

APPENDIX N
OPERATIONS MAINTENANCE AND MONITORING PLAN

Operations Maintenance and Monitoring Plan

Excavation & Capping of Filled First Street Turning Basin, Gowanus Canal

Borough of Brooklyn, New York

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FIGURE

Figure 1: Site Plan

LIST OF ACRONYMS

Acronym	Definition
AKRF-KSE JV	AKRF Engineering, P.C./KS Engineers, P.C. Joint Venture
ASCE	American Society of Civil Engineers
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	constituents of concerns
EC	Engineering Control
EPA	United States Environmental Protection Agency
FS	feasibility study
IC	Institutional Control
NAPL	non-aqueous phase liquid
NPL	National Priorities List
NYC	New York City
NYCDDC	New York City Department of Design and Construction
NYCEDC	New York City Economic Development Corporation
NYSDOH	New York State Department of Health
OM&MP	Operations Maintenance and Monitoring Plan
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PRR	Periodic Review Report
RI	Remedial Investigation
ROD	Record of Decision
SOE	support of excavation
SOW	Statement of Work

1.0 INTRODUCTION

This Operations Maintenance and Monitoring Plan (OM&MP) was prepared by AKRF Engineering, P.C./KS Engineers, P.C. Joint Venture (AKRF-KSE JV), on behalf of the New York City (NYC) Department of Design and Construction (NYCDDC), to detail the maintenance requirements following implementation of the Excavation and Capping of the former filled First Street Turning Basin adjacent to the Gowanus Canal in Brooklyn, New York (the Site). A Site Plan is provided as Figure 1. Details related to the design are presented in the 100% Design Report, to which this OM&MP is included as an appendix and as a supporting plan. This OM&MP will be updated following completion of construction of the project.

The selected remedy described in the Record of Decision (ROD) issued by the United States Environmental Protection Agency (EPA) on September 27, 2013 under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 for the Gowanus Canal Superfund Site (EPA 2013) for the filled First Street Turning Basin is “excavation and restoration of approximately 475 linear feet of the filled-in former First Street Turning Basin.” The remedial design was developed based on the Administrative Order for Remedial Design issued to the City of New York (the City) by EPA on May 28, 2014, which included a Statement of Work (SOW) further defining the selected remedy and remedial action (EPA 2014). Excavation and restoration activities will be completed in phased coordination with other Gowanus Canal sediment remedies and an adjacent development project (i.e., soil remediation and capping activities and potential redevelopment at the Powerhouse site, which began in 2017).

This 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 the monitoring of the sediment cap, intertidal vegetative shelf cap, new ecological habitat, and vegetated area.

1.1 General

In accordance with the ROD, restoration of the excavated area will include the installation of engineered caps (sediment and intertidal vegetative shelf cap) designed to mitigate the potential for migration of Non-Aqueous Phase Liquids (NAPL) and/or dissolved phase constituents of concern (COCs) into the First Street Turning Basin water column, as well as providing a physical barrier to exposure of impacted materials remaining within the excavated area. The caps will be installed across the entire bottom of the excavation area, including across an intertidal vegetative shelf that will be installed during the remediation. The sediment cap has been designed to tie-in to the proposed cap of the adjoining Gowanus Canal.

The sediment cap installed in the First Street Turning Basin will include the following:

- A sand leveling layer to provide a smooth surface for cap installation;
- An active layer comprised of sand mixed with granular activated carbon to address dissolved phase COCs, and oleophilic clay to address potentially mobile NAPL residuals;
- A sand isolation and filter layer to physically isolate remaining impacts from the overlying water column; and
- An articulated concrete block armor layer to protect the cap from injury 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.

An approximate 20-foot-wide intertidal vegetative shelf is to be constructed along the eastern and northern edges of the turning basin using an interior bulkhead wall, behind the bulkhead wall (i.e., landward of the restored extent of the turning basin). A cap (Section 10 of the 100% Remedial

Design) with a minimum of 15 inches of sand planting soil and other materials (e.g., geosynthetics, plantings) will be used to construct an intertidal vegetative shelf.

