**New York State Department of Environmental Conservation**
**Division of Environmental Remediation**
**Remedial Bureau B**
625 Broadway, Albany, New York 12233-7016
**Phone:** (518) 402-9768 • **FAX:** (518) 402-9020
**Website:** www.dec.ny.gov

Alexander B. Grannis
Commissioner

May 16, 2007

Ms. Catherine Weber
Environmental Resources Management
475 Park Ave. South
29th Floor
New York, NY 10016

Re: Brownfield Cleanup Program Draft Remedial Action Work Plan/Supplemental Design Report; 220 Water St. (ID SiteNo.C224098)

Dear Ms. Weber:

The New York State Department of Environmental Conservation, in consultation with the New York State Department of Health, has reviewed the referenced document and conditionally approves it. The following conditions must be appropriately addressed in the final document:

1. Section 4.1.6; Last Paragraph of "System Sampling and Monitoring Reports": This section states that the exhaust pipe will be a minimum of ten feet from any air intakes, however, Figure 4-1 (note 10) states that the discharge must be 25 feet from an air intake. This should be corrected as appropriate and made consistent.

2. Section 4.1.7; Last Paragraph: Please remove this paragraph and replace it with a statement that says "If, after operation and correction measures, pressure field extension tests reveal the system is not performing as required, the NYSDEC will be consulted and an alternate plan of action will be developed."

3. Section 4.2; Page 20; Third Paragraph: Please reference a list of contaminants and concentrations that must be attained in order for fill material to be considered acceptable. Please be certain that the lower of the " Restricted-Residential" and the "Protection of Groundwater" is used as the final criterion to be attained.

4. Section 4.2; Page 20; Fourth Paragraph: It is stated that all soils in excess of "Restricted Residential" SCOs will require management through the Soils Management Plan (SoMP), however, all soils above "Unrestricted" cleanup levels require management through the SoMP.

Please be aware that the Department, in granting approval of the referenced document for the purposes of meeting the design requirements of the Brownfield Cleanup Program, is not granting full approval of the appended Draft Site Management Plan, Draft Soils Management Plan or the Draft Environmental Easement, as these documents can only be adequately written and reviewed following implementation of the physical aspects of the remedy. The following comments are intended to aid in the finalization of those documents in the future:

A. Draft Site Management Plan; Section 1.2.3; Second Paragraph: The site is listed as being at an elevation of 5-feet above mean sea level, however, Figure 4-1 indicates the elevation to be closer to 25-feet above mean sea level. Please correct as appropriate.

B. Draft Site Management Plan; Section 1.4; Fifth Bullet: Please insert "*, or in areas subsequently disturbed,*" after "*...and in areas where excavation is performed.*"

C. Draft Site Management Plan; Sections 1.4.1, 1.4.3, and elsewhere: There are no "*Track 1 SCOs,*" nor are there "*Track 4 SCOs*." Please change these references to "*Unrestricted SCOs,*" and "*Site Specific SCOs,*" respectively.

D. Draft Site Management Plan; Section 3.7 and Section 5.2: It is currently unclear as to whether a "Qualified Environmental Professional" can certify engineering controls. Please modify these sections to say that "*A Professional Engineer authorized to perform engineering services in the state of New York, or a Qualified Environmental Professional, as determined appropriate by the NYSDEC, will perform inspection and certification.*"

E. Draft Soils Management Plan; Section 6.0: Please remove the words *"... within previously remediated areas..."* from the first sentence, as the Soils Management Plan applies to *all* areas of the site.

F. Draft Soils Management Plan; Page 14; Footnote: When discussing backfill requirements, the text should be clear that the soils must attain the lower of the restricted residential SCO and the groundwater protection SCO. Also, a detailed sampling strategy should be included (e.g., the number of samples per cubic yard, etc.).

G. Draft Soils Management Plan; Page 15; Section 8.2: If there is to be a plan for possible reuse of soils, a detailed sampling strategy should be included (e.g., the number of samples per cubic yard, etc.).

Please provide final/corrected documents by June 1, 2008, inclusive of an updated schedule for implementation of the remedy. Please note that the approval of this document does not alleviate or alter the site-owner's responsibility to obtain any necessary permits for demolition and/or construction. If there are any questions regarding this matter, please contact me at (518) 402-9694. Thank you.

Sincerely,

Jonathan Greco
Project Manager
Division of Environmental Remediation
Bureau B, Section B

ec: B. Cozzy
J. Quinn
C. Doroski
D. Walsh

Environmental
Resources
Management

235 Park Avenue South,
4th Floor
New York, NY 10003
(212) 447-1900
(212) 447-1904 (fax)
http://www.erm.com

3 June 2008

Mr. Jonathan Greco
New York State Department of Environmental Conservation
Division of Environmental Remediation
Remedial Bureau B
625 Broadway, Albany, New York 12233-7016

Re: Conditional Approval Letter Acceptance for Brownfield Cleanup Program
Remedial Action Work Plan/Supplemental Design Report
Brownfield Cleanup Program Site ID No.C224098
220 Water Street
Brooklyn, New York

Dear Mr. Greco:

Environmental Resources Management (ERM) is submitting this letter on behalf of Hawthorne Village LLC to acknowledge receipt of the New York State Department of Environmental Conservation's (NYSDEC's) letter dated 16 May 2008 granting conditional approval for the 220 Water Street Remedial Investigation Work Plan dated March 2008 (the Conditional Approval Letter). The purpose of this letter is to modify the Remedial Action Work Plan/Supplemental Design Repot to incorporate the four items required by the conditional approval, as follows:

1. Figure 4-1 is to reflect that the exhaust pipe discharge will be a minimum of ten (10) feet from any air intakes.

2. The last paragraph of Section 4.1.7 is eliminated and replaced with a statement that says "If, after operation and correction measures, pressure field extension tests reveal the system is not performing as required, the NYSDEC will be consulted and an alternate plan of action will be developed."

3. Section 4.2; Page 20; Third Paragraph: Clean soil will constitute soil that meets the 6 NYCRR Part 375-6.7(d) criteria for backfill. Specifically, the lower of the protection of groundwater or the

protection of public health soil cleanup objectives for restricted-residential use listed in Table 375-6.8(b) will be used as the final criterion to be attained.

4. Section 4.2; Page 20; Fourth Paragraph: It is stated that all soils in excess of "Restricted Residential" SCOs will require management through the Soils Management Plan (SoMP), however, all soils above "Unrestricted" cleanup levels require management through the SoMP. This comment is accepted and incorporated into the work plan.

***Remedy Implementation Schedule***

Construction work is planned to commence during Summer 2008. In conclusion, as requested by NYSDEC, the Conditional Approval Letter and this Work Plan Amendment together will be placed in the document repositories and together comprise the Work Plan Addendum for the Remedial Action Work Plan: Supplemental Design Report, and together constitute the final document. Please do not hesitate to contact me if you have any further questions.

Sincerely,

Catherine I. Weber
*Project Manager*

James Perazzo, P.G.
*Partner*

cc: Stephen O'Brien, GDC Properties, Inc.
Kevin Healy, Esq., Bryan Cave

# Remedial Action Work Plan: Supplemental Design Report

220 Water Street
Brooklyn, New York

March 2008
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ERM

FINAL REPORT

220 Water Street

# Remedial Action Work Plan: Supplemental Design Report

*220 Water Street*

*Brooklyn, New York*

March 2008

ERM Ref. No. 0022103

STATE OF NEW YORK
JOHN PAUL MOHLIN
077921
LICENSED PROFESSIONAL ENGINEER

3/17/08

John Mohlin, P.E.

ERM Consulting & Engineering, Inc.
235 Park Avenue South, 4th Floor
New York, NY 10003

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## *1.0 INTRODUCTION*

Environmental Resources Management (ERM) has prepared this Remedial Action Work Plan (RAWP): Supplemental Design Report for the 220 Water Street building located in Brooklyn, Kings County, New York (the "Site"; see Figure 1-1 for location). This Supplemental Design Report is being submitted on behalf of Hawthorne Village, LLC (Volunteer) to fulfill the requirement to perform remediation under the Brownfield Cleanup Program (BCP).

The Remedial Work Plan (RWP), dated May 2007, for the Site was approved by the New York State Department of Environmental Conservation (NYSDEC) in a letter dated 13 August 2007. This Supplemental Design Report serves to supplement the existing RWP for the Site to complete the requirements for a Remedial Action Work Plan (RAWP) for the Site.

The RWP included an Alternatives Analysis Report (AAR), evaluating alternatives according to criteria defined in NYSDEC Division of Environmental Remediation (DER-10). The RWP selected a restricted-residential use remedy for the Site and serves as the decision document for the Site. The Site is comprised of Block 41, Lot 17 as shown on the New York City tax maps, and is zoned as a M1-2. A location map showing the Site and the surrounding area is presented as Figure 1-1. Figure 1-2 presents a Site plan for the property.

Specifically, this document presents details for the sub-slab depressurization (SSD) system at the Site, excavation areas, Site cover, and supporting plans. The design is based on an evaluation of all of the information and data presented in previous environmental reports. This report documents:

- SSD System Layout
- Engineering and Process Description of the SSD System
- Site Cover Layout
- Supporting Plans:
  - Quality Assurance Project Plan (QAPP)
  - Health and Safety Plan (HASP)
  - Community Air Monitoring Plan (CAMP)
  - *Draft* Site Management Plan (SMP)

## *2.0 SITE BACKGROUND*

The following sections provide a site description, description of site topography, site geology and hydrogeology and the nature and extent of contamination.

## *2.1 SITE DESCRIPTION*

The Site consists of an approximate 44,000-square foot, five-story building on a one-acre parcel. The Site was previously used for industrial purposes, and more recently, contains converted loft-style apartments on the fourth and fifth floors and is vacant on the first through third floors. Figure 1-2 presents a Site plan that shows the layout of the building, the adjacent sidewalk, and nearby roadways.

The Site, which is bounded by Front Street, Bridge Street and Water Street to the south, east and north, respectively, has two current addresses: 220 Water Street and 201 Front Street. As noted above, the entire Site is covered by a building. There is no exposed soil at the Site with the exception of a two foot by two foot area of missing concrete in the cellar of the wood building.

The Site is located in a mixed commercial/industrial area zoned as M1-2. According to the City of New York Department of City Planning (City Planning), an M1-2 zone is designated as a Light Manufacturing District (High Performance). According to the Department of City Planning, the properties immediately adjacent to the Site to the north, east and west are all located in an M1-2 zone. However the Volunteer, Hawthorne Village, LLC, has filed an application for a variance with the New York City Board of Standards and Appeals (BSA), authorizing residential use of the property, and a hearing for this is expected in April 2008. The property south of the Site was recently changed to a M1-2/R-8A (General Residence District) zone through a city-initiated rezoning action.

The Site was developed in two phases according to the New York City Building Department records: the eastern portion was constructed in

1893[1] and the western side was constructed in 1905. The lead works facility burned down prior to construction of the existing structures on the Site. The eastern portion of the building is identified as the "wood building" because of its predominant wood frame and flooring, and the western side is referred to as the "concrete building", named for its predominant concrete framing and flooring (KTR Newmark, 2004A). Together these buildings form the Site, creating one functional building.

Nearby property uses include: the former Kirkman and Sons industrial building across Water Street to the north, which has been converted to a residential loft apartment building; an undeveloped parking lot and an undeveloped construction site to the south across Front Street; and a former industrial building to the east across Bridge Street. Directly adjacent to the Site along its western boundary, there is a fenced, vacant lot to the south and a 1-story commercial/industrial building at 173-177 Water Street to the north.

### 2.1.1 *Topography*

The subject property is approximately 5 feet above mean sea level (msl) as interpreted from the United States Geologic Survey topographic map, with a relatively flat topography. The local topography has a northerly slope toward the East River, which is located approximately 331 yards north of the subject property and flows in a westerly direction. Surface drainage at the subject property is via sheet flow across the adjacent sidewalk toward on-street municipal drains.

### 2.1.2 *Site Geology and Hydrogeology*

The area is located on the southern slope of the Harbor Hill Moraine, which is the terminal moraine of the late stage Wisconsin glaciation. This material is undifferentiated till, clays, sand, gravels, and boulders that is approximately 100 feet thick overlying a wedge, that is 80 feet thick, of the Cretaceous Raritan Formation which was deposited as a marine clay with a basal sand. The Raritan is in turn deposited upon Paleozoic schists and gneisses. The overall transport properties of this sequence are poor. The glacial tills and clays in the Harbor Hill Moraine serve to effectively seal the upper reaches of the subsurface. The most permeable unit in the

[1] Previous reports cited that the eastern portion was constructed in 1905 and the western portion in 1952. Further research of the Site history has provided clarification on the construction dates.

sequence is the Lloyd Sand, which is basal to the Raritan Formation at a depth of approximately 170 feet below grade.

The near surface native moraine material has subsequently been covered with undifferentiated urban land. Urban land characteristically has 0 to 8 percent slopes. The soils and foundation material are highly variable, but because urban structures and works cover so much of this land type, identification of the soils is not practical. Most areas have been graded, and the original soil material has been disturbed, filled over, or otherwise destroyed prior to construction. Approximately the first ten to 15 feet of material beneath the Site is considered fill material.

Groundwater flow at the Site is to the north toward the East River. The depth to groundwater ranges from approximately 25 feet below grade along the northern boundary of the Site to 35 feet below grade along the southern boundary of the Site. The maximum depth of borings/ monitoring wells installed at the Site was approximately 57 feet below grade. Bedrock was not encountered at this depth.

## 2.2 *NATURE AND EXTENT OF CONTAMINATION*

Based on the results of the environmental investigations performed at the Site, there are metals and polynuclear aromatic hydrocarbons (PAHs) present in soil at levels exceeding the Part 375 restricted-residential use Soil Cleanup Objectives (SCOs). Additionally, trichloroethene (TCE) and tetrachloroethene (PCE) are present in sub-surface soil vapor. The approved remedy to be implemented at the Site and adjacent sidewalk areas is summarized below:

- Excavation and disposal of approximately 711 cubic yards (cy) of soil from beneath the adjacent sidewalk beyond the building footprint, as depicted in Figure 2-1, with a remedial goal of 400 mg/kg for lead;
- Excavation and disposal of approximately 44 cy of soil from beneath the building footprint through the boiler room floor, as depicted in Figure 2-1, with a remedial goal of 1,000 mg/kg for lead;
- Sample collection and analysis of appropriate end point documentation/confirmation soil samples at approximately 28 locations from both the adjacent sidewalk and below the Site building,

consistent with the frequency of sampling established in the *Draft* DER-10 guidance document (NYSDEC, 2002);

- There are currently no vegetated areas at the Site. The remedy provides for construction and maintenance of a soil cover over all new vegetated areas (i.e., curb boxes for trees or other plantings within the adjacent sidewalk) to prevent exposure to contaminated soils. In the event that plantings are installed in the adjacent sidewalk area, a minimum two-foot thick cover shall consist of clean soil underlain by an indicator layer such as orange plastic snow fence to demarcate the cover soil from the subsurface soil beneath the adjacent sidewalks. The top six inches of soil would be of sufficient quality to support vegetation. Clean soil will constitute soil that meets the 6 NYCRR Part 375-6.7(d) criteria for backfill. The final cover in excavated sidewalk areas will be a minimum six-inches total thickness of aggregate/clean fill and concrete. Sidewalk areas that are not excavated will remain in place. If existing sidewalk is demolished in any location where soil excavation is not currently planned, the final cover will be a minimum six-inches total thickness of aggregate/clean fill and concrete.

- The Site will be covered by the existing building's structural foundation and slab, and in areas where excavation is performed, a concrete system at least 6 inches thick will be installed. An indicator layer will be placed to demarcate between native soils and backfill material. A map showing the Site cover is shown in Figure 2-2;

- Installation of an active SSD system at the Site to restrict soil vapors from entering the building;

- Imposition of an institutional control in the form of an Environmental Easement that will require: (a) limiting the use and development of the Site to restricted-residential use, which would also permit commercial or industrial uses; (b) compliance with the approved SMP; (c) restricting the use of groundwater at the Site as a source of potable or process water, without the necessary water quality treatment as determined by NYSDOH; and (d) the Site owner to complete and submit to the NYSDEC a periodic certification of institutional and engineering controls;

- An SMP for long term management of residual contamination as required by the Environmental Easement, which includes plans for: (1) Institutional Controls/Engineering Controls (ICs/ECs), (2) monitoring, (3) operation and maintenance and (4) reporting;

- The Site owner will provide a periodic certification of ICs/ECs, prepared and submitted by a qualified environmental professional acceptable to NYSDEC, until the NYSDEC notifies the Site owner in writing that this certification is no longer needed. This submittal would: (a) contain certification that the ICs/ECs put in place are still in place and are either unchanged from the previous certification or are compliant with NYSDEC-approved modifications; (b) allow the NYSDEC access to the Site; and (c) state that nothing has occurred that would impair the ability of the control to protect public health or the environment, or constitute a violation or failure to comply with the SMP unless otherwise approved by the NYSDEC;

- The operation of the components of the remedy will continue until the NYSDEC determines that operation is no longer required, is technically impracticable or is not feasible.

The Site and adjacent sidewalk areas have previously been investigated via subsurface soil sampling, sub-slab soil vapor sampling, and groundwater sampling. These results were fully summarized in the May 2007 RWP, and are reviewed below. This Supplemental Design Report focuses on elements of the remedy that will actively be implemented at the Site and adjacent sidewalk areas (i.e., SSD system installation, excavation, and cover construction).

### *2.2.1 Soil Vapor*

The RI for the Site identified elevated concentrations of TCE and PCE within soil vapor beneath the existing building. TCE and PCE were detected in soil gas samples taken during two rounds of sampling. TCE values ranged from 3,600 $\mu g/m^3$ beneath the wood cellar to 7,500 $\mu g/m^3$ beneath the concrete cellar, both during the second round of sampling. PCE values ranged from 350 $\mu g/m^3$ beneath the wood cellar to 560 $\mu g/m^3$ beneath the concrete cellar, both during the second round of sampling.

In the cellars, indoor air concentrations of TCE were 7.0 $ug/m^3$ in IA-01 (concrete cellar) and 28 $ug/m^3$ in IA-02 (wood cellar), the highest concentration being within the wood cellar, an unoccupied area. PCE was also detected in one indoor air sample (IA-02) at 5.6 $ug/m^3$, also in the wood cellar. PCE was not detected at a detection limit of 1.1 $ug/m^3$ in the remaining three indoor air samples.

Generally, TCE and PCE were either not detected or detected at low levels in indoor air, with the exception TCE in the cellars. Most VOCs detected

in indoor air were not detected in sub-slab soil vapor, indicating that there are other sources of these compounds. However, the elevated soil gas concentrations will be addressed by the SSD system described in this document.

### 2.2.2 *Soil*

Soil samples were collected during both the Phase II ESAs and the RI. Lead was the primary constituent detected above Part 375 SCOs. Other metals and two PAH compounds were also detected above SCOs. Soil containing lead above 400 mg/kg beneath adjacent sidewalk areas and soil containing lead above 1,000 mg/kg beneath the Site will be excavated and disposed of off-Site. The Site and adjacent sidewalk areas will have a cover to prevent direct contact with remaining residual soil concentrations (i.e., the other metals and PAH compounds). A full summary of soil data for the Site and adjacent sidewalk areas was presented in the RWP.

### 2.2.3 *Groundwater*

The 2007 RWP made the following conclusions regarding groundwater quality at the Site and vicinity:

- VOCs, specifically TCE and PCE, are present in groundwater above the NYS groundwater quality standard both upgradient and downgradient of the Site. The source of the VOCs is suspected to be an off-Site release;
- The presence of TCE and PCE at detectable concentrations in both upgradient and downgradient wells indicate an upgradient source of contamination; and
- VOC-impacted groundwater exits the Site and potentially extends off-Site.

The Environmental Easement addresses groundwater via a use restriction. Therefore this media is not discussed further in this report.

## *3.0 ENGINEERING DESCRIPTION OF SITE REMEDY*

This Section describes the applicability and components of the active construction elements of the remedy.

## *3.1 REMEDY DESCRIPTION*

### *3.1.1 Sub-Slab Depressurization (SSD) System*

Active SSD is a relatively simple preventative technology for addressing VOC concentrations in the vadose (unsaturated) zone. To implement this technology, a blower is used to apply a small vacuum to extraction points (or network of points) beneath a building. The SSD system acts to create a negative pressure field directly beneath a building and on along the foundation in relation to building ambient pressure. The negative pressure field acts as a "sink" for air present in the vicinity of the structure. VOCs carried by the advection of the negative pressure field are collected and piped to an ambient air vent pipe for discharge.

The SSD system is not intended to remediate soil or groundwater beneath the building. The objective is to prevent soil gases from migrating into the building. Ideally, the minimal possible depressurization and soil gas removal achievable to effectively prevent infiltration should be attained to minimize energy usage. Even though remediation is not a design objective, by default, it is an ancillary effect and benefit. That is, by venting soil gases impacted by VOCs to the atmosphere, the SSD system facilitates the mass removal of these constituents from subsurface media, and for every volume of vented soil gas removed, an equivalent volume of fresh air is drawn into the subsurface. The extent to which this occurs is highly site dependent, a function of contaminant type, location, mass, and SSD flow rate. Though, in most cases SSD systems will not have an appreciable impact on site contaminant levels.

### *3.1.2 Cover of the Site and Adjacent Sidewalk Areas*

The cover at the Site and adjacent sidewalk areas will perform as an engineering control to prevent direct contact with underlying impacted soils. This cover will consist of:

- concrete building slab,
- adjacent sidewalks,

- in areas where excavation is performed, a concrete system at least 6 inches thick, consisting of 4-inch minimum thickness base aggregate material and 2-inch minimum thickness concrete, and
- a minimum of two feet of clean fill, including six inches of top soil of sufficient quality to support vegetation, in any location that does not have concrete.

An Environmental Easement, specifying an SMP (see Appendix A for the *Draft* SMP), will be implemented for the Site to ensure that the cover consisting of concrete building slab, concrete pavement for adjacent sidewalks, or minimum two feet of clean fill are in place and effective. The SMP specifies that the building slab and adjacent sidewalks will be inspected annually and repaired if needed, and that NYSDEC shall be notified should work need to be conducted beneath the cover (e.g., utility repairs). An annual certification of the engineering controls will be provided by the Site owner to the NYSDEC.

### *3.1.3 Soil Excavation*

Soil with lead concentrations greater than 400 mg/kg beneath the adjacent sidewalk areas and with lead concentrations greater than 1,000 mg/kg beneath the Site, as shown in Figure 2-1, will be excavated and disposed off-Site. The 400 mg/kg endpoint goal concentration for soil below adjacent sidewalk areas is consistent with the Part 375 restricted-residential use SCO, which would be protective of potential future utility workers or construction workers conducting work in these areas.

