediment [NYSDEC 2014])
- Volatile organic compounds (VOCs) (below standards in NYSDEC Technical Guidance Screening and Assessment of Contaminated Sediment [NYSDEC 2014])
- Semi-volatile organic compounds (SVOCs) (below standards in NYSDEC Technical Guidance Screening and Assessment of Contaminated Sediment [NYSDEC 2014])
- 1,4-dioxane, soil exceeding 0.1 ppm will be rejected per DER 10: Appendix 5 - Allowable Constituent Levels for Imported Fill or Soil, Subdivision 5.4(e).
- Perfluorooctanic acid (PFOA) or perfluoroctanesulfonic acid (PFOS) detected at or above 1 ppb, then a soil sample will be tested by the Synthetic Precipitation Leaching Procedure (SPLP) and the leachate analyzed. If the SPLP results exceed 70 ppt combined PFOA/S, then the source of backfill will be rejected.

National Grid will retain the option of analyzing samples concurrently for both PFAS in soil and in the SPLP leachate to minimize project delays.

4.2.2 Sampling Frequency

Analytical testing shall be performed at a frequency consistent with DER-10 Table 5.4(e)10, except as noted below. This information will be provided to the Construction Engineer for review prior to use of the material.

- Gravel, rock or stone backfill, consisting of virgin material from a permitted mine or quarry, will be exempt from pre-characterization analytical sampling requirements provided that it contains less than 10% (by weight) material that would pass through a size 80 sieve.

4.2.3 Bathymetric Surveys

A bathymetry survey will be conducted to confirm completion of backfill activities. Surveying will consist of a combination of single- and multi-beam methods based on water depth and proximity to active operations.

Surveys described above will be conducted using survey equipment equipped with an DGPS. Track lines will be spaced to confirm full coverage of the backfill area. Bathymetric surveys will be conducted with multi-beam equipment, supplemented with single-beam equipment for near-shore and shallow water areas. Surveys will be conducted in accordance with the Specifications and the U.S. Army Corps of Engineers' (USACE) Hydrographic Survey Manual (USACE 2013). Surveys will confirm that the Contractor completed the backfilling within a +/- 6-inch tolerance in 95 percent or more of the total area, with no net fill of the dredge area. Refer to Specification Sections 022100 – Surveys and 352023 – Dredging and Subaqueous Backfill for additional information.

4.2.4 Production Monitoring

Backfill production will be monitored by the Contractor and will consist of the following:

- In real-time using instrumentation and software on the backfilling equipment and barge
- On a daily basis through daily backfill reports provided by the Contractor

4.2.4.1 Real-Time Backfill Tracking

Positioning software (such as RTK DGPS positioning software) will be used to track the equipment movements during work. The software will provide a visual output for the Contractor to identify where in the work area and in the specific dredge unit the material is being placed. Output from the positioning software will be included in the daily backfill report, as discussed in the following section. Refer to Specification Sections 022100 – Surveys and 352023 – Dredging and Subaqueous Backfill for additional details.

4.3 Documentation

4.3.1 Daily Dredge Report

During construction, the Contractor will track the progress of sediment removal and backfill activities. The Contractor will be required to provide a daily dredge report, including the following information:

- Weather conditions
- Hudson River tidal elevations
- Daily production rate
- Volume of material removed/placed that day
- Total volume removed/placed to date
- Daily production rate (sediment removed and backfill placed)
- Overall production rate to date (sediment removed and backfill placed)
- Debris encountered during dredging
- Unusual conditions encountered during dredging
- Visual output from positioning software (such as RTK DGPS positioning software) showing locations of dredging and backfill completed to date
- Results of progress bathymetry surveys
- Summary of debris offloading activities for that day, including quantity
- Results of RTK-DGPS system verification

The daily dredge report will be used to track general progress on the sediment removal and backfill activities. The Contractor will submit the dredge report daily to the Engineer and Construction Manager.

4.3.2 Bathymetric Surveys

The Contractor will perform and submit pre-construction, post-dredge, and post-construction bathymetry surveys, including raw survey files and AutoCAD files, to the Construction Engineer for review. The Construction Engineer will compare:

- Pre-construction and post-dredge surveyed surfaces to confirm that the dredging has been completed to project requirements
- Post-dredge and post-construction surveyed surfaces to confirm that the backfill has been completed to project requirements

5 WATER COLUMN AND SURFACE-WATER SHEEN MONITORING

This section presents the water column and surface-water sheen monitoring programs to be performed by the Construction Engineer and the Contractor, respectively, during sediment removal and backfill activities. The subsections that follow describe water column monitoring during construction, actions that may be taken if the monitoring identifies construction-related impacts to the water column, and actions to be taken if observations reveal the release of NAPL/sheens on the surface water.

5.1 Water Column Monitoring During Construction

Water column monitoring will be performed by the Construction Engineer during dredging and backfill activities. The objective of the water column monitoring activities is to identify potential water column impacts that may be the result of sediment removal and restoration activities. Water column monitoring will occur at two locations within the Hudson River). One location will be approximately 200 feet upstream of the northern end of the ARC and the other location will be approximately 200 feet downstream of the southern end of the ARC. All monitoring locations will be outside of the navigation channel at mid-depth of the water column. The proposed turbidity monitoring locations are subject to change based on the remedial work location and conditions. Location changes, if any, will be made in the field with NYSDEC concurrence. At these monitoring stations, turbidity monitoring will be performed continuously during intrusive sediment activities at the approximate mid-depth of the water column in the monitoring location.

At each monitoring location, turbidity will be monitored in real time using a turbidity monitoring system, consisting of the following main components: data station, turbidity sensor, submersible data-logging system, telemetric data transmitter, and computer software. Turbidity levels will be measured using International Organization for Standardization 7027 method and reported in nephelometric turbidity units (NTUs). Turbidity levels will be logged a minimum of every 15 minutes and downloaded and reviewed by the Construction Engineer at least twice per day.

A baseline for turbidity will be established by monitoring conditions in the proposed locations, commencing one week prior to the start of in-river work. Routine water column monitoring will be initiated by the Construction Engineer once in-river activities are initiated and will continue during sediment removal and restoration activities. The proposed action levels for turbidity results is as follows:

$$\text{Turbidity}_{\text{Downstream}} \geq \text{Turbidity}_{\text{Upstream}} + 50 \text{ NTUs}$$

It should be noted that the designation of upstream and downstream location will vary throughout the day given the tidal influence at the site. As such, the corrective action level of 50 NTUs will be compared to the absolute value of the difference in turbidity reading between locations.

In the event that an elevated turbidity measurement is obtained (as defined above), additional readings from both locations will be monitored to determine if the prior sampling result was an anomaly or if the elevated reading was possibly a short-duration event. If the exceedance is not an anomaly and is detected a second time, water samples will be collected at the upstream and downstream monitoring points and will be analyzed for total suspended solids (TSS) and total dissolved solids (TDS).

In parallel with the sampling activities, additional observations of weather, sewer discharges, tidal cycle, and any other observations that would aid in evaluating water quality observations and measurements will be noted. If the elevated turbidity reading is determined to be related to specific work activities, the pertinent activities will be modified to the extent feasible (e.g., slowing production/placement rate), additional controls will be implemented to prevent further impacts to the water column, and/or work will be stopped until turbidity returns to an acceptable level.

5.2 Visual Observation of Turbidity

In addition, visual observations will be made for turbidity causing a substantial visual contrast to natural conditions (6 CRR-NY 703.2) outside the turbidity control measures. Corrective actions including review of the real time turbidity monitoring data, cleaning of monitoring probes, or adjustment of turbidity monitoring stations will be performed. In the event it is determined that the visual increase in turbidity is due to site operations then adjustments would be made to operations to reduce turbidity levels. Operational and engineering adjustments and best management practices that will be employed to reduce turbidity levels prior to a corrective action exceedance include the following: reducing dredging rate or depth of cut; mitigating any spillage; minimizing steepness of dredge cuts to reduce potential for sloughing; sequencing operations in consideration of tidal influence; reducing vessel movement/propeller wash; ensuring equipment inspections and maintenance; and inspection of resuspension controls.

In the instance that the corrective action level is exceeded, contingency measures will be employed. These may include:

- Investigate the cause of the exceedance to confirm if it is associated with project-related activities
- Conduct additional water column monitoring to investigate the cause of the exceedance and/or until levels are within the specified criteria
- Review in-water construction operations to evaluate if the cause of the exceedance can be readily identified and corrected
- Identify possible modifications to equipment (e.g., different dredge bucket or dredge head).

Implementation of turbidity contingency measures will be discussed in the field in consultation with the NYSDEC.

5.3 Observation of Release of NAPL/Sheens on Surface Water

The Contractor will install boundary/perimeter containment boom as described in Specification Section 013543 – Environmental Protection Procedures. An oil absorbent boom will also be place on the interior side of the containment boom to collect any sheen that is contained. The Contractor will provide a boat and crew dedicated to performing sheen control measures onsite during intrusive in-water activities. Visual observations will be made for the presence of NAPL/sheens on the water surface in and around the ARC by the Contractor. If NAPL/sheens are observed, the following procedures will be initiated, as described in Specification Section 013543 – Environmental Protection Procedures:

- Notification will be made to National Grid and NYSDEC or their onsite representatives.
- Absorbent boom(s) and/or pad(s) will be deployed immediately by the Contractor to contain the NAPL/sheen. This procedure will be repeated until the NAPL/sheen is contained. If the boom(s) or pad(s) appears to be saturated, another sorbent boom and/or pad will be deployed to replace the existing and/or additional boom. In addition, ongoing removal and replacement procedures will be reviewed and modified, as appropriate.

The Contractor will document observations of NAPL/sheens in the daily construction report. NAPL/sheen outside of an existing boom, or the presence of a saturated boom, observed by site personnel will be reported to the Contractor immediately.

6 WASTE HANDLING/MANAGEMENT

6.1 General

This section identifies the general CQA activities specific to material dewatering and handling/management of waste materials. Additional information and requirements are provided in the RD.

6.2 Material Dewatering

The Contractor will dewater/stabilize dredged materials as necessary to (at a minimum) pass Paint Filter testing procedures along with landfill-specific requirements prior to leaving the Site. The Contractor is responsible to perform such testing. The Contractor's means and methods of dewatering/stabilizing excavated materials will conform to the requirements of the RD.

The Construction Engineer will document, through visual observation, that 1) dredged materials are sufficiently dewatered/stabilized prior to transporting offsite and 2) water generated during excavation and material dewatering activities is properly collected, treated, and discharged in accordance with the Specifications, and the SPDES effluent discharge permit.

6.3 Waste Handling/Management

The Contractor will arrange for the proper handling, treatment, and disposal of all waste materials generated during the project. Such waste materials include (but are not limited to) sediment, water, NAPL, debris, and municipal solid waste.

All waste profiles will be prepared by the Contractor and reviewed/signed by National Grid or authorized agent. In preparing waste profiles, the Contractor will determine if the waste material can be transported/disposed of under an existing National Grid waste profile (if one exists) or if a new waste profile is required. Waste manifests (hazardous or non-hazardous, as appropriate) will be prepared by the Contractor and reviewed/signed by National Grid or an authorized agent. The Contractor will provide copies of the completed waste profiles and countersigned manifests to National Grid, the Construction Manager, and the Construction Engineer for the project file.

All vehicles transporting dredged materials offsite for treatment/disposal will be fully lined, equipped with non-mesh tarpaulins, and have working turnbuckles to secure tailgates. Transporters will have up-to-date waste transporter permits (pursuant to 6 NYCRR Part 364) and copies of those permits will be maintained onsite for the duration of the project. Vehicles transporting waste materials will follow the approved truck route as shown in the RD.

During the project, the Contractor is responsible for scheduling, coordinating, loading, and transporting waste materials to National Grid-approved offsite treatment/disposal facilities. As part of those activities, the Contractor will verify and ensure that:

- A waste manifest is prepared for each load of material to be transported offsite.
- Waste manifests are signed by National Grid or an authorized agent.

- Vehicles transporting waste materials are fully lined and equipped with non-mesh tarpaulins.
- Waste transporters have up-to-date waste transporter permits and truck numbers match those included on the permits.
- Countersigned waste manifests and disposal tickets are provided periodically (e.g., monthly or other mutually agreeable frequency) to National Grid, the Construction Manager, and the Construction Engineer.
- Waste transporters follow the approved truck route to the Thruway.

The Construction Engineer will document and/or verify that the Contractor performs the above activities in accordance with the Specifications, and all applicable rules and regulations.

6.4 Water Treatment

Water generated from sediment dewatering operations and from decontamination activities will be collected for treatment at the temporary onsite water treatment system. Water from the waste staging and handling area and the decontamination area(s) will be pumped from the sumps within those areas to the influent tanks of the onsite water treatment system.

The onsite water treatment system is expected to include the following primary components:

- influent storage/gravity settling tanks
- oil/water separator
- filtration
- granular-activated carbon (GAC) vessels
- final effluent storage tanks

The Contractor will design, size, operate, and maintain the onsite water treatment system to meet the permit-required discharge criteria and Specification Section 444000 – Water Handling and Disposal. The design will be reviewed by the Engineer. The Construction Engineer will observe assembly of the water treatment system in order to document that the appropriate components have been installed as designed by the Contractor.

Treated effluent will be retained in the effluent storage tanks and sampled by the Contractor prior to discharge to the Hudson River. The Contractor will submit the samples to the analytical laboratory and review the results of the analytical testing. Any exceedance of the discharge limits will be reported to the Construction Manager and Construction Engineer and appropriate modifications will be made immediately to the onsite water treatment system (with subsequent testing). When the analyses are applicable to water that has not yet been discharged, re-treatment of the batch will be required.

Residual solid materials generated as a result of the operation of the onsite water treatment system will be blended with the impacted sediments for offsite treatment/disposal. The Construction Engineer will document the management of the water treatment systems residuals.

7 DECONTAMINATION

The Contractor will decontaminate (as necessary) all vehicles, equipment, and personnel that come into contact with excavated or potentially impacted materials at the Site. The decontamination of Contractor equipment and personnel will be performed within dedicated decontamination area(s) constructed in accordance with the RD. The Contractor is responsible for constructing and maintaining decontamination area(s) to accommodate all loads, vehicles, equipment, and migration scenarios. The Contractor will identify decontamination procedures for vehicles, equipment, and personnel in its Health and Safety Plan (HASP). These procedures will be reviewed by National Grid and the Engineer prior to the initiation of construction activities. The extent and method of decontamination will be at the discretion of the Contractor; however, National Grid, the Construction Manager, and the Engineer reserve the right to require additional decontamination if deemed necessary.

The Contractor will provide appropriately sized decontamination areas for its personnel. Personnel decontamination areas will be located within the contamination reduction zone and include those facilities necessary to decontaminate personnel upon exiting the work area (exclusion zone), in accordance with the Contractor’s HASP, and in accordance with local, state, and federal laws and regulations. Vehicles and equipment will be positioned in a decontamination area and visually inspected by the Contractor prior to handling non-impacted materials or leaving the Site. Any visible sediment or other debris will be promptly removed and disposed of in a manner consistent with the materials dredged. Precautions will be taken to limit contact between the vehicle/equipment, personnel performing the decontamination activities, and any decontamination liquids that may accumulate in the decontamination area. Personnel engaged in vehicle decontamination activities will use personal protective equipment, including disposable clothing, as required by the Contractor’s HASP. Wash water, solids, and other materials generated during decontamination activities will be collected by the Contractor and handled/managed in accordance with the Specifications.

The Construction Engineer will observe the Contractor’s decontamination procedures and document that the following activities are completed in accordance with the RD and/or Contractor’s HASP (as appropriate):

- Vehicles, equipment, and materials (including excavation equipment, steel sheeting, trucks, pumps, hand tools, etc.) that come in contact with excavated or potentially impacted materials are decontaminated prior to handling non-impacted materials or leaving the Site.
- Vehicle and equipment surfaces (including tires) are free of visible sediment, debris, or stains (to the satisfaction of the Engineer).
- Equipment such as pumps are flushed using clean water and appropriate cleaning agents, as necessary (to the satisfaction of the Engineer).
- Wastewater treatment system components (e.g., influent tanks, piping, media vessels, etc.) are decontaminated as required by their respective vendors.
- Wash water, solids, and other materials generated during decontamination activities are collected by the Contractor and handled/managed in accordance with the Specifications.

8 DEMOBILIZATION

8.1 Inspection

Near the completion of the remedial activities, the Construction Engineer, Construction Manager, National Grid, and NYSDEC will conduct an inspection. The inspection will consist of a walkthrough of work areas to evaluate the completeness of construction efforts and its consistency with the RD.

Following the inspection, the Construction Engineer either will specify additional activities to address deficiencies or deviations from the design documents, as appropriate, or will determine that the amended construction activities are complete. If additional construction activities are required, the Construction Engineer or their delegate will prepare a “punch list” and corresponding schedule to complete the activities.

8.2 Post-Remedial Action Material Handling

Any materials (e.g., sediment, debris, wastewater treatment plant [WWTP] spent media, decontamination solids) that remain onsite after demobilization will be inspected and sampled appropriately based on the material’s final disposition. The potential for the material’s reuse at the Site, reuse at an approved offsite location, or for disposal at an approved disposal facility will be evaluated, sampled, and handled appropriately. All analytical data and any correspondence with NYSDEC will be included in the daily CQA reports.

8.3 Transportation and Disposal of Wastes

Prior to the removal of waste to be disposed offsite, waste manifests will be prepared and submitted to the Owner or designee for review and approval in accordance with the Specifications. Waste that may need offsite disposal includes, but is not limited to, debris, WWTP spent media, and decontamination solids.

8.4 Upland Restoration

Upland restoration will involve restoring the areas used for temporary staging and access to pre-construction conditions in accordance with the Specifications and the Design Drawings. The Construction Engineer will confirm completion of the work through visual observation and comparison of pre- and post-construction survey data.

8.5 Post-Construction Closeout

Following the completion of demobilization activities, the Contractor and Construction Engineer will photograph and perform an as-built survey to document restored upland areas. A New York-registered and licensed surveyor will survey the Site to document restored areas. The Contractor will have an New York-registered and licensed surveyor perform a survey of the Site topography in accordance with the Technical Specifications that will include establishing x, y, and z coordinate points for existing structures, vegetation areas, fencing, service poles, wires, paving, survey control points, and monuments that will be left onsite. The survey records, including raw survey files and AutoCAD files, will be submitted to the Project Manager not more than 2 days after completion of the survey.

9 REFERENCES

Arcadis. 2008b. Final Engineering Report – Remedial Action Implementation for Operable Unit 1, Hudson (Water Street) Site. Hudson, New York. May.

BBL. 2003a. Final Remedial Design – Remedial Action for Operable Unit 1 – Contract No. 1 – General, Hudson (Water Street) Site. Hudson, New York. July.

NYSDEC. 2010. DER-10 / Technical Guidance for Site Investigation and Remediation. May 3. Available at: http://www.dec.ny.gov/docs/remediation_hudson_pdf/der10.pdf.

NYSDEC. 2011. DER-31 / Green Remediation. January 20. Available at http//www.dec.ny.gov/docs/remediation_hudson_pdf/der31/pdf.

NYSDEC. 2012. Record of Decision. NM - Hudson MGP, Operable Unit Number 02: Hudson River, Hudson, Columbia County, Site No. 411005. Division of Environmental Remediation. March 28.

NYSDEC. 2014. Screening and Assessment of Contaminated Sediment. June 24.