1.2 Revisions

Any changes to the scope or procedures in this OM&MP will be formally documented as a revision to this document. A revision number will be indicated on the front page of any revised document and will serve as a historical record of any and all revisions made to the document. For changes requiring immediate resolution during the implementation of this OM&MP, approval will be secured from EPA and the Responsible Parties.

1.3 Notifications

EPA is the lead regulatory agency for the First Street Turning Basin and the Gowanus Canal Superfund Sites. Prior to the start of any activities that are related to the implementation of the OM&MP, appropriate representatives from EPA and any private landowners [i.e., 450 Carroll Street (Block 453, Lot 26)] potentially affected will be notified a minimum of 30 days in advance.

2.0 SUMMARY OF PREVIOUS INVESTIGATIONS AND REMEDIAL ACTION

2.1 Site Location, History, and Description

Based on historical aerial photographs, the former First Street Turning Basin was approximately 475- to 560-foot long by 50 to 60-foot wide as a side channel from the Gowanus Canal surface waterway system, which is a brackish, tidal arm of the New York-New Jersey Harbor Estuary, extending approximately 1.8 miles through Brooklyn, New York. The First Street Turning Basin was presumably constructed in a manner similar to the main canal, including installation of bulkheads along the sides of the channel and excavating the area between the bulkheads to form the Turning Basin. In the early 1900s, a power station building, referred to as the Powerhouse, was constructed adjacent to the southern side of the First Street Turning Basin. The former First Street Turning Basin was originally utilized, among other purposes, to deliver coal via barges to the adjacent electric generating station 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. The area between the western-end of the building and the Gowanus Canal was used for coal storage. The First Street Turning Basin was filled between the years 1953 and 1965.

The Gowanus Canal, including the former First Street Turning Basin, was placed on the National Priorities List (NPL) pursuant to Section 105 of CERCLA on March 2, 2010. In April 2010, EPA entered into separate administrative consent orders with various parties to perform work in support of EPA's remedial investigation/feasibility study (RI/FS). The RI/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 outlined in the ROD issued by EPA on September 27, 2013 under CERCLA for the Gowanus Canal Superfund Site (EPA 2013). The Administrative Order for Remedial Design Order, issued to NYC by EPA on May 28, 2014, included a SOW further defining the selected remedy and remedial actions (EPA 2014). Analytical data obtained during the RI in the former First Street Turning Basin showed the existence of contamination in soil and groundwater. According to the ROD, contaminated sediments within the First Street Turning Basin were left in place when the basin was filled. In addition, the ROD states that the fill itself (when it was filled in between the years 1953 and 1965) may have included waste materials and/or the filled-in basin may have been subject to later spills and dumping.

Analytical data obtained during 2017 preliminary investigation activities associated with the project, titled Environmental Sampling and Analysis 30% Field Activity, documented the presence of NAPL, and soil and groundwater contamination.

2.2 Physical Setting

2.2.1 Land Use

The First Street Turning Basin is located within a densely commercial/industrial and residential portion of the Borough of Brooklyn, Kings County, New York. The immediate adjoining property uses are as follows:

North: Multi-tenant industrial building including Alex Figliolia Water & Sewer, LLC at 420 Carroll Street (Block 453, Lot 1); a food truck facility with parking lot at 430 Carroll Street (Block 453, Lot 21); a contractor's parking lot at 450 Carroll Street (which also provides access to the Site from Carroll Street); and an Extra Space Storage facility located at 312 3rd Avenue (Block 453, Lot 54).

South: The former Brooklyn Rapid Transit Powerhouse site located at 332 3rd Avenue (Block 967, Lot 1), currently in the process of an active remedial effort; and a CubeSmart Self Storage facility located at 338 3rd Avenue (Block 967, Lot 24).