The 1,000 mg/kg endpoint goal concentration for soil beneath the Site removes known lead hot spots present under the building slab. During the RI, soil samples with lead concentrations greater than 1,000 mg/kg were composited and subjected to toxicity characteristic leaching procedure (TCLP) analyses. The TCLP results were above the USEPA limit for characteristic hazardous waste for lead of 5 mg/L. Hence, this soil would be considered hazardous upon excavation. As described in Section 4.2, soil will be sampled and analyzed for full target compound list (TCL)/target analyte list (TAL) analyses, TCLP, and Resource Conservation and Recovery Act (RCRA) hazardous waste characteristics prior to disposal.

The endpoint concentrations of 400 mg/kg and 1,000 mg/kg are considered to be cleanup goals for lead in soil for beneath adjacent sidewalk areas and the Site, respectively. However, it is recognized that

some soil concentrations may remain in place above these goals and will be managed through the SMP.

Approximately one 50-foot long and one 40-foot long section of the sidewalk along Water Street will be excavated to four feet below grade, and one 85-foot long section of the sidewalk along Water Street would be excavated to eight feet below grade. An approximate 35-foot long section of the sidewalk along Front Street would be excavated to eight feet below grade. An "L" shaped section, approximately 765 square feet in area, at the corner of Front and Bridge Streets would also be excavated to four feet below grade.

The width of excavation of the adjacent sidewalk areas would extend from the building wall and foundation to the curb line. Excavation will not be conducted past the point of infringing upon the building structure and foundation, and will extend to the curb line. Figure 2-1 presents the areas to be excavated. This figure is provided for the sole purpose of illustrating the location and depth of soil above the Site SCOs and requiring excavation. The excavation contractor shall provide an excavation plan that is approved by a professional engineer licensed in the State of New York prior to conducting work.

Beneath the Site, an approximately 15 foot by 20-foot area of the boiler room in the vicinity of SB3-5 would be excavated to a maximum of four feet below the boiler room floor grade. Excavated areas would be filled with clean fill and paved over with a minimum of two inches of concrete.

Any soil left in place that contains chemical concentrations above the restricted-residential use SCOs will be managed through the Soil Management Plan (SoMP) as part of the overall SMP. The *Draft* SMP is included in Appendix A, which also contains a D*raft* SoMP. Documentation of soil sample results for lead in soil at a concentration above 400 mg/kg will be documented in the SMP, as well as existing PAH and metals concentrations in place that are known to be above the restricted-residential SCOs.

## *3.2 REMEDY APPLICABILITY*

### *3.2.1 Sub-Slab Depressurization (SSD) System*

The New York State Department of Health (NYSDOH) Guidance for Evaluating Soil Vapor Intrusion recommends an active SSD system as the preferred mitigation method for buildings with a basement slab or slab-

on-grade foundation (NYSDOH, 2006). SSD systems are proven methods to prevent sub-slab vapor from infiltrating into indoor air, and have been commonly used for radon mitigation for many years (USEPA, 1994).

### *3.2.2 Cover of the Site and Adjacent Sidewalk Areas*

A site cover, when properly maintained, is a proven method to prevent direct contact with underlying impacted soils. The Environmental Easement will provide for the proper monitoring and maintenance of the cover at the Site and adjacent sidewalk areas.

### *3.2.3 Soil Excavation*

Soil excavation for off-site disposal is a common method for removing contaminants from a site. It is a permanent solution for removed soils.

## *3.3 SYSTEM COMPONENTS*

### *3.3.1 Sub-Slab Depressurization (SSD) System*

The Site will be mitigated by approximately 18 suction pits. The final number may vary based upon an initial communication test . In general, each suction pit point will be piped below the building slab to an existing, nearby column where the piping will run to the ceiling and to a common manifold. Each suction pit will have its own sample/vacuum monitoring port as depicted in Figure 3-1. The SSD equipment will include the following:

- SSD fan;
- butterfly valves for system balancing;
- sample/vacuum monitoring ports;
- vent pipe; and
- instrumentation and controls.

The SSD fan will allow for a flow of soil vapor from each suction pit through the vent pipe up to the roof where it will be released to ambient air. The system shall be able to maintain a vacuum beneath the entire slab.

### *3.3.2 Cover of the Site and Adjacent Sidewalk Areas*

The cover shall consist of commonly-available construction materials. A base layer of Type I recycled concrete aggregate (RCA) shall underlie

concrete located within adjacent sidewalk areas. In excavated areas, clean fill will be used to fill areas where impacted soils are removed. Snow fencing or a similar distinctive separation layer shall be placed between clean fill or aggregate and the underlying native materials. This will serve to alert any future workers performing excavation that unexcavated, impacted materials are present beneath the demarcation layer. Within the Site, four-inches of ASTM #5 aggregate shall be installed beneath any new concrete slab. The ASTM #5 will promote the collection of sub-slab vapors that will then be diverted into the SSD system.

### *3.3.3 Soil Excavation*

Soil excavation shall be performed with standard construction equipment (i.e., backhoe or excavator). Proper shoring shall be utilized as per the approved contractor excavation plan where it is determined to be needed and for excavations extending greater than four feet in depth. Excavated areas will be backfilled to grade and completed with cover material as discussed in Section 3.1.2.

## *4.0 REMEDY DESIGN*

## *4.1 SUB-SLAB DEPRESSURIZATION (SSD) SYSTEM*

### *4.1.1 Sub-Slab Depressurization (SSD) System Objectives and Performance Criteria*

The performance criteria refer to the ability of the components of the system, including mechanical devices, to function as designed. The performance objectives of the SSD system are as follows:

- Soil vapor flow beneath the Site will be achieved throughout the entire area of sub-slab region through implementation of multiple suction pits as depicted in Figure 4-1. Vapors will be ventilated from suction pits, routed to the vent pipe via the manifold, and through the exit point above the roof. The SSD system shall be capable of maintaining a vacuum beneath the entire slab.

- Design and/or operational modifications to achieve the required vacuum measurements, can include, but are not necessarily limited to, the following:

  - Construction of additional suction pits;
  - Increasing the fan size; and
  - Additional sealing of cracks.

- The foremost objective of the SSD system is to prevent VOCs from entering the Site via soil gas intrusion. Once the system is installed and in normal operation for at least 30 consecutive days, indoor air and soil gas samples will be collected as described below:
  - Four indoor air samples will be collected from inside the Site. Four total samples will be collected, two samples each from within the Site's concrete and wood buildings, respectively, at the garage level and on an intermediary floor. The indoor air samples will be collected over a 24-hour period.
  - Two subsurface soil gas samples will also be collected, one each from beneath the Site's concrete and wood buildings, respectively. These samples will be collected from just below the building slab using temporary soil gas sample points. The

subsurface soil gas samples will be collected over a 24-hour period to coincide with the indoor air samples.

- Immediately prior to the collection of each soil gas sample, one gas volume will be purged from the implant using a vacuum pump. To ensure against infiltration of atmospheric air into the sample, the ground surface around the implant will be covered with plastic sheeting, and helium will be injected under the sheeting during implant purging. A sample of the purge air will be collected in a Tedlar bag, and a portable helium indicator will be used to monitor for the presence of helium in the sample. Once it is confirmed that helium (and atmospheric air) is not infiltrating the sample, collection of the soil gas sample will commence.
- The indoor air and soil gas samples will be collected using a Summa Canister at a flow rate of 0.1 liters per minute or less. Each sample will be analyzed using EPA Method TO-15 for TCE and PCE.
- The indoor air and soil gas sample results will be compared to the decision matrices included in the NYSDOH Guidance for Evaluating Soil Vapor Intrusion (NYSDOH, 2006).

### 4.1.2 *Sub-Slab Depressurization (SSD) System Shutdown Criteria*

The *Draft* SMP (Appendix A) outlines periodic monitoring of soil gas and indoor air at the Site and shutdown criteria. Any shutdown request will be subject to NYSDEC approval.

### 4.1.3 *Pilot Testing*

Figure 2-2 presented the cover for the Site. In areas where new concrete slab is to be poured (i.e., where wood flooring is to be removed and in areas of poor concrete condition), a minimum of 4 inches thickness of ASTM #5 aggregate base material will be installed beneath the concrete slab. The ASTM #5 will promote the collection of sub-slab vapors that will then be diverted into the SSD system. Hence, communications tests will not be performed in areas where a 4-inch base layer of ASTM #5 aggregate is installed.

In areas where existing slab is to remain in place, the subsurface soils are presumed to be variable and heterogeneous. Hence, qualitative

communications tests will be implemented in these areas prior to installation of the full-scale SSD system. The purpose of the communications test is to evaluate the air flow beneath the Site, and determine the potential of the suction field to collect and dispel sub-surface vapors.

Small (approximately 3/8 inch) holes will be drilled through the Site slab, and the drill will be used to create a small void below the slab. A vacuum will be used to apply varied vacuums and flow rates to the hole using a portable vacuum pump. The response will be evaluated by measuring the vacuum at other points in the vicinity (using Magnehelic-type differential pressure gauges), or by observing the in-flow of smoke to the monitoring points. In addition, smoke tubes may be used for the communication test. Suction is applied on the centrally positioned hole and then the movement of smoke downward into the slab at radial points is observed.

The results of the communications tests will be scaled up to determine the spacing of suction pits throughout the Site. If the test shows that vacuum response can be observed at the monitoring points, then the SSD system will be installed based upon the applied vacuum, observed flow, and spacing. If the vacuum response is insufficient at the monitoring points, then the spacing would be reduced, until a sufficient response is obtained.

Based upon the results of the communications test, the number of suction pits will be re-evaluated to determine whether 18 pits are necessary or if less suction pits are sufficient. According to USEPA guidance, one suction pit is sufficient to depressurize the subsurface of a 100,000 sf building in a new building, provided that there are no sub-slab walls and there is a continuous four to six inch layer of ASTM Size #5 aggregate under the slab (USEPA, June 1994). A minimum 4-inch layer of ASTM Size #5 aggregate will be placed beneath new concrete slab to be installed within areas of the Site's wood building. In the Site's concrete building, existing slab is to remain in place. Hence, 18 pits were selected as a conservative number of pits with an approximate spacing of one suction pit every 2,500 sf. It is possible based upon the results of the communications test, that a vacuum may be achieved beneath the entire slab by using fewer suction pits. Section 4.1.4 discusses the rationale for suction pit siting in more detail.

After SSD system installation, a pressure field extension test (PFE) will be performed to confirm proper operation as discussed in Section 4.1.7.

### 4.1.4 *Sub-Slab Depressurization System (SSD) Suction Pit Layout*

The extent of the pressure field is the distance that a pressure change is induced in the sub-slab area. The vacuum needs to extend beneath the entire slab to prevent upward vapor migration. This will be evaluated by measuring the vacuum with Magnehelic-type differential pressure gauges and/or smoke testing. An observable influence causing smoke to flow downward into at a monitoring point is evidence of sufficient depressurization of the sub-surface.

The system spacing shown in Figure 4-1 is intended to provide for complete coverage of the Site. Suction pits will be placed in multiple areas based upon the variability of construction throughout the building. That is, foundation elements or existing sub-surface walls may present impediments to air flow between areas of the wood building and the concrete building. Also, the boiler room construction is relatively separate from either the wood or concrete buildings. Finally, there are existing subsurface walls that will remain in place where the existing wood and concrete buildings' cellars are located. The wood and concrete buildings' cellars will be permanently filled and sealed off. Thus, to provide for maximum extension of the pressure field beneath the Site slab, suction pits will be placed in each area of the Site. Additionally, suction pits will be centrally located between column footings.

The following describes the rationale for the placement of suction pits for the SSD system:

- Two suction pits are placed within the existing boiler room area (this is considered to be within the Site's wood building);
- Two suction pits each are placed within the to-be-filled concrete and wood buildings' cellars;
- Four suction pits are placed beneath the remainder of the Site's wood building; and
- Eight suction pits are placed beneath the Site's concrete building;

Thus, soil vapor flow beneath the Site will be achieved throughout the entire sub-slab region through implementation of multiple suction pits as depicted in Figure 4-1. Vapors will be ventilated from suction pits, routed to the vent pipe via the manifold, and through the exit point above the roof. A vacuum level shall be achieved beneath the entire slab. As

discussed in Section 4.1.3 above, the number of suction pits selected (e.g., 18 suction pits) is believed to be a conservative number of pits. Based upon the results of the communications test, less suction pits may be needed to achieve a vacuum beneath the Site's entire slab.

### *4.1.5 Design of SSD Suction Pits*

Figures 3-1 and 3-2 present the two types of suction pits to be utilized for the SSD system. In areas of the wood building where new aggregate and concrete slab are to be installed, approximate three foot by three foot suction pits will be constructed (see Figure 3-1) prior to pouring the new slab. In areas where concrete floor is to remain in place, approximate two foot by two foot suction pits will be constructed through the existing concrete.

As shown in Figure 3-1, a minimum of four inches of ASTM #5 aggregate shall be installed beneath new concrete slab. The ASTM #5 aggregate shall have gravel sized between ½-inch and 1-inch in diameter, with less than 10% passing through a ½-inch sieve. This aggregate will provide a highly permeable layer for collection of any vapors. These suction pits will have a concrete base with #13 expanded metal sides (having ½-inch by 1-inch slots) welded to angle supports, with 1.5-inch galvanized metal deck covers. Suction pits shall be 12-inches in height. A 6-inch diameter Schedule 40 PVC vent pipe shall exit the suction pit horizontally. The vent pipe shall be sloped towards the suction pit so that any moisture vapor will run back into the pit. Where new ASTM # 5 aggregate and concrete slab are to be installed in the Site's wood building, the suction pits and vent piping will be positioned within the aggregate material prior to pouring new concrete.

Figure 3-2 shows a schematic of the suction pits to be installed in the Site's concrete building for the SSD-system, or in any location where new concrete slab and aggregate will not be installed. It is anticipated that suction pits located within the Site's concrete building will be installed by coring a 6-inch hole through the concrete. A trowel or other hand tools will be used to dig out as much material as possible to create a void space as large as possible. Typically, a 2-foot by 2-foot by 2-foot suction pit can be achieved by this method. A 4-inch vent pipe will be installed from the suction pit and through a trench that is cut through existing concrete.

The vent pipes from suction pits shall run below grade to the nearest column where it will connect to a bend to exit the floor to a vertical length that shall be affixed to the nearest column. The vertical length along the

column shall have a sample port. At the ceiling of the garage, there will be another bend and the piping will run along the ceiling to join other piping that runs towards the manifold.

### *4.1.6 Sub-Slab Depressurization (SSD) System Appurtenances*

**Mechanical Components**

The major components of this remedial system include:

- One SSD fan (estimated flow requirement of 500-600 cfm to be verified after performing pilot testing);
- Piping and manifold; and
- Supporting instrumentation.

The SSD system will be equipped with a control panel that includes: start/stop/auto switch, run light, shutdown capability (including: high differential pressure and fan off alarm), and alarm light. It is anticipated that an in-line duct fan rated from 500 to 600 cubic feet per meter (cfm) at zero inches static pressure will be used to generate the necessary sub-slab depressurization. The final fan rating will be verified after pilot testing.

**Piping and Layout**

The layout of the field piping is presented in Figure 4-1. All pipes shall be Schedule 40 6-inch diameter PVC.

**Utilities and Power**

Electric service to the SSD system can be provided by existing electrical service at the Site. There currently exists 240-volt, 3-phase and 110-volt, 1-phase service throughout the Site.

**System Sampling and Monitoring Ports**

The piping from each of the suction pits will manifold together to a common vent pipe. On each of the SSD lines, just above where the pipe exits the concrete slab, a sampling port will be installed. The sampling port will consist of a petcock valve. This port may be used to extract a vapor sample for analysis or to measure the vacuum within the system. This will be located in a straight length of pipe that is approximately three feet upstream and downstream or any turns or fittings.

After the sample valves, the individual pipes will be routed to the manifold location and will manifold together into a single header. The manifolded line will then travel up to the roof. Appropriate fire stop material selected by the building Architect will be placed in any gaps between piping and any fire rated wall, ceiling deck, or floor deck. Labels, identifying the vent pipe, will be placed at regular intervals (i.e., one per floor) along the entire pipe run. A vacuum gauge port and gauge will be installed prior to the fan for measurement collection. The vapor stream will then pass through the fan.

The fan exhaust piping will extend a minimum of 12 inches above the highest point on the roof level of the building, and a minimum of 10 feet away from any air intake. A warning sign shall be permanently labeled on the vent stack at the roof exit that states "Soil gas vent stack may contain volatile organic chemicals; do not place air intake within 10 feet". The blower will operate continuously, and the system will be equipped with a warning device to indicate loss of negative pressure through fan failure or other causes. Following initial system startup, an air sample of the exhaust will be collected for EPA TO-15 VOC analysis. Though it is not expected to exceed any air permit limits, the results of this sample will be compared to permit limits for TCE and PCE to confirm this.

**Shutdown and Alarms**

The SSD system will have a warning device that can measure a loss in vacuum while the system is running. It will be capable of electronically sensing the pressure and triggering an audible alarm and warning light alarm. This can be accomplished through the use of a flow switch capable of sensing air flow through the system piping. When no air flow is detected, the system alarm will sound/light up.

The alarm/warning device will be placed where it can easily be heard and seen on the garage level of the building. The device will be tested to confirm that it is operational upon installation. As discussed in the *Draft* SMP, the building management and/or garage operators will be made aware of its purpose, location, and what to do if the system is not working properly.

### *4.1.7 Sub-Slab Depressurization (SSD) System Pressure Field Extension (PFE) Test*

A PFE test (similar to the communication test) will also be conducted to ensure the SSD system is generating a vacuum beneath the entire Site slab.

Small (approximately 3/8-inch) holes will be drilled through the floor, and smoke tubes will be used to confirm air flow, or vacuum measurements will be used to confirm the system is reaching the extent of the Site slab. If the test shows improper operation, it will be corrected. Possible corrective measures include: increasing the size of the suction pit, adding suction pits, using a different fan size, or using multiple fans.

If, after operation and corrective measures, there is still reason to suspect that the SSD system is not performing as needed (i.e., inadequate pressure field extension test results), additional indoor air sampling will be conducted, at least 30 days after installation, and during the heating season. Air sampling will be conducted while the SSD system is running to confirm that the system is effective at reducing indoor air concentrations even if the full slab is not influenced by the system operation. Approval will be obtained from NYSDEC before collecting these samples.

### *4.1.8 Sub-Slab Depressurization (SSD) System Documentation*

After successful installation, documentation will be provided to the Site owner to facilitate understanding the system's operation, maintenance and monitoring. This package will include the following:

- a description of the mitigation system installed and its basic operating principles;
- how the Site owner or tenant is to check that the system is operating properly;
- how the system is to be maintained and monitored and by whom;
- a list of appropriate actions for the Site owner or tenant to take if the system's warning device indicates system degradation or failure;
- contact information (e.g., names, telephone numbers, etc.) if the Site owner or tenant has questions, comments or concerns;
- copies of contracts and warranties; and
- a description of the proper operating procedures of any mechanical or electrical system installed, including manufacturer's operation and maintenance instructions and warranties.

In addition to the above documentation, the owner of the Site will be shown the indicators of a properly operating fan. Normal operation is indicated by vacuum on the sub-slab region as shown by the manometer or vacuum gauge. An increase in vacuum would indicate an obstruction on the suction side, such as a slug of water in the line or tightness of the sub-slab soil. A marked decrease in vacuum would indicate a break in the suction line. An absence of vacuum would indicate a fan failure. Following successful completion of the pressure field extension test, operation of the warning device will be confirmed.

A contact person's name and telephone number will be affixed to the piping, should the resident have questions or concerns.

### *4.1.9 Sub-Slab Depressurization (SSD) System Operation, Monitoring, And Maintenance*

The SSD system is designed to require minimal monitoring. Following the initial PFE test and any system modifications, the system will run continuously and be inspected annually with a certification sent to NSYDEC. Full details on the system operation, monitoring, and maintenance (OM&M) may be found in Sections 3.3 and 4.0 of the *Draft* SMP.

## *4.2 SOIL EXCAVATION*

As in the NYSDEC-approved RWP, based upon a restricted-residential use, soil exhibiting lead concentrations greater than 1,000 mg/kg, also known as "hot spot" areas, will be excavated from the beneath the adjacent sidewalks along part of Water Street and Front Street, and in the vicinity of the Site's boiler room, as shown in Figure 2-1. Furthermore, soil exhibiting lead concentrations greater than 400 mg/kg beneath the adjacent sidewalk areas will be excavated as shown in Figure 2-1, which includes additional areas along Front and Bridge Streets.

As discussed in Section 3.1.3, the 400 mg/kg endpoint goal concentration for soil beneath adjacent sidewalk areas is consistent with the Part 375 restricted-residential use SCO, which would be protective of potential future utility workers or construction workers conducting work in these areas. The 1,000 mg/kg endpoint goal concentration for soil beneath the Site would remove known lead hot spots present under the Site's slab. The endpoint concentration of 400 mg/kg and 1,000 mg/kg are considered to be cleanup goals for lead in soil for beneath adjacent

sidewalk areas and the Site building, respectively, but it is recognized that some lead soil concentrations may remain in place above these goals.

A sidewalk permit will be obtained to excavate soil from beneath the adjacent sidewalk areas. Excavation will not be conducted past the point of infringing upon the building structure and foundation, and will extend to the curb line. Figure 2-1 presents the areas to be excavated. This figure is provided for the sole purpose of illustrating the location and depth of soil above the Site SCOs and requiring excavation. The excavation contractor shall provide an excavation plan that is approved by a professional engineer licensed in the State of New York prior to conducting work. Excavations where it is determined to be necessary, or extending greater than four feet in depth, will be properly shored in accordance with Occupational Safety and Hazard Administration (OSHA) regulations and any other applicable regulations. Prior to placing backfill, an indicator layer such as orange plastic snow fence will be installed to demarcate the backfill from the underlying subsurface soil beneath the adjacent sidewalks.

In the event that plantings (i.e. curb boxes with trees or flowers) are placed within the adjacent sidewalk areas outside of the delineated excavation areas shown in Figure 2-1, the areas for curb boxes will also be excavated to two feet below existing grade and the soil will be disposed of off-Site. Prior to placing backfill, an indicator layer such as orange plastic snow fence will be installed to demarcate the cover soil from the underlying subsurface soil beneath the adjacent sidewalks. The top two feet of soil will be replaced with clean fill, the top six inches of which will be of sufficient quality to support vegetation. Clean soil will constitute soil that meets the 6 NYCRR Part 375-6.7(d) criteria for backfill.