USACE. 2013. Hydrographic Surveying Manual. November 30.

Design & Consultancy for natural and built assets

Arcadis of New York, Inc.

One Lincoln Center

110 W Fayette Street

Suite 300

Syracuse, New York 13202

Tel 315 446 9120

Fax 315 449 0017

www.arcadis.com

APPENDIX D

Community Air Monitoring Plan

COMMUNITY AIR MONITORING PLAN

Operable Unit 2

Hudson (Water Street) Site

Hudson, New York

July 2020

COMMUNITY AIR MONITORING PLAN

Operable Unit 2
Hudson (Water Street) Site
Hudson, New York

07/17/2020

Mark O. Gravelding, P.E. Date
Senior Vice President

Prepared for:

National Grid

Syracuse, New York

Prepared by:

Arcadis of New York, Inc.

One Lincoln Center

110 W Fayette Street

Suite 300

Syracuse

New York 13202

Tel 315 446 9120

Fax 315 449 0017

Our Ref.:

30003986.00012

Date:

July 2020

CONTENTS

EXHIBITS

ACRONYMS AND ABBREVIATIONS

ARC	Area for Remedial Consideration
Arcadis	Arcadis of New York, Inc.
bss	below sediment surface
CAMP	Community Air Monitoring Plan
cy	cubic yards
GCAMP	Generic Community Air Monitoring Plan
MGP	manufactured gas plant
NAPL	non-aqueous phase liquid
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OU	operable unit
OVA	organic vapor analyzer
PID	photoionization detector
PM_{10}	particulate matter less than 10 microns in diameter
ppm	parts per million
RD	remedial design
ROD	Record of Decision
TAGM	Technical and Administrative Guidance Memorandum
USEPA	United States Environmental Protection Agency
VOC	volatile organic compounds
$\mu g/m^3$	micrograms per cubic meter

1 INTRODUCTION

This *Community Air Monitoring Plan* (CAMP) has been prepared by Arcadis of New York, Inc. (Arcadis), on behalf of National Grid, to support the implementation of the selected remedy for the former National Grid Hudson Water Street manufactured gas plant (MGP) site (the Site) in Hudson, New York. This CAMP fulfills the particulate monitoring requirements set forth by the New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan (GCAMP), dated June 2000 (Exhibit I), and New York State Department of Environment Conservation's (NYSDEC's) Technical and Administrative Guidance Memorandum (TAGM) 4031, "Fugitive Dust Suppression and Particulate Monitoring Program at Inactive Hazardous Waste Sites" (Exhibit II). The purpose of this CAMP is to describe the monitoring activities that will be conducted to detect potential airborne releases of constituents of concern during the implementation of the remedial action. This CAMP specifies the air emission action levels, air monitoring procedures, monitoring schedule, and data collection and reporting to be performed during the above activities.

1.1 Site Description

The Site is located in, and along the east bank of, the Hudson River. It includes property where the former MGP was located on Water Street in Hudson, Columbia County, New York, and sediments within a portion of the Hudson River. The Site consists of two operable units, OU1 and OU2.

OU1 is defined as the onsite source area including Embayment #1. Remediation activities for OU1 were completed from April 2004 to September 2005 in accordance with the Final Remedial Design – Contract No. 1 – General (BBL 2003). The OU1 remediation activities consisted of excavation and offsite disposal of approximately 8,800 cubic yards (cy) of soil from the former gas holder area and former tar tank area of the former MGP; excavation and offsite disposal of approximately 8,600 cy of sediment and soil from Embayment #1 and the surrounding shoreline; and restoration of the Embayment #2 shoreline and the north wall of a building on the City of Hudson property. As described in the Final Engineering Report for the OU1 activities, a permanent sheet pile wall was installed around the sediment removal area and along the western alignment of Embayment #1 (i.e., the mouth of the embayment; Arcadis 2008). This steel sheet pile wall was left in-place to provide additional protection against the potential lateral subsurface migration of impacted material from surrounding properties (e.g., the former oil terminal) into Embayment #1.

OU2 is defined as a portion of the Hudson River adjacent to the Site extending approximately 1,700 feet along the shoreline from the west end of Ferry Street to the Colarusso Ventures, LLC property, and approximately 300 feet offshore into the eastern edge of the shipping channel. OU2 includes Embayment #2, Embayment #3, and Embayment #4.

1.2 Overview of Remedial Action

The selected remedy for OU2 includes the following:

- A Remedial Design (RD) program to provide the details necessary for the construction, operation, maintenance, and monitoring of the remedy. Green remediation principles and techniques will be implemented to the extent feasible in the design, implementation, and management of such program, per DER-31/Green Remediation (NYSDEC 2011).

- Installation and maintenance of appropriate engineering controls around the Area of Remedial Consideration (ARC) during remediation, as feasible, to control and contain re-suspended sediments and mobile non-aqueous phase liquid (NAPL) that may be generated as a result of dredging activities.
- Removal of debris and shoreline riprap within the ARC for offsite disposal or, in the case of the riprap, reuse as feasible.
- Removal of up to 9,000 cy of NAPL-saturated and potentially toxic sediment within the ARC to depths up to 15 feet below sediment surface (bss).
- Management, including dewatering and if necessary pre-treatment, of the dredged sediment in preparation for offsite treatment and/or disposal at a permitted facility. Installation of a temporary containment structure with an air handling and treatment system over the sediment staging and processing area.
- Installation of a temporary wastewater treatment system to treat water removed from the dredged sediment.
- Restoration of the riverbed and banks to the original bathymetry and, to the extent possible, with material similar to the existing substrate.
- Post-remediation monitoring of remedy effectiveness and restoration success.

1.3 Potential Air Emissions Related to the Remedial Action

As defined in the NYSDOH GCAMP, intrusive remedial activities to be performed at the Site have the potential to generate localized impacts to air quality. Such activities to be performed at the Site include, but may not be limited to, the following:

- Site preparation (such as clearing, grading, and construction of access roads).
- Installation of erosion and sediment control measures.
- Dredging and backfilling.
- Waste handling and management.
- Decontamination of equipment and personnel.
- Site restoration activities (e.g., grading).
- Other ancillary intrusive activities.

1.4 Air/Dust Emissions and Control Measures

Air emissions control and fugitive dust suppression measures will be implemented concurrently with the activities identified above (as needed) to limit the potential for organic vapor and dust emissions from the Site. Air emissions associated with material handling and stockpiling, other intrusive activities, and certain nonintrusive activities, such as mobilization, transportation, and restoration activities, will be controlled as further described below. The following vapor and dust control measures may be used during these activities, depending upon specific circumstances, visual observations, and air monitoring results:

- Water spray.
- Polyethylene sheeting (for covering dredged sediment, material stockpiles, etc.).
- Minimizing disturbed soil surface area to be exposed at any given time.

The Contractor will be required to submit a detailed plan for the community air monitoring program. The plan will identify the Contractor's locations for performing community air monitoring. The plan will also include the Contractor's procedures to be implemented in response to an exceedance of community air monitoring action levels, as required by the NYSDOH GCAMP.

2 AIR MONITORING PROCEDURES

As required by the NYSDOH's GCAMP, ambient air monitoring will be implemented at the site for total volatile organic compounds (VOCs) and particulate matter less than 10 microns in diameter (PM_{10}). Air monitoring will occur during any site activity that may generate fugitive dust emissions. Total VOCs and PM_{10} levels in ambient air will be continuously measured in real-time using portable instruments. The sample location rationale, sample methods, action levels, and abatement procedures are discussed below.

2.1 Sampling Location Selection

During the site preparation phase, and prior to commencing intrusive activities, three air monitoring sample locations will be selected based on publicly available local weather data and the nature of the anticipated remediation activities. Air monitoring stations will be deployed at these sampling locations.

If wind direction shifts radically during the workday and for an extended period of time, such that the upwind location and the two downwind locations no longer fall within acceptable guidelines (+/- 60° compass change from the original wind direction), the monitoring stations will be relocated so that the upwind and downwind locations are maintained. Air monitoring location changes will be documented by the Contractor in a field logbook.

2.2 Sampling Methods

2.2.1 VOC Monitoring

Total VOCs in ambient air will be monitored and recorded using a portable organic vapor analyzer (OVA) equipped with a photoionization detector (PID) with data-logging capabilities (MiniRae2000 or equivalent). The OVA-PID will be housed in a watertight shelter attached to a tripod and set at a height of approximately 5 feet above the ground. Total VOC levels will be measured continuously and recorded at 15-minute average intervals.

2.2.2 PM_{10} Monitoring

Fugitive dust migration will be visually assessed during work activities, and reasonable dust suppression techniques will be used during Site activities that may generate fugitive dust. These activities and their design controls are discussed in Section 1.4.

As required by the NYSDOH GCAMP, real-time airborne particulate monitoring will be conducted continuously during all intrusive and/or potential dust generating activities (e.g., installation of erosion and sediment control measures and material handling activities) using instrumentation equipped with electronic data-logging capabilities. A real-time particulate monitor (MIE DataRAM PDR1000 [or equivalent]) will be used for PM_{10} monitoring. The monitor will be housed in a watertight shelter attached to a tripod and set at a height of approximately 5 feet above the ground. PM_{10} concentrations will be measured continuously and recorded at 15-minute average intervals. Results of 15-minute average measurements and any instantaneous measurements taken to facilitate activity decisions will be recorded by the Contractor using an electronic data logger and/or in the field logbook.

2.3 Action Levels

The action levels provided below are to be used to initiate corrective actions, if necessary, based on real-time monitoring. Each piece of monitoring equipment will have alarm capabilities (both audible and visual) to indicate exceedances of the action levels specified below.

2.3.1 Action Levels for VOCs

The following total VOC action levels and responses, based on the NYSDOH's GCAMP, will be implemented during any investigation activity that may generate emissions:

- If the ambient air concentration of total VOCs exceeds 5 parts per million (ppm) above the background (upwind location) for the 15-minute average, intrusive site activities will be temporarily halted while monitoring continues. If the total VOC concentration readily decreases (through observation of instantaneous readings) below 5 ppm above background, then intrusive site activities will resume with continuous monitoring.
- If the ambient air concentrations of total VOCs persist at levels in excess of 5 ppm above background but less than 25 ppm above background, intrusive site work activities will be halted, the source of the elevated VOC concentrations identified, corrective actions to reduce or abate the emissions undertaken, and air monitoring will continue. Once these actions have been implemented, intrusive site work activities will resume provided the following two conditions are met:
  - The 15-minute average VOC concentrations remain below 5 ppm above background.
  - The VOC level 200 feet downwind of the sample location or half the distance to the nearest potential receptor or residential/commercial structure (whichever is less but in no case less than 20 feet) is below 5 ppm over background for the 15minute average.
- If the ambient air concentrations of total VOCs are above 25 ppm above background, intrusive site activities will stop and emission control measures will be implemented if the ambient air concentrations of total VOCs persist at levels in excess of 5 ppm above background.

2.3.2 Action Levels for PM_{10}

The following total PM_{10} action levels and responses, based on the NYSDOH's GCAMP, will be implemented during any investigation activity that may generate emissions:

- If the 15-minute average ambient air PM_{10} concentration of the downwind monitoring locations exceeds 100 micrograms per cubic meter ($\mu g/m^3$) above the average background concentration.
- If airborne dust is visually observed leaving the work area.

If, after implementation of dust suppression measures, the downwind average ambient air PM_{10} concentration is greater than 150 $\mu g/m^3$ above the average background concentration, work activities must be stopped and re-evaluated. Work activities may resume only if dust suppression measures and other corrective actions are successful in reducing the downwind average ambient air PM_{10} concentration to less than 150 µg/m^3 above the average background concentration and if no visible dust is observed leaving the Site.

2.4 Instrument Calibration

Calibration of the CAMP monitoring instrumentation will be conducted in accordance with each of the equipment manufacturer's calibration and quality assurance requirements. Calibrations will be recorded by the Contractor in the field logbook.

2.5 Odor Monitoring

The Contractor and/or the Contractor's air monitoring subcontractor will walk/boat the work area perimeter on a regular basis to detect any nuisance odors that would not be detected by the monitors. Any noticeable odors will be reported to the Contractor's Health and Safety Supervisor and corrected immediately. As needed, engineering controls will be implemented immediately to reduce odors. In the event of an odor complaint, a VOC monitor (MiniRAE 200 or equivalent) will be set up at the location of complaint, vapor emissions documented, and the results reviewed with NYSDEC, National Grid, and the property owner. At a minimum, the Contractor will have one spare PID available at the site to address potential odor complaints. As needed, odor suppression will also be implemented.

3 MONITORING SCHEDULE AND DATA COLLECTION/ REPORTING

The following identifies the monitoring schedule and data collection/reporting requirements.

3.1 Monitoring Schedule

Air monitoring will be conducted prior to initiating intrusive activities to establish adequate baseline data and until such time that significant material handling activities are complete. Real-time VOC and PM_{10} monitoring will be performed during all intrusive and/or potential dust-generating activities (e.g., installation of erosion and sediment control measures and waste handling activities).

3.2 Data Collection and Reporting

Air monitoring data will be collected continuously from VOC and PM_{10} monitors during all intrusive and/or potential dust-generating activities by the electronic data-logging system. The data management software will be set up to continuously monitor instantaneous readings and record 15-minute average concentrations. All average concentrations will be recorded and archived for review by NYSDOH and NYSDEC personnel (if requested).

In the event of an exceedance of a community air monitoring action level for PM_{10}, the Contractor will notify the Construction Manager once the exceedance is observed (i.e., real time). The Contractor will follow-up with the Engineer within 24 hours of the observed exceedance summarizing the data, the cause of the exceedance, and any corrective measures to be implemented as a result of the exceedance. The Engineer will contact the appropriate parties (e.g., National Grid, NYSDEC, and NYSDOH) once notified by the Contractor and will forward the Contractor’s e-mail to these parties once reviewed.

4 REFERENCES

Arcadis. 2008. Final Engineering Report – Remedial Action Implementation for Operable Unit 1, Hudson (Water Street) Site. Hudson, New York. May.

BBL. 2003. Final Remedial Design – Remedial Action for Operable Unit 1 – Contract No. 1 – General, Hudson (Water Street) Site. Hudson, New York. July.

NYSDEC. 2011. DER-31 / Green Remediation. January 20. Available at http//www.dec.ny.gov/docs/remediation_hudson_pdf/der31/pdf.

EXHIBITS

EXHIBIT I

Generic Community Air Monitoring Plan

New York State Department of Health
Generic Community Air Monitoring Plan

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical-specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for volatile organic compounds (VOCs) and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate NYSDEC/NYSDOH staff.

Continuous monitoring will be required for all <u>ground intrusive</u> activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. "Periodic" monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a **continuous** basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

- If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

All 15-minute readings must be recorded and be available for State (DEC and DOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored **continuously** at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring partculate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.

All readings must be recorded and be available for State (DEC and DOH) personnel to review.

June 20, 2000

H:\Southern\gCAMPr1.doc

EXHIBIT II

NYSDEC TAGM 4031 – Fugitive Dust Suppression and Particulate Monitoring Program at Inactive Hazardous Waste Sites

Fugitive Dust Suppression and Particulate Monitoring Program (TAGM - 4031)

To:	Regional Hazardous Waste Remediation Engrs., Bur. Directors & Section Chiefs
From:	Michael J. O'Toole, Jr., Director, Division of Hazardous Waste Remediation (signed)
Subject:	Technical and Administrative Guidance Memorandum -- Fugitive Dust Suppression and Particulate Monitoring Program at Inactive Hazardous Waste Sites
Date:	Oct 27, 1989

1. Introduction

Fugitive dust suppression, particulate monitoring, and subsequent action levels for such must be used and applied consistently during remedial activities at hazardous waste sites. This guidance provides a basis for developing and implementing a fugitive dust suppression and particulate monitoring program as an element of a hazardous waste site's health and safety program.

2. Background

Fugitive dust is particulate matter--a generic term for a broad class of chemically and physically diverse substances that exist as discrete particles, liquid droplets or solids, over a wide range of sizes--which becomes airborne and contributes to air quality as a nuisance and threat to human health and the environment.

On July 1, 1987, the United States Environmental Protection Agency (USEPA) revised the ambient air quality standard for particulates so as to reflect direct impact on human health by setting the standard for particulate matter less than ten microns in diameter (PM_{10}); this involves fugitive dust whether contaminated or not. Based upon an examination of air quality composition, respiratory tract deposition, and health effects, PM_{10} is considered conservative for the primary standard--that requisite to protect public health with an adequate margin of safety. The primary standards are 150 ug/m^3 over a 24-hour averaging time and 50 ug/m^3 over an annual averaging time. Both of these standards are to be averaged arithmetically.

There exists real-time monitoring equipment available to measure PM_{10} and capable of integrating over a period of six seconds to ten hours. Combined with an adequate fugitive dust suppression program, such equipment will aid in preventing the off-site migration of contaminated soil. It will also protect both on-site personnel from exposure to high levels of dust and the public around the site from any exposure to any dust. While specifically intended for the protection of on-site personnel as well as the public, this program is not meant to replace long-term monitoring which may be required given the contaminants inherent to the site and its air quality.

3. Guidance

A program for suppressing fugitive dust and monitoring particulate matter at hazardous waste sites can be developed without placing an undue burden on remedial activities while still being protective of health and environment. Since the responsibility for implementing this program ultimately will fall on the party performing the work, these procedures must be incorporated into appropriate work plans. The following fugitive dust suppression and particulate monitoring program will be employed at hazardous waste sites during construction and other activities which warrant its use:

1. Reasonable fugitive dust suppression techniques must be employed during all site activities which may generate fugitive dust.

2. Particulate monitoring must be employed during the handling of waste or contaminated soil or when activities on site may generate fugitive dust from exposed waste or contaminated soil. Such activities shall also include the excavation, grading, or placement of clean fill, and control measures therefore should be considered.

3. Particulate monitoring must be performed using real-time particulate monitors and shall monitor particulate matter less than ten microns (PM_{10}) with the following minimum performance standards:

   Object to be measured: Dust, Mists, Aerosols
   Size range: <0.1 to 10 microns
   Sensitivity: 0.001 mg/m^3
   Range: 0.001 to 10 mg/m^3
   Overall Accuracy: ±10% as compared to gravimetric analysis of stearic acid or reference dust

Operating Conditions:
Temperature: 0 to 40^{o}C
Humidity: 10 to 99% Relative Humidity

Power: Battery operated with a minimum capacity of eight hours continuous operation

Automatic alarms are suggested.

Particulate levels will be monitored immediately downwind at the working site and integrated over a period not to exceed 15 minutes. Consequently, instrumentation shall require necessary averaging hardware to accomplish this task; the P-5 Digital Dust Indicator as manufactured by MDA Scientific, Inc. or similar is appropriate.

4. In order to ensure the validity of the fugitive dust measurements performed, there must be appropriate Quality Assurance/Quality Control (QA/QC). It is the responsibility of the entity operating the equipment to adequately supplement QA/QC Plans to include the following critical features: periodic instrument calibration, operator training, daily instrument performance (span) checks, and a record keeping plan.

