PHASE I AND PHASE II REMEDIAL ACTIVITIES
OPERABLE UNIT NO. 1 (OU-1)

BAY SHORE FORMER MANUFACTURED
GAS PLANT (MGP) SITE
BAY SHORE, SUFFOLK COUNTY, NEW YORK

Final
Completion Report

NYSDEC Index Number: D1-0001-98-11

OCTOBER 2009

Prepared for:

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CERTIFICATIONS

PROFESSIONAL ENGINEER'S CERTIFICATION

The undersigned on behalf of National Grid and Paulus, Sokolowski, and Sartor Engineering, PC certifies: that I am and at all pertinent times hereinafter mentioned was a Professional Engineer licensed or otherwise authorized under Article 145 of the Education Law of the State of New York to practice engineering; that I am the individual who had primary direct responsibility for the implementation of the subject remedial program; and that all substantive requirements of the said remedial program have been complied with; the data demonstrates that remediation requirements have been or will be achieved in accordance with time frames contained in the approved remedial program and all activities described in this report have been performed in accordance with the said remedial program and any subsequent changes as agreed to and approved by the Department.

Joseph J. Lifrieri, P.E., P.G., P.P.
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N.Y.P.E. License Number 055341

8-October-2009
Date

TABLE OF CONTENTS

FIGURES

LIST OF APPENDICES

LIST OF ACRONYMS

ACRONYM	DEFINITION
ASTM	American Society of Testing Materials
BTEX	Benzene Toluene Ethelbenzene Xylenes
BGS	Below Ground Surface
CAMP	Community Air Monitoring
CM/S	Centimeter per Second
CODs	Certificates of Destruction
CQAPP	Construction Quality Assurance Project Plan
dBA	Decibels A-weighted measurement
DNAPL	Dense Non-Aqueous Phase Liquids
DPW	Department of Public Works
ECs/ICs	Engineering and Institutional Controls
FCR	Field Change Request
GCQAP	Generic Quality Assurance Plan
GPR	Ground Penetrating Radar
HASP	Health And Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
IRM	Interim Remedial Measure
Kg	Kilogram
LGP	Low Ground Pressure
LILCO	Long Island Lighting Company
LIPA	Long Island Power Authority
LIRR	Long Island Rail Road
MGP	Manufactured Gas Plant
NAPL	Non-Aqueous Phase Liquids
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOT	New York State Department of Transportation
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PAH	Poly Aromatic Hydrocarbon
PCBs	Polychlorinated Biphenyls
PID	Photo-Ionization Detector
PM-10	Particulate Matter
PPV	Peak Particle Velocity
PSI	Pressure per Square Inch
RAP	Remedial Action Plan
RDR	Remedial Design Report
RIR	Remedial Investigation Report
ROW	Right of Way
SCGs	Standards, Criteria, and Guidelines
S/MMP	Soil/Materials Management Plan
SMP	Site Management Plan

TAL	Target Analyte List
TVOC	Total Volatile Organic Compounds
UFPO	Underground Facility Protective Organization
USBM	United States Bureau of Mines
VMS	Vapor Management System
VOC	Volatile Organic Compound
QA/QC	Quality Assurance / Quality Control

1.0 BACKGROUND AND SITE DESCRIPTION

National Grid (formerly KeySpan Corporation) entered into Order on Consent, Index Number D1-0001-98-11, with the New York State Department of Environmental Conservation (NYSDEC) in 1999, to investigate and remediate the Bay Shore Former MGP Site located in Bay Shore, Town of Islip, New York. The location of the Bay Shore Former MGP Site is shown on Figure 1 of this report. The implementation of remedial activities for OU–1 was divided into Phase I, Phase IA, Phase II and Phase III. This Report documents the remedial construction and completion of the Phase I and Phase II remedial activities.

The Phase I site is located in the County of Suffolk, New York and is identified as Block 1 and Lots 31, 32, 33, 34, and 45 on the Suffolk County Tax Map Section 392. The Phase II site is located in the County of Suffolk, New York and is identified as Block 1 and portion of Lot 30.1 on the Suffolk County Tax Map Section 392. The Phase I site is situated on an approximately 1.2-acre area located to the south of the Long Island Rail Road (LIRR) Montauk Branch; to the east of North Clinton Avenue; to the west of Fifth Avenue; and, to the north of Union Boulevard (refer to Figure 1). The Phase II site is situated on an approximately 4-acre area located to the north of the LIRR Montauk Branch; to the east of North Clinton Avenue; to the west of Fifth Avenue; and, to the south of Ackerson Street (refer to Figure 1). The boundaries of the site are fully described in Appendix K: Survey Map, Metes and Bounds. A digital copy of this Completion Report with all supporting documentation is included in Appendix L.

The Phase I and Phase II remedial activities were conducted as part of a multi-phase approach to address known soil and groundwater impacts at OU-1 of the Bay Shore Former MGP Site. The remedial construction activities were implemented in accordance with the NYSDEC approved April 2007 and January 2008 Remedial Design Reports, modifications and expansions to the scopes of work as indicated in this Report, and the requirements set forth in the Voluntary Cleanup Agreement with the NYSDEC, Index No. D1-0001-98-11.

The Bay Shore MGP began operations in the late 1880s. The plant was operated by Mutual Gas and Light Company, the Suffolk Gas and Electric Light Company and later the Long Island Lighting Company (LILCO) in 1918. LILCO operated the plant from 1918 to approximately 1973 when most of the facilities were demolished. In 1998, KeySpan Corporation acquired the former MGP property through a merger of LILCO and the Brooklyn Union Gas Company. In 2007 National Grid acquired KeySpan and became responsible for completing this remediation.

A more detailed summary of the operating history of the Bay Shore Former MGP Site is included in the remedial investigation reports that have been prepared for the Site. These reports are entitled “Bay Shore/Brightwaters Former Manufactured Gas Plant Site, Remedial Investigation Report, Bay Shore, New York” dated April 2002 and “Bay Shore/Brightwaters Former Manufactured Gas Plant Site, Final Remedial Investigation Report, Bay Shore, New York” dated January 2003. Both Remedial Investigation Reports (RIRs) were prepared by Dvirka and Bartilucci (D&B). Copies of these documents are on file with the NYSDEC and maintained in the document repositories for the Site

The Bay Shore Former MGP Site is currently divided into four operable units (OUs). OU-1, the subject of this completion report, addresses the former MGP site proper and adjacent downgradient source materials. OU -1 is bound to the north by Ackerson Street, to the east by Fifth Avenue, to the south by Union Boulevard and to the west by North Clinton Avenue.

In addition OU-1 of Bay Shore Former MGP Site also included the adjacent West Parcel located west of North Clinton Avenue, north of the LIRR and east of the National Grid Brightwaters Yard. As stated in the Final RAP, an interim remedial measure (IRM) was previously completed at the Bay Shore West Parcel. The implementation of the IRM as well as the results of the completed IRM is documented in a report entitled "Interim Remedial Measure (IRM) Completion Report for the Bay Shore/Brightwaters Former Manufactured Gas Plant (MGP) Site – Operable Unit No. 1 – West Parcel" prepared by PS&SPC and dated December 2004. A copy of this document is on file with the NYSDEC and maintained in the document repositories for the Site. As such, the RAP did not evaluate or propose any remedial actions for West Parcel portion of OU-1

OU-2 addresses the off-site groundwater plume extending beyond and south of OU-1. OU-3 addresses the Brightwaters Yard and the associated downgradient groundwater plume. OU-4 addresses the former cesspool and pond area and the downgradient Watchogue Creek/Crum's Brook.

The OU-1 Phase I and Phase II Sites encompass approximately five acres and are depicted on Figure 2. Generally the area includes the following:

- The Bay Shore Former MGP Site (Phase II Site) was formerly the main operations area of the manufactured gas plant and is currently owned by National Grid;
- The Bay Shore Former MGP Site (Phase I Site) is located south of the LIRR ROW and potentially impacted by the former operations on the Phase II Site and is currently owned by National Grid;
- Located outside of the Phase II work limits is a decommissioned Long Island Power Authority (LIPA) electric substation located in the northwestern portion of the Phase II Site and an active National Grid natural gas regulator station located in the northern portion of the Phase II Site; and
- The Off-Site area is located south of the LIRR ROW, north of Union Boulevard and west of North Clinton Avenue that included commercial uses. The parcel is currently vacant and owned by National Grid.

2.0 SUMMARY OF SITE REMEDY

2.1 Remedial Action Objectives

The selected remedy for OU-1 of the Bay Shore Former MGP Site was detailed in the "Final Remedial Action Plan, Bay Shore Former Manufactured Gas Plant (MGP) Site – Operable Unit-1, Bay Shore, New York" (RAP) prepared by GEI Consultants in August 2004, and approved by NYSDEC on August 9, 2004. The RAP established the following goals for the OU-1 remedy implemented as part of the Phase I and II work:

- Excavating contaminant source materials in the unsaturated zone to an approximate depth of eight feet below ground surface (bgs) in the On-Site area (Phase II);

- Excavating contaminant source materials in four "hot spot" areas to a maximum depth of 25 feet bgs (Phase I and II);

- Off-site disposal of excavated impacted soil at facilities permitted for thermal desorption (Phase I and II);

- Backfill of excavated areas to pre-remedial grades with approved backfill materials (Phase I and II);

- Use of an in-situ chemical oxidation system to treat/destroy residual source material (Phase III);

- Construction of the Waterloo Barrier® System at the downgradient edge of the operable unit to contain Dense Non-Aqueous Phase Liquids (DNAPL) and to create a treatment zone immediately upgradient of the barrier (Phase I);

- Recovering Non-Aqueous Phase Liquids (NAPL) via extraction wells along the upgradient perimeter of the containment barrier, where practicable (Phase IA);

- Instituting long-term monitoring, operation and maintenance of the containment/treatment system (Phases IA and III); and,

- Developing institutional and/or engineering controls to manage future subsurface disturbance and resultant potential exposure pathways (Phase I and Phase II).

2.2 Description of Selected Remedy

The site was remediated in accordance with the remedy selected by the NYSDEC in the RAP dated August 2004 and approved August 9, 2004 by NYSDEC.

The factors considered during the selection of the remedy included:

- Protection of human health and the environment;
- Compliance with standards, criteria, and guidelines (SCGs);
- Short-term effectiveness and impacts;
- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, or volume of contaminated material;
- Implementability; and
- Cost effectiveness;

To implement the remedy selected in the RAP, the project was divided into three phases with one sub-phase. The following are the components of the selected remedy:

- Phase I: Installation of the subsurface NAPL and groundwater barrier wall (Waterloo Barrier® System) on the downgradient portion of the OU-1 Site located to the south of the Long Island Rail Road (LIRR) Right of Way (ROW) and extending offsite across and north along N. Clinton Ave, and excavation of source materials on the portion of the OU-1 Site located to the south of the LIRR, the Southern Cell Excavation Area;

- Phase IA: Installation of a groundwater treatment support building for the supplemental oxygen injection system on the portion of the OU-1 Site located to the south of the LIRR ROW;

- Phase II: Removal of source materials on the portions of the OU-1 Site located to the north of the LIRR from the Shallow Excavation Area and the deep Hot Spot Excavation Areas; and

- Phase III: Injection of the in-situ chemical oxidation on the portion of the OU-1 Site located to the north of the LIRR ROW.

After approval of the RAP by NYSDEC, National Grid contracted with PS&SPC to prepare the RDR to address implementation of the Phase I and Phase II portions of the selected remedial alternative. The Phase I and Phase II remedial activities were proposed to the New York Department of Environmental Conservation (NYSDEC) in two remedial design reports (RDRs):

- Phase I – "Remedial Design Report, Phase I, Waterloo Barrier® System and Southern Cell Excavation for the Bay Shore Former Manufactured Gas Plant (MGP) Site, Operable Unit No. 1, Bay Shore, Suffolk County, New York)" prepared by PS&SPC and dated April 2007 (RDR). The New York State Department of Environmental Conservation (NYSDEC) approved the RDR by letter to National Grid dated April 25, 2007;

- Phase II - "Remedial Design Report, Phase II, Remedial Excavations for the Bay Shore Former Manufactured Gas Plant (MGP) Site, Operable Unit No. 1, Bay

Shore, Suffolk County, New York)" prepared by PS&SPC and dated January 2008. The NYSDEC approved the RDR by letter to National Grid dated December 11, 2007;

The RDRs were prepared and reviewed by NYSDEC at the 50-75%, 95%, and 100% completion stages. Subsequent to the submission the Phase I 50% to 75% RDR submission to the NYSDEC, the Phase I scope of work was revised to include the Southern Cell Excavation Area. The Southern Cell Excavation was originally included with the Phase II work. The Southern Cell Excavation was included with the Phase I work to avoid potential access constraints associated with relocation of overhead electric transmission line in conjunction with performing the Phase II remedy. An "Interim Remedial Measure Scope of Work for the Remedial Excavation of the Southern Cell" (Supplemental IRM Work Plan) was prepared and submitted to the NYSDEC on July 24, 2006.

During agency review of the Draft 95% RDRs, principal remedial contractors were selected via a competitive bid to implement the Phase I and Phase II remedies. For Phase I, C3 Environmental Limited (C3) was responsible for installing the Waterloo Barrier® System. ENTACT Environmental Services (ENTACT) was responsible for the excavation activities within the Southern Cell Excavation, pre-trenching work along the alignment of the containment barrier and for utility management (i.e., utility disconnection, relocation, re-connection, etc.) and the required site waste management activities. For Phase II, ENTACT was the primary remedial contractor responsible for all aspects of the work. Other subcontractors were utilized by the principal contractors as needed. Both contractors' submissions were incorporated by PS&S into the 100% RDRs for both phases of the work.

The following table presents the various design documents, their submittal dates as well as the date of the NYSDEC approval of the document.

Remedial. Design Report (RDR)	Submittal Date	NYSDEC Comment Letters/ Approval Date
Phase I		
50%-75% RDR (Phase I)	May 2006	July 5, 2006 and September 13, 2006
95% RDR (Phase I)	February 2007	April 17, 2007
100% RDR (Phase I)	April 2007	April 25, 2007
Phase II		
50%-75% RDR (Phase II)	February 2007	February 20, 2007 and March 12, 2007
95% RDR (Phase II)	September 2007	December 11, 2007
100% RDR (Phase II)	January 2008	December 11, 2007 (1)(2)

(1) Limited comments were received from the NYSDEC based on review of the 95% RDR for Phase II. Therefore, the 100% RDR was approved at the 95% RDR level.

(2) A work plan to conduct pre-mobilization activities (i.e., site clearing and grubbing, abandonment of the tunnel extending under North Clinton Avenue and performance of the perimeter utility cut/cap program was submitted to the NYSDEC on July 25, 2007 and approved on August 8, 2007.

2.2.1 Phase I Elements

The main elements of the Phase I remedy consisted of the installation of the Waterloo Barrier® System and the Southern Cell Excavation. These elements which are depicted on Figure 2 and the Phase I As-Built Sheet 2, included in Appendix A.

The sheet piles of the Waterloo Barrier® System were driven to a depth of approximately 80 feet bgs. The top of each sheet was finished below grade to allow for a clear utility working corridor and for restoration of the area. Waterloo Barrier® System was installed in the following alignment:

- Beginning at a point on the western side of North Clinton Avenue approximately 15 to 20 feet south of the LIRR Right-of-Way (ROW) (i.e., OU-1 Southern Area);

- Extending 110 feet south along the western side of North Clinton Avenue both in the public right-of-way and on National Grid property (Phase I Support Area);

- Extending 125 feet southeast diagonally across North Clinton Avenue toward the intersection of North Clinton Avenue and Union Boulevard;

- Extending 163 feet east parallel to the southern property line of the OU-1 Southern Area and north of Union Boulevard; and

- Extend north parallel to the eastern property line of the OU-1 Southern Area and terminate approximately 35 to 40 feet south of the LIRR ROW.

The Southern Cell excavation consisted of:

- Removing source material through the excavation of impacted soils within the identified "Hot Spot " area to a depth of 25-ft bgs;

- Backfill and compaction of the excavation area with both un-impacted onsite unsaturated soil and certified clean off-site backfill material to existing grade;

- Managing generated wastes for off-site disposal; and

- Perform site restoration of the backfill area.

2.2.2 Phase II Elements

The main elements of the Phase II remedial activities consisted of the removal of contaminant source materials from designated Shallow and deeper "Hot Spot"

excavation areas located on the OU-1 Site to the north of the LIRR ROW. The designated Shallow Excavation Area and deeper Hot Spot Excavation Areas as depicted on Figure 2. Within the Shallow Excavation Areas, the excavation of contaminant source materials extended to a depth corresponding with the underlying water table (i.e., approximately eight feet bgs). Within the Hot Spot Excavation Areas, the excavation of contaminant source materials extended to a maximum depth of 25 feet bgs. Foundations within the remedial excavation areas and any subsurface former industrial features (e.g., tanks, foundations, etc.) encountered within the Phase II work area that potentially contain source materials were removed.

3.0 INTERIM REMEDIAL MEASURES

In addition OU-1 of Bay Shore Former MGP Site also included the adjacent West Parcel located west of North Clinton Avenue, north of the LIRR and east of the National Grid Brightwaters Yard. As stated in the Final RAP, an interim remedial measure (IRM) was previously completed at the Bay Shore West Parcel. The implementation of the IRM as well as the results of the completed IRM is documented in a report entitled "Interim Remedial Measure (IRM) Completion Report for the Bay Shore/Brightwaters Former Manufactured Gas Plant (MGP) Site – Operable Unit No. 1 – West Parcel" prepared by PS&SPC and dated December 2004. A copy of this document is on file with the NYSDEC and maintained in the document repositories for the Site. As such, the RAP did not evaluate or propose any remedial actions for West Parcel portion of OU-1.

4.0 DESCRIPTION OF REMEDIAL ACTIONS PERFORMED

Remedial activities completed at the Site were conducted in accordance with the NYSDEC-approved April 2007 Phase I Final RDR and January 2008 Phase II Final RDR. All deviations from the RDRs are noted.

Phase I Approved Work Plan Scope

Mobilization/Demobilization

- Bringing materials, supplies, equipment, and personnel to Phase I Site;
- Establishing safe working conditions for the planned remedial activities;
- Completion of a utility search prior to the initiation of any subsurface intrusive work activities;
- Erection of temporary facilities to support the implementation of the remedial activities;
- Preparing the Phase I Site to facilitate the remedial activities; and,
- Demobilizing and restoring the Phase I Site to facilitate future remedial construction activities associated with Phase IA of the remediation of OU-1.

Site Preparation

- Removal of vegetation, concrete and asphalt surfaces, as required, and any on-site debris within the limits of the remedial work;
- Establishing/upgrading site haul roads, truck routes, and ingress/egress points;
- Mobilizing and erecting the temporary fabric enclosure including vapor management system(s);
- Establishing monitoring locations (community air, noise and vibration);
- Establishing ingress/egress routes;
- Decommissioning or relocation of existing utilities; and,
- Implementing soil erosion and sediment control measures.

Temporary Site Facilities

- Establish temporary facilities (i.e., office trailers, sanitary facilities);
- Establishing equipment and materials staging areas;
- Establishing a decontamination area(s) and pads(s);
- Establishing temporary utilities, as necessary; and,
- Mobilizing the grout plant (i.e., water storage tanks, pressure gauges and reducers, hosing, an air motor driven slow speed agitator, and the colloidal mixer to be used to grout the sheeting interlocks.

Installation of Waterloo Barrier® System

- Pre-Trenching to facilitate installation of the Waterloo Barrier® System. Pre-trenching was performed to a depth just below the top of sheet design elevation. Pre-trenching also entailed location, protection, and restoration of utilities bisecting the trench.
- Installation of the Waterloo Barrier® System along the downgradient edge of the Phase I Site. The general alignment of the containment barrier is depicted on Figure 2 of this Report.

Southern Cell Excavation

- Installing a temporary excavation support system (i.e., steel sheet piling) to facilitate the remedial excavation activities;
- Erecting a temporary enclosure (with a vapor management system) to house the remedial excavation, handling and support activities;
- Excavating contaminant source materials to a minimum depth of 25 feet bgs. The approximate limits of the Southern Cell excavation are depicted on Figure 2.
- Management and off-site disposal of generated wastes;
- Backfilling the excavation areas with un-impacted, unsaturated Site soil and certified clean off-site backfill material;
- Removal of the temporary excavation support system; and
- Backfill and restoration of the work areas to pre-disturbance conditions.

Disposal of Remediation Derived Wastes

- Removing all construction-related wastes and debris. All wastes were transported and disposed of at properly licensed and permitted off-site facilities.

Construction Quality Control/Record Keeping

- Inspection of implementation of remedial activities to ensure compliance with the NYSDEC-approved Remedial Design Report, with thorough documentation of conformance with or modifications from the RDRs.

Report Preparation

- Project activities and monitoring results are reported in this Completion Report.

Phase II Approved Work Plan Scope

Mobilization/Demobilization

- Bringing materials, supplies, equipment, and personnel to Phase II Site;
- Establishing safe working conditions for the planned remedial activities;
- Completion of a utility search prior to the initiation of any subsurface intrusive work activities;
- Erection of temporary facilities to support the implementation of the remedial activities;
- Preparing the Phase II Sites to facilitate the remedial activities;
- Demobilizing and restoring the Phase II Site to facilitate future remedial construction activities associated with Phase III of the remediation of OU-1.