An access way will be installed in the side of the Site to allow excavation machinery to operate in the interior of the building. Approximately 38 cy of overlying concrete will be removed and stockpiled from the lead excavation areas, and subsequently transported to an approved and appropriately licensed disposal facility. Excavated soil will be loaded into trucks and characterized as either hazardous or non-hazardous waste via sampling. Based on previous TCLP soil testing, hazardous soil is considered to be soil exhibiting lead concentrations greater than 1,000 mg/kg. The total soil volume to be excavated is approximately 717 cy. Of this soil volume, approximately 456 cy is considered potentially hazardous upon excavation and the approximate 261 cy balance of the soil is anticipated to be non-hazardous.

Currently, the plan for the Site redevelopment includes filling the Site wood and concrete cellars with backfill and permanently sealing these areas. The RWP included excavating and capping drains in the wood and concrete cellars. Thus, under the current plan for the Site, the cellars will be filled and sealed, and the drains will be permanently covered and inaccessible. Hence, it is not deemed necessary to excavate these areas prior to filling and sealing the Site's cellars. Filling and sealing these cellars will also help to decrease the potential of subsurface vapors migrating into the building.

Soil for off-site disposal will be sampled in place prior to excavation for waste characterization parameters consistent with the selected disposal facility's requirements. Soil will be analyzed at a minimum for full target compound list (TCL)/target analyte list (TAL) analyses, TCLP, and Resource Conservation and Recovery Act (RCRA) hazardous waste characteristics prior to disposal. Following excavation, the soil will be transported to an approved and appropriately licensed disposal facility. It is anticipated that the soil that is excavated with lead concentrations greater than 1,000 mg/kg will be disposed of as hazardous waste. As stated above, the additional soil excavated is presumed to be non-hazardous (i.e., with lead concentrations between 400 mg/kg and 1,000 mg/kg).

Approximately 28 documentation soil samples will be collected for laboratory for total lead analysis, one from each excavation area sidewall and base. After excavation, clean fill material will be provided by a subcontractor as backfill, and concrete will be installed over the backfill. Clean soil will constitute soil that meets the 6 NYCRR Part 375-6.7(d) criteria for backfill.

Any soil left in place that contains chemical concentrations above the restricted-residential use SCOs will be managed through a SoMP as part of the overall SMP. Appendix A is a *Draft* SMP for NYSDEC review, which contains a *Draft* SoMP. Following remedy implementation, documentation of soil sample results for lead in soil at a concentration above 400 mg/kg will be reported in the final SMP, as well as existing PAH and metals concentrations in place that are known to be above the restricted-residential SCOs.

A HASP and CAMP will be implemented during all remedial activities (see Appendices B and C, respectively). These plans will serve to verify the safety of workers potentially exposed to contaminated soil and soil vapor, as well as the air of the surrounding area.

## *4.3 COVER OF THE SITE AND ADJACENT SIDEWALK AREAS*

A cover will prevent direct contact with any underlying impacted residual soils. The cover will be a minimum of six inches in thickness in concrete areas (i.e., concrete pavement in the adjacent sidewalk areas or concrete Site slab) where excavation is performed. In the event that plantings are placed along the adjacent sidewalk areas, the Site cover will be a minimum of two feet of clean fill. Figure 2-2 presented the types of cover to be installed at the Site and over the adjacent sidewalk areas. These are summarized here:

- The existing Site's concrete building's cellar is to be filled and permanently sealed. The cover for this cellar will be existing concrete flooring on the garage level.

- The existing Site's wood building's cellar is to be filled and permanently sealed. The existing wood flooring above this cellar will be demolished. The final cover for this area will be a minimum six-inches combined total thickness of concrete and underlying minimum four inches of ASTM #5 aggregate.

- The concrete building's floor slab was found to be as much as three and a half feet thick in the southern portion of the Site. This concrete slab is to remain in place. Any cracks or discontinuities in the concrete floor will be repaired.

- The concrete slab in the boiler room and the western portion of the wood building is in deteriorated condition. Thus, this slab will be demolished in places, or new slab will be poured over existing slab for a solid surface. The final cover in areas where existing flooring is demolished will be a minimum six-inches total thickness of concrete and underlying minimum four inches of ASTM # 5aggregate.

- Lead-impacted soils will be excavated from beneath the adjacent sidewalk areas and an area of the Site's boiler room. These areas will be backfilled with clean fill. The final cover will be a minimum six-inches total thickness of aggregate/clean fill and concrete.

- Soils beneath adjacent sidewalk areas that are not excavated will remain in place. Any cracks or discontinuities in the concrete sidewalk

will be repaired. Any such repairs will be coordinated to coincide with the work for the redevelopment of the property. Alternatively, if existing sidewalk is to be demolished and new sidewalk to be installed, the final cover will be a minimum six-inches total thickness of aggregate/clean fill and concrete.

- The wood flooring in the Site's wood building will be demolished. Concrete slab will be poured in this area. The final cover will be a minimum six-inches total thickness of concrete and underlying minimum four inches of ASTM #5 aggregate.

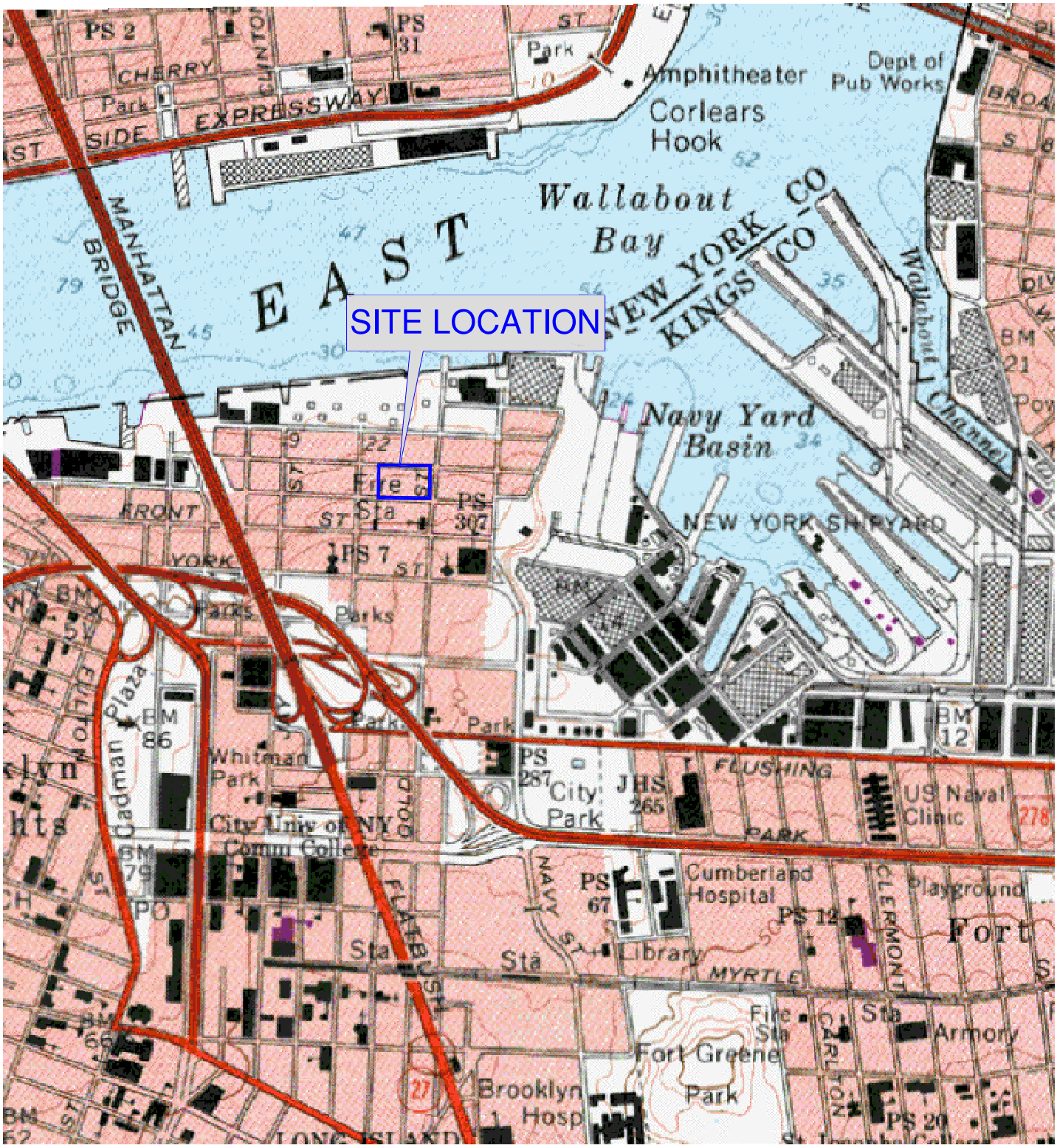
The cover for the Site and the adjacent sidewalk areas will be maintained through the SMP (see Appendix A for the *Draft* SMP) and certified annually to NYSDEC.

## *4.4 SUPPORTING PLANS*

A HASP and CAMP will be implemented during all remedial activities. These plans are attached as appendices, and will serve to verify the safety of workers potentially exposed to contaminated soil and soil vapor, as well as the air of surrounding area. A Quality Assurance Project Plan will be followed for all soil and soil vapor sample collection and analysis. The HASP is provided in Appendix B, the CAMP in Appendix C, and the QAPP in Appendix D.

## *4.5 SCHEDULE*

The schedule for the work is shown in Figure 4-2. The remedial work will be coordinated with the Site redevelopment work to synchronize activities (i.e., suction pits in the wood building should be constructed prior to pouring of new concrete slab). It is anticipated that the remedial work may be complete within three months of NYSDEC approval of the RAWP: Supplemental Design Report, dependent upon the Site redevelopment schedule. Following remedial action implementation, a Remedial Action Report documenting the activities at the Site and adjacent sidewalk areas, results of documentation soil samples, and SSD-system start-up testing will be submitted to NYSDEC.




0 1,000 2,000

GRAPHIC SCALE

N

REFERENCE:
A PORTION OF USGS 7.5 MINUTE TOPOGRAPHIC MAP; BROOKLYN QUADRANGLE, NEW YORK; 1969; PHOTREVISED 1979.

TITLE

SITE LOCATION MAP
220 WATER STREET
BROOKLYN, NEW YORK

PREPARED FOR

220 WATER STREET

ERM Environmental Resources Management

| SCALE | FIGURE |
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| GRAPHIC | 1 – 1 |

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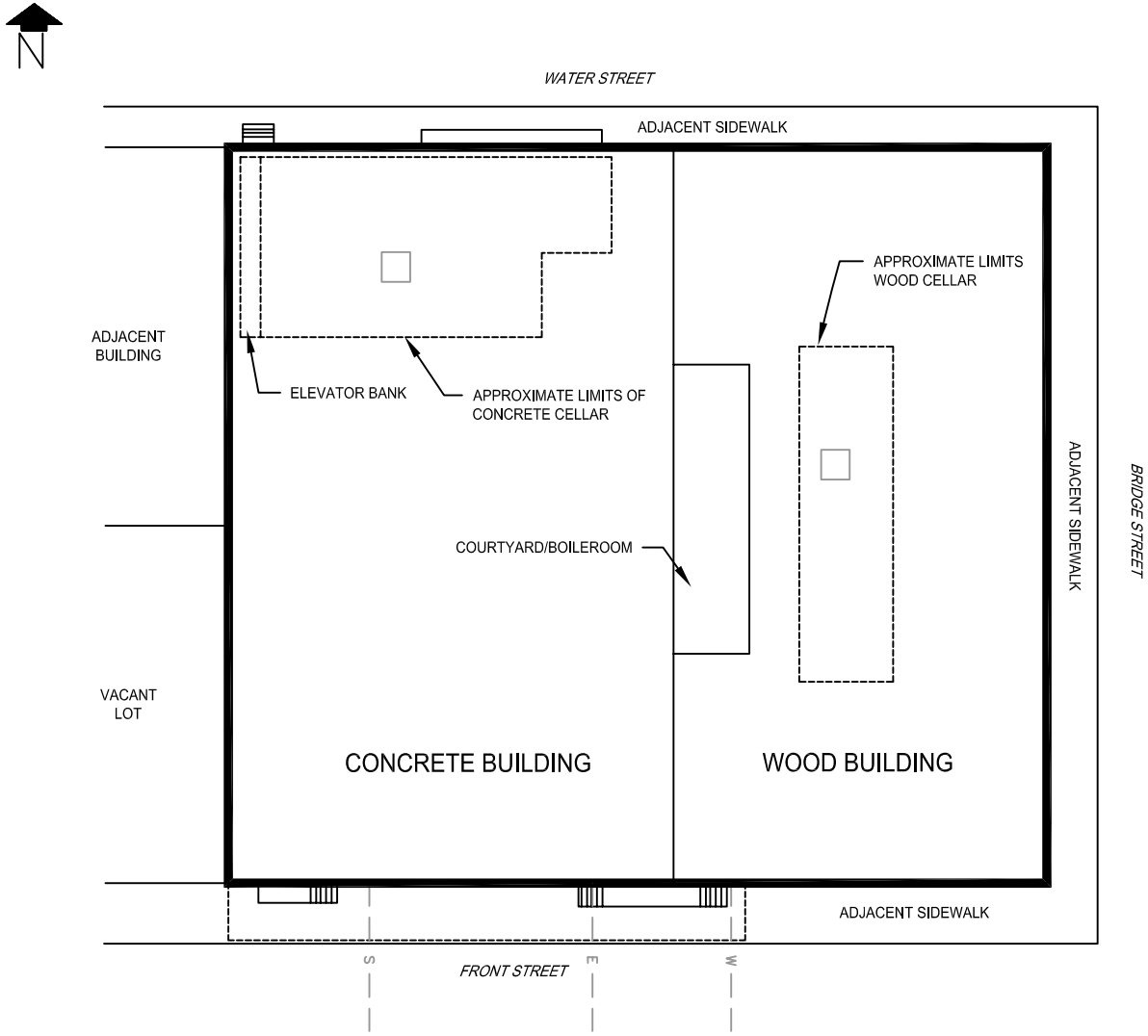


LEGEND

DRAIN (CONCRETE CELLER)/AREA OF MISSING CONCRETE(WOOD CELLER)

SITE BOUNDARY

NOTES:
1. EXTERIOR LOCATIONS TO SCALE
2. INTERIOR LOCATIONS ARE APPROXIMATE
SOURCE: BASED ON JADE ENVIRONMENTAL, INC. DRAWING DATED 07/09/04

50 25 0 50

SCALE IN FEET

TITLE

SITE BOUNDARY AND ADJACENT SIDEWALK AREA
220 WATER STREET
BROOKLYN, NY

PREPARED FOR

220 WATER STREET

ERM Environmental Resources Management

| SCALE | FIGURE |
|---|---|
| GRAPHIC | 1–2 |

| DRAWN: | JOB NO.: | FILE NAME: | DATE |
|---|---|---|---|
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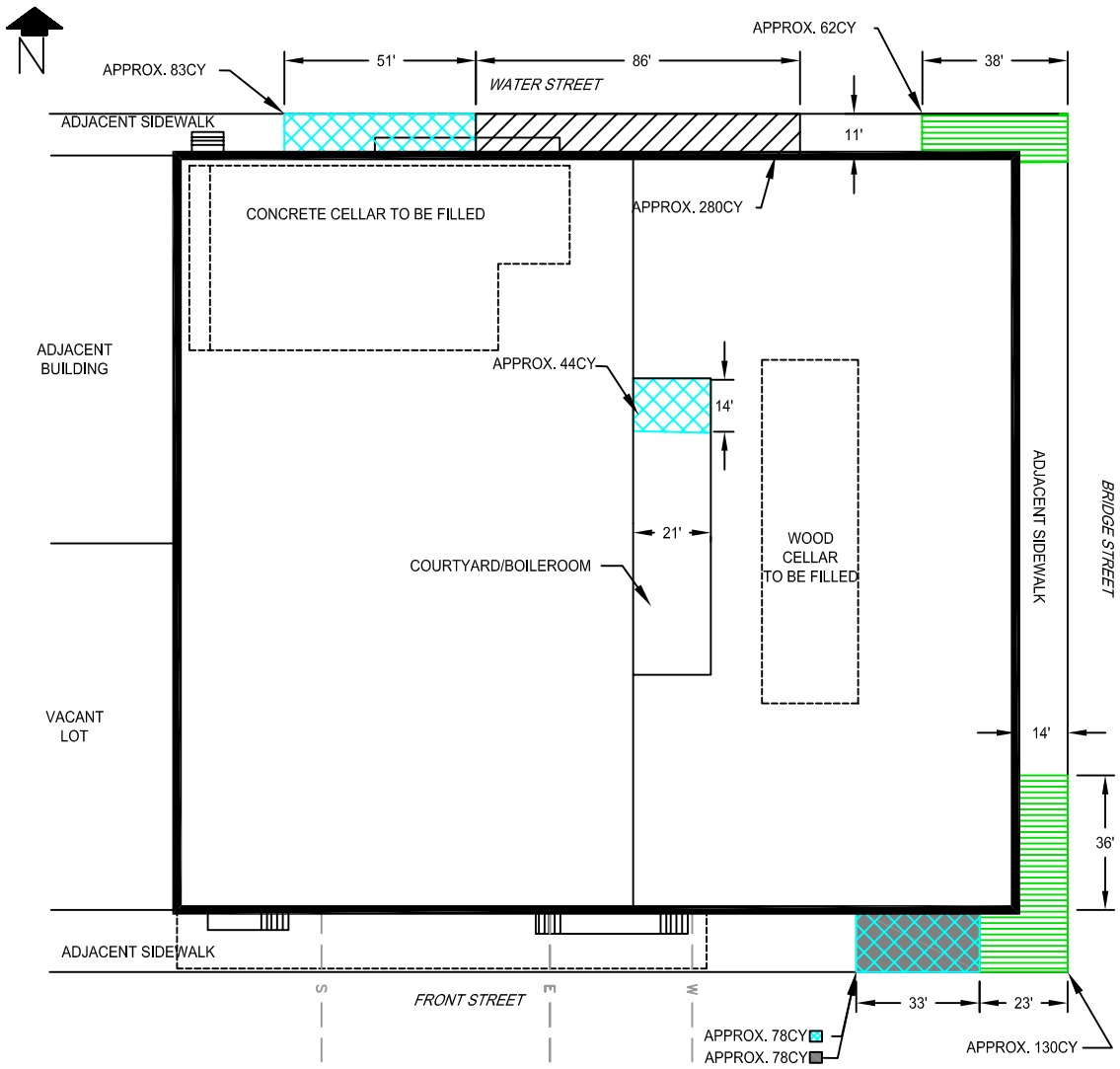


LEGEND

- SITE BOUNDARY
- 0 - 4' EXCAVATION WITH TOTAL LEAD > 400 mg/kg (192 CY)
- 0 - 4' EXCAVATION WITH TOTAL LEAD > 400 mg/kg (192 CY)
- 0 - 4' EXCAVATION WITH TOTAL LEAD > 1,000 mg/kg (205CY)
- 0 - 8' EXCAVATION WITH TOTAL LEAD > 1,000 mg/kg (280CY)
- 4 - 8' EXCAVATION WITH TOTAL LEAD > 400 mg/kg (78CY)
- CELLAR TO BE FILLED AND PERMANENTLY SEALED
- 10' MEASUREMENT IN FEET

NOTES:
1. EXTERIOR LOCATIONS TO SCALE
2. INTERIOR LOCATIONS ARE APPROXIMATE
3. SCO = SOIL CLEANUP OBJECTIVE
4. CY = CUBIC YARDS
5. INDICATED VOLUMES INCLUDE OVERLYING CONCRETE
6. THIS FIGURE IS PROVIDED FOR THE SOLE PURPOSE OF ILLUSTRATING THE APPROXIMATE LOCATION AND DEPTH OF SOIL ABOVE THE SITE SOIL CLEANUP OBJECTIVES (SCO) AND REQUIRING EXCAVATION. ANY MEANS NEEDED TO PROTECT THE INTEGRITY OF THE BUILDING, UTILITIES, SIDEWALK, STREETS, OR ANY OTHER ADJACENT STRUCTURES IS THE RESPONSIBILITY OF OTHERS.

