Borinquen Court

BRONX, NEW YORK

Final Engineering Report

NYSDEC Site Number: C203056

Prepared for:

Borinquen Court Associates, L.P.

2345 Broadway; New York, NY 10454

Prepared by:

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Melville, NY; 11747

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NOVEMBER 2013

CERTIFICATIONS

I, John Mohlin, am currently a registered professional engineer licensed by the State of New York, I had primary direct responsibility for implementation of the remedial program activities, and I certify that the Remedial Action Work Plan and Remedial Design was implemented and that all construction activities were completed in substantial conformance with the Department-approved Remedial Action Work Plan and Remedial Design.

I certify that the data submitted to the Department with this Final Engineering Report demonstrates that the remediation requirements set forth in the Remedial Action Work Plan and Remedial Design and in all applicable statutes and regulations have been or will be achieved in accordance with the time frames, if any, established in for the remedy.

I certify that all use restrictions, Institutional Controls, Engineering Controls, and/or any operation and maintenance requirements applicable to the site are contained in an environmental easement created and recorded pursuant ECL 71-3605 and that all affected local governments, as defined in ECL 71-3603, have been notified that such easement has been recorded.

I certify that a site Management Plan has been submitted for the continual and proper operation, maintenance, and monitoring of all Engineering Controls employed at the site, including the proper maintenance of all remaining monitoring wells, and that such plan has been approved by Department.

I certify that all import of soils from off-site, including source evaluation, approval and sampling, has been performed in a manner that is consistent with the methodology defined in the Remedial Action Work Plan.

I certify that all documents generated in support of this report have been submitted in accordance with the DER's electronic submission protocols and have been accepted by the Department.

I certify that all data generated in support of this report have been submitted in accordance with the Department's electronic data deliverable and have been accepted by the Department.

I certify that all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class “A” misdemeanor,

pursuant to Section 210.45 of the Penal Law. I, John Mohlin, of ERM Consulting & Engineering, Inc., 105 Maxess Road, Suite 316, Melville, NY, 11747, am certifying as Owner's Designated Site Representative for the site.

John Mohlin, P.E.
License No. 077921

12/12/13
Date

Warning: It is a violation of Article 145 of New York State Education Law for any person to alter this document in any way without the express written verification of adoption by any New York State licensed engineer in accordance with Section 7209(2), Article 145, New York State Education Law.

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Acronym	Definition
AST	Aboveground Storage Tank
CAMP	Community Air Monitoring Plan
COC	Certificate of Completion
CP	Community Participation Plan
CQAP	Construction Quality Assurance Plan
cy	Cubic yard
DO	Dissolved Oxygen
DUSRs	Data Usability Summary Reports
ECs/ICs	Engineering and Institutional Controls
EDD	Electronic Data Deliverables
ENB	Environmental Notice Bulletin
ERM	Environmental Resources Management
FER	Final Engineering Report
GWQS	Groundwater Quality Standards
HASP	Health and Safety Plan
ISCO	In-Situ Chemical Oxidation
$\mu g/m^3$	Micrograms per cubic meter
MW	Monitoring Well
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOT	New York State Department of Transportation
ORP	Oxidation-Reduction Potential
OSHA	Occupational Safety and Health Administration
PAH	Polycyclic Aromatic Hydrocarbon
PCBs	Polychlorinated Biphenyls
PCY	Per Cubic Yard
PGWSCO	Protection of Groundwater Soil Cleanup Objectives
PID	Photoionization Detector
ppm	parts per million
PRR	Periodic Review Report

RAO	Remedial Action Objectives
RAWP	Remedial Action Work Plan
RI	Remedial Investigation
RRSCO	Restricted-Residential Soil Cleanup Objectives
QAPP	Quality Assurance Project Plan
QAO	Quality Assurance Officer
QA/QC	Quality Assurance/Quality Control
SWPPP	Storm-Water Pollution Prevention Plan
SB	Soil Boring
SCO	Soil Cleanup Objectives
SMP	Site Management Plan
SOD	Soil Oxidant Demand
SOP	Site Operations Plan
SS/IA	Sub-Slab / Indoor Air
STARS	Spills Technology & Remediation Series
TCLP	Toxicity Characteristic Leaching Procedure
TPH	Total Petroleum Hydrocarbons
UIC	Underground Injection Control
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
UUSCOs	Unrestricted Use Soil Cleanup Objectives
VOC	Volatile Organic Compounds

Final Engineering Report

1.0 BACKGROUND AND SITE DESCRIPTION

East One Thirty Eighth Housing Development Fund Company, Inc. entered into a Brownfield Cleanup Agreement (BCA) with the New York State Department of Environmental Conservation (NYSDEC) in June, 2011, to investigate and remediate a 1.819-acre property located in the Mott Haven section of the Bronx, New York. After a transfer of the property, the BCA was amended on August 19, 2011, to add Borinquen Court Associates, L.P., the current property owner, as a co-applicant. On December 11, 2013, the BCA was further amended to add Tres Puentes, L.P. as a co-applicant. (Collectively, East One Thirty Eighth Housing Development Fund Company, Inc., Borinquen Court Associates, L.P., and Tres Puentes, L.P. are hereafter referred to as the "Volunteer".) The property was remediated to NYSDEC Restricted Residential Soil Cleanup Objectives and will continue to be used for a 145-unit low-income senior housing complex.

The site is located in the County of Bronx, New York, and is identified as Block 2314 and Lot 1 on the Bronx Tax Map. The site is situated on an approximately 1.82-acre area bounded by East 139th Street to the north, East 138th Street to the south, New York City Police 40th Precinct and Alexander Avenue to the east, and Third Avenue to the west (see Figures 1-1 and 1-2). The boundaries of the site are more fully described in the survey map and the metes & bounds descriptions that are part of the Environmental Easement and included as Appendix A.

An electronic copy of this FER with all supporting documentation is included as Appendix B.

Figure 1-3 presents the Areas of Concern at the site as identified in the Remedial Action Work Plan (RAWP) dated April, 2012.

2.0 SUMMARY OF SITE REMEDY

2.1 REMEDIAL ACTION OBJECTIVES

Based on the results of the Remedial Investigation, the following Remedial Action Objectives (RAOs) were identified for this site.

2.1.1 Groundwater RAOs

RAOs for Public Health Protection

- Prevent ingestion of groundwater containing contaminant levels exceeding drinking water standards.
- Prevent contact with, or inhalation of, volatiles emanating from contaminated groundwater.

RAOs for Environmental Protection

- Restore groundwater aquifer, to the extent practicable, to pre-disposal/pre-release conditions.
- Remove the source of groundwater contamination.

2.1.2 Soil RAOs

RAOs for Public Health Protection

- Prevent ingestion/direct contact with contaminated soil.
- Prevent inhalation of, or exposure to, contaminants volatilizing from contaminated soil.

RAOs for Environmental Protection

- Prevent migration of contaminants that would result in groundwater contamination.

- Prevent impacts to biota due to ingestion/direct contact with contaminated soil that would cause toxicity or bioaccumulation through the terrestrial food chain.

The applicable soil cleanup objectives are presented in Table 2-1.

2.1.3 Surface Water and Sediment RAOs

There are no surface water bodies in the vicinity of the site therefore it is not necessary to establish RAOs for surface water or sediment.

2.1.4 Sediment RAOs

As previously stated, there are no surface water bodies in the vicinity of the site, therefore, it is not necessary to establish RAOs for sediment.

2.2 DESCRIPTION OF SELECTED REMEDY

The site was remediated in accordance with the remedy selected by the NYSDEC in the Remedial Action Work Plan (RAWP) dated April, 2012; as well as the Proposed Calcium Peroxide Application dated October, 2012; and the Remedial Design for In-Situ Chemical Oxidation dated January, 2013.

The factors considered during the selection of the remedy are those listed in 6NYCRR 375-1.8. The following are the components of the selected Track 4 remedy:

1. Excavation of uncapped soil within the boundaries of the site that exceeded 6NYCRR Part 375-6 Track 2 RRSCOs to a depth of two feet.
2. Excavation of soil deeper than two feet that exceeded RRSCOs in areas where footings and other construction activities took place.
3. Excavation of soils exceeding PGWSCOs in two areas of impacted groundwater to depths of 5 and 10 feet.
4. Removal of a 500-gallon UST and associated contaminated soil.
5. Placement of a demarcation layer (i.e., orange construction fencing) after all excavations were completed.

6. Construction and maintenance of a cover system to prevent human exposure to remaining contaminated soil/fill at the site. The cover system currently consists of soil, asphalt or concrete pavement, and concrete building slabs. The soil cover layer is a minimum of two feet thick and consists of clean fill and/or top soil that meets the lower value of protection of groundwater or protection of public health SCOs for restricted residential use. This is currently an interim cover system. Upon completion of redevelopment, new paved areas, walkways, and driveways will be constructed. The location and components of the final cover system will be documented in the first Periodic Review Report (PRR), including a new "as-built" drawing.

7. In-Situ Chemical Oxidation (ISCO) to address chlorinated hydrocarbon contamination in the vicinity of four (4) monitoring well locations: MW-02, MW-04, MW-7T and MW-9T. ISCO consisted of the injection of sodium permanganate (NaMnO4) into a series of temporary injection wells to reduce/oxidize chlorinated hydrocarbons to nonhazardous or less toxic compounds.

8. Soil mixing with calcium peroxide in the vicinity of MW-02 and MW-05 to address petroleum related constituents in the groundwater at these locations. The calcium peroxide provided oxygen to enhance biodegradation of the petroleum hydrocarbons.

9. Execution and recording of an Environmental Easement to restrict land use and prevent future exposure to any contamination remaining at the site.

10. Development and implementation of a Site Management Plan for long term management of remaining contamination as required by the Environmental Easement, which includes plans for: (1) Institutional and Engineering Controls, (2) monitoring, and (3) reporting.

11. Periodic certification of the institutional and engineering controls listed above.

12. Monitoring of soil vapor and indoor air once during and once following remedial activities to ensure the pathway remained incomplete.

