100% Design Report

Excavation and Capping of the Filled First Street Turning Basin, Gowanus Canal

Borough of Brooklyn, New York

Project ID: PW77GOWAN
Contract No. HWDRCW02

Prepared for:

NYC DDC Department of Design and Construction

Submitted by:

AKRF | KSE
The AKRF-KSE JV

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LIST OF ACRONYMS

Acronym	Definition
ACB	Articulated Concrete Block
ACI	American Concrete Institute
AISC	American Institute of Steel Construction
AKRF/KSE-JV	AKRF Engineering, P.C./KS Engineers, P.C. Joint Venture
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials International
AWQS	Ambient Water Quality Standards and Guidance Values
AWS	American Welding Society
bgs	below ground surface
BHD	Brooklyn Highway Datum
BSD	Brooklyn Sewer Datum
CAMP	Community Air Monitoring Plan
CEQR	City Environmental Quality Review
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Constituents of Concern
CQAPP	Construction Quality Assurance Project Plan
CSO	Combined Sewer Outfall
CWA	Clean Water Act
DBH	diameter at breast height
DNAPL	Dense Non-Aqueous Phase Liquid
E&SC	Erosion and Sediment Control
EPA	United States Environmental Protection Agency
FS	Feasibility Study
GAC	Granular Activated Carbon
HASP	Health and Safety Plan
LPC	New York City Landmarks Preservation Commission
MHHW	Mean Higher High Water
MHW	Mean High Water
MLLW	Mean Lower Low Water
MLW	Mean Low Water
MMP	Materials Management Plan
MRCE	Mueser Rutledge Consulting Engineers
MSL	Mean Sea Level
NAPL	Non-Aqueous Phase Liquid
NAVD88	North American Vertical Datum of 1988
NAVFAC	Naval Facilities Engineering Command

Acronym	Definition
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List
NYAC	New York Archaeological Council
NYC	New York City
NYCAC	New York City Administrative Code
NYCDDC	New York City Department of Design and Construction
NYCDEP	New York City Department of Environmental Protection
NYCDOB	New York City Department of Buildings
NYCDOT	New York City Department of Transportation
NYSDEC	New York State Department of Environmental Conservation
OC	Oleophilic Clay
OM&MP	Operations Maintenance and Monitoring Plan
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PID	photoionization detector
psf	pounds per square feet
QA/QC	quality assurance and quality control
RAOs	Remedial Action Objectives
RCNY	Rules of the City of New York
RCU	Restricted-Commercial Use
RI	Remedial Investigation
ROD	Record of Decision
RTA	Remediation Target Area
S/NR	State and National Register of Historic Places
SCOs	Soil Cleanup Objectives
SEI	Structural Engineering Institute
SHPO	State Historic Preservation Office
SOE	Support of Excavation
SPLP	Synthetic Precipitation Leaching Procedure
SVOCs	Semi-Volatile Organic Compounds
TB4	4th Street Turning Basin
TCLP	Toxicity Characteristic Leaching Procedure
TIC	Tentatively Identified Compounds
VOCs	Volatile Organic Compounds

1.0 INTRODUCTION

This 100% Design Report for the Excavation & Capping of the Filled First Street Turning Basin, Gowanus Canal, Borough of Brooklyn, New York (Site) was prepared by AKRF Engineering, P.C./KS Engineers, P.C. Joint Venture (AKRF/KSE-JV), on behalf of the New York City Department of Design and Construction (NYCDDC), as part of the Remedial Design for the Site, which is a portion of the Gowanus Canal (Canal) Superfund Site.

1.1 Purpose

The Canal, including the Site, was placed on the National Priorities List (NPL), pursuant to Section 105 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), on March 2, 2010. In April 2010, the United States Environmental Protection Agency (EPA) entered into separate administrative consent orders with various parties to perform work in support of EPA's remedial investigation/feasibility study (RI/FS). An FS Report was completed by EPA in 2011 (EPA 2011) and an FS Addendum Report was issued by EPA in December 2012. The remedial alternatives considered to address the contamination in the Canal and the preferred remedy with the rationale for such preference was described in the Record of Decision (ROD) issued by EPA on September 27, 2013 under CERCLA for the Gowanus Canal Superfund Site (EPA 2013). This 100% Design Report was developed based on the Administrative Order for Remedial Design (Order) issued to New York City (NYC) by EPA on May 28, 2014, which included a Statement of Work further defining the selected remedy (EPA 2014).

As stated in the ROD, the selected remedy for the Site is "excavation and restoration of approximately 475 linear feet of the filled-in former First Street Turning Basin" (EPA 2013). Excavation of material within the Site will remove contaminants, thereby reducing the risk of recontamination to the Canal, but also necessary for the implementation of the sediment remedies and future maintenance of the remedy and Canal infrastructure. Restoration will mitigate the loss of surface water area as a result of new bulkhead encroachment into the Canal.

The design criteria have been developed to achieve compliance with the Performance Standards and Remedial Action Objectives (RAOs) that were established for the Site in the Order (EPA 2014). The RAOs are presented in the Final Remedial Design Work Plan (AKRF/KSE-JV 2016). To achieve the RAOs, the remedy will remove soils to a prescribed depth that could potentially contribute polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyl (PCBs), and metals to Canal sediment, and install a soil/sediment capping system that renders the underlying soil/sediment inaccessible and environmentally isolated. The soil/sediment capping system is being designed to reduce the contribution of PAHs, PCBs, and metals from soils that will remain in place beneath the final depth of excavation, and eliminate the migration of non-aqueous phase liquid (NAPL) into the Canal.

1.2 Project Background

The Canal is a brackish, tidal arm of the New York-New Jersey Harbor Estuary, extending approximately 1.8 miles through Brooklyn, New York. The approximately 100-foot wide channel runs southwest from Butler Street to Gowanus Bay and Upper New York Bay.

Based on historical aerial photographs, the former First Street Turning Basin was approximately 475 to 560 feet long by 50 to 60 feet wide, and part of the Canal surface waterway system until between 1954 and 1966, when it was filled in by unknown party(s). The Site location is illustrated on Figure 1-1.

According to the ROD, the former First Street Turning Basin was originally utilized, among other purposes, to deliver coal via barges to an adjacent electric generating station (the Powerhouse, Block 967, Lot 1). The Powerhouse began operation in 1904, and was originally built to provide

power to the former Brooklyn Rapid Transit Authority subway system, which was later incorporated into NYC's Transit system in 1940. During operations, it consumed large quantities of coal fed from coal piles, which surrounded the building, and were located adjacent to the Canal. The First Street Turning Basin was filled after the Powerhouse became obsolete and was removed from service. The Powerhouse itself was dismantled over the years, and by 1969, the currently existing section of the Powerhouse was the only part of the complex still standing. In 2012, the Powerhouse was purchased for potential re-development as non-profit artist studios and display space. The Powerhouse site (Site No. C224099) is currently enrolled in the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program, and soil remediation and capping activities were conducted during 2017.

The Site has been identified as an area of archaeological interest by EPA due to the possibility that a series of shipwrecks were buried prior to being filled. Additionally, one or more of the early mills and a burial site relating to the Battle of Brooklyn may also be located in the vicinity of the Site.

Analytical data obtained during EPA's RI within the area of the Site and during the preliminary investigation activities associated with the project, titled Environmental Sampling and Analysis 30% Field Activity (previously titled Preliminary Design Investigation), documented the presence of NAPL, and soil and groundwater contamination associated with former industrial activities. According to the ROD, contaminated sediments within the Site were left in place when the basin was filled. In addition, the ROD states that the fill itself may have included waste materials and/or the Site may have been subject to later spills and dumping.

1.3 Remedial Design Overview

The remedial design outlined in this report substantially consists of the following elements, which promote the use of the restored turning basin as an open waterway suitable for navigational and recreational use and ecological habitat:

- Removal of soil and buried sediment to a presumptive depth of approximately of 26 feet below grade at approximately -18 feet (NAVD88). Excavation will be performed in the wet with conventional heavy equipment, with excavated materials direct loaded to scows in the Canal for transport to processing and final disposition.
- Excavation of the basin will be facilitated by installation of temporary support of excavation measures and permanent bulkhead walls that will be incorporated into existing bulkheads and used as part of the restoration of the excavated basin.
- Installation of a cap on the exposed surface at the excavation bottom to re-establish aquatic communities and protect the underlying materials from scour. The cap will consist of a clean isolation layer installed over successive reactive cap layers including organoclay and granular activated carbon. The composite isolation and reactive cap layers will be covered with an engineered concrete surface to protect the cap from deterioration.
- Restoration of the upland perimeter of the area, including the fortification of existing bulkhead walls, installation of new permanent bulkheads in support of the existing land use on the east and south sides of the basin, and the creation of a new intertidal vegetative shelf on the north side.

1.4 Site Datum

The NYC Building Code requires that all elevations noted on construction documents be referenced to the North American Vertical Datum of 1988 (NAVD88). All elevations throughout this 100% Design Report refer to NAVD88. Historical documents for each of the City's five boroughs reference different local vertical datums. For the Borough of Brooklyn, two commonly used datums include the Brooklyn Highway Datum (BHD) and the Brooklyn Sewer Datum (BSD).

These local vertical datums are typically referenced to Mean Sea Level at Sandy Hook, New Jersey (Sea Level Datum of 1929), also known as the National Geodetic Vertical Datum of 1929 (NGVD29). The relationship between these vertical datums are used to develop conversion factors between the different vertical datums.

- NGVD29 = BHD + 2.56
- NGVD29 = BSD + 1.72
- BSD = BHD + 0.84
- NAVD88 = BHD +1.447
- NAVD88 = BSD + 0.61

Tidal information used for the Site is based on the 1983 to 2001 tidal epoch data collected at the Battery Station (No. 8518750) by the National Oceanic and Atmospheric Administration:

- Mean Higher High Water (MHHW) = Elevation (El.) 2.28
- Mean High Water (MHW) = El. 1.96
- Mean Sea Level (MSL) = El. -0.31
- Mean Low Water (MLW) = El. -2.57
- Mean Lower Low Water (MLLW) = El. -2.77

2.0 DESIGN COORDINATION

2.1 Design Implementation Parties

The Responsible Parties is defined as the person, persons, or firm identified by the EPA as responsible for implementing the remedial design included in this 100% Design Report.

The Engineer is defined as party or parties providing on-site and office-based assistance to the Responsible Parties for the implementation of the 100% Design Report.

2.2 Gowanus Canal [Remediation Target Area (RTA) 1 Integration]

This 100% Design Report relies upon the 1st Street Turning Basin Sediment Cap Treatment Layer Conceptual Design Memorandum provided by EPA (Appendix A.1). The cap surface elevation for the Site at the confluence with the Canal at RTA 1 was prescribed to meet an elevation of -12.50 feet. Further coordination may be required, and as directed by EPA, for the integration of the Site and greater Gowanus Canal Remediation Target Area (RTA) 1 sediment cap if capping integration design details are modified.

The bulkheads for the Site were designed to be independent of the planned bulkhead improvements for the adjacent properties to the north and south of the Site [420 Carroll Street (Block 453, Lot 1) and 323 3rd Avenue (the Powerhouse; Block 967, Lot 1)], as the design for these bulkhead improvements has not commenced yet. EPA and representatives for these properties will need to coordinate the integration of the bulkheads based on the bulkheads included in this design. If the bulkhead improvements for these properties are completed before construction for the excavation and capping of the Site, appropriate updates to this Design Report may be needed to ensure proper integration of the bulkheads.

Construction sequencing for the excavation and capping of the Site, the RTA 1 sediment cap installation, and the bulkhead improvements for the adjacent properties will be critical for implementation of the design. This will require coordination with EPA and the applicable parties.

2.3 Construction Access

The Responsible Parties will make good faith efforts to secure access agreements with the necessary adjacent property owners to implement the design. Support from EPA may be needed in securing access agreements, if negotiations stall with the applicable parties.

A review of the adjacent property records indicates that all of the parcels surrounding the Site are owned by private landowners limiting the access for construction. Construction of the project will be implemented via a combination of barge from the Canal and land-based activities. The disposal transport of the material (mostly soil and limited water) will be implemented via barge, while staging, lay-down areas, and access to roads for workers, material, and equipment deliveries will be implemented via land access.

The most suitable construction access point is 450 Carroll Street, the property to the north (Block 453, Lot 26). This property is also the most suitable for staging and laydown areas and provided the main point of access to the Site for the 30% Field Activities (Staging Site). The property owner of 450 Carroll Street is currently leasing a portion of the Site through a revocable license agreement with the City of New York Department of Citywide Administrative Services Asset Management dated August 2, 2013. This license agreement will likely need to be suspended or revoked prior to implementation of the restoration. In addition, the Responsible Parties would negotiate an access agreement and/or lease for a portion of the 450 Carroll Street property proposed for access, staging, and laydown.

The Responsible Parties would also negotiate the relocation and/or decommissioning of the stair case associated with 420 Carroll Street (Block 453, Lot 1) and the drains and fence associated with 430 Carroll Street (Block 453, Lot 21).

In addition, access for the Contractor to monitor buildings and structures within a distance equal to or less than the maximum excavation depth for movement during construction is required. The properties with these buildings and structures are listed below:

- 420 Carroll Street (Block 453, Lot 1
- 312 3rd Avenue (Block 453, Lot 54,)
- 338 3rd Avenue (Block 967, Lot 24)
- 323 3rd Avenue (the Powerhouse; Block 967, Lot 1)

3.0 EXISTING CONDITIONS

Activities to support the selected remedy design consisted of Geotechnical Exploration, Environmental Samplings and Analysis, Bulkhead Inspection, Topographic Survey and Multi-beam Sounding, Adjacent Buildings Research and Inspection, and a Tree Inventory. All activities were completed in accordance with their respective EPA-approved 30% Field Activity Plan. The 30% Field Activity Reports are included in Appendix B.

3.1 Geotechnical Exploration

In August 2017, Mueser Rutledge Consulting Engineers (MRCE) of New York, New York provided oversight for the geotechnical exploration activities. The geotechnical exploration scope included a subsurface investigation to identify and characterize subsurface soil stratigraphy for developing soil design parameters for the following:

- Temporary support of excavation (SOE) systems;
- Groundwater elevations; and
- Permanent bulkheads.

