REMEDIAL ACTION WORK PLAN

for

538-542 WEST 29TH STREET
NEW YORK, NEW YORK

Prepared For:

W29 Owner LLC
148 Madison Avenue, 16th Floor
New York, New York 10016

Prepared By:

Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C.
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June 18, 2019

Langan Project No. 170515401

LANGAN

CERTIFICATIONS

I, Jason J. Hayes, certify that I am currently a New York State (NYS) registered professional engineer and that this Remedial Action Work Plan was prepared in accordance with applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

I certify that all information and statements in this certification are true. I understand that a false statement made herein is punishable as Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law.

DRAFT

NYS Professional Engineer #089491	Date	Signature

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

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ACRONYMS

Acronym	Definition
6 NYCRR	Title 6 of the New York Codes, Rules, and Regulations
μg/L	Micrograms per liter
$\mu g/m^3$	Micrograms per cubic meter
AAI	All Appropriate Inquiries
AGV	New York State Department of Health (NYSDOH) Air Guidance Values
AOC	Area of Concern
ASP	Analytical Services Protocol
AS/SVE	Air Sparge/Soil Vapor Extraction
ASTM	American Society of Testing and Materials
BCA	Brownfield Cleanup Agreement
BCP	Brownfield Cleanup Program
BER	Business Environmental Risks
bgs	Below grade surface
BMP	Best Management Practices
BTEX	Benzene, Toluene, Ethylbenzene and Total Xylenes
BUD	Beneficial Use Determination
CAMP	Community Air Monitoring Program
C&D	Construction and Demolition
CEQR	City Environmental Quality Review
CFR	Code of Federal Regulations
CHASP	Construction Health and Safety Plan
COC	Certificate of Completion
CP-51	Soil Cleanup Guidance (2010)
CPP	Citizen Participation Plan
CQAP	Construction Quality Assurance Plan
CSM	Conceptual Site Model
CU	Commercial Use
CVOC	Chlorinated VOCs

Acronym	**Definition**
DCP	New York City Department of City Planning
DER	Division of Environmental Remediation
DER-10	DER Technical Guidance for Site Investigation and Remediation
DMM	Division of Material Management
DUSR	Data Usability Summary Report
EC	Engineering Controls
ECL	Environmental Conservation Law
EDD	Electronic Data Deliverable
ELAP	Environmental Laboratory Approval Program
ESA	Environmental Site Assessment
ESCP	Erosion and Sediment Control Plan
ESI	Environmental Site Investigation
eV	Electron volt
FER	Final Engineering Report
FIRM	Flood Insurance Rate Map
HASP	Health and Safety Plan
IC	Institutional Controls
GES	Geophysical Engineering Survey
GPR	Ground-penetrating Radar
GQS	Groundwater Quality Standards
Langan	Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C.
MTBE	Methyl tertiary-butyl ether
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NYCDEP	New York City Department of Environmental Protection
NYCDOB	New York City Department of Buildings
NYCDOT	New York City Department of Transportation
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OER	New York City Office of Environmental Remediation
OSHA	Occupational Safety and Health Administration

Acronym	Definition
PAHs	Polycyclic Aromatic Hydrocarbons
PBS	Petroleum bulk storage
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethene
PGW	Protection of Groundwater
PID	Photoionization detector
PM10	Particulates less than 10 microns in diameter
PPE	Personal Protective Equipment
ppm	Parts per million
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RAO	Remedial Action Objectives
RAWP	Remedial Action Work Plan
RCA	Recycled concrete aggregate
RE	Remedial Engineer
REC	Recognized Environmental Condition
RI	Remedial Investigation
RIR	Remedial Investigation Report
RIWP	Remedial Investigation Work Plan
RURR	Restricted Use Restricted-Residential
SCG	Standards, Criteria, and Guidance
SCO	Soil Cleanup Objective
SDS	Safety Data Sheets
SEQRA	State Environmental Quality Review Act
SGV	Standards and Guidance Values
SMMP	Soil/Material Management Plan
SMP	Site Management Plan
SOE	Support of Excavation
SOP	Site Operations Report
SPDES	State Pollutant Discharge Elimination System

Acronym	Definition
SWPPP	Storm-water Pollution Prevention Plan
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TCE	Trichloroethene
TCL	Target Compound List
TOGS	Technical and Operational Guidance Series
QEP	Qualified Environmental Professional
UU	Unrestricted Use
USEPA	United States Environmental Protection
USGS	United States Geological Survey
UST	Underground storage tank
VCP	Voluntary Cleanup Program
VOC	Volatile Organic Compound

EXECUTIVE SUMMARY

Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C. (Langan) prepared this Remedial Action Work Plan (RAWP) on behalf of W29 Owner LLC (the Volunteer) for the property located at 538-542 West 29th Street in the Chelsea neighborhood of New York, New York (the "site"). The Volunteer is applying to the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP) to remediate the 9,900-square-foot (0.227 acre) site in conjunction with site redevelopment, pursuant to a forthcoming Brownfield Cleanup Agreement (BCA) (BCP Site No. Pending). The site contains an E-Designation (E-142) for hazardous materials, noise (window wall attenuation and alternative means of ventilation), and air quality (HVAC fuel limited to natural gas) following the June 23, 2005 High Line/ West Chelsea rezoning (City Environmental Quality Review [CEQR] #03DCP069M). An unrestricted use cleanup is proposed for the property, and when completed, the site development plan currently includes a new commercial building with two cellar levels.

This RAWP evaluates remedial action alternatives and recommends a Track 1 cleanup for addressing impacted site soil, soil vapor and groundwater based on the data summarized in the May 29, 2019 Remedial Investigation Report (RIR). The remedy described in this document is consistent with the procedures defined in the NYSDEC Division of Environmental Remediation (DER) Technical Guidance for Site Investigation and Remediation (DER-10) and complies with applicable federal, state, and local laws, regulations and requirements. A formal Remedial Design document will not be prepared for the site, and an evaluation of fish and wildlife resources was not required.

Site Description/Physical Setting/Site History

The approximately 9,900-square-foot site is located at 538-542 West 29th Street in the Chelsea neighborhood of New York, New York and is identified as Manhattan Borough Tax Map Block 700, Lots 55, 56, and 57. The site is improved with one three-story commercial building (Lot 55), one three-story mixed-use commercial and residential building (Lot 56), and one two-story warehouse (Lot 57). All of the buildings are currently vacant. The site is bounded by West 29th Street to the north, mixed-use residential and commercial buildings followed by the elevated High Line and Tenth Avenue to the east, a multi-story residential apartment building followed by West 28th Street to the south, and a multi-story mixed-use residential and commercial building followed by Eleventh Avenue to the west. The No. 7 subway southern extension runs north-south below Eleventh Avenue, which is about 200 feet to the west of the site.

The site was developed prior to 1890 with two unspecified use buildings that were demolished between 1899 and 1922. Lot 57 was formerly used as a lumber storage yard (1909-1944) and various auto repair facilities over a span of about 50 years (1945-1994). In 1995, Lot 57 was purchased by Gotham Seafood Corporation, a seafood wholesaler. Sanborn maps indicate that Lots 55 and 56 were improved with mixed use-residential and commercial developments from about 1890 to 2005. Certificates of Occupancy (CO) provided by the New York City Department of Buildings (NYCDOB) identified an auto repair shop within Lot 56 in 1924 and 2012. In addition, available CO's for Lot 55 dated 1970 and 1987 identified manufacturing and a heating plant with potential fuel storage. Currently, all of the lots are vacant. Adjoining properties were historically used for residential, commercial, industrial and manufacturing operations.

Summary of the Remedial Investigation

The findings and conclusions of the May 29, 2019 RIR are as follows:

1. Stratigraphy: Historic fill was encountered immediately beneath the building foundation slabs and extends to depths varying from about 7.5 to 10 feet below grade surface (bgs) at 540 West 29th Street (Lots 56), and from about 3 to 12 feet bgs at 542 West 29th Street (Lot 57). Historic fill was encountered below the cellar slab at 538 West 29th Street (Lot 55) at depths ranging from 3 to 5 feet below cellar grade. The historic fill predominately consists of brown fine- to medium-grained sand with varying amounts of gravel, concrete, asphalt, charcoal, slag, ash, wood, brick, and glass. The layer of historic fill is typical for this area of NYC. The fill layer is underlain by native soils typically consisting of reddish-brown to olive, fine- to medium-grained silty sand with varying amounts of gravel and silt. Petroleum impacts, evidenced by odors, staining, and/or photoionization detector (PID) readings above background levels, were apparent in two soil borings (SB03 and SB06) at depths ranging from about 0 to 10 feet bgs and 14 to 15 feet bgs, respectively.
2. Hydrogeology: Groundwater was encountered at 3.2 feet below cellar grade at 538 West 29th Street (Lot 55), 9.2 to 11 feet bgs at 540 West 29th Street (Lot 56) and from 8 to 11.51 feet bgs at 542 West 29th Street (Lot 57). Based on the well gauging results, groundwater appears to flow west toward the Hudson River, which is relatively consistent with regional topography.
3. Historic Fill Quality: Fill contains semivolatile organic compounds (SVOC) and metals at concentrations above Unrestricted Use (UU), Restricted Use Restricted-Residential (RURR) and/or Commercial Use (CU) Soil Cleanup Objectives (SCO). Volatile Organic Compounds (VOC) were also identified within the historic fill, but are likely associated with the petroleum impacts discussed below.
4. Native Soil: The native soil samples did not exceed the Part 375 UU SCOs.
5. Groundwater Quality: VOCs, SVOCs, and metals (total and dissolved) were detected at concentrations above the NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards and Guidance Values (SGV) for drinking water (Class GA) in multiple groundwater samples collected from across the site footprint. The metals are considered typical of regional groundwater conditions, with the exception of arsenic. Arsenic is likely attributed to as off-site source, regional conditions or

interference from the soil matrix (entrained sediment) in groundwater samples. Note that arsenic was not identified in soil above RURR SCOs.

6. Petroleum-Impacted Soil, Groundwater and Soil Vapor:

    a. Petroleum impacts, evidenced by odors, staining, and/or PID readings above background levels, were apparent in two soil borings (SB03 and SB06) at depths ranging from about 0 to 10 feet bgs and 14 to 15 feet bgs, respectively. Petroleum-related VOCs were detected in two soil borings (SB03 and SB04) collected from 0 to 4 feet bgs and 1 to 3 feet bgs, respectively, at concentrations exceeding UU SCOs. Potential petroleum-related SVOCs were detected in 7 soil samples collected from 0 to 8 feet bgs at concentrations exceeding UU, RURR, and/or CU SCOs. The total VOC and SVOC concentrations detected throughout the site indicate petroleum impacts are likely the result of a historical spill from former site usage or indicate a potential off-site source.

    b. Petroleum-related VOCs were detected in groundwater at concentrations exceeding TOGS Class GA SGVs at wells located in the southern and southeastern portions of the site. An elevated headspace reading and petroleum-like odors were observed in the monitoring well TW03 (47.9 parts per million [ppm]).

    c. Elevated benzene, toluene, ethylbenzene and total xylenes (BTEX) compounds above background levels were detected in soil vapor samples throughout the site. BTEX concentrations detected in soil vapor ranged from about 32.1 micrograms per cubic meter ($\mu g/m^3$) in SS-3 to 34,240 $\mu g/m^3$ in SV04 compared to an ambient air concentrations of 8.42 $\mu g/m^3$ and 8.7 $\mu g/m^3$, respectively. Total VOC concentrations in soil vapor samples ranged from 101 $\mu g/m^3$ in SV-1 (Lot 57) to 519,247 $\mu g/m^3$ in SV04 (Lot 55).

    d. Based on the field observations and soil, soil vapor and groundwater analytical results, two petroleum spills were reported to the NYSDEC for Lot 55 (Spill No. 1805506- 538 West 29th Street) and Lot 56 (Spill No. 1805508- 540 West 29th Street). The presence of petroleum-related VOCs in soil, groundwater and soil vapor may be attributed to a combination of releases from site operations (former auto repair) and adjacent and surrounding properties.

7. CVOC-Impacted Soil Vapor: Chlorinated VOCs (CVOC) were identified in soil vapor and sub-slab vapor samples collected across the site, with the highest concentrations located in the southern and southeast portions of the site. No standard currently exists for soil vapor samples in New York State. For reference, soil vapor samples were compared to New York State Department of Health (NYSDOH) Air Guidance Values (AGV). The maximum detected concentrations above AGVs of trichloroethene (TCE) and tetrachloroethene (PCE) in soil vapor and/or sub-slab vapor were 6.9 and 317 $\mu g/m^3$,

respectively. In addition, methylene chloride was detected at a maximum concentration of 110 μg/m^3 at SV02 in exceedance of its associated AGV of 60 μg/m^3. Where paired indoor air and sub-slab vapor samples were collected, the NYSDOH decision matrices were used to evaluate recommended actions (e.g., monitor, mitigate). The NYSDOH decision matrix recommendations include "No Further Action" for detected compounds.

8. Sufficient analytical data was gathered during the previous studies to establish site-specific soil cleanup levels and to develop a remedy for the site. To better delineate the petroleum spill impacts, a supplemental remedial investigation will be performed along the southern site boundary to further evaluate Areas of Concern (AOC) and Contaminants of Concern (COC) defined across the site. The supplemental results and the final remedy will be described and evaluated in a RAWP prepared in accordance with New York State (NYS) BCP guidelines. The remedy will address historic fill impacted with SVOCs and metals, petroleum-impacted soil, groundwater and soil vapor and arsenic in groundwater.

Qualitative Human Health Exposure Assessment

Based on the conceptual site model (CSM) and review of environmental data, complete on-site exposure pathways appear to be present in the absence of protective measures and remediation. The complete exposure pathways indicate there is a risk of exposure to humans from site contaminants via exposure to soil, groundwater, and soil vapor for current and construction conditions.

Complete exposure pathways have the following five elements: 1) a contaminant source; 2) a contaminant release and transport mechanism; 3) a point of exposure; 4) a route of exposure; and 5) a receptor population. A discussion of the five elements comprising a complete pathway as they pertain to the site is provided below.

Current Conditions

Contaminant sources include 1) historic fill with varying levels of VOCs, SVOCs, and metals contamination; 2) Historic site usage that may be related to petroleum-impacted soil, groundwater and soil vapor (documented under NYSDEC Spill Nos. 1805506 and 1805508) and CVOC soil vapor impacts; and 3) historical uses of adjacent and surrounding sites that may be related to CVOCs and petroleum-related contaminants in groundwater and soil vapor.

Contaminant release and transport mechanisms include contaminated soil dermal contact during sampling and dust generation and transport during drilling (dermal, ingestion, inhalation), contaminated groundwater dermal contact, ingestion or inhalation during sampling, and volatilization of contaminants from the soil and groundwater matrices to the soil vapor phase (inhalation).

Under current conditions, the likelihood of exposure to humans is limited, as site access is restricted to authorized workers and guests. The site footprint contains impervious covers (i.e., buildings, concrete) and exposure to soil, groundwater or soil vapor is minimal. Exposure to contaminants in soil and groundwater via dermal contact or ingestion during investigation is minimized, as these activities would occur under a Health and Safety Plan/Construction Health and Safety Plan (HASP/CHASP) with Community Air Monitoring Plan (CAMP) to limit exposure to site workers and the community. In addition, groundwater is not used as potable water supply in Manhattan.

Construction/Remediation Activities

During development and remediation, points of exposure include disturbed and exposed soil during excavation, dust and organic vapors generated during excavation, and contaminated groundwater that could be encountered during excavation and/or dewatering operations. Routes of exposure include ingestion and dermal absorption of contaminated soil and groundwater, inhalation of organic vapors arising from contaminated soil and groundwater (specifically in the area of petroleum and CVOC impacts), and inhalation of dust arising from contaminated soil. The receptor population includes construction and remediation workers and, to a lesser extent, the public adjacent to the site.

The potential for completed exposure pathways is present since all five elements exist; however, the risk will be minimized by the implementation of appropriate health and safety measures during construction and remediation, such as monitoring the air for organic vapors and dust, using vapor and dust suppression measures, cleaning truck undercarriages before they leave the site to prevent off-site soil tracking, maintaining site security, and wearing the appropriate personal protective equipment (PPE).

A CHASP, Soil/Materials Management Plan (SMMP), and CAMP will be implemented and includes measures such as conducting an air-monitoring program, donning PPE, covering soil stockpiles, altering work sequencing, maintaining a secure construction entrance, proper housekeeping, and applying vapor and dust suppression measures to prevent off-site migration of contaminants during construction. Such measures will prevent completion of potential migration pathways for soil, groundwater and soil vapor.

Proposed Future Conditions

For the proposed future conditions, residual contaminants may remain on-site; however, the proposed development plan includes site-wide excavation to about 30 feet bgs into bedrock and removal of all soil/fill from the site. If a Track 1 cleanup is not practicable, residual contaminants may remain on site and exposure pathways will be minimized through the use of engineering and institutional controls. Exposures during sampling activities will be managed under a HASP. Groundwater in New York City is not used as a potable water source and the nearest ecological receptor, the Hudson River, is located about 1,300 feet to the west. The receptor population includes commercial use occupants, patrons and employees, and the nearby community, including children. Accumulation of soil vapor beneath the building is not anticipated considering the building foundation slab is expected to extend into the groundwater table. Additionally, a continuous site-wide waterproofing system will be installed below the slab and along the vertical subgrade foundation sidewalls.

The following conclusions were developed from this human health exposure assessment:

1. Under current conditions, there is a marginal risk for human exposure to site contaminants. The primary exposure pathways are dermal contact, ingestion and inhalation of soil, soil vapor, or groundwater by authorized site visitors during sampling activities. The exposure risks can be avoided or minimized by following the appropriate health and safety and vapor and dust suppression measures outlined in the site-specific HASP and CAMP during investigation activities.
2. In the absence of a HASP and CAMP, there is a moderate risk of exposure during construction and remediation activities. The primary exposure pathways are:
   a. Dermal contact, ingestion and inhalation of contaminated soil, groundwater or soil vapor by construction workers.
   b. Dermal contact, ingestion and inhalation of soil (dust) and inhalation of soil vapor by the community in the vicinity of the site.