3.0 INTERIM REMEDIAL MEASURES, OPERABLE UNITS AND REMEDIAL CONTRACTS

The remedy for this site was performed as a single project, and no interim remedial measures, operable units or separate construction contracts were performed.

4.0 DESCRIPTION OF REMEDIAL ACTIONS PERFORMED

Remedial activities completed at the site were conducted in accordance with the NYSDEC-approved RAWP for the Borinquen Court site dated April, 2012; the Proposed Calcium Peroxide Application dated October, 2012; and the Remedial Design for In-Situ Chemical Oxidation dated January, 2013. Any deviations from the procedures described in these documents are noted below.

4.1 GOVERNING DOCUMENTS

4.1.1 Site Specific Health & Safety Plan (HASP)

All remedial work performed under this Remedial Action was in full compliance with governmental requirements, including site and worker safety requirements mandated by Federal OSHA.

The Health and Safety Plan (HASP) was originally provided as part of the RAWP. It was subsequently updated in October, 2012, and included as part of the Remedial Design for In-Situ Chemical Oxidation. The HASP was complied with for all remedial and invasive work performed at the site.

4.1.2 Quality Assurance Project Plan (QAPP)

The QAPP was included as Appendix H of the RAWP approved by the NYSDEC. The QAPP describes the specific policies, objectives, organization, functional activities and quality assurance/ quality control activities designed to achieve the project data quality objectives.

4.1.3 Construction Quality Assurance Plan (CQAP)

The Construction Quality Assurance Plan (CQAP) managed performance of the Remedial Action tasks through designed and documented QA/QC methodologies applied in the field and in the lab. The CQAP provided a detailed description of the observation and testing activities that were used to monitor construction quality and confirm that remedial construction was in conformance with the remediation objectives and

specifications. A summary of the activities performed in support of the CQAP is provided in the following sections.

4.1.3.1 Project Roles & Responsibilities

Remedial Engineer:

The Remedial Engineer for this project was John Mohlin, P.E. of ERM Consulting & Engineering, Inc. (ERM). The Remedial Engineer had primary direct responsibility for implementation of the remedial program for the site. The Remedial Engineer was responsible for certifying in this report that the remedial activities were observed by qualified environmental professionals under his supervision and that the remediation requirements set forth in the approved remedial action plans have been achieved in substantial conformance with that plan. In addition, ERM was responsible for implementing the groundwater remedy discussed in Section 4.3.5.2 (i.e., in-situ chemical oxidation with sodium permanganate).

Remedial Contractor:

Galaxy General Contracting Corporation (Galaxy) was the remedial contractor on this project, as well as the contractor for overall site redevelopment. Galaxy was responsible for implementing all remedial activities (other than the groundwater remedy performed by ERM). Oracle Trucking Inc. was a subcontractor to Galaxy and provided logistical support and coordination for all waste transport and disposal. Galaxy retained Joseph Nicoletti Associates (a licensed New York surveyor) to perform all surveying.

Site Superintendent:

The Site Superintendent was the lead site representative provided by the Remedial Engineer to ensure that the work was performed in accordance with the approved Remedial Action submittals. The Site Superintendent for this project was James Causarano of ERM. He was the main liaison between the Remedial Engineer and the Contractor regarding all on-site work, and acted as directed by the Remedial Engineer. The Site Superintendent was on-site when construction activities associated with the Remedial Action were being performed, and oversaw daily remedial activities. The Site Superintendent also served as the Remedial Engineer's Site Safety Officer to conduct air monitoring and to determine whether work being performed at the site was conducted in accordance with the HASP.

Laboratory Subcontractor:

The Remedial Engineer's laboratory subcontractor was Spectrum Analytical (NYSDOH Certification No. 11522). The analytical laboratory subcontractor was responsible for supplying properly cleaned and prepared glassware and analyte-free water for field use, and for analysis of all samples collected during the implementation of the Remedial Action.

Quality Assurance Officer:

The Quality Assurance Officer (QAO) coordinated with the laboratory to ensure that the data was collected and analyzed using the appropriate procedures. The QAO coordinated with a third-party who validated all analytical data generated during the RA as described herein. The QAO was Andrew Coenen of ERM.

4.1.3.2 Observation & Testing

The Site Superintendent was responsible for observing, inspecting, and documenting the work of the Remedial Contractor. Therefore, the Site Superintendent was on-site whenever remedial activities were being performed.

Confirmatory sampling and monitoring was conducted in accordance with the RAWP. The RAWP described the sampling methods and analytical procedures to be used for confirmatory sampling of site soil, and subsurface structures, as applicable, as well as quality assurance protocols to be followed for all sampling and analytical procedures. The Remedial Engineer performed all confirmatory sampling, monitoring and analytical work in accordance with the RAWP. Details on the sampling performed are provided in Section 4.4.

To document the post-excavation and post-backfill surface elevations, Joseph Nicoletti Associates performed multiple surveys of the site. As described in the following sections, some areas of the site were not surveyed via instrumentation. In these areas, the Site Superintendent performed manual measurements to confirm the necessary soil was removed and a minimum of two feet of clean material was backfilled.

4.1.3.3 Project Coordination Meetings

Daily meetings were conducted at the start of each work day between the Site Superintendent and the Remedial Contractor. During these meetings, the plans for the day were discussed as well as potential safety hazards and means to address them. On a

weekly basis, representative(s) from the Remedial Engineer, Remedial Contractor, and Owner would meet to review progress of work, status of submittals, and plans for upcoming activities. On an approximately daily basis (and more frequently as necessary), the Remedial Engineer and Site Superintendent would review the progress of work, and determine any necessary action items and/or corrective measures.

4.1.3.4 Reporting & Document Retention

The Site Superintendent prepared a daily log documenting the work performed that day, and included photographs and air monitoring data. The Site Superintendent also maintained records of the daily meetings. All sampling data collected by the Remedial Engineer were stored electronically within ERM's GISKEY database. In addition, Electronic Data Deliverables (EDD) in EQuIS^{TM}-compatible format had been submitted for all sampling data referenced herein (with the exception of waste characterization samples) as per NYSDEC guidance for environmental data submission. All data were submitted to e-mail box NYENVDATA@gw.dec.state.ny.us.

Records of waste shipments and material deliveries were maintained by the Remedial Contractor and transferred to the Remedial Engineer at the conclusion of remedial work. In addition, an Owner's representative distributed minutes from the weekly site meetings a few days after each meeting.

4.1.4 Soil Management Plan

A Soil Management Plan was provided in the RAWP. Key elements of this plan, and their implementation, are described below.

4.1.4.1 Soil Screening Methods

Visual, olfactory and PID soil screening and assessment was performed by the Site Superintendent during all remedial and redevelopment-related excavations into known or potentially contaminated material. Soil screening was performed regardless of when the invasive work was done and during all excavation and invasive work performed in support of the remedy and/or redevelopment, such as excavations for foundations and utility work, prior to issuance of the Certificate of Completion.

4.1.4.2 Stockpile Methods

The site remedy did not require the use of long-term stockpiles. No material was kept piled for more than a few days before either being spread for grading purposes or loaded and hauled away for disposal. Due to the varying nature of the contamination throughout the site and the use of different disposal facilities, particular care was taken not to mix stockpiles. Each zone of contamination was carefully delineated and excavated material was either briefly stockpiled within its zone or directly loaded into a dump truck for disposal. Stockpiles, when present, were regularly inspected. Results of inspections were recorded in the daily field reports and maintained at the site and available for inspection by NYSDEC. Stockpiles were kept covered at all times with appropriately anchored tarps. Damaged tarp covers were promptly replaced. Soil stockpiles were continuously encircled with hay bales. Hay bales were used as needed near catch basins, surface waters and other discharge points. A dedicated water hose was available on-site for dust control when needed.

4.1.4.3 Materials Excavation and Load Out

The Site Superintendent, under the Remedial Engineer's supervision, oversaw all invasive work and the excavation and load-out of all excavated material. The Volunteer and its contractors were solely responsible for the safe execution of all invasive and other work performed under the RAWP. The presence of utilities and easements on the site was investigated by the Remedial Contractor and the Remedial Engineer prior to the start of work at the site. It was determined that neither the utilities nor the easements at the site posed any risk or obstacle to conducting the tasks outlined in the RAWP.

Loaded vehicles leaving the site were appropriately lined/tarped, securely covered, manifested, and placarded in accordance with appropriate Federal, State, local, and NYSDOT requirements. A truck wash was operated on-site. Locations where vehicles entered or exited the site were inspected daily for evidence of off-site sediment tracking. The Remedial Engineer was responsible for ensuring that all egress points for truck and equipment transport from the site were clean of dirt and other materials derived from the site during remediation and/or redevelopment activities. The Volunteer and the Remedial Contractor were responsible for the safe performance of all invasive work, the structural integrity of excavations, and for structures that might have been affected by excavations (such as building foundations and bridge footings). The Remedial Engineer

ensured that site redevelopment activities did not interfere with, or otherwise impair or compromise, remedial activities undertaken pursuant to the RAWP.

Redevelopment-related grading cuts and fills were not performed without NYSDEC approval and did not interfere with, or otherwise impair or compromise, the performance of remediation required by the RAWP. Mechanical processing of historical fill and contaminated soil on-site was prohibited.

Using a surveyed drawing, field measurements were used to mark out the areas of excavation. Following excavation, a licensed surveyor (Joseph Nicoletti Associates) surveyed the elevations across the excavated area to document that approximately two feet of soil was removed. In addition, after backfill, elevations were measured across the site to document that at least two feet of clean soil had been placed. In two areas, this documentation was performed manually. There is a site fence that runs along the property border on 139th Street, 3rd Avenue, and portions of 138th Street. In order to preserve the fence's structural stability during excavation, a two-foot wide strip of soil was left in place. This strip provided the support for the footings. Once clean backfill was on site, the two-foot strip of soil was removed by hand in 10 to 20-foot sections and immediately backfilled without being surveyed, to maintain the structural integrity of the fence. ERM verified the proper depth was attained via manual measurements and photographs. A similar approach was used when excavating and backfilling around the trees in the strip of soil between the parking lot and the 138th Street sidewalk.