Site Preparation

- Removal of vegetation, concrete and asphalt surfaces, as required, and any on-site debris within the limits of the proposed remedial work;
- Establishing/upgrading site haul roads, truck routes, and ingress/egress points;
- Establishing site security measures,
- Mobilizing and erecting the temporary fabric enclosure including vapor management system(s);
- Installing permanent sheet piling along the LIRR

- Establishing monitoring locations (community air, noise and vibration);
- Establishing ingress/egress routes;
- Decommissioning or relocation of existing utilities; and,
- Implementing soil erosion and sediment control measures.

Temporary Site Facilities

- Establish temporary facilities (i.e., office trailers, sanitary facilities);
- Establishing equipment and materials staging areas;
- Establishing a decontamination area(s) and pads(s); and,
- Establishing temporary utilities, as necessary.

Utility Clearance and Perimeter Utility Cut and Cap

- Installing a trench around the perimeter of the Site, with the exception of the southern property boundary adjacent to the LIRR, to locate former utilities and decommission them, as appropriate.

Permanent Sheet Piling Installation

- Excavation of an approximate three to four foot deep trench along the permanent sheet pile alignment to permit driving of the top of sheets to a depth approximately three feet bgs.
- Installation of permanent, perforated (windowed) sheet piling, as per the requirements of the LIRR, to allow for the extraction of the temporary excavation support system associated with Deep Excavation Area C.

Removal of Former MGP-Related Structures

- Removal of former MGP features including foundations, piping, vaults and other industrial features located within the remedial excavation areas and across the entire Phase II work area;
- Off-site disposal of former MGP-related structures that are deemed visually impacted; and,
- Off-site crushing and reuse of former concrete structures as backfill that are visually deemed to be not impacted.

Shallow and Hot-Spot (Deep) Excavation of Contaminant Source Materials

- Excavating Shallow Excavation Areas to a depth corresponding with the water table (i.e., approximately eight feet bgs). The limits of the Shallow Excavation Area are depicted on Figure 2.
- Excavating contaminant source materials in three Hot Spot Excavation Areas (i.e., Areas A, B, and C) to a minimum depth of 25 feet bgs. The limits of the three Hot Spot Excavation Areas are depicted on Figure 2.
- Installing a temporary excavation support system (i.e., steel sheet piling) to facilitate the remedial excavation activities;
- Erecting a temporary enclosure (with a vapor management system) to house the remedial excavation, handling and support activities;
- Management and off-site disposal of generated wastes;

- Backfilling the excavation areas with un-impacted, unsaturated Site soil and certified clean off-site backfill material;
- Removal of the temporary excavation support system; and,
- Backfill and restoration of the work areas to pre-disturbance conditions.

Site Restoration

- Backfill of all excavation area installed beneath the groundwater table with coarse aggregate (NYSDOT Type I Stone);
- Installation of a geotextile over the coarse aggregate backfill to prevent infiltration of fines;
- Backfill of the Shallow Excavation Areas with certified clean well-graded sandy soil;
- Installation of a geotextile demarcation liner between the well-graded sandy-soil and the two-foot Site-Wide Cap;
- Installation of three seepage pits and associated piping to promote in the southern portion of the Site
- Construction of a Site-Wide Cap (i.e., across the entire Site) to limit potential future exposure pathways.

Disposal of Remediation Derived Wastes

- Removing all remediation derived wastes and debris. All wastes were transported and disposed of at properly licensed and permitted off-site facilities.

Construction Quality Control/Record Keeping

- Inspection of implementation of remedial activities to ensure compliance with the NYSDEC-approved Remedial Design Report, with thorough documentation of conformance with or modifications from the RDRs.

Report Preparation

- Project activities and monitoring results are reported in this Completion Report.

Remedial Design Modifications and Expansions

Expansions and/or modifications to the work scopes for each of the Phase I and Phase II Sites were made to the field programs contained in the approved RDRs. Most of these modifications and expansions were dictated by site conditions encountered during the performance of the remedial activities. These modifications/expansions to the RDR were undertaken only after presentation to and approval of the NYSDEC. The modifications/expansions to the scopes of work are detailed at the following of the description of the Phase I and II Remedial Program Elements.

4.1 Governing Documents

4.1.1 Site Specific Health & Safety Plan (HASP)

A Generic HASP was prepared in accordance with 29 CFR 1910 and was included with the Remedial Design Work Plan prepared for the Site. The HASP,

provided to C3 and ENTACT, covered site-specific activities associated with the implementation of the Phase I remedial activities. C3 and ENTACT were given the option of adopting the HASP or preparing their own, with the provision that a C3 or ENTACT HASP must either achieve or be more stringent than the requirements of the Remedial Design Work Plan HASP. ENTACT and C3 elected to prepare their own HASPs for the Phase I remedial activities. The ENTACT HASP for Phase I was adopted by C3. The ENTACT HASP was implemented during the performance of the Phase I and II remedial activities. 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 complied with for all remedial and invasive work performed at the Site.

4.1.2 Generic Construction Quality Assurance Plan (GCQAP)

A Generic Construction Quality Assurance Project Plan (GCQAPP) was included as Appendix F of the Phase I and II RDRs approved by the NYSDEC. The GCQAPPs managed performance of the Remedial Action tasks through designed and documented QA/QC methodologies applied in the field and in the lab. The GCQAPPs 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.

4.1.3 Soil/Materials Management Plan (S/MMP)

Impacted soils and spoils were loaded into trucks after dewatering for subsequent off-site transportation to the disposal facilities. The disposal facilities utilized during the remedial activities included Clean Earth of Delaware and Clean Earth of Southeast Pennsylvania. Both facilities are disposal facilities licensed to accept and treat the remedial derived wastes. Transport vehicles were decontaminated and exited the site via haul roads created with large diameter road stone either through the North Clinton Avenue or the Union Boulevard gates. The haul roads were maintained to minimize the potential for soil tracking into North Clinton Avenue and Union Blvd for the generation of fugitive dust.

All transportation and disposal activities were coordinated by ENTACT. All waste-hauling vehicles were inspected prior to loading and any vehicle that appeared to be in an unacceptable condition for transporting materials were not loaded. Transport vehicles were also inspected for the appropriate placards, vehicle identifications and over-the-road permits for the States in which they traveled. Additionally, transport vehicles and their contents were inspected prior to leaving the Site to verify that the vehicles were properly decontaminated, covered, placarded and that the load was acceptable for transport and disposal. A summary of the off-site disposal activities is contained in the Contaminated Materials Removal section of this Report.

4.1.4 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.

4.1.5 Community Air Monitoring Plan (CAMP)

National Grid retained GEI to conduct a CAMP during the remediation of the Bay Shore Former MGP Site in Bay Shore, New York. GEI prepared the "Community Air Monitoring Completion Report" which is included in Appendix G of this report. GEI's report presents the data collected during the CAMP, compares the data to pre-determined action levels, and documents response actions as required by the contingency plan. The CAMP began on February 21, 2007 and continued through October 3, 2008 employing seven fixed air monitoring locations and one moveable downwind air monitoring location during Phase I and Phase II of remedial activities. Supplemental air monitoring was conducted in response to odors or public complaints. The GEI CAMP Work Plan, dated July 2006, was submitted as Appendix H of the April 2007 Phase I RDR and as Appendix F of the January 2008 Phase II RDR and was approved by the NYSDEC and the NYSDOH.

4.1.6 Contractors Site Operations Plans (SOPs)

The Remediation Engineer reviewed all plans and submittals for this remedial project (i.e. those listed above plus contractor and subcontractor submittals) and confirmed that they were in compliance with the RDRs. All remedial documents were submitted to NYSDEC and NYSDOH in a timely manner and prior to the start of work.

4.1.7 Community Participation Plan

No changes were made to approved Fact Sheets authorized for release by NYSDEC without written consent of the NYSDEC. Document repositories were established at the following locations for the duration of the project and contain all applicable project documents, including this Completion Report, after approval:

National Grid's project web site: www.bayshoreworksmgp.com

Bay Shore / Brightwaters Public Library
1 South Country Road
Brightwaters, NY 11718
Repository is open during normal library hours

4.2 Phase I Remedial Program Elements

The primary remedial activities performed as part of the Phase I remedial activities consisted of, but were not limited to, the following activities:

- Excavation of the Southern Cell Area;
- Backfill and Compaction of Southern Cell Excavation area; and
- Installation of a Waterloo Barrier® System.

Figure 2 of this Report illustrates relative to the site boundaries the general positioning of principal components of Phase I including the Southern Cell Excavation area and Barrier Wall alignment. The Phase I As-Built Drawings presented in Appendix A represent the accurate-detailed and official record of the pre- and post-construction site conditions including the location and limits of the engineering controls install as part the remedial activities.

4.2.1 Phase I Involved Parties

Implementation of the remedial activities for Phase I (as described in the approved April 2007 100% Phase I RDR) commenced in February 2007 with mobilization activities and concluded in June 2008 with restoration activities. During the implementation of the project, on-site personnel included representatives of National Grid, representatives of PS&SPC (i.e., the Construction Quality Assurance/Quality Control Engineer), representatives of the NYSDEC, representatives of demaximis (i.e., the Construction Manager), representatives of C3 Environmental Limited (i.e., C3, the licensed installer of the Waterloo® Barrier Sealed Sheet Pile System) and ENTACT Environmental Services (i.e., ENTACT, the Remediation Contractor for excavation and waste management activities). GEI Consultants, Inc. (GEI) provided services associated with the Community Air Monitoring Program (CAMP). In addition, sub-contractors were utilized by both C3 and ENTACT to perform various aspects of the work. These sub-contractors were considered part of the contracting entity (e.g., J.D. Posillico provided sheet pile installation services for both C3 (barrier wall) and ENTACT (temporary excavation support associated with the Southern Cell Excavation).

4.2.2 Phase I Pre-Mobilization Activities

Prior to mobilization of equipment to the OU-1 Site, National Grid's Design Team prepared the Phase I RDR that provided detailed measures, procedures, and operations relating to the design and implementation of Phase I remedial activities. The Phase I 100% RDR was submitted to the NYSDEC on April 20, 2007 and approved by letter to National Grid dated April 25, 2007.

The approved Phase I 100% RDR (Phase I RDR) included, but was not limited to, the following:

- Description of remedial activities for implementation of the work including but not limited to: obtaining necessary permits; site preparation; construction sequence; installation of the Waterloo Barrier® System, soil excavation, waste management activities; odor and dust control; decontamination; soil erosion and sediment control; noise and vibration monitoring, backfill, etc;

- Existing conditions of the Phase I Site;

- Remedial Action Plan including the layout of the Southern Cell Excavation and the alignment of the Waterloo Barrier® System;

- Design of the modified (windowed) Waterloo Barrier® sheets to be installed along Segment 3 (parallel to Union Boulevard) of the Waterloo Barrier® System;

- Health and Safety Plan (HASP);

- Construction Quality Assurance Project Plan (CQAPP);

- Design of the temporary fabric enclosure and associated vapor management system (VMS) to be utilized to address vapors and odors during the implementation of the excavation activities;

- Design of the temporary excavation support system for excavation of the Southern Cell Excavation area; and

- Design of the backfilling, compaction and restoration of the Southern Cell Excavation area.

The New York Underground Facilities Protective Organization (UFPO) was utilized for utility verification and marking out the locations of subsurface utilities in proximity to the Phase I Site and associated off-site areas. When all subsurface utilities were verified or confirmed, intrusive activities were initiated.

No federal or state permits were required to perform the Phase I remedial activities. ENTACT procured the necessary permits required for the Phase I remedial activities from the Township of Islip. Based upon discussions between National Grid, ENTACT, PS&SPC and the local building officials, no local construction permits were required for the implementation of the Phase I remedial construction. No Phase I activities were conducted within the LIRR ROW.

Pre-mobilization activities associated with the Phase I Site included the following:

- Photo and video documentation of the pre-remedial conditions of the Phase I Site;
- Acclimating on-site personnel to the Phase I Site logistics;

- Ensuring all on-site personnel had the requisite 1910.120 Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) Training as well as site-specific training as per the requirements of the Site-Specific HASP and the Technical Specifications contained in the Phase I RDR;

- Receiving and set-up of office trailers and storage equipment;

- Removal of the existing fence along the northern perimeter of the Phase I Site and installation of temporary fencing to promote the implementation of the Southern Cell Excavation.

4.2.3 Phase I Mobilization

After receiving NYSDEC approval, ENTACT mobilized all necessary equipment, personnel, and materials to the Phase I Site for implementation of the Phase I remedial activities; specifically the Southern Cell Excavation in late February/early March 2007. Staging areas for materials, construction equipment and excavated material, decontamination areas, and support areas were prepared in accordance with the approved Phase I RDR. Soil erosion and sediment control measures were also installed per the approved Phase I RDR. C3 mobilized equipment and materials to the Site for installation of the barrier wall after ENTACT commenced work on the Phase I Site.

The equipment transported to the Phase I Site included construction facility setup (office trailers, security trailer, storage trailers, sanitary facilities), a decontamination trailer, excavation equipment, odor control foam and installation unit, cranes, a vapor management system (VMS), an 80 foot by 70 foot fabric enclosure, New York State Department of Transportation (NYSDOT) specified backfill, soil erosion and sediment control measures, odor and dust control measures, hoses, tanks, drums, and other necessary equipment. In addition, the Waterloo Barrier® sheets (solid and modified (window) were delivered to the Site during mobilization as well as after the completion of the Southern Cell Area excavation activities.

4.2.4 Phase I Site Preparation

Site preparation activities consisted of tasks performed prior to the performance of the Phase I remedial construction in accordance with the Phase I RDR. These activities consisted of the installation of soil erosion control measures (including perimeter silt fencing and hay bales) clearing of vegetation and grading of the work area, relocating existing facility materials, erecting the temporary enclosure

and set-up of the VMS, staking out and surveying the locations of excavations and the alignment of the Waterloo Barrier® System, establishing needed utilities, and the construction of a decontamination pad. The decontamination pad was constructed as per the requirements of the Phase I RDR and maintained throughout the duration of the Phase I excavation work.

The work area was divided into three primary zones: the exclusion zone, the contamination reduction zone, and the support zone. Zones were established and clearly delineated. The exclusion zone included the areas where active remedial operations were being performed (i.e., within the temporary enclosure, along the alignment of the Waterloo Barrier® System, etc.). The entrance to the contamination reduction zone was made through the decontamination area or vehicle access gate.

The support zone included all other portions of the remedial area not listed above which were used for storage and support functions. Temporary field office facilities, including office trailers, chemical toilets, and parking areas, were established on a National Grid owned property located across (west of) North Clinton Avenue in the support area during site preparation.

A NYSDEC-approved project sign was erected at the project entrance and remained in place during all phases of the Remedial Action.

4.2.4.1 Traffic Management

As the Phase I activities included a significant amount of transport and delivery trucks to the Site as well as the installation of a segment (Segment 1) of the Waterloo Barrier® System across North Clinton Avenue and a second segment (Segment 2) along the right-of-way of North Clinton Avenue, a detailed traffic management plan was included in the Phase I RDR. This plan was necessary due to the fact that North Clinton Avenue was required to be closed to traffic during the installation of Segments 1 and 2 of the Waterloo Barrier® System.

The traffic plan was implemented by ENTACT, as per the approved Traffic Management Plan included in the Phase I RDR, beginning with the placement of "Men Working" sign along North Clinton Avenue. Once the permit to close North Clinton Avenue was received by National Grid from Suffolk County, ENTACT deployed more detailed signage (including electronic digital signs) as per the approved Traffic Management Plan. The roadway was closed to traffic on May 1, 2007. Per requirement of Suffolk County, the roadway was required to be re-opened before May 31, 2008 and the associated holiday weekend.

4.2.4.2 Soil Investigation Along Fence Between Phase I Site and LIRR Right-Of-Way (ROW)

Due to issues associated with the presence of utilities along the southern side of the LIRR right-of-way (ROW), it was necessary to relocate the location of the Southern Cell Excavation Area as proposed in the 100% RDR, to a location approximately four feet to the south. To demonstrate that the soils and associated contaminant concentrations in the four foot offset along the LIRR ROW were similar to those scheduled for future remedial activities at OU-1 (i.e., Phase III. the in-situ chemical oxidation), two soil borings were installed in this area. Soil samples were collected from these borings at various depths and submitted to an NYSDOH-ELAP approved laboratory for analysis. Based on the analytical results, the NYSDEC approved relocating the Southern Cell Excavation approximately four feet to the south.

4.2.4.3 Well Abandonment

Prior to mobilization to the Phase I site, 75 wells that included groundwater monitoring, air injection, and vapor recovery wells located in areas subject to remedial activities or located in areas requiring access to perform the remedial activities were abandoned prior to implementation of the Phase I remedial activities. The wells were abandoned by Fenley and Nichol Environmental, Inc. under the oversight of GEI Consultants, Inc. (GEI). The monitoring wells were abandoned in accordance with the NYSDEC Groundwater Monitoring Well Decommissioning Procedure, November 2002. The September 2007 GEI Well Abandonment Summary Report is contained in Appendix D.

4.2.5 Phase I General Site Controls

The handling and dewatering of soil from the Southern Soil Excavation is described in Section 4.3.1. Excavated soil and spoils generated as a result of the installation of the bentonite clay columns were transferred into a lined roll-off container. In order to meet disposal facility acceptance criteria for moisture content, free standing water was pumped from the container into a holding tank for separate testing and handling prior to the drainage of the liquid back to the southern cell excavation as approved by NYSDEC. After dewatering the spoils, the containers were loaded on trucks for subsequent off-site transportation to the disposal facilities.

The disposal facilities utilized during the Phase I remedial activities included Clean Earth of Delaware and Clean Earth of Southeast Pennsylvania. Both facilities are disposal facilities licensed to accept and treat the remedial derived wastes. Transport vehicles were decontaminated within the enclosure or at the decontamination pad and exited the Phase I site via haul roads created with large diameter road stone either through the North Clinton Avenue or Union Blvd

gates. The haul roads were maintained while the enclosure was utilized and the road stone minimized the potential for soil tracking into North Clinton Avenue and Union Blvd for the generation of fugitive dust.

All transportation and disposal activities were coordinated by ENTACT. All waste-hauling vehicles were inspected prior to loading and any vehicle that appeared to be in an unacceptable condition for transporting materials were not loaded. Transport vehicles were also inspected for the appropriate placards, vehicle identifications and over-the-road permits for the States in which they traveled. Additionally, transport vehicles and their contents were inspected prior to leaving the Phase I Site to verify that the vehicles were properly decontaminated, covered, placarded and that the load was acceptable for transport and disposal. A summary of the off-site disposal activities is contained in the Contaminated Materials Removal section of this Report.

4.2.6 Phase I Nuisance Controls

Nuisance control methods are discussed in detail in Contaminated Materials Removal section of this report. Dust and odor control methods included a temporary enclosure utilized in some excavation areas, odor controlling Rusmar foam, decontamination pads, and water spraying for dust.

In addition to the temporary enclosure, point source control was the first line of defense in the mitigation of odors and dust from materials handling activities. The primary function of point source control was to minimize the amount of surface area exposed for long periods of time, thereby mitigating the potential for noxious odors and preventing contaminated dust from becoming airborne. ENTACT utilized Rusmar Foam, as necessary, to control odors and/or achieve compliance with site action levels during excavation activities inside the temporary enclosure. At the end of each work day, soils stockpiled within the enclosure scheduled for load-out the next day were covered with Rusmar Foam overnight to prevent any adverse impacts from the release of odors and/or vapors.

4.2.7 Phase I Monitoring Programs

4.2.7.1 Community Air Monitoring Program

National Grid retained GEI to conduct a CAMP during the remediation of the Bay Shore Former MGP Site in Bay Shore, New York. GEI prepared the "Community Air Monitoring Completion Report" which is included in Appendix G of this report. The following is a summary of GEI's report that presents the data collected during the CAMP, compares the data to pre-determined action levels, and documents response actions as required by the contingency plan. The CAMP began on February 21, 2007 and continued through October 3, 2008 employing seven fixed air monitoring locations and one moveable downwind air monitoring location during Phase I and Phase II of remedial activities.

Supplemental air monitoring was conducted in response to odors or public complaints.

A contingency plan was incorporated into the GEI CAMP Work Plan. The plan employed a three-tiered classification and warning system based on pre-determined site specific action levels as defined in the CAMP Work Plan.

- Site Condition 1. Normal or ambient air conditions where all target concentrations (e.g., total volatile organic compounds [TVOCs], particulate matter [PM-10], etc.) are less than a predetermined level approaching a site specific action level.

- Site Condition 2. Concentration of at least one target compound is greater than or equal to Site Condition 1 but less than the site specific action level.

- Site Condition 3. Concentration of at least one target compound is greater than or equal to the site specific action level.

The appropriate Site Condition was identified by comparing the data to the action levels and the contractor was notified to implement response actions to reduce levels, as necessary.

The measured concentration of TVOC reached the action level upwind of remedial activities on one occasion and the contractor was notified. The concentrations of TVOC at downwind locations were measured below the action level so a Site Condition 1 remained. Outside of the one upwind occasion, concentrations were not measured at Site Condition 1 during the CAMP.