   These exposure risks can be avoided or minimized by following a SMMP, and CAMP and by following the appropriate health and safety, vapor and dust suppression and site security measures outlined in a site-specific HASP.
3. The existence of a complete exposure pathway for site contaminants to human receptors during proposed future conditions is unlikely, as soil will be excavated into existing bedrock and transported to an off-site disposal facility and residual soil is not anticipated below new foundation elements. If present, residual contamination would be managed through the use of ECs/ICs following site development. Regional groundwater is not used as a potable water source in Manhattan so exposure to regional groundwater contaminants is unlikely. The potential pathway for soil vapor intrusion into the building will be addressed by completion of the remedial excavation, installation of the building foundation below the water table and installation of a site-wide waterproofing/ vapor barrier as part of construction.
4. It is unlikely that a complete exposure pathway exists for the migration of site contaminants to off-site human receptors for current, construction phase, or future conditions. Monitoring and control measures would be used during investigation and construction to prevent completion of this pathway. Under future conditions, the site will be remediated and, if necessary, engineering controls may be implemented (e.g. site-wide cap and a waterproofing/ vapor barrier) to prevent completion of this pathway.

Summary of the Remedy

It is anticipated that the site will be remediated to Track 1 standards. The proposed Track 1 remedy and site development consists of the followings tasks:

- Demolition of all on-site buildings in accordance with federal, state, and local regulations to prepare the site for excavation and redevelopment
- Site-wide excavation to about 30 feet bgs to remove soil that exceeds UU SCOs, as defined by 6 NYCRR Part 375-6.8(a) and reach development depths. Of the total excavation volume, about 4,800 cubic yards of contaminated historic fill exceeds UU SCOs and will be excavated as a remedial measure. Based on the RI findings, soil exceeding the UU SCOs is present down to at least 12 feet bgs.
- Screening for indications of contamination (e.g., staining, odor and elevated PID readings) of all excavated soil during any intrusive Site work
- Decommissioning and removal of underground storage tanks (UST) identified during remediation, including documentation of proper handling and disposal
- Collection and analysis of confirmation soil samples to verify Track 1 UU SCOs are achieved at the base of the excavation (if possible based on the bedrock depth)
- If necessary, import and placement of clean fill (e.g., virgin crushed stone, recycled concrete aggregate (RCA), and soil meeting Track 1 Part 375 UU SCOs) to bring the grade up to development depth if there are areas that are over-excavated
- Dewatering and treatment of groundwater by a dewatering contractor for groundwater remediation and to support excavation below the water table in accordance with a New York City Department of Environmental Protection (NYCDEP) sewer discharge permit
- Development and implementation of a CHASP and CAMP for the protection of on-site workers, the community, and the environment during the remediation phase of development
- Construction of a new building foundation below the groundwater table with a waterproofing system

Remedial activities will be performed in accordance with this NYSDEC-approved RAWP and the NYSDEC-issued Decision Document.

1.0 INTRODUCTION

Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C. (Langan) prepared this Remedial Action Work Plan (RAWP) on behalf of W29 Owner LLC (the Volunteer) for the property located at 538-542 West 29th Street in the Chelsea neighborhood of New York, New York (the "site"). The Volunteer is applying to the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP) to remediate the 9,900-square-foot (0.227 acre) site in conjunction with site redevelopment, pursuant to a forthcoming Brownfield Cleanup Agreement (BCA) (BCP Site No. Pending). The site contains an E-Designation (E-142) for hazardous materials, noise (window wall attenuation and alternative means of ventilation), and air quality (HVAC fuel limited to natural gas) following the June 23, 2005 High Line/ West Chelsea rezoning (City Environmental Quality Review [CEQR] #03DCP069M). An unrestricted use cleanup is proposed for the property, and when completed, the site development is anticipated to include a new commercial building with two cellar levels.

This RAWP evaluates remedial action alternatives and recommends a Track 1 cleanup for addressing impacted site soil, soil vapor and groundwater based on the data summarized in the May 29, 2019 Remedial Investigation Report (RIR). The remedy described in this document is consistent with the procedures defined in the NYSDEC Division of Environmental Remediation (DER) Technical Guidance for Site Investigation and Remediation (DER-10) and complies with applicable federal, state, and local laws, regulations and requirements. A formal Remedial Design document will not be prepared for the site, and an evaluation of fish and wildlife resources was not required.

1.1 Site Location and Description

The approximately 9,900-square-foot site is located at 538-542 West 29th Street in the Chelsea neighborhood of New York, New York and is identified as Manhattan Borough Tax Map Block 700, Lots 55, 56, and 57. The site is improved with one three-story commercial building (Lot 55), one three-story mixed-use commercial and residential building (Lot 56), and one two-story warehouse (Lot 57). All of the buildings are currently vacant. The site is bounded by West 29th Street to the north, mixed-use residential and commercial buildings followed by the elevated High Line and Tenth Avenue to the east, a multi-story residential apartment building followed by West 28th Street to the south, and a multi-story mixed-use residential and commercial building followed by Eleventh Avenue to the west. The No. 7 subway southern extension runs north-south below Eleventh Avenue, which is about 200 feet to the west of the site. A Site Location Map and Site Plan are provided as Figure 1 and Figure 2, respectively.

1.2 Proposed Redevelopment Plan

The proposed site development is in the conceptual phase and is anticipated to include demolition of the on-site buildings and construction of a new commercial building with two cellar levels. The building would require site-wide excavation to about 30 feet bgs for the building cellar and foundation, which will necessitate dewatering to lower the groundwater table (encountered at about 9.2 to 11.5 feet bgs). The site-wide excavation for foundation components is anticipated to extend into bedrock, with no residual site soil/fill remaining at development depth. The proposed end-use of the development is consistent with existing zoning regulations. Remediation is anticipated to occur concurrently with redevelopment, under the New York State BCP, and will be completed in accordance to a site-specific Construction Health and Safety Plan (CHASP).

The Remedial Action to be performed under the RAWP is intended to make the site protective of human health and the environment, consistent with the contemplated end use. The proposed redevelopment plan is the basis for this assessment. However, the Remedial Action contemplated under this RAWP may be implemented independent of the proposed redevelopment plan.

1.3 Description of Surrounding Property

The site is located in an urban area primarily characterized by residential, commercial, and industrial properties. Surrounding property usage is summarized in the following table:

<table>
<tr><th>Direction</th><th>Block</th><th>Lot</th><th>Adjoining Properties</th><th>Surrounding Properties</th></tr>
<tr><td rowspan="2">North</td><td rowspan="2">701</td><td>1</td><td>West 29th Ministorage (302 Eleventh Avenue)</td><td rowspan="2">Multiple-story residential building</td></tr>
<tr><td>7501</td><td>529 West 29th Street Apartments (529 West 29th Street)</td></tr>
<tr><td>East</td><td>700</td><td>54</td><td>Residential Development (536 West 29th Street)</td><td>Multiple-story mixed-use residential and commercial buildings, followed by the elevated High Line</td></tr>
<tr><td>South</td><td>700</td><td>9</td><td>Avalon Residential Apartments (539 West 29th Street)</td><td>Multiple-story mixed-use residential and commercial buildings</td></tr>
<tr><td>West</td><td>700</td><td>59</td><td>Residential Development (546 West 29th Street)</td><td>Two-story commercial and industrial building</td></tr>
</table>

Land use within a half mile of the site is urbanized and includes mixed-use buildings, subway tunnels, park land, day care centers and school facilities. The nearest ecological receptor is the

Hudson River, located about 1,300 feet west of the site. Sensitive receptors located within a half-mile of the site are listed in the following table:

Number	Name (Approximate distance from Site)	Address
1	Bright Horizons Day Care at Hudson Yards (approximately 100 feet northeast)	529 West 29th Street New York, NY 10001
2	Avenues: The World School (approximately 0.2 miles southeast)	259 Tenth Avenue New York, NY 10001
3	The High Line Park (approximately 0.2 miles east)	Tenth Avenue New York, NY 10001
4	New York Alternative High School (approximately 0.5 miles northeast)	269 West 35th Street New York, NY 10001
5	New York Public School 11 (approximately 0.5 miles southeast)	320 West 21st Street New York, NY 10011
6	Bella Abzug Park (approximately 0.2 miles northeast)	Hudson Boulevard East & W 34th Street New York, NY 10001
7	Chelsea Park (approximately 0.1 miles southeast)	West 29th Street & 9th Avenue New York, NY 10001
8	Chelsea Waterside Park (approximately 0.3 miles southwest)	557 W 23rd Street New York, NY 10001
9	Hillsong Church (approximately 0.5 miles northeast)	311 W 34th Street New York, NY 10001
10	Keswell School (approximately 0.4 miles southeast)	331 W 25th Street New York, NY 10001
11	Saint Columba Church (approximately 0.4 miles southeast)	343 W 25th Street New York, NY 10001
12	Manor Community Church (approximately 0.4 miles southeast)	350 W 26th Street New York, NY 10001
13	Saint Michael's Catholic Church (approximately 0.3 miles northeast)	424 W 34th Street New York, NY 10001
14	City Knoll Middle School (approximately 0.3 miles northeast)	425 West 33rd Street New York, NY 10001

1.4 Site History

The site was developed prior to 1890 with two unspecified use buildings that were demolished between 1899 and 1922. Lot 57 was formerly used as a lumber storage yard (1909-1944) and various auto repair facilities over a span of about 50 years (1945-1994). In 1995, Lot 57 was purchased by Gotham Seafood Corporation, a seafood wholesaler. Sanborn maps indicate that Lots 55 and 56 were improved with mixed use-residential and commercial developments from about 1890 to 2005. Currently, all of the lots are vacant. Adjoining properties were historically used for residential, commercial, industrial and manufacturing operations.

1.4.1 Past Uses and Ownership

The site was historically occupied by various commercial, industrial and residential tenants, and the site and surrounding areas were developed with an urban grid as early as 1888. There are no current operators on site; all three developments within Lots 55, 56, and 57 are vacant. The New York City Department of Finance – Office of the City Register lists the current owners of Block 700, Lots 55, 56 and 57. The following table provides available deed information for the Subject Property:

Block 700, Lot 55				
Date	**Document Type**	**First Party**	**Second Party**	**Relationship of First Party to Applicant**
3/13/2019	DEED	Elite 29 Realty LLC	W29 Owner LLC	None
8/29/1996	DEED	Alvin Sher	Elite 29 Realty LLC	None
5/28/1985	DEED	538 West 29th Street Corp	Alvin Sher	None
4/26/1985	DEED	Alvin Sher	538 West 29th Street Corp	None
7/12/1984	DEED	Ian Anderson	Alvin Sher	None
12/28/1979	DEED	Rose Blacksin	Ian Anderson	None

Block 700, Lot 56				
Date	**Document Type**	**First Party**	**Second Party**	**Relationship of First Party to Applicant**
3/13/2019	DEED	Kursh 29th Street Holdings LLC	W29 Owner LLC	None
5/11/2006	DEED	Stephen Kursh	Kursh 29th Street Holdings LLC	None
1/19/1983	DEED	Anthjohn Realty Corp.	Stephen Kursh	None
11/18/1968	DEED	Mamal Realty Corp	Anthjohn Realty Corp	None
9/16/1968	DEED	Casel Robert V TR	Mamal Realty Corp	None
10/27/1966	DEED	Henecken Realty Corp	Maries Ex Hencken	None

Block 700, Lot 57				
Date	**Document Type**	**First Party**	**Second Party**	**Relationship of First Party to Applicant**
3/13/2019	DEED	Sean-Sakie Holdings LTD.	W29 Owner LLC	None
01/31/1995	DEED	W. Sander Realty Associates	Sean-Sakie Holdings LTD.	None
11/15/1982	DEED	Frank Michielini	WM. Sander Realty Associates	None

1.4.2 Previous Environmental Reports

Prior to the Volunteer's involvement with the site, several investigation reports were prepared, which are included in Appendix B and summarized below.

1. April 2, 2014 Phase I Environmental Site Assessment (ESA), prepared by AEI Consultants
2. May 2014 Phase II ESA, prepared by P.W. Grosser
3. June 2016 Remedial Investigation Report (RIR), prepared by Hydro Tech
4. April 2018 Phase I ESA, prepared by ESPL Environmental Consultants Corporation
5. March 11, 2019 Phase I ESA, prepared by Langan
6. March 11, 2019, Phase II Environmental Site Investigation (ESI) Report, prepared by Langan

An RIR was prepared by Langan on behalf of the Volunteer. Findings from the RIR are discussed in Section 2.0. Analytical result maps for soil, groundwater and soil vapor are shown on Figures 4, 5, and 6, respectively.

April 2, 2014 Phase I ESA, prepared by AEI Consultants

The Phase I ESA was completed for 542 West 29th Street (Lot 57) in general accordance with American Society of Testing and Materials (ASTM) International Standard E1527-13 and the United States Environmental Protection (USEPA) All Appropriate Inquiries (AAI) Rule. The following recognized environmental conditions (REC) were identified:

- Historic Site Use: The site historically operated as an auto repair facility for about 50 years (1945-1994) and was historically surrounded by auto repair facilities, commercial parking lots/garages and a former metal fabrication facility. Inadvertent releases of petroleum products, solvents, and/or other hazardous materials may have occurred associated with the historical use of the site, or may have migrated to the site from surrounding properties, and adversely impacted soil, groundwater and soil vapor.

- Documented Soil and Groundwater Impacts at the South-Adjoining Property: The Avalon West Chelsea residential development adjoins the site to the south, and subsurface contamination was reported in 2007. Elevated levels of petroleum-related compounds and chlorinated solvents were identified in soil and groundwater. The chlorinated solvents were identified on the eastern side of the Avalon West Chelsea property and determined to originate from up-gradient automotive repair operations or from an up-gradient former metal fabrication operation southeast of the site along West 28th Street. The sources of the petroleum contamination were not directly identified due to the presence of several active and historic auto repair facilities within and in the vicinity of the Avalon property.

  During the Avalon West Chelsea residential redevelopment, a test pit was excavated directly south of 542 West 29th Street (Lot 57). Strong petroleum-like odors were documented as far as 100 feet from the test pit. Subsurface sampling was conducted in January 2012 within the footprint of the Avalon West Chelsea residential development and included collection of soil samples, installation of temporary monitoring wells, and collection of groundwater samples. Petroleum contaminants were identified above NYSDEC standards in both soil and groundwater. The chlorinated solvent, cis-1,2-dichloroethene was identified in one groundwater sample above NYSDEC standards. Remediation via in situ chemical oxidation was conducted at the Avalon West Chelsea development in May 2013. Following treatment, soil samples were collected and all samples met soil cleanup objectives; however, groundwater impacts above the targeted guidelines were still identified.

- Closed Petroleum Spill at Vicinity Property: 524 West 29th Street, located about 260 feet southeast and up-gradient to the site, was listed as "Closed-Lack of Recent Info" in the New York Leaking Tanks and New York Spills databases. According to the regulatory database, a release was reported at this site on October 20, 2003 due to petroleum-contaminated soil and groundwater encountered when one 4,000-gallon and one 550-gallon gasoline underground storage tanks (UST) were removed from the property. Elevated levels of benzene, xylene, methyl tertiary-butyl ether (MTBE), and toluene were found in soil and groundwater samples collected from the UST footprints. Air Sparge/Soil Vapor Extraction (AS/SVE) remediation techniques were performed at the property from November to December 2011. Air samples were collected after four weeks and all targeted volatile organic compounds (VOC) were non-detect. Groundwater contaminant concentrations declined and the AS/SVE system reached asymptotic recovery rates. Additional remediation was not warranted or feasible. The spill case was closed on March 12, 2012. Based on the facility's close proximity to the site, residual contamination from the USTs may have impacted groundwater and soil vapor within Lot 57.

May 2014, Phase II ESA, prepared by P.W. Grosser

P.W. Grosser completed a Phase II ESA at 542 West 29th Street (Lot 57) in June 2014 to determine if subsurface soil, soil vapor and groundwater conditions at the property were impacted as a result of the findings from the April 2, 2008 Phase I ESA performed by AEI Consultants. The investigation included the advancement of five soil borings, collection of three groundwater samples from soil borings, installation and collection of three sub-slab soil vapor samples, and collection of three indoor and one outdoor air samples. Field observations and laboratory analytical results are summarized below:

- Soil: Five soil borings were advanced up to 8 feet bgs using a track-mounted GeoProbe© rig throughout the site. No evidence of petroleum impacts (e.g., staining, odors or photoionization detector [PID] readings above background) were observed during the soil boring investigation. Soil samples were analyzed for VOCs and compared to the NYSDEC Unrestricted Use (UU) Soil Cleanup Objectives (SCO). No VOCs were detected in soil samples collected with the exception of acetone. Acetone is a common laboratory reagent, and its presence in soil samples at the site is likely the result of laboratory contamination.

- Groundwater: Groundwater samples were analyzed for VOCs and analytical results were compared to the NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards and Guidance Values (SGV) for drinking water (Class GA). Two VOCs, benzene and MTBE (maximum concentrations of 1.4 micrograms per liter [µg/L] and 11 µg/L, respectively), were detected in groundwater from soil boring location SB-1 (Lot 57) at concentrations above the NYSDEC criteria. These contaminants are common gasoline constituents. Based on the lack of an on-site source, PW Grosser asserted that it appears the VOC contamination in groundwater is related to an off-site source.

- Soil Vapor: Sub-slab soil vapor and air samples were analyzed for VOCs and analytical results were compared to the Air Guideline Values (AGV) and Soil Vapor/Indoor Air Matrices specified in the New York State Department of Health (NYSDOH) Guidance for Evaluating Soil Vapor Intrusion in the State of New York, dated October 2006 and revised May 2017. Trichloroethene (TCE) was detected above AGVs at a concentration of 2.78 micrograms per cubic meter ($\mu g/m^3$) in sub-slab sample SS-3.

  NYSDOH provides decision matrices for eight chlorinated VOCs (carbon tetrachloride, 1,1-dichloroethene, cis-1,2-dichloroethene, TCE, methylene chloride, tetrachloroethene [PCE], 1,1,1-trichloroethane, and vinyl chloride). The decision matrices recommend a range of activities (e.g., monitor, mitigate) based on the sub-slab and indoor air sample results. Three of the eight VOCs that can be evaluated using the NYSDOH decision matrices were detected in sub-slab soil vapor samples (PCE, TCE, and 1,1,1-trichloroethane). Based on the concentrations reported PW Grosser concluded that no further action is recommended pursuant to the NYSDOH decision matrices.