The geotechnical subsurface investigation consisted of nine borings. Two of the borings were drilled to a depth of approximately 100 feet below the ground surface (bgs) and seven of the borings were drilled to a depth of approximately 60 feet bgs. The soil stratigraphy encountered in the borings generally consists of fill overlying lenses of organic clays and silts of varying thickness, overlying deep sand deposits of varying density. Rock was not encountered in the borings and is expected to be relatively deep. Some of the borings encountered obstructions as deep as 15 to 20 feet bgs. The groundwater table was encountered in the borings at approximately El. 3 (NAVD88), which correlates to approximately 10 feet bgs.

The geotechnical investigation also included six test pits excavated along the assumed former turning basin perimeter. Test pit excavation depth varied from approximately 7.5 to 13.5 feet bgs. Water was not encountered at the time the test pits were excavated. The original timber crib bulkhead was encountered in one of the test pits excavated adjacent to the southern perimeter of the Site. A timber crib structure was not encountered at any of the other five test pit locations. The Geotechnical Investigation Report is included as Appendix B.1.

3.2 Environmental Sampling and Analysis

In July 2017, Preferred Environmental Services of North Merrick, New York provided oversight for the completion of environmental sampling. Technical direction for the sampling was provided by Arcadis of Syracuse, New York. The environmental sampling consisted of a total of eight soil borings advanced using roto-sonic drilling methods. Within the footprint of the proposed restored turning basin, five borings (SB-2, SB-3, SB-4, SB-5, and SB-7) were advanced to a target depth of 33 feet bgs; at three of these locations, well pairs were set at shallow and deep intervals (MW-3S/MW-3D, MW-4S/MW-4D and MW5S/MW-5D). Within the footprint of the proposed intertidal vegetative shelf, three borings (SB-1, SB-6, and SB-8) were advanced to a target depth of 18 feet bgs. The Environmental Sampling and Analysis Summary Report is included as Appendix B.2.

The following is a summary of findings.

3.2.1 Non-Aqueous Phase Liquid

NAPL was detected in soil borings SB-1, SB-2, SB-3, and SB-4 and was noted from 17 to 18 feet bgs (approximately elevation +0.25 to -0.75) at SB-1; from 27 to 30 feet bgs (approximately elevation -13 to -16) at SB-2; from 28 to 31 feet bgs (approximately elevation -13 to -16) at SB-3; and from 23 to 25 feet bgs (approximately elevation -9 to -

11) and 28 to 33 feet bgs (approximately elevation -14 to -19) at SB-4. Based on the soil boring logs, and with the exception of NAPL detected at SB-1, it appears the NAPL accumulations occur at the interface between the black coarse sand and underlying silty clay, and between the silty clay and underlying fine to coarse sand with silt. Drawing C-101 shows the distribution of NAPL impacts and the proposed excavation bottom along Section A-A' of the First Street Turning Basin.

During monitoring well gauging activities, approximately 1.1 and 1.53 feet of dense non-aqueous phase liquid (DNAPL) were measured in MW-4D and MW-27I, respectively.

3.2.2 Soil

A comparison of the reported soil quality to the NYSDEC Restricted-Commercial Use (RCU) Soil Cleanup Objectives (SCOs) indicated the following:

- Various PCBs were reported at concentrations above the RCU SCOs;
- Of the volatile organic compounds (VOCs) and associated tentatively identified compounds (TICs) analyzed, only naphthalene was reported at a concentration above its respective RCU SCO;
- The semi-volatile organic compounds (SVOCs) benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, naphthalene, and phenanthrene were reported at concentrations above the RCU SCOs;
- No pesticides were reported at concentrations above the RCU SCOs; and
- The metals arsenic, barium, cadmium, copper, lead, mercury, and nickel were reported at concentrations above the RCU SCOs.

Toxicity characteristic leaching procedure (TCLP) analyses were completed for VOCs, SVOCs, herbicides, pesticides, and metals, resulting in the following constituents reported as detected above method detection limits:

- VOCs: 2-butanone, benzene, and tetrachloroethene;
- SVOCs: 2-methylphenol, and 3&4-methylphenol; and
- Metals: barium, cadmium, lead, mercury, and nickel.

There were no TCLP detections of herbicides or pesticides. The soil sampling results did not identify any concentrations of TCLP constituents that would result in the materials sampled being characterized as hazardous waste. However, total lead was detected in numerous locations between 1,100 and 4,200 milligrams per kilogram, and additional TCLP testing could reveal the presence hazardous levels of lead.

3.2.3 Groundwater

Groundwater Flow

According to regional groundwater flow, groundwater moves westerly across the Site and discharges to the Canal. However, Site-specific water level measurements do not indicate a westerly sloping potentiometric surface. Site-specific water level observations suggest that Site water levels are influenced by tidal changes in the Canal. Records from the Gowanus Bay station indicate a typical daily tidal range of about 5 feet.

Groundwater Quality

A comparison of the reported water quality to the NYSDEC Ambient Water Quality Standards and Guidance Values (AWQS) indicated the following:

- Various VOCs and SVOCs were reported at concentrations above the AWQS;
- The concentrations of various metals, in both their total and dissolved forms, significantly exceeded the AWQS;
- Aroclor 1242, Aroclor 1254, and total PCBs were reported at concentrations above the AWQS; and
- Chloride and nitrate were reported at concentrations above the AWQS; no other ions or general chemistry parameters were reported at concentrations above the AWQS.

A comparison of the reported water quality results to New York City Department of Environmental Protection (NYCDEP) Limitations for Effluent to Sanitary or Combined Sewers (NYCDEP, 2009) indicate that:

- The permissible effluent limit for naphthalene was exceeded in the samples from monitoring wells MW-3S, MW-3D, MW-4D, and MW-5D;
- The permissible effluent limits for ethylbenzene and toluene were exceeded in the sample from monitoring well MW-4D; and
- The permissible effluent limit for total xylenes was exceeded in the sample from monitoring wells MW-4D and MW-5D.

Except for the exceedances noted above, there were no detections of constituents reported in groundwater above the applicable effluent limit. However, total suspended solids would be expected in untreated groundwater effluent during construction activities.

3.3 Bulkhead Inspection

On May 9, 2017, Moffatt & Nichol of New York, New York performed a detailed visual inspection of the bulkheads along the eastern shore of the Canal at the Site and the properties located immediately north and south of the Site. The purpose of the inspection was to assess and rate the condition of the shoreline, provide structural observations of the bulkheads, characterize the mudline, and document any construction obstructions in support of the design development. The inspection was performed by a diver walking and swimming within a 5- to 10-foot proximity from the shoreline. Approximately 350 feet of the Canal bulkhead line was inspected.

The inspection consisted of three different areas: the earth embankment located at the Site's boundary with the Canal, the 420 Carroll Street timber crib retaining wall located to the north, and the 323 3rd Avenue (the Powerhouse) timber crib retaining wall to the south.

The earth embankment of the Site is not an engineered slope and appears to have been constructed by placing fill material until it reached its natural angle of repose. The surface is littered with stones, concrete debris, trash, and unmaintained vegetation. In general, the embankment appears to be stable and is considered to be in fair condition.

The timber crib walls at 420 Carroll Street and 323 3rd Avenue were in poor condition overall. At the 420 Carroll Street retaining wall, approximately half of the top course of timber beams were missing, allowing for erosion of soil above and behind the wall. The remaining timber elements typically exhibited moderate to severe rot. Where the top course of timber beams were missing, there were voids due to rot on top of the timber beams that were exposed. The upland building, which is located approximately 7 feet away from the bulkhead, was observed to have undermining, approximately 2 to 3 feet in height and 3 feet deep, exposing the foundation.

The timber crib retaining wall at 323 3rd Avenue supports a concrete seawall, which had large voids due to erosion and spalls. This area of severe deterioration extended from the southern extent of the Site to approximately 50 feet south. The observed timber crib elements at 323 3rd Avenue were

in better condition than the timber crib at 420 Carroll Street. The missing timber members at the top of the 323 3rd Avenue retaining structure did not expose the upland fill as seen at 420 Carroll Street, yet did expose the base of the concrete seawall. The remaining timber beams still typically exhibited moderate to severe rot similar to those at 420 Carroll Street. Both bulkheads were observed to return into the Site and appeared to maintain the same type of construction. The bulkheads were only exposed for approximately 10 feet then were buried by the upland fill material. The Bulkhead Inspection Report is included as Appendix B.3.

3.4 Topographic Survey and Multi-Beam Sounding

Topographic survey and multi-beam sounding activities were performed by B.Thayer Associates of Woodbury, New York to support the development of a detailed Site map, illustrating physical surface features and channel characteristics, including channel depths, and potential impediments to construction. The topographic and sounding surveys are included as Appendix B.4.

3.4.1 Topographic Survey

Property research, including a deed search, was performed to determine the property boundaries of the Site. A topographic survey was performed for the Site, plus 25-feet on adjacent properties [with the exception of the property to the south, Block 967, Lot 1 (the Powerhouse)] due to scheduled forthcoming site regrading activities. Either the Powerhouse final grading survey will be imported, or B.Thayer Associates will perform the 25-foot survey following Powerhouse's site regrading activities. The topographic survey was performed as defined in the NYCDDC General Requirement 4.2. The survey includes locations identified from the Geotechnical Exploration, Environmental Sampling and Analysis, and Tree Inventory.

3.4.2 Multi-Beam Sounding (Bathymetry)

On April 27, 2017, a multi-beam sounding survey was performed to provide the location, limits, and description of the existing Canal channel bottom, Canal shorelines and Canal bulkhead lines along the Site area. The multi-beam sounding was performed for an approximate area of 100 feet by 150 feet within the Canal from the centerline of the Site.

A boat and two-person crew, under the direction of an American Congress of Surveying and Mapping certified hydrographer, was used to obtain bottom contours using multi-beam hydrographic technology. In order to maximize the potential coverage, the survey was performed around the time of high water/high tide.

3.5 Tree Inventory

On July 21, 2017, International Society of Arboriculture certified arborists from B.Thayer Associates of Woodbury, New York conducted a tree inventory for the Site. All trees larger than 3-inch diameter at breast height (DBH) that are expected to be within or adjacent to the project limits were tagged with a Tree Tag ID number and inspected individually at ground level, representing a visual analysis as per American National Standards Institute (ANSI) A300 Level 2 standard for tree assessment. The NYC Department of Parks and Recreation "Workbook" format was used as a basis for collecting data.

A total of 18 trees were inventoried. Eastern Cottonwood (*Populus deltoides*), totaling 10, was the dominant tree species found on the project area. There were five White Mulberry (*Morus alba*), two Black Locust (*Robinia pseudoacacia*), and one Tree of Heaven (*Ailanthus altissima*). Overall, the trees assessed were common volunteer species that can grow in poor site conditions. The conditions ratings of each tree concluded that five trees were in good condition, eight trees were in fair condition, and five trees were in poor condition. The Tree Inventory Report is included as Appendix B.5.

3.6 Adjacent Buildings Research and Inspection

3.6.1 Adjacent Building Research and Summary

MRCE completed a search of NYC records and archives for information on the properties adjacent to the proposed construction at the Site. MRCE researched the NYC Department of Buildings (NYCDOB) on-line database and their hardcopy archives, the Topographic Bureau of the Brooklyn Borough President's Office, and the New York Public Library.

3.6.2 Pre-Construction Surveys

The buildings and related visible structures on each property within a 100-foot influence of the Site zone were identified and inspected. The inspections were conducted to better understand the construction, condition, defects (if any), and vulnerabilities of the identified buildings. Survey teams of two engineers visited each building identified for survey and visually inspected and documented visible and accessible portions of the buildings (interior and exterior) through written logs, photographs, and sketches as appropriate. The inspections established existing conditions and included the following:

- 420 Carroll Street (Block 453, Lot 1, 1 building & existing exterior features of the property);
- 312 3rd Avenue (Block 453, Lot 54, 1 building & existing exterior features of the property); and
- 338 3rd Avenue (Block 967, Lot 24, 1 building).

The Adjacent Buildings Research and Inspection Reports are included as Appendix B.6.

4.0 DESIGN CONSTRAINTS

4.1 Debris

Debris removal operations, including potential for sunken vessels buried in the fill and small debris, are expected throughout excavation.

Recommendations for construction activities include the following.

- The Contractor should use a 6-inch grizzly bar to sort debris.
- Odor control will be accomplished with polyethylene covers and the application of long-lasting, odor suppressant foams and odor masking agents/mists.
- All water used to wash debris should be potable. Overspray and mist from the washing also needs to be managed in accordance with Technical Specification 02 51 19 – Excavated Material and Waste Management and the Health and Safety Plan (HASP) to avoid contact with off-site areas. The Contractor may wash debris either on the barge or in a decontamination pad at the Staging Site to provide greater flexibility.
- Wastewater from debris washing should be captured and sent to the on-site water treatment facility, regardless of where the washing occurs (on-barge or at the Staging Site).

4.2 Navigational Requirements

Following excavation, backfilling, and capping of the Site, sufficient underkeel clearance will exist to allow navigation of the anticipated vessels in the Site water channel. There is no promulgated navigation depth for the Site, which is located in the RTA 1. Other vessels operating within the Canal, particularly in RTA 1, will also need to be considered during implementation; information on vessel traffic within the Canal is found in the Fourth Street Turning Basin (TB4) 100% Design Report, Appendix E12 *PD-11: Study of Canal Operations* (TB4 100% Design Report; Geosyntec 2017a).

4.3 Restrictions at Bridges

As provided in the 65% Design Report for the Gowanus Canal Superfund Site (RTA 1 65% Design Report; Geosyntec 2017b) and the TB4 100% Design Report (Geosyntec 2017a), five east-west bridges cross the Canal. From north to south, they are: Union Street, Carroll Street, 3rd Street, 9th Street, and Hamilton Avenue. The Gowanus Expressway and Metropolitan Transit Authority subway trains also pass overhead, co-located with the Hamilton Avenue bridges and the 9th Street Bridge, respectively. Barge access underneath these bridges varies depending on the horizontal and vertical clearance. The following sections address bridge dimensions and restrictions on bridge openings.