The measured concentration of dust reached the action level on three occasions and the contractor was notified. The contractor watered the ground surface in the work areas to control the dust, when applicable. On the occasions when dust reached high levels, wind direction and air monitoring station locations were evaluated. GEI concluded the dust was a result of non-ground intrusive and/or non-impacted soil management activities. These occasions were attributed to off-site dust, equipment exhaust, or surface dust from clean fill and gravel deliveries. GEI determined it is unlikely that nearby receptors were affected.

Measured odor intensity reached the action level on two occasions during remedial activities. In response, odor suppressant foam was applied to the soil stockpile that caused the odors on May 1, 2007 and odor intensity returned to below the action level within fifteen minutes. Naphthalene-like odors were noted on July 26, 2007. The level of odors returned to below the action level in the following fifteen minutes, and GEI continued monitoring to establish a trend of data as a response action. GEI determined that since odors were no longer apparent, work stoppage was not necessary. Real-time and supplemental TVOC and naphthalene data remained below action levels on July 26, 2007.

Four public odor complaints were received and investigated during remedial activities. In response to each of these complaints, real-time air monitoring data, supplemental odor monitoring, and supplemental walk-around air monitoring data were reviewed and it was determined that measured concentrations of TVOC, PM-10, odor, and hydrogen cyanide were below action levels.

The time-weighted average and real-time total VOC results suggest only minor VOC concentrations were present during remediation activities. In general, BTEX concentrations detected during this CAMP are consistent with those collected in a similar urban setting. BTEX compounds were detected at low concentrations and since the detected concentrations did not differ significantly when comparing upwind to downwind locations, GEI determined the results did not indicate an on-site source of BTEX from remediation activities..

The CAMP and mitigation controls were effective at controlling TVOC and PM-10 and the supplemental odor monitoring action levels triggered mitigative responses to further control potential off-site emission of TVOC and PM-10. The CAMP implemented by GEI and the response by on-site personnel, provided an early warning and detection system to prevent and/or mitigate potential off-site exposures to site-related contaminants associated with intrusive operations.

4.2.7.2 Noise Monitoring

Phase I remedial construction activities were performed so as to limit the potential for adverse impacts due to noise. Noise monitoring was conducted during sheet pile driving activities being implemented as part of the proposed remedial construction to assess the effectiveness of the implemented mitigation measures and to assess performance measures (action levels) specified in the Noise and Vibration Mitigation Plan. Noise monitoring was performed in accordance with the approved Noise and Vibration Mitigation Plan for the Bay Shore Former Manufactured Gas Plant Site prepared by PS&S and submitted by KeySpan Corporation to NYSDEC in April 2007.

PS&SPC performed noise monitoring along the perimeter of the Site during the southern cell excavation, the sub-surface containment barrier installation, and the installation of the bentonite clay columns (caissons). Appendix H provides the full Noise and Vibration Mitigation Report with information on the instrumentation used, monitoring locations, methodology employed, approach followed and measurement results. Figure 1 in Appendix H presents the noise and vibration monitoring location plan.

The driving of sheet piles created noise levels in excess of background conditions during the Phase I remedial activities. Typical increases in noise levels above background were on the order of 10 dBA to 15 dBA. On a few occasions, there were 30 dBA to 40 dBA increases in noise levels lasting for short durations.

Measured daily maximum 10-minute Leq values ranged between 60 dBA and 104 dBA during Phase I remedial activities.

Field observations indicate that on several occasions sound levels were in excess of the "warning" and "temporary halt" noise threshold (action) levels due to construction activity in proximity to the sound monitoring equipment (acute construction noise) or due to localized noise sources (i.e., sirens) in proximity to the sound monitoring equipment.

Sound levels exceeded the 85 dBA "warning" noise threshold level at times during the southern cell excavation, installation of the sub-surface containment barrier and the bentonite column installation. Upon exceeding the "warning" threshold, proper site personnel were notified and work continued with caution (with an attention to sound levels).

The "temporary halt" noise threshold level was exceeded on several occasions during the installation of the sub-surface containment barrier. The installation of sheet piles in pairs generated sound levels in excess of the 90 dBA "temporary halt" threshold level. Sheet piles were driven in pairs during installation of the initial wall section. This method was necessary due to time constraints with regard to road closures (North Clinton Avenue) and in order to obtain proper alignment of the containment barrier. In addition, difficulties were encountered during the installation (driving) of the modified Waterloo Barrier® Sheet piles (window) along the southern boundary of the Site. This required several reconfigurations of the sheet piles. The modification of the "window" section during sheet pile installation, and the retracting and re-aligning associated with that activity, generated sound levels in excess of the 90 dBA "temporary halt" threshold level. Sound levels did not exceed the 90 dBA "temporary halt" noise threshold level during the southern cell excavation and the bentonite column installation.

In the event that a "temporary halt" noise threshold sound level was exceeded, the proper site personnel were notified, work was temporarily halted, and attempts were made to investigate and change the methodology employed. Tier 3 mitigation measures were implemented based on individual community feedback. Supplemental monitoring was conducted adjacent to businesses/residences based on observed noise levels and/or to address concerns.

4.2.7.3 Vibration Monitoring

Phase I remedial construction activities were performed so as to limit the potential for adverse impacts due to vibration. Vibration monitoring was conducted during sheet pile driving activities being implemented as part of the planned remedial construction to monitor ground-borne vibration during the driving of steel sheet piles to assess the effectiveness of the implemented mitigation measures and to assess performance measures (action levels) specified in the Noise and Vibration

Mitigation Plan. Vibration monitoring was performed in accordance with the approved Noise and Vibration Mitigation Plan for the Bay Shore Former Manufactured Gas Plant Site prepared by PS&S and submitted by KeySpan Corporation to NYSDEC in April 2007.

PS&SPC operated up to six vibration monitors simultaneously along the perimeter of the Site during the southern cell excavation, the sub-surface containment barrier installation, and the installation of the bentonite clay columns. Appendix H provides the full Noise and Vibration Mitigation Report with information on the instrumentation used, monitoring locations, methodology employed, approach followed and measurement results. Figure 1 in Appendix H presents the noise and vibration monitoring location plan.

Ground-borne vibration levels within the property boundaries of the Site and the abutting commercial/residential property boundaries reached potentially perceptible vibration levels during Phase I remedial activities. The maximum PPV vibration levels ranged from 0.01 inches per second to 0.47 inches per second.

Vibration levels did not exceed the 0.2 inches per second vibration threshold (action) level during the southern cell excavation. There were periods when the maximum PPV vibration levels exceeded 0.2 inches per second PPV, the "warning" vibration threshold level, during the installation of the sub-surface containment barrier. Field observations indicate that vibration levels were in excess of the "warning" threshold level on several occasions due to construction activity in proximity to the vibration monitoring equipment. The 0.2 inches per second "warning" level was not exceeded at the monitoring locations placed adjacent to residential structures at Western, Oak and 5th, and Union Boulevard. Elevated vibration levels only occurred at the monitoring locations closest to pile driving activity.

Maximum PPV vibration levels exceeded 0.2 inches per second PPV, the vibration threshold level, on four days during the bentonite column installation. The exceeded "warning" vibration threshold can be attributed to construction or other activity in proximity to the vibration sensor, as documented in field notes and supported by no intrusive work at the time of the exceedence. Vibration levels were above 0.2 inches per second in one instance due to installation of a non-window sheet pile for grout column closure; that vibration level was measured at the on-site monitoring location.

Upon exceeding the 0.2 inches per second "warning" threshold, responsible site personnel were notified and work continued with caution and with attention to vibration. In the event that a "warning" threshold vibration level was exceeded, the proper personnel were notified and attempts were made to investigate and change the methodology employed. Tier 3 mitigation measures were implemented based on individual community feedback. Additional focused

inspections were conducted at structures deemed potentially vulnerable to the effects of the pile driving activities. Supplemental monitoring was also conducted adjacent to businesses/residences based on observed vibration and/or to address community concerns.

The "stop work" threshold vibration level of 0.5 inches per second was not exceeded at any monitoring location during Phase I remedial activities. These results indicate that ground-borne vibration levels measured within the property boundary of the Site and the surrounding commercial/residential property boundaries reached potentially perceptible vibration levels at times during Phase I remedial construction activity. However, observed ground-borne vibration measurements were less than the USBM vibration threshold levels at which damage may be expected to occur to "typical residential structures."

4.3 Phase I Contaminated Materials Removal

4.3.1 Southern Cell Excavation

4.3.1.1 Temporary Excavation Support System

ENTACT installed a temporary excavation support system, as presented in the Phase I RDR, to support the walls of the Southern Cell Area during the excavation activities. As depicted on design drawings in the Phase I RDR, the temporary excavation support system consisted of two internally braced structural steel sheet piling cells. Each cell measured approximately 24 feet in width and 27 feet in length. Continuous steel sheet piling was installed on all four sides of each cell. The northern extent of the sheet piling cells, located adjacent to the LIRR ROW, was installed to a depth of 38 to 40 feet bgs. The remaining sheet piling was installed to a depth of 35 to 36 feet bgs. The internal bracing for the two sheet piling cells consisted of the installation of whalers on all four sides of each cell at an approximate depth of eight feet below ground surface which was approximately the depth of the existing groundwater table as detailed in the IRM and the Phase I RDR. The sheet piling design was signed and sealed by a Professional Engineer licensed in the State of New York under contract with Posillico and was installed by J.D. Posillico, Inc. (Posillico), a subcontractor to ENTACT.

4.3.1.2 Temporary Enclosure

After the temporary earth support system installation was completed, the temporary enclosure was placed over the Southern Cell Excavation area. The temporary enclosure utilized for the Southern Cell Excavation activities measured 80 feet wide by 75 feet long (measured by maximum width by maximum length). The enclosure was manufactured by Sprung Instant Structures, Inc. (Sprung). The temporary enclosure was designed by a Professional Engineer licensed in the State of New York and was engineered by Sprung to comply with all applicable

building codes. The specific details of the design of the enclosure are included in the Phase I RDR.

The temporary enclosure was positioned over the entire Southern Cell Area to facilitate the excavation activities. The Southern Cell excavation activities were conducted within the temporary enclosure. Upon completion of the excavation and backfill activities, the temporary enclosure was dismantled and demobilized from the Phase I Site.

The temporary enclosure was equipped with a Vapor Management System (VMS) that provided a minimum of six air exchanges from within the enclosure per hour based on the combined interior space of the temporary enclosure and the maximum depth of the excavation. Negative air pressure was maintained within the enclosure during the excavation and backfill of the Southern Cell. The VMS was designed and manufactured by TIGG Corporation and processed the recovered air from within the enclosure, removed the associated contaminants, and discharged the processed air to the exterior of the enclosure. The effluent from the VMS was monitored to ensure that it met the discharge criteria included in the Phase I RDR.

The specific details of the VMS are included in the approved Phase I RDR. The VMS was installed as per the approved design. In general, the VMS consisted of a blower that was utilized to remove the air from within the enclosure and convey the air through an NB20 Carbon Absorber filled with 16,000-pounds of vapor phase carbon to remove contaminants. A sample collection port was located in the outlet ductwork to facilitate the sampling of processed air using a photo-ionization detector (PID). The system was equipped with a gauge to measure pressure drop that, together with real time monitoring of the influent and effluent from the VMS, ensured that there was no breakthrough from the carbon vessel.

4.3.1.3 Southern Cell Excavation

Soils above the existing groundwater table were excavated using a standard reach excavator creating a working platform within each sheet piling cell. The removal of these soils was necessary to allow for the installation of the whalers associated with the temporary excavation support system. The working platform was constructed approximately one foot above the existing groundwater table. The working platform served as a bench in which excavated saturated soils were placed for draining entrained water and for mixing with excavated unsaturated soils or amending materials to achieve the required moisture content.

Using a long reach excavator, ENTACT excavated through and beneath the working platform in the area and removed saturated soils to a depth of approximately 25 feet bgs. The depth of the excavation was verified by PS&SPC by lowering a weighted tape to the base of the excavation and comparing the readings to both known bench marks established on the temporary excavation

support sheeting or roping set-up across the excavation to simulate pre-disturbance conditions. This type of measuring was conducted in several transects across the excavation with readings generally taken along the sides and middle of the excavation. At both cells, the NYSDEC On-Site representative verified the measurements taken by PS&SPC. It should be noted, visual inspection of the excavated soils from both cells of the Southern Cell Excavation did not reveal the presence of source materials through out full depth of the excavation.

Excavated saturated soils were placed on the adjacent working platform to gravity drain back into the excavation. After the western cell was finished and backfilled, soils from the eastern cell were stockpiled on plastic placed on the western cell. The gravity drained excavated saturated soils were then mixed with either excavated unsaturated soils or Calciment, a calcium oxide product used as a drying agent. Amending of the soil was necessary to improve transport characteristics and to meet the acceptance requirements of the disposal facilities. After mixing, amended soils were staged on an impermeable barrier (i.e., plastic sheeting) outside of the temporary excavation support system and within the temporary enclosure.

The excavation activities commenced in the western cell of the Southern Excavation Area and terminated after completion of the eastern cell. The excavation activities in the western cell were completed and restored prior to beginning excavation activities in the eastern cell. No NAPL or source materials were encountered during the excavation activities within the Southern Cell Excavation.

The limits of the Southern Cell Excavation are depicted in As-Built Sheet 2 included in Appendix A of this Report. A total of 2,285.56 tons (86 truck loads) of impacted soil was removed from the Southern Cell Excavation Area. The waste manifests generated as a result of the off-site disposal of soils from the Southern Cell Excavation Area were summarized and tabulated and are presented on Table D-1 included in Appendix E. Copies of the manifests and associated Certificates of Destruction (CODs) from the disposal facilities are included in Appendix E.

4.3.1.4 Dust and Odor Control

In addition to the temporary enclosure, point source control was the first line of defense in the mitigation of odors and dust from materials handling activities. The primary function of point source control was to minimize the amount of surface area exposed for long periods of time, thereby mitigating the potential for noxious odors and preventing contaminated dust from becoming airborne. ENTACT utilized Rusmar Foam, as necessary, to control odors and/or achieve compliance with site action levels during excavation activities inside the temporary enclosure. At the end of each work day, soils stockpiled within the

enclosure scheduled for load-out the next day were covered with Rusmar Foam overnight to prevent any adverse impacts from the release of odors and/or vapors.

4.3.2 Materials Management

All excavated soil and spoils generated as a result of the installation of the bentonite clay columns were transferred into a lined roll-off container. In order to meet disposal facility acceptance criteria for moisture content, free standing water was pumped from the container into a holding tank for separate testing and handling prior to the drainage of the liquid back to the southern cell excavation as approved by NYSDEC. After dewatering the spoils, the containers were loaded on trucks for subsequent off-site transportation to the disposal facilities. The disposal facilities utilized during the Phase I remedial activities included Clean Earth of Delaware and Clean Earth of Southeast Pennsylvania. Both facilities are disposal facilities licensed to accept and treat the remedial derived wastes. Transport vehicles were decontaminated within the enclosure or at the decontamination pad and exited the Phase I site via haul roads created with large diameter road stone either through the North Clinton Avenue or Union Blvd gates. The haul roads were maintained while the enclosure was utilized and the road stone minimized the potential for soil tracking into North Clinton Avenue and Union Blvd for the generation of fugitive dust.

All transportation and disposal activities were coordinated by ENTACT. All waste-hauling vehicles were inspected prior to loading and any vehicle that appeared to be in an unacceptable condition for transporting materials were not loaded. Transport vehicles were also inspected for the appropriate placards, vehicle identifications and over-the-road permits for the States in which they traveled. Additionally, transport vehicles and their contents were inspected prior to leaving the Phase I Site to verify that the vehicles were properly decontaminated, covered, placarded and that the load was acceptable for transport and disposal.

Prior to mobilization to the Site, National Grid provided ENTACT with the analytical results of historical investigation sampling conducted in the area of the Southern Cell Excavation and the Phase I Site. Based on these analytical results, ENTACT worked in conjunction with the selected disposal facilities to develop an acceptance profile for the anticipated wastes. This acceptance profile was generated so that the soils to be excavated could be classified prior to their removal and off-site disposal. The acceptance profile included soils excavated from the Southern Cell Excavation Area as well as the pre-trenching activities associated with the installation of the Waterloo Barrier® System. Spoils generated from the installation of the five bentonite clay columns utilized to closure the barrier wall were disposed of at Clean Earth of New Castle as well as Clean Earth of Southeast Philadelphia. Based on analytical results all materials generated during the Phase I remedial activities and disposed of at Clean Earth of

New Castle and Clean Earth of Southeast Philadelphia were characterized as non-hazardous waste.

A total of 2,285 tons of source material and potentially impacted soils were excavated from the Southern Cell Excavation. A total of 5,281 tons of materials (i.e.., soils, bentonite clay column spoils, and construction debris) were removed from the Phase I Site during the implementation of the remedial activities and transported to Clean Earth of New Castle and Clean Earth of Southeast Pennsylvania. A summary table and copies of the waste classification sample results, non-hazardous waste manifests and certificates of destruction/recycling are included in electronic format on a compact disk contained in Appendix E.

Appendix E includes a table which summarizes the 192 non-hazardous waste manifests generated during the Phase I off-site disposal activities. The table includes the disposal facility's manifest number, the date the load was shipped, the tonnage shipped under each manifest as well as the Certificate of Destruction/Recycling number for each load. The Certificate of Destruction/Recycling documents that the disposal facility thermally treated each load of soils.

4.4 Phase I Imported Backfill

Imported material consisted of New York State Department of Transportation (NYSDOT) Type I coarse aggregate (below the groundwater table), Type II course aggregate (top six inches of Phase II side wide soil cap) and a clean well graded sandy soil fill (above the groundwater table). The coarse aggregate and sandy soil material met the specified gradation requirements as stated in the 100% RDR for both Phases. Clean fill material was obtained from certified virgin sources which included Stony Creek 4001 Daly Blvd, Oceanside, NY 11572; Tilcon NY 162 Old Mill Road, West Nyack, NY 10994; Watral Brothers INC. 45 South 4th Street, North Bay Shore, NY 11706; and A&R Materials 25A Mill Road, Ronkonkoma, NY 11779. Imported fill material was analyzed for polycyclic aromatic hydrocarbons (PAHs) and total volatile organic compounds (VOCs) at a rate of one sample for every 5,000 cubic yards of imported material. Ten percent (10%) of the samples were also analyzed for target analyte list (TAL) compounds and polychlorinated biphenyls (PCBs). The results of the testing are included in Appendix F of this Report.

The Southern Cell Excavation Area was backfilled, as per the Phase I RDR, with coarse aggregate conforming to the specification of New York State Department of Transportation (NYSDOT) Type 1 coarse aggregate below the water table. The NYSDOT Type 1 aggregate was obtained from (Tilcon New York, Inc. located in Clinton Point, New York). A separation geotextile fabric (Mirafi 140N) was placed over the coarse aggregate and the balance of the excavation was backfilled to the surface with certified clean fill meeting the requirements of the Technical Specifications for a well-graded sandy soils. The well-graded sandy soils were obtained from Watral Brothers, Inc. of North Bay Shore, New York.

Fill materials delivered to the Phase I Site were accompanied by documentation that the fill was certified "clean" from a virgin source or a blend of soils originating from virgin sources. Integrity sampling was conducted in accordance with the Technical Specifications. The backfill information was submitted to the NYSDEC for review and approval prior to delivery to the Site. Backfill documentation is included in Appendix F.

The certified clean fill was placed above the geotextile fabric in 12-inch lifts over the entire Southern Cell Excavation area. The well-graded sandy soil was also utilized to supplement native material to backfill the trenches associated with the installation of the barrier wall and the bentonite clay columns. The trenching across North Clinton Avenue was backfilled with Class 4 road base material as approved by on-site inspectors for Suffolk County. The replacement of the materials removed from under the roadway with road base material was a Suffolk County requirement due to concerns with re-compacting the materials to support the roadway.

Each 12-inch lift was mechanically compacted to a minimum of 90 percent of the modified proctor density. To document the effectiveness of the compaction efforts, the Contractor subcontracted MT Group of Farmingdale, NY to perform in-place compaction testing. Compaction documentation is included in Appendix F.

Reuse of On-Site Materials

Excavated soils that did not contain source material (i.e., soil containing visible tar, oils and purifier wastes) based on field observations were evaluated for potential reuse on-site. A representative confirmatory sample was collected from each on-site soil pile intended for reuse as backfill at a rate of one sample every 5,000 cubic yards for the first two approved samples and then reduced to one every 10,000 cubic yards for subsequent samples. Soils designated for reuse were placed below the two foot Site Wide Soil Cap.

Concrete debris generated from the removal of former MGP features was broken on site and used as bottom layer fill material below the water table for the hot spot excavation areas. Only broken debris that was approved for reuse by National Grid and the NYSDEC was used as fill material. In the event the concrete debris was not able to be used as fill, it was properly managed for off-site disposal. If necessary, the debris was cleaned to remove attached soil to meet the criteria for on-site reuse.

4.5 Phase I Residual Contamination Remaining On-Site

Since contaminated soil and groundwater remains 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 Site Management Plan (SMP) approved by the NYSDEC.

4.6 Phase I 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 a primary Engineering Control Systems, as described in the following sections as the Waterloo Barrier® System.

The Waterloo Barrier® System (Waterloo Barrier® sealed steel sheet piling) was installed by C3 along the downgradient edge of the Site. The barrier was installed as shown on Figure 2 and As-Built Sheet 2 included in Appendix A of this completion report. The containment barrier was generally installed in four interconnected segments as follows:

- Segment 1: The section of the wall which diagonally crosses (northwest-southeast direction) North Clinton Avenue. Segment 1 encompasses Sheets 62 (Segment 1/Segment 2 corner) to 133.