East: The entrances of the Extra Space Storage located at 312 3rd Avenue (Block 453, Lot 54) and the CubeSmart Self Storage located at 338 3rd Avenue (Block 967, Lot 24) facilities, followed by 3rd Avenue, which is followed by multi-use buildings with 1st floor retail and residential apartments above, as well as a Consolidated Edison facility located at 323 3rd Avenue.

West: The Gowanus Canal, followed by a multi-story residential apartment building along Bond Street and several mixed-use residential/commercial buildings.

2.2.2 Remedial History

As stated in the ROD, the selected remedy for the former First Street Turning Basin is excavation and restoration of the filled-in former First Street Turning Basin. Excavation and restoration activities will be completed in phased coordination with other Gowanus Canal sediment remedies and the Powerhouse development project.

The presumptive depth of excavation from the filled-in First Street Turning Basin will be to an elevation of approximately -11.8 to -16.0 feet (North American Vertical Datum of 1988). Components of the excavation activities will include, but not be limited to, installation of a support of excavation (SOE) system, dewatering and water treatment/discharge, partial backfilling, installation of armoring and habitat materials to protect an underlying sediment cap, the creation of an intertidal vegetative shelf and associated cap to promote the establishment of ecological communities, and planting vegetation throughout the intertidal vegetative shelf.

2.3 Remaining Environmental Impacts

2.3.1 Sediment

Elevated concentrations of polycyclic aromatic hydrocarbons (PAHs), metals, and polychlorinated biphenyls (PCBs) will remain in deeper sediments beneath the caps after completion of the remedy, but will be isolated by the engineered caps, as described herein.

2.3.2 Groundwater

Elevated volatile organic compounds, semivolatile organic compounds, PCBs, and metals in groundwater were identified in the historic evaluations of the project area. The remedy will serve to eliminate the migration of NAPL into the Gowanus Canal, thereby minimizing NAPL, which is a source of these contaminants.

2.4 OM&MP Performance Objective

The overall objective of the OM&MP is to confirm that the caps achieve the threshold criteria specified for this project in Section 10 of the 100% Remedial Design and that the long-term integrity of the caps are maintained. This OM&MP identifies monitoring methods for assessing the long-term success of the remedy, as well as potential adaptive management measures that will be implemented in the event that the remedy does not meet its long-term performance standards.

The OM&MP includes general recommendations for performing periodic inspection and condition assessment of the bulkheads for developing maintenance and repair requirements. The plan provides minimum requirements for inspection frequency, scope, and reporting.

The OM&MP also includes a monitoring program for the intertidal vegetative shelf that will track the success of the habitat creation effort, with recommendations each year to ensure the continued success of the planting. Maintenance guidelines are included to create an organic approach to the long-term care of the intertidal vegetative shelf.

3.0 INSTITUTIONAL AND ENGINEERING CONTROLS

3.1 General

Since remaining contamination exists at the former filled First Street Turning Basin, Institutional Controls (ICs) and Engineering Controls (ECs) are required to protect human health and the environment. The remedy includes ICs/ECs, which are subject to revision by EPA.

This OM&MP provides:

- A description of all IC/ECs on the Site;
- The basic implementation and intended role of each IC/EC;
- A description of the key components of the ICs set forth in the Environmental Easement;
- A description of the controls to be evaluated during each required inspection and periodic review;
- A description of plans and procedures to be followed for implementation of IC/ECs, and the proper handling of remaining contamination that may be disturbed during maintenance or redevelopment work on the Site; and
- Any other provisions necessary to identify or establish methods for implementing the IC/ECs required by the Site remedy, as determined by EPA.

3.2 Institutional Controls

A series of ICs is required by the ROD to: (1) implement, maintain, and monitor engineering control systems; (2) prevent future exposure to remaining contamination; and (3) limit the use and development of the Site to industrial and marine uses only, and the potential for recreational use.

Because of the anticipated unacceptable human health risk associated with the consumption of PCB-contaminated fish and shellfish after the remedy is implemented, EPA will rely on existing New York State Department of Health (NYSDOH) fish consumption advisories as one of the ICs. Currently, the existing fish consumption advisory for Upper New York Bay identifies PCBs as one of the contaminants of concern.