5. The action level will be established at 150 ug/m^3 over the integrated period not to exceed 15 minutes. While conservative, this short-term interval will provide a real-time assessment of on-site air quality to assure both health and safety. If particulate levels are detected in excess of 150 ug/m^3, the upwind background level must be measured immediately using the same portable monitor. If the working site particulate measurement is greater than 100 ug/m^3 above the background level, additional dust suppression techniques must be implemented to reduce the generation of fugitive dust and corrective action taken to protect site personnel and reduce the potential for contaminant migration. Corrective measures may include increasing the level of personal protection for on-site personnel and implementing additional dust suppression techniques (see Paragraph 7). Should the action level of 150 ug/m^3 be exceeded, the Division of Air Resources must be notified in writing within five working days; the notification shall include a description of the control measures implemented to prevent further exceedences.

6. It must be recognized that the generation of dust from waste or contaminated soil that migrates off-site, has the potential for transporting contaminants off-site. There may be situations when dust is being generated and leaving the site and the monitoring equipment does not measure PM_{10} at or above the action level. Since this situation has the potential to migrate contaminants off-site, it is unacceptable. While it is not practical to quantify total suspended particulates on a real-time basis, it is appropriate to rely on visual observation. If dust is observed leaving the working site, additional dust suppression techniques must be employed. Activities that have a high dusting potential--such as solidification and treatment involving materials like kiln dust and lime--will require the need for special measures to be considered.

7. The following techniques have been shown to be effective for the controlling of the generation and migration of dust during construction activities:

    1. Applying water on haul roads.
    2. Wetting equipment and excavation faces.
    3. Spraying water on buckets during excavation and dumping.
    4. Hauling materials in properly tarped or watertight containers.
    5. Restricting vehicle speeds to 10 mph.
    6. Covering excavated areas and material after excavation activity ceases.
    7. Reducing the excavation size and/or number of excavations.

    Experience has shown that utilizing the above-mentioned dust suppression techniques, within reason as not to create excess water which would result in unacceptable wet conditions, the chance of exceeding the 150 ug/m^3 action level at hazardous waste site remediations is remote. Using atomizing sprays will prevent overly wet conditions, conserve water, and provide an effective means of suppressing the fugitive dust.

8. If the dust suppression techniques being utilized at the site do not lower particulates to an acceptable level (that is, below 150 ug/m^3 and no visible dust), work must be suspended until appropriate corrective measures are approved to remedy the situation. Also, the evaluation of weather conditions will be necessary for proper fugitive dust control--when extreme wind conditions make dust control ineffective, as a last resort remedial actions may need to be suspended.

There may be situations that require fugitive dust suppression and particulate monitoring requirements with action levels more stringent than those provided above. Under some circumstances, the contaminant concentration and/or toxicity may require appropriate toxics monitoring to protect site personnel and the public. Additional integrated sampling and chemical analysis of the dust may also be in order. This must be evaluated when a health and safety plan is developed and when appropriate suppression and monitoring requirements are established for protection of health and the environment.

Arcadis of New York, Inc.

One Lincoln Center

110 W Fayette Street

Suite 300

Syracuse, New York 13202

Tel 315 446 9120

Fax 315 449 0017

www.arcadis.com

APPENDIX E

Storm Water Pollution Prevention Plan

ARCADIS Design & Consultancy for natural and built assets

nationalgrid

STORM WATER POLLUTION PREVENTION PLAN

Operable Unit 2

Hudson (Water Street) Site

Hudson, New York

July 2020

STORM WATER POLLUTION PREVENTION PLAN

Operable Unit 2
Hudson (Water Street) Site
Hudson, New York

07/17/2020

Mark O. Gravelding, P.E. Date
Senior Vice President

Prepared for:

National Grid

Syracuse, New York

Prepared by:

Arcadis of New York, Inc.

One Lincoln Center

110 W Fayette Street

Suite 300

Syracuse

New York 13202

Tel 315 446 9120

Fax 315 449 0017

Our Ref.:

30003986.00012

Date:

July 2020

CONTENTS

ATTACHMENTS

1 INTRODUCTION

This *Storm Water Pollution Prevention Plan* (SWPPP) has been prepared by Arcadis of New York, Inc. (Arcadis), on behalf of National Grid, to support the implementation of the selected remedy for Operable Unit 2 (OU-2) at the former National Grid Hudson Water Street manufactured gas plant (MGP) site (the Site) in Hudson, New York. Details related to the remedial activities are presented in the *Final Remedial Design Report* (RD), to which this SWPPP is appended.

This SWPPP summarizes the storm water management practices that will be implemented during the remedial construction activities to control potential impacts to site-related storm water run-off. This SWPPP has been prepared in accordance with the substantive requirements of New York State Department of Environmental Conservation's (NYSDEC's) *State Pollutant Discharge Elimination System (SPDES) General Permit for Storm Water Discharges from Construction Activity* (SPDES General Permit) (NYSDEC 2015).

1.1 Site Description

The Site is located in, and along the east bank of, the Hudson River. It includes property where the former MGP was located on Water Street in Hudson, Columbia County, New York, and sediments within a portion of the Hudson River. The Site consists of two operable units, OU1 and OU2.

OU1 is defined as the onsite source area including Embayment #1. Remediation activities for OU1 were completed from April 2004 to September 2005 in accordance with the Final Remedial Design – Contract No. 1 – General (BBL 2003). The OU1 remediation activities consisted of excavation and offsite disposal of approximately 8,800 cubic yards (cy) of soil from the former gas holder area and former tar tank area of the former MGP; excavation and offsite disposal of approximately 8,600 cy of sediment and soil from Embayment #1 and the surrounding shoreline; and restoration of the Embayment #2 shoreline and the north wall of a building on the City of Hudson property. As described in the Final Engineering Report for the OU1 activities, a permanent sheet pile wall was installed around the sediment removal area and along the western alignment of Embayment #1 (i.e., the mouth of the embayment; Arcadis 2008). This steel sheet pile wall was left in-place to provide additional protection against the potential lateral subsurface migration of impacted material from surrounding properties (e.g., the former oil terminal) into Embayment #1.

OU2 is defined as a portion of the Hudson River adjacent to the Site extending approximately 1,700 feet along the shoreline from the west end of Ferry Street to the Colarusso Ventures, LLC (Colarusso) property, and approximately 300 feet offshore into the eastern edge of the shipping channel. OU2 includes Embayment #2, Embayment #3, and Embayment #4.

1.2 Overview of Remedial Action

The selected remedy for OU2, as documented in the March 2012 Record of Decision (ROD; NYSDEC 2012), includes the following:

- A RD program to provide the details necessary for the construction, operation, maintenance, and monitoring of the remedy. Green remediation principles and techniques will be implemented to the extent feasible in the design, implementation, and management of such program, per DER-31/Green Remediation (NYSDEC 2011).

- Installation and maintenance of appropriate engineering controls around the Area for Remedial Consideration (ARC) during remediation, as feasible, to control and contain re-suspended sediments and mobile non-aqueous phase liquid (NAPL) that may be generated as a result of dredging activities.
- Removal of debris and shoreline riprap within the ARC for offsite disposal or, in the case of the rip-rap, reuse as feasible.
- Removal of up to 9,000 cy of NAPL-saturated and potentially toxic sediment within the ARC to depths up to 15 feet bss.
- Management, including dewatering and if necessary pre-treatment, of the dredged sediment in preparation for offsite treatment and/or disposal at a permitted facility. Installation of a temporary containment structure with an air handling and treatment system over the sediment staging and processing area.
- Installation of a temporary wastewater treatment system to treat water removed from the dredged sediment.
- Restoration of the riverbed and banks to the original bathymetry and, to the extent possible, with material similar to the existing substrate.
- Post-remediation monitoring of remedy effectiveness and restoration success.

1.3 Revisions

This SWPPP will be kept current so that it at all times accurately documents the erosion and sediment control practices that are being used or will be used during construction. At a minimum, this SWPPP will be amended: 1) whenever the current provisions prove to be ineffective in minimizing pollutants in storm water discharges from the site; 2) whenever there is a change in design, construction, operation, or maintenance at the site that has or could have an effect on the discharge of pollutants; and 3) to address issues or deficiencies identified during an inspection by the Contractor’s qualified inspector, NYSDEC, or other regulatory authority having jurisdiction.

1.4 SWPPP Organization

The remainder of this SWPPP is organized into four sections as follows:

- Section 2 (Site Background), presents general information regarding existing (pre-construction) conditions at the site.
- Section 3 (Erosion and Sediment Control Plan), summarizes the erosion and sediment controls that will be used or constructed during the remedial construction activities.
- Section 4 (Pollution Prevention Plan), summarizes the pollution prevention and control measures that will be implemented during the remedial construction activities.
- Section 5 (References), presents a list of reference documents used in the preparation of this SWPPP.

2 SITE BACKGROUND

This section provides general information regarding the pre-remediation conditions at the site.

2.1 Site History and Current Use

The City of Hudson, New York was settled in the 1700s and became a center for whale oil processing and candle manufacturing. In the 1850s, whale oil streetlamps were replaced with manufactured gas lamps (Bradbury 1908). For more than 100 years, the eastern upland area adjacent to the Site has been used for industrial and commercial purposes. Beginning in the late 1800s, iron and steel works, fuel storage, and metal manufacturing facilities operated near the shoreline of the Site (Beers 1873), and the by-products of these industries were used as fill material for the shoreline areas. The majority of the upland area along the shoreline in the vicinity of the Site was filled with several feet of ash, cinders, brick, clay, sand, and gravel. Railroad spurs were also constructed in the vicinity of the four embayments for loading and unloading materials manufactured in the vicinity of the Site. Coal yards and oil tanks were also located along the shoreline of the Site (Sanborn Map and Publishing Company [Sanborn] 1949). MGP operations in this area were active from 1853 until 1949, when natural gas replaced the need for manufactured gas. Subsequent to 1949, industrial and commercial operations at or near the Site have included a motor freight building, an auto scrap yard, and a lumberyard storage area (Sanborn 1961).

Currently, the land immediately adjacent to the Site is used by the public as a park (Henry Hudson Riverfront Park owned by the City of Hudson [City Park]), and land to the east and south of the Site is used for industrial purposes by New York Central Lines and Colarusso. A commuter rail station is located to the east of the Site, across Water Street. The Site is located within the northwestern portion of the City of Hudson, which contains several active industrial facilities, railroads, streets, and parking lots. A storm water outfall that provides drainage for a majority of the northwestern portion of the City of Hudson discharges to Embayment #3.

The Hudson River in the vicinity of the Site is used as a navigable waterway and for recreational purposes. A large island called Middle Ground Flats divides the river offshore from the Site. The shipping channel is located east of the island and is maintained by the United States Army Corps of Engineers (USACE). A barge docking area is located south of Embayment #4 and adjacent to the Colarusso property. Hudson Cruises, Inc., operates guided boat tours from a dock located just north of Embayment #1 (Spirit of Hudson Dock Area; Figure 2), and a private marina and public boat launch are located to the north of the City Park. A fiber optic line owned by Mid-Hudson Cablevision Inc. (Mid-Hudson Cable) crosses the Hudson River within OU2. A fish consumption advisory issued by the New York State Department of Health (NYSDOH; NYSDOH 2014) is currently in effect for fish caught from the Hudson River in the vicinity of the Site due to non-site-related contaminants.

2.2 Surface Water Hydrology

Site topography slopes gently downward to the northwest across most of the site, from Water and Front Streets to the more steeply sloping east bank of the Hudson River. Hudson River flows from the northeast to the southwest near the site. Existing paved and gravel areas allow for surface water runoff to the Hudson River. The work area contains no distinctive surface water runoff pathways, such as drainage ditches or storm drains.

3 EROSION AND SEDIMENT CONTROLS

This section presents the means and methods for erosion and sediment control to be utilized at the temporary staging area as part of remedial construction activities.

3.1 Remedial Design Components

This section summarizes the erosion and sediment controls that will be used or constructed during the remedial construction activities. Erosion and sediment controls will be installed, inspected, and maintained by the Contractor in accordance with the *New York State Standards and Specifications for Erosion and Sediment Control* (NYS Standards and Specifications) (NYSDEC 2016) and the following components of the Remedial Design:

- Specification Section 013543, Environmental Protection Procedures
- Design Drawing G-100, General Notes and Abbreviations
- Design Drawing G-102, Site Preparation and Environmental Controls Plan
- Design Drawing G-500, Miscellaneous Details

As site conditions allow, temporary erosion and sediment controls will be installed before initiating any intrusive activities, and additional controls will be installed during construction (as needed) to achieve the storm water management objectives of this SWPPP and the SPDES General Permit.

3.2 Temporary Structural Measures

This section presents the temporary structural measures to be utilized for erosion and sediment control as part of remedial construction activities.

3.2.1 Rolled Erosion Control Materials

Rolled erosion control products (RECMs) will be used to reduce or otherwise control the potential offsite migration of suspended sediments in storm water run-off and will be installed before any existing soils or vegetation are disturbed at the site. RECMs will be installed and maintained by the Contractor in accordance with Section 5A of the NYS Standards and Specifications, Specification Section 013543 (Environmental Protection Procedures), and Design Drawings G-100 and G-500.

3.3 Periodic Inspections

Erosion and sediment controls will be inspected by the Contractor once every seven calendar days (at a minimum) and after wet weather events to verify the continued effectiveness and integrity of the erosion and sediment controls. For temporary work stoppages greater than two weeks in duration (e.g., cold weather shut-downs, etc.), the inspection frequency may be reduced to once every 30 calendar days if temporary stabilization measures have been applied to all disturbed surfaces, and if approved by National Grid, the Engineer, and NYSDEC. Contractor personnel responsible for periodic inspections will meet the requirements of a “qualified inspector”, as defined in Appendix A of the SPDES General Permit. The results of each inspection, including any corrective actions to be taken, will be documented using the Storm Water Inspection Report form included in Attachment 2.

Any deficiencies observed during the inspection, and any maintenance activities or corrective actions required to address those deficiencies, will be communicated to the Engineer within one working day after the inspection. Maintenance activities and corrective actions will be initiated within two working days of the inspection and will be completed before the next scheduled inspection. If site conditions prevent the maintenance activities or corrective actions from being completed before the next scheduled inspection, such conditions will be documented in the Storm Water Inspection Report, and the maintenance activities/corrective actions will be completed as soon as site conditions permit.

Erosion and sediment controls will be inspected and maintained by the Contractor for the duration of the remedial construction activities, and until such time as all disturbed or open-soil areas at the site have achieved “final stabilization”, as defined in Appendix A of the SPDES General Permit.

3.4 Site Restoration

All disturbed areas will be restored to pre-construction grades and conditions. A final inspection will be performed to verify that all restoration areas have achieved final stabilization. If the restoration areas are not sufficiently stabilized, corrective actions will be taken by the Contractor and a second final site inspection will be performed. Upon acceptance of the final site stabilization, the Contractor will remove any temporary erosion and sediment controls (e.g., RECMs) that are no longer needed.

3.5 Post-Construction Storm Water Management Controls

Due to the nature of the work being performed (i.e., removal of impacted material under a NYSDEC-approved Remedial Design), post-construction water quality and quantity controls are not been provided.

4 POLLUTION PREVENTION PRACTICES

This section summarizes the prevention practices that will be implemented by the Contractor to control impacted materials, spills, and construction debris from becoming a source of pollutants in site-related storm water run-off.

4.1 Remedial Design Components

Pollution prevention measures will comply with the following components of the Remedial Design:

- Specification Section 011100, Summary of Work
- Specification Section 013543, Environmental Protection Procedures
- Specification Section 015000, Temporary Facilities and Controls
- Specification Section 028100, Transport and Disposal of Impacted Materials
- Specification Section 313200, Material Stabilization
- Specification Section 352023, Dredging and Subaqueous Backfill
- Specification Section 444000, Water Handling and Disposal
- Design Drawing G-100, General Notes and Abbreviations
- Design Drawing G-102, Site Preparation and Environmental Controls Plan
- Design Drawing G-103, Preliminary Truck Routes
- Design Drawing G-300, Sediment Removal Plan
- Design Drawing G-301, Sediment Removal Profiles
- Design Drawing G-400, Site Restoration Plan
- Design Drawing G-500, Miscellaneous Details
- Design Drawing G-501, Miscellaneous Details
- Design Drawing G-502, Miscellaneous Details

4.2 Impacted Material Handling, Transportation, and Treatment/Disposal

This section presents the handling, transportation, and treatment/disposal methods to be implemented for impacted material as part of remedial construction activities.

4.2.1 Sediment

Sediment will be excavated to the horizontal and vertical limits depicted on the Design Drawings. Excavated sediment will be removed from the remedial area, transported by barge to the shoreline, removed from the barge and transferred by truck to the sediment dewatering pad, solidified (as necessary), and loaded for offsite transport by truck to a National Grid-approved waste management facility.

Sediment to be transported over public roadways will be loaded into properly licensed and permitted vehicles (pursuant to Title 6, Part 364 of the New York Codes, Rules, and Regulations [6 NYCRR Part 364]), and will be transported in accordance with applicable laws and regulations. Transport vehicles will be water-tight and/or fully lined with polyethylene liners (or equivalent) and will be equipped with functioning tailgate locks and non-mesh (solid), waterproof tarpaulins.

Before leaving the site, transport vehicles will be staged and inspected within a temporary decontamination area (constructed as shown on Design Drawings G-102 and G-502), and will be cleaned of any visible soil. Upon leaving the site, transport vehicles will follow approved haul routes as specified on Design Drawing G-103.

4.2.2 Debris

Debris generated during the remedial activities is anticipated to include vegetation, stumps/root balls, and/or large stone. Such materials will be segregated as appropriate from other excavated materials, downsized (as required by disposal facilities), and handled separately, where practicable. Debris will be stockpiled onsite within a fully lined roll-off container for characterization prior to offsite disposal. The debris will be transported from the site to an appropriate offsite disposal facility in properly licensed and permitted tanker trucks (pursuant to 6 NYCRR Part 364). Before leaving the site, transport vehicles will be staged and inspected within a temporary decontamination area (constructed as shown on Design constructed as shown on Design Drawings G-102 and G-502) and will be cleaned of any visible debris. Upon leaving the site, transport vehicles will follow approved haul routes as specified on Design Drawing G-103.

4.2.3 Construction-Related Water

Construction-related water generated during the remedial construction activities (e.g., decontamination water, water generated during dewatering) will be collected and transported to the temporary water treatment system for treatment and discharge in accordance with Specification Section 444000 (Water Handling and Disposal) and applicable discharge permit.

4.3 Spill Prevention, Control, and Response

As required by Specification Section 011100 (Summary of Work), the Contractor will prepare a site-specific Health and Safety Plan (HASP) that addresses spill prevention and control, and response to spills and other site emergencies during the remedial construction activities. The HASP will include evacuation procedures for site personnel, directions and a figure showing the route to the local hospital, and a contact list with telephone numbers for local and state emergency responders (e.g., police, ambulance, fire, poison control, etc.).

4.3.1 Spill Prevention

The Contractor's spill prevention practices will include, at a minimum, the following:

- Performing regular inspections of construction vehicles, equipment, and portable fuel tanks to check for leaks.
- Performing routine maintenance on construction vehicles and equipment in accordance with the manufacturer's specifications.
- Promptly repairing or replacing damaged or defective construction vehicles and equipment.
- Storing onsite fuel tanks within a secondary containment area or providing alternate secondary containment (e.g., double-walled fuel tanks, containment dikes, etc.).
- Re-fueling vehicles on level ground within a designated area away from steep slopes and storm water run-off conveyance features (e.g., ditches/diversions, storm sewers, etc.).
- Attending to construction vehicles and equipment while re-fueling.
- Turning off internal combustion engines before re-fueling with a flammable liquid.
- Replacing the cap on vehicle fuel tanks before starting the engine.
- Securing/locking fuel pump dispensers when not in use to avoid accidental fuel release.
- Storing construction vehicles and equipment away from site hazards and sensitive resources, to the extent practicable.