SOURCE: BASED ON JADE ENVIRONMENTAL, INC. DRAWING DATED 07/09/04, AND KELLER AND KIRKPATRICK SURVEY

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SCALE IN FEET

TITLE

SOIL EXCAVATION TO RESTRICTED-RESIDENTIAL USE SCO FOR LEAD BENEATH ADJACENT SIDEWALKS AND TO 1,000mg/kg BENEATH SITE

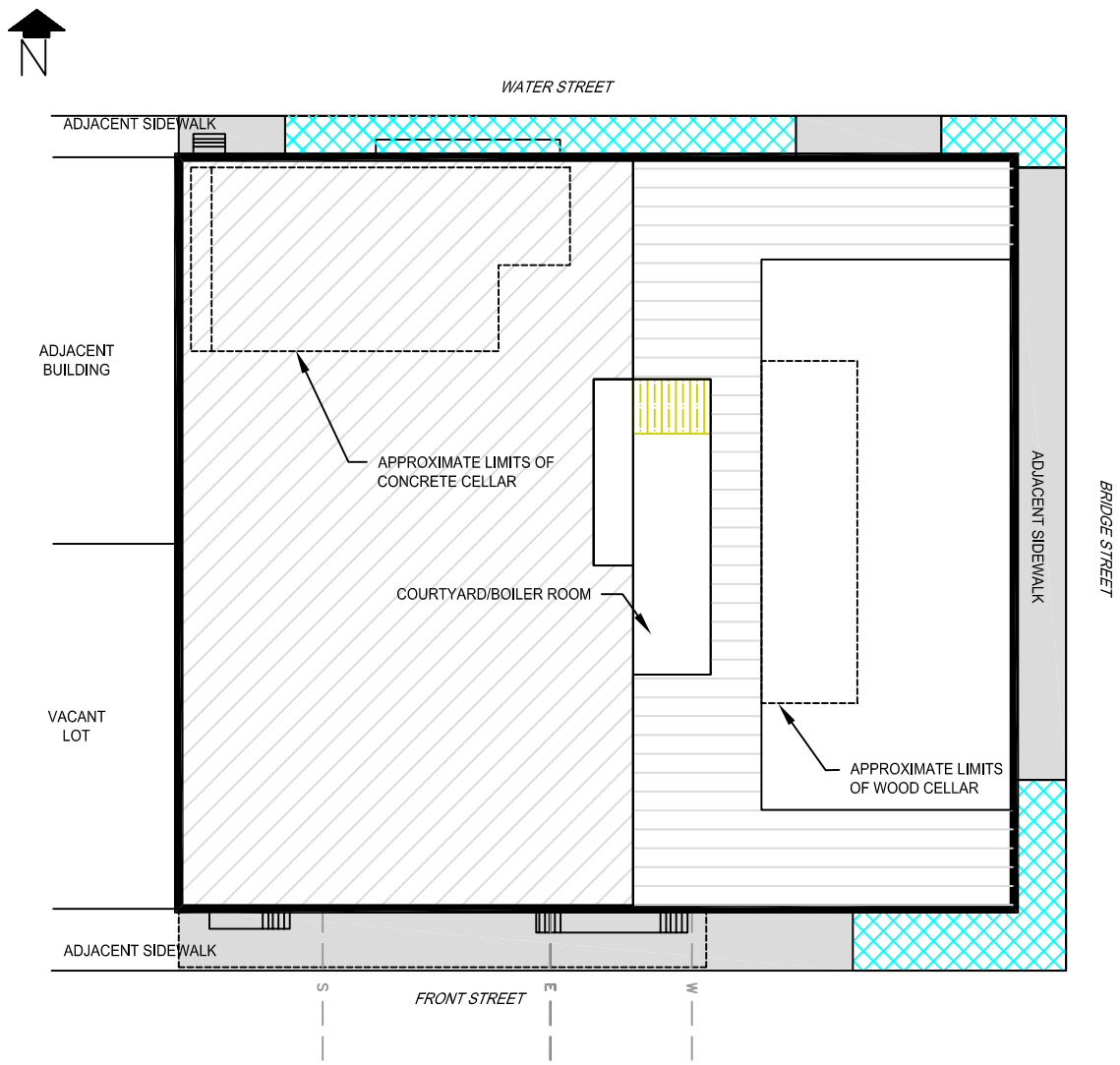
PREPARED FOR

220 WATER STREET

ERM Environmental Resources Management

| SCALE | FIGURE |
|---|---|
| GRAPHIC | 2-1 |

| DRAWN: | JOB NO.: | FILE NAME: | DATE |
|---|---|---|---|
| MLB/EMF | 0022103 | 0022103-00-020 | 2/15/08 |




LEGEND

- SITE BOUNDARY
- APPROXIMATE AREA OF CELLAR TO BE FILLED.
- APPROXIMATE AREA OF EXISTING FLOOR TO REMAIN IN PLACE. ADDITIONAL CONCRETE MAY BE POURED OVER THE EXISTING FLOOR.
- APPROXIMATE AREA OF CONCRETE SLAB TO BE REMOVED AND REPLACED OR ADDITIONAL SLAB TO BE POURED. FINAL COVER WILL BE MINIMUM 6" TOTAL THICKNESS OF ASTM #5 AGGREGATE AND CONCRETE.
- APPROXIMATE AREA OF AREA TO BE EXCAVATED AND DISPOSED OFF-SITE (SEE NOTE 1) THE FINAL COVER WILL BE MINIMUM 6" TOTAL THICKNESS OF ASTM#5 AGGREGATE AND CONCRETE.
- APPROXIMATE AREA OF ADJACENT SIDEWALK AREA TO BE EXCAVATED AND DISPOSED OFF-SITE (SEE NOTE).THE FINAL COVER WILL BE MINIMUM 6" TOTAL THICKNESS OF CLEAN FILL/AGGREGATE AND CONCRETE.
- APPROXIMATE AREA OF EXISTING CONCRETE SIDEWALK TO REMAIN IN PLACE (SEE NOTE 2).
- APPROXIMATE AREA OF WOOD FLOORING/CONCRETE SLAB TO BE REMOVED. CONCRETE SLAB TO BE POURED. FINAL COVER WILL BE MINIMUM 6" TOTAL THICKNESS OF AGGREGATE/CLEAN FILL AND CONCRETE.

SOURCE: BASED ON JADE ENVIRONMENTAL, INC. DRAWING DATED 07/09/04.

NOTES:

1. THESE AREAS ARE TO HAVE SNOW FENCING PLACED AT BASE OF EXCAVATION TO DISTINGUISH BETWEEN COVER AND NATIVE MATERIALS.
2. SOIL TO A DEPTH OF TWO FEET BELOW GRADE BENEATH ADJACENT SIDEWALKS MAY BE EXCAVATED AND DISPOSED OFF-SITE TO ALLOW FOR TWO FEET OF CLEAN FILL FOR CURB BOXES/PLANTIGS TO BE INSTALLED.

50 25 0 50

SCALE IN FEET

TITLE

COVER FOR SITE AND ADJACENT SIDEWALK AREAS
220 WATER STREET
BROOKLYN, NY

PREPARED FOR

220 WATER STREET

ERM Environmental Resources Management

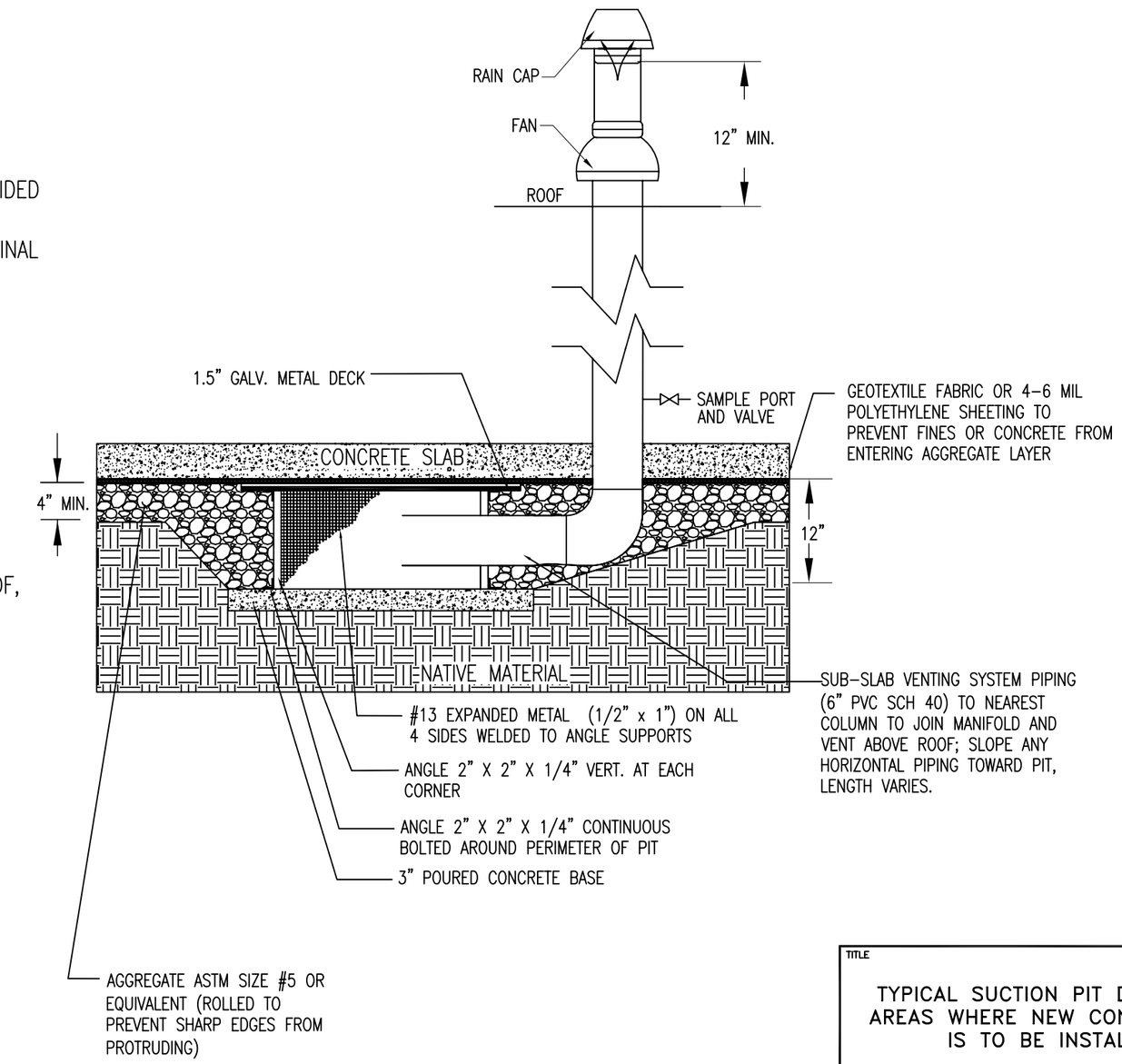
| SCALE | FIGURE |
|---|---|
| GRAPHIC | 2-2 |
| DATE | |
| 2/11/08 | |

| DRAWN: | JOB NO.: | FILE NAME: |
|---|---|---|
| JMC/EMF | 0022103 | 0022103-00-030 |

R:\Melville Projects\220 water street\REPORT\FIGURE 2-2.dwg (03/17/2008 - 5:07pm Boston)

NOTES

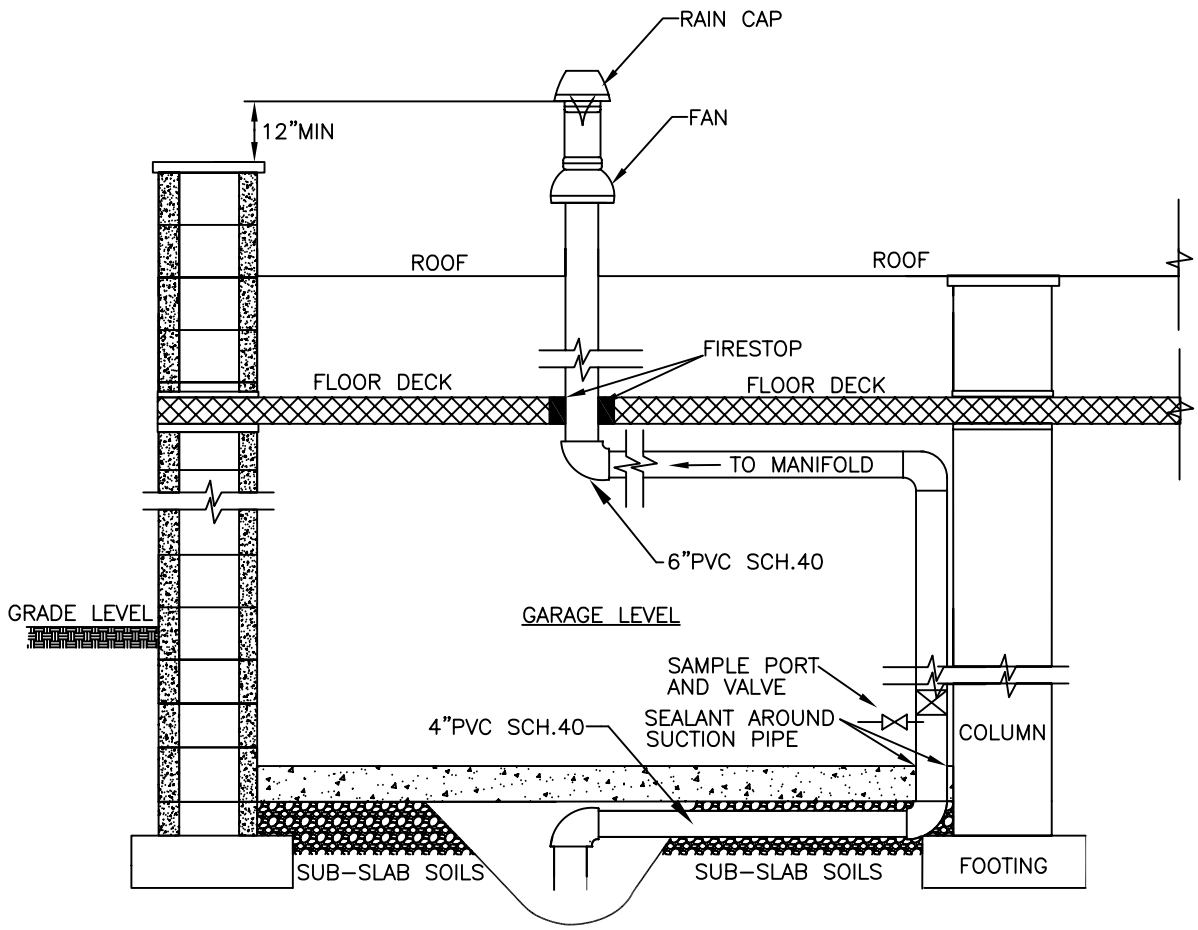
1) THIS DRAWING IS NOT FOR CONSTRUCTION. THIS DRAWING IS PROVIDED TO SHOW THE GENERAL ARRANGEMENT OF THE SUB-SLAB DEPRESSURIZATION SYSTEM AND MAY BE MODIFIED PENDING THE FINAL SITE DESIGN AND COMMUNICATIONS TEST.
2) SUCTION PIT SHALL MEASURE 3FT X 3 FT X 1 FT DEEP.
3) 4" MINIMUM AGGREGATE SHALL EXTEND ACROSS THE WOOD BUILDING FOOTPRINT WHERE NEW CONCRETE IS TO BE INSTALLED. A CONCRETE/AGGREGATE OF 6" MINIMUM TOTAL THICKNESS COVERAGE WILL BE IN PLACE OVER NATIVE MATERIAL.
4) EXHAUST PIPING SHALL BE MOUNTED TO THE NEAREST INTERIOR WALL OR COLUMN CLOSEST TO SUCTION PIT AND MANIFOLDED TO A COMMON VENT TO THE ROOF THROUGH A VERTICAL EXHAUST STACK (6" PVC SCH 40) AT A POINT AT LEAST 12" ABOVE THE HIGHEST POINT ON THE ROOF, AND AT LEAST 10 FT FROM OTHER BUILDINGS AND HVAC INTAKES.
5) A FAN SHALL BE INSTALLED AT THE EXHAUST POINT.
6) SAMPLE PORTS SHALL BE PROVIDED IN THE PIPING FOR EACH SUCTION PIT. SAMPLE PORTS SHALL INCLUDE 1/4" BALL VALVE AND HOSE BARB.
7) THIS DRAWING DEPICTS THE REQUIRED ELEMENTS OF THE SUB-SLAB DEPRESSURIZATION SYSTEM IN AREAS WHERE NEW CONCRETE SLAB IS TO BE INSTALLED. DESIGN OF CONCRETE SLAB AND NECESSARY REINFORCEMENT (I.E.REBAR) IS TO BE PERFORMED BY OTHERS.
8) HORIZONTAL BELOW GRADE PIPE LENGTHS TOWARD SUCTION PITS SHALL BE PITCHED 1/8" PER FOOT.




SUB-SLAB SUCTION PIT CROSS-SECTION

NOT TO SCALE

| | | | | |
|---|---|---|---|---|
| TITLE: TYPICAL SUCTION PIT DETAIL FOR AREAS WHERE NEW CONRETE SLAB IS TO BE INSTALLED | | | | |
| PREPARED FOR: 220 WATER STREET | | | | |
| ERM Environmental Resources Management | | | SCALE: NTS | FIGURE: 3-1 |
| DRAWN: JPM/EMF | JOB NO.: 0022103 | FILE NAME: 0022103-00-029 | DATE: 2/13/08 | |




NOTES

1) THIS DRAWING IS NOT FOR CONSTRUCTION. THIS DRAWING IS PROVIDED TO SHOW THE GENERAL ARRANGEMENT OF THE SUB-SLAB DEPRESSURIZATION SYSTEM AND MAY BE MODIFIED PENDING THE FINAL SITE DESIGN AND COMMUNICATIONS TEST.
2) EXHAUST PIPING SHALL BE MOUNTED TO THE NEAREST INTERIOR WALL OR COLUMN CLOSEST TO SUCTION PIT AND MANIFOLDED TO A COMMON VENT TO THE ROOF THROUGH A VERTICAL EXHAUST STACK (6" PVC SCH 40) AT A POINT AT LEAST 12" ABOVE THE HIGHEST POINT ON THE ROOF, AND AT LEAST 10 FT FROM OTHER BUILDINGS AND HVAC INTAKES.
3) FAN(S) SHALL BE INSTALLED AT THE EXHAUST POINT.
4) SAMPLE PORTS SHALL BE PROVIDED IN THE PIPING FOR EACH SUCTION PIT. SAMPLE PORTS SHALL INCLUDE 1/4" BALL VALVE AND HOSE BARB.
5) THIS DRAWING DEPICTS THE REQUIRED ELEMENTS OF THE SUB-SLAB DEPRESSURIZATION SYSTEM IN AREAS WHERE EXISTING CONCRETE IS TO REMAIN IN PLACE. DESIGN OF CONCRETE SLAB AND NECESSARY REINFORCEMENT (I.E.REBAR) IS TO BE PERFORMED BY OTHERS.
6) HORIZONTAL BELOW GRADE PIPE LENGTHS TOWARD SUCTION PITS SHALL BE PITCHED 1/8" PER FOOT.

TITLE

TYPICAL SUCTION PIT DETAIL WHERE EXISTING CONCRETE IS TO REMAIN IN PLACE

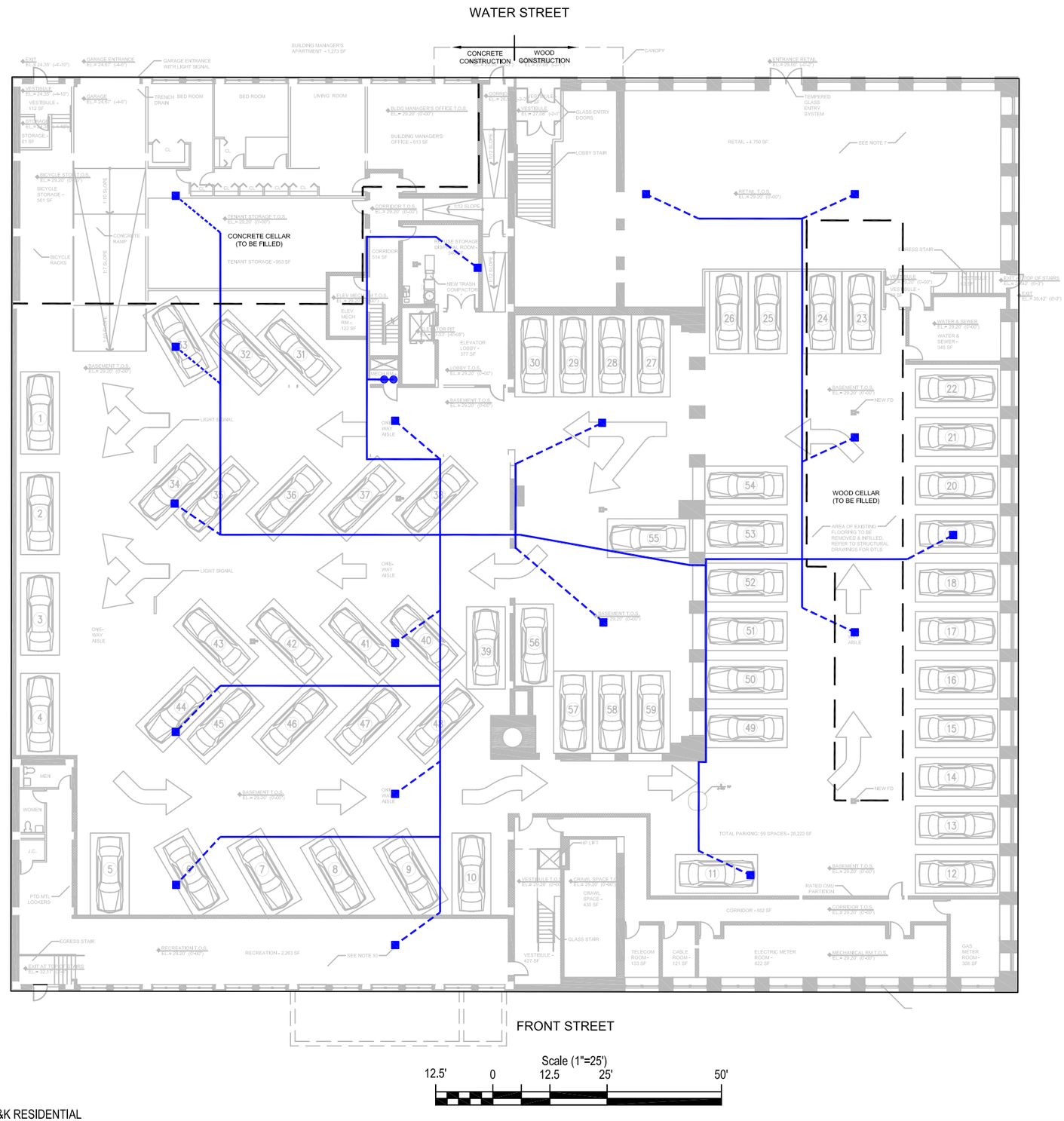
PREPARED FOR

220 WATER STREET

ERM Environmental Resources Management

| DRAWN: | JOB NO.: | FILE NAME: | SCALE | FIGURE |
|---|---|---|---|---|
| SMC | 0022103 | 0022103-00-024 | NTS | 3-2 |
| | | | DATE 2/27/08 | |

R:\Melville Projects\220 water street\REPORT\FIGURE 3-2.dwg (03/17/2008 - 5:18pm Boston)




BASE DRAWING SOURCE: EE&K RESIDENTIAL

Notes:

1. THIS DRAWING IS NOT FOR CONSTRUCTION. THIS DRAWING IS PROVIDED TO SHOW THE GENERAL ARRANGEMENT OF THE SUB-SLAB DEPRESSURIZATION SYSTEM AND MAY BE MODIFIED PENDING THE FINAL SITE DESIGN AND COMMUNICATIONS TEST. LOCATIONS OF PIPING AND VENT SUBJECT TO CHANGE BASED UPON FINAL SITE DESIGN AND COMMUNICATIONS TEST.
2. VENT PIPE SHALL BE CONSTRUCTED TO THE ROOF THROUGH THE STAIRWELL WHERE INDICATED,OR SIMULAR LOCATION.
3. ALL PIPING IS 6-INCH DIAMETER SCHEDULE 40 PVC, EXCEPT PIPING FROM SUCTION PITS IN CONCRETE BUILDING SHALL BE 4-INCH DIAMETER SCHEDULE 40 PVC.
4. IT IS PLANNED IN THE CURRENT SITE REDEVELOPMENT THAT THE WOOD FLOORING IN THE WOOD BUILDING WILL BE REMOVED AND REPLACED WITH MIN. 4-6" LAYER OF CLEAN, COARSE ASTM SIZE #5 AGGREGATE OR EQUIVALENT BENEATH A NEW CONCRETE SLAB. SIMILARLY, THE EXISTING BOILER ROOM FLOOR WILL BE REMOVED AND REPLACED.
5. TRENCHES WILL BE CUT THROUGH THE EXISTING FLOOR IN THE CONCRETE BUILDING FOR ALL BELOW GRADE PIPING.
6. HORIZONTAL BELOW GRADE PIPE LENGTHS TOWARD SUCTION PITS SHALL BE PITCHED 1/8" PER FOOT.
7. SUCTION PITS ARE CENTERED BETWEEN COLUMN FOOTINGS TO MAXIMIZE THE PRESSURE FIELD EXTENSION.
8. MAJOR SLAB PENETRATIONS AND OPENINGS SHALL BE SEALED TO PREVENT VAPOR INTRUSION AND TO IMPROVE ACTIVE SOIL DEPRESSURIZATION.
9. A GEOTEXTILE LAYER AND VAPOR BARRIER IS RECOMMENDED FOR UNDER NEW SLAB.
10. EXHAUST VENT PIPE TERMINATION SHALL EXTEND AT LEAST 12" ABOVE THE HIGHEST POINT ON THE ROOF, AND AT LEAST 25' FROM OTHER BUILDINGS AND HVAC INTAKES, FAN SHALL BE ON ROOF.
11. THE NUMBER OF SUCTION PITS MAY CHANGE DEPENDING UPON BUILDING CONSTRUCTION AND ACTUAL COMMUNICATION WITHIN THE SUBSURFACE PENDING A PRE-INSTALL COMMUNICATION TEST.
12. SAMPLE PORTS WILL BE INSTALLED NEAR EACH SUCTION PIT.
13. SEE FIGURES 3-1 AND 3-2 FOR SUCTION PIT DETAILS.