Permanent ICs would be needed to ensure that long-term potential human direct contact exposures are appropriately limited. The ICs would need to restrict digging or construction activities within the capped areas. ICs will be used to protect the integrity of the caps. The ICs will include restrictions to prevent damage to the caps, including bulkhead maintenance. The remedy already requires the removal of the soft sediment at the Site, which will provide for a sufficient water depth to support future navigation uses and will better protect the sediment cap and prevent damages from barges. Removal of the soft sediment will also limit the risk of future contaminant transport caused by any future storm-related cap damage.

Periodic maintenance of the caps and long-term monitoring will be required to ensure that the remedy continues to function effectively. Long-term monitoring would also be needed to assure that performance criteria continues to be achieved.

In summary, the ICs for the First Street Turning Basin following construction will consist of:

- Requirement for bulkhead maintenance;
- Restriction on digging or construction within the First Street Turning Basin;
- Reliance on existing NYSDOH fish consumption advisories;

- Integrating the monitoring of ICs into other monitoring plans (the Responsible Parties will be performing post-construction monitoring to assess the effectiveness of the ROD); and
- Monitoring to assess the performance and effectiveness of the remedy as defined in this OM&MP.

3.3 Engineering Controls

The ECs that are part of the ROD are the capping of the bottom sediment and intertidal vegetative shelf, as well as the mitigation provided by the installation of the bulkheads. The remedy includes the installation of a SOE system, reconstruction of bulkheads, dewatering and water treatment/discharge, partial backfilling, and installation of armoring and habitat materials to protect the underlying sediment cap and the installation of an intertidal vegetative shelf to promote the establishment of ecological communities. Therefore, the caps are permanent engineering controls and the quality and integrity of these system will be inspected at frequency and duration directed by EPA.

4.0 POST-REMEDATION INSPECTION, MONITORING, AND MAINTENANCE

4.1 General

This OM&MP describes the measures for evaluating the overall performance and effectiveness of the remedy, and may only be revised with the approval of EPA.

4.2 Site-Wide Inspection

Site-wide inspections will be performed annually or at a frequency directed by EPA. Modification to the frequency or duration of the inspections will require approval from EPA. Site-wide inspections will also be performed after all severe weather events that may affect ECs or monitoring devices. During these inspections, an inspection report will be completed. The inspection report will compile sufficient information to assess the following:

- Compliance with all ICs, including Site usage;
- An evaluation of the condition and continued effectiveness of ECs;
- General Site conditions at the time of the inspection;
- The site management activities being conducted, including, where appropriate, confirmation sampling and a health and safety inspection; and
- Confirm that Site records are up to date.

Inspections of all remedial components installed at the Site will be conducted. A comprehensive Site-wide inspection will be conducted and documented according to the OM&MP schedule, regardless of the frequency of the Periodic Review Report (PRR). The inspections will determine and document the following:

- Whether ECs continue to perform as designed;
- If these ECs continue to be protective of human health and the environment;
- Compliance with the requirements of this OM&MP;
- Achievement of remedial performance criteria;
- If Site records are complete and up to date; and
- Reporting requirements, as outlined in Section 5 of this OM&MP.

Inspections will also be performed in the event of an emergency. If an emergency, such as a natural disaster or an unforeseen failure of any of the ECs, occurs that reduces or has the potential to reduce the effectiveness of ECs in place at the Site, verbal notice must be given to EPA by noon of the following day. In addition, an inspection of the Site will be conducted within 5 days of the event (unless conditions at the Site remain unstable or unsafe beyond the 5-day period) to verify the effectiveness of the IC/ECs implemented at the Site by a Qualified Environmental Professional, as determined by EPA. Written confirmation must be provided to EPA within 7 days of the event that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.