4.3.2 Spill Control and Response

The Contractor will maintain onsite sufficient fire extinguishers, spill kits, and oil-absorbent pads, rolls, and booms as required to contain spills (should they occur) and prevent the potential migration of pollutants beyond the work area. In the event of a spill, the Contractor will immediately notify National Grid and implement the following response measures:

1. *Stop/Isolate Source:* As conditions allow, the Contractor will attempt to stop or isolate the source of the spill by closing valves and/or shutting down affected vehicles or equipment.
2. *Containment:* If the spilled material is floating on a water surface, spill-absorbent pads/booms will be placed across the path of the floating spill. If the spilled material sinks below the water surface, a dam, weir, or other containment method will be used to stop the flow of the spilled material. If the spill occurs on land, a containment unit will be constructed to stop the flow of the spilled material and sorbents will be applied as necessary.
3. *Clean-Up:* Spills in water will be recovered using pumps and sorbents as necessary until the spilled material is recovered and no sheen or other evidence of the spill is observed on the water surface. Spills on land will be recovered using pumps, sorbents, and heavy equipment, as necessary until the spilled material is recovered. Construction vehicles and equipment used in the clean-up, or otherwise affected by the spill will also cleaned/decontaminated.

4. *Collection, Storage, and Disposal:* Impacted materials, sorbents, and other wastes will be collected and stored in New York State Department of Transportation (NYSDOT)- approved containers. The containers will be labeled with the waste type and date of accumulation and will be transported offsite for disposal at a permitted facility in accordance with all applicable laws and regulations.
5. *Post-Spill Maintenance:* Following the clean-up of the spill, the Contractor will verify that all impacted materials, vehicles, and equipment have either been transported offsite for disposal, or decontaminated, as appropriate. The vehicle or piece of equipment that may have caused the spill will also be repaired. If the vehicle or piece of equipment cannot be repaired, it will be removed from the site and replaced.

Spill notifications and reporting to the necessary agencies will be coordinated by National Grid and/or the Engineer. Appropriate emergency response groups, including the local fire department, NYSDEC, and National Response Center, will be contacted immediately if the spill or material release has impacted soil, groundwater, or surface water, or is beyond the capabilities of onsite personnel to control using the methods described above.

4.4 Dust Controls

Dust controls will be used to prevent surface and air movement of dust from disturbed or open-soil areas and material staging areas that may cause offsite damage, health hazards, and traffic safety problems. Dust controls will be proactively employed by the Contractor in accordance with Specification Section 015000 (Temporary Facilities and Controls), and may include one or more of the following practices:

- Excavating, loading, handling, and backfill materials in a manner that minimizes the generation of dust.
- Hauling excavated materials and clean backfill materials in properly tarped/covered transport vehicles.
- Restricting vehicle speeds on temporary access roads and active haul routes.
- Wetting roads and other work areas, as needed.
- Covering excavations and temporary stockpiles with 10-mil polyethylene liners (anchored appropriately to resist wind forces) before extended work breaks and at the end of each workday.

4.5 Good Housekeeping Practices

Good housekeeping practices will be used to reduce the potential for construction materials entering site-related storm water run-off. The Contractor will maintain the site in a neat and orderly condition throughout the remedial construction activities in accordance with Specification Section 015000 (Temporary Facilities and Controls). This will include the: 1) routine collection and disposal of trash, rubbish, and sanitary wastes; 2) proper storage of construction materials and equipment at the site; and 3) routine cleaning of public rights-of-way, streets, and sidewalks.

5 REFERENCES

Arcadis. 2008. Final Engineering Report – Remedial Action Implementation for Operable Unit 1, Hudson (Water Street) Site. Hudson, New York. May.

BBL. 2003. Final Remedial Design – Remedial Action for Operable Unit 1 – Contract No. 1 – General, Hudson (Water Street) Site. Hudson, New York. July.

Beers, D.G. 1873. Atlas of Columbia County, New York. Churchville, New York.

Bradbury, A.R. 1908. History of the City of Hudson New York. Hudson, New York.

National Cooperative Soil Survey (NRCS). 2015. Soils information downloaded on June 16, 2016 from NRCS Web Soil Survey website: http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx. Source information based on Broome County, New York Soil Survey Area Version 13. September 20, 2015.

NYSDEC. 2016. *New York Standards and Specifications for Erosion and Sediment Control.* July.

NYSDEC. 2015. *SPDES General Permit for Stormwater Discharges from Construction Activity*, Permit No. GP-0-10-001. January 29.

NYSDEC. 2012. Record of Decision. NM - Hudson MGP, Operable Unit Number 02: Hudson River, Hudson, Columbia County, Site No. 411005. Division of Environmental Remediation. March 28.

NYSDEC. 2011. DER-31 / Green Remediation. January 20. Available at http//www.dec.ny.gov/docs/remediation_hudson_pdf/der31/pdf.

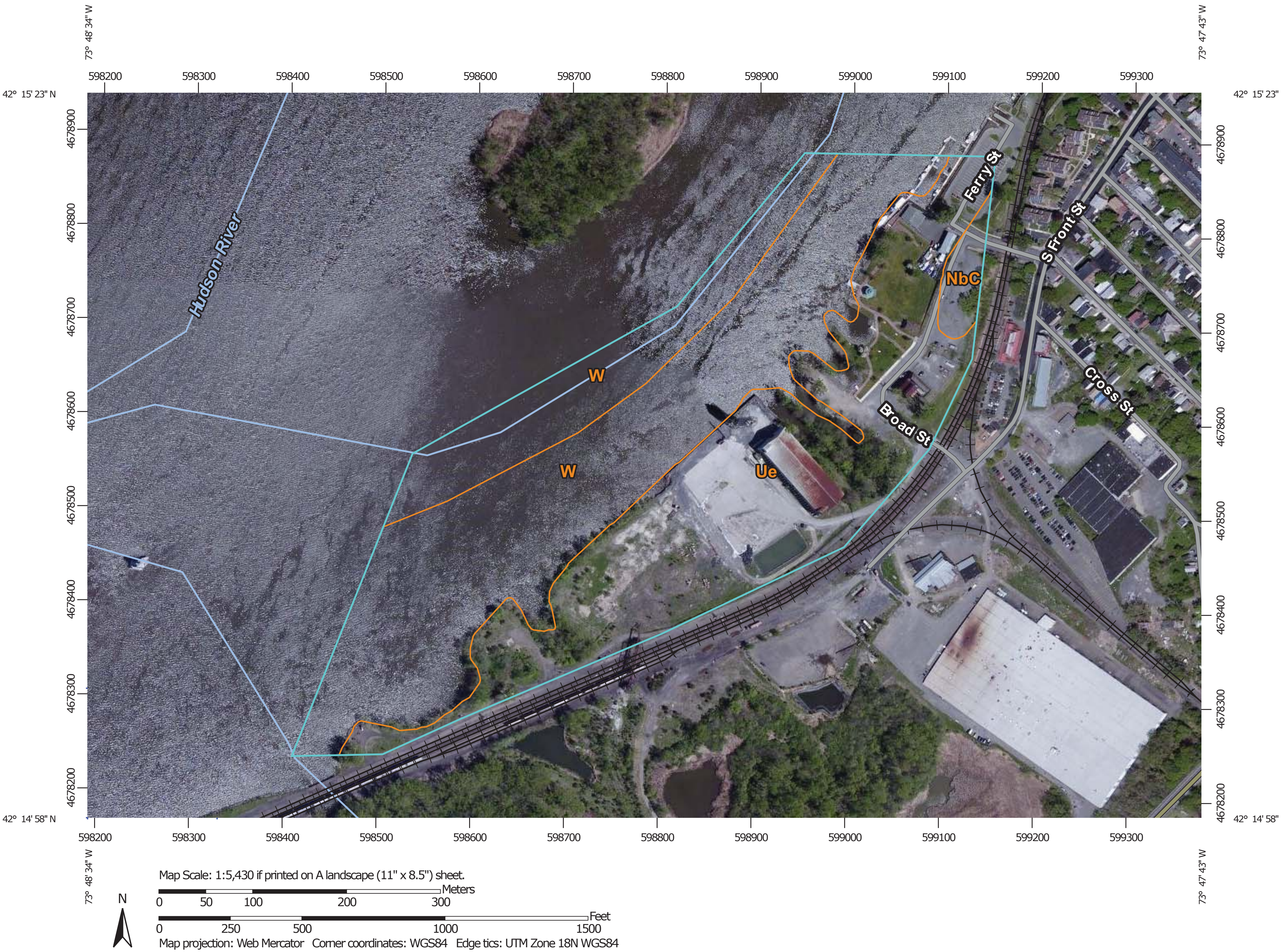
NYSDOH. 2014. Hudson River Tributaries Region Fish Advisories: Hudson River, Troy Dam south to Rip Van Winkle Bridge at Catskill (Columbia County). Available at: http://www.health.ny.gov/environmental/outdoors/fish/health_advisories/regional/hudson_river_and_tributaries.htm.

Sanborn. 1949 and 1961. Hudson, New York. ERIIS. Herndon, Virginia and Syracuse University Library. Syracuse, New York.

ATTACHMENTS

ATTACHMENT 1

NRCS Soil Map



Map Scale: 1:5,430 if printed on A landscape (11" x 8.5") sheet.

0 50 100 200 300 Meters

0 250 500 1000 1500 Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at scales ranging from 1:15,800 to 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Columbia County, New York
Survey Area Data: Version 11, Sep 25, 2015

Soil Survey Area: Greene County, New York
Survey Area Data: Version 14, Sep 21, 2015

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 19, 2010—May 12, 2011

Map Unit Legend

Columbia County, New York (NY021)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
NbC	Nassau channery silt loam, rolling, very rocky	1.2	2.1%
Ue	Udorthents, smoothed	24.6	43.1%
W	Water	24.1	42.1%
Subtotals for Soil Survey Area		**49.9**	**87.3%**
Totals for Area of Interest		**57.1**	**100.0%**

Greene County, New York (NY039)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
W	Water	7.3	12.7%
Subtotals for Soil Survey Area		**7.3**	**12.7%**
Totals for Area of Interest		**57.1**	**100.0%**

ATTACHMENT 2

Storm Water Inspection Report

NATIONAL GRID

OPERABLE UNIT 2, HUDSON (WATER STREET) SITE

CITY OF HUDSON, COLUMBIA COUNTY, NEW YORK

STORM WATER INSPECTION REPORT

Date and Time of Inspection: ______________________________

Qualified Inspector (Name, Title, and Affiliation): ______________________________

Weather Conditions: ______________________________

Soil Conditions: ______________________________

Describe disturbed areas at time of inspection: ______________________________

____

____

____

____

Describe areas stabilized (temporary or final) since previous inspection: ______________________________

____

____

____

____

ATTACH SITE PLAN SHOWING APPROXIMATE LIMITS OF DISTURBED AND NEWLY-STABILIZED AREAS

Describe repairs, maintenance, or corrective actions implemented since previous inspection: ______________________________

____

____

____

____

ATTACH PHOTOGRAPHS OF AREAS OR ITEMS INSTALLED, REPAIRED, OR REPLACED

Maintaining Water Quality

Yes No NA

☐ ☐ ☐ Is there an increase in turbidity causing a substantial visible contrast to natural conditions?
☐ ☐ ☐ Is there residue from oil and floating substances, visible oil film, or globules or grease?
☐ ☐ ☐ All disturbance is within the limits of the approved plans?
☐ ☐ ☐ Have receiving lake/bay, stream, and/or wetland been impacted by silt from project?

Housekeeping

Yes No NA

1. General Site Conditions:

☐ ☐ ☐ Is construction site litter and debris appropriately managed?
☐ ☐ ☐ Are facilities and equipment necessary for implementation of erosion and sediment control in working order and/or properly maintained?
☐ ☐ ☐ Is construction impacting the adjacent property?
☐ ☐ ☐ Is dust adequately controlled?

2. Temporary Stream Crossing:

☐ ☐ ☐ Maximum diameter pipes necessary to span creek without dredging are installed?
☐ ☐ ☐ Installed non-woven geotextile fabric beneath approaches?
☐ ☐ ☐ Is fill composed of aggregate (no earth or soil)?
☐ ☐ ☐ Rock on approaches is clean enough to remove mud from vehicles and prevent sediment from entering stream during high flow?

Run-Off Control Practices

Yes No NA

1. Excavation Dewatering:

☐ ☐ ☐ Upstream and downstream berms (sandbags, inflatable dams, etc.) are installed per plan?
☐ ☐ ☐ Clean water from upstream pool is being pumped to the downstream pool?
☐ ☐ ☐ Sediment laden water from work area is being discharged to a silt-trapping device?
☐ ☐ ☐ Constructed upstream berm with 1-foot minimum freeboard?

2. Level Spreader:

☐ ☐ ☐ Installed per plan?
☐ ☐ ☐ Constructed on undisturbed soil, not on fill, receiving only clear, non-sediment laden flow?
☐ ☐ ☐ Flow sheets out of level spreader without erosion on downstream edge?

3. Interceptor Dikes and Swales:

☐ ☐ ☐ Installed per plan with minimum side slopes of 2H:1V or flatter?
☐ ☐ ☐ Stabilized by geotextile fabric, seed, or mulch with no erosion occurring?
☐ ☐ ☐ Sediment-laden run-off directed to sediment trapping structure?

4. Stone Check Dam:

☐ ☐ ☐ Is channel stable (flow is not eroding soil underneath or around the structure)?
☐ ☐ ☐ Check dam is in good condition (rocks in place and no permanent pools behind the structure)?
☐ ☐ ☐ Has accumulated sediment been removed?

5. Rock Outlet Protection:

☐ ☐ ☐ Installed per plan?
☐ ☐ ☐ Installed concurrently with pipe installation?

Soil Stabilization

Yes No NA

1. Topsoil and Spoil Stockpiles:

☐ ☐ ☐ Stockpiles are stabilized with vegetation and/or mulch?
☐ ☐ ☐ Sediment control is installed at the toe of the slope?

2. Revegetation:

☐ ☐ ☐ Temporary seed and mulch have been applied to idle areas?
☐ ☐ ☐ Six inches minimum of topsoil has been applied under permanent seeding?

Sediment Control Practices

Yes No NA

1. Stabilized Construction Entrance:

☐ ☐ ☐ Stone is clean enough to effectively remove mud from vehicles?
☐ ☐ ☐ Installed per standards and specifications?
☐ ☐ ☐ Does all traffic use the stabilized entrance to enter and leave construction site?
☐ ☐ ☐ Is adequate drainage provided to prevent ponding at entrance?

2. Silt Fence:

Sediment accumulation is ___% of design capacity.

☐ ☐ ☐ Installed on contour, 10 feet from toe of slope (not across conveyance channels)?
☐ ☐ ☐ Joints constructed by wrapping the two ends together for continuous support?
☐ ☐ ☐ Fabric buried six inches minimum below grade?
☐ ☐ ☐ Posts are stable, fabric is tight and without rips or frayed areas?

3. Storm Drain Inlet Protection (Use for Stone and Block; Filter Fabric; Curb; or Excavated Practices)

Sediment accumulation ___% of design capacity.

☐ ☐ ☐ Installed concrete blocks lengthwise so open ends face outward, not upward?
☐ ☐ ☐ Placed wire screen between No. 3 crushed stone and concrete blocks?
☐ ☐ ☐ Drainage area is one acre or less?
☐ ☐ ☐ Excavated area is 900 cubic feet?
☐ ☐ ☐ Excavated side slopes are 2H:1V?
☐ ☐ ☐ 2"x4" frame is constructed and structurally sound?
☐ ☐ ☐ Three-foot maximum spacing between posts?
☐ ☐ ☐ Fabric is embedded one to 1.5 feet below ground and secured to frame/posts with staples at maximum eight-inch spacing?
☐ ☐ ☐ Posts are stable, fabric is tight and without rips or frayed areas?

4. Temporary Sediment Trap:

Sediment accumulation is ___% of design capacity.

☐ ☐ ☐ Outlet structure is constructed per the approved plan or drawing?
☐ ☐ ☐ Geotextile fabric has been placed beneath rock fill?

5. Temporary Sediment Basin:

Sediment accumulation is ___% of design capacity.

☐ ☐ ☐ Basin and outlet structure constructed per the approved plan?
☐ ☐ ☐ Basin side slopes are stabilized with seed and mulch?
☐ ☐ ☐ Drainage structure flushed and basin surface restored upon removal of sediment basin facility?

Describe any repairs, maintenance, or corrective actions required to correct observed deficiencies: ______________

____

____

____

____

____

____

____

____

ATTACH PHOTOGRAPHS OF DEFICIENT AREAS OR ITEMS OBSERVED DURING THE INSPECTION

Qualified Inspector's Certification:

I certify under penalty of Law that this document and all attachments were prepared under my direction or supervision in accordance with a system to ensure that qualified personnel property gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that false statements made herein may be punishable by Law.

Signature: ____ Date: ____________________

Arcadis of New York, Inc.

One Lincoln Center

110 W Fayette Street

Suite 300

Syracuse, New York 13202

Tel 315 446 9120

Fax 315 449 0017

www.arcadis.com

APPENDIX F

Remedial Action Contingency Plan

Design & Consultancy for natural and built assets

REMEDIAL ACTION CONTINGENCY PLAN

Operable Unit 2

Hudson (Water Street) Site

Hudson, New York

July 2020

REMEDIAL ACTION CONTINGENCY PLAN

Operable Unit 2
Hudson (Water Street) Site
Hudson, New York

07/17/2020

Mark O. Gravelding, P.E. Date
Senior Vice President

Prepared for:

National Grid

Syracuse, New York

Prepared by:

Arcadis of New York, Inc.

One Lincoln Center

110 W Fayette Street

Suite 300

Syracuse

New York 13202

Tel 315 446 9120

Fax 315 449 0017

Our Ref.:

30003986.00012

Date:

July 2020

CONTENTS

ACRONYMS AND ABBREVIATIONS

Arcadis	Arcadis of New York, Inc.
MGP	manufactured gas plant
NYSDEC	New York State Department of Environmental Conservation
OSHA	Occupational Safety and Health Administration
PEC	Project Emergency Coordinator
PEL	Permissible Exposure Limits
RACP	Remedial Action Contingency Plan
RD	Remedial Design
SDS	safety data sheets
SHSO	Site Health and Safety Office

1 INTRODUCTION

This *Remedial Action Contingency Plan* (RACP) has been prepared by Arcadis of New York, Inc. (Arcadis), on behalf of National Grid, to support the implementation of the selected remedy for the former National Grid Hudson Water Street manufactured gas plant (MGP) site (the Site) in Hudson, New York. The RACP provides responses to potential emergencies that may arise during construction of the selected remedy at the site as required by the New York State Department of Environmental Conservation (NYSDEC) under DER-10/Technical Guidance for Site Investigation and Remediation (NYSDEC 2010). Details related to the selected remedy, including construction-related contingencies, are presented in the *Final Remedial Design Report* (RD), to which this RACP is appended.

1.1 Contingency Plan Responsibilities

National Grid's Remedial Contractor (Contractor) will identify a Site Health and Safety Officer (SHSO). The SHSO shall be made aware of any emergencies and coordinate any response activities carried out at the site. The SHSO shall also serve as the overall Project Emergency Coordinator (PEC) and have the ultimate authority in specifying and facilitating any contingency action.