4.3.1 Bridge Dimensions

Bridge dimensions, including summary tables for bridge opening widths and overhead clearances, are provided in the calculation package entitled "Restrictions to Navigation Evaluation" submitted with the RTA 1 35% Remedial Design Report (Geosyntec 2016).

4.3.2 Restrictions on Openings

For scheduling bridge openings along the Canal, a two-hour lead time notice to the bridge supervisor is required for the 9th Street, 3rd Street, Carroll Street, and Union Street bridges. The New York City Department of Transportation (NYCDOT) typically does not have crews on standby at these bridge locations and thus requires a lead time to mobilize the crew. The Hamilton Avenue bridges can typically be opened on demand. Bridge openings may be restricted during periods of high street traffic, or during times of elevated

temperatures due to operational issues at higher temperatures (i.e., greater than 90 degrees Fahrenheit). These advanced notice requirements are provided on Drawing G-3 of the RTA 1 65% Remedial Design Report (Geosyntec 2017b).

4.4 Utilities

There are no known cables or utilities within the Site that would restrict excavation, with the exception of the drains associated with 430 Carroll Street (Block 453, Lot 21). The relocation and/or decommissioning of these drains would need to be coordinated by the Responsible Parties before the Contractor's Notice to Proceed.

The Contractor is responsible for notifying the underground facilities protection organization for a Code 753 utility mark-out a minimum of three (3) days prior to any excavation activities. In addition, the Contractor will confirm that all potentially affected utilities are deactivated or otherwise protected prior to any excavation. The Contractor is required to protect against unknown utilities during drilling and excavation activities.

4.5 Support of Excavation/Permanent Bulkheads

The temporary support of excavation (SOE) walls and permanent bulkheads have been designed as cantilever structures, so as not to require the use of external tiebacks or tie-rods anchored to deadmen for lateral support. The use of external bracing would otherwise encroach on adjacent properties and require access agreements with adjacent property owners, which is not desired for this project.

The temporary SOE wall and permanent bulkhead design along the south perimeter considered the future grades planned by the adjacent property owner (the Powerhouse). The design of the walls was based on the proposed grading plan provided by Powerhouse included in Appendix C. All other SOE and bulkhead walls along the other adjacent properties were designed for existing grades and use. Resiliency considerations are not included in the scope of this project and were not evaluated for determining the elevations of the SOE and bulkhead walls.

4.6 Sediment Cap

The base and thickness of the sediment cap for the Site are designed to tie in to the dredge depth and cap thickness measurements for RTA 1, as presented in the 65% Design Report for the Gowanus Canal Superfund Site (Geosyntec 2017b), and as updated based on information provided by EPA in the memorandum titled 1st Street Turning Basin Sediment Cap Treatment Layer Conceptual Design (Appendix A.1). Specifically, the Phase III dredge surface in RTA 1 is an elevation of -15.00 feet, and the cap surface in that same area is -12.50 feet. As such, the dredge surface (bottom) elevation and cap thickness parameters (top of cap) for the Site were designed to meet the elevations of -15.00 and -12.50 feet, respectively, at the confluence with the Canal.

4.7 Methodology for Material Excavation

The results of the Environmental Sampling and Analysis Summary Report (Appendix B.2) slug tests indicated that the hydraulic conductivity of the formation of the Site are in the range typically associated with fine to medium sand (i.e., $2x10^{-2}$ to $9x10^{-5}$ centimeter per second), as summarized in Domenico and Schwartz, 1990.

For excavation to occur "in the dry," groundwater cut-off would be required to reduce drawdown outside the excavation limits and control construction dewatering volume. This would increase the structural design requirements for the excavation support walls for the temporary case during excavation, and requires a bottom cutoff. Excavation "in the dry" would likely have significant additional construction challenges associated with constructing a groundwater cut-off from below the excavation and potentially affect adjacent structures during dewatering.

Performing the excavation "in the wet" will not require construction of a groundwater cut-off below the excavation. Excavation "in the wet" reduces the structural design requirements for the wall during excavation, eliminates the need for a bottom plug and tension elements for resisting buoyancy forces on the bottom plug during excavation and dewatering to final excavation subgrade. However, it makes impacted soil waste separation handling and disposal more complex, and installation of bracing underwater more challenging. The recommended approach in this design report is to excavate the basin "in the wet."

4.8 Post Excavation Elevation and Volume

The excavation elevation surface represents the depth to which material is to be removed. The lateral extent of excavation is defined by the bulkheads. An over-excavation allowance of 6 inches is assumed within the excavation volume calculations (Appendix D) and is based on the limits presented in Construction Drawing C-101 (Appendix E) and the Technical Specifications (Appendix F).

4.9 Environmental Restrictions

4.9.1 Noise

Site- and project-specific control measures will be determined in collaboration with the Contractor prior to the start of construction. EPA will provide lessons learned from the TB4 Pilot Study, which will be considered during evaluation of appropriate noise control measures for the implementation of the project.

4.9.2 Air Emissions and Odor Control

Background air monitoring and community air monitoring will be conducted during all soil disturbing activities. Air monitoring will include VOCs, particulates, and odors, and be performed in accordance with the Community Air Monitoring Plan (CAMP; Appendix G).

The CAMP describes the monitoring activities that will be conducted to detect potential airborne releases of constituents of concern (i.e., VOCs), including dust, during the implementation of remedial activities. The CAMP describes applicable thresholds related to the detection of airborne particulates, chemical concentration, and odor, and a description of, in the event of exceedances, the mitigation and reporting mechanisms associated with daily air monitoring.

4.9.3 Water Quality Monitoring

Water quality monitoring during construction includes installation of remote real time data loggers to record turbidity conditions in the Canal and assess any impacts that may be related to construction. In addition, routine consistent visual observations will be made during the course of construction activities for the presence of sheens or turbidity plumes in the Canal. If any sheens and turbidity plumes are observed, they will be reported to EPA. Water quality monitoring requirements are provided in Technical Specification 01 57 19 – Temporary Environmental Controls (Appendix F).

4.9.4 Operating Hours

Noise-producing work will be performed in accordance with Rules of the City of New York (RCNY) Title 15, Chapter 28: "Citywide Construction Noise Mitigation" and New York City Administrative Code (NYCAC) Title 24, Chapter 2: "Noise Control." Construction may occur between the hours of 7:00 AM and 6:00 PM local time on weekdays, unless authorized in accordance with procedures outlined in RCNY Title 15, Chapter 28. In the event of a noise complaint or specific exceedance, the Contractor will

be required to respond in accordance with RCNY Title 15, Chapter 28 and NYCAC Title 24, Chapter 2.

4.9.5 Security

The Contractor will be responsible for maintaining 24-hour security at the Site to include limiting access to the excavation area as well as any staged or moored heavy equipment or water vessels. Security requirements related to the Contractor's equipment is addressed as part of Technical Specification 31 10 00 – Site Preparation.

5.0 PROJECT DESIGN EXTENTS

The property boundary research for the project topographic survey determined that the Site is not a well-described property, and no deed was identified presenting metes and bounds developed specifically for the Site. Therefore, the property boundary research was performed by compiling various pieces of information obtained. The outcome of the property boundary research was that the Site was determined to be a rectangle with a length of 554.67 feet (along the northern boundary) and a width of 60 feet. However, the 60-foot width presents two key areas to note.

1. The building associated with Block 453, Lot 1, which is to the north of the Site along the Canal, appears to be encroaching onto the Site. There was no identified documentation supporting their encroachment and there may be a conflict concerning this property boundary.
2. Surveys dated 2002 and 2004 provided by Extra Space (the property owner of Block 453, Lot 54), which is to the northeast of the Site, presented their property boundary along the former First Street Turning Basin as "stepping" into the Site rectangle, while a survey performed by NYCDDC dated 2000 presents the Site as a rectangle without the "stepping," suggesting this property boundary as a potential conflict.

To avoid any conflicts with the adjacent property owners and to facilitate implementation of the design, the restoration design will not encroach on adjacent properties and avoid property boundary disputes. Therefore, the restoration for the Site has been defined as a length of 475 linear feet (east – west), as directed in the ROD, from the northwestern corner of the Site adjacent to the Canal. The restoration design width is defined as a maximum of 60 linear feet (north – south) and will follow the identified property boundaries along the southern and northern boundary, with exception of the identified encroachment along the boundary with Block 453, Lot 1, and follow the "stepping" along the property boundary with Block 453, Lot 54. The restoration design extents are shown on Construction Drawing C-101 (Appendix E). Both the 2002 and 2004 surveys provided by Extra Space and the NYCDDC survey dated 2000 are included in Appendix H.

6.0 PROJECT SCOPE

6.1 Health and Safety

An Environmental HASP is provided as Appendix I and details health and safety measures to be implemented when handling contaminated soil and groundwater, in order to protect the public, workers, and the environment during construction. All environmental activities to be performed at the Site will be in full compliance with governmental requirements, including Site and worker safety requirements mandated by Federal Occupational Safety and Health Administration. The HASP has been prepared in accordance with 29 Code of Federal Regulations (CFR) 1910 by a certified health and safety professional.

6.2 Project Support and Environmental Controls

Prior to initiation of intrusive work, the Contractor will mobilize to and prepare the Staging Site located at 450 Carroll Street (see Construction Drawing G-102; Appendix E). In addition, erosion and sediment control (E&SC) measures will be installed as specified in Technical Specification 01 57 13 – Temporary Erosion and Sediment Control and Technical Specification 01 57 19 – Temporary Environmental Controls (Appendix F). Erosion and sediment control best management practices will be implemented for all construction activities where any excavation, staging, loading, capping, or restoration activities will be conducted.

Since direct loading of removed material will be implemented following the dewatering and conditioning of excavated soils, the duration of on-site staging of soils will be limited. The general sequence of actions to control erosion and sedimentation is runoff control, stabilization, and then sediment control. The controls utilized for this project will comply with the requirements set forth in the New York State Standards and Specifications for Erosion and Sediment Control (November 2016).

The E&SC measures anticipated to be used during the described activities include the following:

- Utilization of silt fencing or compost filter socks around the perimeter of the active Site area to reduce the potential for migration of suspended sediments beyond the Site boundary;
- Stabilization of construction access drives and staging areas through the use of stone to prevent erosion; and
- Construction of a vehicle wheel wash station to limit the off-site tracking of Site-related materials.

6.3 Geotechnical Support of Excavation/Permanent Bulkheads

The geotechnical SOE/permanent bulkheads scope of work includes design of the temporary SOE systems and permanent bulkheads for the excavated basin. Various SOE systems were evaluated and summarized in a technical memorandum, dated October 26, 2017, that was submitted to EPA and is included in Appendix A.2.

Additional SOE/bulkhead wall options were evaluated following the initial submission of the Preliminary Design Report (January 2018) in response to EPA comments via e-mail correspondence. These included walls installed using vibration-free methods, such as the press-in method, and drilled-in walls with steel reinforced concrete cores. Construction schedule and constructability issues were evaluated for each method.

Based on the evaluations performed, drilled-in walls appeared most favorable due to constructability concerns with using the press-in method for advancing through buried obstructions and very dense soil strata deep below the ground surface. Drilled-in systems are most effective for drilling through obstructions. The SOE systems will consist of continuously interlocked pipe piles

drilled to depth for the north, east, and south perimeters. A temporary pipe pile wall will be provided at the Canal/basin interface (west perimeter) for the intertidal vegetative shelf and temporary support of the Canal mudline during excavation of the basin. Once the Canal is dredged to the required elevation, the pipe pile wall within the excavated basin width can be cut to the desired elevation to allow an integrated construction of the cap at the Canal/basin interface. The SOE wall at the intertidal vegetative shelf/basin interface will be integrated into the permanent bulkhead structures. The pipe pile interlocks will be treated with sealant to create low-permeability walls that minimize groundwater flow through the sides of the excavated basin. The geotechnical details are discussed further in Section 7.

6.4 Materials Management

Materials management involves the in-situ waste characterization soil sampling and laboratory analyses, the review of soil analytical data, and the characterization of soils as hazardous or non-hazardous to determine the appropriate disposal facilities for excavated material.

As this excavation project will be conducted "in the wet," materials management also involves management and treatment of water drained or decanted from soils following excavation, the separation of any NAPL impacts from the water before returning the water to the excavation, and the segregation of any separated NAPL for appropriate disposal. Materials management details are discussed in more detail in Section 9.

6.5 Sediment Capping Design

Design of the sediment cap includes the selection of appropriate cap materials and capping layer thicknesses to achieve the remediation goals stated in the ROD. Critical design components include interim and final cap surface elevations, and the coordination of the design with the adjacent cap to be installed in the Canal at RTA 1. For the purposes of this 100% Design Report, the elevations for the top of the sediment cap at the mouth of the basin are consistent with those for RTA 1 (to allow for continuation of the cap elevation at RTA 1 throughout the basin). Section 10 presents discussion related to the sediment cap design.

6.6 Ecological Habitat

An intertidal vegetative shelf will be constructed on top of bulkhead walls on the eastern and northern edges of the basin. Final elevations of excavation in this area to facilitate intertidal vegetative shelf creation, cap components similar to those used for the sediment cap within the basin, and final surface elevations and hydraulic conditions are all key components of the intertidal vegetative shelf design. Design considerations and a preliminary description of vegetation that may be installed are included in Section 11.

6.7 Urban Design

A temporary 8-foot-tall steel chain link fence will be installed along the full length of the northern and eastern edges of the basin, protecting the public from the steep drop to the intertidal vegetative shelf. A fence along the southern edge of the basin was deemed unnecessary to include in this project, as a guardrail or a fence has already been incorporated into the Powerhouse design plans. Section 12 presents discussion related to the fence design.

6.8 Construction Quality Assurance

A Construction Quality Assurance Project Plan (CQAPP) with monitoring requirements related to bulkhead construction is included in Appendix J.