4.1.4.4 Materials Transport Off-Site

All transport of materials was performed by licensed haulers in accordance with appropriate local, State, and Federal regulations, including 6 NYCRR Part 364. Haulers were appropriately licensed and trucks properly placarded. All trucks loaded with site materials exited the site using only the approved truck routes identified in the RAWP. Those truck transport routes were as follows:

For Trucks Heading North - Head west 0.3 miles on 138th Street and turn right on entrance road to Major Deegan Expressway (Route 87) north.

For Trucks Heading East/South - Head east 0.3 miles on 138th Street to Route 278 (Bruckner Expressway) and make left under the expressway. The entrance to the Bruckner Expressway east was approximately 0.1 miles on the left.

Trucks were prohibited from stopping and idling in the neighborhood outside the site. Egress points for truck and equipment transport from the site were kept clean of dirt

and other materials during remediation and redevelopment. Material transported by trucks exiting the site was secured with tight-fitting covers. No loads contained wet material capable of producing free liquid. All trucks were cleaned of excess debris prior to leaving the site.

4.1.4.5 Materials Disposal Off-Site

Due to the variation in type and concentrations of contaminants across the site, three (3) disposal facilities were selected for the disposal of the excavated material: 1) Clean Earth of North Jersey in Kearny, Jersey; 2) Lincoln Park West Landfill in Hudson County, New Jersey; and 3) Former New Jersey Zinc West Plant in Palmerton, Pennsylvania. Analytical data from the RI was used to determine which soils would be accepted at which facility. Additional samples were also collected to meet disposal facility requirements and to further document the levels of polycyclic aromatic hydrocarbons (PAHs) in soil. The analytical results for these samples are provided in Table 4-1, and the sample locations are provided in Figure 4-1.

The following documentation was prepared for each of these disposal facilities to demonstrate and document that the material derived from the site conformed with all applicable laws: (1) a letter from the Remedial Engineer to the receiving facility describing the material to be disposed and requesting formal written acceptance of the material. This letter stated that material to be disposed was contaminated material generated at an environmental remediation site in New York State. The letter provided the project name and the name and phone number of the Remedial Engineer. The letter included as an attachment a waste profile form with a summary of all chemical data for the material to be transported; and (2) a letter from all receiving facilities stating that it was in receipt of the correspondence (above) and is approved to accept the material. These documents are provided in Appendix C. Oracle Trucking Inc. was a subcontractor to Galaxy and provided logistical support for waste characterization, transportation, and disposal.

A non-hazardous waste manifest system was used for off-site movement of soil from the site. Copies of these manifests are provided in Appendix C.

Section 4.3 provides additional detail on the excavation and off-site disposal of soil from the site.

4.1.4.6 Materials Reuse On-Site

Following soil excavation activities, it was determined that the parking lot entrance needed to be reconfigured as part of the site redevelopment. On 9 May 2013, soil from below the driveway pavement was excavated and placed within a previously excavated area, which was covered with three inches of pavement on 15 November 2013. Additional detail is provided on this activity in Section 4.3.1.2.

All construction debris was carted off-site for disposal.

4.1.4.7 Fluids Management

There was no dewatering or other fluids created during remediation or redevelopment activities, and therefore; no fluid management was necessary.

4.1.4.8 Demarcation

After the completion of soil excavation and any other invasive remedial activities and prior to backfilling, an elevation survey was performed by a New York State licensed surveyor (Joseph Nicoletti Associates). This survey defined the top elevation of the residually contaminated soils. A physical demarcation layer, consisting of orange snow fencing material, was placed on the surface to provide a visual indicator of the top of the 'Residuals Management Zone.' It signals that this zone requires compliance with special conditions for disturbance defined in the Site Management Plan. The survey was conducted prior to the placement of cover soils, pavement and sub-soils, structures, or other materials. This survey and the demarcation layer constitute the physical and written record of the upper surface of the 'Residuals Management Zone' in the Site Management Plan.

Following placement of clean fill material, an additional survey was conducted to document the elevation at the same locations, or similar locations surveyed in the post-excavation survey. These elevations were compared to the post-excavation elevations to confirm placement of a minimum of two feet of clean backfill. See Section 4.7 for further details on final survey and elevations.

4.1.4.9 Backfill From Off-Site Sources

All materials proposed for import onto the site were approved by the Remedial Engineer and were determined to comply with provisions in the RAWP prior to receipt at

the site. In particular, the backfill met the requirements identified in Appendix 5 of DER-10 "Allowable Constituent Levels for Imported Fill or Soil" for a Restricted Residential Site; these limits correspond to the lower of the PGWSCOs and the RRSCOs. Section 4.5 contains further details on the specific materials imported to the site.

As noted in the RAWP, the certification for this report contains the following language: "I certify that all import of soils from off-Site, including source evaluation, approval and sampling, has been performed in a manner that is consistent with the methodology defined in the Remedial Action Work Plan".

All trucks entering the site with imported soils were securely covered with tight fitting covers.

4.1.4.10 Contingency Plan

As noted in the Soil Management Plan, if underground tanks or other previously unidentified contaminant sources were found during on-site remedial excavation or redevelopment related construction, sampling would be performed on product, sediment and surrounding soils, etc. As anticipated, a UST was found in the front of the building that stored diesel fuel for use in an adjacent emergency generator. Further details on the UST removal and endpoint sampling are discussed in Section 4.3.4. These findings were also included in daily and periodic electronic media reports.

4.1.5 Storm-Water Pollution Prevention Plan (SWPPP)

The erosion and sediment controls for all remedial construction were performed in conformance with requirements presented in the New York State Guidelines for Urban Erosion and Sediment Control and the site-specific Storm Water Pollution Prevention Plan. A copy of the SWPPP and NYSDEC's Acknowledgement of Notice of Intent No. NYR 10V867 is provided as Appendix D.

4.1.6 Community Air Monitoring Plan (CAMP)

The CAMP provided in the RAWP included requirements for continuous real-time air monitoring for total volatile organic compounds (VOCs), and particulates (PM-10) during remedial activities. Real-time monitoring was conducted at the perimeter of the work area, defined as the property line, and included one monitoring location at each

of the four corners of the site (see Figure 4-2 for locations). Real-time monitoring occurred during activities that disrupted soils at the site. Upwind concentrations were measured at the start of each workday and periodically thereafter to establish background conditions.

Ambient air monitoring was conducted using direct-reading real-time instruments. The continuous total VOC perimeter monitoring was performed using a portable, direct-reading photoionization detector (i.e., RAE MiniRAE 2000 PID). Total VOCs were reported in running 15-minute average concentrations. The PID lamp voltage used for this Site was 11.7 eV. The particulate monitoring was performed using real-time monitoring equipment (i.e., TSI 8530 DUSTTRAKII) capable of measuring particulate matter less than 10 micrometers in size (PM-10) and of integrating concentrations over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment was outfitted with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration was visually assessed during all work activities.

The CAMP data were downloaded each day and are included as part of each daily log (see Appendix E). In accordance with the CAMP, the following action levels were applied:

VOC Monitoring, Response Levels, Actions

- If the 15-minute average ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeded 5 parts per million (ppm) above background, work activities would be temporarily halted and monitoring continued. If the total organic vapor level readily decreased (per instantaneous readings) below 5 ppm over background, work activities would resume with continued monitoring.
- If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persisted at levels in excess of 5 ppm over background but less than 25 ppm, work activities would be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities could resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest

potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, was below 5 ppm over background for the 15-minute average.

- If the organic vapor level was above 25 ppm at the perimeter of the work area, activities would be shutdown.

  PID readings never exceeded 5 ppm during excavation at the site.

  Particulate Monitoring, Response Levels, and Actions

Particulate concentrations were monitored continuously at the four monitoring stations. The equipment was outfitted with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration was visually assessed during all work activities.

- If the downwind PM-10 particulate level was 100 micrograms per cubic meter (ug/m3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust was observed leaving the work area, then dust suppression techniques would be employed. Work would continue with dust suppression techniques (water spraying) provided that downwind PM-10 particulate levels did not exceed 150 ug/m3 above the upwind level and provided that no visible dust was migrating from the work area.
- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels were greater than 150 ug/m3 above the upwind level, work would be stopped and a re-evaluation of activities initiated. Work could resume provided that dust suppression measures and other controls were successful in reducing the downwind PM-10 particulate concentration to within 150 ug/m3 of the upwind level and in preventing visible dust migration.

  No particulate action levels were exceeded during this project.

4.1.7 Contractors Site Operations Plan (SOP)

The Remedial Engineer reviewed all plans and submittals for this remedial project (including contractor and subcontractor submittals) and confirmed that they were in

compliance with the RAWP and Remedial Design. The Contractor's Site Operations Plan was reviewed and submitted to NYSDEC and NYSDOH prior to the start of remedial excavations in October, 2012. The sequence of work in the Site Operations Plan indicated that soil excavation would be performed in the following order:

- soil from areas designated for Clean Earth of North Jersey, Inc.;
- soil from areas designated for former New Jersey Zinc Plant Site in Palmerton, Pennsylvania;
- soil from areas designated for Lincoln Park West Landfill.

After further review, this sequencing was deemed unnecessary and an excavation plan, based on delineating the areas of soil designated for each disposal facility, was developed. Soil excavation sequencing was based on considerations such as accessibility of an area or availability of trucks for a particular disposal facility.