If the SHSO is not able to perform the duties of the PEC, the SHSO shall specify another senior individual (working for Contractor) to serve as the PEC. The alternate PEC shall become familiar with contingency plans developed by each Contractor/subcontractor.

1.2 Identifying the Hazards and Assessing the Risk

The objectives during any emergency shall be to first, protect human health and safety, and then the environment. Possible hazards to human health or the environment that may result from any emergency situation shall be identified by the PEC. The PEC shall take into consideration both direct and indirect effects of the incident. The PEC shall assess the possible risks to human health or the environment that may result from the emergency (e.g., release, fire, explosion, or severe weather conditions). The PEC shall make this assessment by:

- Identifying the materials involved in the incident.
- Consulting the appropriate occupational health guideline or safety data sheets (SDS) to determine the potential effects of exposure/release, and appropriate safety precautions.
- Identifying the exposure and/or release pathways and the quantities of materials involved.

Based on this information, the PEC shall determine the best course of action for dealing with the emergency and identify possible follow-up requirements (e.g., equipment repair, material disposal, etc.).

If the Contractor's personnel cannot control the incident without incurring undue risk, the PEC shall implement the Site Evacuation Procedures described in Section 3. If offsite neighboring population is at risk, the PEC will implement the Offsite Evacuation Procedures described in Section 3. The PEC shall notify the Engineer, National Grid's Project Manager, and the appropriate government agencies and departments that a situation resulting in the need for evacuation has occurred. Should emergency assistance in treating injuries or carrying out the evacuation be required, the PEC shall request assistance of local emergency response personnel (e.g., ambulance service, fire department, police department).

1.3 Conditions for Implementing the Contingency Plan

Potential emergency conditions that require implementation of this RACP include the following:

- Fire or explosion.
- Occurrence of a spill or material release.
- Severe weather conditions.
- Physical or chemical injury to a worker.

These emergency conditions are discussed in the following subsections. Additional emergency conditions that may require implementation of this RACP shall be identified by the PEC.

1.3.1 Fire and/or Explosion Conditions

Contingency procedures shall immediately be implemented upon notification that any of the following scenarios involving fire and/or explosion is imminent or has occurred:

- A fire that causes, or could cause, the release of toxic fumes.
- A fire that could possibly ignite nearby flammable materials or could cause heat-induced explosions.
- A fire that could possibly spread to offsite areas.
- A danger exists that an explosion could occur causing a safety or health hazard.
- An explosion has occurred.

1.3.2 Spill or Material Release Conditions

The following scenarios involving a spill or material release, whether imminent or having already occurred, shall cause implementation of contingency procedures:

- A spill or material release that could result in the release of flammable liquids or vapors, thus causing a fire or gas explosion hazard.
- A spill or material release that could cause the release of toxic vapors or fumes into the atmosphere in concentrations higher than the Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs).
- A spill or material release that can be contained on site where a potential exists for groundwater or surface water contamination.
- A spill or material release that cannot be contained on site, resulting in a potential for offsite soil contamination, sediment contamination, and/or groundwater or surface water pollution.

All spills or material releases shall be reported immediately to the PEC. The PEC shall immediately identify the character, source, amount, and extent of any release. Initial identification shall be based on visual analysis of the material and location of the release. If the released material cannot be identified, samples of potentially affected media shall be taken for analysis, as directed by National Grid.

1.3.3 Severe Weather Conditions

The following severe weather conditions, whether imminent or having occurred, may cause implementation of contingency procedures.

- A tornado has been sighted in the area.
- A tornado warning is in effect for the area.
- A lightning storm is underway in the area (storm center less than 5 miles away).
- Other severe weather or weather induced conditions (e.g., hurricane or flood).

1.3.4 Physical or Chemical Injury Conditions

The following worker injuries may cause implementation of the RACP:

- Major physical injuries.
- Chemical injuries.
- Severe symptoms of chemical overexposure.

2 CONTINGENCY PROCEDURES

If any of the aforementioned conditions for implementing the RACP are met, the appropriate following contingency procedure(s) shall be performed.

2.1 Contingency Procedures for Fire/Explosion

When fire or explosion appear imminent or have occurred, all normal site activity shall cease. The PEC shall make an assessment of the potential risk and severity of the situation to decide whether the emergency event shall or shall not be readily controllable with existing portable fire extinguishers or site equipment and materials at hand. Firefighting shall not be done at the risk to site workers. Local fire departments shall be contacted in all situations in which fires and/or explosions have occurred. The following steps shall be taken for localized fire.

- Contact local fire departments.
- Move all personnel to an upwind location at an appropriately safe distance away.
- Determine if fire is within onsite personnel capabilities to attempt initial firefighting.
- Determine if smoke and/or fumes from fire are potentially impacting offsite areas.
- If the fire is not impacting offsite areas and is within onsite personnel capabilities, utilize most appropriate means of extinguishing fire (e.g., fire extinguishers, water, covering with soil).
- Once fire is extinguished, containerize and properly dispose of any spilled material, runoff, or soil.

If the situation appears uncontrollable and poses a direct threat to human life, fire departments shall be contacted, and the evacuation procedures described in Section 3 shall be implemented. If the chances of an impending explosion are high, the entire area within a 1,000-foot radius of the fire source shall be evacuated. The PEC shall alert personnel when all danger has passed, as determined by the chief fire fighter from the responding fire department. All equipment (e.g., fire extinguishers) used in the emergency shall be cleaned and refurbished as soon as possible after the emergency has passed so that it will be ready for use in the event of any future emergency.

2.2 Contingency Procedures for Spills or Material Releases

If a hazardous waste spill, material release, or process upset resulting in probable vapor release is identified, the PEC shall immediately assess the magnitude and potential seriousness of the spill or release based upon:

- SDS for the material spilled or released.
- Source of the release or spillage of hazardous material.
- An estimate of the quantity released and the rate at which it is being released.
- The direction in which the spill or air release is moving.
- Personnel who may be or may have been in contact with the material, or air release, and possible injury or sickness as a result.
- Potential for fire and/or explosion resulting from the situation.
- Estimates of area under influence of the release.

If the spill or release is determined to be within the onsite emergency response capabilities, the PEC shall ensure implementation of the necessary remedial action. If the accident is beyond the capabilities of the operating crew, all personnel not involved with emergency response activity shall be evacuated from the immediate area and the appropriate emergency response group(s) shall be contacted.

2.3 Contingency Procedures for Severe Weather

When severe weather is forecasted or occurs, the information shall be immediately relayed to the PEC. In the case of a tornado sighting, the PEC shall institute emergency evacuation procedures, and all personnel shall be directed to proceed indoors after completing appropriate shutdown procedures. In the case of a tornado warning, or lightning storm, the PEC shall have operations stopped and direct all personnel to stand by for emergency procedures. Other types of weather or weather induced conditions (e.g., hurricane or flooding) for which long range prediction is available may also require positive action as identified herein.

When the severe weather has passed, the PEC shall direct the Contractor to inspect onsite equipment to ensure its readiness for operation prior to restarting operations. If an inspection indicates a fire, explosion, or release has occurred as the result of a severe weather condition, the contingency procedures for those events shall be followed.

2.4 Contingency Procedures for Flooding

If based on the results of weather and Hudson River flow monitoring flooding is anticipated, the Contractor shall implement the following contingency measures:

- Secure all water-based vessels from flooding conditions and move all upland heavy equipment to the highest onsite elevation.
- If upland flooding is possible secure (or remove from the site, if possible) all chemicals and materials, including impacted material within staging areas.

2.5 Contingency Procedures for Physical Injury to Workers

Regardless of the nature and degree of the injury, the PEC shall be notified of all injuries requiring first aid treatment of any kind. A report of the injury or incident shall be completed by the PEC.

Upon notification that a worker has been injured, the PEC shall immediately determine the severity of the accident, and whether the victim can be safely moved from the incident site. Local medical assistance shall be requested immediately, if appropriate.

Minor injuries sustained by workers shall be treated onsite using materials from the first aid kits. Whenever possible, such treatment shall be administered by trained personnel in a “clean” support zone. Examples of minor injuries include small scrapes and blisters. Minor injuries would not be expected to trigger implementation of the RACP.

A major injury sustained by a worker will require professional medical attention at a hospital. The PEC shall immediately summon an ambulance and contact the hospital to which the injured worker will be transported. The PEC shall notify National Grid project manager as soon as practical. The hospital and ambulance should be advised of:

- The nature of the injury.
- Whether the injured worker will be decontaminated prior to transport.
- When and where the injury was sustained.
- The present condition of the injured worker (e.g., conscious, breathing).

2.6 Contingency Procedures for Chemical Injury to Workers

Injuries involving hazardous chemicals or symptoms of severe chemical overexposure shall result in implementation of the RACP. Upon notification that a chemical injury has been sustained or severe symptoms of chemical exposure are being experienced, the PEC shall notify the hospital and ambulance of the occurrence. The PEC shall provide, to the extent possible, the following information:

- The nature of the injury (e.g., eyes contaminated).
- The chemical(s) involved.
- The present condition of the injured worker (e.g., conscious, breathing).
- Whether the injured worker will be decontaminated prior to transport.
- When and where the injury was sustained.

The victim(s) shall be immediately removed from the incident site using appropriate personal protective equipment (PPE) and safety equipment. Rescuers shall check for vital signs and, if possible, remove contaminated outer clothing. If the victim’s eyes have been contaminated, personnel trained in administering first aid shall flush the victim’s eyes with eyewash solution until the emergency response team arrives.

- Details on the nature of the contaminant and methods for treating exposure or injury can be obtained from the SDSs or Occupational Health Guidelines.

2.7 Contingency Procedures for Unanticipated Obstructions

The potential exists for encountering unanticipated obstructions during the course of the work. If encountered, the Contractor initially will attempt to remove the obstruction using the means and methods available at the site. If the obstruction cannot be removed through conventional means, the Contractor immediately will notify the Construction Manager to discuss potential options for handling the obstruction.

2.8 Contingency Procedures for Sheet Pile Installation

In the event that installation of the sheet pile at the site is impeded due to unidentified debris and/or obstructions of any kind, the Contractor will evaluate the conditions associated with the obstruction and immediately notify to the Construction Manager to review the potential options for handling the obstruction and/or alternate methods of sheet pile installation.

3 EMERGENCY EVACUATION PROCEDURES

In the event that emergency conditions require evacuation, the site and offsite evacuation procedures described in the following subsections shall be implemented.

3.1 Site Evacuation Procedures

If an emergency occurs that requires the evacuation of an onsite area to ensure personnel safety, including (but not limited to) fire, explosion, severe weather or hazardous waste/material spills, or a significant release of vapors into the atmosphere, an air horn shall be sounded on the site by the nearest person aware of the event. The horn shall sound continuously for approximately 15 seconds, signaling that immediate evacuation of all personnel from the area is necessary, as a result of an existing or impending danger. In areas where only two or three people are working side by side, and the need to evacuate can be communicated verbally by the nearest person aware of the event, the air horn shall not be necessary.

All heavy equipment in the area shall be shut down. Under no circumstances shall incoming visitors (other than emergency response personnel) be allowed to enter any area where an emergency is occurring. Visitors or observers and all non-essential personnel present in the area of an emergency shall be instructed to evacuate the area immediately.

Contractor(s) emergency coordinators and/or health and safety officers (as designated) will be responsible for ensuring that emergency response requirements specific to their own operations are carried out. These parties shall report their activities to the PEC. The PEC, however, has final authority regarding all emergency response activities.

All non-essential personnel shall evacuate the emergency areas and notify personnel in adjacent areas to evacuate also. The evacuated workers shall assemble at the site construction office trailer, where the PEC shall give directions for implementing necessary actions. In the event that the primary assembly area is involved, unapproachable, or unsafe due to the event, evacuated workers shall assemble at the alternate assembly area identified by the PEC.

Personnel are to avoid encountering smoke/gas plumes as practicable during evacuation and assembling.

The PEC shall take charge of all emergency response activities and dictate the procedures that will be followed until emergency personnel arrive. The PEC shall assess the seriousness of the situation, and direct whatever efforts are necessary until the emergency response units arrive.

After initiating emergency response procedures, the PEC shall assign appropriate personnel to check and attempt to ensure that access roads are not obstructed. If traffic control is necessary (e.g., in the event of a fire or explosion), personnel who have been trained in traffic control procedures and designated at the project safety meeting shall take over these duties until emergency units arrive.

The PEC shall remain at the site to provide any assistance requested by emergency response personnel when arriving to deal with the situation. The PEC shall have the authority to shut down any part or the entire project after an emergency, until the PEC deems it safe to continue operations. The PEC shall dictate any changes in project safety practices, which are made necessary by the emergency that has occurred or are required for preventing further emergencies.

3.2 Offsite Evacuation Procedures

If the PEC deems that human health beyond the site limits is at risk, the PEC shall notify the appropriate agencies and departments (e.g., National Grid Project Manager, police, NYSDEC, fire department) of the need, or potential need, to institute offsite evacuation procedures. The PEC shall provide, at a minimum, the following information:

- His or her name and telephone number.
- Name and address of facility.
- Time and type of incident (e.g., release, fire).
- Name and quantity of materials or materials involved, to the extent this information is known.
- The extent of injuries, if any.
- The possible hazards to human health or environment, and cleanup procedures.

3.3 Hudson River Evacuation Procedures

In the event that the PEC requires evacuation from the Hudson River, all personnel will proceed immediately to the designated rallying point(s) (established in the Contractor's Health and Safety Plan). Personnel within in-river work areas will promptly return to land and secure vessels.

Upon exiting the in-river work area, project personnel will proceed to the designated rallying point and immediately report to the PEC for roll call. Primary rallying point should be the material staging area.

3.4 Personnel Accountability Procedures after Evacuation

After evacuation, the PEC is responsible for accounting for each employee assigned to them by rallying at the designated point and conducting a roll call. All personnel are responsible for reporting to his or her Field Superintendent so an accurate role call can be made. All personnel will be accounted for by name. The PEC will then report their role call to the SHSO (if applicable).

All site personnel and visitors not assigned to a Field Superintendent will be required to sign in with the SHSO upon entering the site. Upon evacuation, site personnel and visitors not assigned to a Field Superintendent will proceed promptly to the designated rallying point and report directly to the SHSO.

4 REFERENCES

NYSDEC. 2010. DER-10 / Technical Guidance for Site Investigation and Remediation. May 3. Available at: http://www.dec.ny.gov/docs/remediation_hudson_pdf/der10.pdf.

Arcadis of New York, Inc.

One Lincoln Center

110 W Fayette Street

Suite 300

Syracuse, New York 13202

Tel 315 446 9120

Fax 315 449 0017

www.arcadis.com

APPENDIX G-1

Restoration Plan

MEMO

Arcadis of New York, Inc.
6723 Towpath Road
P O Box 66
Syracuse
New York 13214-0066
Tel 315 446 9120
Fax 315 449 0017

To:
Michael Donegan, National Grid

Copies:
Mark Gravelding, Arcadis

From:
Heather VanDewalker

Date:
June 10, 2016

Arcadis Project No.:
B0036702.0002

Subject:
Hudson Water Street Sediment Restoration Approach

Introduction

On March 28, 2012, the New York Department of Environmental Conservation (NYSDEC) issued a Record of Decision (ROD) regarding Operable Unit Number 02 (OU-2) at the National Grid former manufactured gas plant (MGP) site in Hudson, New York (the site). The Description of Selected Remedy section of the ROD includes the following element pertaining to restoration of the site:

8) Restoration of the stream bed and banks to the original bathymetry. To the extent possible, restoration will be with material similar to the existing substrate. A restoration plan will be developed during design and will meet the requirements of Article 15 and 6 NYCRR Part 608.

This memorandum serves as that restoration plan and proposes a restoration strategy that meets the requirements of the ROD to gain concurrence with NYSDEC ahead of completing and submitting the full Remedial Design.

Previous Habitat-Related Studies

Previous habitat-related studies conducted at the site include the following:

- General characterization during sediment sampling (1995-2009)
- Diver investigation of specific species and extent (2013)

Observations during sediment sampling events conducted in 1995-2009 as documented in the Revised Comprehensive Sediment Investigation Report for Operable Unit 2 (CSIR; ARCADIS 2010) and diver observations conducted in 2013 as documented in the Remedial Design Work Plan (RDWP; ARCADIS 2014) indicate that SAV is not present at the site. These studies also indicate that, based on specific site conditions, including irregular (steep and rocky) bed surface and water depths 3 to 4 times deeper than the desired 4- to 5-foot range, SAV growth is not expected within the boundaries of the remedial area. The RDWP provides a comprehensive detailed review of observations regarding submerged aquatic vegetation (SAV) at the site. The relevant text of this report is provided as Attachment 1 for reference.

Benthic data collected and analyzed at the site are discussed in general in Section 3.5.3 of the CSIR (ARCADIS 2010), the text of which is included as Attachment 2. The results are discussed in more detail in Sections 5.2 and 5.3 of Appendix A to the CSIR, the text of which is included as Attachment 3. Table 4-5 of this appendix, included here as Attachment 4, presents the benthic survey indices. In general, the benthic indices did not show significant correlation to the sediment chemistry data. Additionally, all but two individual sample locations correlated well with the reference locations.

Existing sediment grain size analyses are discussed in Section 3.1.3.1 of the RDWP (ARCADIS 2014), included in Attachment 1, with the raw data presented in Table 3-6 to that report, included here as Attachment 5. Of the 36 samples collected, all but three were considered coarse-grained. As anticipated, the top 6 inches of each sample typically contained the coarsest material with finer material in deeper samples and the embayment areas. This upper layer of coarse material indicates a level of natural armoring at the site.

Proposed Restoration Approach

SAV

Based on the various observations documented in the RDWP indicating the lack of SAV at the site and lack of growth potential, no subaqueous planting will be performed as part of the site restoration.

Benthic Habitat Restoration

As the benthic studies did not reveal any significant findings, the restoration will consist of replacing the removed sediment with similar material to allow the benthic community to recolonize naturally.

Backfill materials

The goal of the backfill strategy is to restore to the original bathymetry and replace the surficial sediment with material of a similar type. Two backfill materials will be specified: a silty medium to fine sand fill (Type 1 Fill) will be placed to within 2 feet of the pre-construction grade; and coarse-grained sand with gravel (Type 2 Fill; similar in grain size to the existing sediment surface) will be placed in the top two feet to meet pre-construction grade. The fill material was selected both to match the existing sediment gradation as closely as possible and to be representative of locally-available materials. The fill will be clean material free of debris, lumps or rocks larger than 3 inches, and loam organic matter. It is anticipated that the fill materials will be similar to the gradation of material presented in Tables 1 and 2. A plan view and cross sections of the remediation area, including information on post-removal restoration, are included in Attachment 6.

Table 1: Type 1 Fill Material Gradation

Sieve Size	Percent Passing
3”	100
1”	80-100
#4	70-95
#40	55-80
#200	10-30

Table 2: Type 2 Fill Material Gradation

Sieve Size	Percent Passing
3”	100
1”	80-100
#4	65-90
#40	50-75
#200	0-20

References

ARCADIS (with Foth and GEI Consultants). 2010. Revised Comprehensive Sediment Investigation Report for Operable Unit 2, Hudson (Water Street) Site. Hudson, New York. May 20.