LEGEND

- SUCTION PIT
- BELOW GRADE PIPING
- PIPING RUN ALONG CEILING
- VENT(S) TO ROOF
- APPROXIMATE EXTENT OF UNDERLYING EXISTING CELLARS

TITLE

SUB–SLAB DEPRESSURIZATION SYSTEM LAYOUT
220 WATER STREET
BROOKLYN, NY

PREPARED FOR

220 WATER STREET

ERM Environmental Resources Management

| DRAWN: | JOB NO.: | FILE NAME: | SCALE | DATE | FIGURE |
|---|---|---|---|---|---|
| SMC | 0022103 | 0022103–00–030 | GRAPHIC | 02/11/08 | 4–1 |

R:\Melville Projects\220 water street\REPORT\FIGURE 4-1(New Basement).dwg (03/17/2008 - 5:24pm Boston)

*Figure 4-2*
*Tentative Remedial Action Schedule*
*220 Water Street*
*Brooklyn, New York*

| **Weeks Following NYSDEC Approval of Supplemental Design Report:** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ITEM** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bid Work to Contractors | ■ | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bid Period | | ■ | | | | | | | | | | | | | | | | | | | | | | | | |
| Evaluate Bids | | | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| Award Contract | | | | ◆ | | | | | | | | | | | | | | | | | | | | | | |
| Mobilization | | | | | ■ | | | | | | | | | | | | | | | | | | | | | |
| Excavate Soils Beneath Site Building | | | | | | ■ | | | | | | | | | | | | | | | | | | | | |
| Laboratory Analysis of Documentation Soil Samples | | | | | | | ■ | ■ | ■ | ■ | | | | | | | | | | | | | | | | |
| Drain Closure | | | | | | ■ | | | | | | | | | | | | | | | | | | | | |
| *Construct Sub-Slab Depressurization System* | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Pilot Testing | | | | | | | ■ | | | | | | | | | | | | | | | | | | | |
| Install System | | | | | | | ■ | ■ | ■ | | | | | | | | | | | | | | | | | |
| Pressure Field Extension Test and System Startup | | | | | | | | | | ■ | | | | | | | | | | | | | | | | |
| Excavate Soils beneath Adjacent Sidewalk Areas | | | | | | ■ | ■ | | | | | | | | | | | | | | | | | | | |
| Laboratory Analysis of Documentation Soil Samples | | | | | | | | ■ | ■ | ■ | ■ | | | | | | | | | | | | | | | |
| Prepare Remedial Action Report | | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | | |
| Submit Remedial Action Report | | | | | | | | | | | | | | | | | | | | ◆ | | | | | | |
| NYSDEC Review of Remedial Action Report | | | | | | | | | | | | | | | | | | | | | ■ | ■ | ■ | ■ | | |
| Public Mailing of Remedial Action Report Fact Sheet | | | | | | | | | | | | | | | | | | | | | | | | | ■ | |
| Provide NYSDEC with Certification of Mailing | | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| Finalize Remedial Action Report | | | | | | | | | | | | | | | | | | | | | | | | | | ◆ |
| Finalize Environmental Easement | | | | | | | | | | | | | | | | | | | | | | ■ | ■ | ■ | ■ | |
| Execute Environmental Easement | | | | | | | | | | | | | | | | | | | | | | | | | | ◆ |

◆ Milestone dependent upon Site redevelopment schedule
■ Task duration and timing dependent upon Site redevelopment schedule
■ Task timing dependent upon Site redevelopment schedule
NYSDEC = New York State Department of Environmental Conservation

Notes:

1. Site redevelopment is tentatively planned to begin in Spring 2008. The remedial action components of excavation, sub-slab depressurization, and drain closure will be coordinated with the Site redevelopment.

# *APPENDIX A*

# *SITE MANAGEMENT PLAN*

# *APPENDIX B*

# *HEALTH AND SAFETY PLAN*

ERM

# Level 2- Short Form

# PROJECT HEALTH AND SAFETY PLAN

**This form, in conjunction with ERM's Health and Safety Guidance Manual, is intended to provide health and safety guidelines for intrusive project field activities where:**

**The PIC and PM judge that the Short Form provides sufficient level of risk assessment and management**
**A more detailed HASP is not required by law or the client**
**The work does not require complicated interactions with subcontractors**
**The work is of relatively short duration such as 1-14 days**
**The activities described below should be conducted using good work practices and judgments consistent with employee training.**

**The Project Manager and PIC must ensure that all project personnel review and sign this form, and document these activities in the project file. Their signatures indicate approval of methods and precautions in this plan.**

| **Administrative Information** | | |
|---|---|---|
| | **Site Name and Location:**<br><br>220 Water Street, Brooklyn, NY | |
| | **Client:** Hawthorne Village, LLC | |
| | **Project Name:**<br><br>Brownfield Cleanup Program Remedial Action | |
| | **Health & Safety Plan Date**<br><br>January 2008 | **Revision Number and Date:**<br><br>Version 2, January 2008 |
| | **Project Field Work Start Date**:<br><br>To Be Determined (TBD) | **Anticipated Project Field Work End Date:**<br><br>TBD |
| | Project Manager<br><br>Catherine Weber | Principal-in-Charge<br><br>James Perazzo |
| | **Project H&S Officer (If other than the PM)**<br><br>Paulina Gravier | **Site Safety Officer (*If other than the PM*)**<br><br>Michel Jean Baptiste |

| Site/Project General Information | Scope of Work: |
|---|---|
| **Develop a Task Hazard Analysis Sheet for each unique site task and attach to the HASP.** | The following work will be performed at 220 Water Street Brooklyn, NY ("Site") and the adjacent sidewalk areas as part of the Remedial Action:<br><br>**Task 1:** Collect soil grab samples from beneath the adjacent sidewalk areas and at perimeter of a limited area beneath the building slab. Samples will be subsequently analyzed for metals using EPA SW846 Method 6061B;<br>**Task 2:** Provide documentation of contractor excavation work performed indoors at the Site in the boiler room and outdoor excavation activities under the adjacent sidewalk. The expected depth of the excavation will be between 4-8 feet; and<br>**Task 3:** Provide documentation of contractor work installing suction pits that will be used for the sub-slab depressurization system inside the Site building. |
| | **History of Site:**<br><br>According to the results of previous ERM subsurface site investigations performed at the Site and adjacent sidewalk areas, soil appears to be adversely impacted by former on-Site historical operations, and groundwater and soil vapor have been adversely impacted by an upgradient source of groundwater contamination. Specifically, tetrachloroethene (PCE) and trichloroethene (TCE) have been detected in groundwater at levels above the New York State Department of Environmental Conservation (NYSDEC) drinking water standards; soil vapor samples collected from below the Site indicate that PCE and TCE concentrations are above New York State Department of Health (NYSDOH) screening levels; and soil was impacted by lead and RCRA metals as well as polynuclear aromatic hydrocarbons (PAHs), which were detected in composite soil samples. |
| | **Site Description:**<br><br>The Site is located in the Borough of Brooklyn, City of New York, Block 41, Lot 17. The Site is bound by Water Street to the north and Front Street to the south. Bridge Street, followed by a former industrial building now converted into a residential loft apartment building, is located at the eastern portion of the Site. The western portion of the Site is bound by a fenced-in vacant lot to the south and a one-story commercial/industrial building at 173-177 Water Street to the north. The Site is a one-acre property that is entirely developed by a five-story building and was historically used for industrial processes. The fourth and fifth floors of the Site house residential loft apartments, including two home-based businesses, Klass Photographs Inc., and South Pole. The ground, second and third floors and portions of the fourth floor are vacant. |

**Site Hazard Assessment Summary**

*Chemical:* The primary concern at the Site and adjacent sidewalk areas is to protect workers from potential exposure to chemicals of potential concern (COPC) identified in the soil. The key COPCs identified are as follows: Arsenic, Barium, Benzo(a)anthrancene, Benzo(a)pyrene, Chromium, Lead, Mercury, PCE, and TCE. "Hot spots" where COPCs are located at maximum concentrations include SB2-1, SB2-2, SB-6, SB-2.

*Physical:*
Physical hazards of concern are working and walking surfaces, including slips, trips and falls (high level of activity will be present with multiple contractors performing a variety of activities in a small area) traffic, heat stress/stroke, cold Stress/hypothermia, material handling activities (when collecting soil grab samples), heavy machinery, overhead activities related to ongoing renovations (e.g., scaffolding), subsurface clearance and shoring (excavation related). The sampling team is required to wear brightly colored (Orange, Yellow or Red) safety vests when collecting soil grab samples beneath the sidewalk. Excavation pits will be assessed prior to entry to determine if it meets the definition of a permit required confined space (e.g., contains a hazardous atmosphere or potential for entrapment). For soil sample collection, ERM employees are advised to allow the contractors to bring the materials to surface level to allow soil samples to be collected without entry into a confined space. Otherwise, the potential permit required entry shall be discussed with the ERM NE OpCo H&S Director. In addition, shoring will be required on any excavation performed over a depth of 4 feet. All work sites shall be kept neat and orderly to minimize the potential slip and trip hazards. Contractors shall supply project-specific confined space entry plans and HASP for excavation as needed. Contractors shall follow the chemical protection safety measures outlined in this HASP when handling impacted materials.

Depending on the season, heat stress/stroke or cold stress/hypothermia are potential physical hazards. Proper clothing and PPE will be employed, as well as necessary rest periods. During the summer months the sampling team will ensure they remain properly hydrated to avoid heat stress. Summer storms with severe wind, hail and lightening are other potential hazards; the sampling team will remain alert to changing weather conditions and take appropriate measures to seek shelter in the event of storms. All work shall stop in the event of lightening in the area and take shelter within the sampling vehicles or other suitable shelter.

**Precautions For Preventing Contractor-Equipment Related Incidents**

During the daily team briefing meeting, ERM personnel must communicate with the subcontractors on the project to understand the activities to be performed by them over the course of the day and any additional precautions to be implemented (e.g., expect dust generating activities related to building renovation). This communication ensures that our personnel do no enter restricted areas that may be poorly marked and to implement extra caution (e.g., heavy machinery).

| Subsurface Clearance<br><br>**Document the steps that must be followed and justify any exceptions.** | SSC Requirement | Yes | No | How will it be done?<br>Why the exception? |
|---|---|---|---|---|
| | Contractor prequalification of SSC capability | ☒ | | |
| | "Designated Person" assigned | ☒ | | |
| | Project information review | ☒ | | |
| | Project walkover | ☒ | | |
| | Utility mark out | ☒ | ☐ | Utility markouts will be completed by contractor performing subsurface work. |
| | Consider/document "Critical Zones" | ☒ | ☐ | |
| | Will manually clear all drilling points | ☒ | ☐ | As required by the ERM subsurface clearance procedures |

| Chemicals of Concern | Chemical Name | ACGIH TLV, mg/m$^3$ | Highest Reported Concentration | | | Location/Source at Site and Adjacent Sidewalk Areas |
|---|---|---|---|---|---|---|
| | | | Indoor Air | Ground-water | Soil | |
| | Arsenic | 0.01 | NA | NA | 54 mg/kg | SB2 (0'-4') |
| | Barium | 0.5 | NA | NA | 1160 mg/kg | SB9 (0'-4') |
| | Benzo(a) anthrancene | NA | NA | NA | 950 ug/kg | Interior Composite |
| | Benzo(a)pyrene | NA | NA | NA | 730 ug/kg | Interior Composite |
| | Chromium | 0.5 | NA | NA | 120 mg/kg | SB9 (0'-4') |
| | Lead | 0.05 | NA | NA | 3770 mg/kg | SB3-5 (1'-3') |
| | Mercury | 0.01 | NA | NA | 0.32 mg/kg | SB2 (4'-8') |
| | PCE | NA | 5.6 ug/m3 | 15 ug/L | NA | Wood Basement, MW-3 |
| | TCE (1ppm=5.37 mg/m3) | 269 | 7 ug/m3, 28 ug/m3 | 4.9 ug/L | NA | Concrete and Wood Basement, MW-2 |

| Air Monitoring Action Levels | Constituent | Action Level (ppm) | Level of Protection | Monitoring Instrument |
|---|---|---|---|---|
| **If air monitoring is necessary to control acutely hazardous issues on site, document the short-term limit that requires response** | Organic Vapors | <5 ppm<br>>5 ppm | D<br>C | Photoionization detector (PID) with 11.8 eV bulb or FID |
| | Explosion | NA | NA | NA |
| | Dust (during excavation activities) | Background to <150 ug/m³ (protective for total particulates, lead and PAHs) | D | Thermo MIE pDR-1000 Personal Data Ram |
| | Oxygen | NA | NA | NA |

| Level of Protection | Task Description | Level | | | | |
|---|---|---|---|---|---|---|
| | | A | B | C | Mod D | D |
| | Documentation of soil samples beneath the adjacent sidewalk areas and limited area underneath the Site | ☐ | ☐ | ☐ | ☐ | ☒ |
| | ERM oversight of excavation activities conducted by a sub-contractor | ☐ | ☐ | ☐ | ☐ | ☒ |
| | ERM oversight of a sub-contractor installing boring holes for Site sub-slab depressurization. | ☐ | ☐ | ☐ | ☐ | ☒ |

| Personal Protective Equipment | Equipment | Req | Rec | NA | Equipment | Req | Rec | NA |
|---|---|---|---|---|---|---|---|---|
| **Req = Required**<br>**Rec = Recommended**<br>**NA = Not Applicable** | Steel Toe Boots | ☒ | ☐ | ☐ | Hard Hat | ☒ | ☐ | ☐ |
| | Outer Disposable Boots | ☐ | ☒ | ☐ | Safety Glasses with Side Shields | ☒ | ☐ | ☐ |
| | Coveralls or Long Sleeve Shirt &Pants | ☒ | ☐ | ☐ | Indirect Vented (Splashproof) Goggles | ☐ | ☐ | ☒ |
| | Tyvek Suit | ☐ | ☒ | ☐ | SCBA | ☐ | ☐ | ☒ |
| | Poly-coated Tyvek / Saranex Suite | ☐ | ☐ | ☒ | Respirator | ☐ | ☐ | ☒ |
| | Fully Encapsulated Chemical Suite | ☐ | ☐ | ☒ | Other: Cones surrounding Exclusion Zone | ☒ | ☐ | ☐ |
| | Hearing Protection | ☐ | ☒ | ☐ | Inner Chemical Gloves | ☐ | ☒ | ☐ |
| | Outer Chemical Gloves (nitrile) | ☒ | ☐ | ☐ | Other: Orange Safety Vest (in traffic areas) | ☒ | ☐ | ☐ |

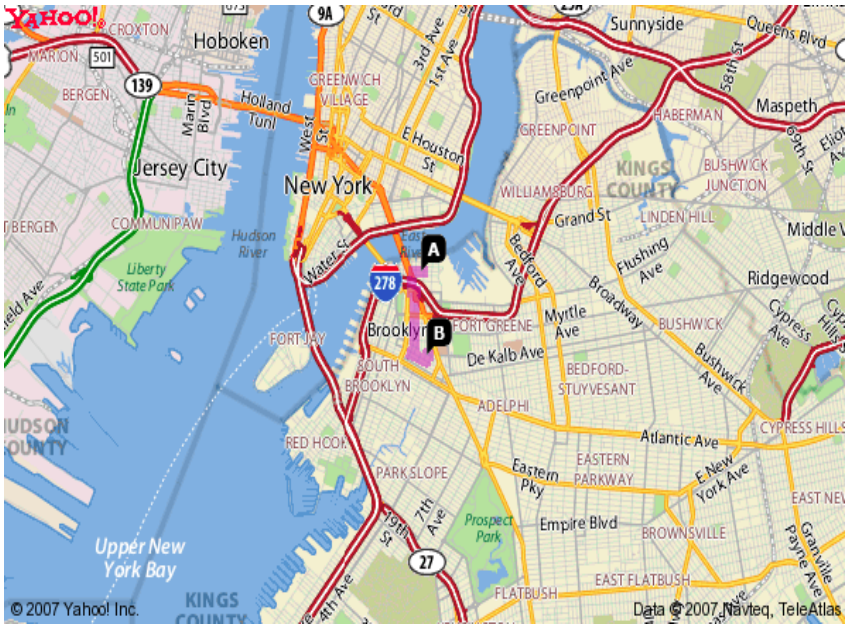
Some countries (U.S.) require documentation of the PPE needs assessment and certification of the selection process. If this applies, please complete below:

Name of PPE Assessor/ Certifier: Paulina Gravier

Date of Assessment/Certification: February, 2008

| | |
|---|---|
| **Work Zones**<br><br>**If exclusion zones are necessary because of chemical OR equipment hazards, describe the plan.** | Exclusion Zone:<br>Cones and/or caution tape shall be used to mark exclusion zones around intrusive activities, such as drilling and excavating. Collecting samples also presents a potential chemical exposure hazard, and, therefore, the soil staging area will also be designated as an exclusion zone with cones and/or caution tape. |
| | Contamination Reduction Zone:<br>Adjacent to and upwind of EZ |
| | Support Zone:<br>All areas surrounding EZ and CRZ, vicinity of support vehicles. |
| **Project Access/Control**<br><br>**How do we limit unauthorized entry to the site itself?** | Access to work activities is limited to authorized personnel with proper training (i.e., ERM, Subcontractors, Client Representatives, and Regulatory Agents). Workers must remain upwind of excavation equipment whenever possible. However, pedestrians will be passing by the work area, which will need to be clearly marked. Work area must be demarcated so pedestrians are not subject to dust, loud noise, or potential VOCs in breathing zone. |
| **Decontamination Procedures** | ***Personnel and Equipment:*** Workers must thoroughly wash hands prior to eating/drinking. Follow ERM Health and Safety Guidance Procedures for non-disposable equipment. |
| **Accident Investigation** | All accidents and injuries will be investigated using ERM Accident Investigation Procedures found in the "Policies and Procedures" section of the *ERM Northeast Health and Safety Management System Database.*<br><br>**Incident Reporting Forms**<br>Incident Report - Sort Form (Near Miss Incidents, Minor First Aid, etc.)<br>Incident Report Form (Injuries that Require Professional Medical Attention, Property Damage, etc.) |
| **Emergency Contacts** | Name and Address of Nearest Hospital:<br>Long Island College Hospital<br>525 Fulton St<br>Brooklyn, NY 11201 |
| | Hospital Phone Number: (718) 522-4800 ***or*** 911 |

Route To the Nearest Hospital:
1) Depart on Water St. Turn LEFT (South) onto Pearl St.
2) Turn LEFT (East) onto Sands St.
3) Take Ramp (RIGHT) onto I-278 [Brooklyn-Queens Expressway]. At exit 30, turn RIGHT onto Ramp.
4) Bear LEFT (North) onto Classon Ave, then immediately turn RIGHT (East) onto Flushing Ave.
5) Bear RIGHT (East) onto Broadway.
6) Keep RIGHT onto Van Sinderen Ave.
7) Bear LEFT (East) onto Fulton St.




| Other Contact Information | | | |
|---|---|---|---|
| Agency | Contact | Location | Phone Number ("911" or other if they are active) |
| Police Dept | 911 | Brooklyn, NY | 911 |
| Fire Dept/ Ambulance | Chief/Rescue | Brooklyn, NY | 911 |
| Hawthorne Village, LLC | Steve O'Brien | Hawthorne, NY | (914) 742-4406 |
| Project Manager | Cathy Weber | Boston, MA | (617) 646-7852 |
| Project H&S Officer | Paulina Gravier | New York,NY | (212) 447-1942 |
| Site Safety Officer | Michel Jean Baptiste | Melville, NY | (631) 756-8900 |

| **Health & Safety Plan Evaluation**<br><br>**Complete after the Field Work is done- place in the file and send suggested improvements to the H&S Leader** | To evaluate the effectiveness of this health and safety plan and make future plans responsive to unexpected situations, the Project Manager or Site Safety Officer should complete the following and file a copy of this entire document with the OpCo Health and Safety Leader and others who would benefit. | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Actual Dates of the Field Tasks: | Was the H&S Plan followed as Presented? | | | Was the H&S Plan Adequate? | | | |
| | | Yes | ☐ | No | ☐ | Yes | ☐ | No | ☐ |
| | Describe in detail any changes to the H&S Plan while on-site: | | | | | | | |
| | Reason For Change: | | | | | | | |
| | What Changes Would You recommend: | | | | | | | |

| **Signatures** | Project Manager (If other than the PM) | Date: |
|---|---|---|
| | Project Health and Safety Officer (If other than the PM) | Date: |
| | Site Safety Officer (If other than the PM) | Date: |

| **Acknowledgement** | This Health & Safety Plan has been discussed with me. I understand its content, and have been given opportunity to ask questions. | | |
|---|---|---|---|
| Printed Name | Signature | Company | Date |
| | | | |
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# Incident Report – Short Form