4.1.8 Citizen Participation Plan

NYSDEC involves the public to improve the process of investigating and cleaning up contaminated sites, and to enable citizens to participate more fully in decisions that affect their health, environment, and social well-being. A Citizen Participation Plan was developed for this site in order to provide information about how NYSDEC would inform and involve the public during the investigation and cleanup. The pertinent elements of this plan carried out thus far include:

- Prepared site contact list;
- Established document repositories;
- Published notice in Environmental Notice Bulletin (ENB) announcing receipt of application and 30-day public comment period (April 6, 2011);
- Published above ENB content in two local newspapers (April 6, 2011);
- Mailed above ENB content to site contact list (April 2011);
- Conducted 30-day public comment period (concluded May 6, 2011);
- Prepared Citizen Participation Plan (approved October 11, 2011);

- Distributed fact sheet to site contact list about proposed RI activities and announcing 30-day public comment period for draft RI Work Plan (October 2011);
- Conducted 30-day public comment period (concluded November 17, 2011);
- Distributed fact sheet to site contact list that described RI results (February 2012);
- Distributed fact sheet to site contact list about proposed RAWP and announcing 45-day public comment period (February 2012);
- Conducted 45-day public comment period (concluded March 9, 2012);
- Distributed fact sheet to site contact list describing upcoming remedial activities (June 29, 2012);
- Placed NYSDEC approved documents related to the remedial action as appropriate in the document repository (October 22, 2012 and February 6, 2013);
- Distributed fact sheet to site contact list announcing that remedial activities have been completed and summarizing the Final Engineering Report (18 October 2013);

  At this point, the elements of the Community Participation Plan that remain to be carried out are;
- Distribute fact sheet to site contact list announcing issuance of Certificate of Completion (COC); and
- Place final report documents in the document repository.

4.2 REMEDIAL PROGRAM ELEMENTS

4.2.1 Contractors and Consultants

- Contractor - Galaxy General Contracting Corporation
- Consultant - ERM Consulting & Engineering, Inc.
- Engineer of Record/Remedial Engineer - John Mohlin, P.E. (ERM Consulting & Engineering, Inc.)

4.2.2 Site Preparation

- Toward the end of June, 2012, Galaxy General Contracting Corporation mobilized to the site. A section of the lobby in the existing building was enclosed and became the temporary construction office and equipment staging area.
- Work began by installing plywood on the existing site fencing. Three points of egress were created using 12-ft gates attached to rollers on the site fence. After all perimeter erosion and sediment controls were established, two (2) 20x50x2 feet construction entrances/truck wash areas were created by excavating two feet of the existing ground and backfilling with two feet of gravel. These pads allowed for a stable location for excess debris to be removed from vehicles entering or exiting the site. Galaxy General Contracting Corporation than began removing site features within the footprint of the proposed excavation including trees, walkways, benches and site lighting.
- The erosion and sediment controls at the site consisted of perimeter silt fencing and hay bales, stabilized construction entrance ways, and inlet protection. Because redevelopment activities continued after completion of remediation activities, temporary stabilization was not necessary. Hay bales were generally used on steep slopes greater than 3:1 and at the bases of any long-term clean fill stockpiles. These erosion controls were established by early July 2012, and were regularly inspected through completion of remedial activities. Any deficiencies were brought to the Contractor's attention for correction.
- Utility marker layout.
- Upon determining that soil disturbance would exceed one acre, a SWPPP was prepared during August, 2012, with NYSDEC Acknowledgement of the Notice of Intent received on 6 September 2012.
- A pre-construction meeting was held with NYSDEC and all contractors on 20 June 2012.
- A NYSDEC-approved project sign was erected at the project entrance and remained in place during all phases of the Remedial Action.

4.2.3 General Site Controls

- The building is an active senior housing complex with a main lobby and security desk. The entire site is surrounded by a 10-foot fence with barbed wire on top except for the area around the parking lot. All entrants to the building are required to sign in and out with the personnel at the security desk and a log of activities is also maintained there.
- Daily 'tailgate' kick off meetings were held by ERM in order to review the expected activities for that day and to review any special health and safety-related items. Attendees were asked to provide a brief description of planned activities for the day as well as what personnel protective equipment or any other health and safety requirements for said tasks.
- Equipment decontamination and residual waste generation during the remedial action was significantly minimized through the use of dedicated equipment for contaminated and clean soil (e.g., excavator buckets, trucks, etc. being used exclusively for contaminated or clean soil). Excavation and other equipment were cleaned prior to exit from the site. The following procedures were generally used for decontamination of remedial excavation equipment over contaminated soil piles or at dedicated cleaning areas (e.g., at truck-washing stations) as appropriate based on site conditions:

  - scrape or brush visible soil or other material from the surface.

  - visual inspection and assessment of cleaned equipment using appropriate field meters (PID).

  - chemical-resistant gloves or other PPE used by workers were disposed with contaminated soil leaving the site for disposal at a permitted disposal facility.
- Excavated soil (all non-hazardous) was direct-loaded from the excavation or temporary stockpiles within the excavation into trucks for transport to one of the three approved disposal facilities.

4.2.4 Nuisance Controls

- The Contractor was constantly sweeping and removing debris from equipment entering and exiting the site at the construction entrances. Occasionally the

Contractor would need to remove stray material from the parking area taking care not to create an airborne dust problem.

- Dust control was achieved by use of a dedicated potable water hose. If dust was observed to be forming, intrusive activities would be halted and the ground beneath the location that the dust was forming was lightly wetted.
- Similar measures were used in the case of odor control. When any odors were discovered, intrusive activities were halted and the area producing the odor was either sprayed with potable water, covered by clean fill, or a combination or spraying and clean fill until the odor subsided.
- Trucks generally entered the site from 139th Street (a one-way street) to avoid disruption to traffic on the more heavily trafficked 138th Street.

4.2.5 CAMP Results

Volatile organic compounds (VOCs) and particulate concentrations were monitored at all four locations on a continuous basis or as otherwise specified. Upwind concentrations were measured at the start of each workday and periodically thereafter to establish background conditions.

Throughout the project, no action levels were exceeded for either particulates or VOCs. Periodically during the hotter months, the ground was lightly sprayed with water to reduce the potential for dust formation. On 12 December 2012, the highest levels of dust and VOCs were recorded at the site, but were still well below the action limits set for the site (see Appendix E for results). These readings were associated with the deeper (approximately nine-foot) excavation around MW-02 and were accompanied by a slight odor. The odors occurred when gray or black soil at depths of approximately 6-10 ft. was exposed. In general, the odors were confined to the excavation and would dissipate after several minutes. When odors were noticed extending beyond the excavation, further excavation was halted and work did not resume until odors dissipated. Air monitoring conducted immediately adjacent to the excavation did not identify any exceedances of VOC or dust action levels. To prevent the possibility of odors migrating into the building, the nearby doorway was sealed with plastic. At the end of the day, the bottom of the excavation was covered with a few inches of clean fill to suppress any odor that

might still be present. After the second day of excavation (13 December 2012), previously-excavated non-odorous soil, was placed within the excavation to provide support for the sidewalls; this also had the effect of reducing odors within the excavation. This soil was removed for disposal prior to backfill.

The CAMP data are attached to each daily log (see Appendix E).

4.2.6 Reporting

Daily reports were generally submitted to NYSDEC and NYSDOH Project Managers by 12:00 PM the following day of the reporting period and included:

- An update of progress made during the reporting day;
- Locations of work and quantities of material imported and exported from the Site;
- A summary of any and all complaints with relevant details (names, phone numbers);
- CAMP data;
- A summary of CAMP finding, including excursions; and
- An explanation of notable site conditions.

Daily reports were not the mode of communication for notification to the NYSDEC of emergencies (accident, spill), requests for changes to the RAWP or other sensitive or time critical information. However, such conditions were included in the daily reports. Emergency conditions and changes to the RAWP were addressed directly to NYSDEC Project Manager via personal communication. Daily Reports included a description of daily activities and their approximate locations. The reports also included a summary of air sampling results, odor and dust problems and corrective actions, and all complaints received from the public. Monthly reports were submitted to NYSDEC and NYSDOH Project Managers within one week following the end of the month of the reporting period and included:

- Activities conducted at the site during the previous reporting period and those anticipated for the next reporting period, including a quantitative presentation of work performed (i.e. tons of material exported and imported, etc.);
- Description of approved activity modifications, including changes of work scope and/or schedule;
- Sampling results received following internal data review; and
- An update of the remedial schedule including the percentage of project completion, unresolved delays encountered or anticipated that may affect the future schedule, and efforts made to mitigate such delays.

All daily and monthly reports are included in electronic format in Appendix E.

The digital photo log required by the RAWP is also included in electronic format in Appendix E as part of the daily reports.

4.3 CONTAMINATED MATERIALS REMOVAL

Prior to the start of the remedial excavation, analytical data from the RI was evaluated in order to determine acceptable disposal facilities for the soils. Additional waste characterization samples were collected by Galaxy for analysis of lead (seven samples) and polycyclic aromatic hydrocarbons (PAHs) (two samples). Analyses were performed by Accutest Laboratories (NYSDOH Certification No. 10983). In addition, a sample of soil from former RI soil boring SS-03 was collected for analysis of TCLP Metals. This testing was performed by Spectrum Analytical (NYSDOH Certification No. 11522). Figure 4-1 shows the location of these samples, and Table 4-1 presents the analytical results.

It was anticipated that the majority of the excavated soil would be disposed at Lincoln Park West Landfill in New Jersey. In some locations, the concentrations of polycyclic aromatic hydrocarbons (PAHs) exceeded this facility's limits for acceptance. Therefore, soil from these areas was disposed at the Former NJ Zinc Plant site in Palmerton, Pennsylvania. Lastly, the soils in two areas at the site contained elevated

levels of lead, which prevented disposal at either of these facilities. Therefore, the lead-contaminated soil was disposed at Clean Earth of North Jersey in Kearny, New Jersey. All three facilities received a letter and a waste characterization form describing the soils to be transferred to that facility. Each facility then responded with a letter indicating their acceptance of soil from particular areas of the site. This documentation is provided in Appendix C. Prior to excavation, the area designated for each disposal facility was marked in the field with a combination of spray paint and flags. These designated areas are represented in Figure 4-3.