ARCADIS. 2014. Remedial Design Work Plan, Operable Unit 2, Hudson (Water Street) Site. Hudson, New York. April 14.

Attachments

Attachment 1: RDWP Text

Attachment 2: CSIR Text

Attachment 3: CSIR Appendix A Text

Attachment 4: CSIR Appendix A Table 4-5

Attachment 5: RDWP Table 3-6

Attachment 6: Draft Restoration Profiles

ATTACHMENT 1

RDWP TEXT

1.5.1 Submerged Aquatic Vegetation Survey

As part of the PDI, a SAV evaluation was conducted that consisted of a desktop review of existing SAV information, followed by a diver survey. The preliminary desktop review of existing information identified that the growing zone of SAV in the Hudson River is often constrained to narrow fringing beds along the sub-tidal slope, a sufficient distance from the shoreline to avoid ice scour (Nieder et al. 2004) yet shallow enough to maintain adequate light penetration (Koch 2001). Specifically, while various entities have verified SAV beds in other areas of the upper (tidal) Hudson River, SAV has not been observed in the ARC during previous sampling events (ARCADIS 2010).

A diver survey of the ARC was performed by ARCADIS on August 7, 2013. The results of the diver survey indicate that the substrate within and along the front of Embayments #1 and #2 is soft silt (a few feet to a few inches) over rock. With increasing distance from the shoreline, the substrate is entirely rock and gravel with most substrate covered in zebra mussels. In front of Embayments #1 and #2, a tongue of the soft silt extends out and covers the rock substrate. This is likely caused by the surge created by the wakes of large ships passing through the navigation channel adjacent to the Site causing finer grained sediments to move into/out of the embayments. During the diver survey, ARCADIS divers observed the surge into/out of the embayments, and could also feel the movement while underwater.

The desktop review of existing SAV mapping information indicated that SAV was present in areas of the Hudson River near the Site. The regional SAV mapping was used to identify what species were growing in what water depths in areas surrounding the Site. Along the eastern shoreline of the Hudson, *Trapa natans* (water chestnut) and *Myriophyllum spicatum* (Eurasian water milfoil) were observed growing in a cove downstream of the Holcim property. Both of these species are considered to be invasive and undesirable. Upon visual observation, the SAV bed in this area was irregular at best, and growth occurred in depths of water between 4 to 5 feet (at high tide). The shoreline upstream of the Site was predominantly steep and rocky, and supported the boat docking and marina operations. No SAV was previously mapped or observed during the reconnaissance in this area upstream of the Site. The only place water depths of 4 to 5 feet exist onsite are along the inner ends of Embayments #1 and #2 – where *T. natans* and *M. spicatum* were observed during the diver survey. Water depths in the ARC exceed these growing zones of 4 to 5 foot water depths (at high tide) by at least 3 to 4 times. As such, SAV would not be expected to grow within the boundaries of the ARC. This assumption was confirmed during the diver survey, as no SAV was observed in the ARC.

What appears to be a remnant bulkhead feature runs the length of the waterfront – immediately offshore of the peninsula between Embayments # 1 and #2 and continues along the shore-side of the Hudson River Cruise boat docks. Due to poor underwater visibility, it was difficult to determine the configuration of the structure, but there appeared to be two parallel timber-pile walls with 3 to 4 feet of void space between them. Various pieces of timber-piles and driftwood/logs were caught in the void space. The lack of visibility and entrapment hazards associated with that void space precluded any further investigation of the timber-pile wall. The feature appeared to be consistent over the entire length of the Site waterfront except in front of Embayment #1, and appeared to be in various states of degradation.

1.5.2 Environmental Borings

Environmental drilling activities were conducted by Atlantic Testing Laboratories (ATL) under the direct supervision of ARCADIS between August 28, 2013 and September 17, 2013. Drilling was conducted with a CME-850X drill rig situated on the deck of a 70-foot CL-105 Lift Boat provided by Northstar Environmental & Marine Services (Northstar). Four-inch inside diameter steel casing was advanced into the sediment at each location for water quality considerations and drilling rod stability. Two-inch and 3-inch split spoon samplers were used to conduct continuous sampling at each boring location. Soil was visually characterized and screened with a photoionization detector (PID). The geologic composition, recovery, PID screening results, and the presence of visible NAPL, coating, staining, sheens, and odors were documented per the NYSDEC Field Descriptions of Samples for Former MGP Sites. Each boring was backfilled to grade with a bentonite/cement grout.

Five borings (EB-1, EB-6, EB-11, EB-13, and EB-18) were advanced within the ARC in an effort to refine the horizontal extent of the ARC boundary. A sample from each of these borings was collected and submitted for analysis of PAHs in porewater by solid phase microextraction (SPME). Twelve borings (EB-2 to EB-5, EB-7 to EB-10, EB-10A, EB-10B, EB-12, and EB-19) were advanced to refine the depths of the proposed dredge polygons. Four borings (EB-14 to EB-17) were advanced in an area to the south of the ARC to either confirm or refute the presence of sheen-producing sediments. Samples of the surface water sheen generated during advancement of borings EB-14 to EB-17 were collected and submitted for analysis of forensic PAHs and forensic total petroleum hydrocarbons (TPH).

The results of the borings designed to refine the horizontal extent of the ARC boundary are presented in Table 5 below. The environmental boring logs are presented in Appendix A.

ATTACHMENT 2

CSIR TEXT

The survival and growth of *H. azteca* exposed to the 32 Site sediment samples were compared to the survival and growth of the nine pooled reference location samples using the non-parametric Wilcoxon Rank Sum Test with Bonferroni's adjustment (USEPA 2000). All statistical analyses were performed using MINITAB® Release 14 (Minitab, Inc.).

- Amphipod Survival - Significant ($p < 0.05$) reduction in *H. azteca* survival compared to the field reference sample was observed for amphipods exposed to the Site sediment samples HD131, HD138, HD142, HD143, HD146, HD147, and HD148. The geographic distribution of samples determined to result in a significant reduction in survival was localized adjacent to Embayment #1 and two sample locations downriver (HD131 and HD138). Five of the seven samples which indicated a significant reduction in survival contained NAPL, including HD-131, HD-143, HD-146, HD-147, and HD-148.

- Amphipod Growth - Significantly reduced growth ($p < 0.05$) of *H. azteca* compared to the field reference sediments was observed in amphipods exposed to Site sediment samples HD118 and HD139.

3.5.3 Benthic Macroinvertebrate Data

The 41 sediment samples evaluated for toxicity testing were also evaluated for benthic macroinvertebrates. Macroinvertebrates recovered from each sample were sorted, counted, and identified down to the lowest feasible taxonomic level (Genus). The complete laboratory report from Aquatec is provided in Appendix A.

Up to 679 total organisms (N) and 25 individual taxons (S) were identified in the sediment samples (Appendix A). To simplify the data reporting and subsequent interpretation, several common indices were calculated from these raw count data. The four main indices were: diversity; richness; Hilsenhoff Biotic Index (HBI); and dominance. In order to more easily compare diversity, richness, HBI, and dominance, it was necessary to reverse the scaling for dominance and HBI by subtracting their values from 10. This allowed all four factors to be examined side-by-side, with high values representing good sediment conditions, and low values representing poor conditions. A detailed description of how each index was calculated, including method references, is provided in Appendix A.

- The ranges for N in the reference and Site sediment samples were from 10 to 414 and 4 to 679 organisms, respectively. The ranges for S were from 5 to 20 and 1 to 25, respectively.

- The ranges for each of the indices were similar between the reference and Site sediment samples. Diversity ranged from 0.9 to 3.1 in the reference sediments and 0.0 to 3.8 in the Site sediments. Richness ranged from 1.3 to 4.3 in the reference sediments and 0.0 to 4.2 in the Site sediments. The 10-HBI ranged from 0.1 to 2.8 in the reference sediments and 0.5 to 3.6 in the Site sediments. Finally, 10-dominance ranged from 1.7 to 7.6 in the reference sediments and 0.0 to 8.4 in the Site sediments.

3.5.4 Data Interpretation

The three measurement endpoints were evaluated in a weight-of-evidence (WOE) assessment to characterize surface sediments at the Site: sediment chemistry, toxicity testing, and benthic macroinvertebrate survey. This WOE assessment was organized into four main components:

1. Correlation between sediment total (PAH_{16}) and pore water (PAH_{34}) measurements and the survival and growth of *H. azteca*

2. Correlation between sediment total and pore water PAH measurements and the benthic macroinvertebrate survey indices

3. Comparison of benthic macroinvertebrate survey indices between reference and Site sediment samples

4. SQT assessment combining the three measurement endpoints into a matrix.

3.5.4.1 Sediment Chemistry and Toxicity Testing

NYSDEC technical guidance sediment screening values of 4.0 mg/kg Effects Range Low (ERL) and 44.8 mg/kg total PPPAHs Effects Range Median (ERM) (NYSDEC 1999) did not provide sufficient discrimination between “toxic” and “non-toxic” sediments at the Site. For example, 33 of the 41 (81 percent) sediment samples analyzed from the Site exceeded the ERL value, despite the fact that only seven of the 33 sediment samples (21percent) were toxic to *H. azteca*. Twenty-four samples exceeded the ERM value, but only seven of the 62samples (29 percent) were toxic to *H. azteca* (Table 3-22).

The Lowest Observed Effect Level (LOEL) total PAH_{16} concentration associated with a significant reduction in amphipod survival was 112 mg/kg (HD142 at 18 percent survival). However, sediment samples with total PAH_{16} concentrations as high as 566 mg/kg (HD151) showed no significant reductions in *H. azteca* survival (Table 3-21). Therefore, a LOEL

ATTACHMENT 3

CSIR APPENDIX A TEXT

Table of Contents

The survival and growth of *H. azteca* exposed to the 32 site sediment samples was compared to the survival and growth of the nine pooled reference sediment samples using the nonparametric Wilcoxon Rank Sum test with Bonferroni's adjustment (U.S. EPA, 2000).

Amphipod Survival

Survival of *H. azteca* in the laboratory controls and all nine field reference sediments was 100%. Significant ($p < 0.05$) reduction in *H. azteca* survival compared to the field reference sample was observed for amphipods exposed to the sediment samples HD131, HD138, HD142, HD143, HD146, HD147, HD148 (Table 4-4).

The geographic distribution of samples determined to result in a significant reduction in survival was concentrated adjacent to Embayment #1, with two sample locations extending down-river (HD131 and HD138) [Figure 4-3].

Amphipod Growth

Growth of *H. azteca* for the nine field reference samples ranged from 0.303 ± 0.096 to 0.442 ± 0.061 mg dry wt./organism. Significantly reduced growth ($p < 0.05$) of *H. azteca* compared to the field reference sediments was observed in amphipods exposed to samples HD118 and HD139 (Table 4-4).

4.5 Benthic Macroinvertebrate Data

The 41 sediment samples were evaluated in the laboratory to determine their effects on the benthic macroinvertebrate community structure. Macroinvertebrates recovered from each sample were sorted, counted, and identified down to the lowest feasible taxonomic level (Genus) by Aquatec. The complete digital reporting of the laboratory results from Aquatec is provided in Appendix E.

Up to 679 total organisms (N) and 25 individual taxons (S) were identified in the sediment samples (Table 4-5). To simplify the data reporting and subsequent interpretation, several common indices were calculated from these raw count data. The four main indices included:

1. Diversity,
2. Richness,
3. Hilsenhoff Biotic Index (HBI), and
4. Dominance.

Detailed descriptions of how each index was calculated, including method references, are provided below.

Calculation of Indices

Shannon's diversity index (diversity) was computed according to Shannon (1948):

$$Diversity = -\sum_{i=1}^{s} p_i \log_2 p_i$$

where s is the number of taxons per sample and p_i is the proportion of total individuals in the *i*th species.

Margalef's species richness index (richness) was computed according to Margalef (1958):

$$Richness = \frac{s-1}{\ln(N)}$$

where s is the number of taxons and N the total number of individuals in a sample.

The HBI was adapted from Hilsenhoff (1987) to include tolerance values listed by NYSDEC (NYSDEC, 2002):

$$HBI = \frac{\Sigma TV_i N_i}{\Sigma N_i}$$

where TV_i is the pollution tolerance value of the *i*th species (1 = very intolerant and 10 = highly tolerant) and N_i is the abundance of the *i*th taxa. HBI was expressed as (10-HBI) for order of scales (i.e., a low 10-HBI correlates with degraded conditions).

Lastly, dominance was the percent contribution of the most numerous species (NYSDEC, 2002). Dominance was also expressed as (10-dominance) for order of scales (i.e., a low 10-dominance correlates with degraded conditions, which represent conditions that are dominated by only a limited number of species).

Benthic Index Summary

Table 4-5 lists the results of the benthic macroinvertebrate survey. The ranges for N in the reference and site sediment samples were from 10 to 414 and 4 to 679 organisms, respectively. The ranges for S were from 5 to 20 and 1 to 25, respectively.

The ranges for each of the indices were similar between the reference and site sediment samples as shown below:

- Diversity ranged from 0.9 to 3.1 in the reference sediments and 0.0 to 3.8 in the site sediments;
- Richness ranged from 1.3 to 4.3 in the reference sediments and 0.0 to 4.2 in the site sediments;
- The 10-HBI ranged from 0.1 to 2.8 in the reference sediments and 0.5 to 3.6 in the site sediments; and
- 10-dominance ranged from 1.7 to 7.6 in the reference sediments and 0.0 to 8.4 in the site sediments.

The benthic macroinvertebrate indices were variable across the site. For example, diversity varied by a factor of two within an individual reference area and, unlike the PAH chemistry and toxicity testing, showed no relationship with Embayment #1 (Figure 4-4). These indices are discussed along with all of the other measurement endpoints in Section 5 (Interpretation).

The growth of *H. azteca* showed no significant correlation with respect to the concentration of total PAH_{16}, total PAH_{34}, or SPME pore water PAH_{34} (Figure 5-2). The p-values for the Spearman's rho for total PAH_{16}, total PAH_{34}, and SPME pore water TU_{34} concentrations versus *H. azteca* growth were 0.437, 0.405, and 0.139, respectively. Therefore, none of the measurements of PAH concentration could explain a significant ($p < 0.05$) fraction of the variability in the growth of *H. azteca*.

Due to the lack of correlation between sediment PAH chemistry and the growth endpoint, this measurement endpoint was not considered further in the WOE assessment of sediments at the Site.

5.2 Sediment Chemistry and Benthic Indices

Comparisons of sediment total and pore water PAH measurements to benthic macroinvertebrate indices were also made using Spearman's rho. The benthic macroinvertebrate indices showed no significant correlation ($p > 0.322$ for all comparisons) with respect to the concentration of total PAH_{16}, total PAH_{34}, or SPME pore water TU_{34} (Figure 5-3).

The benthic macroinvertebrate survey data are potentially the most ecologically relevant of the three measurement endpoints, as these data represent a snapshot of the in-situ benthic community. Therefore, rather than exclude this measurement from further evaluation, the benthic macroinvertebrate indices for site sediment samples were compared against the nine reference sediment samples (Section 5.3).

5.3 Site and Reference Benthic Indices

Four benthic macroinvertebrate indices (diversity, richness, 10-HBI, and 10-dominance) were compared simultaneously between site and reference sediment samples. Prior to this comparison, the metrics were scaled on a 0 to 99-scale for inter-metric scale consistency per NOAA (2004):

$$\text{Scaled Value} = \frac{(\text{Initial Value} - \text{Minimum Value})}{(\text{Maximum Value} - \text{Minimum Value})} \times 99$$

This methodology for scaling introduces no mathematical aberrations (i.e., noise) into the data, and was therefore chosen for the multi-metric comparison as opposed to the NYSDEC Appendix V formulas for calculating biological assessment profile values for ponar samples (NYSDEC, 2002).

The range in the four benthic macroinvertebrate indices for the reference sediment samples, normalized on a 99-scale for comparison, was similar to the range observed in the site sediment samples. Two site sediment samples were consistently lower than the reference range for diversity, richness and 10-dominance, and were in the bottom 25^{th} percentile (i.e., less than 25) for these indices (HD143 and HD148). One reference sediment sample was consistently lower than the others (HD157). The 10-HBI metric did not provide discrimination between reference and site sediment samples, as the reference range was lower than the range for site sediment samples (Figure 5-4).

Based on this multi-metric comparison, the in-situ benthic macroinvertabrate community in the site sediment samples, with the exclusion of HD143 and HD148, is commensurate with (i.e., within the expected range) the three reference locations. Therefore, in the WOE assessment, only samples HD143 and HD148 are classified as "significant".

5.4 Sediment Quality Triad Assessment

The three measurements endpoints were combined into a matrix (table) for a WOE evaluation of impacts (Table 5-2). Sediment samples were denoted with an asterisk for the following metrics:

- If they exceeded 44.8 mg/kg total PAH_{16} PEC value (Section 4.1, MacDonald et al., 2000);
- If they exceeded 5.4 SPME pore water TU_{34}, the lower 95% confidence level (LCL_{95}) for the LD_{20} (Section 5.1);
- If they had significantly reduced *H. azteca* survival as compared to the field reference sediment samples (Section 4.4); and
- If they were consistently lower than the reference range for the benthic macroinvertabrate multi-metric comparison between site and reference sediment samples (Section 5.3).

Only two of the site sediment samples failed all four criteria, HD143 and HD148. Of the 12 site sediment samples exceeding 5.4 SPME pore water TU_{34}, seven of these samples had significantly reduced *H. azteca* survival as compared to the field reference sediment samples.

The relatively high fraction of SOC/TOC in the sediment samples (up to 90% in some site sediment samples, Table 4-1) provides an explanation for why the ER-L/ER-M screening values for total PAH_{16} concentrations do not predict biological effects. The PAHs are much more strongly bound to sediment organic carbon than is assumed by the standard equilibrium partitioning assumptions. PAHs sorb to anthropogenic sources of "hard" organic carbon (e.g. charcoal, soot, coal or coke fines, or coal tar pitch) more strongly than to natural sources of "soft" organic carbon (e.g., natural organic matter). As a consequence, the total PAH_{16} concentration is not bioavailable. By contrast, the direct measurement of sediment pore water (SPME pore water TU_{34}) only measures the concentration of PAHs that partition from the solid phase (i.e., sediment) to the dissolved phase (i.e., pore water). It is this bioavailable fraction which drives exposure, and is therefore a better predictor of biological effects (e.g., *H. azteca* survival).

The reduction in *H. azteca* survival in the seven site sediments can positively be attributed to PAHs in sediment. Logistic regression shows a high degree of certainty between these two measurement

6. Conclusions

This characterization of toxicity and bioavailability of PAHs in aquatic sediments from Hudson indicates that the PAHs present in sediment samples are not as toxic to benthic aquatic organisms as is currently assumed by the NYSDEC regulatory guidance for screening contaminated sediments. Sediment samples with total PAH_{16} concentrations as high as 566 mg/kg showed no significant reductions in *H. azteca* survival.

The concentrations of pore water PAHs measured using SPME were a better predictor of *H. azteca* survival than total PAH_{16} concentrations. The site-specific threshold value for Hudson appears to be closer to 5 SPME pore water TU_{34} instead of the 20 SPME pore water TU_{34} value determined from the previous work conducted in 2003, 2005, and 2006.

The locations where toxicity to *H. azteca* is due to bioavailable PAHs are primarily adjacent to Embayment #1.