4.3 Environmental Media Monitoring

Inspection, monitoring, and maintenance activities to be conducted as post-construction Site control activities pursuant to the SOW for the components of the remediation include:

- Monitoring and maintenance of the sediment and intertidal vegetative shelf cap systems; and
- Inspections and maintenance of the backfilled, restored, and vegetated areas of the intertidal vegetative shelf.

4.4 Periodic Assessment/Evaluation

4.4.1 Climate Change Vulnerability Assessment

Increases in both the severity and frequency of storms/weather events, an increase in sea level elevations along with accompanying flooding impacts, and shifting precipitation patterns and wide temperature fluctuation resulting from global climactic change and instability have the potential to significantly impact the performance, effectiveness, and protectiveness of a given site and associated remedial systems. Vulnerability assessments provide information so that the Site and associated remedial systems are prepared for the impacts of the increasing frequency and intensity of severe storms/weather events and associated flooding.

The Site is located in an area of potential flooding. Future vulnerability assessments will be performed after the completion of the remedy.

4.4.2 Green Remediation Evaluation

EPA's Incorporating Sustainable Environmental Practices into Remediation of Contaminated Sites, EPA Agency Office of Solid Waste and Emergency Response, April 2008 EPA 542-R-08-002 and Consideration of Greener Cleanup Activities in the Superfund Cleanup Process (August 2, 2016) requires that green remediation concepts and techniques be considered during all stages of the remedial program, including site management, with the goal of improving the sustainability of the cleanup and summarizing the net environmental benefit of any implemented green technology. This section of the OM&MP provides a summary of any green remediation evaluations to be completed for the Site during site management, as reported in the 100% Design Report.

Electric Usage

The Site does not currently have any electrical usage for the maintenance of the ECs.

Fossil Fuel Usage

The ECs do not directly use fossil fuels as part of their maintenance; however, fossil fuels are indirectly used during the completion of maintenance and monitoring activities. Indirect fossil fuel use results from completion of the following Site related activities:

- Transportation to and from the Site for inspection activities;
- Disposal of waste generated at the Site during monitoring and maintenance activities (if applicable).

Water Usage

The ECs do not directly use water as part of their maintenance.

Air Emissions

There are no direct air emissions associated with the ECs for the Site; however, as noted above, there are air emissions associated with the transportation to and from the Site for inspection and maintenance.

Consumption of Materials and Generation of Waste

Monitoring, maintenance, and reporting activities associated with the ECs result in material consumption and the generation of waste. A summary of the current material consumption and waste generation activities for the ECs are summarized below:

- Paper and office supplies associated with field logs, monitoring logs, and report preparation; and
- Efforts will be made to minimize to the extent practicable the energy consumption, waste generation and water usage for implementation of this OM&MP.

4.5 Bulkhead Condition Assessment

4.5.1 Inspection Standards

Bulkhead inspection should be performed using industry guidelines for inspection and maintenance of waterfront facilities, such as the New York City Economic Development Corporation (NYCEDC) “Waterfront Facilities Maintenance Management System” Inspection Guidelines Manual (NYCEDC 2016) and/or the American Society of Civil Engineers (ASCE) “Waterfront Facilities Inspection and Assessment” Manual of Practice 130 (ASCE 2015).

4.5.2 Inspection Frequency

The frequency of inspections is a function of several variables, such as the age of the structure, material type, structure use, and environmental exposure conditions. The initial inspection of the bulkheads may be performed 10 years after their construction. Routine inspections thereafter should be performed every three to five years. This frequency can be adjusted as necessary based on the extent of deterioration observed. An inspection should also be performed after a potentially damage-causing event, such as a major storm, earthquake, vessel impact, or other similar event.