7.0 GEOTECHNICAL SUPPORT OF EXCAVATION / PERMANENT BULKHEADS

The basis of geotechnical SOE/permanent bulkhead design for the Site is presented in the following subsections, including applicable codes and standards, SOE methodology, design criteria, and materials of construction.

7.1 Governing Codes and Standards

The strength, serviceability, or quality standards will in no case be less than that required by the governing code. The governing code for the proposed design and construction of the Site is the currently adopted 2014 NYC Construction Codes, including the 2014 NYC Building Code.

7.1.1 Supplemental Codes and Standards

Selected provisions from the following codes are used for the project:

American Society of Civil Engineers (ASCE) 7 Minimum Design Loads for Buildings and Other Structures, 2005 edition except where 2014 NYC Building Code specifically references 2010 edition

- ASCE/Structural Engineering Institute (SEI) 37-14 Design Loads on Structures During Construction; and
- ASCE 24 Flood Resistant Design and Construction.

7.1.2 Codes and Standards for Specific Materials

Design of specific materials is performed in accordance with the standards, codes, and specifications adopted by the governing code, as listed below.

7.1.2.1 All Materials

American Society for Testing and Materials International (ASTM) standards, as referenced by the governing code or other codes, standards, or specifications, are listed herein.

7.1.2.2 Structural Materials

Design of steel elements meets the following codes and standards:

- American Institute of Steel Construction (AISC) - Steel Construction Manual, 14th Edition; and
- American Welding Society (AWS) D1.1 (2004), Structural Welding Code - Steel.

7.1.2.3 Reinforced Concrete

Design of reinforced concrete meets the following codes and standards:

- American Concrete Institute (ACI) 318 (2011), Building Code Requirements for Structural Concrete and Commentary;
- ACI 315-99, Details and Detailing of Concrete Reinforcement; and
- AWS D1.4 (1998), Structural Welding Code - Reinforcing Steel.

7.1.3 References

Design manuals referenced for the geotechnical design codes and standards identified in this section include the following:

- Naval Facilities Engineering Command (NAVFAC) Design Manual DM7.2, Foundations and Earth Structures, 1982; and
- NAVFAC Design Manual DM7.3, Soil Dynamics, Deep Stabilization, and Special Geotechnical Construction, 1983.

7.2 Basis of Design for Support of Excavation/Permanent Bulkheads

Structural and geotechnical requirements for the design of the proposed excavation support structures and permanent bulkheads for the Site are described in the following subsections. Construction Drawings are included in Appendix E.

7.2.1 Support of Excavation

The SOE systems for the excavated basin consist of interlocked steel pipe piles. The SOE walls are designed to facilitate the excavation "in the wet" to reduce the structural requirements for the SOE walls and eliminate project elements that would be necessary, but otherwise challenging, to excavate in a dewatered condition.

The pipe pile walls are designed as cantilever elements to avoid the need for external lateral bracing elements that would otherwise require access agreements with adjacent property owners. The pipe pile walls will be installed using drilling methods to minimize vibrations that would occur from pile driving methods and adversely affect existing adjacent structures. The south SOE wall will require temporary internal bracing near the top during excavation to maintain lateral wall deflections to an acceptable level. The pipe pile walls will be drilled from existing grade. Trenching (excavation) will be conducted as necessary to clear and remove any subsurface obstructions prior to and/or during the installation of the pile walls.

7.2.2 Permanent Bulkheads

The SOE walls along the north, south, east, and intertidal vegetative shelf perimeters will be filled with concrete and integrated into the permanent bulkhead structures for the service conditions. The south wall will consist of 34.5-inch diameter pipe piles reinforced with steel core beams; the north and east walls will consist of 24.5-inch diameter pipe piles; and the intertidal vegetative shelf perimeter will consist of 20-inch diameter pipe piles.

The interlocks for the permanent walls will be treated with a sealant to create low-permeability barriers that minimize groundwater flow through the sides of the basin and prevent migration of pollutants into the Canal. The south bulkhead wall will require a permanent internal brace below the sediment cap to maintain lateral wall deflections to acceptable levels. The permanent brace will span between the south wall and the intertidal vegetative shelf wall.

7.2.3 General Load Combinations

The load combinations listed in Table 7-1 will be used in the design of temporary excavation support structures. Additional load combinations, which may produce a maximum stress condition, will also be considered, as appropriate. Load combinations, which clearly do not govern, will not need to be fully analyzed.

Table 7-1
SOE/Bulkhead Load Combinations

General Combinations
Temporary Excavation Condition:
Earth Pressure + 2' Groundwater Pressure + 600 pounds per square feet (psf) Construction Surcharge
Permanent Condition:
Earth Pressure + 2' Groundwater Pressure + 250 psf Live Load Surcharge
Earth Pressure + 2' Groundwater Pressure + Seismic Earth Pressure

Excavation support systems will be designed to support the full soil, groundwater, and uniform live and construction surcharge loads for all stages of excavation, including bracing installation and removal, as coordinated with the basin excavation. The SOE walls for the permanent bulkheads will also be designed to resist permanent lateral ground forces. Surcharge forces in the permanent condition may consist of a uniform live load, foundation pressures from adjacent buildings, or a combination of both.

7.2.4 Design Methodology

Soil design parameters for temporary excavation support and permanent bulkheads are based on results of the Geotechnical Exploration and are summarized in a memorandum, dated December 4, 2017, included as Appendix A.3.

The subsurface investigation identified the types and extents of the soil strata encountered in the borings and groundwater conditions at the Site. Anticipated lateral soil loads applied to SOE walls, and anticipated passive resistance provided by soil to the SOE walls for the temporary condition, are computed based on soil unit weights and shear strengths provided in the Geotechnical Data Report. Similarly, groundwater pressures on SOE walls are determined from groundwater levels observed during the Geotechnical Exploration.

SOE walls and bracing elements will be designed for forces resulting from the applied loads using either Load and Resistance Factor Design, where a set of factors are applied to the loads for the various load combinations and a different set of factors are applied to reduce material strength, or Allowable Stress Design, where the nominal member strength is divided by a suitable composite safety factor.

7.2.5 Serviceability

In addition to the design requirements in the governing code and specific material codes, additional design requirements to ensure serviceability of the SOE/permanent bulkhead walls will be used. Serviceability of a structure is defined as its ability to behave under load in a manner that does not adversely affect the structure's intended use.

7.2.5.1 Deflection Considerations

Limiting lateral deflection of the SOE/permanent bulkhead wall is critical for limiting ground movements behind the wall and maintaining its ability to behave under load in a manner that does not adversely affect its intended use. Temporary or permanent bracing members will be provided where computed deflections are excessive. For temporarily braced walls, bracing members will be preloaded to a percentage of the design load to limit elastic deformation during excavation, if required.

7.2.5.2 Durability Considerations

Structural elements in a marine environment require special consideration to protect the structure from corrosion and deterioration. Steel elements exposed to brackish waters will require special coatings to deter the start of steel corrosion and extend the structure's durability. The permanent pipe piles will be coated with epoxy to a specified depth below the ground surface or mudline. The design of the pipe piles incorporates 1/16-inch loss of steel thickness for corrosion allowance. Permanent structural steel members embedded in concrete will be galvanized.

Concrete elements will require more concrete cover over the reinforcement than typically provided for structures constructed upland to limit possible structural deterioration for long-term durability. A low-permeability, low water/cementitious ratio, dense concrete combined with pozzolans will be specified to provide protection against sulfate/chloride

attack typically occurring in the marine environment. Reinforcing steel will be epoxy coated.

7.2.6 Seismic Considerations

Seismic soil pressures are computed assuming yielding (flexible wall) conditions using lateral soil coefficients applicable to the designated seismic site class for the Site in accordance with the Governing Code and ASCE 7, as applicable for seismic design. The liquefaction analysis revealed the fill layer and the underlying soil strata are liquefiable below the groundwater table between depths of approximately 11 to 22 feet and 35 to 65 feet bgs. Anticipated soil lateral loads to SOE walls for the seismic case are computed based on soil shear strengths developed from the liquefaction assessment results. The results of the liquefaction assessment are presented in a memorandum, dated December 12, 2017, included as Appendix A.4.

7.2.7 Global Stability

Global stability analyses were performed using Slope/W 2007 software. Analyses were performed using the Spencer method of slices with critical slip surfaces and two-dimensional conditions. Analyses were performed for three different cases: temporary construction, service condition, and seismic condition. The temporary construction case was evaluated in the north to south direction and the south to north direction. The static and seismic were evaluated for the north to south, south to north, and east to west directions.

The stability analyses are summarized in a memorandum, dated December 8, 2017, included as Appendix A.5.

7.3 Materials of Construction

Materials of construction for the geotechnical aspects of the SOE/bulkhead design are described in the following subsections.

7.3.1 Steel

Structural materials will be specified to have the minimum properties listed in Table 6-2.

Table 7-2
Minimum Properties for Structural Metals

Material Type	ASTM Designation
Structural steel W shapes	ASTM A992
Structural steel HP shapes	ASTM A572, Grade 50
Structural steel M, S, C and MC	ASTM A36
Structural steel pipe	ASTM A252
High strength steel bolts	ASTM A325

7.3.2 Concrete

Concrete materials for the geotechnical aspects of the SOE/bulkhead design will be specified to have the minimum properties listed in Table 6-3.

Table 7-3
SOE/Bulkhead Wall Properties

Concrete – Structural	
28-day compressive strength (f'_c)	4,000 to 5,000 pounds per square inch (psi)
Cementitious materials	ASTM C150 Type I or II
Maximum water/cementitious materials	0.40
Air content	4.5% to 7.0%
Unit weight	150 pounds per cubic foot
Reinforcing Steel	
Deformed reinforcing bars	ASTM A615 Grade 60 or 75
Deformed reinforcing bars to be	ASTM A706
Welded wire fabric	ASTM A185

7.4 Protection of Adjacent Structures

Adjacent properties must be protected from damage during construction in accordance with the NYC Building Code. A condition survey of buildings and utilities within the established construction influence zone must be performed prior to the start of construction. A pre-construction condition survey of buildings located within 100 feet of construction was performed in August 2017 (Section 3.6). The surveyed buildings are shown on Figure 7-1 and listed in Table 7-4. The findings were presented in a summary report prepared for each building, dated November 30, 2017, and transmitted under a separate cover (Appendix B.6).

Table 7-4
Pre-Construction Condition Survey of Adjacent Buildings

Building Address	Building Type
312 3rd Avenue	4-Story Steel Frame
420 Carroll Street	1, 2 and 3-Story Masonry
338 3rd Avenue	4-Story Steel Frame

Buildings and structures that are within a distance equal to or less than the maximum excavation depth must be monitored for movement during construction. Requirements for movement and vibration monitoring, including threshold and limiting action levels for implementation during construction, monitoring frequency, and reporting criteria, are detailed in the Construction Drawings (Appendix E) and Technical Specifications (Appendix F).

8.0 EXCAVATION METHODOLOGY

8.1 Excavation Sequence

Excavation activities will include two phases of work. Phase I will include excavation of unsaturated overburden and Phase II will include excavation of saturated silts and sediments. Approximate locations and depths of these materials are described in the Environmental Sampling and Analysis Summary Report (Appendix B.2). Phase I excavation is needed to install the bulkhead supports. Phase II excavation activities will be performed in a series of lifts to the grades, as shown in the Construction Drawings.

Throughout the excavation process, inspections will be performed to ensure that the stability of existing structures adjacent to excavation activities is not compromised.

During Phase I excavation activities, unsaturated overburden material will be transported to scows to be located within the Canal adjacent to the Site. Debris will be separated from overburden material using grizzly bars. Following separation, soil and debris will be transported for off-site disposal via barges.

During Phase II excavation activities, saturated soils and sediment will be transported to drainage pads located on scows, where excess water from the excavated material will be drained into holding tanks and the remaining unsaturated soils will be segregated, characterized, and transported for off-site disposal via barges, in accordance with Technical Specification 02 51 19 – Excavated Material and Waste Management. Potentially impacted water from the saturated soil draining operations will be pumped from holding tanks to a water treatment facility adjacent to the Site in the staging area locations shown on Construction Drawing G-102 and described in Technical Specifications 01 55 29 – Staging Areas and 31 10 00 – Site Preparation. Following the water treatment process, liquid waste will be characterized for off-site disposal. Clean water will be characterized to verify it meets water quality requirements specified in Technical Specification 44 08 40 – Water Treatment System Requirements before discharge to existing stormwater utilities or back to the Basin.

8.2 Equipment

Excavation will be conducted with the use of cranes and/or excavators using various types of attachments, including environmental buckets, grapples, clamshells, and rakes. Equipment requirements are outlined in Technical Specification 31 23 16 – Excavation.

The equipment and methods will be selected by the Contractor based on actual field conditions.

8.3 Operations in Proximity to Sensitive Structures

A portion of the work described herein will be performed adjacent or proximal to certain existing structures and Underground Facilities. Existing information related to the locations of known utilities and structures, as illustrated in the Construction Drawings, was obtained from existing records and is not guaranteed to be correct or complete. As a result, prior to proceeding with excavation, additional Site survey and utility location investigations will be performed to determine the exact location of all existing structures and underground facilities.

Additionally, prior to construction, the Contractor will prepare and submit to the Engineer and utility owners (as applicable), and received acceptance therefrom, a plan describing the Contractor's analysis of the loads to be imparted and the Contractor's proposed measures to protect structures and underground facilities during the project. Additional protective measures will be made in coordination with utility owners to shut off services in active piping and conduits, and for testing, shut-off of services, and draining, purging, or de-energizing where specified or required of piping and conduits of unknown status.

8.4 Backfilling

Backfilling will be needed to provide a consistent surface for capping and in areas where slotted excavation is required to install the permanent bracing below the cap. These trenches will be excavated level and filled with tremie concrete to completely encase the bracing. The bottom elevation of the trenches will be stepped up incrementally starting from the west end of the basin moving east. Additional sand backfill will be required above the tremie concrete encasement to establish the 1% cap subgrade slope. Post-excavation sand backfill will consist of the same material and construction processes used for the sand leveling layer for the cap (Section 10).