June 2016, Remedial Investigation Report, prepared by Hydro Tech

Hydro Tech performed a Remedial Investigation (RI) at 542 West 29th Street (Lot 57) to determine the nature and extent of contamination and to establish remedial action objectives. The investigation consisted of a site inspection, advancement of five soil borings, installation of three groundwater monitoring wells, installation of two soil vapor points and collection of ten soil, three groundwater, and two soil vapor samples and one indoor ambient air sample. Field observations and laboratory analytical results are summarized below:

- Stratigraphy: Historic fill was observed up to 12 feet bgs.
- Soil: Five soil borings were advanced up to 12 bgs using a track-mounted GeoProbe© rig. No evidence of petroleum impacts (e.g., staining, odors or PID readings above background) were observed during the soil boring investigation. Soil samples were analyzed for VOCs, semivolatile organic compounds (SVOC), polychlorinated biphenyl (PCB), pesticides, and metals and compared to the NYSDEC UU and Restricted Use Restricted-Residential (RURR) SCOs. PCBs and pesticides were not detected at concentrations exceeding SCOs. One VOC (acetone) and seven SVOCs (benzo[a]anthracene, benzo[k]fluoranthene, benzo[a]pyrene, benzo[b]fluoranthene, chrysene, dibenzo[a,h]anthracene, and indeno[1,2,3-cd]pyrene) were detected above UU and RURR SCOs, respectively. Metals (arsenic, barium, cadmium, copper, lead, mercury, hexavalent chromium, zinc, selenium and nickel) were detected at concentrations above UU SCOs and lead, mercury, barium, copper, and cadmium were detected at concentration above RURR SCOs in both shallow and deep soil samples.

- Groundwater: Groundwater samples were analyzed for VOCs, SVOCs, PCBs, pesticides, and metals (total and dissolved) and analytical results were compared to the NYSDEC Title 6 New York City Rules and Regulation (6 NYCRR) Part 703.5 class GA Groundwater Quality Standards (GQS). Six SVOCs (benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, and indeno[1,2,3-cd]pyrene) and six dissolved metals (arsenic, magnesium, manganese, selenium, sodium, and thallium) were detected at concentrations greater than their respective GQSs. VOCs, PCBs and pesticides were not detected above GQSs.
- Soil Vapor: Soil vapor and air samples were analyzed for VOCs and analytical results were compared to the NYSDOH AGV and Soil Vapor/Indoor Air Matrices specified in the NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York, dated October 2006 and revised May 2017. The maximum total petroleum VOCs detected in soil vapor samples were lower than the total petroleum concentration for indoor air. TCE was detected above AGVs at a concentration of 6.9 $\mu g/m^3$ in soil vapor sample SV-1. Methylene chloride was detected above AGVs at a concentration of 110 $\mu g/m^3$ in soil vapor sample SV-2. Six of the eight VOCs that can be evaluated using the NYSDOH decision matrices were detected in sub-slab soil vapor samples (PCE, TCE, carbon tetrachloride, cis-1,2-dichloroethene, methylene chloride, and 1,1,1-trichloroethane). Based on the concentrations reported, Hydro Tech concluded no further action is recommended pursuant to the NYSDOH decision matrices.

April 2018 Phase I ESA, prepared by ESPL Environmental Consultants Corporation

The Phase I ESA was completed for 538-540 West 29th Street (Lots 55 and 56) in general accordance with ASTM International Standard E1527-13 and the USEPA AAI Rule. The following REC was identified:

- E-Designation: The site was listed in the New York City Department of Buildings (NYCDOB) with an environmental E-Designation (E-142) for hazardous materials, noise attenuation, and air quality.

March 11, 2019 Phase I ESA, prepared by Langan

The Phase I ESA was completed for 538-542 West 29th Street (Lots 55, 56, and 57) in accordance with ASTM International Standard E1527-13 and the USEPA AAI Rule. The following RECs and Business Environmental Risks (BER) were identified:

- REC 1 - Documented Contamination at the Site: The site was previously developed for commercial, residential and minor manufacturing uses including: a lumber yard (1930); auto repair facility (1924-2012); private garage (1950-1987); a light manufacturer (1970); and auto repair shop (1927 to 2005). Based on the analytical data generated during environmental investigations at the site in 2014, 2016, and 2018, there is documented soil, groundwater and soil vapor contamination at the site. Petroleum-related VOCs and SVOCs were detected in soil and groundwater at concentrations exceeding applicable regulatory criteria. Sub-slab and soil vapor analytical results identified petroleum and chlorinated solvent-related compounds beneath the existing building slabs.

Open NYSDEC Spill Nos. 1805506 and 1805508 were reported on August 20, 2018 due to identification of petroleum impacts to soil, soil vapor and groundwater during a subsurface investigation performed at 538 and 540 West 29th Street. The petroleum impacts were observed in the southern portions of Tax Lots 55 and 56.

- REC 2 - Historical Use of Adjoining and Surrounding Properties: Historical uses of adjoining and surrounding properties include:
  - A gasoline filling station located at 563 West 29th Street (1930)
  - Auto repair shops/garages (516-520 West 29th Street [1938, 2002 to 2005, 2010], 522-532 West 29th Street [1930, 1963-2001], 539 West 28th Street [1930], 546 West 29th Street [1930], 548 West 29th Street [1976 to 2006], 312 Eleventh Avenue [1930 to 2005])
  - A planning mill (lumber) and box factory located at 547-557 West 28th Street (1890 to 1911)
  - A light manufacturer (1956) and chemical dying factory (1968) located at 515 West 29th Street
  - A chemical corporation located at 533 West 29th Street (1920)
  - A motor freight station at 529-537 West 29th Street (1950 to 1991)

  Multiple surrounding properties are subject to environmental regulatory oversight through the OER and NYSDEC based on historic site use or documented contamination. Adjacent and surrounding sites with environmental regulatory oversight include: Avalon West Chelsea (282 Eleventh Avenue), Midtown Center Auto (548 West 29th Street), 534 West 29th Street (VCP Site No. 14CVCP199M), 550 West 29th Street (Voluntary Cleanup Program [VCP] Site No. 15CVCP060M) and 522-532 West 29th Street (VCP Site No. 13CVCP151M). Publicly available documents associated with these sites reported petroleum and chlorinated solvent impacts in soil, groundwater and/or soil vapor that may have contributed to the documented contamination at the site.

- BER 1 – E-Designation: The site is listed with an environmental E-Designation (E-142) for hazardous materials, noise (window wall attenuation and alternative means of ventilation), and air quality resulting from the June 23, 2005 High Line/ West Chelsea rezoning (CEQR #03DCP069M). Satisfaction of the E-Designation requirements is subject to review and approval by the OER. If the site is remediated under the BCP, the OER will defer to the NYSDEC for compliance with the E-Designation for hazardous materials.

- BER 2 - Historic Fill: Based on previous subsurface investigations performed at the site in 2014, 2016, and 2018, historic fill was identified at the site. Historic fill is typical in this area of NYC. The fill layer, predominately consisting of sand with varying amounts of gravel, silt, wood, brick, asphalt, concrete, ash, slag, and coal, extends to depths ranging from about 3 to 12 feet below grade surface. The presence of this material does not trigger a regulatory reporting requirement, but will require implementation of management and off-site disposal that can carry a cost premium as compared to clean native soil during any future site redevelopment that includes excavation and off-site disposal.

March 11, 2019 Phase II ESI, prepared by Langan

The Phase II ESI was prepared for due diligence purposes and summarizes the May/June 2018 RI, in addition to previous site investigations performed in May 2014 and June 2016 at the site. The results of the investigations are included in Section 2.0 of this RAWP, and the Phase II ESI is included in Appendix B.

2.0 DESCRIPTION OF REMEDIAL INVESTIGATION FINDINGS

The RI was performed at the site between May 2014 and June 2018. The purpose of the RI was to further delineate the nature and extent of impacts, in accordance with DER-10-3.1, to formulate a conceptual site model and an effective strategy for site remediation. Soil boring, monitoring well and soil vapor locations are shown on Figure 3.

The RI was conducted in accordance with:

- 6 NYCRR Part 375,
- NYSDEC DER-10 (May 2010), the NYSDEC Draft BCP Guide (May 2004), and
- NYSDOH Guidance for Evaluation Soil Vapor Intrusion in the State of New York (October 2006, and updated May 2017).

The RIR will be included as part of the RAWP package, which will be submitted to the NYSDEC in June 2019.

2.1 Summary of Remedial Investigation

The scope of the RI performed at the site between May 2014 and June 2018 included the following field tasks:

542 West 29th Street (Lot 57) - May 2014:

- Advancement of five soil borings (SB-1 through SB-5), and collection and analysis of four soil samples;
- Collection and analysis of three groundwater samples from a four-foot stainless steel screen set at the water table at soil boring locations SB-1, SB-4, and SB-5); and
- Installation of three sub-slab soil vapor probes and collection and analysis of three sub-soil vapor samples, two indoor air samples, and one ambient sample.

542 West 29th Street (Lot 57) - June 2016:

- A geophysical survey to identify subsurface anomalies consistent with utilities, subsurface structures, physical obstructions, and USTs, and to pre-clear soil boring locations;
- Advancement of five soil borings (SP-1 through SP-5), and collection and analysis of 10 soil samples;
- Installation of three groundwater monitoring wells (MW-1 through MW-3) and collection and analysis of three groundwater samples; and

- Installation of two soil vapor probes (SV-1 and SV-2) and collection and analysis of two soil vapor samples and one indoor air ambient sample.

538-540 West 29th Street (Lots 55 and 56) – May/June 2018:

- A geophysical survey to identify subsurface anomalies consistent with utilities, subsurface structures, physical obstructions, and USTs, and to pre-clear soil boring locations;
- Advancement of six soil borings (SB01 through SB06), and collection and analysis of 21 soil samples, including two field duplicate quality assurance/quality control (QA/QC) samples;
- Installation of two temporary groundwater monitoring wells (TW03 and TW05) and collection of three groundwater samples, including one duplicate QA/QC sample; and
- Installation of two sub-slab and two soil vapor probes (four total) and collection of four soil vapor samples, and one ambient air sample.

Recovered soil from each investigation was screened for visual, olfactory, and PID evidence of environmental impacts, and was visually classified for soil type, grain size, texture and moisture content. Monitoring wells were screened across the groundwater table, which was observed at depths ranging from 3.2 feet below cellar grade at 538 West 29th Street (Lot 55), 9.2 to 11 feet bgs at 540 West 29th Street (Lot 56), and 8 to 11.51 feet bgs at 542 West 29th Street (Lot 57).

2.1.1 Summary Sample Collection and Laboratory Analysis

Thirty-five soil samples (including QA/QC samples) were collected for laboratory analysis during the RI performed between May 2014 and June 2018. Per each soil boring advanced in May 2014 at 542 West 29th Street (Lot 57), one soil sample was collected from the historic fill interval (1.5-3.5 feet bgs and 6-8 feet bgs). During the June 2016 investigation at 542 West 29th Street (Lot 57), two samples were collected from each soil boring; one from the shallow historic fill interval (0 to 2 feet bgs) and one from the deeper historic fill interval (4 to 6 or 10 to 12 feet bgs). Per each soil boring advanced in May/June 2018, a minimum of three samples were collected; one from the shallow fill (0 to 2 feet bgs), one from the historic fill interval, and one from the bottom of the proposed excavation depth (12 to 13 feet bgs) or from native material if observed below fill at 13 to 14 feet bgs. When applicable, soil sample collection was generally biased toward the intervals with the greatest evidence of environmental impacts (i.e., PID readings above background, staining, chemical/petroleum-like odors).

In May 2014, groundwater samples at 542 West 29th Street (Lot 57) were collected through a four-foot stainless steel screen set at the top of the water table from soil borings SB-01, SB-04, and SB-05. Groundwater samples were also collected from permanent monitoring wells MW-1, MW-2, and MW-3 following installation in June 2016 within Lot 57. Groundwater samples were collected from 538-540 West 29th Street (Lots 55 and 56) immediately following development of temporary groundwater monitoring wells TW03 and TW05 in May/June 2018. In addition, one duplicate sample was collected for QA/QC purposes in June 2018.

In May 2014, three sub-slab soil vapor probes (SS-1 to SS-3) were installed immediately below the building slab at 542 West 29th Street (Lot 57) using a portable electric rig. Three soil vapor samples, two indoor air, and one outdoor air sample were collected for laboratory analysis in May 2014. In June 2016, two soil vapor probes (SV-1 and SV-2) were installed to about 6 feet bgs on the first floor of 542 West 29th Street (Lot 57) using a direct-push Geoprobe® rig. Two vapor samples and one indoor ambient air sample were collected in 2016. During the May/June 2018 portion of the RI, Langan documented installation of two soil vapor probes (SV01 and SV03) and two sub-slab soil vapor probes (SV02 and SV04) by AARCO. Sub-slab soil vapor probes SV02 and SV04 were installed immediately below the cellar slab of 538 West 29th Street (Lot 55) using a portable electric rig. Soil vapor probes SV01 and SV03 were installed from the first floor of 540 West 29th Street (Lot 56) using a direct-push Geoprobe® 6610DT track-mounted drill rig. One soil vapor sample was collected from each vapor point, in addition to one ambient air sample.

Soil, groundwater, and soil vapor samples collected during the RI were analyzed by a NYSDOH Environmental Laboratory Approval Program (ELAP)-certified laboratory as follows:

- Soil samples were analyzed for Target Compound List (TCL)/NYSDEC Part 375 List VOCs by USEPA Method 8260C*, TCL/Part 375 SVOCs by USEPA Method 8270D, PCBs by USEPA Method 3546, pesticides by USEPA Method 3546, herbicides by USEPA Method 8151A**, and Target Analyte List (TAL)/Part 375 metals (including cyanide, hexavalent chromium and trivalent chromium) by USEPA Method 6010C
    - *Note: soil samples collected in May 2014 were only analyzed for VOCs by USEPA Method 8260C
    - **Note: soil samples collected in June 2016 were not analyzed for herbicides by USEPA Method 8151A
- Groundwater samples were analyzed for TCL/Part 375 VOCs by USEPA Method 8260C*, TCL/Part 375 SVOCs by USEPA method 8270D, PCBs by USEPA Method 3546, pesticides by USEPA Method 3546, herbicides by USEPA Method 8151A**, and TAL/Part 375 metals (total and dissolved, including cyanide, trivalent and hexavalent chromium) by USEPA method 6010C.
    - *Note: groundwater samples collected in May 2014 were only analyzed for VOCs by USEPA Method 8260C

  - **Note: groundwater samples collected in June 2016 were not analyzed for herbicides by USEPA Method 8151A
- Soil vapor and ambient air samples were analyzed for VOCs by USEPA method TO-15.

2.2 Geological Conditions

2.2.1 Historic Fill

Historic fill was encountered immediately beneath the building foundation slabs and extends to depths varying from about 7.5 to 10 feet bgs at 540 West 29th Street (Lots 56), and from about 3 to 12 feet bgs at 542 West 29th Street (Lot 57). Historic fill was encountered below the cellar slab at 538 West 29th Street (Lot 55) at depths ranging from 3 to 5 feet below cellar grade. The historic fill predominately consists of brown fine- to medium-grained sand with varying amounts of gravel, concrete, asphalt, charcoal, slag, ash, wood, brick, and glass.

2.2.2 Native Soil

The historic fill layer is underlain native soils typically consisting of reddish-brown to olive, fine- to medium-grained silty sand with varying amounts of gravel and silt. The sand generally extended to the termination depth of each boring advanced during the environmental investigations. This stratigraphy was generally consistent across the site.

2.2.3 Bedrock

The United States Geologic Survey (USGS) "Bedrock and Engineering Geologic Maps of New York County and Parts Kings and Queens Counties, New York, and Parts of Bergen and Hudson Counties, New Jersey" indicates that the bedrock underlying the site is part of the Hartland Formation. Bedrock was not encountered during previous environmental investigations and this RI, but in general is found within 20 to 30 feet bgs in this area of Manhattan.

2.2.4 Hydrogeology

Synoptic groundwater level measurements were collected on May 7, 2016 and June 1, 2018 from monitoring wells installed within 542 West 29th Street and from two temporary monitoring wells located within 538 and 540 West 29th Street. Groundwater was encountered at depths ranging from 3.2 feet below cellar grade at 538 West 29th Street (Lot 55), 9.2 to 11 feet bgs at 540 West 29th Street (Lot 56) and from 8 to 11.51 feet bgs at 542 West 29th Street (Lot 57). Based on the well gauging results, groundwater appears to flow west toward the Hudson River, which is relatively consistent with regional topography.

2.3 Contamination Conditions

2.3.1 Conceptual Model of Site Contamination

A conceptual site model (CSM) was developed based on the RI findings and previous investigations to produce a simplified framework for understanding the distribution of impacted materials, potential migration pathways, and potentially complete exposure pathways.

Potential Sources of Contamination

Potential sources of contamination have been identified and include historic fill, historic site usage, and possible off-site sources.

- Historic Fill

  Historic fill was encountered immediately beneath the building foundation slabs and extends to depths varying from about 7.5 to 10 feet bgs at 540 West 29th Street (Lots 56), and from about 3 to 12 feet bgs at 542 West 29th Street (Lot 57). Historic fill was encountered below the cellar slab at 538 West 29th Street (Lot 55) at depths ranging from 3 to 5 feet below cellar grade. SVOCs and metals detected at concentrations above the Part 375 UU, RURR and CU SCOs, are likely related to the nature of the historic fill. Additionally, SVOCs in groundwater may be related to the nature of the historic fill.

- Historic Site Usage and Off-Site Sources

  Petroleum-like impacts, evidenced by odors, staining and/or PID readings above background levels were observed at similar depths in two soil borings from 0 to 10 feet below cellar grade (SB03) and 14 to 15 feet bgs (SB06). Petroleum-related VOCs were detected at concentrations exceeding their respective UU SCOs in two soil borings. Petroleum-related VOCs were detected in groundwater samples above TOGS Class GA SGVs and petroleum-like odors were observed in purged groundwater generated from TW03 during the RI. Monitoring well headspace PID measurements ranged from 0.0 to 47.9 ppm during sampling. Petroleum-related VOCs were identified in soil and sub-slab soil vapor samples. The petroleum impacts to soil, groundwater and soil vapor are likely associated with historic site usage as an auto repair facility for over 50 years, or an off-site source to the south and east.