4.5.3 Inspection Scope

There are three industry standard levels of inspection effort that can be performed for the bulkheads depending upon the purpose for the inspection. These are Level I, Level II, and Level III inspections as defined below:

- Level I: General visual/tactile inspection to detect obvious or major damage. This type of inspection is an overview inspection or “swim-by” that does not involve cleaning of structural elements.
- Level II: Detect surface defects that may be hidden by marine growth. This type of inspection involves the cleaning of structural elements to evaluate the general condition and obtain measurements of any observed defects. This type of inspection is generally performed on representative or critical areas of the bulkhead.
- Level III: Detect hidden damage and collect more detailed information on observed defects. This type of inspection typically requires prior cleaning of structural elements and the use of non-destructive or destructive testing methods to assess the extent of deterioration or damage, such as interior damage and loss of coating or metal due to corrosion. This type of inspection is typically performed on suspect or critical areas of the bulkhead.

Routine inspections should include, at a minimum, a Level I inspection for all of the above and below water elements of the bulkheads, a Level II inspection for 10% of the elements, and a Level III inspection (includes additional testing from the Level II inspection) for 5% of the elements. At a minimum, a Level I inspection should be performed for all above water elements following a major potentially damage-causing event. More detailed investigations may be required to record various parameters for performing engineering calculations to evaluate capacity/service life and develop repair designs. The Level I inspection will inform the extent/nature of Level II and Level III inspections required.

4.5.4 Inspection Report

All bulkhead inspections should be documented in a report using a format consistent with industry standards. The report should include adequate detail for making an overall assessment of the bulkhead condition for developing a maintenance and repair program, including cost estimates for recommended repairs.

Observed conditions should be documented on standardized field inspection forms that can be used for making a condition assessment comparison with subsequent inspections. The report should also include drawings of the bulkhead, color photographs of typical observed conditions and any measurements taken of observed defects.

The report text should at a minimum include a description of the bulkheads, purpose and scope of the inspection, observed conditions, a statement of the overall condition of the bulkheads, recommendations for additional investigations or repairs, and the scope and time frame for the next inspection.

4.6 Intertidal Vegetative Shelf Monitoring and Maintenance

4.6.1 Introduction

As part of the future First Street Turning Basin, the Responsible Parties have developed a habitat creation plan that includes the construction of 8,300 square feet of an intertidal vegetative shelf. The monitoring program will track the success of the habitat creation effort over the course of three years and make corrective actions as necessary to ensure the continued success of the intertidal vegetative shelf. Intertidal vegetation will be monitored during the growing season, and a photographic inventory of the vegetation will be taken annually throughout the monitoring program to document progression towards 90% area coverage of vegetation and to document the presence of invasive species or wildlife.

4.6.2 Project Goal and Strategy

The goal of the intertidal vegetative shelf portion of the project is to transform the hard edge of the turning basin bulkhead into a vegetated area that would provide some habitat and aesthetic value to the Site and Gowanus Canal. The shelf has been sloped to allow for the establishment of multiple habitats within a restricted area. A low marsh system planted with saltwater cord-grass (*Spartina alterniflora*) is located below mean high water, and a high marsh system planted with salt-meadow cordgrass (*Spartina patens*) and coastal salt grass (*Distichlis spicata*) is located above mean high water.

Tidal wetlands (salt marshes) contain a higher number of diverse habitats and support a high plant and animal species richness. In general, salt marshes provide educational and aesthetic value. They also provide the ecological functions of food chain production and habitat for fish and wildlife, along with storm and flood water storage.

The relative contribution of these ecological functions is, however, limited in this particular case, as the intertidal vegetative shelf is a narrow, constructed planter that does not function as a true tidal wetland. The bulkhead fully separates the intertidal vegetative shelf from the adjacent upland and the Site's water channel. This separation negates a wetland's key function of absorbing pollutants from run off, purifying the water before it joins the basin.

4.6.3 Monitoring Protocols

The following monitoring protocols will be used to characterize the general condition of the intertidal vegetative shelf and to assess the specific characteristics of the vegetation. Each year, the Contractor will conduct sampling during low tide between August and September when vegetation is fully established and when grass and grass-like species can be identified (when fruiting bodies are present).

The Contractor will evaluate the intertidal vegetation to assess the general condition. Any signs of disease, predation, or disturbance of the vegetation will be recorded. Observations of invasive species in the intertidal vegetative shelf will be noted and the approximate locations of the plants will be described.