8.5 Prevention of Sedimentation of the Restored Turning Basin Following Construction

The Contractor will implement E&SC practices for all construction activities where any excavation, staging, or loading activities are conducted for the duration of the project. The required E&SC primarily consists of runoff control, stabilization, and then sediment control.

Prior to the start of the remedial activities, the Contractor shall construct/install E&SC measures in general accordance with the Construction Drawings and the New York State Standards and Specifications for E&SC. The Engineer will document, through visual observations and inspection logs, that E&SC measures are constructed and being maintained by the Contractor, as required. These control measures shall be maintained as necessary for the duration of the project to prevent sedimentation of previously completed elements of the construction phases.

8.6 Excavation Construction Quality Assurance

A CQAPP has been prepared to detail the quality assurance and quality control (QA/QC) procedures that will be used to maintain data accuracy and completeness during implementation of the selected remedy. This CQAPP describes the materials, procedures, and testing necessary for proper construction, evaluation, and documentation of construction activities. A copy of the CQAPP, with monitoring requirements related to dredging and backfill, is included in Appendix J.

9.0 MATERIALS MANAGEMENT

Material excavated from the Site will include fill (consisting of construction debris, concrete, rebar, and brick), and sand with varying proportions of silt and clay. In-situ characterization of the soils will need to be conducted prior to excavation by the Contractor to meet the to-be-selected disposal facility requirements. The excavated material will be removed from the Site and properly disposed in accordance with Federal, State, and local regulations. Following excavation and prior to off-site transport, excavated material will be temporarily staged to drain excess moisture from the saturated material. The drained water will be treated before returning to the excavation.

A Materials Management Plan (MMP) has been prepared to govern the handling, storage, and disposal of any hazardous and contaminated soil and construction-related spoils encountered, as well as the treatment requirements for any contaminated dewatering fluids (if any). All encountered soil/spoils will be screened for evidence of contamination visually, with a photoionization detector (PID), and for odor. Any identified contaminated soil/spoils would be segregated, sampled in accordance with the proposed receiving disposal facilities requirements, and transported in compliance with applicable laws and regulations to the selected disposal facility. The MMP is included as Appendix K.

Additionally, a separate MMP will be prepared by the Contractor to detail the means and methods of the proposed approach to materials staging and handling. The Contractor's MMP will be subject to review by EPA, and any EPA comments/concerns will be addressed before the Contractor can proceed with construction activities. The EPA review period will be 30 days.

Groundwater will be encountered during the excavation of the Site. Based on earlier Site characterization efforts (described in Section 3.2), the water table may be encountered at an elevation of approximately +2 to +3 feet (between 8 and 15 feet bgs, depending on Site topography). Excavation dewatering will not be implemented as part of the soil removal activities; excavation below the water table will be conducted "in the wet" to the final vertical limits of the excavation.

The following subsections describe proposed soil management, temporary groundwater management/treatment, and temporary controls.

9.1 Soil/Debris Management

In accordance with Technical Specification 02 51 19 – Excavated Material and Waste Management, debris will initially be loaded into material handling scows moored in the Canal. Debris will be separated using grizzly bars or similar screening equipment, and power washed in the scow to remove associated soils. Washed debris will then be staged on-site and prepared for transport to an appropriately regulated disposal facility.

Earlier Site characterization efforts have identified multiple areas of NAPL impacted soil, and laboratory analysis indicated that Site soils are impacted by SVOCs, PCBs, and metals, and that groundwater is impacted by VOCs, SVOCs, PCBs, and metals. It is likely that the water draining from the staged soil will be impacted with NAPL and may be impacted by VOCs, SVOCs, PCBs, and metals.

Due to the generally high permeability of the sandy soils being removed, dewatering of these excavated materials will be conducted by loading the material into barges that will be moored adjacent to the Site. Soils will be decanted on the barges and the water will be conveyed to the on-site water treatment facility. The soils will be conditioned with cement (or lime or kiln dust) or other appropriate material via in-barge mixing to absorb remaining free liquids to facilitate off-site transportation and disposal.

The decanted water will be conveyed through a treatment system before being returned to the excavation, as described in Section 9.2.

As described in the MMP, contaminated soil/spoils will be characterized, conditioned as necessary, and transported off-site for disposal in accordance with Federal, State, and local regulations.

Although some NAPL impacts may be left behind following the prescribed soil excavation requirements, those impacts will be rendered inaccessible and environmentally isolated by the soil/sediment capping system, and therefore, potential NAPL migration from below the cap into the Canal will be reduced or eliminated.

9.1.1 Excavated Soil Disposal

Excavated/dredged sediment from the excavation footprint will be processed to meet acceptance criteria at beneficial use end placement facilities, to the extent practical. As described in the Environmental Sampling and Analysis Summary Report (Appendix B.2), soil samples were collected to establish a preliminary waste characterization evaluation, and a summary of the key findings is provided in Section 3.2.2. Soil sampling results did not identify any constituent concentrations that were indicative of a hazardous waste classification.

Studies conducted at TB4 provide relevant information for soil disposal options because the chemical quality of materials at the Site are generally similar with materials at TB4. Sediment samples were collected throughout the Canal for bench scale dredged material treatability testing as part of PD-10/21 (Geosyntec 2017a). Sample locations coincided with areas of the Canal in which historical analytical data indicated the presence of average to relatively high concentrations of PAHs. TCLP, reactivity, and ignitability testing results indicate that treated dredged material can be considered non-hazardous. During the initial phase of the TB4 Pilot Study, 5% Portland cement addition was adequate to stabilize soft sediment for transportation; draft results of the pH testing indicated that sediment stabilized with 12% Portland cement increased the pH to 12.5 or higher, which is consistent with the pH of cement mixed in water. This increase in pH after stabilization with Portland cement must be considered in developing potential options for beneficial use.

Despite a non-hazardous waste classification, draft analytical bulk sediment results indicated relatively high concentrations of PAHs present in both the soft and native stabilized material from samples collected from the Canal. Although bulk sediment concentrations of VOCs appear to have decreased after stabilization in some instances, volatilization during mixing likely contributed to this observed decrease. Mixing during full-scale operations will likely be less rigorous than mixing performed during PD-10/21, and less VOC loss is expected during mixing. Additionally, Synthetic Precipitation Leaching Procedure (SPLP) results of stabilized material indicate that while addition of Portland cement can limit mobility of metals in the treated sediment, mobility of certain SVOCs and VOCs may potentially increase. The complete treatability test results are included in the PD-10/21 Dredged Material Stabilization and Dewatering Treatability Study Report as provided in Appendix E5 of the 65% Design Report for RTA 1 (Geosyntec 2017b).

The results of the PD-10/21 Treatability Study were shared with thermal treatment and end-placement facilities operating in the New York, New Jersey, and Pennsylvania geographic region to evaluate the potential for these facilities to accept the material. Feedback from the thermal treatment and end-placement facilities is provided in the "Thermal Treatment and Beneficial Use End-Placement Acceptability Evaluation" submitted as an addendum to the PD-10/21 Report. Feedback from thermal treatment facilities suggests that dredged material would potentially be acceptable at Clean Earth, Inc. thermal treatment facilities, should thermal treatment be necessary prior to end-placement for beneficial use. Feedback from beneficial use end-placement facilities

identified a total of nine potential beneficial use end-placement facilities that would accept dredged material from the Canal treated via stabilization/solidification without thermal treatment. Acceptance criteria for thermal treatment and end-placement facilities are provided in the addendum to the PD-10/21 Treatability Study.

As discussed above, the total mass soil quality results and TCLP analyses from soil samples collected at the Site indicate soil/sediment chemical composition that is generally similar to the description of chemical quality for sediment samples collected at TB4. Based on the generally similar quality of materials to be dredged at the Site and the treatability test results from TB4, the Contractor will coordinate with potential beneficial use end-placement facilities regarding the option of accepting dredged material treated via stabilization/solidification without thermal treatment.

9.1.2 On-Site Processing by Contractor

Based on a review of the operating space available at the Staging Site, processing of excavated soil on the Staging Site is not a feasible option. In-barge mixing will be performed by the Contractor to achieve material stabilization suitable for transport. If necessary, the need for additional off-site mixing at a commercial receiving facility will be coordinated with the Contractor and the Responsible Parties, in consultation with EPA. The proposed location will be provided to EPA for EPA review and approval a minimum of 30 days prior to construction mobilization.

All saturated soils will be directly loaded into barges that will be moored adjacent to the Site at a location to be determined by the Contractor in consultation with the Responsible Parties, the Engineer, and EPA. Per Technical Specification 44 08 40 – Water Treatment System Requirements, prior to the initiation of construction, the Contractor will submit a plan depicting planned dredge equipment layout and moorings within RTA 1.

Soils will be decanted on the barges and the water will be conveyed to the on-site wastewater treatment facility. The Contractor will process the soils on-site via in-barge mixing and will develop amending means and methods to achieve adequate stabilization/dewatering. The Contractor is responsible for determining the appropriate percent of Portland cement required to stabilize the Site materials. Based on the similarity in composition between Site materials and those found at TB4, it is anticipated that stabilization will require a minimum of 5% Portland. The Contractor's MMP will include additional information related to the use of Portland for material stabilization, and will discuss plans for the delivery and storage of the amending agent(s) and methods to ensure that dust is not generated during application of the amendment.

Additional details regarding on-site processing of excavated soil is provided in the MMP (Appendix K).

9.1.3 Beneficial Use Options

The most likely beneficial use application for end-placement of dredged material from the Site is daily landfill cover at a Subtitle D landfill. Feedback from end-placement facilities pertaining to Gowanus Canal dredged material indicates that the chemical characteristics of the material are more significant than the physical characteristics in determination of acceptability for use as daily cover, and is unlikely to be a viable option.

9.2 Temporary Groundwater Management/Treatment

This excavation effort will proceed "in the wet." That is, no dewatering of the excavation will be conducted. As noted above, water drained from excavated soil will be returned to the excavation following treatment. The treatment train will consist of the following components:

- A flow equalization tank to remove settable solids;
- An oil/water separator to allow for further gravity separation of settable solids and floatable hydrocarbons and/or other petroleum products. A separation/storage chamber will disperse flow and collect oily solids and sediments;
- Polymer feed and pH adjustment systems;
- Clarifier unit(s) to facilitate settling and flocculation;
- Bag filter units for particulate filtration;
- A granular activated carbon (GAC) tank; and
- A backwash/effluent water tank.

NAPL impacts in the water will be separated from the water and containerized for disposal. There may also be a need to conduct limited pumping to temporarily provide for dry conditions in a localized excavation. If such a need arises, a sump pump will be used to remove water, and the water will be treated prior to being returned to the excavation.

The Contractor will prepare a submittal related to the design, construction, and operation of the water treatment system. This submittal will be subject to review by EPA, and any EPA comments/concerns will be addressed before proceeding with construction activities. The EPA review period will be 30 days. It is anticipated that to accommodate both water decanting from and return of sludge solids to moored scows, the Contractor will use a Flexifloat™ or similar platform ballast system that could be tailored to the dimensional needs of the project as a temporary fixture within the Canal that does not present a navigation obstacle. The system will treat water to comply with the Water Quality Requirements for Permit Equivalency presented in Table 44 08 40-2 of the Technical Specifications appended to the 65% Remedial Design Report for RTA 1 (Geosyntec, 2017b). These limits are modified or further defined based on the Additional Conditions and Footnotes for Table 44 08 40-2.

9.2.1 Decant Water Construction Quality Assurance

A CQAPP with requirements related to water treatment is included in Appendix J.

9.2.2 Decant Water Specifications

The water treatment system requirements are presented in Technical Specification 44 08 40 – Water Treatment System Requirements and included in Appendix F.

10.0 CAPPING DESIGN

In accordance with the ROD, restoration of the excavated area will include the installation of an engineered cap designed to mitigate the potential for migration of NAPL and/or dissolved phase constituents of concern (COCs) into the Site water column, as well as providing a physical barrier to exposure to impacted materials remaining in the excavated area. A cap will be installed across the entire bottom of the excavation area, including across the intertidal vegetative shelf at the Site.

The cap construction requirements are presented in Technical Specification 35 43 00 – Cap Construction (Appendix F).

10.1 Sediment Capping in the Basin

The sediment cap at the Site will connect to that at RTA 1. As discussed in the Environmental Sampling Analysis Summary Report (Appendix B.2), there are NAPL deposits and concentrations of COCs in both pore water and soils that require remediation. Some of these impacts reside at lower elevations, which will not be addressed by excavation, and thus a sediment cap will serve to prevent the migration of dissolved phase COCs and NAPL residuals. As a result, the cap to be installed in the basin will consist of the following functional layers:

- A sand leveling layer to provide a smooth surface for cap installation;
- An active layer comprised of sand mixed with oleophilic clay (OC) and sand mixed with granular activated carbon (GAC) to address remaining NAPL residuals and dissolved phase COCs, respectively;
- A sand isolation layer to provide a physical barrier minimizing the potential for exposure to impacted materials remaining in the excavated area; and
- An articulated concrete block (ACB) armor layer to protect the installed cap from erosion and material loss which may diminish its performance. Note that voids in the armor layer between individual concrete blocks will be filled with a coarse sand/gravel material to provide an ecological habitat suitable for benthic recolonization.

Mixing ratios for the GAC, OC, and sand in the active layer of the sediment cap and sediment and intertidal vegetative/cap layer thicknesses are provided on Construction Drawing C-501 (Appendix E).

The remainder of this section details the preliminary design of the sediment cap and discusses potential implementation methods.

10.1.1 Sediment Capping Extents and Elevations

The sediment cap will be installed over the entire extent of the excavated area in the basin between the western boundary with the Canal. Construction Drawing C-101 (Appendix E) illustrates the plan and profile views for the sediment capping extents and elevations. As shown therein, three types of sediment cap of varying composition and thickness have been designed for placement in the basin.

