

3.0 Investigation Activities

This section provides a description of the activities performed during the RI and the methods used for conducting the fieldwork at the RI Study Area. Unless otherwise noted in the following sections, the procedures used were consistent with the methods and procedures described in the NYSDEC-approved RIWP, FSAP, QAPP, HASP, and CAMP. Each field activity performed during the investigation, grouped by field task or environmental media, is described in the following sections. The RI sample locations, and the locations of the samples collected during the previous investigation are shown on Figure 3-1.

3.1 Subsurface Utility Location

Subsurface utilities were located prior to starting the invasive subsurface investigation work. The utility locating was initiated by contacting Dig Safely New York. Each company or municipality that had subsurface utilities present in the investigation area marked out their utility lines prior to the initiation of the subsurface work. Following the utility mark out, each sampling location was then scanned using ground penetrating radar (GPR) and electromagnetic (EM) survey methods by Advanced Geologic Services, Inc. to confirm the location of marked utilities and/or to identify other unmarked utilities. In addition, prior to advancing soil borings, each boring/well was pre-cleared using soft dig techniques (combination of air knife, vacuum extraction, and hand digging) to a depth of 5 feet to verify utilities were not located at deeper investigative depths.

3.2 Surface Soil Sampling

Three surface soil samples were collected along the western limits of the Current Site adjacent to the Gowanus Canal bulkhead to evaluate existing surface soil at the Current Site, as shown on Figure 3-1. The designated sample locations were approved by the NYSDEC prior to collection.

Surface soil samples were collected in September 2010 from 0 to 2-inches bgs using a properly decontaminated stainless steel spoon. The necessary volume for VOC samples was placed directly into sample containers to minimize volatilization. Using a stainless steel trowel, the remaining sample was homogenized and placed into the remaining sample containers.

Two surface soil samples were analyzed for the following standard parameters (USEPA, 1980 – SW846):

- VOCs by USEPA Method 8260B
- SVOCs by USEPA Method 8270C
- Resource Conservation and Recovery Act (RCRA) 8 metals by USEPA Method 6000-7000 Series
- Free cyanide (extraction by USEPA Method 9013A and analysis by Microdiffusion, American Society for Testing Materials (ASTM) International Method D4282-02)

One surface soil sample was analyzed for an expanded list of the following parameters:

- Full Target Compound List (TCL) VOCs by USEPA Method 8260B
- Full TCL SVOCs by USEPA Method 8270C

- Target Analyte List (TAL) Metals by USEPA Method 6000-7000 Series
- TCL Pesticides by USEPA Method 8081A
- TCL Herbicides by USEPA Method 8151A
- Polychlorinated Biphenyls (PCBs) (as Aroclors) by USEPA Method 8082
- Free cyanide (extraction by USEPA method 9013A and analysis by Microdiffusion, ASTM International method D4282-02)

Following sample collection, any remaining soil was used to backfill the sample area. Decontamination of sampling equipment was performed between sample locations in accordance with field procedures in the RI Work Plan. RI Study Area sample locations were surveyed as described in Section 3.12.

Sample details including sample ID, date, associated rationale, and laboratory analysis are summarized on Table 3-1. Analytical results are discussed in Section 5.

3.3 Test Pit Excavations

In June 2010, two test pits (TP-1 and TP-2) were advanced per the RI Work Plan. TP-1 was excavated adjacent to Holder 5 in the parking lot to the west of the 12th Street and Hamilton Place intersection to evaluate the location and contents of former Holder No. 5, the valve house area, and the coal line along 12th Street. TP-2 was excavated adjacent to Holder 5 along the northern boundary of Block 1025, Lot 100 in the former used car parking lot to the east of the 12th Street and Hamilton Place intersection to evaluate the location and contents of former Holder No. 5 and the valve house area adjacent to the current building located at Block 1025, Lot 26. The locations of the test pits are provided on Figure 3-1. Sample details including sample ID, sample date, sample collection method, rationale, and laboratory analysis are summarized on Table 3-1. Test pit logs are included in Appendix B. The results of the observations made and the results of subsurface soil analytical testing performed during the test pit excavations are discussed in Sections 4 and 5, respectively.