  CVOCs were detected in soil vapor; however, the site investigation found no on-site sources of chlorinated VOCs in soil or groundwater. CVOC concentrations in sub-slab and soil vapor samples may originate from an unidentified site source or an off-site source.

Exposure Media and Contaminants of Concern

Impacted media includes soil, groundwater, and soil vapor. Analytical data from the subsurface investigations indicates the historic fill across the site contains VOCs, SVOCs and metals in excess of regulatory standards. In addition, petroleum-impacted material observed in the southeast corner of the site contains VOCs in excess of regulatory standards. Groundwater was encountered at 3.2 feet below cellar grade at 538 West 29th Street (Lot 55), 9.2 to 11 feet bgs at 540 West 29th Street (Lot 56) and from 8 to 11.51 feet bgs at 542 West 29th Street (Lot 57) and impacts include VOCs, SVOCs, and metals. Soil vapor is impacted with both petroleum-related VOCs and CVOCs.

Receptor Populations

The site is currently vacant with limited access to authorized workers and the project development team. Under future conditions, human receptors may include construction and remediation workers, authorized guests visiting the site, the public adjacent to the site, and potential future building occupants.

2.3.2 Description of Areas of Concern (AOC)

2.3.2.1 AOC 1 – Historic Fill

Historic fill encountered immediately beneath the building foundation slabs extended to depths varying from about 7.5 to 10 feet bgs at 540 West 29th Street (Lots 56), and from about 3 to 12 feet bgs at 542 West 29th Street (Lot 57). Historic fill was encountered below the cellar slab at 538 West 29th Street (Lot 55) at depths ranging from 3 to 5 feet below cellar grade. The historic fill predominately consists of brown fine- to medium-grained sand with varying amounts of gravel, concrete, asphalt, charcoal, slag, ash, wood, brick, and glass. The historic fill layer was encountered across the site. A summary of the analytical results from historic fill for AOC 1 are summarized as follows:

AOC 1 - Soil

- VOCs (acetone, benzene, n-propylbenzene, and total xylenes) were detected at concentrations exceeding their respective UU SCOs in four soil borings (SB-2, SB03, SB04, and SB06) from samples collected within the historic fill.
- SVOCs (benzo[a]anthracene, benzo[a]pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo[a,h]anthracene and indeno[1,2,3-cd]pyrene) were detected above the UU, RURR and/or CU SCOs in samples collected from the historic fill layer in soil borings SB01, SP-1, SP-2, SB04, and SP-5.
- Metals were detected at concentrations exceeding their respective UU SCOs (arsenic, hexavalent chromium, nickel, selenium, and zinc), and RURR/ CU SCOs (barium, cadmium, copper, lead, and mercury) in samples collected from the historic fill layer.
- Total PCBs and pesticides were not detected above UU SCOs in soil samples collected.

AOC 1 - Groundwater

- Several petroleum-related VOCs were detected at concentrations above TOGS Class GA SGVs, including 1,2,4,5-tetramethylbenzene, 1,2,4-trimethylbenzene, benzene, ethylbenzene, MTBE, isopropyl benzene, naphthalene, n-butylbenzene, n-propylbenzene, and sec-butylbenzene. This contamination is also associated with AOC 2 and 3.
- SVOCs, including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene and indeno(1,2,3-cd)pyrene, were detected above TOGS Class GA SGVs.
- Metals (arsenic, copper, iron, lead, magnesium, manganese, selenium, sodium and thallium) were detected at concentrations above the above TOGS Class GA SGVs in groundwater samples. Dissolved copper and lead were not detected in groundwater samples; therefore, the detections in unfiltered samples are likely the result of suspended solids in groundwater derived from historic fill. With the exception of arsenic, the concentrations detected are attributed to regional groundwater contamination and are not considered a localized concern. The presence of arsenic at a concentration above its TOGS Class GA SGV may be due to the quality of the historic fill.

AOC 1 - Soil Vapor

Historic fill does not appear to have impacted soil vapor.

AOC 1 - Conclusions

Historic fill was identified in all borings extending to depths from about 3 to 12 feet bgs. VOCs, SVOCs, and metals were detected above UU, RURR and CU SCOs in samples of historic fill, with the deepest exceedance identified at 10 to 12 feet bgs. Concentrations of SVOCs and metals are likely associated with the general quality of the fill placed at the site or historical industrial uses of the site (i.e., auto repair, heating plant, manufacturing, lumber yard – AOC 2).

Similar compounds detected in soil were also identified in groundwater at concentrations above TOGS Class GA SGVs. SVOC and metals concentrations detected in groundwater are likely related to entrained sediments that may be related to on-site historic fill. Iron, magnesium, manganese, selenium and sodium are regionally present in groundwater throughout New York City. The analytical data indicate that the contaminants associated with historic fill have not impacted soil vapor.

2.3.2.2 AOC 2 – Historical Site Use

The site was developed prior to 1890 with two unspecified use buildings that were demolished between 1899 and 1922. Lot 57 was formerly used as a lumber storage yard (1909-1944) and various auto repair facilities over a span of about 50 years (1945-994). In 1995, Lot 57 was purchased by Gotham Seafood Corporation, a seafood wholesaler. Sanborn maps indicate that Lots 55 and 56 were improved with mixed use-residential and commercial developments from about 1890 to 2005. CO's provided by the NYCDOB identified an auto repair shop within Lot 56 in 1924 and 2012. In addition, available CO's for Lot 55 dated 1970 and 1987 identified manufacturing and a heating plant with potential fuel storage. The historic on-site operations within Lot 57 may have included the use of metals, petroleum, and solvents. Releases of petroleum products, solvents, and/or other hazardous materials associated with auto repair during the 50 years of on-site operations appear to have adversely affected soil, groundwater and/or soil vapor. A summary of AOC 2 findings is provided below:

AOC 2 - Geophysical Survey

- The April 2016 geophysical survey was conducted using GPR across 542 West 29th Street (Lot 57). The May/June 2018 geophysical survey identified scattered anomalies across the footprints of 538 (Lot 55) and 540 (Lot 56) West 29th Street; the majority of identified anomalies were consistent with utilities (i.e., electric, telecom, gas, sewer line and water line). A sump pump was identified in the northwest corner of the cellar in 538 West 29th Street (Lot 55). Anomalies consistent with USTs were not observed.

AOC 2 - Soil

- Petroleum-like impacts, evidenced by odors, staining and/or PID readings above background levels were observed at similar depths in two of the 16 soil borings advanced during the RI. Elevated PID readings above background and petroleum-like odors were observed in soil borings SB03 (maximum PID reading of 408 ppm VOCs) and SB06 (maximum PID reading of 1.6 ppm VOCs). Petroleum-like odors were observed in soil boring SB03 from 0 to 10 feet below cellar grade. Petroleum-like odors and gray staining were observed in soil boring SB06 from 14 to 15 feet bgs.
- Petroleum-related VOCs, including benzene, n-propylbenzene, and total xylenes, were detected at concentrations exceeding their respective UU SCOs in four soil borings (SB-2, SB03, SB04, and SB06).
- Metals, including barium, copper, mercury, and lead, were present at concentrations above levels typical in historic fill (AOC 1) in the southwest portion of the site where historic site usage included auto repair. SVOCs detected in historic fill are likely attributed to historic auto repair operations or the quality of historic fill placed beneath the site.

AOC 2 - Groundwater

- Petroleum-related VOCs detected in groundwater samples above TOGS Class GA SGVs (1,2,4,5-tetramethylbenzene, 1,2,4-trimethylbenzene, benzene, ethylbenzene, isopropylbenzene, naphthalene, n-butylbenzene, n-propylbenzene, sec-butylbenzene, and

MTBE) are attributed to the former auto repair activities documented in Lots 56 and 57 or an off-site (AOC 3) source. SVOCs (benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, and indeno[1,2,3-cd]pyrene) are associated with historic site usage including auto repair, the quality of historic fill placed beneath the site (AOC 1), or an off-site (AOC 3) source. SVOCs were identified in groundwater samples collected in the southwest portion of the site (MW-3) at concentrations exceeding their respective TOGS Class GA SGVs.

- Free product was not detected; however, petroleum-like odors were observed in purged groundwater generated from TW03 in May/ June 2018. Monitoring well headspace PID measurements ranged from 0.0 to 47.9 ppm during sampling.

AOC 2 – Soil Vapor

- Elevated benzene, toluene, ethylbenzene and total xylenes (BTEX) compounds above background levels were detected in soil vapor samples throughout the site. BTEX concentrations detected in soil vapor ranged from non-detect in samples SS-1, SV-1, and SV-2 (Lot 57) to 34,240 μg/m^3 in SV04 (Lot 56).
- CVOCs, including TCE (non-detect to 6.9 μg/m^3 in SV-1), PCE (non-detect to 317 μg/m^3 in SV04) and vinyl chloride (non-detect to 1.39 μg/m^3 in SV01) were identified in soil vapor samples collected across the site, with the highest concentrations located in the southern and southeast portions of the site.

AOC 2 Conclusions

The geophysical surveys did not identify anomalies indicative of storage tanks, vaults, or other buried abandoned structures.

Metals detected in historic fill samples may be related to the historical site use as an auto repair facility (Lots 56 and 57) or may be indicative of historic fill present beneath building foundations (AOC 1). In particular, barium, copper, mercury, and lead were present at concentrations above levels typical in historic fill in the southwest portion of the site where historic site usage included auto repair.

SVOCs detected in historic fill are likely attributed to the quality of the historic fill (AOC 1), historic auto repair operations on-site (AOC 2) and may have been contributed to by an off-site (AOC 3) source.

Petroleum-related VOCs detected in groundwater samples above TOGS Class GA SGVs are attributed to the former auto repair activities documented in Lot 57 and may have been contributed to by an off-site (AOC 3) source. CVOCs and petroleum-related VOCs detected in soil and sub-slab soil vapor samples may be indicative of a chemical and/or petroleum release associated with historical site use as an auto repair facility and may have been contributed to by an off-site source (AOC 3).

Based on field observations and soil analytical results, two petroleum spills were reported to the NYSDEC for Lot 55 (Spill No. 1805506- 538 West 29th Street) and Lot 56 (Spill No. 1805508- 540 West 29th Street).

2.3.2.3 AOC 3 – Historical Use of Adjoining and Surrounding Properties

Historical uses of adjoining and surrounding properties included gasoline filling stations, auto repair shops/garages, a planning mill (lumber) and box factory, manufacturing, a chemical dying factory, a chemical corporation, and a motor freight station. Undocumented spills or releases of petroleum products or hazardous substances associated with historical uses of nearby properties may have adversely affected groundwater or soil vapor beneath the site.

In addition, multiple surrounding properties are subject to environmental regulatory oversight through the OER and NYSDEC based on historic site use or documented contamination. Adjacent and surrounding sites with environmental regulatory oversight include: Avalon West Chelsea (282 Eleventh Avenue), Midtown Center Auto (548 West 29th Street), 534 West 29th Street (VCP Site No. 14CVCP199M), 550 West 29th Street (VCP Site No. 15CVCP060M) and 522-532 West 29th Street (VCP Site No. 13CVCP151M). Publicly available documents associated with these sites reported petroleum and chlorinated solvent impacts in soil, groundwater and/or soil vapor that may have contributed to the documented contamination at the site.

Contaminants of Concern (COC) associated with AOC 3 include petroleum compounds and chlorinated solvents. A summary of the findings for AOC 3 is provided below:

- Petroleum-like impacts, evidenced by odors, staining and/or PID readings above background levels were observed at similar depths in two of the 16 soil borings advanced during RI. In addition, petroleum-related VOCs were detected at concentrations exceeding their respective UU SCOs in two soil borings. The petroleum impacts to soil are further described in AOC 2 above.
- Petroleum-related VOCs were detected in groundwater samples above TOGS Class GA SGVs and petroleum-like odors were observed in purged groundwater generated from TW03 during the May/ June 2018 portion of the RI. Monitoring well headspace PID measurements ranged from 0.0 to 47.9 ppm during sampling. The petroleum impacts to groundwater are further described in AOC 2 above.
- PCE was detected in three soil vapor samples collected at the site. PCE concentrations detected in soil vapor ranged from 10 μg/m^3 in SV-1 to 15.6 μg/m^3 in SV01. PCE was detected in three sub-slab soil vapor samples at concentrations ranging from 1.48 μg/m^3 in SS-2 to 317 μg/m^3 in SV04. PCE was detected in the ambient air samples at a

concentration of 0.678 µg/m^3 in SVAA to 0.814 µg/m^3 in OA-1. PCE concentrations detected in indoor air samples ranged from 2.67 µg/m^3 in IA-1 to 2.82 µg/m^3 in IA-2.

- TCE was detected in one sub-slab soil vapor sample at a concentrations of 2.78 µg/m^3 in SS-3, and at a concentration of 6.9 µg/m^3 in soil vapor sample SV-1. Vinyl chloride was also detected in one soil vapor sample SV01 at a concentration of 1.39 µg/m^3.
- Elevated BTEX compounds were detected in soil and soil vapor samples, and are further described in AOC 2 above.

AOC 3 - Conclusions

Petroleum impacts to soil, groundwater and soil vapor in the southern portion of the site may be related to an off-site source (e.g., historic spill to the south) or an on-site source (AOC 2). A PCE source to soil vapor was not identified on-site and may be related to an off-site source. In addition, TCE was only detected in one sub-slab soil vapor (SS-3) and one soil vapor sample (SV-1), both of which are located in the western portion of the site (Lot 57). Potential off-site sources include gasoline filling stations, auto repair shops/garages, a planning mill (lumber) and box factory, manufacturing, a chemical dying factory, a chemical corporation, and a motor freight station.

2.3.3 Nature and Extent of Contamination

This section evaluates the nature and extent of soil, groundwater and soil vapor contamination. The nature and extent of the contamination is derived from a combination of field observations and analytical data that were discussed in Section 5.0, and incorporates field observations and analytical data from the RI performed at the site between May 2014 and June 2018.

2.3.3.1 Soil Contamination

Soil contamination is divided into the following classifications:

1. Historic Fill
2. Petroleum-Impacted Soil/Fill

Historic Fill

Contaminants related to historic fill at the site include VOCs, SVOCs, and metals. Historic fill exists across the site, extending from surface grade to depths ranging from about 3 to 12 feet bgs. Soil samples collected from the historic fill layer contained concentrations of VOCs (benzene, n-propylbenzene, and total xylenes), SVOCs (benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, dibenzo[a,h]anthracene, and indeno[1,2,3-cd]pyrene), and metals (arsenic, barium, cadmium, hexavalent chromium, copper, lead, mercury, nickel, selenium, and zinc) exceeding their respective UU and, in some cases, RURR and/or CU SCOs.

Petroleum-Contaminated Material

During the RI, petroleum-like odors and PID readings were observed in two soil borings, SB-3 and SB-6, located in the southern portion of Lot 55 and Lot 56. Petroleum-like odors were observed between 0 and 10 feet below cellar grade in boring SB-3, with a maximum PID reading of 408 ppm recorded at 4 feet below cellar grade. Petroleum-like odors and staining were identified at 14 feet below cellar grade in boring SB-6 with a PID reading of 1.6 ppm. Analytical results for soil samples collected from borings SB03 and SB04 exhibited concentrations of petroleum-related VOCs, including benzene, n-propylbenzene, and total xylenes, exceeding UU SCOs. The concentrations of petroleum-related VOCs in the southern portion of the site may be indicative of a historical on-site release associated with former auto repair usage or an adjacent off-site source. Contaminant concentrations above the Part 375 UU SCOs were not identified in native soil underlying historic fill.

2.3.3.2 Groundwater Contamination

The discussion is divided by the following contaminant classifications:

1. Petroleum-Contaminated Groundwater
2. Regional Groundwater Quality
3. Arsenic-Contaminated Groundwater

Petroleum-Contaminated Groundwater

During the RI, sheen and petroleum-like odors were observed during well development/ purging activities at TW03 and TW05. Analytical results for samples collected from wells TW03 and SB-1 (GW) in the southeast and southern portions of the site, respectively, exhibited concentrations of petroleum-related VOCs (1,2,4,5-tetramethylbenzene, 1,2,4-trimethylbenzene, benzene, ethylbenzene, isopropylbenzene, MTBE, naphthalene, n-butylbenzene, n-propylbenzene, sec-butylbenzene) exceeding their respective TOGS Class GA SGVs. Groundwater VOC contamination appears localized to the southern and southeast portions of the site in the vicinity of wells TW03 and SB-1 (GW) and is likely due to a release in this area associated with former auto repair usage or an off-site source migrating to the site.

Regional Groundwater Quality

Metals concentrations detected above TOGS Class GA SGVs include nine total metals (arsenic, copper, iron, lead, magnesium, manganese, selenium, sodium, and thallium) and seven dissolved metals (arsenic, iron, magnesium, manganese, selenium, sodium, and thallium). With the exception of arsenic, the concentrations detected are attributed to regional groundwater contamination and are not considered a localized concern.

<u>Arsenic-Contaminated Groundwater</u>

Arsenic was detected above TOGS Class GA SGVs in four dissolved metal samples. The presence of arsenic at a concentration above its TOGS Class GA SGV may be the result of historical site usage as an auto repair facility or due to the quality of the historic fill. Note that arsenic was not identified in soil above RURR SCOs.

2.3.3.3 Soil Vapor Contamination

Total VOC concentrations in soil vapor samples ranged from 101 µg/m^3 in SV-1 (Lot 57) to 519,247 µg/m^3 in SV04 (Lot 55). The maximum detected concentrations of TCE and PCE in soil vapor and/or sub-slab vapor were 6.9 µg/m^3 and 317 µg/m^3, respectively, in soil vapor sample SV-1 and sub-slab vapor sample SV04. In addition, methylene chloride was detected at a maximum concentration of 110 µg/m^3 at SV-2 (April 2016 RI). BTEX concentrations detected in soil vapor ranged from 32.1 µg/m^3 in SS-3 to 34,240 µg/m^3 in SV04 compared to an ambient air concentrations of 8.7 µg/m^3. The highest concentrations of CVOCs and BTEX compounds were detected in the southern and southeastern portions of the site. The soil vapor contamination is likely a result of historic site operations (e.g., auto repair, heating plant) and may have been contributed to by an off-site source (adjacent spills/industrial operations).