- Segment 2: The section of the wall extending in a north-south direction along the western side of North Clinton Avenue. Segment 2 encompasses Sheets 5 to 62 (Segment 1/Segment 2 corner).

- Segment 3: The section of the wall extending in an east-west direction (parallel to Union Boulevard). Segment 3 encompasses Sheets 133 (Segment 1/ Segment 3 corner) to 224 (Segment 3/Segment 4 corner).

- Segment 4: The section of the wall extending in a north-south direction along the eastern perimeter of the Phase I Site. Segment 4 encompasses Sheets 244 (Segment 3/Segment 4 corner) to 301.

The containment barrier was installed to serve two purposes. First, in the deeper portion of the saturated zone the barrier prohibits the migration of DNAPL to areas located downgradient of the OU-1 Site. As per design, the barrier was keyed into the underlying low permeability Magothy Unit to inhibit DNAPL from migrating underneath the containment barrier. The depth of the key was as per the approved 100% design (i.e., approximately five feet into the formation) with the exception of the last thirteen sheets along the northern terminus of Segment 4.

Second, the containment barrier will serve to direct groundwater flow through the in-situ groundwater treatment system to be installed (Phase IA, ozone injection system) to treat the dissolved phase contamination. After treatment, groundwater will flow through the openings (windows) installed in upper 38 feet of Segment 3 preventing mounding behind the wall and allowing the return to natural groundwater flow patterns downgradient of the Site.

For the purposes of discussion in this report and as shown on As-Built Sheet 2 included in Appendix A, the wall begins at the northern terminus of Segment 2. The stations continue along Segment 2, Segment 1, Segment 3 and Segment 4 ending at the northern terminus of Segment 4.

The Waterloo Barrier® System, with the exception of the last thirteen sheets at the northern terminus of Segment 4, was installed to depths, extending at a minimum of five feet into the underlying Magothy Formation. As shown on the as-built profile of the barrier wall (DWG-002 of the C3 Installation Report), the wall was often installed to depths deeper than the required five feet embedment. Refer to Modification to the Depth of the Barrier at the Northern Terminus of the Segment 4 for a discussion of the NYSDEC-approved modification to the scope of work for these thirteen sheets.

C3, the installer of the subsurface barrier containment wall, prepared a System Installation Report which summarizes the installation of the Waterloo Barrier® System. This report, included as Appendix C to this Report, contains the followings documentation:

- Project overview;
- Waterloo Barrier® sheet pile specifications;
- Information on the sealant material;
- Information on the sheet pile installation equipment;
- Installation procedures;
- Flushing and grouting procedures;
- Inspection procedures;
- Project records;
- Information on the modified Waterloo Barrier® sheet piles (perforated/windowed) utilized along segment 3 of the wall;
- Information regarding the design and installation of the five bentonite clay grouted columns utilized to close the gap in the wall east of the Segment 1/Segment 3 corner;
- As-built figures;
- Representative photographs;
- Statement of certification;
- Visual pile inspection summary;
- Sheet pile driving logs and summary;
- Sealant (grout) installation logs;
- Technical data sheets on the grout sealant as well as the materials utilized to form the bentonite clay grouted columns; and
- Letter Addendum with grout permeability testing results.

4.6.1 Phase I Pre-Trenching

The alignment of the Waterloo Barrier® System was pre-trenched to clear obstructions, if any, and manage utilities, if present, prior to installation of each

segment of the barrier wall. The trench was generally installed using the procedures outlined in the Phase I RDR and to the dimensions referenced in that document. The width of the trench for Segment 1 (across North Clinton Avenue) varied from the design document based on the requirement of the utility companies (Suffolk County Water Authority, Verizon, Suffolk County Department of Public Works (DPW), National Grid Gas) so that they could either protect, relocate or penetrate the barrier wall with their utilities to facilitate installation of Segment 1. The trench was enlarged as necessary to accommodate the utility company's requirements:

- National Grid Gas: Required a minimum trench width of ten feet so that they could pinch or by-pass any gas mains.

- Suffolk County DPW: Required a minimum trench width of ten feet on each side of the drive line in order to cut and replace sewer mains and laterals as well as penetrate the barrier wall.

- Suffolk County Water Authority: Required at least two access points to any water lines at least 35 feet from the drive line in order to valve off and cap the water lines. The Water Authority also requested assistance in the form of trenching in order to install the new water line.

- Verizon: Required a 10 to 15 foot wide trench on either side of the drive line.

Pre-trenching activities began in late April 2007 at the northeastern corner of North Clinton Avenue (i.e., the Segment 1/Segment 3 corner). The initial activities included locating known utilities (i.e., Verizon fiber-optic, National Grid gas mains, etc.) and relocation of a fire hydrant by the Suffolk County Water Authority. Once located, the utilities were protected, relocated, or temporarily disconnected to facilitate installation of the Waterloo Barrier® System. During the pre-trenching and installation activities, the sanitary sewer main located in the center of North Clinton Avenue was uncovered and temporarily disconnected. Additional shoring (trench boxes) was added around the gas mains to provide an added level of protection.

The sequencing of the pre-trenching generally conformed to that in the Phase I RDR. The pre-trenching started immediately northwest of the corner of Segment 1/Segment 3. The pre-trenching proceeded along Segment 1 (across North Clinton Avenue) and then along north along Segment 2 (north from the corner of Segment 1/Segment 2). Pre-trenching resumed along the western portion of Segment 3 until the driving difficulties resulted in the drive path switch to Segment 4. At this point, the trenching continued at the corner of Segment 3/Segment 4 and proceeded northerly along the alignment of Segment 4 (north). After the installation of Segment 4 was completed, pre-trenching resumed along

Segment 3 starting at the Segment 3/Segment 4 corner and proceeding in a westerly direction.

Soils removed from the trenches and from beneath North Clinton Avenue were continuously screened with a properly calibrated photo-ionization detector and visually assessed for the presence of contamination. Soils deemed to be impacted were stockpiled on-site for off-site disposal. Soils deemed to be non-impacted were stockpiled on-site and reused as backfill material on-site. No excavated material was re-used as backfill in North Clinton Avenue.

4.6.2 Phase I Utility Management

The procedure for managing utilities during the installation of the Waterloo Barrier® System, as detailed in the Phase I RDR, was, in general, followed in the field.

The penetration associated with the 8" diameter main sanitary sewer line that extends in a north-south direction was performed, as per the Phase I RDR, between Sheets 102 and 103 located at approximately Station 2+12 of Segment 1. In addition, as per the approved Phase I RDR, three 6" diameter sanitary sewer laterals were installed through the wall at Sheets 24, 44 and 62 of Segment 2. The laterals were requested to be installed by the Suffolk County DPW for future use if the adjacent properties are developed. The remaining utilities were located at depths shallower than the installed top of the wall, generally 3 to 4 feet bgs, so penetrations through the wall were not required.

4.6.3 Phase I Installation of the Waterloo Barrier® System

The installation of the Waterloo Barrier® System began on May 3, 2007 along Segment 1 with the installation of the first four sheets located immediately west of the Segment 1/Segment 3 corner. The sheets were installed with a 120-foot crane equipped with a vibratory hammer. The corner sheet was installed at a later date. During the installation of the barrier wall, pre-trenching activities continued ahead of the sheet pile installation activities.

After a series of sheets were installed to design depths, flushing and grouting operations began at a safe distance away from the installation activities. The method for flushing and grouting the joints is described in the C3 Report contained in Appendix C and generally preceded as follows:

- The joints were flushed by inserting a hose using the standard pressure from a potable water supply truck until refusal was encountered or the design depth of the joint was reached.

- If refusal was encountered before the design depth the pressure was increased as needed to clear the joint to the design depth.

- Once flushing reached the design depth in a sufficient number of joints to accommodate a batch of grout, approximately 12 joints, the grout sealant was installed in each joint by using a tremie hose "grout line" inserted to the base of the joint and grout was pumped into the joint from the mixing plant until it was observed at the surface and the grout line was slowly removed.

- Just prior to grout installation the joints were re-flushed (Secondary Flushing) with the standard pressure hose to remove the any materials that may have re-accumulated and clear the joint and promote grouting of the entire length of the interlock.

- The grout was prepared on site in a mixer in batches made by mixing 12 pre-measured 30 Kg bags of grout with approximately 132 liters of potable water and pumped directly from the mixer to the joint inserted grout line.

- Due to sealant loss to the surrounding porous soils some grout level drop was recorded prior to the grout setting and grout was added in a until each joint filled to the surface.

Waterloo Barrier® System Installation Milestones	
Date	**Milestone**
Segment 2 (Sheet 5 to Sheet 62)	
May 10, 2007	Complete installation of Sheets 49 to 60
May 11, 2007	Complete installation of Sheets 39 to 48
May 14, 2007	Complete installation of Sheets 27 to 38
May 16, 2007	Complete installation of Sheets 61 to 62 (Corner Sheet)
May 14, 2007	Complete installation of Sheets 27 to 38
May 21, 2007	Complete installation of Sheets 23 to 26 and 16 and 17
May 22, 2007	Complete installation of Sheets 12 and 13
May 23, 2007	Complete installation of Sheets 5 to 11, 14 and 15, 18 to 22

Waterloo Barrier® System Installation Milestones	
Date	**Milestone**
Segment 1 (Sheet 62 to Sheet 133)	
May 4, 2007	Complete installation of Sheets 125 and 126
May 5, 2007	Complete installation of Sheets 118 to Sheet 124
May 6, 2007	Complete installation of Sheets 127 to 131
May 7, 2007	Complete installation of Sheets 104 to 117
May 8, 2007	Complete installation of Sheets 85 to 103
May 9, 2007	Complete installation of Sheets 70 to 84
May 16, 2007	Complete installation of Sheets 62 (Corner Sheet) to 67
May 21, 2007	Complete installation of Sheets 68 and 69
June 11, 2007	Complete installation of Sheet 132
June 13, 2007	Complete installation of Sheet 133 (Corner Sheet)
Segment 3 (Sheet 133 to Sheet 224)	
June 13, 2007	Complete installation of Sheet 133 (Corner Sheet)
August 8, 2007	Complete installation of Sheets 219 to 222
August 9, 2007	Complete installation of Sheets 213 to 218, 223 and 224 (Corner Sheet)
August 13, 2007	Complete installation of Sheets 208 to 212
August 14, 2007	Complete installation of Sheets 199 to 207
August 15, 2007	Complete installation of Sheets 195 to 198
August 17, 2007	Complete installation of Sheets 182 to 194

Waterloo Barrier® System Installation Milestones	
Date	**Milestone**
August 20, 2007	Complete installation of Sheets 176 to 181
August 22, 2007	Complete installation of Sheets 173 to 175
August 23, 2007	Complete installation of Sheets 165 to 172
August 24, 2007	Complete installation of Sheets 158 to 164
August 27, 2007	Complete installation of Sheets 151 to 157
August 29, 2007	Complete installation of Sheets 149 to 150
August 30, 2007	Complete installation of Sheets 144 to 148
GROUTED COLUMN CLOSURE	
April 21, 2008	Complete installation of Sheets 143
April 23, 2008	Complete installation of Sheets 134, 141 and 142
April 23, 2008	Complete installation of Sheets 140
Segment 4 (Sheet 224 to Sheet 301)	
July 11, 2007	Complete installation of Sheets 228 to 235
July 12, 2007	Complete installation of Sheets 236 to 248
July 13, 2007	Complete installation of Sheets 249 to 256
July 17, 2007	Complete installation of Sheets 257 to 271
July 19, 2007	Complete installation of Sheets 272 to 286
July 20, 2007	Complete installation of Sheets 287 to 301
August 9, 2007	Complete installation of Sheets 224 (Corner Sheet) to 227

NOTES:

(1) The above referenced dates note the date of the completion of the installation of the individual sheets. This does not represent the date of the start of installation rather the date that the sheet was installed to its final depth.
(2) There was no need to install Sheets 1 through 4 along the northern terminus of Segment 2 as the installation of the wall reached its design terminus (i.e., the wall "ran" long).
(3) Segment 1/Segment 2 Corner – Sheet 62
(4) Segment 1/Segment 3 Corner – Sheet 133
(5) Segment 3/Segment 4 Corner – Sheet 224
(6) Northern Terminus of Segment 2 – Sheet 5
(7) Northern Terminus of Segment 4 – Sheet 301

4.6.4 Phase I Installation of Modified (Windowed) Waterloo Barrier® Sheets (Segment 3)

To achieve the remedial goal of containing DNAPL at depth while allowing shallow groundwater flow over the barrier, after treatment, and prevent ground water mounding behind the barrier by the design of the Waterloo Barrier® sheets of Segment 3 were modified to be open (windowed) over the upper 38 feet. The installation of the windowed Waterloo Barrier® sheets along Segment 3 of the barrier wall originally encountered difficulties resulting in:

- The need to modify the design of the windowed sheets;
- Replacing some of the windowed sheets with solid sheets;
- Change the installation direction for Segment 3; and
- Ultimately develop an alternative method to close a gap in Segment 3 of the barrier wall located immediately east of the Segment 1/Segment 3 corner (Sheet 133).

The following sections of this Report summarize the process of installing Segment 3 of the barrier wall. These modifications are also detailed in the C3 report contained in Appendix C of this report.

4.6.4.1 June 11, 2007 Field Change Request

As detailed in this Field Change Request (FCR) submitted to the NYSDEC on June 11 2007, the windowed sheets were designed to permit the passage of groundwater through the containment barrier while preventing the groundwater from mounding beyond the allowable 0.5 foot maximum behind the barrier wall. Each sheet, as designed and presented in the Phase I RDR, had an effective windowed area of 37 square feet per sheet. The original process of installing the windowed sheets was to torch cut the remaining portion of the sheet (i.e., tabs) while the sheet was being driven into the ground to achieve the total 37 square

foot opening area. A total of 90 window sheets were originally proposed to be installed along Segment 3.

While attempting to install the first half-dozen modified sheets (from west to east along Segment 3), difficulties were encountered in driving the sheets to their design depth once the tabs between the windows were removed. To address these difficulties, modifications to the driving methods (i.e., driving the sheets in sets to minimize flexing and modifying the frequency of the vibratory hammer) were attempted. Despite these changes, driving conditions remained difficult. The difficulties were attributed to excessive friction and warping of the interlock between the corner sheet of Segment 1/Segment 3 (Sheet 133) and the first windowed sheet. To address this situation, sheets were removed from the eastern end of Segment 1 and a new corner sheet was installed. To add rigidity to the corner sheet and facilitate installation of the Segment 3 widowed sheets, a solid sheet was proposed to replace the initial windowed sheet at the western end of Segment 3. Analysis of the loss of effective window spacing along Segment 3 was performed and noted that the total windowed area of Segment 3 would be reduced by approximately 1.1%. The analysis also noted that the replacement of the windowed sheet with a solid sheet would not affect the groundwater mounding. Therefore, the first windowed sheet at the western end of Segment 3 (Sheet 134) was replaced with a solid sheet.

4.6.4.2 June 25, 2007 Field Change Request

As detailed in this Field Change Request submitted to the NYSDEC on June 25, 2007, the extracted Segment 1 sheet and the newly fabricated corner sheet were re-installed and the new solid sheet was installed along the Segment 3 alignment as proposed. Once the solid sheet was installed, one window sheet was threaded onto the solid sheet and driven in place. A second connecting window sheet was then attempted to be driven. Although the first windowed sheet was installed with little difficulty, the second windowed sheet could not be effectively driven to the design depth. Based on these field results, National Grid's Design Team believed that windowed sheets, as designed, did not provide sufficient rigidity along the full length of the interlock between the sheets to allow for installation to the design depth. Based on this finding, the Design Team developed a tiered approach to test and finish installation of the remaining Segment 3 windowed sheeting. This tiered approach was outlined in the June 25, 2007 Field Change Request and included installation testing consisting of:

- Use of a rack support system;
- Installing the modified (windowed) sheets as single sheets;
- Driving the modified (windowed) sheets in pairs;
- Modifying the length of the window openings and the length of the reinforcing angle iron installed down the center of the modified sheets;
- Removing sections of the joints to reduce friction;

- Supplementing the reinforcement around the window opening and along the centerline of the sheet; and
- Testing of alternate installation equipment.

The testing noted was performed off of the alignment of the barrier wall to assess drivability of the modified window sheets.

4.6.4.3 August 15, 2007 Field Change Request

Based on the tiered approach testing as proposed in the June 11, 2007 FCR, several modifications to the design of the modified (windowed) sheets were made in an attempt to reinforce the window sections of the sheeting. These modifications included increasing the window openings by the addition of 6" diameter cut outs in the inter-window tabs and adding a 2' window below the existing windows to allow for the tabs between the windows to be left in-place as well as extending the central angle iron to the bottom of the individual sheet. These modifications are detailed in the C3 report contained in Appendix C. Installation testing off of the alignment of the barrier was successful in driving the newly modified windowed sheets. However, attempts to install these sheets when they were connected to Sheet 134 were unsuccessful.

Therefore, in order to maintain the project implementation, National Grid's Design Team decided to proceed with the installation of Segment 4 while options for the installation of Segment 3 were considered.

Installation of Segment 4 began with the installation of the Segment 3/Segment 4 corner (Sheet 224) and proceeded north along Segment 4 to its terminus. After the installation of Segment 4 was completed, a solid transition sheet (Sheet 224) was installed at the eastern end of Segment 3 and connected to the corner sheet. The solid transition sheet allowed for Segment 3 installation activities to continue in an east-west direction from the Segment 3/Segment 4 corner to the Segment 1/Segment 3 corner while plans were being developed to address the installation difficulties realized at the Segment 1/Segment 3 corner. As with the previous replacement of a windowed sheet with a solid sheet, analysis determined that the use of solid Sheet 224 would not have an adverse effect on the groundwater mounding. Installation of the newly modified windowed sheets progressing from east to west from the Segment 3/Segment 4 corner progressed successfully. The installation halted once Sheet 144 was installed to facilitate installation of the closure of the wall in the area (i.e., adjacent to the Segment 1/Segment 3 corner and the adjacent Sheet 134) resulting in an approximate 12 foot wide gap in the wall. The gap encompassed the proposed locations of Sheets 135 through Sheet 143.

The proposal to address the driving difficulties at the Segment 1/Segment 3 corner using overlapping sheets installed through a grout filled column was included in the August 15, 2007 Field Change Request. The columns were to be constructed

using steel caissons drilled or driven 80 feet into the underlying confining layer, removal of the materials from within the caissons and backfilling with bentonite-clay material. In order to ensure that the overlap of the sheets fall within a grouted column, based on the to date as-built geometry of the wall, inclinometer testing was performed to determine the alignment (north/south direction as well as the east/west direction) of one or more of the sheets previously installed adjacent to the closure point. After the alignment was determined through the inclinometer testing and a more exact location of the bottom of the sheets was determined, a total of five overlapping columns needed to be installed via the caisson installation method.

4.6.4.4 October 26, 2007 Field Change Request

National Grid submitted a Field Change Request to the NYSDEC dated October 26, 2007 which refined the Grouted Column Connection of Segment 3 of the Waterloo Barrier® System as well as address the NYSDEC comments presented in their letter dated August 22, 2007. The August 22, 2007 letter presented comments from the NYSDEC as well as from the Suffolk County Department of Health Services via e-mail dated August 17, 2007 on their review of the grouted column connection.

The October 26, 2007 Field Change Request included the following:

- A proposal to increase the number of bentonite clay columns from one to a maximum of five based on testing to be performed to determine the alignment as the in-place sheeting;
- Replacement of the Quick-Grout® bentonite clay material with HOLEPLUG® bentonite clay material due to its particle characteristics as well as its decreased permeability;
- The method to construct the bentonite clay columns and associated well-graded sandy soil cover;
- The depth of the columns;
- Waste handling requirements; and
- Odor control methods.

4.6.4.5 November 7, 2007 Field Change Request

The November 7, 2007 Field Change Request was submitted to the NYSDEC to respond to comments generated as a result of review of the October 26, 2007 Field Change Request and its methods and details to close Segment 3 of the barrier wall with overlapping sheets installed within bentonite clay columns. This

Field Change Request confirmed that five columns would be installed as part of the closure of the wall. Further, the request served to address the NYSDEC concern regarding the depth of sandy backfill to be installed over the bentonite clay column.

4.6.4.6 Installation of the Bentonite Clay Columns and Closure of Segment 3 of the Barrier Wall

As previously stated, as installation activities moved from east to west along Segment 3, the last sheet prior to the area to be subject to the bentonite clay column closure activities was Sheet 144. This sheet was installed on August 30, 2007. Sheet 134, the last sheet installed to the east of the Segment 1/Segment 3 corner, was removed to facilitate installation of the bentonite clay columns.

C3 and their installation subcontractor re-mobilized to the Phase I Site in early November 2007 to begin the installation of the bentonite clay columns. Initial mobilization tasks included receiving delivery of the steel caissons, the HOLEPLUG materials. Installation of the first steel caisson commenced on Wednesday, November 7, 2007 and was performed using the vibratory hammer. However, on November 9, due to potential vibrational impacts realized on an adjacent property, the installation of the caisson via vibratory hammer was halted. To avoid potential additional concerns with the installation of the caissons via the vibratory hammer, it was decided that the installation would be suspended until the necessary equipment could be mobilized to install the caissons via rotary drill.