3.4 Soil Borings and Subsurface Soil Sampling

As outlined in the RIWP and subsequent Addendum Work Plans, 26 soil borings were advanced by Boart Longyear, Inc. of Northborough, Massachusetts using sonic drilling methods during multiple field mobilizations to complete the scopes of work for the initial RI and RI Addenda between April 2010 and April of 2012 as discussed in the previous section. One soil boring (SB-26) was advanced by Zebra Environmental of Lynbrook, New York using a direct push drilling method in March 2012. Soil borings were conducted during the RI program in five phases:

- April 2010 through June 2010– Commencement of RI work: advancement of 19 soil borings and installation of seventeen monitoring wells.
- September 2010 through October 2010– Completion of initial RI scope of work: advancement of one difficult access soil boring (SB-9) and installation of three monitoring wells (MW-9 S/I/D).
- April 2011 – Completion of RI Addendum No. 1 scope of work: advancement of two soil borings (SB-19 and SB-20) and two monitoring well pairs (MW-19 S/I and MW-20 S/I) at 381/539 Smith Street (bordering the western edge of the Gowanus Canal) within the RI Study Area.
- April 2011 and September through October of 2011 – Completion of RI Addendum No. 2 and No. 3 scopes of work: advancement and installation of the two deep wells, MW-4D1 and MW-4D2 within

the RI Study Area and advancement of five soil borings (SB-21 through SB-25) and installation of six groundwater monitoring wells (MW-21D, MW-22 I/D, MW-23D, and MW-25 S/I) in the Lowes parking lot bordering the eastern side of the Gowanus Canal (within the RI Study Area).

- March through April of 2012 – Completion of RI Addendum No. 4 scope of work: advancement of one soil boring (SB-26) as a step out location to the 381/530 Smith Street property advanced in the right-of-way area along Smith Street southwest of 381/530 Smith Street (within the RI Study Area).

All boring locations were hand cleared to a minimum depth of five feet bgs for utility clearance purposes. Following hand clearing activities to five ft bgs, continuous soil samples were collected using a disposable plastic liner or macro core at five foot intervals. Soil samples were screened using a photoionization detector (PID) and were logged by an on-site geologist. A minimum of three soil samples were collected from each boring location and submitted for laboratory analysis. Sample collection rationale was based on the following:

- A sample was collected at the greatest observed impact, based on olfactory and visual observation and PID readings, between 0 and 5 ft bgs.
- A second sample was collected at the greatest observed impact, based on olfactory and visual observation and PID readings, between 5 feet and the bottom of the borehole.
- A third sample was collected below the deepest impacts or at the base of the boring to provide vertical delineation information.
- If no impacts were observed, the second and third samples, as described above, were not collected, and a sample was collected at the water table instead.
- Additional samples were collected at impacted or non-impacted depths correlated to impacts observed in adjacent borings for horizontal delineation.

Locations of borings are provided on Figure 3-1. The majority of the subsurface soil samples collected from test pits and borings were analyzed for the standard parameters listed above for surface soils. A subset of subsurface soil samples (approximately 20%) were analyzed for the expanded list of parameters detailed above for surface soils. Sample details including sample ID, sample date, sample collection method, rationale, and laboratory analysis are summarized on Table 3-1. Boring logs are provided in Appendix C. The results of observations made during soil boring advancement are discussed in Section 4. Analytical results are discussed in Section 5. Sampling tools were decontaminated between sample intervals and between borehole locations in accordance with field procedures in the RIWP (AECOM, 2009).

The following locations were completed as monitoring wells: SB-1, SB-2, SB-3, SB-4, SB-5, SB-6, SB-7, SB-8, SB-9, SB-19, SB-20, SB-21, SB-22, SB-23, and SB-25. The remaining borings were backfilled with grout, tremied to the surface. Soil cuttings were placed in 55-gallon drums, labeled, and later disposed at an approved off-site facility (see Section 3.13 for Investigation Derived Waste (IDW) details). Following boring activities each location was surveyed as described in Section 3. 12.