2.4 Qualitative Human Health Exposure Assessment

Based on the CSM and review of environmental data, complete on-site exposure pathways appear to be present in the absence of protective measures and remediation. The complete exposure pathways indicate there is a risk of exposure to humans from site contaminants via exposure to soil, groundwater, and soil vapor for current and construction conditions.

Complete exposure pathways have the following five elements: 1) a contaminant source; 2) a contaminant release and transport mechanism; 3) a point of exposure; 4) a route of exposure; and 5) a receptor population. A discussion of the five elements comprising a complete pathway as they pertain to the site is provided below.

2.4.1 Current Conditions

Contaminant sources include 1) historic fill with varying levels of VOCs, SVOCs, and metals contamination; 2) Historic site usage that may be related to petroleum-impacted soil, groundwater and soil vapor (documented under NYSDEC Spill Nos. 1805506 and 1805508) and CVOC soil vapor impacts; and 3) historical uses of adjacent and surrounding sites that may be related to CVOCs and petroleum-related contaminants in groundwater and soil vapor.

Contaminant release and transport mechanisms include contaminated soil dermal contact during sampling and dust generation and transport during drilling (dermal, ingestion, inhalation), contaminated groundwater dermal contact, ingestion or inhalation during sampling, and volatilization of contaminants from the soil and groundwater matrices to the soil vapor phase (inhalation).

Under current conditions, the likelihood of exposure to humans is limited, as site access is restricted to authorized workers and guests. The site footprint contains impervious covers (i.e., buildings, concrete) and exposure to soil, groundwater or soil vapor is minimal. Exposure to contaminants in soil and groundwater via dermal contact or ingestion during investigation is minimized, as these activities would occur under a Health and Safety Plan/Construction Health and Safety Plan (HASP/CHASP) with Community Air Monitoring Plan (CAMP) to limit exposure to site workers and the community. In addition, groundwater is not used as potable water supply in Manhattan.

2.4.2 Construction/Remediation Activities

During development and remediation, points of exposure include disturbed and exposed soil during excavation, dust and organic vapors generated during excavation, and contaminated groundwater that could be encountered during excavation and/or dewatering operations. Routes of exposure include ingestion and dermal absorption of contaminated soil and groundwater, inhalation of organic vapors arising from contaminated soil and groundwater (specifically in the area of petroleum and CVOC impacts), and inhalation of dust arising from contaminated soil. The receptor population includes construction and remediation workers and, to a lesser extent, the public adjacent to the site.

The potential for completed exposure pathways is present since all five elements exist; however, the risk will be minimized by the implementation of appropriate health and safety measures during construction and remediation, such as monitoring the air for organic vapors and dust, using vapor and dust suppression measures, cleaning truck undercarriages before they leave the site to prevent off-site soil tracking, maintaining site security, and wearing the appropriate personal protective equipment (PPE).

A CHASP, Soil/Materials Management Plan (SMMP), and CAMP will be implemented and includes measures such as conducting an air-monitoring program, donning PPE, covering soil stockpiles, altering work sequencing, maintaining a secure construction entrance, proper housekeeping, and applying vapor and dust suppression measures to prevent off-site migration of contaminants during construction. Such measures will prevent completion of potential migration pathways for soil, groundwater and soil vapor.

2.4.3 Proposed Future Conditions

For the proposed future conditions, residual contaminants may remain on-site; however, the proposed development includes site-wide excavation to about 30 feet bgs into bedrock and removal of all soil/fill from the site. If a Track 1 cleanup is not practicable, residual contaminants may remain on site and exposure pathways will be minimized through the use of engineering controls (EC) and institutional controls (IC). Exposures during sampling activities will be managed under a HASP. Groundwater in New York City is not used as a potable water source and the nearest ecological receptor, the Hudson River, is located about 1,300 feet to the west. The receptor population includes commercial use occupants, patrons and employees, and the nearby community, including children. Accumulation of soil vapor beneath the building is not anticipated considering the building foundation slab is expected to extend into the groundwater table. Additionally, a continuous site-wide waterproofing system will be installed below the slab and along the vertical subgrade foundation sidewalls.

2.4.4 Human Health Exposure Assessment Conclusions

The following conclusions were developed from this human health exposure assessment:

1. Under current conditions, there is a marginal risk for human exposure to site contaminants. The primary exposure pathways are dermal contact, ingestion and inhalation of soil, soil vapor, or groundwater by authorized site visitors during sampling activities. The exposure risks can be avoided or minimized by following the appropriate health and safety and vapor and dust suppression measures outlined in the site-specific HASP and CAMP during investigation activities.
2. In the absence of a HASP and CAMP, there is a moderate risk of exposure during construction and remediation activities. The primary exposure pathways are:
    a. Dermal contact, ingestion and inhalation of contaminated soil, groundwater or soil vapor by construction workers.
    b. Dermal contact, ingestion and inhalation of soil (dust) and inhalation of soil vapor by the community in the vicinity of the site.

    These exposure risks can be avoided or minimized by following a SMMP, and CAMP and by following the appropriate health and safety, vapor and dust suppression and site security measures outlined in a site-specific HASP.
3. The existence of a complete exposure pathway for site contaminants to human receptors during proposed future conditions is unlikely, as soil will be excavated into existing bedrock and transported to an off-site disposal facility and residual soil is not anticipated below new foundation elements. If present, residual contamination would be managed through the use of ECs/ICs following site development. Regional groundwater is not used as a potable water source in Manhattan so exposure to regional groundwater contaminants is unlikely. The potential pathway for soil vapor intrusion into the building will be addressed by completion of the remedial excavation, installation of the building foundation below the water table and installation of a site-wide waterproofing/ vapor barrier as part of construction.

4. It is unlikely that a complete exposure pathway exists for the migration of site contaminants to off-site human receptors for current, construction phase, or future conditions. Monitoring and control measures would be used during investigation and construction to prevent completion of this pathway. Under future conditions, the site will be remediated and, if necessary, ECs may be implemented (e.g. site-wide cap and a waterproofing/ vapor barrier) to prevent completion of this pathway.

3.0 DESCRIPTION OF REMEDIAL ACTION PLAN

This section presents an analysis of the proposed remedial actions that can potentially be achieved under the BCP. The proposed SCOs will be the Part 375 UU SCOs for the Alternative I Track 1 remedy and Part 375 RURR SCOs for the Alternative II Track 2 remedy.

The intent of the remedial action plan is to achieve a Track 1 remedy. All soil is expected to be removed during foundation excavation. In the event that a Track 1 remedy is not achieved, a Track 2 RURR remedy will be achieved and an SMP and environmental easement may be required to address residual contamination.

3.1 Standards, Criteria, and Guidance and Remedial Action Objectives

In accordance with ECL § 27-1415 and DER-10, the objectives of the remedial action are to: (1) reduce the concentrations of contaminants of concern at the site to meet those levels that will protect public health and the environment, and (2) isolate the site from migration of contaminated groundwater and soil vapor from potential off-site sources. In accordance with DER-10, the Volunteer will have no remedial responsibilities with respect to groundwater contamination migrating under the site from an off-site source; however, remedial alternatives will be developed for such a case that eliminate or mitigate on-site environmental impacts or human exposures, to the extent feasible, resulting from the off-site contamination entering the site. Where identifiable sources of contamination are found on the site, the sources will be removed or treated to the greatest extent feasible.

Also, in accordance with DER-10, the Remedial Action Objectives (RAO) for this site are defined as medium-specific objectives for the protection of public health and the environment and are developed based on contaminant-specific standards, criteria, and guidance (SCG), which include:

- Code of Federal Regulations (CFR) Title 29 Part 1910.120 – Hazardous Waste Operations and Emergency Response Standard;
- CFR Title 29 Part 1926 – Safety and Health Regulations for Construction;
- 6 NYCRR Part 364 – Waste Transporter Permits;
- 6 NYCRR Part 370 – Hazardous Waste Management System;
- 6 NYCRR Part 375 – Environmental Remediation Programs;
- 6 NYCRR Part 376 – Land Disposal Restrictions;
- 6 NYCRR Part 612 – Registration for Petroleum Storage Facilities (February 1992);
- 6 NYCRR Part 700-706 – Surface Water and Groundwater Classification Standards;
- 6 NYCRR Part 750 – State Pollutant Discharge Elimination System (SPDES) Regulations;

- NYSDEC – BCP Guide (draft 2004);
- CP-43 – Commissioner Policy on Groundwater Monitoring Well Decommissioning (December 2009)
- NYSDEC CP-51 – Soil Cleanup Guidance (2010);
- NYSDEC DER-10 – Technical Guidance for Site Investigation and Remediation (2010);
- NYSDEC – Permanent Closure of Petroleum Storage Tanks (July 1988);
- NYSDEC – Spill Response Guidance Manual;
- NYSDEC TOGS 1.1.1 – Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations (1998);
- NYSDEC TOG 5.1.8 – New York State Stormwater Management Design Manual (2008);
- NYSDEC TOGS 5.1.10 – New York State Standards and Specifications for Erosion and Sediment Controls (2005);
- NYSDOH – Guidance for Evaluating Soil Vapor Intrusions in the State of New York (2006);
- Permanent Closure of Petroleum Storage Tanks (July 1988);
- STARS #1 – Petroleum-Contaminated Soil Guidance Policy; and
- DER-23 – Citizen Participation Handbook for Remedial Programs (March, 2010)
- Spill Response Guidance Manual.

3.2 Remedial Action Objectives

Based on the results of the previous subsurface investigations and the RI, the following RAOs have been identified.

RAOs	RAOs for Public Protection	RAOs for Environmental Protection
Soil	• Prevent ingestion/direct contact with contaminated soil • Prevent inhalation of, or exposure to, contaminants volatilizing from contaminated soil	• Prevent migration of contaminants that would result in groundwater contamination

RAOs	RAOs for Public Protection	RAOs for Environmental Protection
Groundwater	• Prevent ingestion of groundwater containing contaminant levels exceeding drinking water standards • Prevent contact with, or inhalation of, volatiles emanating from contaminated groundwater	• Restore the groundwater aquifer, to the extent practicable, to pre-disposal/pre-release conditions • Remove on-site source of groundwater contamination • Minimize the source of groundwater contamination
Soil Vapor	• Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into buildings at the site	

3.3 Alternative I – Conditional Track 1 Technical Description

The Alternative I Track 1 remedy and site development will be achieved by completing the following tasks:

- Demolition of all on-site buildings in accordance with federal, state, and local regulations to prepare the site for excavation and redevelopment
- Site-wide excavation to about 30 feet bgs to remove soil that exceeds UU SCOs, as defined by 6 NYCRR Part 375-6.8(a) and reach development depths. Of the total excavation volume, about 4,800 cubic yards of contaminated historic fill exceeds UU SCOs and will be excavated as a remedial measure. Based on the RI findings, soil exceeding the UU SCOs is present down to at least 12 feet bgs.
- Screening for indications of contamination (e.g., staining, odor and elevated PID readings) of all excavated soil during any intrusive Site work
- Decommissioning and removal of USTs identified during remediation, including documentation of proper handling and disposal
- Collection and analysis of confirmation soil samples to verify Track 1 UU SCOs are achieved at the base of the excavation (if possible based on the bedrock depth)
- If necessary, import and placement of clean fill (e.g., virgin crushed stone, recycled concrete aggregate [RCA], and soil meeting Track 1 Part 375 UU SCOs) to bring the grade up to development depth if there are areas that are over-excavated
- Dewatering and treatment of groundwater by a dewatering contractor for groundwater remediation and to support excavation below the water table in accordance with a New York City Department of Environmental Protection (NYCDEP) sewer discharge permit.
- Development and implementation of a CHASP and CAMP for the protection of on-site workers, the community, and the environment during the remediation phase of development.

- Construction of a new building foundation below the groundwater table with a waterproofing system

The requirements for each of the Alternative I tasks are described below.

3.3.1 Fill and Soil Removal

Based on the findings of the RI, petroleum impacts, VOCs, SVOCs and metals were identified in the historic fill layer at concentrations that exceed the UU and/or RURR SCOs down to at least 12 feet bgs. The remediation will require demolition of all existing structures and soil/fill removal across the site footprint from surface grade to a depth of about 12 to 15 feet bgs. The development cut requires additional removal down to about 30 feet bgs, which is anticipated to extend to bedrock and remove all soil present at the site. An SOE system will need to be installed to facilitate the remedial excavation, which will likely include SOE to bedrock to cut off the flow of groundwater in support of the required dewatering. The estimated volume of material requiring removal and off-site disposal is about 4,800 cubic yards of contaminated historic fill and petroleum-impacted material that exceeds the UU and/or RURR SCOs. The excavation anticipated to achieve an Alternative I remediation is shown on Figure 7.

3.3.2 Dewatering

To accommodate groundwater remediation, remedial excavation, and construction of the foundation elements, dewatering and treatment of the effluent is expected. A well-point dewatering system consisting of perimeter wells connected via a common header will be installed at the site to facilitate building construction. The dewatering treatment system is anticipated to include a settling tank, bag filters, and carbon units located upstream of the off-site discharge point into the NYC sewer system. The dewatering and treatment system will be designed and implemented by a dewatering contractor. Verification sampling will be conducted in accordance with a NYCDEP permit, obtained by the dewatering contractor. The NYCDEP permit and final dewatering system design, including treatment train details, will be provided to NYSDEC prior to site dewatering. The dewatering system is anticipated to operate continuously for six to eight months. The effectiveness of the dewatering and treatment system in achieving a reduction in groundwater contaminants will be evaluated through collection and analysis of groundwater samples from the dewatering system effluent.

3.3.3 UST System Removal

USTs that may be encountered during excavation will be removed as required. If encountered, USTs and/or associated appurtenances will be decommissioned in accordance with 6 NYCRR Part 613.9, NYSDEC Commissioner's Policy (CP)-51, and other applicable NYSDEC tank closure requirements including DER-10 Section 5.5. Confirmation soil samples will be collected in accordance with DER-10. If encountered, USTs and/or associated appurtenances will be disposed of off-site, and the NYSDEC petroleum bulk storage (PBS) registrations will be updated accordingly. Petroleum-impacted soil, if encountered, will be excavated, stockpiled separately, characterized, and disposed of off-site at a permitted disposal facility in accordance with applicable regulations.

3.3.4 Confirmation Soil Sampling

No overburden is anticipated to remain in place after foundation excavation is complete, and the proposed excavation extends into bedrock. Documentation soil samples will not be collected. If native soil remains in a portion of the excavation, endpoint samples will be collected in accordance with DER-10. If USTs are discovered and removed, documentation samples will be collected where required.

3.3.5 Excavation Backfill

Although not anticipated, areas of the site that are over-excavated to achieve Track 1 cleanup standards will be backfilled to development subgrade elevation. Imported backfill will comply with 6 NYCRR Part 375-6.7(d) and NYSDEC DER-10 Section 5.4(e), Table 5.4(e)10, and Appendix 5.

Imported material will consist of clean fill that meets the UU SCOs or other acceptable fill material such as virgin stone from a quarry or RCA. If RCA is imported to the site, it will come from a NYSDEC-registered facility in compliance with 6 NYCRR Part 360 registration and permitting requirements for the period of RCA acquisition. RCA imported from compliant facilities will not require chemical testing, unless required by NYSDEC under its terms for operation of the facility. Imported RCA must be derived from recognizable and uncontaminated concrete and must conform to Section 304 of the New York State Department of Transportation Standard Specifications Construction and Materials Volume 1 (2002). A Beneficial Use Determination (BUD) shall be obtained for acquisition of RCA, where required by NYSDEC. RCA is not acceptable for, and will not be used as site cover.

The clean fill will be segregated at a source/facility that is free of environmental contaminants. Qualified environmental personnel will collect representative samples at a frequency consistent with NYSDEC CP-51 (Table 4). The samples will be analyzed for Part 375 VOCs, SVOCs, pesticides, PCBs, and metals by an NYSDOH ELAP-certified laboratory. Acceptable backfill will not exceed the UU SCOs. Upon meeting these criteria, the certified-clean fill will be transported to the site and segregated from impacted material, as necessary, on plastic sheeting until used as backfill.

3.3.6 On-Site Worker, Public Health and Environmental Protection

A site-specific CHASP will be enforced during excavation and foundation construction to protect on-site workers from accidents and acute and chronic exposures to the identified contaminated media. Public health will be protected by implementing and enforcing dust, odor, and organic vapor control and monitoring procedures included in the CAMP. The CAMP will include real-time continuous monitoring of dust and organic vapors at the site perimeters. A field representative will monitor site perimeters and work zones for visible dust and odors on behalf of the remedial engineer.

3.4 Alternative II – Track 2 Technical Description

The Alternative II Track 2 remedy is proposed as a contingency remedy if a Track 1 remedy is not achieved. The total depth of excavation will remain at about 30 feet bgs for a Track 2 remedy, which is expected to extend into bedrock. If residual petroleum-impacted groundwater and/or contaminated soil remains at the site following source removal and dewatering, a Track 2 remedy with potential ECs will be achieved. Alternative II will include all of the elements of Alternative I, except for the following modifications:

- The cleanup criteria will be the protection of groundwater (PGW) SCOs for contaminants found in on-site groundwater at concentrations above TOGS Class GA SGVs.
- Placement of an engineered composite cover system (e.g., concrete building slab and waterproofing/vapor barrier), as required, over the site footprint to prevent exposure to residual contaminated soil and/or contaminated groundwater.

Under a Track 2 cleanup, an environmental easement may need to be recorded for ECs and ICs that are part of the selected remedy, which will be binding upon all subsequent owners and occupants of the property. A Track 2 cleanup may require ICs that will restrict the use of the site to restricted-residential, commercial and industrial uses, and may require implementation of an SMP if residual petroleum-impacted groundwater and/or soil remains at the site following source removal and dewatering. If required, the SMP will identify EC/IC monitoring, maintenance, and certification requirements.

3.5 Evaluation of Remedial Alternatives

The following is an evaluation of the proposed remedy based on the NYSDEC BCP remedy evaluation criteria listed below. The first two criteria are considered “threshold criteria” and the remaining criteria are “balancing criteria”. A remedial alternative must meet the threshold criteria to be considered and evaluated further under the balancing criteria.