A total of 10 fixed transects is to be established for the monitoring program, set perpendicular to the bulkhead and basin. Two 1-square-meter (m²) quadrants will be located at lower and upper ends of each transect, for a total of 20 monitoring quadrants. The Contractor will record the name of each plant species occurring in each 1-m² quadrat. The percent cover of herbaceous plant species, open water, bare soil, rocks, and debris will be recorded for each quadrat so that the total percent cover for each quadrat will equal 100%.

The following metrics will be recorded:

1. Percent Cover by Species by Quadrat;
2. Stem counts;
3. Height of Vegetation;
4. Quadrat Photos; and
5. General Observations.

A minimum of 10 photographs at fixed point photograph stations will be used to visually characterize the entire Site. The date, time, tide, and direction of view will be recorded.

4.6.4 Annual Monitoring Reports

The intertidal vegetative shelf will be monitored for three years beginning at the end of the first growing season following construction to ensure that the planting is in compliance with the project goals and objectives. Annual Monitoring Reports will be prepared by the Contractor and submitted to the Responsible Parties to present the results of a monitoring program. The reports will include: 1) an evaluation of the data collected in the field; 2) Site photographs; and 3) field data sheets.

The Annual Monitoring Reports will evaluate whether project goals are being met and if vegetation problems or human or pest disturbances are observed during the field surveys. The Annual Monitoring Reports will document the corrective actions performed to address any disturbances.

Each Annual Monitoring Report will contain an adaptive management section that discusses whether the Site is progressing toward establishing a self-sustaining system.

Each year, an analysis of ecological controlling factors will be evaluated to determine whether adjustments are necessary to bring the project into compliance with the project goals and objectives. Each Annual Monitoring Report will contain summary conclusions about the condition of the Site and will make recommendations if needed.

The Annual Monitoring Reports will include detailed information regarding the presence of invasive plant species, such as common reed, and nuisance wildlife such as geese or raccoons. Guidance on remediation measures, along with a timeline for implementation, will be provided within each of reports.

4.6.5 Routine Maintenance

The conditions of the intertidal vegetative shelf create a challenging environment for the marsh plantings. Debris may be deposited by the tidal waters, wildlife will likely use the area, and the bulkhead wall may inhibit drainage of the planting area. These conditions pose particular challenges to establishing a stable and diverse emergent intertidal vegetative community. The intertidal vegetative shelf will require regular inspections and maintenance to ensure that it functions properly. The plantings will be the most visible feature of the project, and the success of the intertidal vegetative shelf will have an enormous impact on the public's response to the project.

These maintenance guidelines are prepared as recommendations to create an organic approach to the long-term care of the intertidal vegetative shelf that will set the Site apart as an example of a low-maintenance, sustainable public landscape. The information provided herein represents routine best management practices using organic and locally available products. Unique or special conditions, such as an ice storm or hurricane, could result in damages that require the expertise of a horticulturalist to adequately address such events. Contacting specialized landscape experts for consultation prior to attempting treatment of unfamiliar or unusual conditions is recommended.

Trash and Debris Removal

Litter to be removed by a litter-picker tool during low-tide to maximize visible and accessible areas to be cleaned.

Inspect Vegetation

In the spring and fall, inspect the vegetation in the intertidal vegetative shelf. Reestablish vegetation as needed.

Weeding

Weeding should be done by hand and with the aid of a hand tool to facilitate removal of accompanying root systems. A "weed" is a non-conforming, invasive plant that appears within any planted area. No weed shall be permitted to grow taller than 6 inches before it is extracted. Particular attention must be paid to prevent the establishment of *Phragmites*. No chemical herbicides will be permitted.

Inspect Drainage

Inspect the pile cap drainage to determine if sediment, dirt, or debris is obstructing the flow of water from the intertidal vegetative shelf to the water channel. Sediment around pile cap drainage openings should be removed.