**FOR ERM MANAGEMENT INTERNAL USE ONLY**
**CONFIDENTIAL - WITHOUT PREJUDICE REPORT**

## INSTRUCTIONS:

1. An accident can be defined as "A series of unplanned events that caused or could have caused personal injury or property damage."
2. **This short form may only be used to report minor first aid injuries (does not require professional medical treatment) and near miss incidents. If the incident results in an injury that requires professional medical treatment or property damage is involved (either ERM, subcontractor, or client property), then the regular incident report form must be completed.**
3. **The OpCo Health & Safety Coordinator must be notified immediately following the incident.** Brian Winsor is the H&S Coordinator for the Northeast OpCo. He can be reached at 860-524-5678 (Office) or 413-519-8729 (Cell).
4. This form should be completed immediately following the incident.
5. As necessary, the OpCo H&S Coordinator will notify the following personnel of the incident: Branch Manager, Corporate H&S Director, OpCo President, and Regional CEO.

| | | |
|---|---|---|
| **1) Incident Type** (circle all that apply): Early Report of Pain First Aid/ Minor Injury Near Miss | | |
| **2) Date of Incident:** | **3) Time of Incident:** | **4) Project Number:** |
| **5) Project Manager:** | **6) Location of Incident (Name & Address)** | |
| **7) Principal –In-Charge:** | | |
| **8) OpCo H&S Coordinator Notified?** Yes / No | | |
| **8) Information About Person Involved:** | | |
| **9) Name:** | **10) Home Phone:** | |
| **11) Job Title:** | | |
| **12) If an injury occurred, please describe it in as much detail as possible (e.g., cut to left ring finger, sprained right ankle, snake bite to left shin, pulled muscles in the lower back):** | | |
| **13) Please list any first aid treatment given and give the name of the person who administered the treatment:** | | |
| **14) What activity/task was taking place just prior to the incident? Describe the activity/task as well as tools, equipment and material involved that set the stage for the incident (What was the worker doing?):** | | |

# Incident Report – Short Form

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| |
|---|
| **15) What changed about the situation or task to cause the incident? How did the incident happen? (Describe the incident in as much detail as possible):** |
| **16) List any immediate corrective actions taken:** |
| **17) List the Names of Any Witnesses:** |
| **18) Was any other person exposed to blood or body fluids (if yes, please explain)?** Yes / No |

**Employee Signature** **Date**

**Project Manager Signature** **Date**

**THIS SECTION TO BE COMPLETED BY OPCO HEALTH & SAFETY COORDINATOR**

| |
|---|
| **19) Notes/Comments upon review of the incident:** |

# Incident Report – Short Form

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| 20) Additional Corrective Actions (if necessary): | | | | |
|---|---|---|---|---|
| **Description** | **Person(s) Responsible** | **Deadline** | **Date Completed** | **Corrective Action Verified By:** |
| **A.** | | | | |
| **B.** | | | | |
| **C.** | | | | |
| **D.** | | | | |
| **E.** | | | | |

**OpCo Health & Safety Coordinator Signature** **Date**

**21) Health & Safety Committee Review (as necessary):**

Date Reviewed:

# Incident Report

**FOR ERM MANAGEMENT INTERNAL USE ONLY**
**CONFIDENTIAL - WITHOUT PREJUDICE REPORT**

## INSTRUCTIONS:

1. An accident can be defined as "A series of unplanned events that caused or could have caused personal injury or property damage."
2. **The Incident Report Short Form may be used to report minor first aid injuries (does not require professional medical treatment) and near miss incidents. If the incident results in an injury that requires professional medical treatment or property damage is involved (either ERM, subcontractor, or client property), then this incident report form must be completed.**
3. **The OpCo Health & Safety Coordinator must be notified immediately following the incident.** Brian Winsor is the H&S Coordinator for the Northeast OpCo. He can be reached at 860-524-5678 (Office) or 413-519-8729 (Cell).
4. **Section 1 of this form should be completed within 24 hours** following the incident and **Sections 2 and 3 should be completed within 3 working days** following the incident. Sections 2 and 3 will be completed under the direction of the OpCo H&S Coordinator.
5. In addition to the Project Manager and OpCo Health and Safety Coordinator, who are primarily involved with the investigation, please ensure that the following individuals are made aware of the incident at least verbally within 24 hours and receive the completed incident form as soon as it is completed: **Branch Manager**; **Corporate H&S Director**, **OpCo President**, and **Regional CEO**.
6. Based on the requirements of the company's claims reporting procedure (which shall be updated from time to time), if necessary, the OpCo President will notify the company's Legal Department.

## SECTION I: INCIDENT DATA AND SUMMARY

| **1) Incident Type** (circle all that apply): | Early Report of Pain | First Aid/ Minor Injury | Professional Medical Treatment Required | Property Damage | Near Miss |
|---|---|---|---|---|---|

| **2) Date of Incident:** | **3) Time of Incident:** | **4) Project Number:** |
|---|---|---|

| **5) Project Manager:** | **6) Location of Incident (Name & Address)** |
|---|---|
| **7) Principal –In-Charge:** | |

| **8) Information About Person Involved:** | | |
|---|---|---|
| **Name:** | | **Home Address:** |
| **Home Phone:** | | |
| **Date of Birth:** | **Sex:** Male / Female | |
| **Date of Hire at ERM:** | **Job Title:** | |

| **9) Is Person Involved a Sub-Contractor Employee?** Yes / No | **10) Sub-Contractor Employer (If Applicable):** |
|---|---|
| **11) Time Person Involved Began Work:** | **12) Weather Conditions at Time of Incident:** |

# Incident Report

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| | |
|---|---|
| **13) Date Incident Reported:** | **14) Incident Reported To:** |
| **15) List the Names of Any Witnesses:** | **16) OpCo H&S Coordinator Notified?**<br>Yes / No |
| **17) What activity/task was taking place just prior to the incident? Describe the activity/task as well as tools, equipment and material involved that set the stage for the incident (What was the worker doing?):** | |
| **18) What changed about the situation or task to cause the incident? How did the incident happen? (Describe the incident in as much detail as possible):** | |
| **19) If an injury occurred, please describe it in as much detail as possible (e.g., cut to left ring finger, sprained right ankle, snake bite to left shin, pulled muscles in the lower back):** | |
| **20) Was anything suspicious noticed about the incident (e.g., suspicion of drug/alcohol impairment, inconsistent accounts of what happened, etc.)? If so please be as descriptive as possible?** | |

# Incident Report

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**21) Statement from Person Involved. Have the employee involved in the incident give a written statement as soon as possible following the incident. If the injury requires prompt medical treatment, do not delay treatment, as the statement will be taken at the next earliest opportunity.**

**Note to Person Involved: In your own words, please describe what happened. Please be as descriptive as possible:**

**Signature:** _____ **Date:** _____

# Incident Report

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**22) Witness Statement. Each witness to the incident must submit a written statement of what happened. Each witness (if multiple witnesses) must complete his or her own copy of this page. If there is no access to multiple copies of this page, have the witness(es) write down their statement on a blank sheet (be sure that they sign and date it)**

**Note to Witness: In your own words, please describe what happened. Please be as descriptive as possible:**

**Signature:** _____ **Date:** _____

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**23) Whenever possible, please take pictures (preferably digital) of the incident scene, injuries, equipment involved, etc. Use the space provided on this page to attach photos:**

# Incident Report

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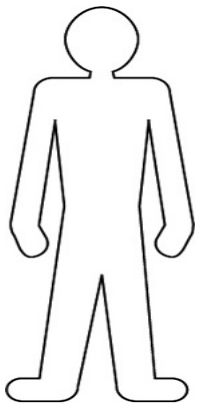
| | |
|---|---|
| **24) What object or substance directly harmed the employee? (Examples, concrete floor, chlorine, H2S, manhole cover. If this question does not apply to the incident, write N/A.)** | |
| **25) Please describe any additional consequences of the incident (Describe damage to property/equipment, consequences to other employees or community, schedule.):** | |
| **26) Was any other person exposed to blood or body fluids (if yes, please explain)?** Yes / No | |
| **27) Was professional medical treatment required away from the Worksite?** Yes / No | **28) Name of Treating Facility:** |
| **29) Address of Treating Facility:** | **30) Telephone Number of Treating Facility:** |
| | **31) Name of Treating Health Care Professional** |
| **32) Was the injured person treated in an emergency room?** Yes / No | **33) Was the injured person hospitalized overnight as an in-patient?** Yes / No |
| **34.) Please note the position of the injury on the diagram and sketch any other instructive diagrams here as well.** | |



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| | | |
|---|---|---|
| **35) Please provide any information, if known, about the injured person's condition, return to work status etc. (e.g., is given work restrictions, unable to return to work, etc.):** | | |
| **36) Did the injured person receive any prescriptions for medication (if yes, please list below)?** Yes / No | | |
| **37) List any immediate corrective actions taken:** | | |
| **38) Please list any first aid treatment given and give the name of the person who administered the treatment:** | | |
| **39) Additional Notes:** | | |
| **40) If the employee died, give date of death:** | | |
| **41) Name of person completing form (print):** | **42) Title of person completing form:** | |
| **43) Signature of person completing form:** | **44) Date Completed** | **45) Telephone Number:** |

# Incident Report

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## SECTION II: DETERMINATION OF RECORDABILITY

**INSTRUCTIONS:** This section of the form will be completed as directed by the OpCo Health & Safety Coordinator.

| | |
|---|---|
| **44) Is the incident recordable/reportable under any governmental requirement (completed by OpCo H&S Coordinator)?** Yes / No | **45) Assigned Incident Number (if recordable):** |
| **46) Notes concerning determination of recordability:** | |

## SECTION III: ROOT CAUSE ANALYSIS AND CORRECTIVE ACTIONS

**46) Actions leading to incident (circle all that apply and explain):**

| | | | |
|---|---|---|---|
| Failure to observe warning/follow rules | Failure to use PPE | Failure to Warn | Other |
| Delayed Discovery | Procedure not followed | Abuse/misuse of equipment | |

**47) Conditions leading to incident (circle all that apply and explain):**

| | | |
|---|---|---|
| Temperature/weather | Inadequate maintenance | Lack of PPE |
| Nature (animals, insects, plants) | Improper/defective tools or equipment | Construction Deficiencies |
| Improper design/engineering | Lack of proper instructions | Other |

# Incident Report

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**48) Job Factors leading to incident (circle all that apply and explain):**

| | | |
|---|---|---|
| Inadequate leadership/supervision | Inadequate work procedures/practices | Poor Job Planning |
| Inadequate/lack of tools or equipment | Inadequate Training | Other |
| Inadequate communication | Inadequate inspections | |

**49) Personal factors leading to incident (circle all that apply and explain):**

| | | |
|---|---|---|
| Physical capability | Physical Stress/fatigue | Mental stress |
| Knowledge of task | Employee skills | Other |
| Impairment (drugs, alcohol, etc) | Inattention/Distraction | |

**50) Additional Notes:**

# Incident Report

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| 51) Corrective Actions: | | | | |
|---|---|---|---|---|
| **Description** | **Person(s) Responsible** | **Deadline** | **Date Completed** | **Corrective Action Verified By:** |
| **A.** | | | | |
| **B.** | | | | |
| **C.** | | | | |
| **D.** | | | | |
| **E.** | | | | |
| **F.** | | | | |

**OpCo Health & Safety Coordinator Signature** **Date**

**21) Health & Safety Committee Review:**

**Date Reviewed:**

# *APPENDIX C*

# *COMMUNITY AIR MONITORING PLAN*

***COMMUNITY AIR MONITORING PLAN***
***220 WATER STREET, BROOKLYN, NY***
***FEBRUARY 2008***

## *INTRODUCTION*

The objective of the Community Air Monitoring Plan (CAMP) is to focus on potential community exposures related to migration of chemicals of potential concern (COPCs) beyond the boundary of the Site and adjacent sidewalk areas where remedial work will be undertaken (e.g., nearby residences, public). The COPCs discussed in this document are applicable to both the CAMP and HASP, and therefore, monitoring methodologies, documentation and recordkeeping will be similar.

The organization of this document is as follows:

- Chemicals of Potential Concern (COPC)
- Community Air Monitoring Plan (CAMP)
- Mitigative Measures
- Documentation and Recordkeeping

## *CHEMICALS OF POTENTIAL CONCERN (COPCs)*

The COPCs also identified in the site-specific HASP include, but are not limited to, the following:

### *Tetrachloroethene*

Tetrachloroethene, also known as perchloroethylene (PCE) is a colorless liquid solvent with a sweet chloroform-like odor. PCE is non-flammable and insoluble in water. PCE may be a carcinogen in humans. Potential exposure routes include inhalation, absorption, and ingestion. The target organs are eyes, skin, respiratory system, liver, kidneys, and the central nervous system. Exposure can damage a developing fetus, cause dizziness, nausea, confusion, difficulty speaking and walking, unconsciousness and death. The OSHA PEL is 100 ppm (TWA) and 300 ppm for a 5-minute peak in any three (3) hours.

### *Trichloroethene*

Trichloroethene (TCE) is a colorless liquid (sometimes died blue) with a chloroform-like odor. Potential exposure routes include inhalation, absorption through skin, ingestion, and dermal contact. The target organs that TCE would affect are eyes, skin, respiratory system, heart, liver, kidneys, and the central nervous system. This compound is a

known carcinogen. Symptoms of exposure include irritation to eyes and skin, headache, vision disorder, dizziness, tremors, drowsiness, nausea, vomiting, dermatitis, and cardiac arrhythmia. The OSHA PEL is 100 ppm and 300 ppm for a 5-minute maximum peak in any 2 hours.

*Lead*

Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. Lead can be found in all parts of our environment. Much of it comes from human activities including burning fossil fuels, mining, and manufacturing. Lead can affect almost every organ and system in your body. The main target for lead toxicity is the nervous system, both in adults and children. The OSHA PEL is 0.05 mg/m3 for an 8-hour day.

## *COMMUNITY AIR MONITORING PLAN*

This CAMP has been developed in accordance with the New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan (CAMP) as well as the National Ambient Air Quality Standards (NAAQS) developed by the Environmental Protection Agency (EPA). The intent of the CAMP is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne releases of COPCs as a direct result of investigative and remedial work activities. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

Based on the NYSDOH guidance document, the CAMP includes requirements for continuous real-time air monitoring for total volatile organic compounds (VOCs), and particulates (PM-10) for select remedial activities. Real-time monitoring will be conducted at the perimeter of the work area, which may also be defined as the exclusion zone, and will include one upwind and one downwind monitoring location. Real-time monitoring will occur during activities that disrupt impacted media from the Site or adjacent sidewalk areas. The definition of activities that disrupt such impacted media is as follows:

- Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

The objective of the monitoring is to confirm that work area activities do not result in a sustained (i.e., 15 minute average) release of COPCs beyond the work area boundary above levels established herein. Upwind and downwind locations of the this boundary

will be determined using a wind sock. Depending on the remedial activity, perimeter monitoring at the exclusion zone will involve real-time total particulate and VOC measurements, which may also be supplemented by collecting active samples for specified constituents (e.g., lead). Additional monitoring may also be conducted under any of the following circumstances:

- Change in ambient levels of hazardous constituents as indicated by the sense of smell;
- Changes in the physical appearance of the soil or groundwater; and/or
- When new hazardous substances are encountered.

The remainder of this CAMP discusses the associated actions related to this monitoring plan as well as monitoring frequency and data reporting.

*VOC Monitoring, Response Levels, Actions*

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should also be measured at the start of each workday and periodically thereafter to establish background conditions.

Ambient air monitoring will be conducted using direct-reading real-time instruments. The continuous total VOC perimeter monitoring will be performed using a portable, direct-reading photoionization detector (e.g., RAE MiniRAE 2000 PID) or a flame ionization detector (FID). The instrumentation used for perimeter monitoring will be used to calculate a running 15-minute average concentration. The PID lamp voltage of to be used for this Site is 11.7 eV, which is based on the ionization potentials for trichloroethene and tetrachloroethene.

Direct reading instrumentation will be calibrated daily per manufacturer's instructions. Cylinders of the appropriate calibration gas (e.g., isobutylene) will be required for fieldwork lasting longer than one day. The monitoring location, date, time, weather conditions, activities performed and the 15 minute interval readings in ppm shall be recorded.

The VOC response levels and actions are as follows:

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

- If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

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

*Particulate Monitoring, Response Levels, and Actions*

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level (e.g., Thermo Anderson PM-10 DataRAM). The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter (ug/m3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 ug/m3 above the upwind level and provided that no visible dust is migrating from the work area.

- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 ug/m3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 ug/m3 of the upwind level and in preventing visible dust migration.

*Chemical Specific Monitoring*

The potential need for chemical specific air monitoring at the perimeter of the exclusion zone shall be evaluated on a case by case basis dependent on the location of the area of concern. Chemical specific sampling may be required because 1) some COPCs may not be detected using real-time direct reading instruments (e.g., heavy PAHs), and, therefore, chemical specific sampling would be required for this type of assessment; and 2) there may be chemicals that have more restrictive regulatory exposure limits (e.g., lead) than those outlined in the CAMP, warranting chemical specific sampling. However, it is important to note that calculation methods may be used to determine if the CAMP action limits provide adequate protection with regards to other specific COPCs. The equation that may be used calculates a corresponding particulate level that equates to the maximum detected concentration in media and the equation used is:

Airborne Dust Level (mg/m3) = Regulatory Threshold Value (mg/m3)/ Soil Concentration (mg/kg) x Conversion Factor ($10^6$ mg/kg)

The 24-hour EPA NAAQS for lead is 1.5 ug/$m^3$. A corresponding particulate level can be calculated assuming that the total particulate concentration in ambient air may reach the 1.5 ug/$m^3$ lead action level and that it is attributable to the maximum detected lead concentration for select site media. Therefore, dividing NAAQS of 1.5 ug/$m^3$ by 3660 mg/kg of lead (SB3-5) results in a value of approximately 0.4 mg/m3 of total particulate, indicating that the 100 ug/m3 limit is protective for total particulates, PAHs, and lead.

***MITIGATIVE MEASURES***

Potential mitigative measures to control airborne levels may include, but are not limited to, the following:

- Water spraying and/or other dust suppression techniques
- Soil gas control techniques
- Ventilation techniques to provide dilution and/or isolation of VOCs
- Covering containers, trucks, etc. that may be transporting VOCs or groundwater potentially containing VOCs
- Personal protective equipment (worker exposures)
- Administrative controls

## *DOCUMENTATION AND RECORDKEEPING*

All 15-minute readings will be recorded and available for personnel and management to review. Instantaneous readings, if any, used for decision purposes will also be recorded. Sampling data will be evaluated daily and a summary report will be generated weekly. The summary report shall include equipment type, serial number, calibration results, flow rates, sampling locations, sampling dates, sampling times, sampling results in the required units, and corrective actions implemented based on any threshold level exceedances.

A copy of any laboratory analytical results will be kept on-site along with any datalogged results as well as by the Project Manager at ERM.

# *APPENDIX D*

# *QUALITY ASSURANCE PROJECT PLAN*

# BROWNFIELD CLEANUP PROGRAM REMEDIAL ACTION WORK PLAN

## APPENDIX D – QUALITY ASSURANCE PROJECT PLAN

*220 Water Street*
*Brooklyn, New York*

*March 2008*

Prepared by:

**ERM**
235 Park Avenue South, 4th Floor
New York, NY 10003

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## *1.0 PURPOSE AND OBJECTIVES*

### *1.1 PURPOSE*

This Quality Assurance Project Plan (QAPP) was prepared for the Brownfield Cleanup Program (BCP) Remedial Action (RA) and Site Management Plan (SMP) at the 220 Water Street site located in Brooklyn, New York (the "Site"). It is intended to set forth guidelines for the generation of reliable data by measurement activities, such that data generated are scientifically valid, defensible, comparable and of known precision and accuracy.

This QAPP contains a detailed discussion of the quality assurance (QA) and quality control (QC) protocols to be utilized by Environmental Resources Management (ERM) and laboratory personnel, as well as a project description, and project organization and responsibilities. Soil samples will be collected and analyzed for lead as part of RA for the Site and adjacent sidewalk areas. The soil samples will provide documentation of soil conditions at the limits of excavation where lead-impacted soil is removed. The SMP provides for sub-surface air sampling to assess below-building soil vapor conditions.

### *1.2 DEFINITIONS*

The parameters that will be used to specify data quality objectives (DQO), and to evaluate the analytical system performance for all analytical samples are precision, accuracy, representativeness, completeness and comparability (PARCC). Definitions of these and other key terms used in this QAPP are provided below.

- ***Accuracy*** - the degree of agreement of a measurement with an accepted reference value. Accuracy is generally reported as a percent recovery, and calculated as:

$$\frac{\text{Measured Value}}{\text{Accepted Value}} \times 100$$

- ***Analyte*** - the chemical or property for which a sample is analyzed.
- ***Comparability*** - the expression of information in units and terms consistent with reporting conventions; the collection of data by equivalent means; or the generation of data by the same analytical method. Aqueous samples will be reported as µg/l and solid samples will be reported in units of mg/kg, dry weight.
- ***Completeness*** - the percentage of valid data obtained relative to that which would be expected under normal conditions. Data are judged valid if they meet the stated precision and accuracy goals.
- ***Duplicate*** - two separate samples taken from the same source by the same person at essentially the same time and under the same conditions that are placed into separate containers for independent analysis. Duplicate samples are intended to assess the effectiveness of equipment decontamination, the precision of sampling efforts, the impacts of ambient environmental conditions on sensitive analyses (e.g., volatile organics analysis (VOA)), and the potential for contaminants attributable to reagents or decontamination fluids. Identifying such potential sources of error is essential to the success of the sampling program and the validity of the environmental data. Each QC sample is described below. As a minimum, each set of ten or fewer field samples will include a trip blank (TB), a duplicate and one sample collected in a sufficient volume to allow the laboratory to perform a matrix spike.
- ***Field Blanks*** – field blanks (FB) (sometimes referred to as "equipment blanks" or "sampler blanks") are the final analyte-free water rinse from equipment decontamination in the field and are collected at least once during a sampling episode. If analytes pertinent to the project are found in the FB, the results from the blanks will be used to qualify the levels of analytes in the samples. This qualification is made during data validation. The FB is analyzed for the same analytes as the sample that has been collected with that equipment.
- ***Precision*** - a measure of the agreement among individual measurements of the sample property under prescribed similar conditions. Precision is generally reported as Relative Standard Deviation (RSD) or Relative Percent Difference (RPD). Relative

standard deviation is used when three or more measurements are available and is calculated as:

$$\text{RSD} = \frac{\text{Standard Deviation}}{\text{Arithmetic Mean}} \times 100$$

Relative percent difference is used for duplicate measurements and is calculated as:

$$\text{RPD} = \frac{\text{Value 1 - Value 2}}{\text{Arithmetic Mean}} \times 100$$

- ***Quality Assurance (QA)*** - all means taken in the field and inside the laboratory to make certain that all procedures and protocols use the same calibration and standardization procedures for reporting results; also, a program which integrates the quality planning, quality assessment, and quality improvements activities within an organization.
- ***Quality Control (QC)*** - all the means taken by an analyst to ensure that the total measurement system is calibrated correctly. It is achieved by using reference standards, duplicates, replicates, and sample spikes. Also, the routine application of procedures designed to ensure that the data produced achieve known limits of precision and accuracy.
- ***Replicate*** - two aliquots taken from the same sample container and analyzed separately. Where replicates are impossible, as with volatile organics, duplicates must be taken.
- ***Representativeness*** - degree to which data represent a characteristic of a set of samples. The representativeness of the data is a function of the procedures and caution utilized in collecting and analyzing the samples. The representativeness can be documented by the relative percent difference between separately collected, but otherwise identical sample volumes.
- ***Trip Blanks*** - trip blanks (TB) are samples that originate from analyte-free water taken from the laboratory to the sampling site and returned to the laboratory with the volatile organic samples. One TB should accompany each cooler containing volatile organics; it will be stored at the laboratory with the samples, and analyzed with the sample set. TBs are only analyzed for volatile organic compounds (VOCs).