- Protection of human health and the environment;
- Compliance with SCGs;
- Short-term effectiveness and impacts;
- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, or volume of contaminated material;

- Implementability;
- Cost effectiveness;
- Community Acceptance; and
- Land use.

3.5.1 Protection of Public Health and the Environment

Alternative I - The remedy will eliminate exposure pathways from on-site contaminated media by removal of all on-site sources of contamination and soil. The RAOs for public health and environmental protection will be met through the removal of contaminated media at the site, which will eliminate ingestion, inhalation, or dermal contact.

Alternative II - The Track 2 remedy will provide a similar overall protection to public health and the environment as Alternative I. Under a Track 2 remedy, residual soil is not anticipated to remain on-site as soil will still be removed to about 30 feet bgs to facilitate the proposed development foundation, which is anticipated to extend into bedrock. As required, use restrictions will be imposed to control site uses, and a site cap and waterproofing/vapor barrier will be installed to prevent future exposure. Groundwater in New York City is not used as a source of drinking water.

Public health will be protected during remediation under each remedial alternative by implementing and enforcing dust, odor, and organic vapor control and monitoring procedures when needed. The environment will be protected by implementing and enforcing soil erosion and sediment controls when needed.

3.5.2 Compliance with Standards, Criteria, and Guidance

Both Alternatives will be in compliance with all applicable standards, criteria, and guidance listed in Section 3.1 by removing all on-site sources of contamination to achieve the RAOs. While implementing either remedy, protection of public health and the environment will be maintained by enforcing a site-specific CHASP and CAMP. Occupational Safety and Health Administration (OSHA) requirements for on-site construction safety will be followed by site contractors performing work.

3.5.3 Short-Term Effectiveness and Impacts

The most significant short-term adverse impacts and risks to the community will be during construction of the site foundation. Both of the alternatives are estimated to require about 195 25-cubic-yard truck trips to haul excavated soil/fill from the site for off-site disposal. Additional short-term adverse impacts include potential impositions on roadway and pedestrian traffic associated with construction. Truck traffic will be routed on the most direct course using major thoroughfares where possible and flaggers will be used to protect pedestrians at site entrances and exits.

Potential exposure during soil disposal for site contaminants to the community, workers and the environment will be minimized by implementing appropriate control plans (including the CHASP, CAMP, and dust, odor and vapor control measures).

3.5.4 Long-Term Effectiveness and Impacts

Both of the Alternatives will remove on-site sources of contamination. Potential exposure pathways for contaminated soil vapor migrating with groundwater beneath the site from off-site sources are not expected to exist because the building foundation will be constructed below the groundwater table, preventing the transition of VOCs from the dissolved to vapor phase. Local laws also prohibit potable use of groundwater in New York City without prior approval from NYSDEC. Additionally, the support of excavation will act as a hydraulic cutoff wall to potential contaminated water migrating onto the site. Therefore, the long-term effectiveness of the remedy will eliminate risks and satisfy the objectives of this criterion.

3.5.5 Reduction of Toxicity, Mobility, or Volume of Contaminated Material

Both remedies will permanently and significantly reduce the toxicity, mobility, and volume of contamination through excavation and removal of all soil onsite. The support of excavation will act as a hydraulic cutoff wall to potential contaminated water migrating onto the site. Subsurface building structures will also be lined with a waterproofing membrane/vapor barrier.

3.5.6 Implementability

Implementing each Alternatives is feasible because the excavation of about 30 feet bgs can be achieved using conventional construction methods and equipment, including the use of standard bucket excavators, SOE, and underpinning for the buildings adjoining the site. The availability of local contractors, personnel and equipment suitable to working in structurally challenging environment is high, due to the frequency of this type of remediation in the region.

3.5.7 Cost Effectiveness

The cost to implement remedial Alternative I is estimated to be about $5.2 million, and the cost to implement remedial Alternative II is estimated to be about $5.6 million.

Alternative I – As the site will be remediated to meet UU SCOs, there will be no long-term operation, maintenance, or monitoring costs associated with the proposed remedy. Table 1 details the individual cost components used to arrive at this cost estimate.

Alternative II – The Track 2 remedy has potential to carry higher costs in the long-term than a Track 1 remedy because of potential ECs, preparation and implementation of a Site Management Plan and ongoing compliance with RAOs for residual contamination. Table 2 outlines the individual cost-components used to arrive at this cost estimate. Additional costs are expected to be incurred if periodic inspections and preparation of Professional Engineer-certified reports are required.

3.5.8 Community Acceptance

Both remedial Alternatives are expected be acceptable to the community, because the potential exposure pathways to on-site contamination will be eliminated or significantly reduced upon completion of the remedial actions. The selected remedy will be subject to a 45-day public comment period and will incorporate substantive public comments before being approved.

3.5.9 Land Use

The current, intended, and reasonably anticipated future land use of the site and its surroundings are compatible with both remedial alternatives. The proposed remediation and site development is in the conceptual phase and is anticipated to include the demolition of the on-site buildings and construction of a new commercial building with two cellar levels. The building would require site-wide excavation to about 30 feet bgs for the building cellar and foundation, which will necessitate dewatering to lower the groundwater table (encountered at about 9.2 to 11.5 feet bgs). The site borders residential and mixed-use commercial and residential buildings to the south, east and west. Industrial buildings border the site to the north, and the surrounding land-use is a mix of residential, commercial, industrial, and institutional buildings.

3.6 Selection of the Preferred Remedy

Based on the remedial alternatives evaluation described above, both alternatives will be protective of human health and the environment and meet the RAOs. Alternative I is the selected remedy and proposes a Track 1 remedy that will achieve all the RAOs established for the project and is effective in the short- and long-term. The selected remedy effectively reduces the mobility, toxicity, and volume of contaminants and is effective in the long-term because it allows for unrestricted land use that is free of long-term site management, ECs, ICs, and potential additional future costs that will be required to address residual soil and/or contaminated groundwater left after a Track 2 remedy. The selected remedy is considered feasible because the excavation depths can be practically achieved.

Alterative I provides for removal of historic fill and all soil on-site into bedrock to achieve a Track 1 remedy. Contaminated groundwater will be primarily remediated by treatment and discharge during construction dewatering. Potential exposure pathways will be eliminated following source removal during construction of the building foundation.

Alterative I can be feasibly and practically implemented, while providing protection to human health and the environment. Therefore, Alternative I is the recommended remedial alternative for this site.

3.7 Summary of Selected Remedial Action

The selected Alternative I Track 1 remedy and site development will include the following:

- Demolition of all on-site buildings in accordance with federal, state, and local regulations to prepare the site for excavation and redevelopment
- Site-wide excavation to about 30 feet bgs to remove soil that exceeds UU SCOs, as defined by 6 NYCRR Part 375-6.8(a) and reach development depth. Of the total excavation volume, about 4,800 cubic yards of contaminated historic fill exceeds UU SCOs and will be excavated as a remedial measure. Based on the RI findings, soil exceeding the UU SCOs is present down to at least 12 feet bgs.
- Screening for indications of contamination (e.g., staining, odor and elevated PID readings) of all excavated soil during any intrusive Site work
- Decommissioning and removal of USTs identified during remediation, including documentation of proper handling and disposal
- Collection and analysis of confirmation soil samples to verify Track 1 UU SCOs are achieved at the base of the excavation (if possible based in the bedrock depth)
- If necessary, import and placement of clean fill (e.g., virgin crushed stone, RCA, and soil meeting Track 1 Part 375 UU SCOs) to bring the grade up to development depth if there are areas that are over-excavated
- Dewatering and treatment of groundwater by a dewatering contractor for groundwater remediation and to support excavation below the water table in accordance with a NYCDEP sewer discharge permit.
- Development and implementation of a CHASP and CAMP for the protection of on-site workers, the community, and the environment during the remediation phase of development.
- Construction of a new building foundation below the groundwater table with a waterproofing system

Remedial activities will be performed in accordance with this NYSDEC-approved RAWP and the Department-issued Decision Document. Deviations from the RAWP will be promptly reported to the NYSDEC for approval and fully explained in the Final Engineering Report (FER).

4.0 REMEDIAL ACTION PROGRAM

4.1 Governing Documents

The primary documents governing the remedial action are summarized in this section. As referenced, copies of the full plan are provided in the appendices.

4.1.1 Remedial Design and Green Remediation Principles

A remedial design program will be implemented to provide the details necessary for the construction, operation, optimization, maintenance, and monitoring of the remedial program. Green remediation principles and techniques will be implemented to the extent feasible in the design, implementation, and site management of the remedy as per DER-10. The major green remediation components to be considered are as follows:

- Considering the environmental impacts of treatment technologies and remedy stewardship over the long term;
- Reducing direct and indirect greenhouse gases and other emissions;
- Increasing energy efficiency and minimizing use of non-renewable energy;
- Conserving and efficiently managing resources and materials;
- Reducing waste, increasing recycling and increasing reuse of materials that would otherwise be considered a waste;
- Maximizing habitat value and creating habitat when possible;
- Fostering green and healthy communities and working landscapes which balance ecological, economic and social goals; and
- Integrating the remedy with the end use where possible and encouraging green and sustainable re-development.

4.1.2 Site Specific Construction Health & Safety Plan

The Remedial Engineer (RE) prepared a site-specific CHASP, which is provided as Appendix C. The CHASP specifically addresses health and safety requirements pertaining to site contamination and will apply to all remedial and construction-related work on-site. Contractors operating on the Site are required to adhere to their own plans that, at a minimum, meet the requirements of the CHASP. The CHASP requires that all remedial work performed under this plan be in full compliance with governmental requirements, including site and worker safety requirements mandated by OSHA. The CHASP provides a mechanism for establishing on-site safe working conditions, safety organization, procedures, and PPE requirements during implementation of the remedy. The CHASP meets the requirements of 29 CFR 1910 and 29 CFR

1926 (which includes 29 CFR 1910.120 and 29 CFR 1926.65, respectively). The CHASP includes, but is not limited to, the following components:

- Organization and identification of key personnel;
- Training requirements;
- Medical surveillance requirements;
- List of site hazards;
- Excavation safety;
- Drill rig safety;
- Work zone descriptions and monitoring procedures;
- Personal safety equipment and protective clothing requirements;
- Decontamination requirements;
- Standards operating procedures;
- Contingency plan; and
- Safety data sheets (SDS).

The Volunteer and associated parties preparing the remedial documents submitted to the state and those performing the construction work, are completely responsible for the preparation of an appropriate CHASP and for the appropriate performance of work according to that plan and applicable laws.

The CHASP and requirements defined in this RAWP pertain to all remedial and invasive work performed at the site until the issuance of a Certificate of Completion. The Langan Site Safety Coordinator will be William Bohrer. If required for site workers, confined space entry will comply with all OSHA requirements to address the potential risk posed by combustible and toxic gasses. Langan personnel will not enter confined spaces.

4.1.3 Quality Assurance Project Plan (QAPP)

The RE prepared a QAPP that describes the quality control components employed so that the proposed remedy accomplishes the remedial goals, remedial action objectives, and is completed in accordance with the project specifications. The QAPP is provided as Appendix D and includes:

- Responsibilities of key personnel and their organization for the proposed remedy;
- Qualifications of the quality assurance officer;
- Sampling requirements including methodologies, quantity, volume, locations, frequency, and acceptance and rejection criteria; and

- Description of the reporting requirements for quality assurance activities including weekly quality assurance review reports, periodic quality assurance and quality control audits, and other report and data submissions.

4.1.4 Construction Quality Assurance Plan (CQAP)

The RE prepared a CQAP that describes the quality control components employed so that the proposed remedy accomplishes the remedial goals, RAOs and is completed in accordance with the project specifications. Because the remedy is being accomplished through building construction, the contractor and construction manager will have primary responsibility to provide construction quality. A list of engineering personnel involved in implementation of the CQAP and procedures that will be carried out by the remedial engineering team are identified below. Project personnel resumes are provided in Appendix E.

The following project personnel are anticipated for the RAWP implementation:

Remediation Engineer (RE):	Jason J. Hayes, P.E.
Project Manager:	Joseph Good, P.E.
Langan Health and Safety Officer:	Tony Moffa, CHMM
Site Safety Coordinator:	William Bohrer, PG
Field Team Leader:	Emily Snead, PG
Quality Assurance Officer:	Michael Burke, CHMM, PG

The RE will directly supervise field personnel that will be on-site during the remedial action to monitor particulates and organic vapor in accordance with the CAMP. Daily reports will be submitted to NYSDEC and NYSDOH and will include reporting of any CAMP results that exceed the specified action levels as well as measures taken to reduce action levels.

A Qualified Environmental Professional (QEP) or the RE will directly supervise field personnel that will meet with the Construction Superintendent on a daily basis to discuss the plans for that day and schedule upcoming activities. The field personnel will document all remedial activities in daily reports. This document will be forwarded to the Field Team Leader on a daily basis and to the Project Manager and the RE on a weekly basis.

A QEP or the RE will directly supervise field personnel that will screen the excavation with a PID during intrusive activities. All readings will be noted in the record. Elevated readings will be reported to the NYSDEC and NYSDOH in the daily reports. The field personnel will collect the excavation confirmation samples in accordance with this RAWP.

A photo log will be kept to document construction activities by still photos. The photo log may also be used to record activities in the daily report.

The project field book will be used to document all sampling activities and how they correspond to the RAWP. All observations, field and laboratory tests will be recorded in the project field book or on separate logs. Recorded field observations may take the form of notes, charts, sketches or photographs.

The Field Team Leader will maintain the current field book and original field paperwork during the performance of work. The project manager will maintain the field paperwork after completion and will maintain submittal document files.

4.1.5 Soil/Materials Management Plan

The RE prepared a SMMP that includes detailed plans for managing soils/materials that are disturbed at the site, including excavation, handling, storage, transport and disposal. It also includes controls that will be applied to these efforts to facilitate effective, nuisance-free performance in compliance with applicable federal, state and local laws and regulations. The SMMP is detailed further in Section 5.4.

4.1.6 Stormwater Pollution Prevention Plan (SWPPP)

Erosion and sediment controls will be used as necessary in conformance with requirements presented in the New York State Guidelines for Urban Erosion and Sediment Control. Erosion and sediment controls that will be implemented are briefly described in Section 5.4.10 (Stormwater Pollution Prevention) and will be further detailed in the Soil Sediment and Erosion Plan provided in Appendix F. Stormwater will be discharged to a combined sewer, in accordance with the New York City generic stormwater pollution discharge elimination system permit.

Since the planned earthwork activities will be below the adjacent sidewalk grade, full-time erosion and sedimentation measures are not anticipated. Best Management Practices (BMP) for soil erosion will be selected and implemented, as needed, to minimize erosion and sedimentation off-site. A SWPPP is not required for this site.

4.1.7 Community Air Monitoring Plan

Community air monitoring will be conducted in compliance with the CAMP discussed in the CHASP and in accordance with the NYSDOH Generic CAMP included as Appendix 1A in DER-10.

4.1.8 Contractors Site Operations Plan (SOP)

The RE will review plans and submittals for this remedial project (including those listed above and contractor and sub-contractor document submittals) and will confirm that plans and submittals are in compliance with this RAWP. The RE is responsible for documenting that contractor and subcontractor document submittals are in compliance with this RAWP. Remedial documents, including contractor and subcontractor document submittals, will be submitted to NYSDEC and NYSDOH in a timely manner and prior to the start of work as necessary.

4.1.9 Citizen Participation Plan (CPP)

A certification of mailing will be sent by the Volunteer to the NYSDEC project manager following the distribution of all Fact Sheets and notices that includes: (1) certification that the Fact Sheets were mailed, (2) the date they were mailed; (3) a copy of the Fact Sheet, (4) a list of recipients (contact list); and (5) a statement that the repository was inspected on (specific date) and that it contained all of applicable project documents.

No changes will be made to approved Fact Sheets authorized for release by NYSDEC without written consent of the NYSDEC. No other information, such as brochures and flyers, will be included with the Fact Sheet mailing. The Citizen Participation Plan for this project is attached in Appendix G.

Document repositories have been established at the following locations and contain all applicable project documents:

New York Public Library – Muhlenberg Branch
209 West 23rd Street
New York, NY 10011
Phone: (212) 924-1585
Hours:

Monday through Thursday:	10 AM – 7 PM
Friday	10 AM – 6 PM
Saturday:	10 AM – 5 PM
Sunday:	CLOSED

Manhattan Community Board 4
Burt Lazarin, Chair
330 West 42nd Street, 26th Floor
New York, NY 11106
Phone: (212) 736-4536

4.2 General Remedial Construction Information

4.2.1 Project Organization

This section presents the anticipated project organization and associated roles, including key personnel, descriptions of duties and lines of authority in the management of the RAWP. Information regarding the organization/personnel and their associated responsibilities is provided below. Resumes of key personnel involved in the Remedial Action are included in Appendix E.

4.2.2 Remedial Engineer

The RE for this project will be Jason J. Hayes. The RE is a registered professional engineer licensed by the State of New York. The RE will have primary direct responsibility for implementation of the remedial program for the 538-542 West 29th Street Site (NYSDEC BCP Site No. Pending). The RE will certify in the FER that the remedial activities were observed by qualified environmental professionals under his supervision and that the remediation requirements set forth in the RAWP and any other relevant provisions of ECL 27-1419 have been achieved in full conformance with the RAWP. Other RE certification requirements are listed later in this RAWP.

The RE will document the work of other contractors and subcontractors involved in all aspects of remedial construction, including soil excavation, stockpiling, characterization, removal and disposal; air monitoring; emergency spill response services; import of backfill material; and management of waste transport and disposal. The RE will be responsible for all appropriate communication with NYSDEC and NYSDOH.

The RE will review all pre-remedial plans submitted by contractors for compliance with this RAWP and will certify compliance in the FER. The RE will provide the certifications listed in Section 8.0 in the FER.

4.2.3 Remedial Action Construction Schedule

The anticipated project/remediation construction schedule is discussed below in Section 9.0 and included in Appendix H. The NYSDEC will be promptly notified of proposed changes, delays, and/or deviations to the schedule.