Maintenance Tasks and Schedule is as follows:

Task	Frequency Schedule
Inspect for sediment accumulation	Annually
Remove sediment accumulation	Every 5-10 years or as needed
Inspect for debris (dead vegetation and trash)	Monthly and after major storms
Clean debris	As needed
Inspect for erosion	Early spring, fall and after major storms
Reestablish permanent vegetation	As needed
Rake out dead vegetation	Annually - early spring
Inspect for and remove invasive species	Monthly

5.0 REPORTING REQUIREMENTS

5.1 Site Management Reports

All site management inspection, maintenance, and monitoring events will be recorded on the appropriate site management forms. These forms are subject to EPA revision.

All applicable inspection forms and other records generated for the Site during the reporting period will be provided in electronic format to EPA.

All interim monitoring/inspections reports will include, at a minimum:

- Date of event or reporting period;
- Name, company, and position of person(s) conducting monitoring/inspection activities;
- Description of the activities performed;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents noted (included either on the checklist/form or on an attached sheet);
- Any observations, conclusions, or recommendations; and
- A determination as to whether contaminant conditions have changed since the last reporting event.

Routine maintenance event reporting forms will include, at a minimum:

- Date of event;
- Name, company, and position of person(s) conducting maintenance activities;
- Description of maintenance activities performed;
- Any modifications to the Site;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents noted (included either on the checklist/form or on an attached sheet); and
- Other documentation, such as copies of invoices for maintenance work (attached to the checklist/form).

Non-routine maintenance event reporting forms will include, at a minimum:

- Date of event;
- Name, company, and position of person(s) conducting non-routine maintenance/repair activities;
- Description of non-routine activities performed;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents (included either on the form or on an attached sheet); and
- Other documentation such as copies of invoices for repair work (attached to the checklist/form).

Data will be reported in digital format as determined by EPA.

5.2 Periodic Review Report

A PRR will be submitted to EPA beginning 12 months after the remedy is completed. After submittal of the initial PRR, the next PRR shall be submitted annually to EPA or at another frequency required by EPA. The report will include:

- Identification, assessment, and certification of all ECs/ICs required by the remedy for the Site;
- Results of the required annual Site inspections and severe condition inspections, if applicable; and
- All applicable site management forms and other records generated for the Site during the reporting period in EPA-approved electronic format, if not previously submitted.

5.3 Certification of ICs/ECs

Following the last inspection of the reporting period, a Professional Engineer licensed to practice in New York State will prepare, and include in the PRR:

“For each institutional or engineering control identified for the Site, I certify that all of the following statements are true:

- The inspection of the Site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under my direction;
- The institutional controls and/or engineering controls employed at the Site is unchanged from the date the control was put in place, or last approved by the United States Environmental Protection Agency;
- Nothing has occurred that would impair the ability of the control to protect the public health and environment;
- Nothing has occurred that would constitute a violation or failure to comply with any site management plan for this control;
- The engineering control systems are performing as designed and are effective;
- To the best of my knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the Site remedial program (and generally accepted engineering practices); and
- The information presented in this report is accurate and complete.”

The signed certification will be included in the PRR.

5.4 Corrective Measures Work Plan

If any component of the remedy is found to have failed, or if the periodic certification cannot be provided due to the failure of an IC or EC, a Corrective Measures Work Plan will be submitted to EPA for approval. This work plan will explain the failure and provide the details and schedule for performing work necessary to correct the failure.

6.0 REFERENCES

- ASCE. 2015. Waterfront Facilities Inspection and Assessment, Manual of Practice 130.
- EPA. 2011. Draft Gowanus Canal Feasibility Study Report. Prepared by CH2M Hill for EPA Region 2. December.
- EPA. 2013. Record of Decision for the Gowanus Canal Superfund Site. September 27.
- EPA. 2014. Administrative Order issued to New York City by EPA. May 28.
- NYCEDC. 2016. Waterfront Facilities Maintenance Management System, Inspection Guidelines Manual. May.

FIGURE