## *1.3 DATA QUALITY OBJECTIVES*

### *1.3.1 Overall Data Quality Objectives*

DQO are quantitative and qualitative statements specifying the quality of the environmental data necessary to support the decision-making process to guide the RA and any subsequent corrective actions. DQO define the total uncertainty in the data that is acceptable for each activity. This uncertainty includes both sampling error and analytical error. Ideally, the prospect of zero uncertainty is the objective; however, the very processes by which data are collected in the field and analyzed in the laboratory contribute to the uncertainty of the data. It is the overall objective to keep the total uncertainty to a minimal level such that it will not hinder the intended use of the data.

As discussed above, the parameters that will be used to specify data quality requirements and to evaluate the analytical system performance for the samples are PARCC. The overall objectives are established such that there is a high degree of confidence in the measurements.

### *1.3.2 Remedial Cleanup Documentation Samples*

In order to permit calculation of precision and accuracy for the samples, blind field duplicate, FB, TBs and matrix spike/matrix spike duplicate (MS/MSD) samples will be collected, analyzed and evaluated.

Through the submission of field QC samples, the distinction can be made between laboratory problems, sampling technique considerations, sample matrix effects, and laboratory artifacts. To assure sample representativeness, all sample collection will be performed in strict accordance with the procedures set forth in this QAPP.

Precision will be calculated as RPD if there are only two analytical points and percent relative standard deviation (% RSD) if there are more than two analytical points. Blind field duplicate and MS/MSD sample analyses will provide the means to assess precision. The submission of FBs and TBs will provide a check with respect to accuracy and will monitor chemicals that may be introduced during sampling, preservation, handling, shipping and/or the analytical process. In the event that the blanks are contaminated and/or poor precision is obtained, the associated data will be appropriately qualified.

Representativeness will be assured through the implementation of the structured and coherent workplan which this QAPP is a part. This workplan has been designed so that the appropriate numbers of samples of each matrix and of each location of interest are obtained for analysis.

Ideally, 100% completeness is the goal. However, it must be recognized that unforeseen issues may result in the generation of some data that may not be acceptable for use. Therefore, a completeness target of 90%, as determined by the total number of usable data points versus the total number of data points measured, will be the realistic goal of this program.

Comparability is defined as the extent to which data from one data set can be compared to similar data sets. Comparability between data sets is often questionable due to issues such as different analytical methods used or inter-laboratory differences. In order that the data generated as part of this project remain comparable to any previously generated data or data to be generated in the future, currently published analytical methods have been identified for the analysis of the collected samples. These methods will be performed by an analytical laboratory with a demonstrated proficiency in the analysis of similar samples by the referenced methods.

In addition, samples will be collected using documented procedures to ensure consistency of effort and reproducibility if necessary.

### *1.3.3 Laboratory Data Quality Objectives*

The analytical laboratory will demonstrate analytical precision and accuracy by the analysis of various QC samples (i.e., laboratory duplicates, spike samples, matrix spike duplicates and laboratory control samples). Table 1 present the relevant precision and accuracy criteria for lead. Precision, as well as instrument stability, will also be demonstrated by comparison of calibration response factors from the initial calibration to that of the continuing calibrations. Laboratory accuracy will be evaluated by the addition of surrogate and matrix spike compounds, and will be presented as percent recovery (%R). Precision will be presented as RPD, % RSD, or percent difference (%D), whichever is appropriate for the number and type of QC samples analyzed. Laboratory blanks can also be used to demonstrate the accuracy of the analyses and possible effects from laboratory artifact contamination.

## 2.0 *PROJECT ORGANIZATION AND RESPONSIBILITY*

While all personnel involved in an investigation and in the generation of data are implicitly a part of the overall project management and QA program, certain members of the Project Team have specifically designated responsibilities. Project Team members with specific management and quality assurance roles in the RA are the ERM Project Director (PD), the ERM Project Manager (PM), the ERM Field Team Leader (FTL) and the ERM Quality Assurance Officer (QAO). In the following sections, the roles and responsibilities of key personnel are identified.

### 2.1 *REMEDIATION PROJECT MANAGER*

The NYSDEC Remediation Project Manager (RPM) is the lead technical representative of the NYSDEC.

### 2.2 *ERM PROJECT DIRECTOR*

The ERM Project Director (PD) will be James Perazzo. Mr. Perazzo will oversee the ERM Project Manager (PM) and be responsible for all technical aspects of the project including the overall quality of the project and project deliverables for ERM. Mr. Perazzo has extensive experience with the management and coordination of multi-disciplinary environmental field investigation and remedial projects in New York State.

### 2.3 *ERM PROJECT MANAGER*

The ERM PM, Ms. Catherine Weber, will report to the ERM PD. Ms. Weber will oversee the ERM QAO and the ERM FTL, field investigation staff, and any subcontractors. Ms. Weber will also be responsible for all technical aspects of the project for ERM. This includes scheduling,

communicating to the client, technical development and review of all field activities, subcontracting, and the overal quality of the project and project deliverables for ERM. Ms. Weber has extensive experience with the management and coordination of multi-disciplinary environmental field investigation and remedial projects in New York State.

## *2.4 ERM QUALITY ASSURANCE OFFICER*

The ERM Quality Assurance Officer (QAO), Mr. Andrew Coenen, will report to the ERM PM. Mr. Coenen will have overall responsibility for QA/QC review of all analytical data generated during the field investigation, data validation and qualification of analytical results in terms of data usability. Mr. Coenen has extensive analytical laboratory experience and experience in the validation of analytical data and the protocols and QC specifications of the analytical to be utilized.

## *2.5 ERM FIELD TEAM LEADER*

The ERM Field Team Leader (FTL), will report to the ERM PM and the RPM. The FTL will be responsible for the day to day management and coordination of ERM field staff and subcontractors as wekk as for the implementation and quality of the field activities. An experienced ERM geologist or engineer with extensive environmental field investigation/subcontractor oversight experience in New York State will be assigned for this role.

The following table summarizes the Personnel Information on this project and also provides contact information:

| *Name* | *Title* | *Company* | *Address* | *Telephone Number* |
|---|---|---|---|---|
| Jonathan Greco | Remediation Project Manager | NYSDEC | 625 Broadway, 12th Floor Albany, New York 12233-7016 | (518) 402-9694 |
| James Perazzo | Project Director (PD) | ERM | 520 Broad Hollow Road Suite 210 Melville, New York 11747 | (631) 756-8947 |
| Catherine Weber | Project Manager (PM) | ERM | 399 Boylston Street, 6th Floor Boston, MA, 02116 | (617) 646-7800 ext 67852 |
| Andrew Coenen | Quality Assurance Officer (QAO) | ERM | 520 Broad Hollow Road Suite 210 Melville, New York 11747 | (631) 756-8959 |
| To be assigned | Field Team Leader (FTL) | ERM | 520 Broad Hollow Road Suite 210 Melville, New York 11747 | (631) 756-8900 |
| Steve Grant | Laboratory Project Manager (PM) | Accutest | 2235 Route 130 Dayton, NJ 08810 | (732) 329-0200 |

## *3.0 FIELD QUALITY ASSURANCE/QUALITY CONTROL*

### *3.1 EQUIPMENT MAINTENANCE*

A maintenance, calibration, and operation program will be implemented to ensure that routine calibration and maintenance is performed on all field instruments. The program will be administered by ERM FTL and the field team members. Monthly and annual maintenance, calibration and equipment operation will follow the procedures outlined in the manufacturer's Operation and Field Manuals accompanying the respective instruments.

### *3.2 EQUIPMENT CALIBRATION*

Trained field team members will be familiar with the field calibration, operation, and maintenance of the equipment. They will perform field calibrations, checks, and instrument maintenance daily. A photoionization detector (PID) will be used to assess the health and safety condition of workers while excavating and collecting soil samples. The (PID) will be calibrated prior to use on a daily basis with isobutylene. A trained team member will perform daily field checks and instrument maintenance prior to use. A real-time particulate monitor (e.g., PM-10 DataRam and personal pDR1000 MIE RAM) will be calibrated by the manufacturer and zeroed in the field prior to each use. Field maintenance, calibration and equipment operation will follow the procedures outlined in the manufacturer's Operation and Field Manuals accompanying the respective instruments. All maintenance and calibration will be documented on an instrument-specific master calibration/ maintenance form.

The FTL will be responsible for keeping a master instrument calibration/maintenance form for each measuring device. Each form will include at least the following relevant information:

- Name of device and/or instrument calibrated;
- Device/instrument serial and/or identification (I.D.) number;
- Frequency of calibration;
- Date of calibration;
- Results of calibration;
- Name of person performing the calibration; and
- Identification of the calibration standards;

In lieu of a form, this information may be recorded in the field log book.

## *3.3 EQUIPMENT DECONTAMINATION*

In order to minimize the potential for cross-contamination, all drilling and sampling equipment will be properly decontaminated prior to and after each use.

### *3.3.1 General Procedures*

All heavy equipment will be decontaminated in a designated clean area. Sampling equipment and probes will be decontaminated in an area covered by plastic near the sampling location. All solvents and wash water used in the decontamination process will be collected and drummed for off-site disposal. All disposable sampling equipment will be properly disposed of in dry containers.

Extraneous contamination and cross-contamination will be controlled by wrapping the sampling equipment with aluminum foil when not in use and changing and disposing of the sampler's gloves between samples. Decontamination of sampling equipment will be kept to a minimum in the field, and wherever possible, dedicated sampling equipment will be used.

Personnel directly involved in equipment decontamination will wear appropriate protective equipment.

### 3.3.2 *Heavy Equipment (drill rigs, etc.)*

All drilling equipment and the back of the drilling rig will be decontaminated by steam cleaning prior to performance of the first boring/well installation and between all subsequent borings/well installations. This will include all hand tools, casing, augers, drill rods and bits, tremie pipe and other related tools and equipment. The steam cleaning equipment will be capable of generating live-steam with a minimum temperature of 212 °F.

All water used during drilling and/or steam cleaning operations will be from a potable source. The drilling contractor is responsible for obtaining all permits from the local potable water purveyor and any other concerned authorities, and provision of any requested back-flow prevention devices. The equipment will be cleaned with proper field decontamination techniques.

### 3.3.3 *Non-Aqueous Sampling Equipment (trowels, split-spoons, bowls, bailers, etc.)*

All non-aqueous sampling equipment will be decontaminated before each use as follows:

- Laboratory-grade glassware detergent and tap water scrub to remove visual contamination;
- Generous tap water rinse; and
- Distilled and deionized (American Standard for Testing of Materials (ASTM) Type II) water rinse.

### 3.3.4 *Meters and Probes*

All meters and probes that are used in the field (other than those used solely for air monitoring purposes, e.g., oxygen meters, explosimeters, etc.) will be decontaminated between use as follows:

- phosphate-free laboratory detergent solution;
- tap water;
- methanol rinse (at the FTL's discretion if deemed necessary); and
- deionized water (triple rinse).

### 3.3.5 *Non-Aqueous Sampling Equipment (trowels, split-spoons, bowls, bailers, etc.)*

- All non-aqeous sampling equipment will be decontaminated before each use as follows:
- Laboratory-grade glassware detergent and tap water scrub to remove visual contamination;
- Generous tap water rinse; and
- Distilled and deionized (American Standard for Testing of Materials (ASTM) Type II) water rinse.

## 3.4 *QUALITY ASSURANCE/ QUALITY CONTROL SAMPLING*

Specific guidance regarding the collection of field and laboratory QA/QC samples is presented separately below.

### 3.4.1 *Field QA/QC Samples*

*Trip Blanks*

The TB will be used to determine if any cross-contamination occurs between aqueous samples during shipment. TBs will be supplied by the

analytical laboratory as aliquots of distilled, deionized water that will be sealed in a sample bottle prior to initiation of each day of fieldwork. Glass vials (40 ml) with Teflon®-lined lids will be used for TBs. The sealed TB bottles will be placed in a cooler with the empty sample bottles and will be shipped to the site by the laboratory personnel. If multiple coolers are necessary to store and transport aqueous VOC samples, then each cooler must contain an individual TB. TBs are analyzed for VOCs only.

*Field Blanks*

FBs will be collected to evaluate the cleanliness of soil and aqueous sampling equipment, sample bottles and the potential for cross-contamination of samples due to handling of equipment, sample bottles and contaminants present in the air. FBs will be collected at a frequency of one per decontamination event for each type of sampling equipment, and each media being sampled at a minimum of one per equipment type and/or media per day.

FBs will be collected prior to the occurrence of any analytical field sampling event by pouring deionized or potable water over a particular piece of sampling equipment and into a sample container. The analytical laboratory will provide field blank water and sample jars with preservatives for the collection of all FBs. Glass jars will be used for organic blanks. The FBs as well as the TBs will accompany field personnel to the sampling location. The FBs will be analyzed for the same analytes as the environmental samples being collected that day and will be shipped with the samples taken.

FBs will be taken in accordance with the procedure described below:

- Decontaminate sampler using the procedures specified in the QAPP;

- Pour distilled/deionized water over the sampling equipment and collect the rinsate water in the appropriate sample bottles;
- The sample will be immediately placed in a sample cooler and maintained at a temperature of 4°C until receipt by the laboratory; and
- Fill out sample log, labels and COC forms, and record in field notebook.

*Temperature Blanks*

The temperature blank will be used to determine the temperature of the samples within the cooler upon arrival at the analytical laboratory. A laboratory-supplied temperature blank will be an aliquot of distilled, deionized water that will be sealed in a sample bottle. The sealed temperature blank bottles will be placed in a cooler with the empty sample bottles and will be shipped to the site by the laboratory personnel. If multiple coolers are necessary to store and transport samples, then each cooler must contain an individual temperature blank.

### 3.4.2 *Laboratory QA/QC*

*Blind Field Duplicate Samples*

Blind field duplicate samples will be collected and analyzed to check laboratory reproducibility of analytical data. Blind field duplicate samples will be collected at a frequency of at least 5% (one out of every 20 samples) of the total number of samples collected to evaluate the precision and reproducibility of the analytical methods. All blind field duplicate samples will be submitted to the analytical laboratory as a normal sample, however, will have a trackable, fictitious sample identification and fictitious time of sample collection. Each blind field duplicate will be cross-referenced to document which actual sample it is a blind field duplicate of in the field notes and on the master sample log.

*Matrix Spike/Matrix Spike Duplicate*

Additional environmental sample volume will be collected for use as MS/MSD samples at a frequency of at least 5% (one out of every 20 samples) of the total number of samples collected to evaluate the precision and reproducibility of the analytical methods. To ensure the laboratory has sufficient volume for MS/MSD analysis, triple sample volume must be submitted for aqueous organic extractable and volatile samples once per every 20 samples in a sample delivery group (SDG).

The following guidelines shall apply for the field QA/QC samples and laboratory QA/QC samples to be utilized for this work plan:

- Duplicates are generally collected at a minimum frequency of five percent (1 per 20 field samples). More frequent collection may be warranted based on field conditions/observations and/or at the discretion of the FTL.
- MS/MSD Pairs (two samples) are generally collected at a minimum frequency of five percent (1 per 20 field samples). More frequent collection may be warranted based on field conditions/observations and/or at the discretion of the FTL. Two samples are required for each MS/MSD pair.
- Field Blanks are generally collected at a minimum frequency of one per day. More frequent collection may be warranted based on field conditions/observations and/or at the discretion of the Field Team Leader.
- Trip Blanks are generally for VOCs only and will not be conducted for lead anlaysis.

## 3.5 *FIELD RECORDS*

Proper management and documentation of field activities is essential to ensure that all necessary work is conducted in accordance with the RA, and QAPP in an efficient and high quality manner. Field management procedures include following proper chain of custody (COC) procedures to track a sample from collection through analysis, noting when and how samples are split (if necessary), making regular and complete entries in the field logbook, and the consistent use and completion of field management forms. Field management forms and field logbook will be used to document all field activities, as this documentation will support that the samples were collected and handled properly, making the resultant data complete, comparable and defensible. Field logbook procedures and field management forms are identified in the following sections.

### 3.5.1 *Field Logbook*

The sample team or individual performing a particular sampling activity will keep a weatherproof field notebook. Field notebooks are intended to provide sufficient data and observations to enable participants to reconstruct events that occurred during projects and to refresh the memory of the field personnel if called upon to give testimony during legal proceedings. In a legal proceeding, notes, if referred to, are subject to cross-examination and are admissible as evidence. The field notebook entries should be factual, detailed, and objective. All entries are to be signed and dated. All members of the field investigation team are to use this notebook, which will be kept as a permanent record. The field notebook will be filled out at the location of sample collection immediately after sampling. It will contain sample descriptions including: sample number, sample collection time, sample location, sample

description, sampling method used, daily weather conditions, field measurements, name of sampler, and other site-specific observations. The field notebook will contain any deviations from protocol and why, visitor's names, or community contacts made during sampling, geologic investigation activities, and other site-specific information which may be noteworthy.

### *3.5.2 Field Management Forms*

In addition to maintenance of a field logbook, the use of field management forms will supplement field logbook entries for all field activities associated with this project. Field management forms provide a regular format to record the relevant information for a particular field activity. Use of these forms will ensure that the field team consistently and completely records all pertinent data relative to a particular field activity on a regular basis. All forms, sample labels, custody seals and other sample documents will be filled out completely.

A list of the forms and the associated activities for which each form could potentially be completed is presented below.

| ***Form*** | ***Activity*** |
|---|---|
| Daily Field Report | Every day of field activity |
| Daily Instrument Calibration Log | Every day a field instrument is used |
| Soil Boring Logs | All borings |
| Well Development Data Sheet | All well development efforts |
| Sampling Equipment Checklist | All field sampling efforts |
| Laboratory Sample Bottle Request | All field sampling efforts |
| COC Form | All field sampling efforts |

## *3.6 SAMPLE PREPARATION AND CUSTODY*

### *3.6.1 Sample Identification*

In order to provide for proper identification in the field, and proper tracking in the laboratory, all samples must be labeled in a clear and consistent fashion using the procedures and protocols described below and within the following subsections.

- Sample labels will be waterproof and have a pre-assigned, unique number that is indelible.
- Field personnel must maintain a field notebook. This notebook must be water resistant with sequentially numbered pages. Field activities will be sequentially recorded in the notebook.
- The notebook, along with the COC form, must contain sufficient information to allow reconstruction of the sample collection and handling procedure at a later time.
- Each sample will have a corresponding notebook entry which includes:
  - Sample ID number;
  - Well or other sample location and number;
  - Date and time;
  - Analysis for which sample was collected;
  - Additional comments as necessary; and
  - Samplers' name.
- Each sample must have a corresponding entry on a COC manifest.
- The manifest entry for sampling at any one well is to be completed before sampling is initiated at any other well by the same sampling team.
- In cases where the samples leave the immediate control of the sampling team (i.e., shipment via common carrier) the shipping container must be sealed.

Each sample collected will be designated by an alpha-numeric code that will identify the type of sampling location and a specific sample designation (identifier). Location types will be identified by a two-letter code. Soil samples for documentation collected from excavations will begin with "SS". The depth will also be added to soil samples if applicable. The specific sampling designation (identifier) will be identified using a two-digit number. Soil vapor (air) samples will begin with "AIR".

In the case of QC samples such as FBs, TBs and blind field duplicate samples, six digits will follow FB, TB and DUP respectively to represent the date (e.g., FB010508 would represent a field blank collected on 5 January 2008). For matrix spike/matrix spike duplicate samples, MS/MSD will be added following the applicable sample identification.

### 3.6.2 *Sample Containers*

- The analytical laboratory will provide all sample containers.
  - If glass bottles are used, extra glass bottles will be obtained from the laboratory to allow for accidental breakage that may occur.
  - If sample preservation is specified, the necessary preservatives will be placed in the sample bottles by the laboratory.
- The sample bottles will be handled carefully so that any preservatives are not inadvertently spilled.

A more detailed description of the sample containers to be utilized for this RA can be found in Table 2.

### 3.6.3 *Sample Preservation*

*Sample Preservation*

Soil samples collected during the RA will be preserved by cooling to 4°C and maintained at this temperature until time of analysis.

*Sample Holding Time*

- All samples will be shipped the same day they are obtained to the analytical laboratory. Any exceptions will be documented in the field logbook and proper preservation techniques followed.
- The samples must be stored at or near 4°C and analyzed within specified holding times.
- The analytical laboratory will be a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP)-certified laboratory, and conform to meeting specifications for documentation, data reduction and reporting. The laboratory will follow all method specifications pertaining to sample holding times contained in the NYSDEC ASP (revised 2005) and/or as prescribed by the specific analytical method.

A more detailed description of the sample holding times to be utilized for this RA can be found in Table 2.

*Sample Custody*

***Chain of Custody (COC)*** - The primary objective of the sample custody procedures is to create an accurate written record that can be used to trace the possession and handling of all samples from the moment of their collection, through analysis, until their final disposition. All field sampling personnel will adhere to proper sample custody procedures because samples collected during an investigation could be used as evidence in litigation. Therefore, possession of the samples must be traceable from the time each sample is collected until it is analyzed at the laboratory.