3.5 Monitoring Well Installation

A total of 32 monitoring wells were installed during the RI and RI Addendum phases to obtain groundwater data at locations upgradient, crossgradient, and downgradient of various former MGP features. All wells were constructed as two-inch diameter wells using schedule 40 polyvinyl chloride (PVC), 10-slot well screens with 2 feet sump intervals with the exception of the two extra deep (DD-series) wells that did not contain sumps. Monitoring wells were set in three generalized zones within the water-saturated overburden:

shallow(S-series), intermediate (I-series), deep (D-series), and extra deep (DD-series). Collocating/pairing wells into a single borehole was approved by the NYSDEC and is described in the following paragraph.

Locations with monitoring wells screened at deep and intermediate aquifer zones were co-located within one borehole and the shallow well was completed adjacent to the paired location as a single well. For the co-located wells, the deep well was installed first with the bottom of the borehole backfilled with bentonite to within 6-inches of the top of the sump. A 2-foot sump was installed at the bottom, and then a 10 foot screen with a sand pack to just above the lowest screened interval. Before installing the intermediate zone well, bentonite was added (as needed) to the borehole above the deep screened interval to within 6-inches of the bottom of the intermediate screen. A two foot sump was installed, then a 10 foot screen, with a sand pack and a riser to just below grade. Above the intermediate zone sand pack, a 2- foot bentonite seal was placed, followed by tremie grout to just below the ground surface. The paired wells were completed at the surface with one flush-mounted, limited access, road box. The entire construction of the intermediate zone has the riser of the deep zone well adjacent to it. For locations with an additional shallow zone well, a second boring adjacent to the deep and intermediate well cluster was advanced for installation of the shallow zone well. Locations with this nested well construction include SB-1/MW-1S/I/D, SB-5/MW-5S/I/D, and SB-9/MW-9S/I/D. The same construction approach was used for nesting the wells screened in the intermediate and shallow aquifer zones. Locations with this type of well construction include SB-3/MW-3S/I, SB-4/MW-4S/I, SB-6/MW-6S/I, SB-7/MW-7S/I, and SB-8/MW-8S/I. The location of each monitoring well is shown on Figure 3-1.

A summary of monitoring well information, including the well designation, date installed, screened interval, total depth of the boring, and the elevation of the top of each well riser (in feet above NAVD88), is provided in Table 3-2. The construction details for each well are shown on the respective soil boring logs in Appendix C, and on the cross-sectional views discussed in Section 4.

3.6 Well Development

Following a minimum 24-hour wait period after well installation, each of the RI monitoring wells was developed in order to remove fine-grained sediment and fluid residue from the well and the sand pack and to create maximum well efficiency. A surge-and-pump method was used to develop the wells. The surging action was used to actively agitate the water column by forcing water back and forth through the well screen and sand pack. Following surging, the wells were pumped with a submersible pump. Wells were developed until turbidity readings were below 50 nephelometric turbidity units (NTU) or a minimum of ten well volumes was removed. Well development equipment was decontaminated between locations in accordance with field procedures in the RIWP. Well development water was containerized in 55-gallon drums for off-site disposal (see Section 3. 13 for IDW details). A copy of the well development logs is provided in Appendix D.

3.7 Hydraulic Conductivity Testing and Tidal Monitoring

On October 7 and October 15, 2010 hydraulic conductivity testing was performed at nine wells: MW-1S, MW-3S, and MW-5S (shallow water table wells); MW-1I, 3I, and 5I (intermediate water table wells); and MW-1D, 2D, and 5D (deep water table wells). Solid slug test methods were used for the shallow wells which were screened across the water table and pneumatic test methods were used for the intermediate and deep wells screened below the water table. Slug test data was analyzed using AQTESOLV[®] software produced by HydrOSOLVE, Inc. Rising head data were matched against the Bouwer-Rice solution (Bouwer and Rice, 1976) for unconfined aquifers using the straight-line fitting method. The AQTESOLV[®] output files, including graphs of the fitted lines are provided in Appendix E.