Soil excavation activities commenced on October 15, 2012 and were substantially complete on January 17, 2013. Additional grading and backfill occurred in March 2013. In April and May 2013, groundwater remediation was performed.

As outlined in the RAWP, the remedial objective was to achieve a Track 4 Cleanup for Restricted Residential Use. To accomplish this objective, approximately two feet of soil was removed from across the site (except for those soils beneath the building and the parking lot), and replaced with a minimum two-foot layer of clean backfill. In addition, two deeper excavations (located near MW-02 and MW-05) were conducted to remove soil exceeding Protection of Groundwater Soil Cleanup Objectives (PGWSCOs). The location of the areas where excavations were performed is shown in Figure 4-3. As noted in this figure, excavated soil was disposed at one of the three facilities. The quantity of material disposed at each facility is as follows:

- 298.5 tons at Clean Earth of North Jersey in Kearny, New Jersey;
- 1,725.2 tons at Former NJ Zinc Plant in Palmerton, Pennsylvania; and
- 5,083.4 tons at Lincoln Park West Landfill in New Jersey.

In total, approximately 7,107 tons of soil were removed from the upper two feet of the site, from the area around the UST, and from areas that exceeded the PGWSCOs. In addition, this total includes excavation of soil deeper than two feet that exceeded RRSCOs in areas where other redevelopment-related construction occurred (e.g., footers for light poles). Oracle Trucking Inc. coordinated and planned all waste shipments to designated facilities using multiple waste haulers. Manifests for all shipments are

provided in Appendix C. Table 4-2 presents a summary of the shipments including date, manifest number, amount of material, and disposal facility.

At the conclusion of soil excavation, a minimum of two feet of soil had been removed from the site, with additional soil removed at three locations, as noted in Figure 4-3. Figure 4-4 presents surveyed elevation data documenting that at least two feet of clean fill material was placed above contaminated soil (with the exception of soil beneath the building and the parking lot).

A list of the soil cleanup objectives (SCOs) for the contaminants of concern for this project is provided in Table 2-1. These remediation activities have achieved Track 4 SCOs for Restricted Residential Use.

The following sections provide more detail on the soil and groundwater remediation undertaken in each of the areas described above.

4.3.1 Surface Soils (0-2 feet)

4.3.1.1 Excavation & Disposal Details

The remedial action approved for the site was to remove all surface soils (0-2 feet) or cover the soil with two feet of clean fill material or cap with pavement within the boundaries of the site. In the portion of the site bounded by 3rd Avenue, 138th Street and the building, the ground was uneven and included numerous rolling hills. Prior to the start of remedial excavation activities, this section of the property was graded to create a more consistent slope that would match the final design grades. A more consistent slope also made it easier to accurately track the excavation and backfill depths during the project.

All exposed areas of the Site were excavated to a minimum depth of approximately two feet from October 2012 through January 2013. As discussed in Section 4.3, soil excavated from the site was disposed at three different disposal facilities depending on the concentrations and types of contaminants. In accordance with the RAWP, no endpoint samples were collected. The remedial action was designed to replace the upper two feet of soil in all exposed areas of the site with at least two feet of

clean backfill. Therefore, no endpoint samples were necessary. Figure 4-4 demonstrates that a minimum of two feet of clean material has been placed across the Site. Figures 4-7 and 4-8 illustrate the concentrations of residual soil contamination remaining below the 2 foot clean cover.

Following excavation in an area and placement of a demarcation layer, clean backfill was imported to the Site, stockpiled, and placed as needed. The material was compacted with a plate tamper. Further details on the backfill quality and sources are provided in Section 4.5.

Table 4-2 shows the total quantities of each category of material removed from the site and the disposal locations. A summary of the additional samples collected to characterize the waste, and associated analytical results are summarized on Table 4-1.

Letters from Applicants to disposal facility owners and acceptance letters from disposal facility owners are attached in Appendix C.

Manifests are included in electronic format in Appendix C.

4.3.1.2 On-Site Reuse

As discussed in Section 4.1.4.6, there was limited soil reuse at the site, which was not anticipated in the RAWP.

Following soil excavation activities, it was determined that the parking lot entrance needed to be reconfigured. The curbed north-south (N/S) edge of the driveway (referred to as a verge) had previously been excavated to a depth of two feet and backfilled with clean fill. The Owner desired to remove this verge and create a new verge approximately three feet to the west. On May 9, 2013, the Remedial Contractor excavated approximately two feet of clean fill from the N/S verge down to the demarcation layer, and removed the surrounding curb. A two-foot wide by 24-foot long section of asphalt three feet to the west of and parallel to the N/S verge was saw-cut and removed. This section of the entry drive was excavated to a depth of 1.0-1.5 feet bgs where a concrete pad limited further soil removal. Soil from the drive excavation was placed in the original N/S verge and was covered in asphalt. The soil was screened with

a PID, and no volatiles were detected. Orange snow fencing was placed in the bottom of the new drive trench to serve as a new demarcation layer. This area was then backfilled with clean fill removed from the original N/S verge, and compacted. Additional clean fill was needed to bring the level up to 0.5 feet bgs. The trench was brought to grade with gravel and compacted. The extra gravel was mounded over the N/S verge and was covered with pavement on November 15, 2013. Photographs of this work are presented in the daily log for May 9, 2013 (see Appendix E).

Figure 4-5 presents the location of both areas of soil reuse.

4.3.2 MW-05 Soil (0-5 feet)

4.3.2.1 Excavation & Disposal Details

Soil containing concentrations of contaminants that exceeded the PGWSCOs was also excavated from the area around MW-05. Between December 20 and 21, 2012, a 17-foot by 29-foot rectangular area was excavated to a depth of five (5) feet at this location (see Figure 4-3). Upon reaching the target depth of five (5) feet, four (4) sidewall samples and one (1) bottom sample were collected and sent out for analysis for VOCs, SVOCs, pesticides and metals in accordance with USEPA SW-846 Method 8260B, 8270C, 8081, 6010 and 7471. These sample locations (SB-20 through SB-24), and the extent of the excavation are depicted in Figure 4-3.

The soil sampling results are presented in Table 4-3. Soil samples from the MW-05 excavation contained some parameters (PAHs, barium, and mercury) that were in excess of PGWSCOs. However, none of these parameters were detected in the groundwater in concentrations above groundwater criteria. Therefore, it was determined that the remaining soil was not a source of groundwater contamination and no further excavation was necessary. This decision was discussed with and approved by e-mail from Jane O'Connell of NYSDEC on January 3, 2013 (a copy of the email is provided in Appendix F).

Following this approval, residual petroleum hydrocarbon groundwater contamination was treated in situ via the addition of a calcium peroxide compound. On

January 4, 2013, one hundred and thirty (130) pounds of calcium peroxide was mixed in the 0-5 ft. interval below the bottom of the MW-05 excavation in accordance with the Proposed Calcium Peroxide Application dated October 15, 2012 and approved by NYSDEC on October 16, 2012. Once the calcium peroxide was sufficiently mixed the MW-05 excavation was than backfilled with approved clean fill.

Table 4-2 shows the total quantities of each category of material removed from the site and the disposal locations. A summary of the additional samples collected to characterize the waste, and associated analytical results are summarized on Table 4-1.

Letters from Applicants to disposal facility owners and acceptance letters from disposal facility owners are attached in Appendix C.

Manifests are included in electronic format in Appendix C.

4.3.2.2 On-Site Reuse

No soil was reused within this area.

4.3.3 MW-02 Soils (0-10.5 feet)

4.3.3.1 Excavation & Disposal Details

Soil with contaminants in concentrations that exceeded the PGWSCOs was also present adjacent to MW-02. Excavation was conducted between December 12 and 14, 2012. It was originally anticipated that the excavation would be approximately 29 feet by 40 feet by 9 feet deep. During excavation, gray or black odorous soil was encountered starting at a depth of about six feet bgs. Upon reaching the target depth of nine feet, dark and odorous soil was still present. The excavation continued until neither the dark soils nor odor were present, and ended at approximately 10.5 feet bgs. Once a depth of 10.5 feet was achieved, and the soil appeared to be uncontaminated, six (6) sidewall samples and two (2) bottom samples were collected for laboratory analysis for VOCs, SVOCs, pesticides and metals in accordance with USEPA SW-846 Method 8260B, 8270C, 8081, 6010 and 7471.

The soil sampling results are presented in Table 4-4. No parameters exceeded the RRSCOs or the PGWSCOs. Therefore, it was determined that the remaining soil was not a source of groundwater contamination and no further excavation was necessary. These sample locations (SB-12 through SB-19), and the extent of the excavation are depicted in Figure 4-3. The final size of the excavation was approximately 30 feet by 43 feet by 10.5 feet deep.

Following receipt of endpoint analytical results that met the SCOs, residual petroleum hydrocarbon groundwater contamination was treated in-situ via the addition of a calcium peroxide compound. On 21 of December 2012, seventy (70) pounds of calcium peroxide were mixed in the 0 to1-foot interval below the bottom of the MW-02 excavation in accordance with the Proposed Calcium Peroxide Application dated October 15, 2012 and approved by NYSDEC on October 16, 2012. Once the calcium peroxide was sufficiently mixed, the MW-02 excavation was backfilled with approved clean fill. The presence of chlorinated VOC groundwater contamination in this area was later treated in-situ via the injection of sodium permanganate ($NaMnO_4$) as described in Section 4.3.5.2.

Table 4-2 shows the total quantities of each category of material removed from the site and the disposal locations. A summary of the additional samples collected to characterize the waste, and associated analytical results are summarized on Table 4-1.

Letters from Applicants to disposal facility owners and acceptance letters from disposal facility owners are attached in Appendix C.

Manifests are included in electronic format in Appendix C.

4.3.3.2 On-Site Reuse

No soil was reused within this area.