As discussed in the ROD, the basin sediment cap will be installed to meet the elevation of the adjoining cap in the Canal at RTA 1. At this time, the final top of cap elevation of the basin sediment cap at the confluence with the Canal is anticipated to be an elevation of -12.50 feet, with an excavation elevation of -15.00 feet, to match the elevations anticipated for RTA 1. As excavation proceeds towards the east (from RTA 1), the bottom of excavation dips to an elevation of -16.00 feet to accommodate a thicker treatment layer within the restored turning basin. A grade of approximately +1% will be imparted resulting in a top of cap elevation of -7.22 feet, and excavation elevation of -11.80 feet, at the base

of the bulkhead to be installed at the eastern-end of the restored turning basin. This will result in a -1% percent grade (from east to west) in the final cap surface to minimize sediment accumulation in the basin.

10.1.2 Sediment Cap Placement

Sediment capping is expected to sequentially follow material removal, bulkhead construction, and backfilling as soon as practically feasible to limit potential recontamination from ongoing sources. Sediment cap placement is anticipated to be performed through the water column using conventional heavy equipment (e.g., excavator, cranes) and/or tele-belt based equipment (e.g., stone slinger). Final equipment selection will be made in coordination with the Contractor and after approval by EPA. Although available space is limited in the area around the Site, construction of the cap is anticipated to be coordinated from the Staging Site on shore. Barges or scows may become necessary to facilitate cap placement and the transport/staging of clean construction materials. The Contractor will have flexibility to determine the most appropriate means and methods for constructing the cap, including mixing of sand and amendments, transport of capping materials, and placement of capping materials (treatment layer and armor layer). All details from the Contractor related to the application of cap materials will be submitted for review by EPA, and any EPA comments/concerns will be addressed before proceeding with construction activities. The EPA review period will be 30 days. Excavation elevations and the thickness of each treatment layer will be confirmed as specified in Technical Specification 35 43 00 – Cap Construction (Appendix F) before proceeding to construction of the next layer. If the measurements indicate that the targeted minimum thickness has not been achieved, the deficiency will be corrected.

10.1.3 Performance of Cap

The sediment cap for the Site is designed based on information provided by EPA in the memorandum titled 1st Street Turning Basin Sediment Cap Treatment Layer Conceptual Design Memorandum; Gowanus Canal Superfund Site, Brooklyn, New York (Appendix A.1).

10.1.3.1 Pre-Design Evaluation and Performance Criteria

In support of the cap design, the regional groundwater flow model developed by Geosyntec Consultants was modified to reflect planned remedial enhancements to bulkheading, the removal of native alluvial sediments, and the placement of an engineered cap throughout RTA 1 and the Site. The model was used by Geosyntec to evaluate changes in model-predicted groundwater flux and water levels under both pre- and post-remedy conditions. The model predicted a reduction in groundwater discharge to the Canal, and an increase in groundwater levels adjacent to some parts of the Canal. At the Site, the model predicted that post-remedy groundwater levels will be approximately 4 feet higher than current groundwater levels adjacent to the Site. As designed, the engineered cap will offer treatment capacity for the anticipated flux of contaminants through the bottom of the Site for a design life of 100 years.

A review of the model data found the work presented to be technically sound, and the results of the simulations discussed above were relied upon for the development of the Site Remedial Design.

10.1.3.2 Continued Sources of Contaminated Sediment

Following cap placement, contaminated sediment is expected to continue to enter the Site from various sources [e.g., combined sewer outfalls (CSOs), stormwater flow, runoff from upland sites, and/or sediment and surface water from tidal and storm-driving events],

resulting in contaminated sediment depositing on the surface of the cap. The contaminated sediment may accumulate on the cap and possibly integrate into the cap layers. EPA has stated that they "would require the Responsible Parties to remove any sediment accumulated prior to full implementation of the CSO remedy." (EPA 2016). The Responsible Parties' future removal of accumulated sediments has been accounted for in the armor layer design through the use of ACB mats, which can serve as a demarcation for the Responsible Parties' post-remedy maintenance dredging, as needed.

10.1.4 Treatment Layer

The treatment layer is intended to sequester NAPL and dissolved-phase PAHs migrating from the native sediment through the cap prior to release to the surface water through diffusion and/or advective processes. The treatment layer is designed according to the ROD requirements, to (i) "isolate and prevent the migration of PAHs and residual NAPL from native sediments" in the upper and mid-reaches of the Canal (i.e., RTA 1 and RTA 2); and (ii) "prevent the migration of PAHs from native sediments" in the lower reach of the Canal (i.e., RTA 3) (EPA 2013). The overall process of the cap treatment layer design builds on the work conducted by EPA detailed in the technical memorandum dated February 10, 2015 and titled "Sediment Cap Treatment Layer Analysis" (CH2M Hill 2015).

As stated above, the treatment layer will include a combination of OC to prevent NAPL migration and GAC to sequester dissolved-phase PAHs, each of which will be placed over the extent of the excavation. For the purposes of the Site treatment layer design, the OC and sand layer will be 8 inches thick and combined with the following GAC and sand layer variations:

- Type 1: 16 inches thick and to consist of minimum GAC dosage, by weight, of 44%
- Type 2: 29 inches thick and to consist of minimum GAC dosage, by weight, of 44%
- Type 3: 29 inches thick and to consist of minimum GAC dosage, by weight, of 8%

Additional information related to the treatment layer composition and thickness is illustrated on Construction Drawing C-501 (Appendix E).

10.1.5 Isolation and Filter Layer

An isolation and filter layer will be placed above the treatment layer and will serve as the base for the armoring layer. Benefits of an isolation and filter layer include: (i) limiting impacts to the treatment layer during placement of the armor layer; (ii) promoting benthic recolonization as part of the ecological habitat layer; (iii) reducing loss of treatment layer material during construction; and (iv) limiting deposited sediment from integrating into the treatment layer. For the purposes of this design, the isolation and filter layer was assumed to be 6 inches thick and to consist of a type of sand.

10.1.6 Armor Layer

The armor layer will be placed on top of the isolation and filter layer and is intended to (i) become the new sediment-water interface and (ii) provide physical stability to prevent erosion and/or material loss. The armor layer will consist of appropriately-sized ACBs to withstand tidal erosional forces and vessel traffic, according to ROD requirements. The ACBs to be used will be consistent with the ACBs employed at TB4 and will be proposed by the Contractor and submitted for review by EPA, and any EPA comments/concerns will be addressed before proceeding with construction activities. The EPA review period will be 30 days. In addition, gravel will be placed within the voids of the armor layer to facilitate benthic recolonization as part of the ecological habitat layer, where the ecological habitat

layer consists of both the gravel within the armoring layer and the sand constituting the isolation and filter layer.

10.1.7 Ecological Habitat Layer

Per the ROD, the ecological habitat layer is typically placed on top of the armor layer to fill the voids between stones and help establish sufficient depth of material for facilitating benthic recolonization. The ecological habitat layer will consist of gravel within the voids of the 6-inch thick ACBs and the sand that constitutes the 6-inch thick isolation and filter layer underlying the armor layer. The combined thicknesses of these two layers will provide the recommended ecological habitat layer thickness of 12 inches. The ecological habitat layer will meet ROD requirements for benthic recolonization and account for bioturbation processes, is comparable to several capping projects reviewed, and is within the recommended bioturbation component cap thickness from subaqueous capping guidance (Clarke et al. 2001).

10.2 Intertidal Vegetative Shelf Capping

The intertidal vegetative shelf cap at the Site consist of the following functional layers:

- A low permeability clay mat to address remaining NAPL residuals and dissolved phase COCs;
- A gravel and sand isolation layer to provide a physical barrier minimizing the potential for exposure to impacted materials remaining in the excavated area; and
- A sand planting soil layer to provide a planting medium for intertidal vegetation plantings.

The remainder of this section details the preliminary design of the intertidal vegetative shelf cap and discusses potential implementation methods.

10.2.1 Intertidal Vegetative Shelf Capping Extents and Elevations

The intertidal vegetative shelf cap will be installed behind the northern and eastern bulkheads, creating a shelf with a maximum width of approximately 20 feet. The plan, profile, and detail view of the intertidal vegetative shelf cap are provided on Construction Drawings C-101 and C-501 (Appendix E).

10.2.2 Intertidal Vegetative Shelf Cap Placement

A vegetative shelf cap placement is anticipated to be performed behind the bulkhead walls using conventional heavy equipment. Although available space is limited in the area around the Site, construction of the cap is anticipated to be coordinated from the Staging Site on shore. Barges or scows may become necessary to facilitate cap placement and the transport/staging of clean construction materials. The Contractor will determine the most appropriate means and methods (e.g., material mixing, material placement) for construction of the cap. Excavation elevations and the thickness of each treatment layer will be confirmed and verified using conventional survey equipment before proceeding to construction of the next layer. If the measurements indicate that the targeted minimum thickness has not been achieved, the deficiency will be corrected.

10.3 Cap Placement Construction Quality Assurance

A CQAPP with requirements related to cap placement is included in Appendix J.

11.0 ECOLOGICAL HABITAT

Restoration of the basin will seek to merge green infrastructure and active design principles while maintaining consistency with the surrounding developed area and enhancing the local ecology through use of natural and green infrastructure concepts. To that end, an approximately 20-foot wide intertidal vegetative shelf will be constructed along the eastern and northern edges of the restored turning basin (Construction Drawing C-101; Appendix E).

11.1 Vegetative Shelf Capping

To facilitate construction of the intertidal vegetative shelf, an interior bulkhead wall will be installed approximately 20 feet away from the eastern and northern boundaries of the Site to separate the intertidal vegetative shelf area from the main basin. Details of the wall installation are discussed in Section 7. Behind this bulkhead wall (i.e., landward of the restored extent of the turning basin), the existing materials will be excavated to an approximate elevation of -3.07 feet to allow for installation of the cap (discussed in Section 10), as well as other materials (e.g., jute matting, plantings) needed for the construction of the intertidal vegetative shelf.

The area intended for the construction of the intertidal vegetative shelf has similar environmental conditions as the remainder of the Site, and as a result requires installation of a sediment cap.

As part of the cap in this area, a minimum of a 15-inch thick layer of planting soil will be installed over a 12-inch sand layer, a 12-inch gravel drainage layer to support establishment of the overlying intertidal vegetative area and provide benthic habitat, and 6-inch low permeability clay mats. The final elevation of the topsoil adjacent to the seaward bulkhead wall (i.e., immediately adjacent to the basin) will be +0.70 feet to allow for the intertidal vegetative shelf to be inundated during high tide and above the water elevation during low tide. Weep holes will be located in the bulkhead just above the mean low water line to allow the intertidal vegetative shelf to drain during low tide. Prior to vegetation planting, the finished surface of the intertidal vegetative shelf will be graded at an approximate 10:1 (Horizontal:Vertical) or 10% slope downward from the upland retaining wall towards the turning basin water channel to promote drainage and a more diverse habitat.

11.2 Vegetation

The design of the intertidal vegetative shelf includes development of a multi-zoned intertidal vegetation area with plant species native to the New York/New Jersey area. Representative plant species include the following.

11.2.1 Low Salt Marsh

The low salt marsh, part of the intertidal vegetative shelf between mean low tide and mean high tide, will be dominated by a monoculture of smooth cordgrass (*Spartina alterniflora*), which can exist in both tall and short forms (i.e., large tidal ranges are often dominated by the tall form and restricted tidal ranges will be dominated by the short form).

11.2.2 High Salt Marsh

The high salt marsh, at the high end of the intertidal vegetative shelf, is part of the intertidal area between mean high tide and spring high tide, and is periodically flooded by spring tides and flood tides. Given this infrequent inundation by tides, the floral diversity of this community increases in comparison to the low salt marsh community. Dominant species will include saltmeadow cordgrass (*Spartina patens*) and saltgrass (*Distichlis spicata*).

12.0 URBAN DESIGN

12.1 Fence

A temporary steel chain link fence will be installed along the full length of the northern and eastern edges of the basin, protecting the public from the steep drop to the intertidal vegetative shelf. Fence posts will be embedded into the concrete pile cap at 6-foot, 9-inch intervals. To allow for easier planting access, infill chain link will be installed following the planting of the intertidal vegetative shelf. The fence will reach a minimum of 8 feet above the walking surface of the adjacent property and will step up in 12-inch intervals, following the elevation of the concrete cap.

A fence along the southern edge of the basin was deemed unnecessary to include in this project, as a guardrail or fence has already been incorporated into the Powerhouse design plans.

13.0 ARCHAEOLOGICAL MONITORING

Archaeological monitoring was performed during the excavation of the Geotechnical Exploration test pits and the 30% Field Activity Reports described in Section 3 were reviewed for archaeological sensitive information (particularly Geotechnical Exploration, Environmental Sampling and Analysis, and Bulkhead Inspection).

All archaeological work followed the rules and regulations established by Section 106 of the National Historic Preservation Act, 36 CFR 800—Protection of Historic Properties, and was undertaken in keeping with the current guidelines of State Historic Preservation Officers (SHPO), NYC Landmarks Preservation Commission (LPC), and the New York Archaeological Council (NYAC). The State and National Register of Historic Places (S/NR)-eligible Gowanus Canal Bulkhead and potential sunken ships were the primary focus of this monitoring. Since the entirety of the basin is sensitive, a field archaeologist was present to monitor all excavation activities (Geotechnical Exploration test pit excavation).

An Archaeological Sensitivity Study for the Canal specifically identified two classes of "sites of potential archaeological interest": sites with a "very low to low" likelihood of being intact and sites with a "greater certainty" of being intact (Hunter Research, Inc. 2011). According to the study, the *Sites of Low Archaeological Potential* located in the general vicinity of the basin consist of the following.

- *Prehistoric Archaeological Potential*: An area of prehistoric archaeological sensitivity was identified in the vicinity of the Canal between Douglass Street and 3rd Street.
- *Tide Mill Complex Sensitivity*: This complex was located on the east side of the Canal between Sackett Street and 3rd Street.
- *Revolutionary War Burial Sensitivity*: Two potential sites of Revolutionary War burials have been identified, one on the east side of the Canal between 1st and 3rd Streets and the second in the vicinity of 7th Street and 8th Street on 3rd Avenue, approximately 500 feet east of the Canal.