Additionally, continuous water level measurements were collected during a 24-hour period to evaluate potential tidal effects on water levels. Measurements were collected between October 7th and October 8th, 2010 at 14 locations: MW-2D, 3S, 3I, 4S, 4I, 5S, 5I, 5D, 6S, 6I, 7S, 8S, 8I, and a designated location at the surface of the Gowanus Canal.

Results of the hydraulic conductivity testing and continuous water level monitoring are discussed in Section 4.

3.8 Groundwater Monitoring

3.8.1 Depth-to-Water Measurements

Groundwater level measurements were collected using an electronic oil/water interface level indicator fitted with a weighted cord, accurate to 0.01 ft. Depth to water was measured from the surveyed elevation mark on the well riser. The water level indicator was decontaminated between measurement locations in accordance with field procedures in the RIWP. Depth to water measurements and calculated groundwater elevations are provided on Table 3-2. Groundwater contour maps and a discussion of the data are provided in Section 4.

Groundwater monitoring was conducted during the RI program in several phases:

- June 1, 2010 – Static groundwater gauging event completed prior to groundwater well development activities.
- July 26, 2010 – First of five monthly groundwater gauging event corresponding with high tide of the Gowanus Canal. The event was coordinated with gauging events performed by the USEPA during their RI work along the Gowanus Canal and included gauging by National Grid at two nearby former MGP sites: the former Citizens Works MGP site and the former Fulton Municipal Works MGP site.
- August 23, 2010– Second of five monthly groundwater gauging event corresponding with high tide of the Gowanus Canal. The event was coordinated with gauging events performed by the USEPA during their RI work along the Gowanus Canal and included gauging by National Grid at two nearby former MGP sites: the former Citizens Works MGP site and the former Fulton Municipal Works MGP site.
- September 29, 2010 – Third of five monthly groundwater gauging event corresponding with high tide of the Gowanus Canal. The event was coordinated with gauging events performed by the USEPA during their RI work along the Gowanus Canal and included gauging by National Grid at two nearby former MGP sites: the former Citizens Works MGP site and the former Fulton Municipal Works MGP site.
- October 4, 2010 – Static groundwater gauging event prior to a round of groundwater sampling for monitoring wells installed to date.
- October 8, 2010 – Static groundwater gauging event prior to the initial aquifer testing.
- October 22, 2010 - Fourth of five monthly groundwater gauging event corresponding with low tide of the Gowanus Canal. The event was coordinated with gauging events performed by the USEPA during their RI work along the Gowanus Canal and included gauging by National Grid at two nearby former MGP sites: the former Citizens Works MGP site and the former Fulton Municipal Works MGP site.
- November 22, 2010 – Fifth of five monthly groundwater gauging event corresponding with low tide of the Gowanus Canal. The event was coordinated with gauging events performed by the USEPA

during their RI work along the Gowanus Canal and included gauging by National Grid at two nearby former MGP sites: the former Citizens Works MGP site and the former Fulton Municipal Works MGP site.

- April 29, 2011 – Static groundwater gauging of MW-4D1 and MW-4D2, only, prior to well development of these wells.
- March 14, 2012 – Static groundwater gauging event prior to a round of groundwater sampling for wells MW-19S/I, MW-20S/I, MW-21D, MW-22I/D, MW-23D, and MW-25S/I.

3.8.2 Groundwater Sampling

Wells were developed (as described in Section 3.6 above) and allowed to stabilize for a minimum of two weeks prior to the low-flow groundwater sampling events. Groundwater sampling was conducted on two occasions (October 4, 2010 and March 14, 2012) during the RI field program, as listed in section 3.8.1 above.

Samples were collected using low-flow purging and sampling techniques. Peristaltic pumps were used for purging and sampling each well. Pump intakes were set at the midpoint of the saturated screened interval. Water levels were monitored during purging using an electronic oil/water interface indicator. Flow rates ranged from 200 to 400 milliliters per minute (ml/min). Groundwater was pumped through a flow-through cell during purging, and pH, specific conductivity, temperature, dissolved oxygen (DO), and oxygen reduction potential (ORP) were measured. Turbidity was measured using a separate meter. Parameter measurements were recorded after the flow-through cell was full and approximately every five minutes thereafter. Purging was complete and sampling began when three consecutive readings were within the stabilization parameters as specified in the RIWP and as indicated on the groundwater sample collection records. Prior to sample collection using a peristaltic pump, the flow-through cell was disconnected.