C3 and their installation subcontractor remobilized the Site on March 3, 2008. Initial mobilization activities included delivery of the Delmag-type rotary drill rig, new steel caisson material (39-inches in diameter instead of 36-inches) and the rotary caisson auger bit. The caisson that was previously installed was removed utilizing the crane and vibratory hammer.

Installation of the first caisson commenced on March 10, 2008, via the rotary method. As the installation commenced, soils were removed from the caisson via the auger bit and placed into roll-off containers for off-site disposal. The first caisson (Caisson A) was installed to design depth of 60 feet below mean sea level (msl) and the soils excavated on March 17, 2008.

The addition of the bentonite clay (HOLEPLUG®) into Caisson A began on March 17, 2008. The HOLEPLUG material was added to the caisson by lifting the 3,000 lb super sacks of the material over the caisson, via winch on the Delmag rig, and empting the material into the caisson. The process of placing the HOLEPLUG and removing the caisson incrementally continued until the material was within approximately five feet of the surface.

The process of installing the remaining four caissons continued in this manner to depths between 60 feet and 65 feet below msl. The following table presents the milestone dates for the completion of the installation of the five caissons.

Date	Milestone
March 25, 2008	Complete installation of Caisson A
March 31, 2008	Complete installation of Caisson B
April 3, 2008	Complete installation of Caisson C
April 8, 2008	Complete installation of Caisson D
April 14, 2008	Complete installation of Caisson E

The layout of the five bentonite grouted columns is depicted on DWG 001 contained in the C3 System Installation Report.

After completion of the five caissons, the remaining sheets along Segment 3 (Sheets 134 and Sheets 139 to 144) were installed via crane equipped with the vibratory hammer. Installation of the remaining sheets began with Sheet 143 and continued to the west with Sheets 142 and 141. Sheet 140 was connected to Sheet 141 and installed with the western joint embedded in the bentonite clay columns. All joints with the exception of the joint embedded in the column were flushed and grouted as per the approved design. The western joint was not connected to an adjacent sheet and did not require grouting as it was embedded in the bentonite clay material.

To complete the installation of the wall, Sheet 134 was connected to Sheet 133 (i.e., the Segment 1/Segment 3 corner sheet) and installed with the eastern joint embedded in the bentonite clay columns. The eastern joint was not connected to an adjacent sheet and did not require grouting as it was embedded in the bentonite clay material. The western joint was flushed and grouted as per the approved design.

Date	Milestone
April 21, 2008	Complete installation of Sheet 143
April 23, 2008	Complete installation of Sheet 142
April 23, 2008	Complete installation of Sheet 141
April 23, 2008	Complete installation of Sheet 134
April 24, 2008	Complete installation of Sheet 140

Sheet 139, was to be installed as part of the bentonite clay column closure of the barrier wall, but could not be installed as the wall "ran long" and there was not room between the ends of Sheet 134 and Sheet 140 to facilitate its installation. The installation of Sheet 139 was not necessary as the eastern end of Sheet 134 and the western end of Sheet 140 were embedded into the bentonite clay columns.

A plan view depiction of the bentonite clay closure is depicted on DWG 001 contained in the C3 System Installation Report contained in Appendix C of this Report. In addition, a profile view of the as-built subsurface containment wall noting surface grade, the depth to the underlying Magothy Formation, the required five foot embedment depth, the installed depth of the barrier wall and the bentonite clay columns is included as DWG 002 in the C3 System Installation Report.

4.6.5 Phase I Site Restoration

Trenches excavated to facilitate the Waterloo Barrier® sheet pile wall installation were backfilled as previously specified in this Report. A final gravel cover of Type II crushed stone was placed over areas disturbed during activities for the Southern Cell Excavation. Facility utilities that were temporary relocated were re-established to pre-remedial conditions. The final features are depicted on the Phase I As-Built Sheet 3 in Appendix A.

4.6.5.1 North Clinton Avenue

All soils removed from roadway trenching were disposed of off-site. All backfill consisted of dense graded aggregate (Tilcon-Clinton Point) compacted to 100% modified proctor as required by Suffolk County. The street pavement was restored along North Clinton Avenue from the LIRR tracks north to Union Blvd, as required by Suffolk County.

4.6.5.2 Site Fence

The site fence from the southwest corner north along North Clinton Avenue were removed to facilitate the installation of the barrier wall. Upon completion of the site work, the fence was replaced by Residential Fence Co. to its preconstruction alignment.

4.6.5.3 Sidewalk

As part of the site restoration activities certain areas of the sidewalks (and grass strips) along both sides of North Clinton Ave and the north side of Union Blvd were restored as required by Suffolk County following the remediation activities.

4.6.5.4 Utilities

All utility lines disturbed during the trenching across North Clinton Avenue were restored to full use prior to backfill and the repaving of the roadway.

4.6.5.5 Excess Soils to Phase II Site

After the Phase I work was completed, the Phase I area was re-graded for the future Phase 1A requirements. Excess soils removed from the Phase I site during the re-grading were allowed for re-use as backfill material on the Phase II site beneath the site wide cap. Excess soils not meeting the requirements for the Phase II site-wide cap or found to contain visual evidence of possible contamination were loaded out to a disposal facility with Phase II excavated materials. This reuse of material was approved by NYSDEC in an email correspondence dated May 23, 2008.

4.6.6 Engineering Controls and Institutional Controls Conclusion

Planned engineering controls for Phase I, the Waterloo Barrier® System, elimination of the Southern Cell Hot Spot Area, and backfilling and placement of clean cover soils to eliminate potential exposures were successfully implemented. Additional engineering controls to be installed in the Phase I area include oxygen injection system, monitoring wells, ozone injection systems and a groundwater treatment support building for the supplemental oxygen injection system will be installed as part of Phase IA. The institutional controls to manage future subsurface disturbance and resultant potential exposure pathways including a site management plan will be implemented as remaining Phases IA and III of the OU-1 remediation are completed

4.7 Deviations from the Phase I RDR

The following modifications/expansions to the approved 100% RDR for the Phase I (Phase I RDR) activities were performed during implementation of the Phase I construction activities:

- Replacement of the specified two, electrically operated, roll-up doors on the temporary enclosure with one sliding, manually operated, cargo door;

- Expansions of the Southern Cell Excavation Area from the horizontal extent as defined in the Phase I RDR. The expansion was required due to the design of the ”fixed” corner temporary excavation support system;

- Modification of the configuration and size of the windows and the extension of the central angle-iron bracing of the modified (window) Waterloo Barrier® Sheets (Segment 3). The modifications were necessary due to difficulties

encountered during the installation (driving) of the modified Waterloo Barrier® Sheets;

- Replacement of two modified (window) Waterloo Barrier® Sheets with standard (solid) Waterloo Barrier® Sheets at the eastern and western ends of Segment 3. These solid sheets were installed at the corner of Segment 1/Segment 3 (west side of Segment 3) and Segment 3/Segment 4 (east side of Segment 3) to provide additional rigidity to the corner sheets to facilitate installation of the remainder of the Segment 3 modified (window) Waterloo Barrier® Sheets;

- Modification to the installation depth of the northern terminus (northernmost thirteen (13) sheets) of Segment 4 due to vibrational impacts to a building on an the adjacent property to the east of the Phase I Site; and

- Closure of the western end of Segment 3 of Waterloo Barrier® System (immediately east of the Segment 1/Segment 3 corner) utilizing five (5) overlapping, bentonite clay filled columns.

The modifications to the Phase I RDR are detailed in the following sections.

4.7.1 Replacement of Electrically Operated Roll-Up Doors (Temporary Fabric Enclosure)

The replacement of the electrically operated roll-up doors with the single manually operated cargo door was deemed appropriate due to the relatively small size of the enclosure utilized, site logistics and the fact that the enclosure was going to be utilized on-site for a short period of time (i.e., 10 to 15 days). Therefore, the installation of the mechanical and electrical systems associated with these types of doors was deemed unnecessary. In addition, the Remedial Contractor believed that the single manually operated sliding door was sufficient for gaining access to the Southern Cell Excavation Area for material load out and backfill operations.

4.7.2 Expansion of Southern Cell Excavation Area

The dimensions of the Southern Cell area, presented in the Phase I RDR Design Drawings are approximately 26 feet by 40 feet. To facilitate the installation of the temporary earth support system (i.e., temporary steel sheet piling), required due to the depth of the excavation (i.e., approximately 25 feet bgs), the areal extent of the Southern Cell footprint was expanded to 28 feet by 50 feet. The expanded excavation area encompassed the entire area of the original Southern Cell Excavation Area. The as-built location and areal extent of the Southern Cell Excavation Area is depicted on Figure 2.

4.7.3 Modification of the Windows and Bracing of the Waterloo Barrier® Window Sheets

The Segment 3 Waterloo Barrier® sheets were designed with windows installed on both flanges. The windows extended from a depth of 8.0 to 28.0 feet along the flanges of the sheets. In addition, an angle iron was welded along the centerline of the interior web on both sides of the sheets extending from a depth of 2.0 to 33 feet. The objective of the angle irons was to transmit the driving force from the vibratory hammer down the center of the sheet instead of through the windows. The original design of the window sheets is depicted on Design Drawings of the Phase I RDR.

Due to alignment and rigidity issues during the sheet driving of the in driving the window Waterloo Barrier® sheets, the placement and orientation of the windows and the center angle iron were reconfigured. In general, the modification included reconfiguring the shape of the flange windows from a single large opening to an alternating series of large oval (6 inch wide by 2 to 3 feet long) and small circular (6 inches in diameter) windows. Further, the central angle iron reinforcement was extended down the entire length of the sheet. The modifications of the sheets was developed to ensure that the original intent of the windows (i.e., to prevent adverse groundwater mounding on the upgradient side of the sheets and allow treated groundwater (Phase IA) to continue on its natural downgradient flow pattern) was not affected. The redesign of the window sheet is depicted on Drawing No. 003 contained in the Waterloo Barrier® System Installation Report (C3 Report) contained in Appendix C of this Report.

4.7.4 Starter (Solid) Sheets at Segment 1/3 and Segment 3/4 Corner

Segment 1/Segement 3 Corner

Due to difficulties previously referenced above in the driving of the window Waterloo Barrier® sheets, in order to provide additional rigidity to the first Segment 3 sheet to be installed after the corner sheet, the first window sheet adjacent to the Segment 1/Segment 3 corner was replaced with a solid (i.e., non-windowed) Waterloo Barrier® steel sheet. Subsequent Segment 3 sheets consisted of the windowed Waterloo Barrier® steel sheet as shown in the C3 Report contained in Appendix C.

Segment 3/Segment 4 Corner

Due to the driving difficulties related to sheet alignment encountered at the Segment 1/Segment 3 corner, in order to minimize down time and keep the project schedule moving forward, the installation of Segment 4 began while options for completing the installation of Segment 3 were considered. Installation of Segment 4 began with the installation of the Segment 3/Segment 4 corner sheet and proceeded to the north.

After the installation of Segment 4 was completed, a solid transition sheet was installed at the eastern terminus of Segment 3 attached to the Segment 3/Segment 4 corner sheet. This transition sheet was used to allow for the Segment 3 installation activities to be performed in an east to west direction advancing the barrier wall from the Segment 3/Segment 4 corner towards the Segment 1/Segment 3 corner.

An assessment of the potential impact of the loss of windowed area as a result of the use of the two solid sheets instead of the two window sheets was completed to determine the impact, if any, of this change on groundwater hydraulics. Based on this review, the use of the solid sheets in place of the windowed sheets reduced the overall open area of the barrier by only a slight percentage (approximately three percent). The groundwater model yielded a maximum predicted mound height of well below the 0.5 foot threshold. These facts, combined with the built-in conservatism of the groundwater model, indicate that the use of the solid sheets would not result in unacceptable groundwater mounding or negatively impact the groundwater capture zone (Phase IA). As no modifications to the bottom section of the solid sheets occurred, the ability of the Waterloo Barrier® System to serve as the design DNAPL containment barrier has not been altered.

4.7.5 Modification to the Depth of the Barrier at the Northern Terminus of Segment 4

Segment 4 of the barrier wall consists of 77 solid steel sheets extending approximately 165 linear feet from the corner of Segment 3/Segment 4 to its northern terminus south of the Long Island Rail Road tracks. The sheets are 74 feet in length and were designed to be installed a minimum of five feet into the underlying Magothy Formation.

Out of the 77 total installed sheets, thirteen (13) sheets at the northern end of Segment 4 (Sheet Nos. 289 through 301) were driven to varying depths before field work was suspended due to vibrational impacts to a structure located on the east adjacent property. These 13 sheets were not driven to their final design depths. The following table summarizes the design depth of the Sheets 289 through 301 versus the installed depths as stated in the C3 Report included in Appendix C.

DESIGN VS INSTALLED DEPTHS STEEL SHEETS NOS. 289 THROUGH 301					
Sheet Designation	**Design Bottom of Sheet Elevation (ft)**	**As-Built Bottom of Sheet Elevation (ft)**	**Top of Magothy Formation (ft)**	**Actual Embedment (ft)**	**Embedment Deviation (ft)**
289	-52.8	-50.68	-47.8	-2.88	2.12
290	-52.8	-51.48	-47.8	-3.68	1.32
291	-52.8	-51.24	-47.8	-3.44	1.56
292	-52.8	-51.39	-47.8	-3.59	1.41
293	-52.8	-51.3	-47.8	-3.59	1.41
294	-52.8	-50.99	-47.8	-3.19	1.81
295	-52.8	-50.77	-47.8	-2.97	2.03
296	-52.8	-50.08	-47.8	-2.28	2.72
297	-52.8	-51.56	-47.8	-3.76	1.24
298	-52.8	-50.90	-47.8	-3.1	1.9
299	-52.8	-51.53	-47.8	-3.73	1.27
300	-52.8	-51.15	-47.8	-3.35	1.65
301	-52.8	-46.78	-47.8	1.02	6.02

An evaluation of the potential impact of this change to the overall design and function of the barrier wall was conducted. The findings of this evaluation noted the following:

- Sheets 289 through 300 are embedded into the Magothy Formation ranging from 2.28 feet to 3.76 feet, achieving more than half of the design embedment of five feet;

- Sheet 301 was driven to a depth of 1.02 feet above the top of the Magothy Formation. Sheet 301 is the final and northern-most sheet of Segment 4. However, due to increases in the linear extent of Segment 4, this sheet is located beyond the northern design terminus of the segment by approximately one full sheet; and

- The subsurface data developed during the investigation phases of the Site and the adjacent property as well as the geotechnical investigation conducted to support the barrier wall design found no evidence of NAPL at the base of the upper glacial aquifer (above the Magothy confining layer) in this portion of the Site.

Based on these findings, this modification did not alter the ability of the Waterloo Barrier® sheeting to serve as the design DNAPL containment.

4.7.6 Closure of the Segment 3 Barrier Wall

As stated above, due to the sheet pile installation difficulties realized at the common corner between Segment 1/Segment 3; the installation of Segment 4 was completed first. In addition, the installation direction for Segment 3, originally scheduled to be performed from west to east, was reversed. Based on the change in installation direction of Segment 3 and the alignment difficulties encountered during in the area of the Segment 1/Segment 3 corner, the two segments of the wall (i.e., Segment 3 coming from east to west and the Segment 1/Segment 3 corner) could not be joined with the Waterloo Barrier® steel sheeting system.

The gap in the wall segments (approximately 13 feet in length, was closed utilizing five bentonite filled columns. The columns were formed by installing (drilling) 39 inch diameter steel caisson sections to an approximate depth of 87 feet bgs. As the caisson sections were installed, soils from the interior were removed via an auger bucket. During the removal of soil, potable water was pumped into the caisson to keep hydrostatic pressure in the hole and prevent a sand blow out in the caisson base. Upon reaching design depth and removal of all remaining soils, the caisson was filled with HOLE PLUG, a bentonite clay based grout mixture as manufactured by Baroid Industrial Drilling Products of Houston, Texas. This material has been used to grout monitoring wells and other boreholes at contaminated sites and is capable of providing a permeability of 2.5x10-8 centimeters per second (cm/s). The specified design permeability for the Waterloo Barrier® System is 1x10-5 cm/s.

Once the caisson was filled with the bentonite clay mixture, the steel caisson liner was extracted leaving a bentonite clay grout column. The remaining four columns were installed in a similar overlapping fashion.

During removal of the steel caissons, difficulties were encountered as the bentonite clay material would adhere to the interior of the steel caisson. To compensate for this, the caisson removal process was performed in stages as the bentonite was placed. Further, during installation of the last bentonite filled column, a liquid polymer dispersion, IDP-433, manufactured by Baroid Industrial Drilling was added to the excavated caisson. The IDP-433 provided friction reduction and inhibition and lubricity to prevent the HOLE PLUG bentonite clay material from adhering to the interior of the caisson during removal.

After the five bentonite clay columns were installed, the last step in the process was to complete the installation of the Segment 3 sheet piles. The remaining sheets were installed with the last sheet from the east to west section and the last sheet from the west to east section installed within the bentonite filled columns as stated in the C3 Report contained in Appendix C.

4.8 Phase II Remedial Program Elements

The primary remedial actions performed as part of the Phase II remedial activities consisted primarily of, but were not limited to, the following activities:

- Excavation of the Shallow Excavation Area;
- Excavation of Hot Spot Areas A, B and C;
- Backfilling the Excavation Areas and
- Construction of a Site-Wide Soil Cap.

Figure 2 of this Report illustrates relative to the site boundaries the general positioning of principal components of Phase II including the Shallow Excavation Area, and Hot Spot Areas. The Phase I As-Built Drawings presented in Appendix A represent the accurate-detailed and official record of the pre- and post-construction site conditions including the location and limits of the engineering controls install as part the remedial activities.

4.8.1 Phase II Involved Parties

Implementation of the remedial activities for Phase II (as described in the January 2008 100% Phase II RDR) commenced in August 2007 with pre-mobilization activities and concluded in October 2008 with completion of construction of the Site-Wide Soil Cap and restoration activities. At various points during the implementation of the project, on-site personnel included representatives of National Grid, representatives of PS&SPC (the Construction Quality Assurance/Quality Control Engineer), representatives of the NYSDEC, representatives of demaximis (the Construction Manager), representatives of ENTACT Environmental Services (the Remediation Contractor for excavation and waste management activities). In addition, sub-contractors were utilized by ENTACT to perform various aspects of the work. These sub-contractors were considered part of the ENTACT contracting entity e.g., J.D. Posillico provided sheet pile installation services for the permanent sheeting along the LIRR and temporary excavation support associated with Hot-Spot Excavation Areas A, B and C). In addition, GEI Consultants, Inc. (GEI) provided services associated with the Community Air Monitoring Program (CAMP).

4.8.2 Phase II Pre-Mobilization Activities

Prior to mobilization of equipment to the OU-1 Site, National Grid's Design Team prepared the RDR which provided detailed measures, procedures, and operations relating to the design and implementation of Phase I and Phase II remedial activities. The Phase II RDR activities were submitted to the NYSDEC on January 22, 2008. The NYSDEC approved this Phase II RDR at the time of the 95% submission (due to minimal review comments and required revisions) by letter to National Grid dated December 11, 2007.

The approved Phase II RDR included the following:

- Description of remedial activities for implementation of Phase II of the OU-1 remedy including, but not limited to: obtaining necessary local permits for construction; site preparation; construction sequence; soil excavation, waste management activities; odor and dust control; decontamination; soil erosion and sediment control; noise and vibration monitoring, backfill, etc;

- Existing conditions of the Phase II Site;

- Remedial Action Plan presented the layout of the Shallow Excavation Area, the location of three Hot-Spot Excavation Areas (A, B and C), the location of former MGP structures across the site, the alignment of the permanent sheeting to be installed along the LIRR ROW, and the limits of the Site-Wide Soil Cap;

- Design of the modified (windowed) permanent sheeting to be installed along the right-of-way;

- Health and Safety Plan (HASP);

- Construction Quality Assurance Project Plan (CQAPP);

- Design of the temporary fabric enclosure and associated vapor management system (VMS) to be utilized to address vapors and odors during the implementation of the excavation activities; and

- Design of the temporary excavation support system for excavation of the three Hot-Spot Excavation Areas (A, B and C).

A Generic HASP was prepared in accordance with 29 CFR 1910 and was included with the Remedial Design Work Plan prepared for the Site. The HASP, provided to ENTACT, covered site-specific activities associated with the implementation of the Phase II remedial activities. ENTACT was given the option of adopting the HASP or preparing their own, with the provision that an ENTACT HASP must either achieve or be more stringent than the requirements of the Remedial Design Work Plan HASP. ENTACT elected to prepare their own HASP for the Phase II remedial activities. The ENTACT HASP was implemented during the performance of the Phase II remedial activities.

No local, federal or state permits were required to perform the Phase II remedial activities. Due to the proximity of the existing Long Island Rail Road (LIRR) tracks to portions of the work, personnel working within the LIRR right-of-way as well as in proximity of the LIRR tracks obtained the necessary LIRR Roadway Worker Protective Training. LIRR provided National Grid with flagmen for rail

road protection during the implementation of the Phase II remedial activities when work was performed adjacent to the tracks.

The New York Underground Facilities Protective Organization (UFPO) was utilized for utility verification and marking out the locations of subsurface utilities in proximity to the Phase II Site and associated off-site areas. When all subsurface utilities were verified or confirmed, intrusive activities were initiated.