The *Sites of High Archaeological Potential* identified in the study consist of:

- *Canal Bulkhead Sensitivity*: The Canal's bulkheads and associated cribbing and fill extend the entire length of the approximately 2-mile Canal, including the former basin.
- *Sunken Ship Sensitivity*: At least four sunken ships have been identified within the Canal and there is a potential that additional ship hulls have survived within the former basin fill.

Based on the monitoring and review of the 30% Field Activity Reports, the First Street Turning Basin retains its sensitivity for the presence of historic ship hulls and structural components of the Canal itself, such as the bulkhead. However, the soils used to fill in the basin to a depth of approximately 8 to 13 feet bgs have little to no archaeological sensitivity.

The Archaeological Monitoring Report recommended monitoring occur during implementation of the remedy to document any buried ship hulls present on the bottom of the filled-in basin. Additionally, due to the poor condition of a portion of bulkhead observed within the basin during this monitoring effort and its similarity to extant bulkheads to the north and south of the basin along the Canal, consultation with SHPO and LPC is recommended, which will be led by EPA to determine the need for documentation and relevant research questions. The extent of archaeological monitoring during construction will be agreed upon between SHPO, LPC, and EPA. The Archaeological Monitoring Report is included as Appendix L.

14.0 IMPLEMENTATION AND POST IMPLEMENTATION

14.1 Implementation

14.1.1 Estimated Construction Schedule

The major tasks and general sequence of construction for the project include:

- Prepare Staging Site and install facilities to support work;
- Install SOE / bulkhead;
- Perform excavation;
- Manage and transport excavated material;
- Install permanent bracing;
- Install capping materials;
- Install fence posts;
- Plant intertidal vegetation within shelf;
- Install chain link fence infill; and
- Implement air, noise, odor, and water quality control measures as required to meet environmental monitoring action levels.

An estimated construction schedule, presented as a Gantt Chart schedule (i.e., scheduling chart) and the associated assumptions, is provided as Appendix M.

Preliminary and final construction schedules will be provided by the Contractor following procurement and award. These schedules will provide specific information on the durations associated with bulkhead installation, excavation, capping, and planting, and must, at a minimum, meet the construction schedule durations specified in this Design Report. A more compressed schedule is acceptable.

14.1.2 Conformance with EPA Clean and Green Policy

The design and implementation will incorporate green remediation practices, including the principles found in the EPA Region 2 Clean and Green Policy on green remediation (2009). The goal of the EPA Region 2 Clean and Green Policy is to enhance the environmental benefits of Superfund cleanups by promoting technologies and practices that are sustainable (EPA 2009). Identified green technologies will be incorporated into the design specifications for implementation by the Contractor. Potential opportunities for incorporation include:

- Use of green concrete in support of construction and/or restoration;
- Use of low-impact development technology in temporary construction areas;
- Use of clean diesel fuels in construction equipment and trucks; and
- Opportunities to enhance habitat during restoration.

Throughout all phases of the design effort, the design team will assess green remediation opportunities.

14.1.3 Regulatory Requirements and Approvals

The Order gives EPA authority to supersede all formal Federal, State, and local permitting and environmental review requirements for the implementation of this project. However,

documentation would still be prepared that outlines equivalent permit requirements and conditions to demonstrate substantive compliance with the applicable rules, regulations, and the means by which compliance with each will be achieved by this design and recorded during implementation. For example, formal wetland/bulkhead permits from NYSDEC and the United States Army Corps of Engineers would not be necessary. An outline describing the applicable regulatory requirements and associated compliance is provided in the attached Table 14-1.

Similarly, formal environmental review requirements under the National Environmental Policy Act, New York State Environmental Quality Review Act, and New York City Environmental Quality Review (CEQR) would not be required, although technical studies normally conducted under CEQR will be completed for the project, with some of the more critical areas including cultural/archaeological resources, traffic, hazardous materials, and construction impacts. In addition, the implementation of the design will be performed with consistency to applicable requirements for relevant City agencies (e.g., NYCDEP, NYCDOT, NYCDOB, etc.).

14.1.4 Protection of the Public, Workers, and the Environment

During implementation of the design, governing plans, such as the HASP (Appendix I), CAMP (Appendix G), and MMP (Appendix K), will detail health and safety measures and best management practices to be implemented during the handling of contaminated soil and groundwater. The governing plans are provided as appendices to this 100% Design Report.

14.1.5 Photographic Documentation

Requirements for photographic documentation will be included in Technical Specification 01 32 00 – Construction Progress Documentation (Appendix F).

14.2 Post-Implementation

An Operations Maintenance and Monitoring Plan (OM&MP) is provided as Appendix N and specifies the maintenance requirements for the Site following completion of construction. The OM&MP covers activities related to the sediment and intertidal vegetative shelf caps and provides a description of required maintenance of the permanent bulkheads, as well as monitoring of the sediment cap, the intertidal vegetative shelf cap, and the vegetation associated with the intertidal vegetative shelf area.

15.0 LIMITATIONS

This document was prepared in accordance with professional standards at the time the services were performed and in accordance with the contract between NYCDDC and AKRF/KSE-JV dated August 14, 2015. This document is governed by the specific scope of work authorized by NYCDDC; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work.

16.0 REFERENCES

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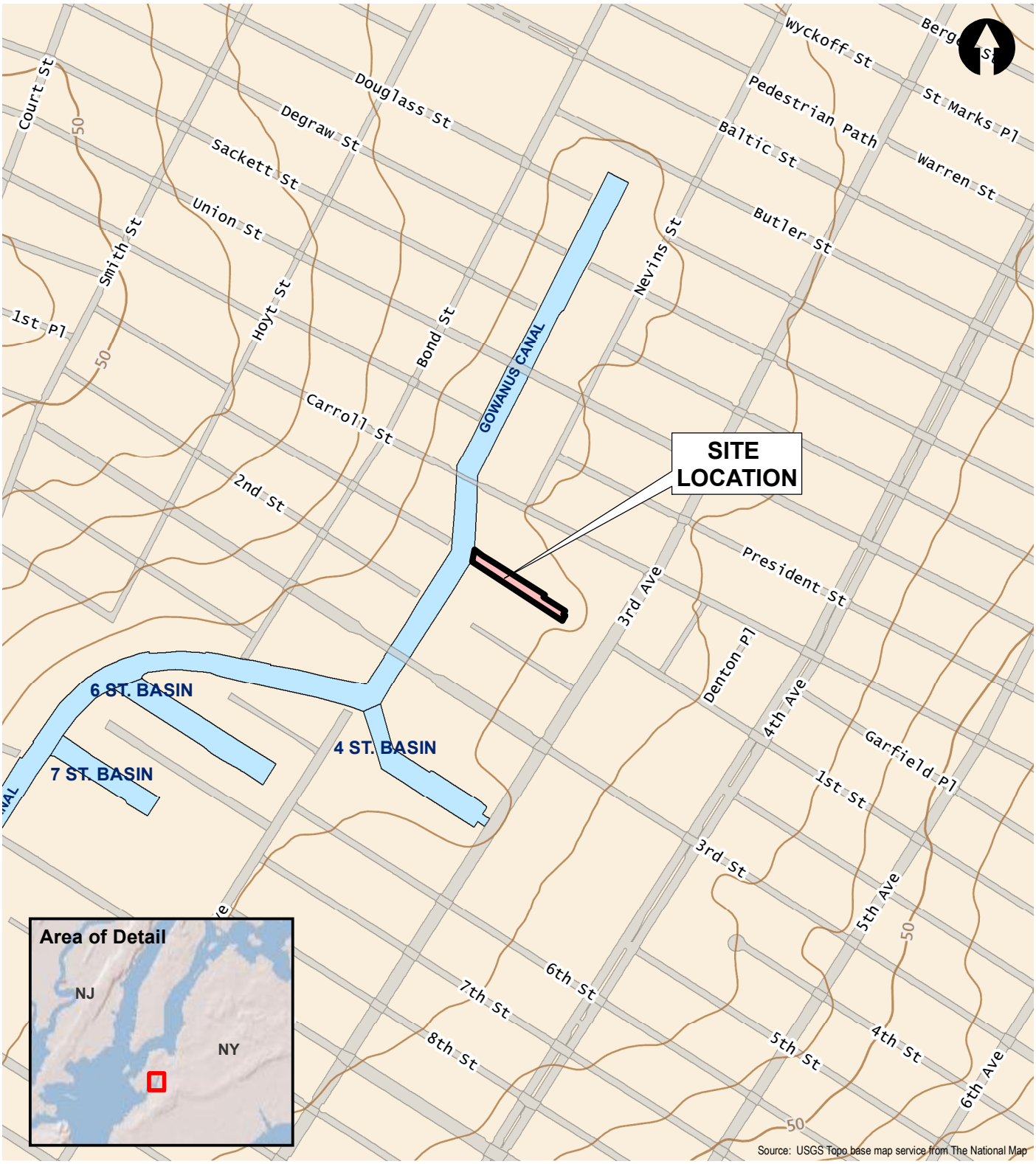
FIGURES



CAPITAL PROJECT: PW77GOWAN
PRELIMINARY AND FINAL DESIGN SERVICES
FOR EXCAVATION AND CAPPING OF FILLED
FIRST STREET TURNING BASIN GOWANUS CANAL

Privileged & Confidential - Prepared at the Request of Legal Counsel

0 800 1,600 Feet

FIRST STREET TURNING BASIN - GOWANUS CANAL
Brooklyn, New York

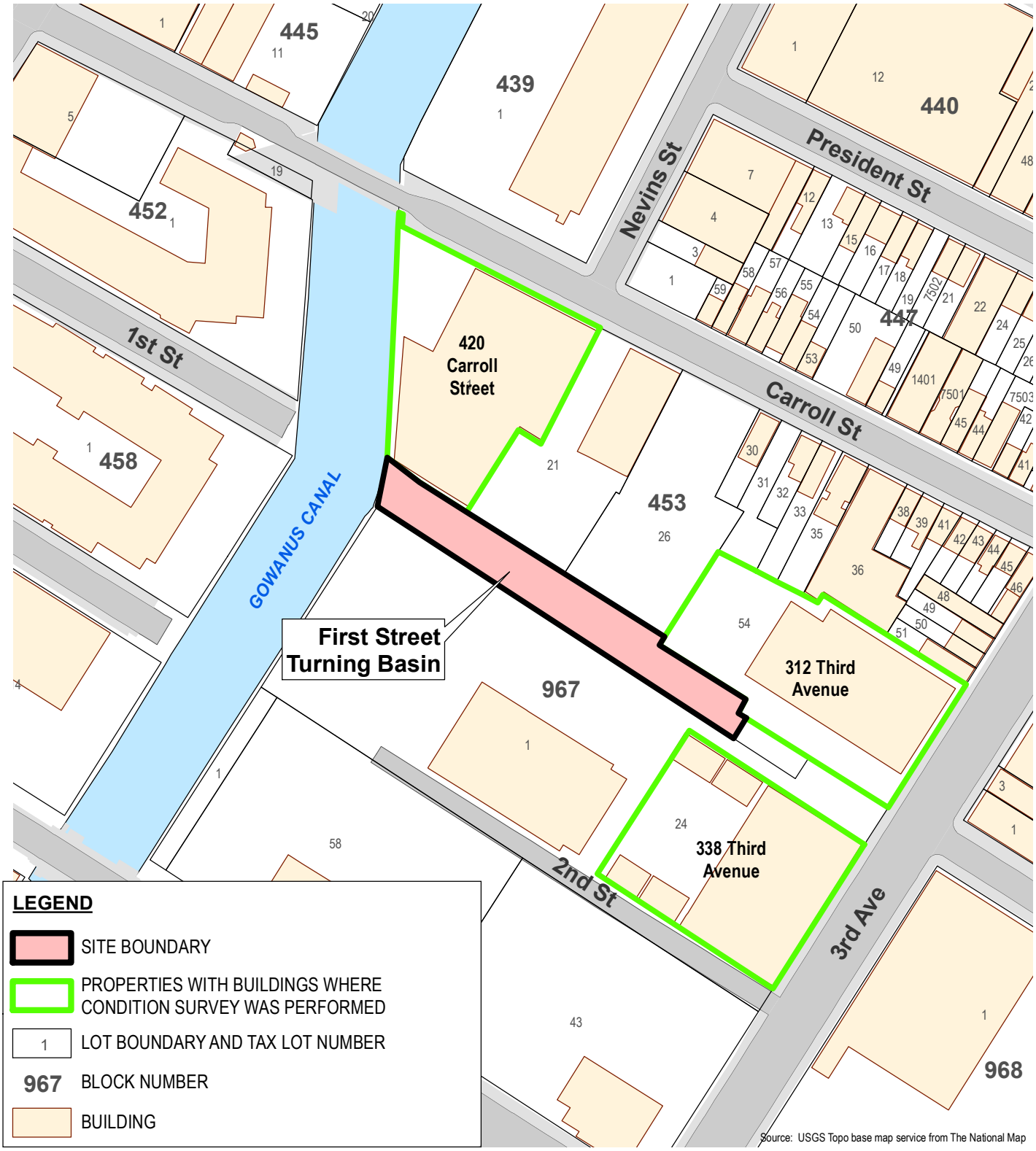
SITE LOCATION

AKRF | KSE
The AKRF-KSE JV

DATE
12/11/2018

PROJECT No.
80468

FIGURE
1-1



CAPITAL PROJECT: PW77GOWAN
PRELIMINARY AND FINAL DESIGN SERVICES
FOR EXCAVATION AND CAPPING OF FILLED
FIRST STREET TURNING BASIN GOWANUS CANAL

FIRST STREET TURNING BASIN - GOWANUS CANAL
Brooklyn, New York

CONDITION SURVEY LOCATION PLAN

The AKRF-KSE JV

DATE
4/9/2019

PROJECT No.
80468

FIGURE
7-1

TABLE

Table 14-1
Key Applicable or Relevant and Appropriate Requirements (ARARs)
Excavation and Capping of the Filled First Street Turning Basin
Gowanus Canal, Brooklyn, New York