***Custody Transfer to Field Personnel -*** The on-site hydrogeologist or the field personnel will maintain custody of samples collected during this investigation. All field personnel are responsible for documenting each

sample transfer and maintaining custody of all samples until they are shipped to the laboratory. COC records will be completed at the time of sample collection and will accompany the samples inside the cooler for shipment to the selected laboratory.

The COC record will be signed by each individual who has the samples in their possession. Preparation of the COC record is as follows:

- For every sample, the COC record will be initiated in the field by the person collecting the sample. Every sample will be assigned a unique identification number that is entered on the COC Record.
- The record will be completed in the field to indicate project, sampling team, etc.
- If the person collecting the sample does not transport the samples to the laboratory or deliver the sample containers for shipment, the first block for Relinquished By _____, Received By _____ will be completed in the field.
- The person transporting the samples to the laboratory or delivering them for shipment will sign the record form as Relinquished By _____.
- If the samples are shipped to the laboratory by commercial carrier, the original COC record will be sealed in a watertight container and placed in the shipping container, which will be sealed prior to being given to the carrier. The carbonless copy of the COC record will be maintained in the field file.
- If the samples are directly transported to the laboratory, the COC will be kept in possession of the person delivering the samples.
- For samples shipped by commercial carrier, the waybill will serve as an extension of the COC record between the final field custodian and the laboratory.
- Upon receipt in the laboratory, the Sample Custodian or designated representative, will open the shipping containers, compare the contents with the COC record, and sign and date the record. Any discrepancies will be noted on the COC record.
- If discrepancies occur, the samples in question will be segregated from normal sample storage and the field personnel immediately notified.
- COC records will be maintained with the records for a specific project, becoming part of the data package.

***Custody Transfer to Laboratory -*** All samples collected during the RA will be submitted to a NYSDOH ELAP-certified laboratory meeting specifications for documentation, sample login, internal chain of custody procedures, sample/analysis tracking, data reduction and reporting. The laboratory will follow all specifications pertaining to laboratory sample custody procedures contained in the NYSDEC ASP (revised 2005).

In general, the following procedures will be followed upon sample receipt. The laboratory will not accept samples collected by project personnel for analysis without a correctly prepared COC record.

The first steps in the laboratory receipt of samples are completing the COC records and project sample log-in form. The laboratory Sample Custodian, or designee, will note that the shipment is accepted and notify the Laboratory Manager or the designated representative of the incoming samples.

Upon sample receipt, the laboratory Sample Custodian, or designee, will:

- Examine all samples and determine if proper temperature has been maintained during shipment. If samples have been damaged during shipment, the remaining samples will be carefully examined to determine whether they were affected. Any samples affected will also be considered damaged. It will be noted on the COC record that specific samples were damaged and that the samples were removed from the sampling program. Field personnel will be notified as soon as possible that samples were damaged and that they must be resampled, or the testing program changed, and provide an explanation of the cause of damage.
- Compare samples received against those listed on the COC record.
- Verify that sample holding times have not been exceeded.
- Sign and date the COC record and attach the waybill to the COC record.
- Denote the samples in the laboratory sample log-in book which contains the following information:
  - Project identification number

- Sample numbers
- Type of samples
- Date received in laboratory
- Record of the verified time of sample receipt (VTSR)
- Date put into storage after analysis is completed
- Date of disposal.

The last two items will be added to the log when the action is taken.

- Notify the Laboratory Manager of sample arrival.
- Place the completed COC records in the project file.

The VTSR is the time of sample receipt at the laboratory. The date and time the samples are logged in by the Sample Custodian or designee, will agree with the date and time recorded by the person relinquishing the samples.

A typical COC can be found as Figure 1.

### *3.6.4 Sampling Packaging and Shipping*

Sample bottles and samples will either be delivered/picked up at the site daily by the analytical laboratory, or delivered/shipped via overnight courier. Once the samples have been collected, proper procedures for packaging and shipping will be followed as described below.

*Packaging*

Prior to shipment, samples must be packaged in accordance with current United States Department of Transportation (USDOT) regulations. All necessary government and commercial carrier shipping papers must be

filled out. The procedure below should be followed regardless of transport method:

- Samples will be transported in metal ice chests or sturdy plastic coolers (cardboard or Styrofoam containers are unacceptable). Soil vapor (air) samples will be transported in their original cardboard packing, if applicable, or similar materials.
- Remove previously used labels, tape and postage from cooler.
- Ship filled sample bottles in same cooler in which empty bottles were received.
- Affix a return address label to the package(s).
- Check that all sample bottles are tightly capped.
- Check that all bottle labels are complete.
- Be sure COC forms are complete.
- Wrap sample bottles in bubble pack and place in packaging.
- Pack bottles with extra bubble pack, vermiculite, or Styrofoam "peanuts". Be sure to pack the TB, if one is being submitted with the samples.
- Separate and retain the sampler's copy of COC and keep with field notes.
- Tape paperwork (COC, manifest, return address) in zipper bag to inside packaging.
- Close packaging and apply signed and dated custody seal in such a way that the seal must be broken to open the package(s). An example custody seal may be found in Figure 2.

*Shipping*

Samples should arrive at the laboratory as soon as possible following sample collection to ensure that holding times are not exceeded. All samples must be hand delivered on the same day as sampling or sent via overnight courier. When using a commercial carrier, follow the steps below.

- Securely package samples and complete paperwork.
- Weigh packages(s) for air transport.
- Complete air bill for commercial carrier (air bills can be partially completed in office prior to sampling to avoid omissions in field). If necessary, insure packages.
- Keep customer copy of air bill with field notes and COC form.
- When package(s) have been released to transporter, call receiving laboratory and give information regarding samplers' names, method of arrival.
- Call the lab on day following shipment to be sure all samples arrived intact. If bottles are broken, locations can be determined from COC and resampled.

## *3.7 ANALYTICAL LABORATORY*

The data collected during the course of the RA activities will be used to determine the presence and concentration of certain analytes in soil. Following RA activities, soil vapor (air) samples will be collected as part of the Site Management Plan (SMP).

All samples collected during the RA will be submitted to Accutest Laboratories (STL) located at 2235 Route 130 Dayton, NJ 08810. Accutest is a NYSDOH ELAP-certified laboratory (Lab I.D. #10893) meeting specifications for documentation, data reduction and reporting. The sub-surface soil vapor (air) sample will be submitted to a NYSDOH ELAP-certified laboratory approved to analyze air samples.

## *3.8 ANALYTICAL TEST PARAMETERS*

The RA will require the analysis of soil samples and associated QA/QC samples for lead. Soil vapor samples collected as part of the SMP for VOC analysis will be analyzed by EPA TO-15. The sample will be collected using

a Summa canister. Analyses will be performed by a laboratory with current ELAP-certification.

Good field management procedures following proper chain of custory procedures to track a sample from collection through analysis, noting when and how samples are split (if necessary), making regular and complete entries in the field logbook, and the consistent use and completion of field management forms. Proper completion of these forms and the field logbook are necessary to support the consequent actions that may result from sample analysis. This documentation will support hat the samples were collected and handled properly making the resultant data complete, comparable and defensible.

## *3.9 INSTRUMENT CALIBRATION*

The frequency of laboratory instrument calibration and associated procedures for the specific analytical methods to be followed by the selected laboratory are specified in the individual USEPA analytical method procedures. The selected laboratory's calibration schedule will adhere to all analytical method specifications. Additionally, the laboratory specific and analytical method specific reporting levels and method detection limits for lead in soil and VOCs in soil vapor are summarized in Tables 3 and 3A, respectively.

## *3.10 DATA MANAGEMENT AND REPORTING PLAN*

### *3.10.1 Data Use and Management Objectives*

*Data Use Objectives*

The typical data use objectives for workplan are:

- Ascertaining if there is a threat to public health or the environment.
- Locating and identifying potential sources of impacts to soil or ground water.
- Delineation of horizontal and vertical constituent concentrations, identifying clean areas, estimating the extent and/or volume of impacted soil and ground water.
- Determining treatment and disposal options.
- Formulating remediation strategies, and estimating remediation costs.

*Data Management Objectives*

The primary objective of proper data management is to ensure and document that all necessary work is conducted in accordance with the workplan and QAPP in an efficient and high quality manner thereby maximizing the confidence in the data in terms of PARCC. Data management procedures not only include field and laboratory documentation, but also include how the information is handled after the conclusion of field investigation and laboratory analyses area completed. Data handling procedures include project file management, reporting, usability analysis (review and validation) and use of consistent formats for the final presentation of the data.

*Project File Specifications*

All project information will be kept in a central Project File maintained by the ERM Project Manager. The Project File will be assigned a unique project number that will be clearly displayed on all project file folders (including electronic files). Electronic files will be maintained in a similarly organized Project File located on the ERM Central Network system that is backed up on a weekly basis. Both hard copy and electronic Project Files will contain, at a minimum copies or originals of the following key project information:

- All correspondence including letters, transmittals, telephone logs, memoranda, and emails;
- Meeting notes;
- Technical information such as analytical data; field survey results, field notes, field logbooks and field management forms;
- Project calculations;
- Subcontractor agreements/contracts, and insurance certificates;
- Project-specific health and safety information/records;
- Access agreements;
- Project document output review/approval documentation; and
- Reports: Monthly Progress, Interim Technical and Draft/Final Technical.

### *3.10.2 Reporting*

*Field Data*

Field data will be recorded and reported by field personnel using appropriate field data documentation materials such as the field logbook, field management forms and COC forms.

Good field management procedures include following proper COC procedures to track a sample from collection through analysis, noting when and how samples are split (if necessary), making regular and complete entries in the field logbook, and the consistent use and completion of field management forms. Proper completion of these forms and the field logbook are necessary to support the consequent actions that may result from the sample analysis. This documentation will support that the samples were collected and handled properly making the resultant data complete, comparable and defensible.

*Laboratory Data*

The analytical results of all samples collected as part of the RA will be reported following NYSDEC ASP 2005 specifications. All laboratory analytical data will be reported as NYSDEC Category B deliverables. The Category B data deliverables include all backup QA/QC documentation necessary to facilitate a complete validation of the data.

In addition, NYSDEC "Sample Identification and Analytical Requirement Summary" and "Sample Preparation and Analysis Summary" forms will be completed and included with each data package. The sample tracking forms are specified and supplied by the 2005 NYSDEC ASP.

The laboratory will also transmit the analytical data in an electronic format to minimize the chances of transposition errors in summarizing the data. The data will be transmitted in an electronic data deliverable (EDD) in GISKEY (most recent version) format and a PDF copy of each ASP deliverable.

### *3.10.3 Data Review*

All field and laboratory data will be reviewed, as necessary to assess data usability by direct comparison to the specified data quality objectives and/or procedures set forth in this QAPP. Information that can be obtained includes comparison of results obtained from samples taken at the same location, and the identification of missing data points. Examination of the data at the end of the process allows for the assessment of data quality with respect to PARCC.

### 3.10.4 *Data Presentation Formats*

Project data will be presented in consistent formats for all letters, Monthly Progress Reports, Interim Technical Reports, and Draft/Final Technical Reports. Specific formats will be tailored to best fit the needs of the data being presented but general specifications are described below.

*Data Records*

The data record will generally include one or more of the following:

- Unique sample or field measurement code;
- Sampling or field measurement location and sample or measurement type;
- Sampling or field measurement raw data;
- Laboratory analysis ID number;
- Property or component measured; and
- Result of analysis (e.g., concentration).

*Tabular Displays*

The following data will generally be presented in tabular displays:

- Unsorted (raw) data;
- Results for each medium or for each constituent monitored;
- Data reduction for statistical analysis;
- Sorting of data by potential stratification factors (e.g., location, soil layer/depth, topography, etc.); and
- Summary data.

*Graphical Displays*

The following data will be presented in graphical formats (e.g., bar graphs, line graphs, area or plan maps, isopleth plots, cross-sectional plots or transects, three dimensional graphs, etc.):

- Sample locations and sampling grid;
- Boundaries of sampling area;
- Areas where additional data are necessary;
- Constituent concentrations at each sample location;
- Geographical extent of impacts;
- Constituent concentration levels, averages, minima and maxima;
- Changes in concentration in relation to distance from the source, time, depth or other parameters;
- Features affecting intramedia transport; and
- Potential receptors.

## 3.11 PERFORMANCE AUDITS

### 3.11.1 Field Audits

During field activities, the QAO will accompany sampling personnel into the field to verify that the sampling program is being properly implemented and to detect and define problems so that corrective action can be taken. All findings will be documented and provided to the ERM PM and FTL.

### 3.11.2 Laboratory Audits

The NYSDOH ELAP CLP certified laboratory that has satisfactorily completed performance audits and performance evaluation samples will be used for all sample analysis. The results of the most recent

performance audits and performance evaluations will be made available upon request.

### *3.11.3 Corrective Actions*

The NYSDOH ELAP CLP certified laboratory utilized for this project will meet the specifications for corrective action protocols typical for performing contract laboratory services. Laboratory corrective action may include instrumentation maintenance, methods modification, cross contamination/carry over issues, sample tracking practices, laboratory information management (LIMs), etc.

Prior to mobilization for the field investigation, a meeting may be scheduled among representatives of ERM and the laboratory to discuss general corrective action approach and establish procedures to ensure good and timely communications among all parties during the investigation. New procedures will be put into effect as appropriate.

## *3.12 WASTE DISPOSAL PLAN*

### *3.12.1 Investigative Derived Wastes*

The following section describes the general protocol for handling and disposal of solid and liquid wastes generated during the RA. Waste generated during the RA is expected to consist of trash (boxes, paper, etc.), auger cuttings, decontamination wash water, and used protective clothing.

The following guidance documents and regulations may be relied upon to guide the management, staging and storage of investigative derived waste materials:

- NYSDEC's TAGM #4032 on " Disposal of Drill Cuttings" {November 21, 1989}; (See Exhibit 3)
- NYSDEC's RCRA TAGM #3028 on " Contained-In Criteria for Environmental Media" {November 30, 1992}; (See Exhibit 3)
- 40 C. F. R. Part 262 (Standards Applicable to Generators of Hazardous Waste);
- 40 C. F. R. Part 263 (Standards Applicable to Transporters of Hazardous Waste;
- 40 C. F. R. Part 264 (Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities); and
- 40 C. F. R. Part 268 (Land Disposal Restrictions).

Accordingly, handling and disposal will be as follows:

- Cuttings from soil borings and the tailings from the unused portion of the samples will be placed back down the borehole. The remainder of the borehole will be grouted by hand or with a tremie pipe. If necessary, the borehole will also be sealed at or near the water table with a non-shrinking impermeable material to prevent the hole from acting as a conduit for surface runoff.
- Cuttings from monitoring well installations will be collected in drums stored onsite. A waste subcontractor will then dispose of the drums at an off-site location.
- Used protective clothing and equipment that is suspected to be contaminated with hazardous waste will be placed in plastic bags, packed in 55-gallon ring-top drums, and transported to the drum staging area.

### *3.12.2 Other Wastes*

- Non-contaminated trash and debris will be placed in a trash dumpster and disposed of by a local garbage hauler.
- Non-contaminated protective clothing will be packed in plastic bags and placed in a trash dumpster for disposal by a local garbage hauler.

*TABLES*

*FIGURES*

***FIGURE 1-1***
***Example Chain of Custody***

ERM

Environmental Resources Management

# Chain of Custody

Project Name / No. _____

Project Coordinator / Contact _____

Sampler(s) _____

Bottles Supplied By _____

Sheet No. _____

Type and No. of Containers

| Date | Time | Comp. | Grab | Sample Identification | Soil | Water | Total No. of Containers | | | | | | | | | | Analysis Requested |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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| Relinquished By (Signature) | Date/Time | Received By (Signature) | Date/Time | Reason for Transfer |
|---|---|---|---|---|
| | | | | |
| | | | | |

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*FIGURE 2*
*EXAMPLE CUSTODY SEAL*

ERM

CHAIN OF CUSTODY SEAL

*TABLES*

*TABLE 1*
*ANALYTICAL LABORATORY DATA QUALITY OBJECTIVES (DQOs) FOR PRECISION AND ACCURACY*
*LEAD ANALYSIS*

| ***Matrix*** | ***QC Compounds*** | ***Blind Field Duplicate Precision (% RPD)*** | ***Calibration*** *ICV & CCV* | ***Method Blank*** | *Matrix Spike Accuracy* ***(% Rec.)*** | *Duplicate Precision* ***(% RPD)*** | ***Serial Dilution*** *Precision* ***(% D)*** | ***Lab Check Sample Accuracy (% Rec.)*** |
|---|---|---|---|---|---|---|---|---|
| Soil | Lead | < 100% | 90-110 | < ± CRDL | 75-125 [1] | < 20 [2] | < 10 [3] | Manufacturer's Control Limits |

**Notes:**

1.Spike recovery limits do not apply when the sample concentration exceeds the spike added concentration by a factor of 4 or more.
2.Limit is ± 35% if values are ≥ 5x CRDL; limit is ± 2x CRDL if values are <5x CRDL; no limit if both values are < instrument detection limit (IDL).
3.Limit applies only when the analyte concentration in the original sample (I) is > 50 x IDL; if I < 50x IDL then no limit.

QC = Quality Control; RPD = Relative Percent Difference; CRDL = Contract Required Detection Limits;
ICV = Initial Calibration Verification Check; CCV = Continuing Calibration Verification Check;
MS = Matrix Spike Sample; % Rec. = Percent Recovery; IDL = Instrument Detection Limit.

*TABLE 2*
*DETAILED SUMMARY OF SAMPLING PROGRAM*
*SAMPLE, ANALYTICAL METHODS, PRESERVATIVES, HOLDING TIMES AND CONTAINERS*

| *Analytical Parameters* | *Analytical Method Reference* | *Sample Preservation* | *Holding Time* [1] | *Container* [2] |
|---|---|---|---|---|
| Lead | USEPA SW-846 Method 6010 | Cool, 4°C | 180 days | 1 – 8 oz. glass jar |
| VOCs | USEPA Method TO-15 | None | 14 days | Summa Canister |

**Notes:**
1. Holding time is days after collection until analysis.
2. As specified by the laboratory.

*TABLE 3*
*TOTAL LEAD ANALYSIS*
*REPORTING LEVELS, AND METHOD DETECTION LIMITS FOR SOIL*

| *Analyte List* | *CAS Number* [1] | *Reporting Levels* [2, 3] | *Instrument Detection Limits* [2, 3] |
|---|---|---|---|
| Lead | 7439-92-1 | 0.60 mg/kg | 0.60 mg/kg |

**Notes:**

1. Chemical Abstracts Service (CAS) Registry Number.
2. As per the laboratory.
3. Reporting Levels and Instrument Detection Limits (IDLs) for soil will vary depending on percent moisture. Subject to change throughout the course of the project if the laboratory is required to update the IDLs.

*TABLE 3A*
*VOLATILE ORGANIC COMPOUND REPORTING LIMITS AND METHOD DETECTION LIMITS FOR*
*SOIL VAPOR (AIR)*

| *Compound List* | *CAS Number* [1] | *Reporting Levels (ppbv)* [2] | *Method Detection Limit (ppbv)* [2, 3] |
|---|---|---|---|
| dichlorodifluoromethane | 75-71-8 | 0.5 | 0.0960 |
| chloromethane | 74-87-3 | 0.5 | 0.141 |
| 1,2-dichloro-1,1,2,2-tetrafluoroethane | 76-14-2 | 0.5 | 0.101 |
| vinyl chloride | 75-01-4 | 0.5 | 0.0859 |
| bromomethane | 74-83-9 | 0.5 | 0.0925 |
| chloroethane | 75-00-3 | 0.5 | 0.120 |
| trichlorofluoromethane | 75-69-4 | 0.5 | 0.394 |
| 1,1,-dichloroethene | 75-35-4 | 0.5 | 0.106 |
| methylene chloride | 75-09-2 | 0.5 | 0.120 |
| 1,1,2-trichloro-1,2,2-trifluoroethane | 76-13-1 | 0.5 | 0.0905 |
| 1,1-dichloroethane | 75-34-3 | 0.5 | 0.105 |
| cis-1,2-dichloroethene | 156-59-2 | 0.5 | 0.114 |
| chloroform | 67-66-3 | 0.5 | 0.0870 |
| 1,2-dichloroethane | 107-06-2 | 0.5 | 0.103 |
| 1,1,1-trichloroethane | 71-55-6 | 0.5 | 0.117 |
| benzene | 71-43-2 | 0.5 | 0.0902 |
| carbon tetrachloride | 56-23-5 | 0.5 | 0.112 |
| 1,2-dichloropropane | 78-87-5 | 0.5 | 0.0826 |
| trichloroethene | 79-01-6 | 0.5 | 0.0723 |
| cis-1,3-dichloropropene | 10061-01-5 | 0.5 | 0.0994 |
| trans-1,3-dichloropropene | 10061-02-6 | 0.5 | 0.0886 |
| 1,1,2-trichloroethane | 79-00-5 | 0.5 | 0.0791 |
| toluene | 108-88-3 | 0.5 | 0.0689 |
| 1,2-dibromoethane (EDB) | 106-93-4 | 0.5 | 0.117 |
| tetrachloroethene | 127-18-4 | 0.5 | 0.0788 |
| chlorobenzene | 108-90-7 | 0.5 | 0.0745 |
| ethylbenzene | 100-41-4 | 0.5 | 0.0984 |
| m-xylene | 108-38-3 | 0.5 | 0.133 |
| p-xylene | 106-42-3 | 0.5 | 0.133 |
| styrene | 100-42-5 | 0.5 | 0.0938 |
| 1,1,2,2-tetrachloroethane | 79-34-5 | 0.5 | 0.0826 |
| o-xylene | 95-47-6 | 0.5 | 0.0767 |
| 1,3,5-trimethylbenzene | 108-67-8 | 0.5 | 0.147 |
| 1,2,4-trimethylbenzene | 95-63-6 | 0.5 | 0.0742 |
| 1,3-dichlorobenzene | 541-73-1 | 0.5 | 0.0994 |
| 1,2-dichlorobenzene | 95-50-1 | 0.5 | 0.0586 |
| 1,4-dichlorobenzene | 106-46-7 | 0.5 | 0.0625 |
| 1,2,4-trichlorobenzene | 120-82-1 | 0.5 | 0.111 |
| hexachlorobutadiene | 87-68-3 | 0.5 | 0.207 |

**Notes:**

1. Chemical Abstracts Service (CAS) Registry Number.
2. As per the laboratory.

*Subject to change throughout the course of the project.*