Pre-mobilization activities associated with the Phase II Site included the following:

- Photo and video documentation of the pre-remedial conditions of the Phase II Site;
- Attendance of Site-workers in the LIRR Protective Training Class;
- Acclimating on-site personnel to the Phase II Site logistics;
- Ensuring all on-site personnel had the requisite 1910.120 Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) Training as well as site-specific training as per the requirements of the Site-Specific HASP and the Technical Specifications contained in the Phase II RDR; and
- Relocating, receiving and set-up of office trailers and storage equipment from the Phase I Site to the Phase II Site.

To maintain continued progress on completion of the overall OU-1 remedy, during the implementation of the Phase I activities and finalizing the RDR for Phase II, National Grid proposed to initiate certain pre-mobilization tasks prior to the approval of the Phase II RDR. These activities included site clearing and grading to facilitate to implementation of the Phase II activities, closure/abandonment of the subsurface tunnel located beneath North Clinton Avenue, a utility clearance program and completion of a perimeter utility cut and cap program. The proposal to conduct these pre-mobilization activities was presented to the NYSDEC in a letter work plan dated July 25, 2007. The Pre-Mobilization Letter Work Plan was approved by the NYSDEC on August 8, 2007 with a request for a minor revision to the plan. The revised plan was submitted to the NYSDEC on August 9, 2007.

4.8.3 Phase II Mobilization

ENTACT mobilized all necessary equipment, personnel, and materials to the Phase II Site for implementation of the pre-mobilization activities on August 1, 2007. Initial mobilization activities consisted of installing stabilized construction access/egress way, installing soil erosion and sediment control measures and

assisting with locating the perimeter air monitoring units. Staging areas for materials, construction equipment and excavated material, decontamination areas, and support areas were prepared in accordance with the approved RDR. Soil erosion and sediment control measures were also installed per the approved RDR.

Site Clearing

Prior to the remedial construction mobilization at the Phase II Site, National Grid directed other contractors to demolish a two-story brick building located in the northwest portion of the Phase II site. ENTACT commenced site work on August 3, 2007 and began clearing the area of vegetation and debris. The clearing activities included sorting through existing piles of concrete generated from historical activities on the Phase II Site. All concrete was stockpiled on-site and visually assessed for the presence of contamination. Concrete determined to be un-impacted was segregated from that determined to be impacted. Visually un-impacted concrete material was assessed for the potential for processing and reuse as backfill material. Construction debris was segregated into individual stockpiles by the type of material (i.e., concrete, scrap metal, general construction and demolition debris, etc.) for eventual off-site disposal.

Abandonment of Subsurface Tunnel Underneath North Clinton Avenue

ENTACT initially accessed the subsurface tunnel on August 14, 2007 by removing the soils in front of the eastern side of the tunnel during the performance of the perimeter cut and cap program. Upon removing the soil from the front of the tunnel and accessing approximately five feet of tunnel to the west, a masonry bulkhead was uncovered. The bulkhead spanned the entire width and height of the tunnel with no openings noted to allow for visual observation into the tunnel. A similar bulkhead was noted during the tunnel abandonment activities conducted during the Interim Remedial Measure performed on the adjacent West Parcel. A photograph of the tunnel access and the bulkhead was previously forwarded to the NYSDEC in a summary letter regarding the tunnel abandonment activities dated October 5, 2007, and is included in Appendix I.

Based on the presence of the bulkhead as well as the presence of a Verizon duct bank containing phone and fiber optic cables which spanned the top of the tunnel entrance, National Grid's Design Team decided to conduct an investigation of the tunnel by drilling a boring into the tunnel from North Clinton Avenue. The proposed plan for the investigation was to install a boring of sufficient diameter through the roadway into the tunnel and to lower a camera into the tunnel to allow for visual inspection of the tunnel interior.

On September 9th, 2007, Universal Testing of West Babylon, New York, performed the investigation of the tunnel by installing a boring through the North Clinton Avenue roadway. The boring was installed along the eastern side of North Clinton Avenue approximately one foot west of the curb and along the

centerline of the subsurface tunnel. Prior to installing the boring, Universal Testing arranged for a utility survey and mark-out of the proposed location. Based on the locations of the utility duct bank, a Verizon representative was onsite to verify the utility mark out prior to advancing the soil boring.

The boring was installed and the borehole continuously sampled, via split spoons, to a refusal depth corresponding with the bottom of the tunnel (approximately 8.5 feet below grade surface). No concrete top of the tunnel was encountered. The boring was noted to consist of a continuous soil column indicating that the tunnel was filled with soils. The recovered soil samples were visually inspected and field screened, utilizing a properly calibrated photo ionization detector (PID), by PS&SPC to assess the presence of indications of contamination (i.e., staining, odor, organic vapors, etc.). No indications of contamination were noted from the recovered soil samples (no staining, odors, organic vapors, etc). A boring log detailing the stratigraphy of the encountered soils was previously forwarded to the NYSDEC as part of the October 5, 2007 letter report.

The investigation activities were observed by the NYSDEC on-site representative. This representative concurred with the findings of the investigation. Based on these observations and conversations with the NYSDEC, it was determined that no additional remedial effort would be required to address the interior of the tunnel.

ENTACT completed the abandonment of the tunnel from the masonry bulkhead east into the Site by filling the annular space with flowable fill (i.e., lightweight concrete). This abandonment was accomplished by constructing an earthen berm at the tunnel entrance and filling the space between the entrance and the bulkhead with flowable fill. A photograph documenting the abandonment of the subsurface tunnel was previously forwarded to the NYSDEC as part of the October 5, 2007 letter report. Location of the tunnel can be seen on As-Built Sheet 3 included in Appendix B.

Utility Clearance and Perimeter Cut and Cap Program

As part of the pre-mobilization activities, ENTACT conducted a utility clearance program and a perimeter cut and cap along the northern, eastern and western perimeters of the Site to identify and manage utilities entering the Site. Prior to the implementation of intrusive activities, ENTACT conducted a subsurface survey utilizing ground penetrating radar (GPR) along the perimeter of the Site to locate the presence of potential subsurface anomalies which could represent utilities. Potential utilities were marked at the surface to avoid impacting these anomalies until their disposition could be verified.

After completion of the survey, the perimeter utility cut and cap program began. In accordance with the Phase II RDR, a trench six to eight feet deep was installed around the perimeter of the Site. The trench was installed using an excavator and,

in the presence of subsurface anomalies or utilities, hand digging as necessary to protect the utilities until their disposition could be verified. Upon locating a former pipe or utility, the interior of the pipe was accessed to determine if the utility was active. Non-active pipes were cut and the property boundary and capped by filling the pipe end with flowable fill materials. The locations of abandoned pipes are depicted on As-Built Sheet 3, included in Appendix B of this Report.

In addition, to the removal of soils from the trenches during the perimeter cut and cap program, ENTACT also removed former MGP-related structures that would impeded the progress of the implementation of the Phase II remedial activities. These structures were removed via a combination of an excavator and a second excavator equipped with a hoe ram or hydro hammer. Water spray was utilized during the removal operations to minimize dust impacts. Former removed structures, as per the Phase II RDR, included those located within the Shallow and Hot-Spot Excavation Areas, those that would impeded the progress of installation of the permanent sheeting to be installed along the LIRR ROW as well as the temporary earth support systems associated with Hot Spot Excavation Areas A, B and C. Odor suppression foam (i.e., Rusmar Foam) was applied to all open trenches and excavations, as necessary, to minimize impacts from vapors and odors.

Soils and concrete generated during implementation of the perimeter cut and cap program were stockpiled on-site in staging areas. The staging areas were constructed on areas of the Phase II Site subject to subsequent excavation activities. The staging areas were lined with plastic sheeting and surrounded by hay bales. Stockpiles were covered with odor suppressing foam (i.e., Rusmar Foam) and covered with plastic sheeting at the end of each work day. Once a sufficient volume of soil/concrete was accumulated in a stockpile area, the materials were loaded into transport trucks and disposed of at approved off-site facilities for thermal treatment.

In-Situ Waste Characterization

ENTACT began the performance of the in-situ waste characterization activities on August 13, 2007. As detailed in the Phase II RDR, the in-situ waste characterization sampling activities were performed to satisfy several purposes. First, the program was performed to characterize impacted soils for the purposes of off-site thermal desorption/waste disposal. Secondly, the program was performed to generate sufficient data to obtain initial facility approvals for the anticipated waste volume to allow direct load-out of wastes. Finally, the in-situ waste characterization program was performed as a pre-mobilization activity to minimize the amount of contaminated soil stockpiling and on-site handling as well as to avoid delays associated with facility approvals.

The in-situ waste characterization sampling was performed using direct push drilling technology. The characterization sampling program obtained a sufficient amount of samples to perform all necessary laboratory analysis required to obtain initial approvals at the perspective disposal facilities (i.e., Clean Earth of New Castle, Clean Earth of Southeast Pennsylvania and Casie Protank). The initial waste characterization activities were performed in general accordance with the Phase II RDR.

4.8.4 Phase II Site Preparation

During the implementation of the pre-mobilization activities, site preparation activities were also conducted to facilitate implementation of the full-scale Phase II remediation. The site preparation activities consisted of tasks performed prior to the performance of the Phase II remedial construction in accordance with the approved RDR. These activities consisted of the installation of soil erosion control measures, clearing of vegetation and grading of the work area, relocating existing facility materials, staking out and surveying the locations of excavations, establishing needed utilities, and the construction of the decontamination pad. The decontamination pad was constructed as per the requirements of the approved Phase II RDR and maintained throughout the duration of the Phase II excavation work. The pad was moved to the 5th Ave Gate at on January 2008, where it remained until that area was approached for the Site Wide Cap Excavation in late August 2008.

The work area was divided into three primary zones: the exclusion zone, the contamination reduction zone, and the support zone. Zones were established and clearly delineated. The exclusion zone included the areas where active remedial operations were being performed (i.e., within the temporary enclosure). The entrance to the contamination reduction zone was made through the decontamination area or vehicle access gate.

The support zone included all other portions of the remedial area not listed above which were used for storage and support functions. Temporary field office facilities, including office trailers, chemical toilets, and parking areas, were established on the OU-1 West Parcel and the Brightwaters Yard located across (west of) North Clinton Avenue) in the support area during site preparation.

A NYSDEC-approved project sign was erected at the project entrance and remained in place during all phases of the Remedial Action.

4.8.4.1 Well Abandonment

Prior to mobilization to the Phase II site, 125 wells including monitoring wells and remedial pilot test wells were located in areas subject to remedial activities or were located in areas requiring access to perform the remedial activities. As such, these wells were abandoned prior to implementation of the Phase II remedial

activities. The wells were abandoned by Fenley and Nichol Environmental, Inc. under the oversight of GEI. The monitoring wells were abandoned in accordance with the NYSDEC Groundwater Monitoring Well Decommissioning Procedure, November 2002. All 125 of the wells were sampled by GEI prior to abandonment. The GEI Well Abandonment summary Report is contained in Appendix D.

4.8.4.2 Permanent Sheet Pile Installation – Long Island Rail Road Right-of-Way

As detailed in the Phase II RDR, the temporary excavation support system (i.e., steel sheet piling) associated with Hot Spot Excavation Area C is located immediately adjacent to and potentially within the LIRR ROW. As the LIRR typically does not allow for sheet piles installed within a ROW to be removed due to potential negative impacts to the ROW (i.e., settlement, lateral movement, etc.), the Phase II RDR contained a contingency to install protective, permanent sheeting to the south of the temporary excavation shoring system (i.e., in between the temporary excavation shoring and the LIRR railroad tracks. The installation of the permanent protective sheeting was required as the temporary excavation sheet piles could not be left in place due to adverse impacts to the documented groundwater flow patterns at the Site and consequently, the ability of subsequent phases of the remediation (i.e., Phase III, the in-situ chemical oxidation) to achieve the remedial objectives for the Site.

The design of the permanent sheeting to be installed in the LIRR ROW was included on Drawing No. 11 in the Phase II RDR. As noted, on this drawing, in order not to adversely affect the natural groundwater flow pattern, the sheet piles were windowed. The 40-foot long sheet piles had an alternating series of openings (either 0.5 feet wide by 3.5 feet long or 0.5 feet wide by 4 feet long) cut along 27 feet of the flange area.

The installation of the permanent sheet piling commenced with the installation of temporary fencing to replace the permanent fencing along the north side of the western portion of the LIRR ROW. The permanent fencing was removed and the temporary fencing installed approximately nine feet to the south of its original location (i.e., closer to the LIRR tracks) to allow room for the installation of the sheet pile. The movement of the fence began on September 14, 2008.

A three to four foot deep trench was excavated along the permanent sheet pile alignment prior to the driving of sheets. This trench was installed to clear obstructions that would impede the installation of the permanent sheet piling as well as to allow for the top elevation of the permanent sheeting to be installed to a depth approximately three feet bgs. Soil and concrete generated as part of the trenching activities were stockpiled on-site pending off-site disposal. Stockpiling of these materials was performed on plastic and foamed to prevent odors and

vapor, as necessary. Water spray was utilized to minimize impacts from dust during removal of former foundations.

The installation of the permanent sheeting commenced on September 26, 2008 and was completed on October 23, 2007. The sheets were installed utilizing a 120-foot crane equipped with a vibratory hammer. The sheets were installed to a depth of 40 feet and a linear distance of 210.5 feet. The as-built alignment of the permanent sheeting is depicted on As-Built Sheet 5 and the configuration of the window cutouts is depicted on As-Built Sheet 6 included in Appendix B of this Report.

4.8.5 Phase II General Site Controls

All excavated soil generated as a result of the site excavations were prepared, as necessary, to meet disposal facility acceptance criteria for moisture content. After excavation and stockpiling, materials were loaded into transport trucks for subsequent off-site transportation to the disposal facilities. The disposal facilities utilized during the Phase II remedial activities included Clean Earth of New Castle, located in New Castle, DE; Clean Earth of Southeast Pennsylvania, located in Morrisville, PA; and Casie Pro-Tank, located in Vineland, NJ. All three disposal facilities are licensed to accept and treat the remedial derived material. Transport vehicles were decontaminated within the enclosure or at the decontamination pad and exited the Phase II site via haul roads created with large diameter road stone either through the North Clinton Avenue or Fifth Avenue gates. The haul roads were maintained throughout the duration of the project and the road stone minimized the potential for soil tracking into North Clinton Avenue and Fifth Avenue and the generation of fugitive dust.

All transportation and disposal activities were coordinated by ENTACT. All waste-hauling vehicles were inspected prior to loading and any vehicle that appeared to be in an unacceptable condition for transporting materials were not loaded. Transport vehicles were also inspected for the appropriate placards, vehicle identifications and over-the-road permits for the States in which they traveled. Additionally, transport vehicles and their contents were inspected prior to leaving the Phase II Site to verify that the vehicles were properly decontaminated, covered, placarded and that the load was acceptable for transport and disposal. A summary of the off-site disposal activities is contained in the Materials Management section of this Report and the exported waste manifests are included within Appendix E.

4.8.6 Phase II Nuisance controls

Nuisance control methods are discussed in detail in report sections describing the remedial activities. Dust and odor control methods included a temporary enclosure utilized in some excavation areas, odor controlling Rusmar foam, decontamination pads, and water spraying for dust.

In addition to the temporary enclosure, point source control was the first line of defense in the mitigation of odors and dust from materials handling activities. The primary function of point source control was to minimize the amount of surface area exposed for long periods of time, thereby mitigating the potential for noxious odors and preventing contaminated dust from becoming airborne. ENTACT utilized Rusmar Foam, as necessary, to control odors and/or achieve compliance with site action levels during excavation activities inside the temporary enclosure. At the end of each work day, soils stockpiled within the enclosure scheduled for load-out the next day were covered with Rusmar Foam overnight to prevent any adverse impacts from the release of odors and/or vapors.

4.8.7 Phase II Monitoring Programs

4.8.7.1 Community Air Monitoring Program

GEI prepared the "Community Air Monitoring Completion Report" which is included in Appendix G of this report. The following is a summary of GEI's report.

National Grid retained GEI to conduct a CAMP during the remediation of the Bay Shore Former MGP Site in Bay Shore, New York. This report presents the data collected during the CAMP, compares the data to pre-determined action levels, and documents response actions as required by the contingency plan. The CAMP began on February 21, 2007 and continued through October 3, 2008 employing seven fixed air monitoring locations and one downwind air monitoring location during Phase I and Phase II of remedial activities. Supplemental air monitoring was conducted in response to odors or public complaints. The GEI CAMP Work Plan, dated July 2006, was submitted as part of the Phase I RDR in Appendix H (April 2007) and the Phase II RDR in Appendix F (January 2008), which was approved by the NYSDEC and the NYSDOH.

A contingency plan was incorporated into the GEI CAMP Work Plan. The plan employed a three-tiered classification and warning system based on pre-determined site specific action levels as defined in the CAMP Work Plan.

- Site Condition 1. Normal or ambient air conditions where all target concentrations (e.g., total volatile organic compounds [TVOCs], particulate matter [PM-10], etc.) are less than a predetermined level approaching a site specific action level.

- Site Condition 2. Concentration of at least one target is greater than or equal to Site Condition 1 but less than the site specific action level.

- Site Condition 3. Concentration of at least one target is greater than or equal to the site specific action level.

The appropriate Site Condition was identified by comparing the data to the action levels and the contractor was notified to implement response actions to reduce levels, as necessary.

The measured concentration of TVOC reached the action level upwind of remedial activities on one occasion and the contractor was notified. The concentrations of TVOC at downwind locations were measured below the action level so a Site Condition 1 remained. Outside of the one upwind occasion, concentrations were measured at Site Condition 1 during the CAMP.

The measured concentration of dust reached the action level on three occasions and the contractor was notified. The contractor watered the ground surface in the work areas to control the dust, when applicable. On other occasions when levels of dust reached high levels, wind direction and air monitoring station locations were evaluated and it was concluded that the dust was not caused by remedial site activities. These occasions were a result of non-ground intrusive and/or non-impacted soil management activities.

Measured odor intensity reached the action level on two occasions during remedial activities. In response, odor suppressant foam was applied to the soil stockpile that caused the odors on May 1, 2007 and odor intensity returned to below the action level within fifteen minutes. Naphthalene-like odors noted on July 26, 2007 returned to below the action level within fifteen minutes and work continued.

Four public odor complaints were received and investigated during remedial activities. In response to each of these complaints, real-time air monitoring data, supplemental odor monitoring, and supplemental walk-around air monitoring data were reviewed and it was determined that measured concentrations of TVOC, PM-10, odor, and hydrogen cyanide were below action levels.

The time-weighted average and real-time total VOC results suggest only minor VOC concentrations were present during remediation activities. In general, BTEX concentrations detected during this CAMP are consistent with those collected in a similar urban setting. The detections of BTEX compounds were minor in concentration and not indicative of an on-site source of BTEX from remediation activities. Since the relative difference between upwind and downwind BTEX concentrations was minimal, there is no strong evidence to support an on-site source of BTEX compounds.

The CAMP and mitigation controls were effective at controlling TVOC and PM-10 and the supplemental odor monitoring action levels triggered mitigative responses to further control potential off-site emission of TVOC and PM-10. The CAMP implemented by GEI and the response by on-site personnel, provided an early warning and detection system to prevent and/or mitigate potential off-site exposures to site-related contaminants associated with intrusive operations.

4.8.7.2 Noise Monitoring

Noise monitoring during Phase II remedial activities was performed simultaneously with segments of Phase I remedial activity. Noise monitoring was conducted during excavation support sheet pile driving and concrete removal activity being implemented as part of the proposed remedial construction. Noise monitoring was performed in accordance with the approved Noise and Vibration Mitigation Plan for the Bay Shore Former Manufactured Gas Plant Site prepared by PS&S and submitted by KeySpan Corporation to NYSDEC in April 2007.

PS&SPC performed noise monitoring along the perimeter of the Site during Phase II remedial activity. Appendix H provides the full Noise and Vibration Mitigation Report with information on the instrumentation used, monitoring locations, methodology employed, approach followed and measurement results. Figure 1 in Appendix H presents the noise and vibration monitoring location plan.

The installation of the excavation support sheet piles and concrete removal operations generated noise levels in excess of background conditions. Typical increases in noise levels above background were on the order of 10 dBA to 15 dBA. On a few occasions, there were 20 dBA to 30 dBA increases in noise levels lasting for short durations.

Measured daily maximum 10-minute Leq values ranged between 68 dBA and 102 dBA. The daily average ten-minute Leq sound levels ranged from 60 dBA to 85 dBA over the duration of Phase II activities. Noise associated with Phase II operations was primarily due to general construction activities; the highest sound levels were due to excavation support sheet pile driving of sheet pile pairs and concrete removal.

Sound monitors were located on-site near active work areas due to access and security constraints. Due to the proximity of the sound monitoring equipment, the noise threshold "warning" level (85 dBA) and the noise threshold "temporary halt" level (90 dBA) were exceeded on multiple occasions during Phase II construction activity. Localized noise sources (i.e., local traffic) also contributed to increased sound levels.

The majority of noise threshold level exceedences between February 2008 and June 2008 were due to the installation of sheet piles in pairs and encountering obstructions (sub-surface resistance), and the majority of exceedences between (mid) August and (early) September, 2008 were due to the breaking of concrete, and backfill and compaction, in proximity to sound monitoring equipment.