4.3.4 Underground Storage Tank (UST)

4.3.4.1 Excavation & Disposal Details

On December 3, 2012, one 500-gallon UST was excavated and removed from the site. This UST held diesel fuel for an emergency generator that was used to power the hallway lights in the event of a power outage. The UST and the generator were located near the front entrance of the building off of 138th Street (see Figure 4-3 for location). After the installation of a temporary above ground storage tank (AST) to service the relocated generator, the approximately 500-gallon UST was excavated, cleaned, and removed from the site by Rigid Tank Maintenance.

Based on visual, olfactory, and PID screening, there was no evidence of release from the tank. In accordance with the NYSDEC Petroleum Bulk Storage Regulations, because the total petroleum storage capacity at the site (including this tank) is less than 1,100 gallons, this tank did not require registration. Once the tank was removed, four sidewall samples and one bottom sample from the excavation were collected and sent out for analysis of STARS List VOCs/SVOCs. The soil sampling results are presented in Table 4-5.

The samples from the UST excavation showed that concentrations of some SVOCs were above PGWSCOs or RRSCOs. However, the SVOC concentrations were similar to those in soils remaining in other areas of the site. Further, none of the SVOCs found in concentrations above the PGWSCOs were detected in groundwater above the groundwater criteria. Therefore, in a conversation between Ernie Rossano of ERM and Jane O'Connell of NYSDEC on December 13, 2012, NYSDEC agreed that no further action was necessary and approved placement of backfill of 7 ft. of clean fill in the UST excavation. The sample locations and the extent of the excavation are depicted in Figure 4-3. The final size of the excavation was approximately 5 feet by 15 feet by 7 feet deep.

Table 4-2 shows the total quantities of each category of material removed from the Site and the disposal locations. A summary of the additional samples collected to characterize the waste, and associated analytical results are summarized on Table 4-1.

Letters from Applicants to disposal facility owners and acceptance letters from disposal facility owners are attached in Appendix C.

Manifests are included in electronic format in Appendix C.

4.3.4.2 On-Site Reuse

No soil was reused within this area.

4.4 GROUNDWATER REMEDIES

During the RI, chlorinated VOCs were detected in concentrations above Class GA GWQS at monitoring wells MW-02 and MW-04. Petroleum hydrocarbons were detected above Class GA GWQS at MW-02 and MW-05. Soil mixing with an oxygen release compound (calcium peroxide) was selected to reduce the concentrations of petroleum hydrocarbons following excavation of impacted soils. The selected remedy to address the chlorinated VOCs was in-situ chemical oxidation (ISCO) with sodium permanganate. The following sections provide details on the implementation of these remedies.

4.4.1 Soil Mixing With Calcium Peroxide

A design document, Proposed Calcium Peroxide Application, was submitted to NYSDEC on October 15, 2012 and approved on October 16, 2012. The document specified that calcium peroxide (CaO_2) would be mixed into soil at the approximate groundwater table interface at MW-02 and MW-05. The addition of calcium peroxide would promote the aerobic biodegradation of residual petroleum hydrocarbons to nonhazardous or less toxic compounds in the capillary and intermittently (seasonal) saturated zone. The calcium peroxide would decompose and release oxygen over time (three months to one year depending upon site conditions) to stimulate biodegradation of the petroleum hydrocarbons by enhancing the growth of native bacterial populations.

Calcium peroxide is a white powder solid available from a variety of manufacturers in a variety of formations. For this site, FMC PermeOx Plus® (> 75% (by weight) CaO_2) was used. FMC developed a dosing calculator used to calculate recommended PermeOx Plus® dosing for specified treatment volumes (length, width and thickness), soil conditions (porosity and organic carbon) and given groundwater and soil demands from target compounds. Based on the dosing calculator, the concentrations of compounds present in each treatment area required minor amounts (i.e., insignificant, less

than 2 pounds) of PermeOx Plus®. It is recognized that the success of any soil treatment is dependent upon the effective delivery of the amendment to the target soil. Therefore, rather than apply a de minimus amount of PermeOx Plus® to a large soil volume, application of an additional amount of material was recommended as follows:

- In an initial calculation, an additional demand of 2 mg/L TPH was added as a surrogate for additional hydrocarbon demands not captured by historical groundwater analysis. Even with the inclusion of 2 mg/L of TPH, the dose required remained small (78 pounds) for the combined areas.
- Based upon ERM's experience, coupled with the practicality of mixing the calcium peroxide solid in the soil column, ERM further recommended doubling the overall dose and rounding to the nearest shipping container. In this manner, a total of 200 pounds was proposed for application.

A breakdown of the recommended 200-pound PermeOx Plus® dose by area is summarized below:

- MW-02 area – 70 pounds (initial excavation to 9 feet, mixing interval 9 to 10 feet below ground surface (bgs), dose applied 1.57 pounds per cubic yard (PCY)).
- MW-05 area – 130 pounds (initial excavation to 5 feet, mixing interval from 5 to 10 feet, dose applied 1.56 PCY).

As described in Sections 4.3.2.1 and 4.3.3.1, soil was mixed with a backhoe following the excavations at MW-05 and MW-02. The PermeOx Plus® was applied to the base of each excavation, distributed relatively uniformly and mixed into the soil (using the backhoe bucket and teeth). At MW-02, the material was mixed over the 0 to1-foot interval below the bottom of the excavation. At MW-05, the material was mixed over the 0 to 5-foot interval below the bottom of the excavation. After mixing was completed, the excavations were backfilled with clean fill material. Groundwater sampling to assess this remedy was conducted in September 2013, and results of the sampling are provided in Section 4.5.2.

4.4.2 In-Situ Chemical Oxidation with Sodium Permanganate

As identified in the RAWP, In-Situ Chemical Oxidation (ISCO) with sodium permanganate was selected to address the chlorinated VOCs in MW-02 and MW-04. To further define the extent of chlorinated VOCs and to collect additional data about subsurface conditions, a pre-design study was conducted in July 2012.

On July 11, 2012, five additional wells were installed and sampled (MW-06T through MW-10T). Figure 4-6 shows the locations of these wells, and Table 4-6 presents the sampling results. Data Usability Summary Reports (DUSRs) were prepared for these data, and are included in Appendix G; associated raw data are provided electronically in Appendix H. Wells MW-07T and MW-09T were found to contain tetrachloroethene, trichloroethene, and cis-1,2-dichloroethene above the NYSDEC Groundwater Quality Standards. Therefore, it was decided that ISCO would be performed in the vicinity of these wells, in addition to the areas around MW-02 and MW-04 as described in the RAWP.

On July 3, 2012, also as part of the pre-design study, ERM completed falling head tests in two wells in the ISCO areas (MW-02 and MW-04) to measure site-specific infiltration rates. During each test, a volume of water was poured into the well as quickly as possible and the resulting decline in water level was measured every ten seconds using a dedicated pressure transducer. Recharge rates of 0.40 and 0.14 gallons per minute per well were obtained from MW-02 and MW-04, respectively. On July 11, 2012, ERM collected soil samples for soil oxidant demand (SOD) analysis from 13 to 18 feet bgs at six locations. Samples were collected from the approximate depth corresponding to the upper two feet of the saturated zone. These samples were analyzed for 48-hour permanganate SOD using ERM's procedure Remlab-01 Ver. 1.5 entitled '*Natural Oxidant Demand Test Using Potassium Permanganate ($KMnO_4$).*' The SOD results ranged from non-detectable (< 0.10 grams per kilogram (g/kg)) to low values of 0.643 and 0.752 g/kg, to one moderate outlier value of 3.02 g/kg.

These data were used to prepare a design document. The Remedial Design for In-Situ Chemical Oxidation was submitted to NYSDEC on January 22, 2013 and approved on February 4, 2013. On March 5, 2013, prior to implementing the remedy, ERM submitted an Underground Injection Control (UIC) application to the United States Environmental Protection Agency (USEPA) for permanganate injection wells. This application was approved by USEPA on March 6, 2013 via e-mail. Copies of the UIC application and approval documents are provided as Appendix I.

On April 15, 2013, ERM mobilized to the site to install 39 temporary ISCO injection wells. Figure 4-6 shows the location and construction of these temporary wells. Each well consisted of a two-inch screen with riser extending approximately two feet above the ground surface. As these were temporary wells for permanganate injection, no sand packs or grout seals were necessary. Soils generated during drilling (approximately 4 cy) were placed into drums and transported off-Site to the Clear Brook transfer station

in Deer Park, New York. The material was ultimately disposed at Apex Sanitary Landfill in Amsterdam, Ohio. Appendix C contains a waste characterization form, acceptance letter, and manifests for the soil.

On April 22, 2013, constant-head injection with sodium permanganate commenced. Constant head injection employs a continuous low-pressure application approach to deliver ISCO agents over a longer period of time. A continual automated demand-based flow system was used to maintain a constant fluid level in multiple injections wells concurrently. The system hardware was configured to dilute 40% stock sodium permanganate solution with water (provided by a garden hose connection) to a 5 percent (weight/weight) solution, transfer the mixed solution to a 10-point manifold, and into up to ten injection wells controlled by liquid sensors.

By setting the sensors at the desired levels in each well (generally 2 to 5 feet above static water table so the sensors remain immersed in water as the permanganate solution is added to the well), the mixed oxidant solution was conveyed to each injection well as needed under gravity via a surface flex-hose. The benefit of this approach is that the injections were completed at a low flow rate, automatically and continuously over time, allowing each injection location to accept fluid at a maximal rate under no external pressure. By May 1, 2013, permanganate injections had been completed at the four injection areas in accordance with the approved Remedial Design for In-Situ Chemical Oxidation. Below is a summary of the mass of sodium permanganate delivered to each area in the form of a 5% solution:

MW-02 area: 1,368 pounds (lbs)

MW-07T area: 220 lbs

MW-09T area: 271 lbs

MW-04 area: 542 lbs

Total mass of sodium permanganate: 2,400 lbs

Following injection, the 39 injection wells were decommissioned. In September 2013, eight wells were installed and groundwater samples were collected to assess the effectiveness of the remedy. The results of the sampling are provided in Section 4.5.2.