The majority of the groundwater samples were analyzed for the following parameters:

- VOCs by USEPA Method 8260B
- SVOCs by USEPA Method 8270C
- TAL Metals by USEPA Method 6000-7000 Series
- Total cyanide by USEPA Method 9012

A subset (approximately 20%) of the total number of groundwater samples were analyzed for an expanded list of the following parameters:

- Full TCL VOCs by USEPA Method 8260B
- Full TCL SVOCs by USEPA Method 8270C
- TAL Metals by USEPA Method 6000-7000 Series
- TCL Pesticides by USEPA Method 8081A
- TCL Herbicides by USEPA Method 8151A
- PCBs (as Aroclors) by USEPA Method 8082
- Total cyanide by USEPA Method 9012

Purge water was stored in 55-gallon drums later for off-site transport and disposal (see Section 3.13 for IDW details). Decontamination of equipment was not necessary as disposable materials were used to collect the samples. Sample details including sample date(s), rationale, and laboratory analysis are summarized on Table 3-1. A copy of groundwater collection records are provided in Appendix F. Analytical results are discussed in Section 5.

3.9 Community Air Monitoring

Community air monitoring was performed to provide real-time measurements of total VOCs and particulate (airborne dust) concentrations in air at the downwind perimeter of each designated work area when intrusive investigation activities were in progress at the Current Site. The procedures followed methods described in the CAMP. Additionally, site personnel monitored the perimeter stations to determine if any odors were being produced as a result of the intrusive sampling activities. The monitoring was designed to provide protection for the downwind community, such as those present at the adjacent public areas and commercial properties, from releases of airborne constituents potentially resulting from the investigation activities.

Total VOCs and particulates were monitored with a PID and dust meter, respectively, located upwind and downwind of each work zone. The VOC and particulate levels at each location were recorded on field forms every 15 minutes, and are included in Appendix G. The PIDs and dust meters were also set to log information continuously throughout the work day. This information was downloaded to a laptop computer so that the NYSDEC and NYSDOH could review the information if needed. The specific action levels for VOCs and particulates are provided in the CAMP. Action levels were not reached as a result of the intrusive investigation activities at any time during the RI, so no response actions were necessary.

3.10 Vapor Intrusion Evaluation Sampling

A vapor intrusion survey was conducted during the RI by collecting four sub-slab soil vapor samples from two different building locations along 12th Street as shown on Figure 3-1 during three separate sampling events. Prior to conducting the sampling, utilities were cleared by geophysical methods as described in Section 3.1 above. In addition, a chemical inventory was conducted within the two building locations, along with completion of the NYSDOH indoor air quality questionnaire and building inventory form (Appendix H). Once utilities were cleared, sub-slab soil vapor samples were collected immediately below the concrete floor slabs of the Hamilton Plaza building located in Block 1007, Lot 172 and the Milea property located in Block 1025, Lot 26. Sampling implants were installed by drilling a 4 -inch diameter hole through the slab and placing Teflon® tubing in the hole. An air-tight seal was created by filling the space between the tubing and the concrete with hydrated bentonite. The tubing used for sampling was attached to a sampling canister with Swagelok™ fittings. A helium-filled "shroud" was placed around the insertion points to confirm the integrity of the seals. One to three volumes of air were then purged from the tubing with a helium meter at a rate less than 0.2 liters per minute. During sampling activities, no helium was detected indicating that no leaks were found in the seals for each location. Once the seals were checked, the samples were collected in batch certified, 6-liter Summa canisters fitted with eight-hour regulators. Following sample collection, all concrete coring holes were sealed and patched to match the existing grade.

Four indoor air samples were also collected at the same locations as the sub-slab soil vapor samples. Three ambient air samples were collected at locations upwind of the buildings at the time of sampling during the three sampling events. Samples were collected using individually certified, 6-liter Summa canisters fitted with eight-hour regulators.