4.2.4 Work Hours

The hours for operation of remedial construction will conform to the NYCDOB construction code requirements or according to specific variances issued by that agency. The NYSDEC will be notified by the Volunteer of any variances issued by the NYCDOB. The NYSDEC reserves the right to deny alternate remedial construction hours.

4.2.5 Site Security

The site perimeter will be secured with gated, signed, plywood fencing with points of entry in accordance with NYCDOB and New York City Department of Transportation (NYCDOT) permits and requirements. The purpose of the fencing is to limit site access to authorized personnel, protect pedestrians from site activities, and maintain site security.

4.2.6 Traffic Control

Site traffic will be controlled through designated points of access along West 29th Street. Access points will be continuously monitored and if necessary, a flagging system will be used to protect workers, pedestrians, and authorized guests. Traffic will also adhere to applicable local, state, and federal laws.

4.2.7 Contingency Plan

Contingency plans, as described below, have been developed to effectively deal with unexpected discoveries of additional contaminated media and/or USTs.

4.2.7.1 Discovery of Additional Contaminated Soil

During remediation and construction activities, the soil will be continuously monitored by the RE's field representatives using a PID and observing for staining, odor, etc. to identify soil that may not be suitable for the selected disposal facility(ies). Material that is not suitable will be segregated and sampled for lab analysis in accordance with disposal facility requirements. If the facility is not permitted to receive the sampled materials, the material will be disposed of off-site at a permitted facility able to receive the material based on the characterization data.

If other previously unidentified contaminant sources are found during on-site remedial excavation or development-related construction, sampling will be performed. Chemical analytical work will be for full scan parameters (VOCs, SVOCs, PCBs, pesticides, and metals). Analyses will not be otherwise limited without NYSDEC approval.

Identification of unknown or unexpected contaminated media identified by screening during invasive site work will be promptly communicated by phone to the NYSDEC Project Manager. These findings will be detailed in daily reports and subsequent monthly BCP progress reports. Potential additional remedial measures will be coordinated with NYSDEC.

4.2.7.2 Discovery of Unexpected USTs

Previously unidentified USTs may be discovered during site-wide excavation. Additional USTs encountered during remedial and/or construction activities will be decommissioned in accordance with 6 NYCRR Parts 612.2 and 613.9 and NYSDEC DER-10 Section 5.5. Once the tank, its contents, and associated piping are removed, post-excavation soil samples will be collected per the requirements of NYSDEC DER-10. If encountered, petroleum-impacted soils will be excavated, stockpiled separately, and disposed of off-site at a permitted disposal facility in accordance with applicable regulations. UST closure documentation, including contractor affidavits, waste manifests, and tank disposal receipts, will be included as appendices to the FER. NYSDEC PBS registration requirements will be complied with, as necessary, based on the type, number, and capacity of the discovered USTs.

If USTs are encountered during invasive site work, the findings will be promptly communicated by phone to the NYSDEC's Project Manager and detailed in daily reports and subsequent monthly BCP progress reports.

4.2.8 Worker Training and Monitoring

Worker training and monitoring will be conducted in accordance with the site-specific CHASP provided in Appendix C.

4.2.9 Agency Approvals

There are no State Environmental Quality Review Act (SEQRA) remediation requirements for this site. Permits or government approvals required for remedial construction have been, or will be, obtained prior to that start of remedial construction.

The planned end use for the Site is in conformance with the current zoning for the property as determined by New York City Department of City Planning (DCP). A Certificate of Completion will not be issued for the project unless conformance with zoning designation is demonstrated.

4.2.10 NYSDEC BCP Signage

Signs are optional for BCP sites and should be discussed with the NYSDEC Project Manager. If a sign is to be displayed, it must follow NYSDEC specifications for design and content. The NYSDEC Project Manager can provide details on signage protocol.

4.2.11 Pre-Construction Meeting with NYSDEC

Prior to the onset of construction, a meeting will be held between the NYSDEC, RE, Volunteer, Construction Manager, and Contractor to discuss project roles, responsibilities, and expectations associated with the NYSDEC-approved RAWP. Notice will be provided to the NYSDEC seven days prior to Site mobilization.

4.2.12 Emergency Contact Information

An emergency contact sheet with names and phone numbers is included in the CHASP. That document will define the specific project contacts for use by NYSDEC and NYSDOH in the case of a day or night emergency.

4.2.13 Remedial Action Costs

The total estimated cost of the Remedial Action is $5,200,000 (includes contractor and engineering cost and does not include other potential project costs [e.g., legal, insurance, construction management]). An itemized and detailed summary of estimated costs for Track 1 remedial activity is provided in Table 1.

4.3 Site Preparation

4.3.1 Mobilization

Before commencing the remedial excavation, the remediation contractor will mobilize to the site and prepare for remedial activities. Mobilization and site preparation activities may include the following:

- Identifying the location of all aboveground and underground utilities (e.g., power, gas, water, sewer, telephone), equipment, and structures (as necessary to implement the remediation);
- Mobilizing necessary remediation personnel, equipment, and materials to the site;
- Constructing one or more stabilized construction entrances consisting of virgin crushed stone or RCA at or near the site exit, which takes into consideration the site setting and site perimeter;
- Constructing a decontamination pad for trucks, equipment, and personnel that come into contact with impacted materials during remedial activities;
- Installing erosion and sedimentation control measures, as necessary; and
- Installing temporary fencing or other temporary barriers to limit unauthorized access to areas where remediation activities will be conducted.

4.3.2 Monitoring Well / Vapor Probe Decommissioning

Existing groundwater monitoring wells will be properly decommissioned in accordance with NYSDEC policy CP-43. If required, well decommissioning will be performed by an experienced driller and logged by the driller and a Langan field personnel. Decommissioning documentation will be provided in the FER.

4.3.3 Stabilized Construction Entrance(s)

Stabilized entrance areas will be constructed to prevent decontaminated trucks from being re-contaminated by site soil before exiting. The areas will be covered with virgin crushed stone or RCA and graded so that runoff water will be directed onto the site. The contractor will protect and maintain the existing sidewalks and roadway at site entrance points.

4.3.4 Utility Marker and Easements Layout

The Volunteer and its contractors are responsible for the identification of utilities that might be affected by work under the RAWP and implementation of all required, appropriate, or necessary health and safety measures during performance of work under this RAWP. The Volunteer and its contractors are responsible for safe execution of all invasive and other work performed under this RAWP. The Volunteer and its contractors must obtain any local, state or federal permits or approvals pertinent to such work that may be required to perform work under this RAWP. Approval of this RAWP by NYSDEC does not constitute satisfaction of these requirements.

Impediments to the planned work under this RAWP are not expected by known utilities or easements on the site.

4.3.5 Support of Excavation

Appropriate management of structural stability of on-site or off-site structures during on-site activities including excavation is the sole responsibility of the Volunteer and its contractors. The Volunteer and its contractors are responsible for safe execution of all invasive and other work performed under this RAWP. The Volunteer and its contractors must obtain any local, state or federal permits or approvals that may be required to perform work under this Plan. Further, the Volunteer and its contractors are responsible for the implementation of all required, appropriate, or necessary health and safety measures during performance of work under this RAWP.

4.3.6 Equipment and Material Staging

The contractor will notify the RE and the Volunteer in writing with receipt confirmed, of pending site work mobilization at least 30 calendar days in advance. During mobilization, construction equipment will be delivered to the site, temporary facilities will be constructed, and temporary utilities will be installed. The contractor will place and maintain temporary toilet facilities within the work areas for usage by all site personnel. The contractor will provide drinking water for all site personnel.

4.3.7 Decontamination Area

The contractor will construct decontamination pads at each site entrance/exit planned for construction vehicle usage. The location of decontamination pads may change periodically to accommodate the contractor's sequencing of work. Where required, the pads will be constructed by the contractor to collect wastewater for off-site disposal or treatment and discharge, if generated during decontamination activities. The design will consider adequate space to decontaminate site equipment and vehicles, and sloping and liners to facilitate collection of wastewater. Where required, collected truck rinsate and decontamination wastewater shall be either discharged in accordance with the a NYCDEP discharge permit or tested and transported to an off-site disposal facility that is permitted to accept this waste, in accordance with applicable local, state and federal regulations. The contractor will maintain the decontamination pad(s) throughout the duration of site work. Prior to demobilization, the contractor will deconstruct the pads and dispose of materials as required. Decontamination will be documented as necessary in the project field log book.

If the contractor uses high pressure washing methods, the contractor shall provide splash protection around the vehicle decontamination facility to prevent splatter and mist migrating off-site during the vehicle decontamination process. Splash protection shall be temporary and stable and capable of being dismantled in the event of high winds.

4.3.8 Site Fencing

The site perimeter will be secured with gated, signed, plywood fencing. The purpose of the fencing is to limit site access to authorized personnel, protect pedestrians from site activities and maintain site security.

4.3.9 Demobilization

After remediation and construction is completed, the Contractor will be responsible for demobilizing labor, equipment, and materials not designated for off-site disposal. The RE will be responsible to document that the Contractor performs follow-up coordination and maintenance for the following activities:

- Restoration of areas that may have been disturbed to accommodate support areas (e.g., staging areas, decontamination areas, storage areas, temporary water management area[s], and access area);
- Removal of temporary access areas (whether on-site or off-site) and restoration of disturbed access areas to pre-remediation conditions;
- Removal of sediment and erosion control measures and disposal of materials in accordance with acceptable rules and regulations;
- Equipment decontamination; and
- General refuse disposal.

4.4 Reporting

Daily and monthly reports and an FER will be required to document the remedial action. The RE responsible for certifying the FER will be an individual licensed to practice engineering in the State of New York; Jason Hayes, P.E., of Langan, will have this responsibility. Should Mr. Hayes become unable to fulfill this responsibility, another suitably qualified New York State professional engineer will take his place. All daily and monthly reports will be included in the FER. In addition to the periodic reports and the FER, copies of all relevant Contractor documents will be submitted to the NYSDEC.

4.4.1 Daily Reports

Daily reports will be submitted to NYSDEC and NYSDOH Project Managers by the end of each following calendar day/ reporting period and will include:

- An update of progress made during the reporting day;

- Locations of work and quantities of material imported and exported from the site;
- References to alpha-numeric map for site activities;
- A summary of complaints with relevant details (names, phone numbers);
- A summary of CAMP finding, including triggered action levels; and
- An explanation of notable site conditions.

Daily reports are not intended to be the mode of communication for notification to the NYSDEC of emergencies (accident, spill), requests for changes to the RAWP or other sensitive or time critical information. However, such conditions must also be included in the daily reports. Emergency conditions and changes to the RAWP will be addressed directly to NYSDEC Project Manager via personal communication.

Daily Reports will include a description of daily activities keyed to an alpha-numeric map for the Site that identifies work areas. These reports will include a summary of air sampling results, summary of off-site disposal and import activities, odor and dust problems and corrective actions, and complaints received from the public. The NYSDEC assigned project number will appear on all reports.

4.4.2 Monthly Reports

Monthly BCP reports will be submitted to NYSDEC and NYSDOH Project Managers by the tenth of the month following the reporting period and will include, as well as the information required in the BCA:

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

4.4.3 Other Reporting

Photographs will be taken of all remedial activities and submitted to NYSDEC in digital (JPEG) format. Photos will illustrate all remedial program elements and will be of acceptable quality. Representative photos of the site prior to any Remedial Actions will be provided. Representative photos will be provided of each contaminant source, source area and site structures before, during and after remediation. Photos will be included in the daily reports as needed, and a comprehensive collection of photos will be included in the FER.

Jobsite record keeping for all remedial work will be appropriately documented. These records will be maintained on-site at all times during the project and be available for inspection by NYSDEC and NYSDOH staff.

4.4.4 Complaint Management Plan

The management plan for documenting complaints is detailed below.

Item	Description
Approach	Complaints regarding remediation or construction activities/operations will be minimized and mitigation measures will be implemented to reduce the incidence of complaints.
Objective	To manage environmental complaints from the community regarding construction or remediation.
Implementation Strategy/Mitigation Measures	All complaints will be documented on a complaint register. The register will be maintained as an ongoing record. Each entry will include the following information: • Time, date and nature of complaint; • Type of communication (telephone, letter, personal, etc.); • Name, contact address and contact number; and • Response and investigation undertaken as a result of the complaint and action taken with the signature of the responsible person. Each complaint will be investigated as soon as practicable in relation to the requirements.
Monitoring	A representative from the Volunteer or the RE will follow up on the complaint within two weeks of receipt to ensure it has been resolved.
Reporting	Upon receipt, the NYSDEC will be notified. Complaints and resolutions will be documented in the daily reports.
Corrective Action	Should an incident or failure to comply occur in relation to the management of environmental complaints, one or more of the following corrective actions will be undertaken as appropriate: • Conduct additional training of staff to handle environmental complaints; • Investigate why the environmental complaint was not addressed within the specified time frame; and • Investigate the complaint and action follow-up according to the investigation results.

4.4.5 Deviations from the Remedial Action Work Plan

Necessary deviations from the RAWP will be coordinated with the NYSDEC in advance. Notification will be provided to the NYSDEC by telephone/email for conditions requiring immediate action (e.g., conditions judged to be a danger to the surrounding community). Based on the significance of the deviation, an addendum to this RAWP may be necessary and will include:

- Reasons for deviating from the approved RAWP;
- Approval process to be followed for changes/editions to the RAWP; and
- Effect of the deviations on the overall remedy.

5.0 REMEDIAL ACTION IMPLEMENTATION

Remediation will be completed concurrently with foundation construction and will include the following material removal tasks:

- Demolition and off-site disposal of all on-site buildings in accordance with federal, state, and local regulations to prepare the site for excavation and redevelopment;
- Site-wide excavation to about 30 feet bgs to remove soil that exceeds UU SCOs, with required SOE installation;
- Appropriate off-site disposal of all material removed from the site in accordance with all Federal, State, and local rules and regulations for handling, transport, and disposal;
- Decommissioning and removing USTs encountered during remedial activities; and
- Dewatering and treatment, as necessary, to remediate site groundwater, accommodate remedial excavation and foundation construction;

5.1 Soil Cleanup Objectives

Track 1 UU SCOs, which are listed in Table 3, will be the objective for this site. Soils and materials management on-site and off-site will be conducted in accordance with the SMMP as described in Section 5.4. Pre-remediation soil sample locations and results that exceed the Track 1 SCOs are shown on Figure 4.

5.2 Remedial Performance Evaluation (Confirmation Sampling)

5.2.1 Soil Sampling Frequency

Endpoint sampling is not expected due to the removal of all soil on-site. Soil will be excavated to bedrock on the base of the excavation and SOE will preclude access to sidewall soil. In the event bedrock is deeper than anticipated, one confirmation soil sample will be collected for every 900 square feet of excavation base in accordance with NYSDEC DER-10.

5.2.2 Methodology

If unexpected residual soil remains on the site after excavation, confirmation soil samples will be collected from non-source contaminant areas, as follows:

- One soil sample will be collected from the excavation base for every 900 square feet of area. If the size of the development area changes, the number of soil samples to be collected will be amended in accordance with NYSDEC DER-10; and
- If USTs are encountered, a minimum of five additional soil samples may be collected from UST removal areas, including four sidewall samples and one base sample - Sampling from

UST areas is not expected where the development excavation will extend more than 2 feet below the original base of the tank.

Should additional confirmation samples be deemed necessary (e.g., additional tank closure, unknown environmental condition through visual evidence of a remaining source, over-excavation of failed confirmation sample), confirmation sampling will occur in accordance with NYSDEC DER-10 and CP-51.

Confirmation soil samples, plus QA/QC samples, will be analyzed for the Part 375 list of VOCs, SVOCs, PCBs, pesticides, and metals.

5.2.3 QA/QC

Quality control procedures for confirmation soil sampling are included in the QAPP (refer to Appendix D). Confirmation analytical results will be provided in the NYSDEC's electronic data deliverable (EDD) format for EQuIS ™. Guidance on the sampling frequency is presented in Section 5.4 of NYSDEC DER-10.

The QA/QC procedures required by the NYSDEC Analytical Services Protocol (ASP) and SW-846 methods will be followed. This will include instrument calibration, standard compound spikes, surrogate compound spikes, and analysis of quality control samples. The laboratory will provide sample bottles, which are pre-cleaned and persevered. Where there are differences in the SW-846 and NYSDEC ASP requirements, the NYSDEC ASP will take precedence.

5.2.4 DUSR

ASP Category B deliverables will be prepared for all remedial performance samples collected during implementation of this RAWP. Data Usability Summary Reports (DUSR) will be prepared by Emily Strake, a qualified data validator, and findings will be reported in the FER.

5.2.5 Reporting

Chemical labs used to analyze confirmation soil samples, prepare results, and perform contingency sampling will be NYSDOH ELAP-certified laboratories.

Confirmation soil sampling is not expected at this site. If residual soil remains, confirmation soil sampling will be performed in accordance with NYSDEC DER-10 sample frequency requirements. Bottom samples will be collected at a rate of one for every 900 square feet. The FER will provide a tabular and map summary of all confirmation sample results with comparison to Track 1 UU SCOs.

5.3 Estimated Material Removal Quantities

The estimated quantity of soil/fill to be removed from the site is 4,800 cubic yards. About 1,440 tons of excavated soil is estimated to be petroleum-impacted material. Over-excavation areas, if any, will require backfill meeting the UU SCOs.

5.4 Soil/Materials Management Plan

This section presents the approach to management, disposal and reuse of soil, fill, and debris excavated from the site. This plan is based on the current knowledge of site conditions, and will be augmented, as necessary, using additional data collected during remediation. Field personnel, under the direction of the RE or QEP, will monitor and document the handling and transport of contaminated material removed from the site for disposal as a regulated solid waste. Field personnel, under the direction of the RE or QEP, will assist the remedial contractor in identifying impacted materials during excavation, determining materials suitable for direct load-out versus temporary on-site stockpiling, selection of samples for waste characterization, and determining the proper off-site disposal facility. Separate stockpile areas will be constructed as needed to stage various excavated materials with the intent to more efficiently manage and characterize the materials and to avoid comingling of impacted materials with non-impacted soil.

5.4.1 Soil Screening Methods

Visual, olfactory and PID soil screening and assessment will be performed by field personnel under the direct supervision of the RE or QEP during all remedial and development excavations into known or potentially contaminated material. Soil screening will be performed regardless of when the invasive work is done and will include all excavation and invasive work performed during the remedy and during development phase, such as excavations for foundations and utility work, prior to issuance of the Certificate of Completion.