Soil vapor monitoring was also conducted after the injection program. Soil vapor monitoring conducted during the RI indicated that under those conditions, no further action was required with respect to potential soil vapor intrusion. However, there was a possibility that the chemical reactions associated with ISCO could increase the potential

for soil vapor intrusion. Therefore, soil vapor and indoor air were monitored in May and August 2013 to confirm there was no increased potential for vapor intrusion. Details of these sampling events are presented in Section 4.5.3.

4.5 REMEDIAL PERFORMANCE/DOCUMENTATION SAMPLING

4.5.1 Soil

Endpoint samples were collected for the following areas:

- MW-05 excavation;
- MW-02 excavation; and
- UST removal.

In accordance with DER-10 Part 5.4(b)(5), the sampling frequency in each area was as follows:

- One sample from the bottom of each sidewall for every 30 linear feet of sidewall; and
- One sample from the excavation bottom for every 900 square feet of bottom area.

At these frequencies, four sidewall samples and one bottom sample were collected from the MW-05 excavation and the UST excavation. The larger dimensions of the MW-02 excavation necessitated six sidewall samples and two bottom samples. A summary of endpoint sampling results is provided in Tables 4-3 through 4-5. Figure 4-7 shows the location of all endpoint sampling locations as well as exceedances of UUSCOs. Figure 4-8 shows all endpoint sampling locations and all exceedances of RRSCOs and PGWSCOs. Figure 4-8 also shows locations identified during the RI where contaminants occurred in concentrations above the RRSCOs and PGWSCOs. However, in locations where contaminants in soil were above the PGWSCOs, none of the contaminants were detected in the groundwater in concentrations above groundwater criteria. All soil containing contaminants in concentrations that exceed the RRSCOs was located below the two-foot soil cover and no further excavation was deemed necessary.

Data Usability Summary Reports (DUSRs) were prepared for all data generated in this remedial performance evaluation program. These DUSRs are included in Appendix

G, and associated raw data are provided electronically in Appendix H. All soil data have been submitted to NYSDEC in the appropriate electronic data deliverable (EDD) format.

4.5.2 Groundwater

During a meeting on April 11, 2013, NYSDEC requested that one round of groundwater samples be collected to demonstrate that the groundwater remedies (calcium peroxide soil mixing and sodium permanganate injections) had been or were expected to be effective in reducing concentrations of volatile organics in the groundwater. Effectiveness was to be demonstrated by a declining trend in VOC concentrations and/or field measurements indicating that the expected chemical reactions had or were occurring in the subsurface. Since all of the wells installed during the RI were removed during excavation of soils at the site, it was necessary to install new monitoring wells to collect the necessary groundwater data. The Post-Remediation Groundwater Monitoring Plan was submitted to NYSDEC on August 28, 2013 and approved on September 3, 2013.

4.5.2.1 Well Installation

Between 20 and 24 September 2013, eight (8) monitoring wells were installed at the approximate locations shown in Figure 4-9 following the approved Groundwater Monitoring Plan. These areas were selected because they coincided with the four areas in which sodium permanganate and/or calcium peroxide were undertaken. A couplet of pre-packed monitoring wells was installed at each of the four treatment areas using direct push methods. The couplets were designed to monitor shallow and deeper treatment zones in the subsurface. The wells were constructed of 1-inch inside diameter, threaded flush joint, schedule 40 polyvinylchloride (PVC) casing with five (5) foot length PVC screen having slot openings of 0.010-inches. The wells were temporarily finished with stick-ups to allow for installation of pavers around the wells. Following these activities, the wells will be finished at the surface with a locking cap and a flush grade manhole. The wells will then be surveyed to obtain horizontal positioning as well as a measuring point elevation for water levels.

During well installation, refusal was encountered at several different locations, and the water level was found to be deeper than in past sampling events. As a result, some well screen intervals were modified as detailed below:

Well	Proposed Screen Zone (ft. bgs)	Final Screen Zone (ft. bgs)
MW-11S	13 - 18	13 – 18
MW-11D	19 - 24	19 - 24
MW-12S	11 - 16	13 - 18
MW-12D	18 - 23	18 - 23
MW-13S	13 - 18	15 - 20
MW-13D	19 - 24	15 - 20
MW-14S	13 - 18	15 - 20
MW-14D	19 - 24	19 - 24

It should be noted that while the final screen zones for MW-13S and MW-13D appear to be the same depth below grade, the difference in grade elevation is approximately one foot. Therefore, the actual elevation of the MW-13D screen zone is one foot deeper than that of MW-13S. Following installation, the wells were developed by over pumping until the turbidity was consistently below 50 NTUs.

4.5.2.2 Groundwater Sampling

On September 25 and 26, 2013, a round of groundwater samples was collected from all wells. Groundwater samples were collected using low-flow sampling procedures, per the Standard Operating Procedures in the approved October 2011 Remedial Investigation Work Plan (RIWP). Samples were analyzed for the following parameters:

- VOCs via EPA Method 8260B;
- Color;
- dissolved oxygen (DO);
- pH;
- conductivity; and
- oxidation-reduction potential (ORP).

VOC analysis was performed by Accutest Laboratories (NYSDOH Certification No. 10983). Colorimetry analysis was conducted by ERM at its Providence, Rhode Island laboratory. The remaining parameters were measured in the field.

DUSRs were prepared for all data generated in this remedial performance evaluation program. These DUSRs are included in Appendix G, and associated raw data

are provided electronically in Appendix H. All groundwater data has been submitted to NYSDEC in the appropriate EDD format.

Table 4-7a presents all VOC analytical results for the September 2013 groundwater sampling event. Figure 4-9 presents a comparison of pre-remedial (MW-01 through MW-05, MW-06T through MW-10) and post-remedial VOC analytical results (MW-11S/D through MW-14S/D). The pre-remedial results show all the compounds that were present above Technical & Operational Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards and Guidance Values (GWQS) prior to implementation of remediation activities. The data from the September 2013 round of monitoring show that the concentrations of these same compounds were all below detectable levels. Other compounds were also detected during the September 2013 round of sampling, however all concentrations were below GWQS.

A series of geochemical parameters were also measured in the field during pre-remediation and post-remediation sampling and compared. Table 4-7b presents a comparison of pre- and post-remediation dissolved oxygen (DO), conductivity, and oxidation-reduction potential (ORP). A significant shift in DO was observed, increasing from a pre-remediation site average of 2.04 mg/L to a post-remediation average of 4.83 mg/L. Increased groundwater DO is the expected and desirable result of the chemical reactions that take place following the application of both calcium peroxide and sodium permanganate, and serves as one indicator of successful destruction of contaminants. A minor increase in ORP was observed, which is also an indicator of the success of oxidant applications.

The colorimetric analysis was designed to track the presence and concentration of sodium permanganate. As shown in Table 4-7c, no sodium permanganate was detected in any of the new wells. This indicates that the oxidant has either been a) completely reacted with contaminant (and/or natural soil oxidant demand), and is thus no longer detectable, or b) has not yet reached the screened zones of the monitoring wells. Given the reduction in groundwater VOC concentrations, and the proximity of the new wells to previous injection wells, it is anticipated that the oxidant has affected the targeted area and has been completely reacted. This is further supported by the presence

of a yellow color before filtering and brown sediment in some samples. The yellow color is typical of soluble manganese (Mn), and the brown sediment is typical of manganese (IV) oxide (MnO_2) floc resulting from the permanganate reaction.

In summary, the decrease in target VOC concentrations to non-detectable levels demonstrates that the groundwater remedies were effective in reducing VOC concentrations. Therefore, no further remedial action is planned for groundwater and groundwater monitoring will proceed as outlined in the Site Management Plan (SMP).

4.5.3 Vapor Intrusion Sampling

As discussed in Section 4.4.2, there was a possibility that the reactions associated with ISCO could increase the potential for soil vapor intrusion. Therefore, soil vapor and indoor air samples were collected in May and August 2013. Four sets of co-located sub-slab and indoor air samples, and one outdoor ambient air sample, were collected at the locations shown in Figure 4-10. Three of these locations (SS/IA-01, SS/IA-02, and SS/IA-04) were identical to the locations sampled during the RI. One sample (SS/IA-05) was located approximately ten feet west of the original RI location (SS/IA-03). The New York State Department of Health (NYSDOH) Indoor Air Quality Questionnaire & Building Inventory, as well as sampling logs, for both events are provided in Appendix J.

A summary of the vapor intrusion sampling data collected in May and August 2013 is included in Table 4-8, Table 4-9, and Figure 4-10. Of the seven compounds evaluated by the NYSDOH Decision Matrices in the NYSDOH Guidance Document For Evaluating Soil Vapor Intrusion in the State of New York (October 2006), only 1,1,1-trichloroethane and PCE were detected in sub-slab soil vapor. The maximum concentrations of PCE in sub-slab soil vapor and indoor air were 10.51 micrograms per cubic meter ($\mu g/m^3$) and 1.42 $\mu g/m^3$, respectively. When evaluated with NYSDOH Decision Matrix 2, the required response is 'No Further Action'. The maximum concentrations of 1,1,1-trichloroethane in sub-slab soil vapor and indoor air were 3.11 $\mu g/m^3$ and <0.55 $\mu g/m^3$, respectively. When evaluated with NYSDOH Decision Matrix 2, the required response is 'No Further Action'. Based on the May and August 2013 results, and comparison to the NYSDOH Decision Matrices, no additional soil vapor monitoring or mitigation activity is necessary at the site.

DUSRs were prepared for all data generated in this remedial performance evaluation program. These DUSRs are included in Appendix G, and associated raw data are provided electronically in Appendix H. All soil vapor intrusion sampling data has been submitted to NYSDEC in the appropriate EDD format.

4.6 Imported Backfill

The backfill placed at the site was as follows:

- Crushed rock from Thalle Industries in Elmsford, New York; and
- Top soil from Organic Recycling Inc. in Tappan, New York.