Upon exceeding the "warning" threshold, proper personnel were notified and work continued with caution (with an attention to sound levels). Upon exceeding

the "Halt" threshold, proper personnel were notified and work was stopped to access the sources of the noise exceedence.

4.8.7.3 Vibration Monitoring

Vibration monitoring during Phase II remedial activities was performed simultaneously with segments of Phase I remedial activity. Vibration monitoring was conducted during sheet pile driving and concrete removal activity being implemented as part of the proposed remedial construction. Vibration monitoring was performed in accordance with the approved Noise and Vibration Mitigation Plan for the Bay Shore Former Manufactured Gas Plant Site prepared by PS&S and submitted by KeySpan Corporation to NYSDEC in April 2007.

PS&SPC operated up to seven vibration monitors during Phase II activities; four locations were along the perimeter of the Site and three locations were south of the Site adjacent to Phase I. Appendix H provides the full Noise and Vibration Mitigation Report with information on the instrumentation used, monitoring locations, methodology employed, approach followed and measurement results. Figure 1 of Appendix H presents the noise and vibration monitoring location plan.

The installation of the excavation support sheet piles generated vibration levels within the property boundaries of the Site and the abutting commercial/residential property boundaries that reached potentially perceptible vibration levels. Measured maximum PPV vibration values ranged between 0.02 inches per second to 0.46 inches per second. The maximum PPV averaged between 0.05 inches per second and 0.16 inches per second.

Vibration monitors were located on-site near active work areas due to access and security constraints. Due to the proximity of the vibration monitoring equipment, the "warning" threshold level (0.2 inches per second) was exceeded on multiple occasions during Phase II construction activity.

The majority of vibration threshold level exceedences between February 2008 and September 2008 were due to the installation of sheet piles in pairs and the encountering of obstructions (sub-surface resistance); the majority of the exceedences between (mid) August 2008 and (early) September 2008 were due to concrete removal operations in proximity to the vibration monitoring equipment.

In the event that a "warning" threshold vibration level was exceeded, the proper personnel were notified and attempts were made to investigate and change the methodology employed. Tier 3 mitigation measures were implemented in response to individual community feedback. Focused structural inspections were conducted at structures deemed potentially vulnerable to the effects of the pile driving activities. Supplemental monitoring was also conducted adjacent to businesses/residences based on observed vibration and/or to address community concerns as requested by National Grid.

The "stop work" vibration threshold of 0.5 inches per second was not exceeded at any monitoring location during Phase II remedial activities, other than a few elevated vibration measurements recorded from work activity occurring directly over or adjacent to the vibration sensor (as documented in field notes). These results indicate that ground-borne vibration levels measured within the property boundary of the Site and the surrounding commercial/residential property boundaries reached potentially perceptible vibration levels at times during Phase II remedial construction activity. However, observed ground-borne vibration measurements were less than the USBM vibration threshold levels at which damage may be expected to occur to "typical residential structures".

4.9 Phase II Contaminated Materials Removal

Remedial excavation activities as part of the Phase II remedial activities were performed at four areas of the Site. These areas are as follows:

- Shallow Excavation Area - Excavation of contaminant source materials in the unsaturated zone (i.e., approximately eight feet bgs);

- Hot-Spot Excavation Areas A, B and C - Excavation of contaminant source materials in three "hot-spot" areas (Hot Spot Excavation Areas A, B and C) to a depth of 25 feet bgs.

- Isolated Shallow Excavation in Northern Portion of the Site - Excavation of contaminant source materials in the unsaturated zone (i.e., approximately eight feet bgs) in an isolated area long the northern perimeter of the Phase II Site; and,

- Site-Wide Cap Excavation – Excavation in areas outside of the three aforementioned excavation areas to allow for the installation of a two foot thick Site-Wide Soil Cap. The cap was constructed, as per the requirements of the Phase II RDR with an 18-inch layer of well graded sandy soil material overlain with six inches of New York State Department of Transportation (NYSDOT) Type II coarse aggregate and underlain with a fabric barrier to demarcate the cap from the subgrade materials.

The four areas subject to the Phase II excavation activities are depicted on Figure 2 and surveyed limits of the excavations are presented on As-Built Sheet 2 contained in Appendix B.

The majority of the excavation activities associated with the Shallow Excavation Area and all three Hot-Spot Excavation Areas were conducted within a temporary fabric enclosure equipped with a vapor management system (VMS) to minimize impacts from dust and odors.

All impacted soils removed were either temporarily stockpiled within the enclosure or loaded directly into transport vehicles for off-site disposal. The details of the enclosure and VMS are detailed in the Phase II RDR and described in Material Management section of this report.

Water saturated soils removed during excavation were moisture conditioned by first staging the soil adjacent to the excavation allowing any free drain water to gravity drain back into the excavation. Moisture conditioning required beyond gravity drainage was accomplished by the addition of drier waste soils or calcium oxide. These were mixed with the wet soils until soils met the disposal facility parameters for moisture content and were adequately dried for loading into transport vehicles. During site excavation activities, an adequate supply of calcium oxide was maintained on-site. Calcium oxide was delivered to the Site in one ton tote bags. Calcium oxide bags were stored outside the temporary enclosure on top of pallets and covered with polyethylene sheeting to reduce exposure to moisture and weather.

ENTACT began excavation activities by removing the top six to eight foot layer of soil from within the entire impacted area (Hot Spot and Shallow Excavation Areas). This mass removal allowed access to the subsurface features to facilitate their removal prior to installation of sheet piling around the perimeter of the deeper Hot Spot Excavation Areas. Additionally, the initial six to eight foot cut provided a uniform surface across the Site and allowed for ease of temporary enclosure movement and placement. Prior to moving the temporary enclosure structure, the bottom of this initial shallow excavation was covered with a 1-2 foot layer of clean fill to serve as a working platform for the deeper excavations. The covered shallow excavation served as a uniform working platform from which the deeper Hot Spot excavations were performed. Specific activities related to the Shallow and Hot Spot Excavation Areas are described in the following sections.

4.9.1 Temporary Fabric Enclosure

All remedial excavation activities within the Shallow Excavation Area and Hot-Spot Excavation Areas, with the exception of the Utility Cut/Cap Area, were performed by ENTACT within a temporary fabric enclosure. ENTACT utilized one fabric enclosure measuring approximately 118 feet by 115 feet equipped with a 45 degree peak roof.

The fabric enclosure was a stressed membrane enclosure consisting of aluminum framework of arched ribs, which support a durable all-weather PVC fabric membrane. The fabric membrane was designed to be resistant to the elements of weather on the enclosure's exterior while also being resistant to environmental impacts on the enclosure's interior. The fabric enclosure was designed for a standard wind load of 110 mph (based on an "Exposure Category C" factor and a 3 second gust) in accordance to Chapter 31 of the New York State Building Code.

The enclosure was equipped with adequate lighting to allow for those limited instances when site work must be conducted in low ambient light conditions. To

facilitate the viewing of remedial construction activities within the enclosure, observation windows were placed at two strategic locations to allow for viewing from multiple angles. Finally, one 14 foot by 16 foot cargo door and one personnel ingress/egress door were included to facilitate both vehicle and site worker movement within and outside of the enclosure. The temporary fabric enclosure was presented in the design specifications of the RDR.

4.9.2 Vapor Management System

The temporary fabric enclosure was equipped with a VMS that provided a minimum of six air exchanges per hour for the interior of the enclosure and the depth of excavation while maintaining negative air pressure within the enclosure. The volume of the enclosure was approximately 400,000 cubic feet.

Excavation within the enclosure created at most an additional 61,200 cubic feet of air space for a total volume of approximately 461,200 cubic feet. At six air changes per hour, the required flow rate was 46,120 cubic feet per minute (cfm). Each NB20 air handling/treatment system was rated for 20,000 cfm. Therefore, three air handling systems were used to achieve the required air change for the remediation activities as directed in the Phase II RDR.

The VMS processed air recovered from within the enclosure utilizing carbon absorbers to remove contaminants in order to meet NYSDEC air emission standards and the requirements of the Health and Safety Plan (HASP). ENTACT continuously monitored the emissions from the VMS utilizing a properly calibrated PID. ENTACT ensured that the type and quantity of carbon media used in the VMS met the emission limits for BTEX. At no time during the project did the PID readings approach 10 ppm the level at which the Phase II RDR directed additional monitoring.

4.9.3 Shallow Excavation Area

Horizontal Extent of the Shallow Excavation Area

The proposed horizontal limits of the Shallow Excavation Area are depicted on Design Drawings of the Phase II RDR. Due to the visual observation of impacted soils outside of the limits of the proposed Shallow Excavation Area, the actual limits were extended to the north and east. The NYSDEC representative confirmed horizontal limits of the excavation, and the removal of visually impacted soils. The as-built limits of the excavation, and total volume removed, are presented on As-Built Sheet 2 included in Appendix B.

Vertical Extent of the Shallow Excavation Area

As stated in the Phase II RDR, the intent of the excavation activities in the Shallow Excavation Area was to remove source materials to a depth corresponding with the underlying water table (i.e., approximately eight feet bgs). Due to visual observations of impacted materials at the proposed excavation depth limits, portions of the Shallow Excavation Area were extended to the water table or until no impacted soil was observed. The average depth of the Shallow Excavation Area was 8.11 feet and the surveyed bottom elevations are shown on As-Built Sheet 2 included in Appendix B.

4.9.3.1 Removal of Former MGP Features within Shallow Excavation Area

Former MGP features including foundations, piping, tanks and other industrial features encompass a substantial portion of the Site. The majority of these features were below grade but there were some visible at grade. The existence of these features was the result of the former MGP operations that occurred at the Site. Former MGP features within the planned remedial excavation areas were removed, to the extent practical, within the temporary enclosure. In order to facilitate the unimpeded installation of the sheet pile support system associated with the Hot Spot Excavation Areas, the visual surface and subsurface features were removed during the Shallow Excavation activities. Features included tank pads, piping, dry wells, concrete vaults, building foundations and footings.

Existing foundations and Site features associated with the former MGP were removed to the horizontal limits of the property. In the event removal would have resulted in damage to adjacent Site features (i.e., sidewalk, roadway, etc.), the MGP structure was not removed. Structures consisting of solid material which could not trap source material were removed and inspected to for potential use as on-site fill material.

Underground piping encountered was cleaned of residue prior to removal, any remaining fluids or debris was removed and disposed of off-site with excavated soils. Piping that extended to the perimeter of the Site had been flushed, cut and capped at the perimeter. No pipe insulated or wrapped with asbestos containing material (ACM) was encountered during the excavations.

The majority of the MGP structures within the excavation areas consisted of concrete and masonry many exposed at the ground surface and sub piping. These structures were removed during the shallow excavation activities in order to facilitate unimpeded installation of the sheet pile around the perimeter of the Hot Spot Areas. Structures outside the excavation areas were removed, as required, to facilitate installation of the Site Wide Cap. Rusmar foam was used for odor and dust controls as needed when removing former MGP structures outside of the temporary enclosure.

An excavator with a hydraulic hammer attachment was used to break up the concrete and masonry structures. The structures were broken up with the hammer, removed with an excavator and placed in a staging area. The hammer was used to further break the masonry and concrete to a maximum size of eight cubic feet, to facilitate transportation to off-site crushing or disposal sites.

The debris from excavated concrete and masonry structures was segregated into separate piles on site based if MPG impacts were visibly apparent. If the broken debris was not visibly impacted it was able to be used as fill material under the cap, it was placed back in the excavation during backfill operations, set at the deepest points of the hot spot excavations. Only broken debris that was not contaminated and approved for reuse by the NYSDEC was used as fill material. In the event the broken debris was not able to be used as fill, the material was returned to the enclosure and stockpiled for off-site disposal.

Contaminated demolition debris was stockpiled with excavated soils in a lined staging area equipped with perimeter berms and covered with tarps or foam near the excavation area until able to be loaded out for off-site disposal.

4.9.3.2 Removal of Former MGP Subsurface Features Outside Shallow Excavation Area

The remedial construction activities also included the removal of former MGP subsurface features (i.e., vaults, container-like structures, piping, etc.) outside of the remedial excavation areas that had the potential to contain source materials. Subsurface piping that contained product, product residue or exhibits significant PID readings was removed to the extent practical. Piping that extended to the perimeter of the Site was flushed, cut and capped at the perimeter. The material flushed from the piping was transported off-site for disposal. Manifests and certificates of destruction/recycling are included in Appendix E.

4.9.4 Temporary Excavation Support System

Temporary excavation- support sheet pile was installed to provide structural support during the deeper excavation in the Hot Spot Areas. ENTACT performed preparation activities necessary to allow uninterrupted sheet pile installation prior to mobilizing the installation sub-contractor, Posillico. This included confirming no apparent overhead or underground obstructions present that would interfere with the installation. Below grade structures within the excavation areas had been removed during the Shallow Excavation Area phase. Standard AZ sheet piles were used for the A and B excavation cells and most of the C cells. Along the south end on the C excavation areas, PZ sheet piles were used to create the southern wall and first 16 feet north from the southern wall in the C excavation cells. This substitution was proposed in the ENTACT Submittal – Temporary Sheeting Design Modification – Hoesch 1700 Substitution with PZ27 Steel Sheet Pile, dated March 17, 2008 and approved by PS&S on March 18, 2008. The PZ

sheets, being of a thinner gauge steel and not as wide as the AZ sheets, had less of a vibrational impact on the surrounding area (LIRR ROW) when being driven, as seen in the vibration monitoring performed by PS&S. PZ and AZ sheets could not be interlocked due to different joints. Therefore, to stabilize the north-south wall, the PZ and AZ sheets were installed with an overlap of approximately 3 feet. The exact alignment of the temporary sheet pile, as shown on As-Built Sheet 2, was surveyed and staked in the field.

A leveled area was prepared along the sheet pile alignment providing a stable platform for equipment access and installation. The shoring/sheeting design for the Hot Spot Excavation Areas, signed and stamped by a Professional Engineer licensed in the State of New York, is presented on Drawing Nos. A-1 & A-2 of the RDR. Further, the engineering calculations associated with this design area were included in the RDR.

The shoring design called for unclosed corners in each excavation cell. Due to this, gaps formed at the intersections of the shoring walls that bifurcated the C excavation cells. These gaps caused material from the adjacent cell to migrate through the gap and into the excavation at times creating sinkholes to form as material was excavated from one side of the shoring. Approved Type I and 1½ inch stone fill was used to fill and close the sinkholes as needed to prevent continued soil migration from an adjacent cell into the excavation. A gap formed at the overlap between the AZ and PZ sheets of the wall between C-1 and C-3. Type I stone was placed in sand bags and then used to fill the sinkhole created by the gap between the sheet piles. 1½" stone was then added to the area above the stone filled bags to block and seal the gap.

4.9.5 Hot Spot (Deep) Excavation Areas

The Hot Spot Excavations were done in three main areas, A, B and C. The Hot Spot Excavation Areas are depicted on Figure 2 and surveyed excavation limits and volumes are shown on As-Built Sheet 2 in Appendix B. Do to its larger surface area; the C excavation was bifurcated into ten cells. All areas were excavated down to elevation -2, or 25 feet below pre-construction grade. Two track excavators with slotted one and half yard buckets were used to remove the impacted soils and source materials. A long arm excavator, with a 45 foot reach, was also used to help achieve final depth in the larger excavation cells. The majority of the excavation was conducted below the water table, and therefore a number of methods were used to moisture condition the soils before being loaded out. As the soils were excavated, the material was suspended above the excavation and the waters were able to drain out through the slotted buckets as the operator held them above the hole for a few minutes. The excavated soils were piled onto a plastic lined staging area adjacent to the excavation area, and waters were allowed to drain back into the open excavation. The staging area was bermed with Jersey barriers, lined with poly sheeting.

The depth of the excavation was verified by PS&SPC by lowering a weighted tape to sound the base of the excavation and comparing the readings to both known bench marks established on the temporary excavation support sheeting or roping set-up across the excavation to simulate pre-disturbance conditions. Sounding of the excavation bottom were conducted in several transects across the excavation with reading generally taken along the sides and middle of the excavation. During the initial set of soundings and periodically thereafter, the NYSDEC site representative verified the measurement method and readings.

As per the NAPL Contingency Plan, NAPL present on the water table in the Hot-Spot Excavations was removed by containing the NAPL in floating booms and using adsorbent pads to collect the NAPL from the surface of the water table. The absorbent pads were added to the stockpile of impacted soils and disposed of along with the soil.

4.9.6 Materials Management

All excavated soil generated as a result of the site excavations were prepared, as necessary, to meet disposal facility acceptance criteria for moisture content. After excavation and stockpiling, materials were loaded into transport trucks for subsequent off-site transportation to the disposal facilities. The disposal facilities utilized during the Phase II remedial activities included Clean Earth of New Castle, located in New Castle, DE; Clean Earth of Southeast Pennsylvania, located in Morrisville, PA; and Casie Pro-Tank, located in Vineland, NJ. All three disposal facilities are licensed to accept and treat the remedial derived material. Transport vehicles were decontaminated within the enclosure or at the decontamination pad and exited the Phase II site via haul roads created with large diameter road stone either through the North Clinton Avenue or Fifth Avenue gates. The haul roads were maintained throughout the duration of the project and the road stone minimized the potential for soil tracking into North Clinton Avenue and Fifth Avenue and the generation of fugitive dust.

All transportation and disposal activities were coordinated by ENTACT. All waste-hauling vehicles were inspected prior to loading and any vehicle that appeared to be in an unacceptable condition for transporting materials were not loaded. Transport vehicles were also inspected for the appropriate placards, vehicle identifications and over-the-road permits for the States in which they traveled. Additionally, transport vehicles and their contents were inspected prior to leaving the Phase II Site to verify that the vehicles were properly decontaminated, covered, placarded and that the load was acceptable for transport and disposal. A summary of the off-site disposal activities is contained in Contaminated Materials Removal section this Report and the exported waste manifests are included within Appendix E.

Prior to mobilization to the Site, ENTACT conducted an in-situ sampling program to characterize the soils to be excavated, in place, prior to their removal and off-

site disposal. The purpose of the in-situ waste classification activities was to characterize the soils as per the requirements of the selected disposal facilities prior to the performance of the Phase II remedial activities.

Approximately 101,546 tons of soils, concrete and other construction debris were excavated during the Phase II remedial activities and transported to Clean Earth of New Castle, Clean Earth of Southeast Philadelphia and Casie Protank. The soils generated from the Shallow Excavation Area, Deep Excavation Area A, Deep Excavation Area B, Deep Excavation Area C as well as the excavation associated with construction of the Site-Wide Cap were characterized in-situ prior to excavation as per the requirements of the selected disposal facilities. Waste characterization analytical parameters, as well as the frequency of collection of waste characterization samples, were dictated by the disposal facilities. Based on analytical results, all materials generated during the Phase II remedial activities and disposed of at Clean Earth of New Castle, Clean Earth of Southeast Philadelphia and Casie Protank were characterized as non-hazardous waste. Copies of the waste characterization sample results, non-hazardous waste manifests and the certificates of destruction/recycling are included in electronic format on a compact disk contained in Appendix E.

Appendix E includes a table which summarizes the 3,510 non-hazardous waste manifests generated during the Phase II off-site disposal activities. The table includes the disposal facility's manifest number, the date the load was shipped, the tonnage shipped under each manifest as well as the Certificate of Destruction/Recycling number for each load. The Certificate of Destruction/Recycling documents that the disposal facility thermally treated each load of soils.

4.10 Phase II Imported Backfill

Imported material consisted of New York State Department of Transportation (NYSDOT) Type I coarse aggregate (below the groundwater table), Type II course aggregate (top six inches of Phase II side wide soil cap) and a clean well graded sandy soil fill (above the groundwater table). The coarse aggregate and sandy soil material met the specified gradation requirements as stated in the 100% RDR for both Phases. Clean fill material was obtained from certified virgin sources which included Stony Creek 4001 Daly Blvd, Oceanside, NY 11572; Tilcon NY 162 Old Mill Road, West Nyack, NY 10994; Watral Brothers INC. 45 South 4th Street, North Bay Shore, NY 11706; and A&R Materials 25A Mill Road, Ronkonkoma, NY 11779. Imported fill material was analyzed for polycyclic aromatic hydrocarbons (PAHs) and total volatile organic compounds (VOCs) at a rate of one sample for every 5,000 cubic yards of imported material. Ten percent (10%) of the samples were also analyzed for target analyte list (TAL) compounds and polychlorinated biphenyls (PCBs). The results of the testing are included in Appendix F of this Report.

The Phase II Deep Excavation Areas were backfilled, as per the Phase II RDR, with coarse aggregate conforming to the specification of New York State Department of Transportation Type 1 coarse aggregate (Type 1 aggregate) below the water table. The Type 1 aggregate was obtained from (Tilcon New York, Inc. located in West Nyack, New York). Using a wheeled front-end loader the Type 1 aggregate backfill placement was advanced from one end of the excavation to the other. Residual LNAPL on the water table was displaced in front of the backfill to the opposite end of the excavation and collected with a combination of oil absorbent pads and booms, and an oil skimmer for off site disposal. As the Type 1 aggregate was placed, groundwater in the excavation was displaced and would temporarily rise above static levels. It was necessary at times to pause the backfilling progress and allow the water levels in the excavation to equilibrate and return to static levels. Groundwater was not allowed to rise above the excavation perimeter. Once the area was completely backfilled, the enclosure was moved to the next excavation area and the temporary sheeting was removed.