Evaluation of the benthic macroinvertebrate data showed that there were no significant correlations between higher concentrations of PAHs measured by total PAH_{16} or SPME pore water TU_{34} and lower diversity, richness, dominance, or HBI of the sediments analyzed.

The WOE assessment of sediment chemistry, toxicity testing, and benthic macroinvertebrate survey shows that only the seven site sediments with both SPME pore water TU_{34} concentrations greater than 5.4 TU and significant reduction in *H. azteca* survival pose a potential risk to benthic invertebrates at the Site. The locations of these seven sediment samples are primarily adjacent to Embayment #1.

ATTACHMENT 4

CSIR APPENDIX A TABLE 4-5

Table 4-5
Benthic Macroinvertebrate Survey Indices

SID	Type	Total N[1]	Total S[2]	Shannon Diversity[3]	Margalef Richness[4]	Dominance[5]	10-Dominance	Hilsenhoff Biotic Index[6]	10-HBI
HD113	TEST	37	11	3.0	2.8	2.7	7.3	7.1	2.9
HD118	TEST	97	19	3.8	3.9	1.6	8.4	7.5	2.5
HD119	TEST	45	13	2.9	3.2	4.4	5.6	6.4	3.6
HD120	TEST	124	18	3.2	3.5	3.2	6.8	7.0	3.0
HD122	TEST	182	22	3.4	4.0	2.3	7.7	7.2	2.8
HD123	TEST	54	13	3.0	3.0	3.3	6.7	7.4	2.6
HD124	TEST	171	13	2.7	2.3	3.1	6.9	7.6	2.4
HD127	TEST	39	9	2.0	2.2	6.2	3.8	9.5	0.5
HD128	TEST	47	8	2.4	1.8	3.2	6.8	8.2	1.8
HD129	TEST	186	16	3.3	2.9	2.3	7.7	8.2	1.8
HD130	TEST	109	16	3.1	3.2	3.2	6.8	7.4	2.6
HD131	TEST	40	12	2.9	3.0	4.0	6.0	7.3	2.7
HD132	TEST	157	16	3.1	3.0	3.3	6.7	7.4	2.6
HD133	TEST	192	12	2.9	2.1	2.7	7.3	8.4	1.6
HD134	TEST	128	12	2.5	2.3	4.1	5.9	7.2	2.8
HD137	TEST	18	8	2.8	2.4	2.8	7.2	7.4	2.6
HD138	TEST	32	8	2.0	2.0	5.9	4.1	9.2	0.8
HD139	TEST	130	13	3.1	2.5	2.4	7.6	8.0	2.0
HD140	TEST	222	16	3.1	2.8	3.4	6.6	8.5	1.5
HD141	TEST	137	20	3.1	3.9	2.7	7.3	8.1	1.9
HD142	TEST	161	22	3.1	4.1	3.2	6.8	7.7	2.3
HD143	TEST	10	2	0.5	0.4	9.0	1.0	8.0	2.0
HD144	TEST	679	25	2.0	3.7	6.4	3.6	6.7	3.3
HD145	TEST	85	13	3.1	2.7	2.2	7.8	7.5	2.5
HD146	TEST	8	5	2.2	1.9	3.8	6.3	7.2	2.8
HD147	TEST	200	23	2.8	4.2	4.2	5.8	7.5	2.5
HD148	TEST	4	1	0.0	0.0	10.0	0.0	8.0	2.0
HD149	TEST	105	15	3.2	3.0	2.8	7.2	8.4	1.6
HD150	TEST	27	11	3.0	3.0	3.0	7.0	8.4	1.6
HD151	TEST	239	16	2.2	2.7	5.7	4.3	6.9	3.1
HD152	TEST	325	14	1.9	2.2	6.7	3.3	6.7	3.3
HD153	TEST	169	18	3.1	3.3	3.4	6.6	7.3	2.7
HD154	REFERENCE	206	18	3.1	3.2	2.4	7.6	7.9	2.1
HD155	REFERENCE	339	20	2.7	3.3	3.7	6.3	7.6	2.4
HD156	REFERENCE	40	7	2.0	1.6	5.5	4.5	7.4	2.6
HD157	REFERENCE	18	5	0.9	1.4	8.3	1.7	9.9	0.1
HD158	REFERENCE	11	5	2.1	1.7	3.6	6.4	8.2	1.8
HD159	REFERENCE	10	8	2.8	3.0	3.0	7.0	8.7	1.3
HD160	REFERENCE	192	8	2.1	1.3	4.6	5.4	7.4	2.6
HD161	REFERENCE	90	9	2.5	1.8	4.3	5.7	8.0	2.0
HD162	REFERENCE	414	16	2.1	2.5	4.6	5.4	7.2	2.8

[1]Total N is the total number of organisms identified in a sample.
[2]Total S is the total number of taxons identified in a sample.
[3]Shannon's diversity index (Diversity) was computed according to Shannon (1948).
[4]Margalef's species richness index (Richness) was computed according to Margalef (1958).
[5]Dominance was the percent contribution of the most numerous taxon (NYSDEC, 2002).
[6]Hilsenhoff Biotic Index (HBI) was computed according to Hilsenhoff (1987) with species tolerance values take from NYSDEC (2002).

ATTACHMENT 5

RDWP TABLE 3-6

Table 3-6. Summary of Sediment Grain-Size Data
Revised Comprehensive Sediment Investigation Report for OU2
Hudson (Water Street) Site - Hudson, New York - National Grid

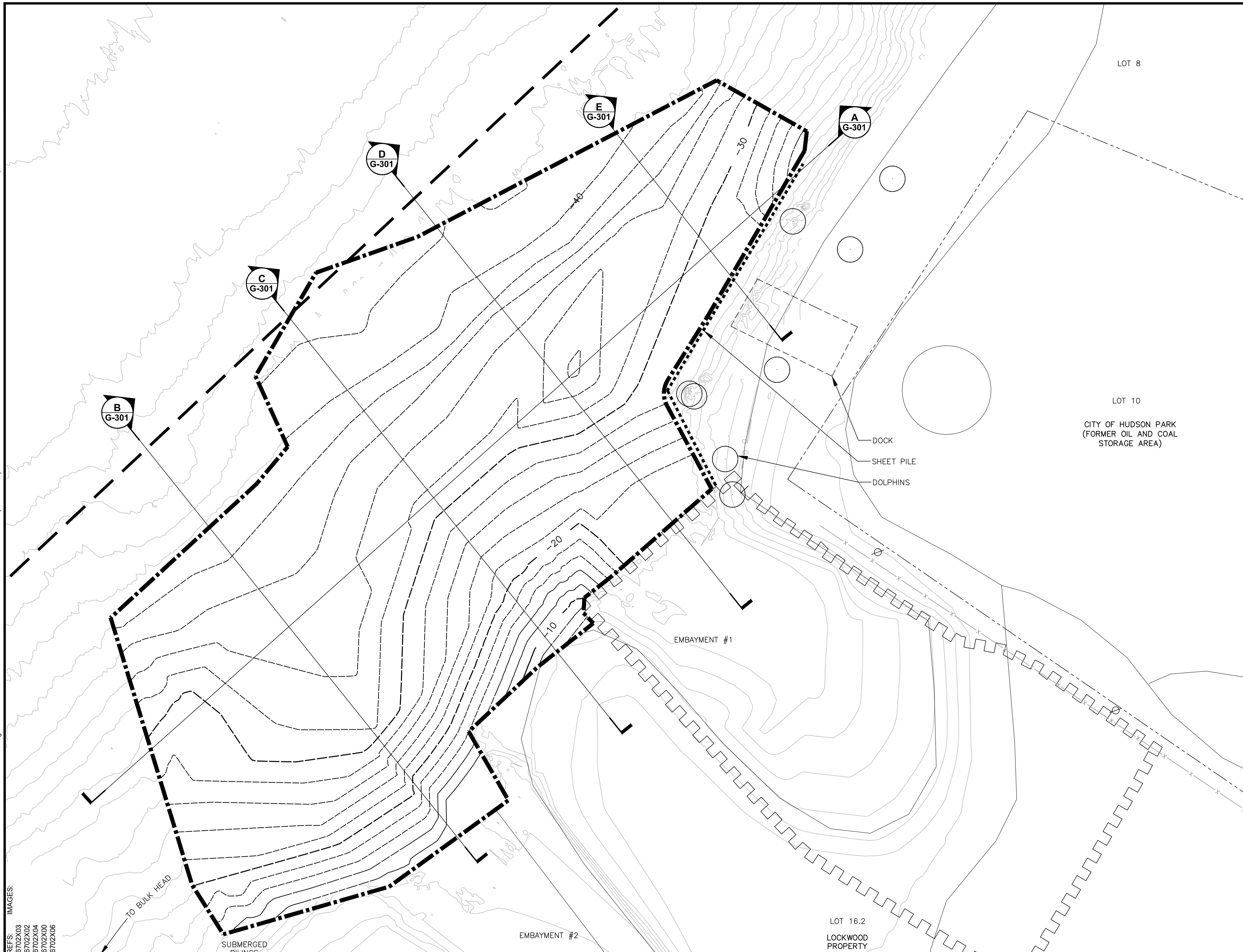
Sample Location	Depth	Sieve Size (Percent Passing)														
	(ft)	3"	2"	1 1/2"	1"	3/4"	1/2"	3/8"	1/4"	#4	#10	#30	#40	#60	#100	#200
Phase I																
SD-10A and SD-04D	CS	100	100	100	100	100	100	100	99.1	99.0	98.2	92.4	85.8	66.4	21.8	10.2
SD-19B and SD-09B	2-4	100	100	100	100	100	100	100	98.2	96.2	91.9	83.1	80.4	59.6	46.5	21.3
SD-02B and SD-09A	CS	100	100	100	100	100	98.8	97.5	93.6	90.1	78.9	63.8	60.1	51.5	38.0	26.4
SD-17A, SD-03A, SD-01A, SD-13A, and SD-15A	0-2	100	100	100	100	100	92.0	78.9	63.3	55.8	42.8	32.8	29.9	19.4	7.8	3.5
Phase II																
SD-04	0-0.5	100	100	100	100	95.4	85.5	77.9	67.3	63.5	56.6	49.2	46.6	33.4	12.3	4.5
SD-05	0.5-2	100	100	100	95.9	85.9	66.0	50.4	30.7	23.1	14.5	9.9	9.0	7.5	5.8	4.0
SD-11	0-0.5	100	100	100	97.3	96.8	93.0	89.4	85.1	82.8	79.0	74.9	73.7	67.3	14.2	4.7
SD-15	0-0.5	100	100	100	95.6	92.2	85.5	81.1	72.6	69.3	61.9	49.1	43.0	25.7	8.7	2.6
SD-16	0-0.5	100	100	100	96.1	91.8	84.2	80.3	74.7	70.8	61.4	48.3	44.7	36.9	28.4	19.9
SD-22	4-6	100	100	100	97.8	97.7	97.6	97.1	96.1	95.7	94.7	91.9	90.2	85.9	58.6	38.1
SD-25	4-6	100	100	100	100	92.0	90.5	90.0	89.1	88.9	87.7	84.8	83.6	80.2	61.3	44.4
SD-29	0.5-2	100	100	100	97.7	97.7	96.9	95.8	95.1	94.4	93.1	90.2	88.1	79.2	26.7	9.6
SD-30	0-0.5	100	100	100	100	100	98.8	98.5	97.1	96.0	94.3	93.0	92.7	92.1	91.1	88.0
SD-30	6-8	100	100	100	100	100	98.4	98.3	97.5	97.2	96.7	95.6	95.2	94.4	93.4	89.2
2002 Site Investigation																
SD-05	0.5-2	100	100	100	100	97.6	94.8	93.7	91.8	90.7	86.8	81.0	79.1	75.1	62.5	37.7
SD-09	0-0.5	100	100	100	98.2	96.3	90.4	84.3	73.4	67.4	55.9	41.6	37.1	26.0	12.4	6.3
SD-12	0-0.5	100	100	100	100	98.6	96	92.8	90.6	89.6	86.3	80.6	77.9	68.2	30.8	13.5
SD-12	0.5-2	100	100	100	100	100	99.9	99.6	99.5	99.5	98.9	97.3	96.5	91.8	55.3	32.5
SD-13	0-0.5	100	83.5	77.1	70.9	69.1	67.8	67.5	66.0	64.2	59.6	49.5	45.9	36.9	13.5	5.3
SD-13	0.5-2	100	100	86.8	81.2	65.8	56.5	49.2	43.7	39.7	32.1	21.9	19.3	14.2	9.2	4.4
SD-13	2-4	100	70.3	70.3	70.3	70.3	70.3	70.0	69.1	68.6	67.0	63.8	61.7	55.3	20.0	8.8
SD-16	0-0.5	100	100	100	89.9	88.9	86.2	83.5	78.6	75.3	67.4	56.4	52.0	26.7	7.3	3.0
SD-22	0-0.5	100	100	91.6	91.6	90.7	89.1	86.5	83.9	82.6	79.3	75.1	73.6	70.0	47.4	20.1
SD-22	0.5-2	100	77.9	77.9	77.9	77.1	75.4	74.2	72.5	71.4	69.5	66.2	64.7	61.0	43.9	30.3
SD-22	2-4	100	100	100	100	100	100	99.6	97.2	95.7	92.5	88.7	87.3	84.0	69.7	47.6
SD-23	0-0.5	100	100	95.7	92.0	88.2	81.0	76.4	71.5	69.8	65.2	58.8	55.9	43.1	17.0	7.2
SD-34	0-0.5	100	100	100	97.9	97.9	96.7	95.0	92.6	91.4	90.0	87.9	86.8	76.3	18.7	3.0
SD-36	0-0.5	100	81.6	81.6	78.7	75.1	68.7	65.4	60.5	58.0	51.5	44.5	42.3	34.1	15.0	7.2
SD-45	0-0.5	100	100	100	100	99.5	99.3	98.4	96.7	95.7	93.2	88.4	84.9	71.8	33.7	17.5
SD-66	0-0.5	100	100	100	100	98.7	94.1	88.0	78.6	73.4	65.0	59.5	58.3	51.8	23.9	8.9
SD-69	0-0.5	100	100	100	100	99.3	97.3	95.0	91.8	89.8	85.0	78.9	75.9	66.9	22.4	8.6
SD-73	0-0.5	100	100	100	100	97.2	96.9	95.7	94.1	93.1	88.8	80.4	75.8	62.4	17.0	6.2
SD-73	2-4	100	100	100	100	100	100	99.2	99.1	98.8	91.8	38.7	35.5	31.9	19.4	10.6
SD-73	4-6	100	100	100	100	100	100	100	100	100	100	99.8	99.8	99.8	99.8	99.7
SD-79	0-0.5	100	100	100	100	100	98.6	98.6	97.9	97.6	96.2	94.0	92.9	86.0	34.4	19.2
SD-80	0-0.5	100	100	100	100	97.5	90.2	85.4	80.3	77.9	73.0	68.3	66.9	64.4	60.3	47.4

Notes:

1. CS = Indicates a composite sample:
   - A = Samples labeled with an "A" are from the 0- to 2-foot depth interval.
   - B = Samples labeled with a "B" are from the 2- to 4-foot depth interval.
   - D = Samples labeled with a "D" are from the 6- to 8-foot depth interval.

ATTACHMENT 6

DRAFT RESTORATION PROFILES



LEGEND:

- APPROXIMATE PROPERTY LINE
- CHAIN-LINK FENCE
- EXISTING BATHYMETRIC CONTOUR (2-FOOT INTERVAL)
- AS-BUILT SHEETPILE
- DREDGE AREA LIMIT
- APPROXIMATE BOUNDARY OF THE SHIPPING CHANNEL
- PROPOSED REMOVAL CONTOUR (MAJOR)
- PROPOSED REMOVAL CONTOUR (MINOR)
- EXISTING PERMANENT DOCK
- EXISTING DOLPHIN
- APPROXIMATE TEMPORARY SHEET PILE WALL

NOTES:

1. BASE MAP INFORMATION FROM C.T. MALE ASSOCIATES, P.C. WASBUILT.DWG DATED NOVEMBER 15, 2005, AT A SCALE OF 1 INCH = 20 FEET
2. BASE MAPS ARE IN COORDINATE SYSTEM NEW YORK, EAST ZONE, NAD 1983, FEET

CITY: SYRACUSE, NY DIV/GROUP: IMDV/CAD DB/LD: L.POSENAUER, K.SARTORI PM/TM: C.GUEST LYR:ON=*;OFF=*REF* G:\ENVCAD\SYRACUSE\ACT\B0036702\0002\00005\DWG\CONTRACT\OU-2\36702G300.dwg LAYOUT: G-300 SAVED: 6/10/2016 9:13 AM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 6/10/2016 9:13 AM BY: SARTORI, KATHERINE

XREFS: 36702X03 36702X02 36702X04 36702X00 36702X06 IMAGES:

20' 0 20' 40'
1"=20'

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name: MARK GRAVELING
Professional Engineer's No.: (PE NUM)
State: NY | Date Signed: | Project Mgr.: (MGR)
Designed by: (DSN) | Drawn by: KLS | Checked by: (CHK)

DRAFT

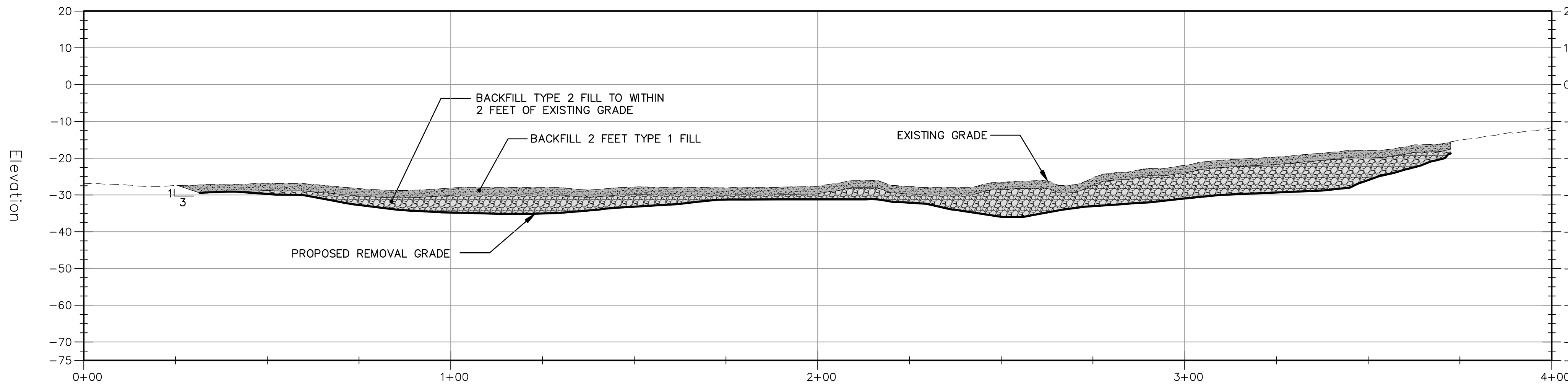
ARCADIS
ARCADIS OF NEW YORK, INC.