Regulation	Citation	Description	Means by which ARAR will be Addressed
Chemical Specific ARARs			
Clean Water Act [Federal Water Pollution Control Act, as amended] Toxic Pollutant Effluent Standards	33 USC Parts 1251-1387 40 CFR Part 129	Parts 1251-1387 establish pollutant effluent standards for multiple constituents including: aldrin/dieldrin, DDT, endrin, toxaphene, benzidene, and polychlorinated biphenyls (PCBs). Part 129 applies to direct discharge to surface water of treatment system effluent. Must comply with substantive requirements (effluent standards) of a State Pollutant Discharge Elimination System (SPDES) permit.	There is no practical alternative to the approved remediation with less adverse impacts to the subject waterway. A Materials Management Plan and a Water Treatment System Plan (included in the 100% Design Report), all of which include details related to the means by which water quality standards will be maintained, will be submitted for EPA comment and approval. Decant water generated during excavated materials handling activities will be maintained within lined staging areas, or within a lined scow, before preparation for water treatment. In coordination with the Contractor, the water treatment system will achieve water quality standards in accordance with local regulations and demonstrable water quality effluent standards. At no time will decant water, or other water that may come into contact with impacted materials, be discharged to surface water without first passing through the water treatment system. A Quality Assurance Project Plan and a Water Quality Control Plan will be submitted for EPA comment and approval, which will include provisions for water quality monitoring and water treatment system performance standards.
Federal Water Quality Standards	40 CFR Part 131	Establishes the requirements for states and local agencies to review, revise, and adopt water quality standards. It also establishes the procedures for United States Environmental Protection Agency (EPA) to review, approve, disapprove and promulgate water quality standards pursuant to section 303 (c) of the Clean Water Act. States are granted enforcement jurisdiction over direct discharges and may adopt reasonable standards to protect or enhance the uses and qualities of surface water bodies in the state. Substantive requirements are applicable to direct discharge of treatment system effluent.	
Use and Protection of Waters and Water Quality Certifications	6 NYCRR Part 608	Requires that construction or operation of facilities that may discharge to navigable waters demonstrate compliance with Clean Water Act (CWA) Parts 301–303, 306, and 307, and 6 NYCRR Parts 751.2 (prohibited discharges) and 754.1 (effluent prohibitions; effluent limitations and water quality-related effluent limitations; pre-treatment standards; standards of performance for new sources).	
New York State Surface Water and Groundwater Quality Standards	6 NYCRR Part 703	Establishes surface water and groundwater quality standards and groundwater effluent limitations. The turbidity standard is non-numeric: No increase that will cause a substantial visible contrast to natural conditions. The suspended, colloidal, and settleable solids standard is nonnumeric: None from sewage, industrial wastes or other wastes that will cause deposition or impair the waters for their best usages.	

Table 14-1
Key Applicable or Relevant and Appropriate Requirements (ARARs)
Excavation and Capping of the Filled First Street Turning Basin
Gowanus Canal, Brooklyn, New York

Regulation	Citation	Description	Means by which ARAR will be Addressed
Action Specific ARARs			
Clean Water Act [Federal Water Pollution Control Act, as amended]	Section 404(c) of the Clean Water Act; 33 USC Part 1344; 40 CFR Part 231; 33 CFR Parts 320-329	These regulations apply to all existing, proposed, or potential disposal sites for discharges of dredged or fill materials into U.S. waters, including wetlands. Includes special policies, practices, and procedures to be followed by the United States Army Corps of Engineers (USACE) in connection with the review of applications for permits to authorize the discharge of dredged or fill material into waters of the U.S., pursuant to Section 404 of the Clean Water Act. The USACE and EPA regard the use of mechanized earth-moving equipment to conduct earthmoving activity in waters of the U.S. as resulting in a discharge of dredged material unless project-specific evidence shows that the activity results in only incidental fallback. Any proposed discharge must avoid, to the fullest extent practicable, adverse effects, especially on aquatic ecosystems.	Though actual discharge of dredged material back into the Canal is not anticipated, requirements apply to dredging and capping. Substantive requirements are likely to include measures to minimize re-suspension of sediments and erosion of sediments during excavation (i.e., measures to avoid adverse effects, especially on aquatic ecosystems, to the fullest extent practicable).
United States Department of Transportation (USDOT) Placarding and Handling	49 CFR Part 171	Provides transportation and handling requirements for materials containing PCBs.	A Materials Management Plan, a Waste Management Work Plan, and a Transport Plan will be developed in coordination with the Contractor and submitted to EPA for comment and approval. All transport of materials for disposal will be performed by licensed and insured transport contractors who will be obligated to comply with all applicable regulations regarding ground transport.
Occupational Safety and Health Act (OSHA)	29 CFR 1904, 1910, and 1926	Specifies minimum requirements to maintain worker health and safety, including training and construction safety requirements.	In coordination with the Contractor, a Health and Safety Plan (HASP) governing the performance of all on-site activities will be developed and submitted to EPA for comment and approval. The HASP will be maintained on-site. The Contractor and any other on-site personnel will be made familiar with the HASP and daily safety briefings will be performed. All on-site personnel will have, at a minimum, received an OSHA 40-hour training certificate.

Table 14-1
Key Applicable or Relevant and Appropriate Requirements (ARARs)
Excavation and Capping of the Filled First Street Turning Basin
Gowanus Canal, Brooklyn, New York

Regulation	Citation	Description	Means by which ARAR will be Addressed
Action Specific ARARs (continued)			
Clean Air Act	42 USC Parts 7401-7671q; 40 CFR Parts 50, 51 and 52	Specifies requirements for air emissions such as particulates, sulfur dioxide, volatile organic compounds (VOCs), hazardous air pollutants, and asbestos.	Particulates are not likely to be generated during excavation but may be observed during material handling and or cap placement activities. A Community Air Monitoring Plan (CAMP) has been developed with the 100% Design Report and a Construction Air Emissions and Odor Control Plan, and Dust Control Plan will be developed in coordination with the Contractor and submitted to EPA for comment and approval. Best management practices for dust, vapor, and odor control will be used, as needed, during remedial activities.
Rivers and Harbors Act (Section 10)	33 USC Part 403; 33 CFR Parts 320, 321 and 322	Prohibits unauthorized obstruction or alteration of any navigable water in the U.S. (dredging, fill, cofferdams, piers, etc.). USACE approval is generally required to excavate or fill, or to alter or modify in any manner the course, location, condition, or capacity of the channel of any navigable water of the U.S.	There is no practical alternative to the approved remediation with less adverse impacts to the subject waterway. Although the approved remedy creates a new open and navigable waterway, all construction practices will be performed in compliance with all applicable regulations. Applicable to remedial activities that include dredging, capping, and/or pier-type ice control structures.
Use and Protection of Waters	New York State ECL Article 15, Title 5; Article 17, Title 3; 6 NYCRR Part 608	A permit is required to change, modify, or disturb any protected stream, its bed or banks, or remove from its bed or banks sand or gravel or any other material; or to excavate or place fill in any of the navigable waters of the state. Any applicant for a federal license or permit to conduct any activity which may result in any discharge into navigable waters must obtain a State Water Quality Certification under Section 401 of the Federal Water Pollution Control Act, 33 USC Part 1341. In accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Sections 121(d)(2) and 121(e), neither a permit nor a water quality certification is required for on-site CERCLA response actions, although such actions would comply with substantive requirements of 6 NYCRR Part 608.	
National Pollutant Discharge Elimination System	40 CFR Part 122	Requires the development and implementation of a Stormwater Pollution Prevention Plan or a Stormwater Best Management Plan. Also outlines monitoring and reporting requirement for a variety of facilities.	As part of the Site Preparation Work Plan, a Site-specific Erosion and Sedimentation Control Plan will be developed in coordination with the Contractor and submitted to EPA for comment and approval. Best management practices (e.g., stormwater retention, silt fences) will be in place for the duration of construction activities.

Table 14-1
Key Applicable or Relevant and Appropriate Requirements (ARARs)
Excavation and Capping of the Filled First Street Turning Basin
Gowanus Canal, Brooklyn, New York

Regulation	Citation	Description	Means by which ARAR will be Addressed
Action Specific ARARs (continued)			
New York State Pollution Discharge Elimination System (SPDES)	6 NYCRR Parts 750 – 758	No person shall discharge or cause a discharge to New York State waters of any pollutant without a permit under the SPDES program. In accordance with CERCLA Section 121(e), a permit is not required for on-site CERCLA response actions, although on-site CERCLA response actions would comply with substantive requirements of 6 NYCRR Parts 750 - 758.	There is no practical alternative to the approved remediation with less adverse impacts to the subject waterway. A Materials Management Plan, Waste Management Work Plan, and Water Treatment System Plan will all be developed in coordination with the Contractor for EPA comment and approval. The water treatment system, also developed in coordination with the Contractor, will achieve water quality standards in accordance with local regulations and demonstrable water quality effluent standards. At no time will decant water, or other water that may come into contact with impacted materials, be discharged to surface water without first passing through the water treatment system. Best management practices (e.g., stormwater retention, silt fences/curtains) selected to control the loss and transport of Site-related materials will be in place for the duration of construction activities. A Quality Assurance Project Plan and a Water Quality Control Plan will be submitted for EPA comment and approval, which will include provisions for water quality monitoring and water treatment system performance standards.
Surface Water Regulations	New York ECL Part 17-0501 and 17-0301; 6 NYCRR Parts 701 and 703	Establishes that it is unlawful for any person, directly or indirectly, to throw, drain, run or otherwise discharge into surface water waters organic or inorganic matter that shall cause or contribute to a condition in contravention of applicable standards adopted by the New York State Department of Environmental Conservation (NYSDEC), pursuant to ECL Part 17-0301.	
Fish and Wildlife Management Practices Cooperative Program - Polluting Streams Prohibited	New York ECL Part 11-0503	Establishes that no deleterious or poisonous substances shall be thrown or allowed to run into any public or private waters in quantities injurious to fish life, protected wildlife, or waterfowl inhabiting those waters, or injurious to the propagation of fish, protected wildlife, or waterfowl therein.	
Air Pollution Control Law	New York State ECL, Article 19, Title 3. Promulgated pursuant to the Federal Clean Air Act, 42 USC Part 7401	Establishes that the emission of air contaminants to the outside atmosphere that may jeopardize human, plant, or animal life, or are ruinous to property, or which unreasonably interfere with the comfortable enjoyment of life or property, is prohibited (6 NYCRR 211.2). New York State Air Quality Standards are promulgated at 6 NYCRR Part 257.	Particulates are not likely to be generated during dredging. Particulates may be generated during material handling and fill placement activities. Best available practices, as needed, will be used to control particulates during remedial activities. A Dust Control Plan will be developed and coordinated with the Contractor and submitted to EPA for comment and approval. The Dust Control Plan will minimize the potential for particulate generation.

Table 14-1
Key Applicable or Relevant and Appropriate Requirements (ARARs)
Excavation and Capping of the Filled First Street Turning Basin
Gowanus Canal, Brooklyn, New York

Regulation	Citation	Description	Means by which ARAR will be Addressed
Location Specific ARARs			
National Historical Preservation Act ARAR. Applicable	16 USC § 470 & 661 et seq.; 36 CFR Part 65; 36 CFR Part 800	Establishes procedures to provide for preservation of scientific, historical, and archaeological data that might be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity or program. If scientific, historical, or archaeological artifacts are discovered at a site, work in the area of the site affected by such discovery will be halted pending the completion of any data recovery and preservation activities required pursuant to the Act and its implementing regulations.	An archaeological and historic survey has been performed, and there are no known resources requiring consideration or protection. However, if scientific, historic, or archaeological artifacts are identified during implementation of the remedy, modifications to the design and construction practices will be implemented to manage such artifacts, in coordination with the with the New York State Historic Preservation Office (SHPO).
Federal Coastal Zone Management Act Coastal Zone Management	Part 307 156 CFR 930.30 16 USC §§ 1451- 1465; 15 CFR Parts 923 and 930	The Act is administered by National Oceanic and Atmospheric Administration (NOAA) and provides for management of the nation's coastal resources, to "preserve, protect, develop, and where possible, to restore or enhance the resources of the nation's coastal zone." Establishes that federal agencies that conduct or support activities that directly affect a coastal use or resource must undertake those activities in a manner that is consistent, to the maximum extent practicable, with state coastal zone management programs that have been approved by the NOAA.	There is no practical alternative to the approved remediation with less adverse impacts to the subject waterway. Implementation of the approved remedy will create new coastal areas and enriched public resources.
Fish and Wildlife Coordination Act	16 USC §§ 622	Whenever the waters of any stream or other body of water are proposed or authorized to be impounded, diverted, the channel deepened, or the stream or other body of water otherwise controlled or modified for any purpose, by any department or agency of the United States, such department or agency first shall consult with the United States Fish and Wildlife Service, Department of the Interior, and with the head of the agency exercising administration over the wildlife resources of the particular state in which the impoundment, diversion, or other control facility is to be constructed, with a view to the conservation of wildlife resources by preventing loss of and damage to such resources.	There is no practical alternative to the approved remediation with less adverse impacts to the subject waterway. Implementation of the approved remedy will be done in accordance with best management practices associated with erosion and sediment transport, environmental controls, and sound construction methods to minimize the potential for unwarranted destruction or degradation of existing biohabitat outside the footprint of the approved remedy. Implementation of the approved remedy will result in the creation of new and/or improved biohabitat.

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Gowanus Canal, Brooklyn, New York

Regulation	Citation	Description	Means by which ARAR will be Addressed
Location Specific ARARs (continued)			
NYC Department of Small Business Services (DSBS)	Waterfront Work Permit	The agency administers the permit application approval process for NYC Department of Buildings for waterfront projects. Construction cannot proceed without a DSBS work permit.	A permit application must be filed with DSBS for approval demonstrating compliance with the applicable sections of the NYC Building Code including signed and sealed contract drawings, applicable TR Forms, PW1, PW3, PC1, POC1 and contractor work plan and insurance. The Contractor will coordinate with the EPA to satisfy this requirement by filing the requisite work permit application or satisfying the permit equivalency requirement.