All samples were shipped via an overnight courier to a NY ELAP-certified laboratory for analysis. Sub slab soil vapor, indoor air, and ambient air samples were analyzed for VOCs (including naphthalene) by USEPA

Compendium Method TO-15. The soil vapor samples were also analyzed for helium using ASTM Method D-1946 Modified and a specific MGP indicator compound list provided by National Grid. Sample details including sample identification, sample date(s), rationale, and laboratory analysis are summarized on Table 3-3. Analytical results are discussed in Section 5. Decontamination of equipment was not necessary as disposable materials were used to collect the samples.

3.11 Analytical Program

The laboratory samples for each media and the chemical analyses performed are summarized in Tables 3-1 and 3-3. Requisite quality assurance/quality control (QA/QC) samples were collected and analyzed in accordance with the QAPP. The majority of the laboratory analysis during the RI was completed by Mitkem Laboratories/Spectrum Analytical, of Warwick, Rhode Island; however, analysis was also performed at Test America of Edison, NJ and H2M Laboratories of Melville, NY.

3.11.1 Quality Assurance/Quality Control Analyses

Field and laboratory quality control samples for the investigation were collected and analyzed to document the accuracy and precision of the sample results. The QA/QC samples included trip blanks, field duplicates and matrix spikes, and matrix spike duplicates. The data quality level for the investigation was Level IV and was consistent with reporting requirements outlined in the NYSDEC ASP June 2000 protocols. A full data package was prepared by the laboratory for all samples collected during the RI and is included in Appendix I.

3.11.2 Data Usability Summary Report

For quality control purposes, comprehensive CLP-equivalent data packages were produced by the various laboratories for the soil, groundwater, soil vapor, and indoor air samples for review by a qualified chemist. A USEPA Region II data usability summary report (DUSR) was prepared by the AECOM Environmental Chemistry Group for each soil and groundwater sampling event. The DUSRs for this project are included in Appendix J.

As part of the data review process, analytical results and data qualifiers were corrected, where necessary, to reflect quality control issues. The Form I Report Sheets in Appendix I and the data summary spreadsheets discussed in this section include the data qualifiers and reflect the findings of the data validation process.

Organic data quality was evaluated by reviewing the following parameters: holding times, GC/MS tuning and performance, internal standards, initial and continuing calibrations, surrogate recoveries, matrix spike/matrix spike duplicate (MS/MSD) samples, MS/MSD relative percent differences (RPDs), laboratory control standards (LCSs), laboratory blanks, laboratory and field duplicates, compound identification, and compound quantitation.

Inorganic data quality was evaluated by reviewing the following parameters: holding times, matrix spikes, initial and continuing calibrations, contract required detection limit (CRDL) standard recoveries, laboratory control samples, ICP interference check sample results, ICP serial dilution results, laboratory and field duplicates, and laboratory blanks, and analyte quantitation.

3.12 RI Study Area Survey

Each investigation location was surveyed by Geod Consultants, Inc. of New Jersey following completion of the RI. The survey included reference points with elevations that were tied to the NAVD88 for vertical

elevations, to the nearest 0.01 foot. These reference points were used to determine the ground surface elevations for each surface soil, test pit, and soil boring location. The ground surface and the top of the PVC inner casing (groundwater elevation reference point) elevations were surveyed for each of the monitoring well locations and the surface water staff gauge along the Gowanus Canal. The datum used for the horizontal measurements obtained during the survey was the North American Datum of 1983 (NAD83), to the nearest 0.01 feet, and the locations were reported in the New York State (NYS) Long Island Zone coordinates. A summary of coordinates and elevations for the RI locations is provided in Table 3-4.

3.13 Investigation-Derived Waste Management

Four types of IDW were generated during the RI activities including:

- Soil
 - soil from the sampling liners
- Water
 - decontamination wash-water from the down hole drilling tools
 - well development water
 - groundwater sampling purge water
- PPE/poly/rags
 - personal protective equipment (PPE)
 - miscellaneous sampling equipment and plastic sheeting.
- Construction Debris (non-environmental)

All IDW generated was placed in drums and properly labeled. The soil and water were sampled for waste profiling purposes. All IDW was transported off site to a permitted disposal facility for proper disposal.