NATIONAL GRID • HUDSON (WATER STREET) SITE, HUDSON, NEW YORK
DRAFT REMEDIAL DESIGN REPORT FOR OPERABLE UNIT 2

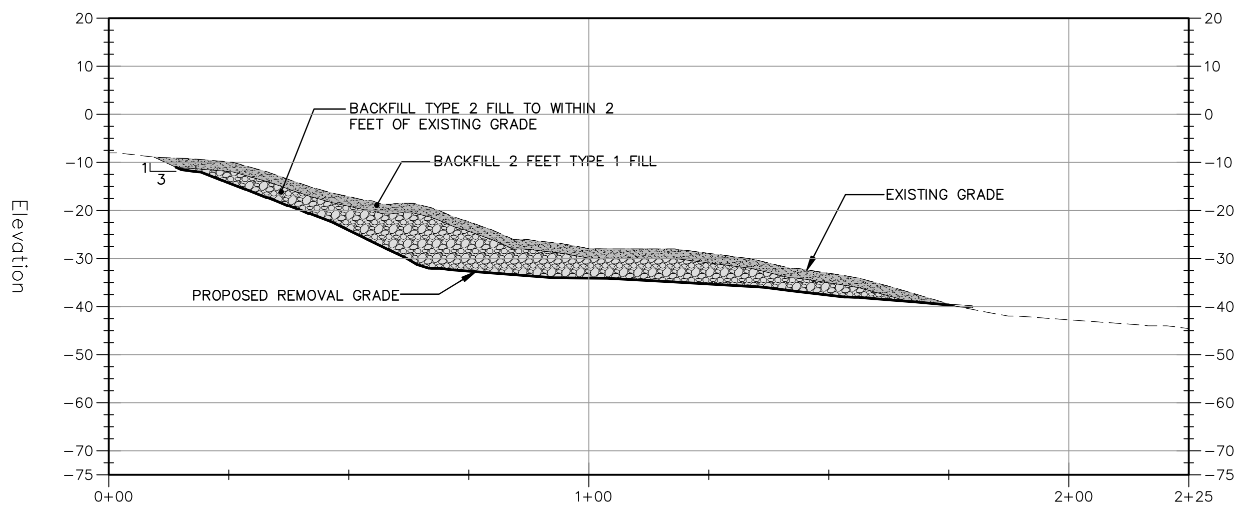
SEDIMENT REMOVAL PLAN

ARCADIS Project No. B0036702.0002.00005
Date JUNE 2016
ARCADIS
6723 TOWPATH ROAD
P.O. BOX 66
SYRACUSE, NY 13214
TEL: 315.466.9120

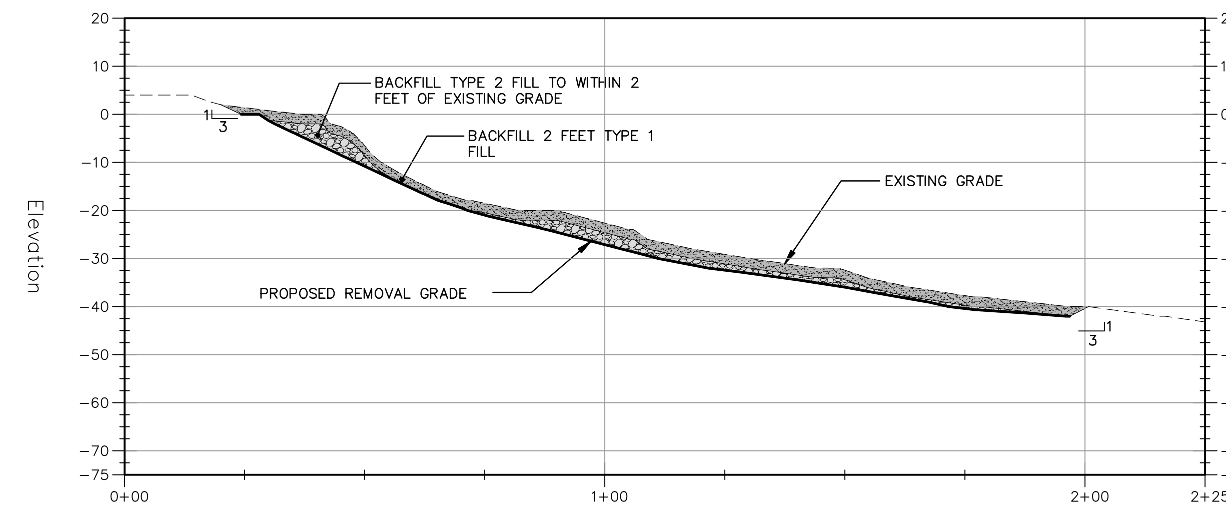
G-300



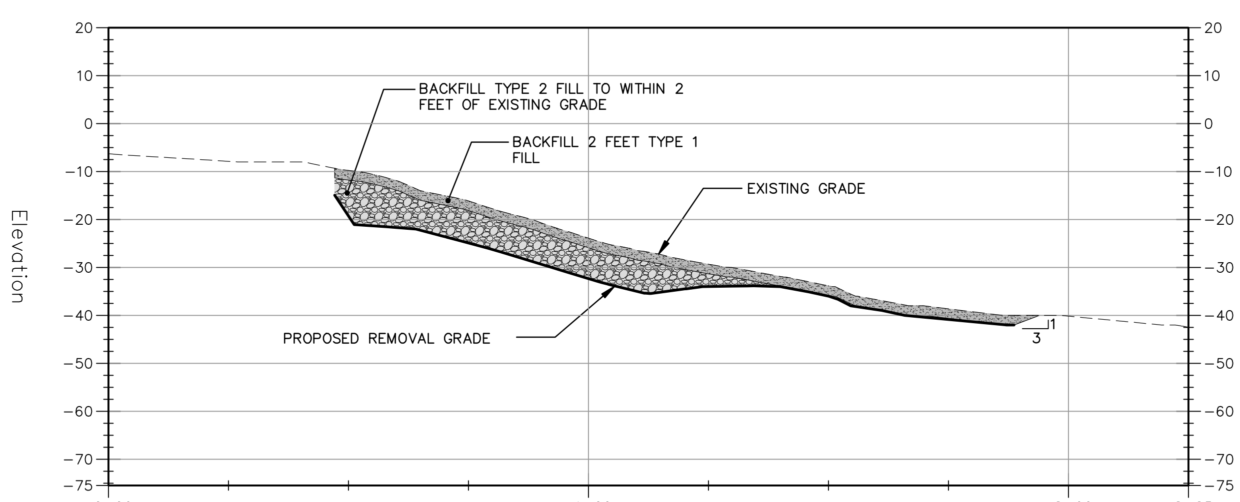
PROFILE A



PROFILE B

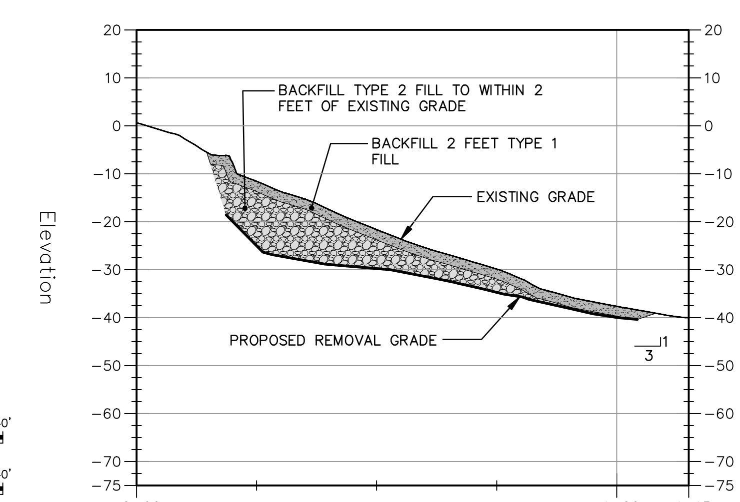


PROFILE C



PROFILE D

0 20' 40'
HORIZONTAL SCALE: 1"=20'
0 20' 40'
VERTICAL SCALE: 1"=20'



PROFILE E

CITY: SYRACUSE, NY DIV/GROUP: IMDV/CAD DB/LD: L.POSENAUER, K.SARTORI PM/TM: C.GUEST LYR:ON=*;OFF=*REF*
G:\ENVCAD\SYRACUSE\ACT\B0036702\0002\00005\DWG\CONTRACT\OU-2\36702G301.dwg LAYOUT: G-301 SAVED: 6/9/2016 11:40 AM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 6/9/2016 11:46 AM BY: SARTORI, KATHERINE
XREFS: 36702X00 36702X02-CIV IMAGES:

SACLAES AS INDICATED

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

THIS DRAWING IS THE PROPERTY OF THE ARCADIS ENTITY IDENTIFIED IN THE TITLE BLOCK AND MAY NOT BE REUSED OR ALTERED IN WHOLE OR IN PART WITHOUT THE EXPRESS WRITTEN PERMISSION OF SAME.

Professional Engineer's Name		
MARK GRAVELING		
Professional Engineer's No. (PE NUM)		
State: NY	Date Signed	Project Mgr. (MGR)
Designed by (DSN)	Drawn by KLS	Checked by (CHK)

DRAFT

ARCADIS

ARCADIS OF NEW YORK, INC.

NO ALTERATIONS PERMITTED HEREON EXCEPT AS PROVIDED UNDER SECTION 7209 SUBDIVISION 2 OF THE NEW YORK STATE EDUCATION LAW

NATIONAL GRID • HUDSON (WATER STREET) SITE, HUDSON, NEW YORK
DRAFT REMEDIAL DESIGN REPORT FOR OPERABLE UNIT 2

SEDIMENT REMOVAL PROFILES

ARCADIS Project No. B0036702.0002.00005

Date JUNE 2016

ARCADIS
6723 TOWPATH ROAD
P.O. BOX 66
SYRACUSE, NY 13214
TEL: 315.466.9120

G-301

APPENDIX G-2

Restoration Plan Addendum

MEMO

To:

Michael Donegan, National Grid

Copies:

Mark Gravelding, Arcadis

Arcadis of New York, Inc.
One Lincoln Center
110 W Fayette Street
Suite 300
Syracuse
New York 13202
Tel 315 446 9120
Fax 315 449 0017

From:

Heather VanDewalker

Date:

January 20, 2017

Arcadis Project No.:

B0036702.0002

Subject:

Addendum to Hudson Water Street Sediment Restoration Approach
(submitted June 10, 2016)

Introduction

On March 28, 2012, the New York Department of Environmental Conservation (NYSDEC) issued a Record of Decision (ROD) regarding Operable Unit Number 02 (OU-2) at the National Grid former manufactured gas plant (MGP) site in Hudson, New York (the site). The Description of Selected Remedy section of the ROD includes the following element pertaining to restoration of the site:

8) Restoration of the stream bed and banks to the original bathymetry. To the extent possible, restoration will be with material similar to the existing substrate. A restoration plan will be developed during design and will meet the requirements of Article 15 and 6 NYCRR Part 608.

That restoration plan was submitted to NYSDEC on June 10, 2016 ahead of completing and submitting the full Remedial Design. The process of completing the Remedial Design led to changes to the original restoration plan, and these changes are discussed in this memorandum.

Final Slope Stability

As part of the design process, Arcadis assessed the anticipated slope stability of the proposed backfill plan. The angle of repose for the proposed fill materials is approximately 28 degrees, or approximately 1.9:1 (horizontal:vertical [H:V]). The removal grades were assessed separately and designed with a slope shallower than 2:1 (H:V) for dredging stability. As such, the backfill material is anticipated to be stable on the post-removal surface.

Several areas, primarily adjacent to the shoreline, exceeded the stability criteria for the final (post-backfill) grade, with existing slopes as steep as 37 degrees. These areas were reassessed both using AutoCAD and conventional engineering to reduce the proposed fill grades to shallower than of 1.9:1 (H:V). This involved regrading the slope in the affected areas such that the final restored slope would be shallower than 1.9:1 (H:V).

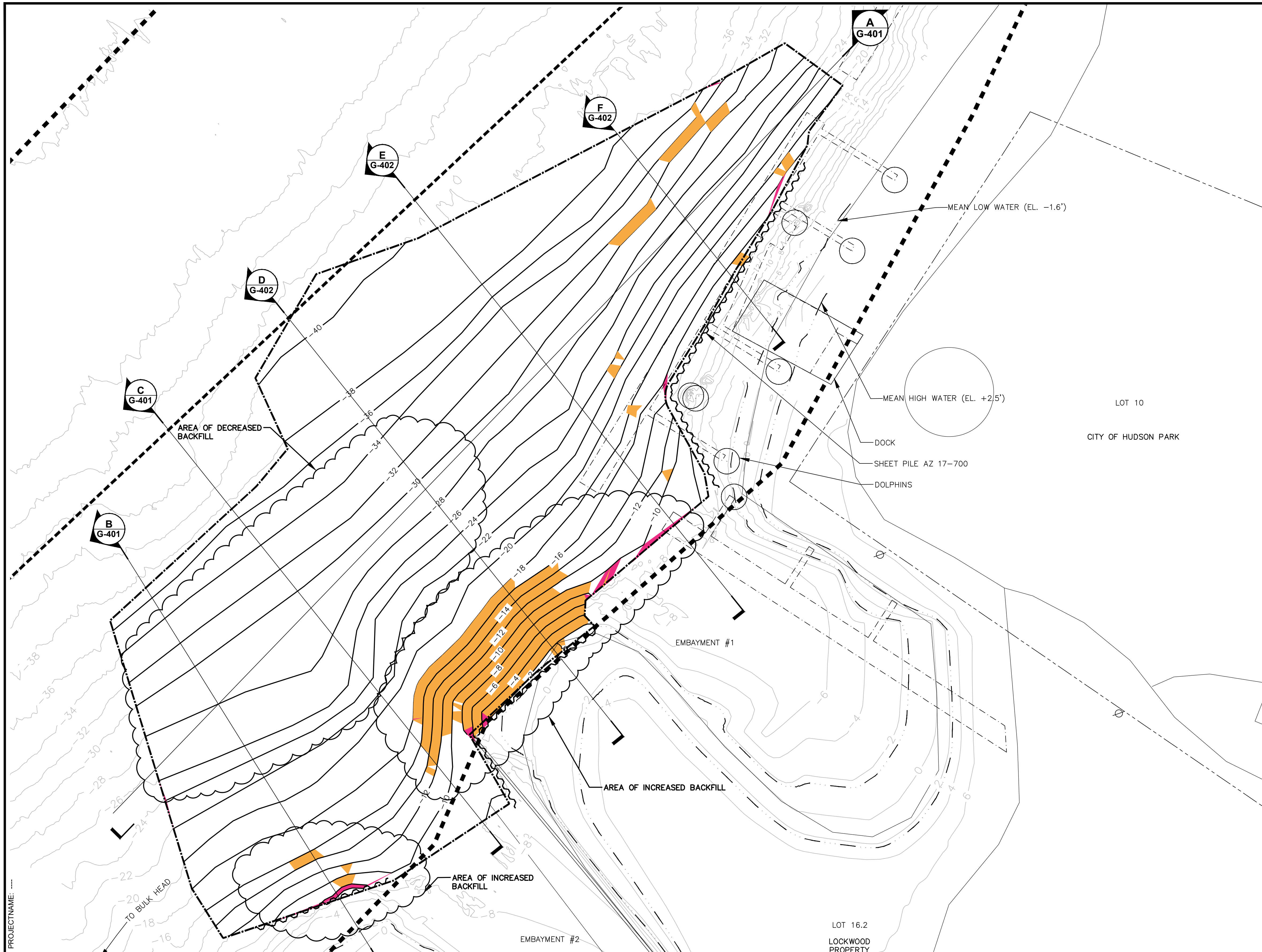
Avoidance of Net Fill

In accordance with Clean Water Act Section 404 and 33 CFR Part 323, further adjustments to the final grades were required to avoid a net fill condition. The adjustments were made primarily in the northwestern portion of the restored dredge area. These areas are shown on Figure 1. The changes involved modifying the backfill placement by decreasing the fill in deeper water (elevation -28 to -36 ft NAVD88) areas to offset the increased backfill volume closer to shore.

Final Design

The final design is anticipated to be stable, avoid net fill, and approximate the existing bathymetry to the extent practicable. The final grades are shown in plan view on Design Drawing G-400 and in profile on Design Drawings G-401 and G-402 (Appendix A to the Final Remedial Design Report). The final design requires neat-line removal of approximately 7,945 cubic yards of existing material (as shown on Drawing G-300 in Appendix A to the Final Remedial Design Report) and neat-line placement of approximately 7,915 cubic yards of backfill. As described in Specification Section 352023 – Dredging and Subaqueous Backfill (Appendix B to the Final Remedial Design Report), up to 6 inches of overdredging will be acceptable, which could lead to up to 900 additional cubic yards of removed material and associated backfill. This design avoids net fill while returning roughly the same quantity of material to the remediated area.

The draft Design Drawings included in the June 10, 2016 Restoration Plan are superseded by those included in Appendix A to the 100% Final Remedial Design Report.



LEGEND:

- APPROXIMATE PROPERTY LINE
- PROJECT WORK LIMIT
- EXISTING CHAIN LINK FENCE
- BATHYMETRIC CONTOUR (2-FOOT INTERVAL)
- -20 PROPOSED FINISHED GRADE
- MEAN LOW WATER / MEAN HIGH WATER
- APPROXIMATE BOUNDARY OF THE SHIPPING CHANNEL
- EXISTING SHEET PILE WALL
- RESTORED DREDGED AREA
- EXISTING PERMANENT DOCK
- EXISTING TEMPORARY DOCK
- EXISTING DOLPHIN
- APPROXIMATE PROPOSED SHEET PILE WALL
- FINAL GRADE SLOPE SHALLOWER THAN 2H:1V
- FINAL GRADE SLOPE SHALLOWER THAN 1.9H:1V AND STEEPER THAN 2H:1V
- FINAL GRADE SLOPE STEEPER THAN 1.9H:1V

NOTES:

1. RESTORE DISTURBED SHORELINE AND NEARSHORE AREAS WITH CLASS 3 RIPRAP. REUSE STOCKPILED RIPRAP WHERE POSSIBLE.
2. SHEET PILE WALL SHALL BE INSTALLED TO PROVIDE EXCAVATION SUPPORT DURING DREDGING ACTIVITIES. FOLLOWING SEDIMENT BACKFILL ACTIVITIES, THE SHEET PILE SHALL BE REMOVED AND/OR CUT AT POST-RESTORATION GRADE AS REQUIRED BY THE CONTRACT DOCUMENTS.

20' 0 20' 40'
1"=20'

NATIONAL GRID
HUDSON (WATER STREET) SITE, HUDSON, NEW YORK
70% DRAFT REMEDIAL DESIGN REPORT

RESTORED SLOPE STABILITY

ARCADIS Design & Consultancy for natural and built assets

FIGURE
1

CITY: SYRACUSE DIV/GROUP: ENVCAD DB: E. KRAHMER, R. BASSETT LD: PIC: J. NUSS PM: A. WEEKS TM: A. WEEKS LYR: ON=*; OFF=*REF*
C:\Users\aschilling\BIM 360\Arcadis\ANA - National Grid\Project Files\Hudson (Water Street) Site OU2\2020\30003986\01-DWG\36702B05.DWG LAYOUT: 1 SAVED: 4/7/2020 6:41 PM ACADVER: 23.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTCONT.CTB PLOTTED: 4/7/2020 6:43 PM BY: SCHILLING, ADAM
XREFS: 36702X03 36702X02 36702X07 36702X00 IMAGES: PROJECTNAME: ----

Arcadis of New York, Inc.
One Lincoln Center
110 W Fayette Street
Suite 300
Syracuse, New York 13202
Tel 315 446 9120
Fax 315 449 0017

www.arcadis.com