The majority of backfill placed at the site was the crushed rock. This material was derived from crushing of virgin underground rock that was obtained from the 2nd Ave. subway station project in Manhattan. Per DER-10 Section 5.4(e)(3), soil may be approved for backfill if it is from a virgin source and at least one analysis has been conducted showing the material meets the applicable Soil Cleanup Objectives. The applicable SCOs are listed in DER-10 Appendix 5 - Allowable Constituent Levels for Imported Fill or Soil for Restricted Residential Use. This is equivalent to the lower of the Protection of Groundwater or Protection of Public Health SCOs for restricted residential use. The documentation and sampling results provided in Appendix K demonstrate that the material in fact meets Unrestricted Use Soil Cleanup Objectives (UUSCOs).

Topsoil was required to backfill the area excavated around the trees in the strip of land adjacent to the parking lot. The provider of the topsoil was Organic Recycling Inc. in Tappan, New York. The topsoil was prepared by mixing soil obtained from three acres of undeveloped wetland area in West Nyack, New York, with composted leaves obtained from the vicinity of Orangetown, New York. A total of seven (7) discrete samples were collected from a dedicated stockpile and tested for VOCs. Two (2) composite samples were collected and tested for SVOCs, pesticides, PCBs, and metals. The analytical results presented in Appendix K show that the topsoil meets DER-10 Appendix 5 - Allowable Constituent Levels for Imported Fill or Soil for Restricted Residential Use. Based on DER-10 Table 5.4(e)10, and the sampling frequency, a maximum of 1,000 cubic yards (cy) of material from this dedicated stockpile was available for use on-site.

A table of all sources of imported backfill with quantities for each source is shown in Table 4-10. Through April 2013, approximately 2,310 cy of crushed rock and 786 cy of topsoil were imported to the site. Tables summarizing chemical analytical

results for backfill, in comparison to allowable levels, are provided in Appendix K. Locations of the clean fill stockpiles are provided in Figure 4-2. The crushed rock was placed in all excavated areas of the site, with the exception of one, as shown in Figure 4-3. The strip of soil between the parking lot and the sidewalk on the 138th Street side of the building was originally backfilled with the crushed rock. However, it was later determined that this material could be detrimental to the health of the trees planted in this area. Therefore, approximately one foot of the crushed rock was removed for use elsewhere at the site, and backfilled with topsoil.

4.7 CONTAMINATION REMAINING AT THE SITE

As identified in the RI, historic fill material is present across much of the site. This material contains chemicals in concentrations that are in excess of the UUSCOs, as well as the RRSCOs. Therefore, soil below the demarcation layer and below the existing buildings and parking lot is anticipated to exceed either the RRSCOs or the UUSCOs (with the exception noted below and in Figure 4-5 for Area C). Tables 4-11 and 4-12, as well as Figures 4-7 and 4-8 summarize the results of all soil samples collected at depths below the demarcation layer and these data are representative of the quality of the soils remaining at the site.

The demarcation layer is depicted in Figure 4-5. As documented in Section 4-5, clean backfill is present above the demarcation layer. The clean backfill consists of: 1) crushed rock, which is gray in color, and the consistency of a fine sand, or 2) black, organic topsoil. The topsoil was used in the 0-1 foot interval in the strip between the parking lot and the sidewalk on 138th Street. The gray sand was used elsewhere.

In area A (shallow excavation areas), the demarcation layer was placed at a depth of approximately 2 feet. In areas B and F, the demarcation layer is at approximate depths of 5 feet and 7 feet, respectively. In Area C, where the bottom of the excavation is at a depth of approximately 10.5 feet, the demarcation layer was placed at a depth of approximately 2 feet to be consistent with the surrounding excavation. It is important to note then that in Area C, soil below the demarcation layer to a depth of 10.5 ft. bgs meets the lower of the PGWSCO or the RRSCOs.

No excavation, demarcation layer or soil cover occurred or was placed in Areas D and E because these are within the building footprint and parking lot area (Figure 4-5). The RAWP does not require removal of soil beneath these areas. However, if the

building or parking lot, or portions thereof, are removed, some form of cover must replace the building or asphalt or soil below must be covered with at least two feet of clean fill material. Furthermore, soil from these areas must be managed in accordance with the Site Management Plan (SMP).

Table 4-11 and Figure 4-7 summarize the results of all soil samples remaining at the site after completion of Remedial Action that exceed the Track 1 (unrestricted) SCOs.

Table 4-12 and Figure 4-8 summarizes the results of all soil samples remaining at the site after completion of the remedial action that exceed the RRSCOs or PGWSCOs.

Since contaminated soil and groundwater remain beneath the site after completion of the Remedial Action, Institutional and Engineering Controls are required to protect human health and the environment. These Engineering and Institutional Controls (ECs/ICs) are described in the following sections. Long-term management of these EC/ICs and residual contamination will be performed under the SMP approved by the NYSDEC.

4.8 ENGINEERING CONTROLS

Since remaining contaminated soil and groundwater exists beneath the site, Engineering Controls (EC) are required to protect human health and the environment. The site has the following primary Engineering Controls, as described in the following subsections.

4.8.1 Soil Cover System

Exposure to remaining contamination in soil/fill at the site is prevented by a soil cover system placed over the entire site. At the time of the publication of this FER, the cover system is comprised of a minimum of 24 inches of clean backfill and/or topsoil, the concrete building slab, concrete sidewalks, and the asphalt parking lot. Once redevelopment activities are complete, a map of the final cover system will be provided in the first Periodic Review Report.

Figure 4-5 shows the location of each cover type present at the site. Procedures for inspecting and maintaining the soil cover system are provided in the Monitoring Plan in Section 3.0 and in the Excavation Work Plan in Appendix C of the Site Management Plan (SMP). The Monitoring Plan also addresses inspection procedures that must occur after any severe weather condition has taken place that may affect on-site ECs.

4.8.2 Monitored Natural Attenuation

Groundwater monitoring activities to assess natural attenuation will continue, as determined by the NYSDEC, until residual groundwater concentrations are found to be consistently below NYSDEC standards or have become asymptotic at an acceptable level over an extended period. Monitoring will continue until permission to discontinue is granted in writing by the NYSDEC. If groundwater contaminant levels become asymptotic at a level that is not acceptable to the NYSDEC, additional source removal, treatment and/or control measures will be evaluated.

Procedures for groundwater monitoring are provided in the Monitoring Plan in Section 3.0 of the Site Management Plan (SMP).

4.9 INSTITUTIONAL CONTROLS

The site remedy requires that an environmental easement be placed on the property to (1) implement, maintain and monitor the Engineering Controls; (2) prevent future exposure to remaining contamination by controlling disturbances of the subsurface contamination; and, (3) limit the use and redevelopment of the site to Restricted Residential uses only.

The environmental easement for the site was executed by the Department on November 26, 2013, and recorded with the NYC Office of the City Register on December 6, 2013. The County Recording Identifier number for this filing is 2013000503766. A copy of the easement and proof of filing is provided in Appendix A.

4.10 DEVIATIONS FROM THE REMEDIAL ACTION WORK PLAN

The following deviations from the RAWP occurred during performance of the remediation.

4.10.1 Excavation Adjacent to Trees

The RAWP stated that the upper two feet of soil across the site would be excavated and replaced with clean fill material. However, the soil between the parking lot and the sidewalk on 138th Street was inadvertently omitted from Figure 5-1, Proposed Soil Excavations, of the RAWP. Results from soil sampling at SS-02 within this area indicated chemical constituents above the RRSCOs. Therefore, the soil needed to be excavated and covered. Four (4) large trees are located within this area, and excavation

of two feet of soil across this area could have resulted in loss of the trees. In a phone call with NYSDEC on August 6, 2012, options to address the situation were discussed including: 1) manual and/or pneumatic digging, and 2) additional sampling to characterize the soil around the root system, and potentially reduce the size of the area requiring excavation.

Ultimately, the soil was excavated and the area filled with clean backfill. In an effort to preserve the trees, manual and pneumatic digging was performed. This approach was successful in excavating two feet of soil without disturbing the trees. To further protect the trees, the excavated area was immediately backfilled, without surveying, to limit the amount of time the tree roots were exposed. ERM verified the proper depth was attained via manual measurements and photographs. However, it was later determined that the clean backfill material could be detrimental to the health of the trees planted in this area. Therefore, approximately one foot of the crushed rock was removed for use elsewhere at the site, and backfilled with topsoil.

4.10.2 Backfill Quality

The RAWP stated that all backfill material must meet UUSCOs and this condition was met at the site. However, as the proposed use of the site is Restricted Residential, this requirement was later determined unnecessary. As documented in NYSDEC's e-mail dated January 16, 2013 (see Appendix F), the requirement was revised such that all imported backfill materials had to meet the lower of the PGWSCOs or the RRSCOs. To the extent future backfilling or other soil disturbance is necessary at the site, the backfill quality can meet the lower of the PGWSCOs or the RRSCOs.

4.10.3 Soil Cover System

The RAWP proposed a soil cover system that was at least two feet thick and composed of a combination of clean fill, pavers, concrete, topsoil, etc. However, it was soon recognized that if the final cover was placed prior to the completion of redevelopment activities, such activities could damage some of the cover materials (such as the pavers). Therefore, a two-foot soil cover consisting of clean backfill and/or topsoil was proposed. As documented in NYSDEC's e-mail dated January 16, 2013 (see Appendix F), NYSDEC determined that a temporary cover with a minimum of two feet of clean soil meeting the lower of the Protection of Groundwater or Protection of Public Health SCOs for Restricted Residential Use was acceptable for obtaining a Certificate of Completion (COC). NYSDEC required that all other elements of the remedy be

implemented and that the temporary soil cover be surveyed and documented in the Final Engineering Report (see Figure 4-4). NYSDEC also required that a description of the elements of the permanent cover (e.g., pavers, topsoil, concrete, etc.) be provided in the SMP. However, a plan for the permanent cover has not yet been finalized, and so could not be included in the SMP. The final plans will be established in late 2013/early 2014 and the final cover system will be documented in the first Periodic Review Report.