Above the water table, geotextile fabric (Mirafi 140N) was placed on top of the Type I aggregate to minimize the downward migration of fines from the upper backfill material into the underlying coarser backfill material. The remedial excavation areas were then backfilled with well graded virgin sandy soil consisting of naturally occurring or blended soil. Clean fill information, gradation testing results from the source, Stoney Creek Industries of Oceanside, New York and Watral Brothers of Bay Shore, New York, as well as analytical results were provided to the NYSDEC for approval. Based on review of this information, the NYSDEC approved the Stoney Creek material for use on the Site above the groundwater table on August 14, 2007 and approved use of Watral Brothers material on August 20, 2007.

The well-graded sandy soil was also utilized to supplement native material to backfill the trenches associated with the installation of the LIRR sheet wall as well as the perimeter utility cut and cap efforts.

The certified clean fill was placed and compacted above the geotextile fabric in 12-inch or less lifts until the planned cap sub-grade was reached. Each lift was mechanically compacted with a vibratory roller and walk behind plate compactor to a minimum of 90 percent of the modified proctor density. In-place compaction testing was performed by MT Group to document the effectiveness of the compaction efforts.

All fill materials delivered to the Phase II Site were accompanied by documentation that the fill was certified “clean” from a virgin source or a blend of soils originating from virgin sources. Integrity sampling was conducted in accordance with the Technical Specifications. The backfill information was submitted to the NYSDEC for review and approval prior to delivery to the Site. Backfill and compaction documentation is included in Appendix F.

Imported material consisted of New York State Department of Transportation (NYSDOT) Type I coarse aggregate (below the groundwater table), Type II course aggregate (top six inches of Phase II side wide soil cap) and a clean well graded sandy

soil fill (above the groundwater table). The coarse aggregate and sandy soil material met the specified gradation requirements as stated in the 100% RDR for both Phases. Clean fill material was obtained from certified virgin sources which included Stony Creek 4001 Daly Blvd, Oceanside, NY 11572; Tilcon NY 162 Old Mill Road, West Nyack, NY 10994; Watral Brothers INC. 45 South 4th Street, North Bay Shore, NY 11706; and A&R Materials 25A Mill Road, Ronkonkoma, NY 11779. Imported fill material was analyzed for polycyclic aromatic hydrocarbons (PAHs) and total volatile organic compounds (VOCs) at a rate of one sample for every 5,000 cubic yards of imported material. Ten percent (10%) of the samples were also analyzed for target analyte list (TAL) compounds and polychlorinated biphenyls (PCBs). The results of the testing are included in Appendix F of this Report.

Reuse of On-Site Materials

Excavated soils that did not contain source material (i.e., soil containing visible tar, oils and purifier wastes) based on field observations were evaluated for potential reuse on-site. A representative confirmatory sample was collected from each on-site soil pile intended for reuse as backfill at a rate of one sample every 5,000 cubic yards for the first two approved samples and then reduced to one every 10,000 cubic yards for subsequent samples. Soils designated for reuse were placed below the two foot Site Wide Soil Cap.

Concrete debris generated from the removal of former MGP features was broken on site and used as bottom layer fill material below the water table for the hot spot excavation areas. Only broken debris that was approved for reuse by National Grid and the NYSDEC was used as fill material. In the event the concrete debris was not able to be used as fill, it was properly managed for off-site disposal. If necessary, the debris was cleaned to removed attached soil to meet the criteria for on-site reuse.

4.11 Phase II Residual Contamination Remaining On-Site

Since contaminated soil and groundwater remains 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 Site Management Plan (SMP) approved by the NYSDEC.

4.12 Phase II 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 primary Engineering Control Systems, described in the following subsections as Seepage Pits and the Site Wide Soil Cap.

4.12.1 Phase II Post-Remediation Drainage (Seepage Pits)

To facilitate on-site storm water management, a seepage pit drainage system was installed within the southern portion of the Site as shown on As-Built Sheet 5 included in Appendix B. The final site grade will direct on-site storm water runoff to this area. To promote installation of the system, this area had been backfilled with fill material only and rough graded.

The seepage pit drainage system was installed as per design, and consists of three 4 by 10 feet precast, 4,000 pounds per square inch (psi) concrete seepage vaults equipped with a surface grate and twelve 12-inch perforated PVC lateral pipelines. The overall layout of the system is depicted on As-Built Sheet 5 in Appendix B. Once the backfill was in-place, the location of the seepage pits and piping had been surveyed and staked. Grade stakes were also set to ensure design elevations were achieved. The location of the three seepage pits and pipe trenches was excavated with a diameter large enough to accommodate the 10-foot diameter of the vaults and the 24-inch layer of 1 ½-inch clean stone surrounding the vaults. The interior of the excavation was lined with Mirafi 140N filter fabric with a 24-inch layer of 1 ½-inch clean stone placed around the vault perimeter.

Construction of the system began with the installation and compaction of the ¾-inch clean stone sub-base and placement of the seepage pits with an excavator. Four windows were cuts into the side of each seepage vault to allow the perforated lateral piping to be mortared to the vaults. The pipe trench and pipe installation continued to the next seepage pit and the installation procedures repeated. The perforated pipe was set in the pipe trench and embedded in ¾-inch clean stone wrapped in filter fabric. Pipe and fittings were joined per manufacturer's recommended procedures. When all three seepage pits and associated piping were installed, the area of the piping was backfilled to final grade with well graded sandy soil material and the six-inch inch Site Wide Cap aggregate layer, Type II stone, was placed. The planned final grade accommodated only a four to six inch layer of sandy soils to be placed atop the seepage pits beneath the six inch layer of Type II stone with the three grated manhole covers at the surface.

4.12.2 Phase II Site Wide Soil Cap Construction

The Site Wide Soil Cap was installed across the entire Site to limit potential future exposure pathways. The final grade for the Site Wide Soil Cap is presented on As-Built Sheet 5 in Appendix B. The cap consisted of an 18-inch layer of well graded sandy soil material overlain with six inches of NYSDOT Type II aggregate meeting the specifications stated in Section 3.7 of the Phase II RDR. The cap is underlain with a geotextile fabric (Mirafi 140N) as a demarcation barrier to distinguish the cap from the subgrade materials.

Outside of the Shallow and Hot Spot Excavation Areas, soil was removed to a minimum of two feet bgs to accommodate construction of the Site Wide Soil Cap. Excavation to accommodate the cap may have been greater in areas of the Site where subsurface structures or visually apparent soil contamination were encountered. The Shallow and Hot Spot Excavations Areas were backfilled to within two feet of final grade to accommodate construction of the Site Wide Cap.

Prior to placing the Site Wide Cap, the Site was graded to promote drainage towards seepage pits installed on the south end of the Site as shown on As-Built Sheet 5 in Appendix B. Once grading was achieved, as documented by a confirmatory survey, installation of the Site Wide Cap commenced. In general, Site Wide Cap installation began on the northwest corner of Site and proceeded in a southeasterly direction.

The demarcation barrier (Mirafi 135N) was installed over the cap subgrade. The geotextile was rolled out with edges overlapping 12 to 18 inches. The leading edges of the barrier were anchored to hold the material in-place while awaiting backfill.

The 18-inch sandy fill material layer was placed in two, nine to 12-inch loose lifts in a manner that would not damage the underlying demarcation barrier. Fill material was placed along the edge of the barrier material and graded in-place with a low ground pressure (LGP) dozer. The LGP dozer remained on the placed fill material and was not in direct contact with the underlying geotextile. The nine to 12-inch lifts were compacted to a minimum 90% of Modified Proctor density per ASTM D1577. In-place quality control compaction testing was performed by MT Group; 145 Sherwood Avenue, Farmingdale, New York 11735 to verify specified compaction has been achieved. Each lift was tested at a frequency of one test per 2,500 square feet. In the event specified compaction was not achieved, the non-conforming area would be re-compacted by passing over it with roller. The compaction test results are included within Appendix F.

Once geotechnical testing of the second lift of sandy soil was complete in an area, placement of the six-inch aggregate layer began. The imported aggregate was placed in one lift and spread with the dozer.

4.13 Phase II Site Restoration

Site restoration activities consisted of the installation of a seepage pit drainage system to facilitate on-site storm water management, removing soil erosion and sediment control measures, replace all damaged sidewalks and egress aprons and re-establishing Site perimeter controls. The final features are depicted on the Phase II As-Built Sheet 5 in Appendix B.

4.13.1 Phase II Seepage Pits

To facilitate on-site storm water management, a seepage pit drainage system was installed within the southern portion of the Site. The final site grade will direct on-site storm water runoff to this area. The construction of the seepage pits is described in Engineering Controls section of this report.

4.13.2 Phase II Site Fence

The Southern fence was removed to facilitate the installation of the LIRR barrier wall and the C excavation cells. Upon completion of the site wide cap in that area, the fence was replaced by Residential Fence Co. to its preconstruction alignment.

4.13.3 Phase II Sidewalk and Egress Aprons

As part of the site restoration activities certain areas of the sidewalks (and grass strips) along North Clinton Ave were restored, as required by Suffolk County and the Technical Specifications of the Phase I and II RDRs following the remediation activities. Also restored was the egress apron of the western site entrance to North Clinton Ave.

4.14 Phase II Engineering and Institutional Controls

Planned engineering controls for Phase II, consisting of the elimination of source material from the unsaturated zone and Hot Spot Areas (A, B and C), excavation backfilling and placement of site wide cap to eliminate potential exposures, and grading and installation of seepage pits to control and contain site surface water have been successfully implemented. Institutional controls to manage future subsurface disturbance and resultant potential exposure pathways including a site management plan will be implemented as remaining Phases IA and III of the OU-1 remediation are completed.

4.15 Deviations from the Phase II RDR

The following modifications/expansions to the approved Phase II 100% RDR (Phase II RDR) activities were performed during implementation of the Phase II construction activities:

- Expansion of the Shallow Excavation Area from its horizontal and vertical limits defined in the Phase II RDR. The expansion was required due to visual observations of impacted soils and also subsurface structures encountered during the excavation;

- Modification to the gradation of the well-graded sandy soil to be used as a backfill material in the Shallow Excavation Areas and the construction of the Site-Wide

Cap. The gradation requirements were modified to accommodate available sources of the clean backfill material;

- Use of New York State Department of Transportation (NYSDOT) Type I coarse aggregate, in a six-inch to 18-inch layer, underlain by Fornit Biaxial Geogrid material, as necessary, between the native materials and the sandy soil backfill. The use of the Type I stone was necessary to bridge the soil/water interface and provide a stabilized platform for the performance of the Deep Excavation Activities;

- Addition of the use of New York State Department of Transportation (NYSDOT) one and one-half inch (1 ½") stone, in a four to six-inch layer, as necessary, on top of the aforementioned Type I stone and below the native materials and the sandy soil backfill. The use of the 1 ½" stone was necessary to supplement the Type I stone due to a large amount of storm water realized during the implementation of the Phase II remedial activities;

- Modification to the Hot Spot c-excavation shoring design. AZ26 steel sheets were substituted for PZ27 sheets along the southern temporary sheet wall and the southern 16 feet of temporary sheeting installed perpendicular to the southern wall;

- Use of loose 1 ½" stone and sand bags filled with type I stone to fill a gap that formed during excavation at the AZ-PZ sheet overlap between cells C-1 and C-3; and,

- Use of NYSDOT Type I coarse aggregate in place of three-quarter inch (3/4") clean stone to form the stone base for the seepage pit installation activities.

The modifications to the Phase II RDR are detailed in the following subsections.

4.15.1 Expansion of the Horizontal and Vertical Limits Shallow Excavation Area

Horizontal Limits of the Shallow Excavation Area

The proposed horizontal limits of the Shallow Excavation Area are depicted in the Design Drawings of the Phase II RDR. Based on the field observations (including visual, olfactory, etc.) of impacted soils outside of the horizontal limits of the Shallow Excavation Area, the final limits of excavation were extended to the north and east.

Vertical Limits of the Shallow Excavation Area

As stated in the Phase II RDR, the intent of the excavation activities in the Shallow Excavation Area was to remove source materials to a depth

corresponding with the underlying water table (i.e., approximately eight feet bgs). Limited portions of the Shallow Excavation Area, to remove observed impacted materials and subsurface structures (foundations and masonry materials) were excavated to nominal depths, one to three feet below the water table.

The final limits of the excavation are depicted on Figure 2 and As-Built Sheet 2 included in Appendix B of this Report.

4.15.2 Modification to the Gradation of the Well-Graded Sandy Soil Backfill Materials to be used Above Groundwater

The Phase II RDR specified the use of well-graded sandy soil to backfill the Shallow Excavation Area (i.e., above the water table) and to construct the Site-Wide Cap. The gradation for the well-graded sandy soil, as specified in the Phase II RDR, is as follows:

Sieve Size	Design Range
2”	100%
3/4 inch	70% - 100%
No. 4	30% - 80%
No. 50	10% - 35%
No. 200	5% - 12%

However, during implementation of the remedial activities, it became necessary to find new sources of well-graded sandy soil materials that met the requirements of the Technical Specifications. As such, the Remedial Contractor proposed the use of sources that satisfied all of the requirements for sandy backfill materials with the exception of the gradation analysis. As sources were proposed, PS&SPC, as the Design Engineer for the project, reviewed all variances from the gradation requirements to determine the materials feasibility for use. Based on this review, a variant to the gradation requirements was approved, as detailed below.

Sieve Size	Accepted Percent
2”	100%
3/4 inch	99.3%
No. 4	91.2%
No. 50	15.6%
No. 200	4%

4.15.3 Use of Type I Coarse Aggregate, Geogrid and 1 ½- Inch Stone to Bridge Groundwater Table (Shallow Excavation Area)

The depth of the Shallow Excavation Area was extended to the water table (approximately eight feet bgs) and often deeper due to the visual observation of impacted materials requiring removal. The saturated conditions at the base of the

Shallow Excavation did not always provide a stable working platform, particularly during precipitation events. As such, a six to 18-inch layer of stone, meeting the NYSDOT requirements for Type I stone, was placed on the excavation bottom to provide a stable platform to complete the remainder of the remedial activities.

To enhance the working platform developed with the addition of the Type I stone, the Remediation Contractor supplemented the stone with the use of a geogrid reinforcement fabric overlain with a four to six inch layer of 1 ½" stone.

4.15.4 Modification to the Hot Spot C-excavation Shoring Design

The Remedial Contractor originally proposed the use of Hoesch 1700, otherwise known as AZ26 steel sheets, for the portion of the Hot Spot Area C temporary sheeting with the bracing system, parallel to the LIRR tracks and the 16 foot returns. These AZ26 steel sheets were replaced by PZ27 steel sheets. This change was implemented to reduce structural impact to the LIRR due to the fact that the narrower width and gauge PZ27 steel sheets were easier to install than the thicker AZ26 steel sheets. This modification did not impact the remedial design or its completion.

4.15.5 Use of Loose 1½ Inch Stone and Sand Bags Filled with Type I Stone

PS&S conditional approval was provided via email on 5/21/08 and subsequent approval form the NYSDEC was provided to PS&S verbally.

ENTACT Field Change Request #5 (Cofferdam C1/C3 Sheet Pile Gap Remedy) concerns a sink-hole that developed within the backfilled Cofferdam-C1 during excavation of the adjacent Cofferdam-C3. The sinkhole developed in the area where the sheet pile overlaps and converts from PZ27 sheeting to AZ26 sheeting. The gap in the sheet pile was located below the groundwater table and the gap in the sheeting was allowing the backfilled Type 1 stone to migrate through the sheet pile from the Cofferdam-C1 area into the Cofferdam-C3 thus creating the sinkhole. ENTACT implemented the following corrective action measures to seal the gap in the sheet pile:

- One hundred twenty three (123) "sandbags" were filled with Type 1 Stone and were placed into the base of the sinkhole; in order to fill the void ;

- Excavation within the C-3 cofferdam continued in the area of the suspected gap to allow for the Type 1 Stone filled bags to migrate down and fill the gap in the sheet pile; and

- Additional backfill was placed into the sink-hole area to fill any potential remaining voids between the sandbags and the sheet pile. The backfill consisted of a mixture of 1.5-inch Stone and Type 1 Stone.

ENTACT estimated that approximately 75 tons of material was needed to fill the sinkhole located in Cofferdam- C1 and to complete the corrective action measures noted above. Once Posillico resumed Cofferdam-C sheet pile installation, they placed an additional sheet pile where the sheet pile converts from PZ27 sheeting to AZ26 in order to mitigate reoccurrence of this issue during future excavation of the adjacent cofferdam located west of Cofferdam-C2.

4.15.6 Use of Type I Stone For Seepage Pit Sub Base

The Phase II RDR reflects the use of ¾" Clean Stone for use as sub base material to be placed below the bottom slab of each seepage pit. ENTACT requested the site approved Type 1 stone be used instead of the ¾" Clean Stone, since Type 1 stone was approved for use as the base of excavation stabilization backfill material and was present at the sub base elevation for the three installed seepage pits. The use of Type I stone in place of ¾" stone was approved.

4.16 Conclusions

4.16.1 Phase I Conclusions

The goals and objectives for the Phase I remedial construction were accomplished, and conclusions for the Phase I remedial activities are listed below.

- Excavation of contaminant source materials in the Southern Cell hot spot area was complete as planned to a maximum depth of 25 feet bgs, removing a total of 2,285 tons of material effectively eliminating source material to a depth of 25 feet in the OU 1 Phase I area;

- The excavated impacted soil were successfully transported to two permitted facilities (CESPA and CENC) for thermal desorption and beneficial recycling;

- A total of 625 linear feet of the Waterloo Barrier® System was successfully installed as per plan and as modified per approved field changes downgradient of Operable Unit 1 to contain Dense Non-Aqueous Phase Liquids (DNAPL) in the lower reaches of the aquifer and in the upper 30 feet of the saturated zone to create a groundwater flow through treatment zone and prevent groundwater mounding immediately upgradient of the barrier;

- Areas excavated including the Southern Cell Hot Spot and areas of pre-trenching for the Waterloo Barrier® were successfully backfilled and compacted as per plan or approved change to pre-remedial grades with approved backfill material;

- Planned engineering controls for Phase I, the Waterloo Barrier® System, elimination of the Southern Cell Hot Spot Area, and backfilling and placement of clean cover soils to eliminate potential exposures were successfully implemented. Additional engineering controls to be installed in the Phase I area include oxygen injection system, monitoring wells, ozone injection systems and a groundwater treatment support building for the supplemental oxygen injection system will be installed as part of Phase IA. The institutional controls to manage future subsurface disturbance and resultant potential exposure pathways including a site management plan will be implemented as remaining Phases IA and III of the OU-1 remediation are completed;

- Based on results of the Community Air Monitoring Program which included real time air analysis for TVOC, PM-10 and odors, and time-weighted average confirmatory VOC sampling, remediation activities did not create conditions that affected nearby receptors;

- Noise impacts at the site boundary were very limited in frequency and duration by the successfully implemented noise monitoring program that identified "temporary halt" noise threshold levels requiring work to stop and work methods altered to reduce noise levels; and

- The "stop work" threshold vibration level was not exceeded at any monitoring location. Vibration levels measured did reached potentially perceptible vibration levels, however, the observed vibration measurements were less than vibration threshold levels at which damage may be expected to occur to "typical residential structures."

4.16.2 Phase II Conclusions

Based on the results of the Phase II Remedial Construction activities, the following conclusions can be made.

- Contaminant source materials have been successfully excavated as per plan in the unsaturated zone to an average depth of 8.11 feet bgs and in the three "hot spot" areas (A, B and C) to a maximum depth of 25 feet bgs effectively eliminating source material to a maximum depth of 25 feet in the OU-1 Phase II area;

- A total of 101,546 tons of source material were removed during the Phase II excavations and successfully transported off-site for disposal at three permitted facilities (Casie, CESPA and CENC) for thermal desorption and beneficial recycling;

- Areas excavated were successfully backfilled and compacted as per plan to pre-remedial grades with approved imported backfill materials and non-

impacted soils generated during the Phase I site grading to the planned Site Wide Cap sub-grade elevations;

- Construction of the Site Wide Soil Cap consisting of a demarcation fabric 2 feet below final grade overlain with 18 inches of clean well graded sandy soil sandy soils and six inches of Type II Stone at the surface, and graded to direct surface water to three subsurface seepage pits was successfully completed as per plan;

- Planned engineering controls for Phase II, consisting of the elimination of source material from the unsaturated zone and Hot Spot Areas (A, B and C), excavation backfilling and placement of site wide cap to eliminate potential exposures, and grading and installation of seepage pits to control and contain site surface water have been successfully implemented. Institutional controls to manage future subsurface disturbance and resultant potential exposure pathways including a site management plan will be implemented as remaining Phases IA and III of the OU-1 remediation are completed.

- Based on results of the Community Air Monitoring Program which included real time air analysis for TVOC, PM-10 and odors, and time-weighted average confirmatory VOC sampling, remediation activities did not create conditions that affected nearby receptors;

- Noise impacts at the site boundary were very limited in frequency and duration by the successfully implemented noise monitoring program that identified "temporary halt" noise threshold levels requiring work to stop and work methods altered to reduce noise levels; and

- The "stop work" threshold vibration level was not exceeded at any monitoring location. Vibration levels measured did reached potentially perceptible vibration levels, however, the observed vibration measurements were less than vibration threshold levels at which damage may be expected to occur to "typical residential structures."