Field screening will be performed by field personnel under the direct supervision of the RE or QEP.

5.4.2 Stockpile Methods

Excavated material will be stockpiled as necessary to separate different types of historic fill and soil. Stockpiles will be constructed for staging of excavated material, pending loading and/or characterization sampling. Separate stockpile areas will be constructed to avoid comingling materials of different waste types. Stockpiles will be inspected at a minimum once each week and after every storm event. Results of inspections will be recorded in a logbook, maintained at the site and made available for inspection by NYSDEC. Stockpile areas will meet the following minimum requirements:

- Stockpiles will be covered at the designated times (see below) with minimum 6-mil plastic sheeting or tarps, which will be securely anchored to the ground. Stockpiles will be routinely inspected and broken sheeting covers will be promptly replaced.
- Equipment and procedures will be used to place and remove the soil that will minimize the potential to jeopardize the integrity of the liner.
- Stockpiles will be covered upon reaching their capacity (i.e., about 1,000 cubic yards) until ready for loading. Stockpiles that have not reached their capacity, whether active or inactive, will be covered at the end of each workday.
- Each stockpile will be encircled with silt fencing and hay bales, as needed, to contain and filter particulates from rainwater that has drained off the soils and to mitigate the potential for surface water run-off.
- A form of water suppressant will be available on-site at a suitable supply and pressure for use in dust control

5.4.3 Materials Excavation and Load Out

The RE or a field personnel under RE supervision will oversee all invasive work and the excavation and load-out of all excavated material.

The Volunteer and its contractors are responsible for safe execution of all invasive and other work performed under this RAWP. The Volunteer and its contractors are responsible for the identification of utilities and/or easements that might be affected by the work conducted under this RAWP.

Loaded vehicles leaving the site will be appropriately lined, securely covered, manifested, and placarded in accordance with appropriate federal, state, local, and NYSDOT requirements (and all other applicable transportation requirements). Trucks hauling historic fill will not be lined unless free liquids are present or the material is grossly impacted.

Vehicles leaving the site will not be overloaded. The field personnel under the supervision of the RE will make reasonable efforts to ensure that vehicles are not loaded beyond their NYSDOT weight rating and that all material is secured beneath the truck bed cover.

A truck cleaning or wash station will be operated on-site. The RE will be responsible for ensuring that all outbound trucks leaving the site will be cleaned or washed at the station, as necessary during remedial activities. Locations where vehicles enter or exit the site shall be inspected daily for evidence of off-site sediment tracking.

The RE will be responsible for documenting that all egress points for truck and equipment transport from the site will be clean of dirt and other materials derived from the site during remediation and development. Cleaning of the adjacent streets will be performed by the contractor as necessary to maintain a clean condition with respect to site-derived materials.

The Volunteer and its relevant engineers and contractors (e.g., the geotechnical engineer and the contractor will design the structural integrity of the excavations) are completely responsible for the safe performance of all invasive work, the structural integrity of excavations, and for structures that may be affected by excavations (such as building foundations and bridge footings).

The RE will document that site development activities will not interfere with, or otherwise impair or compromise, remedial activities proposed in this RAWP.

Development-related grading cuts and fills will not be performed without NYSDEC approval and will not interfere with, or otherwise impair or compromise, the performance of remediation required by this RAWP.

Mechanical processing of historical fill and contaminated soil on-site is prohibited, without prior approval by NYSDEC.

All primary contaminant sources (including but not limited to tanks and hotspots) identified during site characterization, RI, waste characterization and implementation of the remedy will be surveyed by a surveyor licensed to practice in the State of New York. The survey information will be shown on maps to be reported in the FER. Since removal of all soil onsite is anticipated, the final excavation subgrade will not be surveyed. No survey will be required if a Track 1 remedy is achieved.

5.4.4 Materials Transport Off-Site

Transport of materials will be performed by licensed haulers in accordance with appropriate local, state and federal regulations, including 6 NYCRR Part 364. Haulers will be appropriately licensed and trucks properly placarded. Trucks will enter and exit the site using dedicated ingress/egress points. Trucks loaded with site materials will exit the vicinity of the site using only approved truck routes (Figure 9). Trucks will be prohibited from stopping and idling unnecessarily in the neighborhood outside the site. To the extent possible, queuing of trucks will be performed on-site in order to minimize off-site disturbance. Off-site queuing will be minimized.

Trucks loaded with site material will exit the vicinity of the site using approved truck routes. These routes are the most appropriate route and takes into account:

- Limiting transport through residential areas and past sensitive sites;
- Use of city mapped truck routes;
- Prohibiting off-site queuing of idling trucks entering the facility;
- Limiting total distance to major highways;

- Promoting safety in access to highways;
- Overall safety in transport; and
- Community input (where necessary).

All trucks will be cleaned or washed prior to leaving the site. If needed, truck wash waters will be collected and disposed of off-site in an appropriate manner. Material transported by trucks exiting the site will be secured with tight-fitting covers. Loose-fitting canvas-type truck covers will be prohibited. If loads contain wet material capable of producing free liquid, truck liners will be used. Egress points for truck and equipment transport from the site will be kept clean of dirt and other materials during site remediation and development.

Trucks will be prohibited from unnecessary stopping and idling in the neighborhood outside the project site. Queuing of trucks will be performed on-site to the extent possible in order to minimize off-site disturbance. Off-site queuing of idling trucks will be minimized.

5.4.5 Materials Disposal Off-Site

Disposal facilities will be determined at a later date and will be reported to the NYSDEC Project Manager prior to off-site transport and disposal of excavated material.

The estimated quantity of nonhazardous historic fill and native soil to be removed from the site is about 4,800 cubic yards (7,200 tons). About 1,440 tons of material is estimated is to have petroleum impacts. The extent of the site-wide remedial excavation is shown on Figure 7.

Excavated soil/fill material and other solid wastes removed from the site will be handled, transported and disposed of in accordance with local, state (including 6 NYCRR Parts 360 and 361) and federal regulations. If disposal of fill material is proposed for unregulated disposal (i.e., clean soil removed for development purposes), a formal request with an associated plan will be made to the NYSDEC's Project Manager. Unregulated off-site management of materials from this site is prohibited without formal NYSDEC approval.

Material that does not meet Track 1 UU SCOs is prohibited from being taken to a New York State recycling facility (6NYCRR Part 360-16 Registration Facility).

The following documentation will be obtained and reported by the RE for each off-site disposal location used in this project to fully demonstrate and document that the disposal of material derived from the site conforms to applicable laws:

1. A letter from the RE or BCP Volunteer to the receiving facility describing the material to be disposed and requesting formal written acceptance of the material. This letter will state that material to be disposed is contaminated material generated at an environmental remediation site in New York State. The letter will provide the project identity and the name and phone number of the RE. The letter will include as an attachment a summary

of all chemical data for the material being transported (including site characterization data); and

2. A letter from each receiving facility stating it is in receipt of the correspondence (above) and is approved to accept the material. These documents will be included in the FER.

Non-hazardous historic fill and contaminated soils taken off-site will be handled, at minimum, as a Municipal Solid Waste per 6NYCRR Part 360-1.2. Historic fill and contaminated soils from the site are prohibited from being disposed at Part 360-16 Registration Facilities (also known as Soil Recycling Facilities).

Soils that are contaminated but non-hazardous and are being removed from the site are considered by the Division of Materials Management (DMM) in NYSDEC to be Construction and Demolition (C&D) materials with contamination not typical of virgin soils. These soils may be sent to a permitted Part 360 landfill. They may be sent to a permitted C&D processing facility without permit modifications only upon prior notification of NYSDEC Region 2 DMM. This material is prohibited from being sent or redirected to a Part 360-16 Registration Facility. In this case, as dictated by DMM, special procedures will include, at a minimum, a letter to the C&D facility that provides a detailed explanation that the material is derived from a DER remediation site, that the soil material is contaminated and that it must not be redirected to on-site or off-site Soil Recycling Facilities. The letter will provide the project identity and the name and phone number of the RE. The letter will include as an attachment a summary of all chemical data for the material being transported.

The FER will include an account of the destination of all material removed from the site during implementation of the remedy, including non-contaminated soil, contaminated soil, historic fill, solid waste, hazardous waste, C&D debris, and fluids. Documentation associated with disposal of all material must also include records and approvals for receipt of the material. This information will be presented in a table to be included in the FER.

A "Bill of Lading" system or equivalent will be used for off-site movement of non-hazardous wastes and contaminated soils. This information will be reported in the FER. Hazardous wastes, if any, derived from on-site will be stored, transported, and disposed of in full compliance with applicable local, state, and federal regulations.

Appropriately licensed haulers will be used for material removed from this site and will be in full compliance with all applicable local, state and federal regulations.

Supplemental waste characterization sampling (if needed) will be performed for off-site disposal in a manner suitable to the receiving facility and in conformance with applicable permits. Sampling and analytical methods, sampling frequency, analytical results and QA/QC will be reported in the FER. Data available for excavated material to be disposed at a given facility must be submitted to the disposal facility with suitable explanation prior to shipment and receipt.

5.4.6 Materials Reuse On-Site

Soil excavated during installation of the new building foundation is not anticipated to be reused on this site under the proposed remedy. If soil reuse is considered, it will be reused if the requirements in this section and NYCRR Part 360 are met. Grossly-contaminated soil or soil with petroleum staining or odor will not be reused on-site. Soil acceptable for reuse must be non-hazardous and meet UU SCOs. Demolition material is not expected for reuse on-site.

Soil removed during implementation of the remedy or removed for grading or other purposes will not be reused within a cover soil layer, within landscaping berms, or as backfill for subsurface utility lines. Organic matter (wood, roots, stumps, etc.) or other solid waste derived from clearing or grubbing of the site is prohibited for reuse on-site. Reuse of soil will be coordinated in advance with the NYSDEC project manager. Material deemed unfit for reuse will be transported for off-site disposal.

5.4.7 Fluids Management

Liquids removed from the site, including any dewatering fluids, can be handled, transported and disposed of in accordance with applicable local, state and federal regulations. Discharges to the New York City sewer system must be approved by the NYCDEP and tracked under a permit issued by that agency. Groundwater sampling will be performed for NYCDEP effluent criteria parameters prior to obtaining approval for discharge of treated groundwater to the NYC sewer system. Verification sampling will be conducted by the contractor as necessary in accordance with the NYCDEP permit.

Based on the depth-to-groundwater observed during previous investigations (i.e., 9.2 to 11.51 feet bgs on lots 56 and 57, respectively and 3.2 feet below cellar grade on Lot 55), dewatering will be needed for remedial excavation and to facilitate construction of foundation elements. A remediation dewatering treatment system will be designed based on the results of on-site groundwater samples. Dewatering fluids will either be containerized for off-site disposal or discharged to a New York City sewer in accordance with a NYCDEP permit. Fluids will not be recharged back to the land surface or subsurface of the site without a Non-Jurisdictional Determination or SPDES permit.

5.4.8 Demarcation

It is anticipated that all soil will be removed from the site; therefore, contaminated soil is not anticipated to remain on-site and a physical demarcation barrier will not be installed. A survey denoting the base and sidewalls of the excavation will not be required, because an Environmental Easement will not be filed. If residual soil is left onsite that do not achieve a Track 1 remedy, a physical demarcation layer, consisting of orange snow fencing material or equivalent will be placed on this surface to provide a visual reference. The surveyed limits of the excavation and demarcation elevation (if a Track 1 remedy is not obtained and residual soil remains) will be provided in the FER, as appropriate.

5.4.9 Backfill from Off-Site Sources

Materials proposed for import to the site will be approved by the RE and will be in compliance with provisions in this RAWP before they are shipped to the site. Imported backfill will consist of clean fill meeting the UU SCOs or other acceptable fill material such as virgin, native stone from a quarry or RCA. Material from industrial sites, spill sites, other environmental remediation sites or other potentially contaminated sites will not be imported to the site. Solid waste will not be imported onto the site.

Import of soils from off-site, including source evaluation, approval and sampling, will be performed in a manner that is consistent with the methodology defined in the RAWP.

Imported soils (i.e., clean fill) will meet the Track 1 UU SCOs. Non-compliant soils will not be imported to the site. Clean fill will be segregated at a source/facility that is free of environmental contaminants. Composite samples (with the exception of VOCs) of imported soil/fill will be taken at a frequency in accordance with CP-51 Soil Cleanup Guidance Table 4, or at a lesser frequency negotiated with the NYSDEC Project Manager, depending on the proposed source material. The samples will be analyzed for Part 375 VOCs, SVOCs, metals, pesticides and PCBs, including all compounds listed in Table 375-6.8 of 6 NYCRR Part 375, by a NYSDOH ELAP-certified laboratory. Prior to import, a NYSDEC Request to Import form will be completed. Once it is determined that the fill material meets imported backfill SCOs, the material will be loaded onto trucks with secure covers for delivery.

Backfill material will consist of clean fill (as described in the above paragraph) or other acceptable fill material such as virgin stone from a quarry or RCA. If RCA is imported to the site, it will be from a NYSDEC-registered facility with a valid 6 NYCRR Part 360 registration for the period of RCA acquisition. RCA imported from compliant facilities will not require chemical testing, unless required by the NYSDEC under their terms for operation of the facility. Imported RCA must be derived from recognizable and uncontaminated concrete and must conform to Section 304 of the New York State Department of Transportation Standard Specifications Construction and Materials Volume 1 (2002). RCA is not acceptable for and will not be used as cover or drainage material. RCA or virgin stone must contain less than 10% by weight of fines passing a No. 80 sieve to be excluded from NYSDEC DER-10 sampling requirements.

Soils that meet 'exempt' fill requirements under 6 NYCRR Part 360, but do not meet backfill or cover soil objectives for this site, will not be imported onto the site without prior approval by NYSDEC. Nothing in this RAWP should be construed as an approval for this purpose.

5.4.10 Stormwater Pollution Prevention

An Erosion and Sediment Control Plan (ESCP) that conforms to the requirements of the NYSDEC Division of Water guidelines and NYS regulations will be developed by the contractor or other project engineer and approved by the RE. This plan will be provided to the NYSDEC prior to any remedial or development construction activities.

Silt fencing or hay bales will be installed around the perimeter of the remedial construction area, as required. Barriers and hay bale checks will be installed and inspected once a week and after every storm event; necessary repairs shall be made immediately. Results of inspections will be recorded in a logbook maintained at the site and available for inspection by the NYSDEC. Accumulated sediments will be removed as required to keep the barrier and hay bale check functional. Undercutting or erosion of the silt fence toe anchor shall be repaired immediately with appropriate backfill materials. Manufacturer's recommendations will be followed for replacing silt fence damaged due to weathering. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters.

5.4.11 Contingency Plan

As discussed in Section 4.2.7, if USTs or other previously unidentified contaminant sources are found during on-site remedial excavation or development-related construction, sampling will be performed on product, if encountered, and surrounding subsurface materials (e.g., soil, stone, etc.). Chemical analytical work will be for full scan parameters (Part 375 VOCs, SVOCs, PCBs, pesticides, and metals). Analyses will not be otherwise limited without NYSDEC approval.

UST closures will conform to the criteria defined in 6 NYCRR Part 613.9, NYSDEC CP-51, and other applicable NYSDEC UST closure requirements including and DER-10 Chapter 5.5.

Identification of unknown or unexpected contaminated media identified by screening during invasive site work will be promptly communicated by phone to NYSDEC Project Manager. These findings will be also be detailed in daily reports and the subsequent monthly BCP progress report.

5.4.12 Community Air Monitoring Plan

Community air monitoring will be conducted in compliance with the NYSDOH Generic CAMP outlined below.

The CAMP includes real-time continuous monitoring for VOCs and particulates at the downwind perimeter of each designated work area when certain activities are in progress. Continuous monitoring is required for all ground intrusive activities and during demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, advancement of trenches and test pits, and the installation of soil borings or monitoring wells. Periodic monitoring for VOCs is required during non-intrusive activities such as the collection of groundwater samples from existing monitoring wells. "Periodic" monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well bailing/purging, and taking a reading before leaving a sample location.

CAMP monitoring for VOC levels will be conducted with PIDs, and monitoring for dust/particulates will be conducted with particulate sensors equipped with filters to detect particulates less than 10 microns in diameter (PM10). Monitoring for particulates and odors will be conducted during all ground intrusive activities by the RE's field inspector. The work zone is defined as the general area in which machinery is operating in support of remediation activities. A portable PID will be used to monitor the work zone and for periodic monitoring of VOCs during activities such as soil and groundwater sampling. The site perimeter will be visually monitored for fugitive dust emissions.

The following actions will be taken based on VOC levels measured:

- If total VOC levels exceed 5 ppm above background for the 15-minute average at the perimeter, work activities will be temporarily halted and monitoring continued. If levels readily decrease (per instantaneous readings) below 5 ppm above background, work activities will resume with continued monitoring.
- If total VOC levels at the downwind perimeter of the work zone persist at levels in excess of 5 ppm above background but less than 25 ppm, work activities will be halted, the source of vapors identified, corrective actions taken to abate emissions and monitoring continued. After these steps work activities will resume provided that the total organic vapor level 200 feet downwind of the work 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 above background for the 15-minute average.
- If the total VOC level is above 25 ppm at the perimeter of the work zone, activities will be shut down.

The following actions will be taken based on visual dust observations:

- If the downwind particulate level is 100 $\mu g/m^3$ greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work zone, then dust suppression must be employed. Work may continue with dust suppression techniques provided that downwind PM10 levels do not exceed 150 $\mu g/m^3$ above the background level and provided that no visible dust is migrating from the work zone.
- If, after implementation of dust suppression techniques, downwind PM10 levels are greater than 150 $\mu g/m^3$ above the background 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 PM10 concentration to within 150 µg/m³ of the upwind level and in preventing visible dust migration.

Concentrations detected above action levels observed in the CAMP will be reported to the NYSDEC and NYSDOH Project Managers and included in the daily report. In addition, a map showing the location of the downwind and upwind CAMP stations will be included in the daily report.

5.4.13 Odor, Dust and Nuisance Control Plan

Dust, odor, and nuisance control will be accomplished by the Contractor as described in this section. Invasive development work will be conducted in accordance with dust and odor suppression methodology defined in the RAWP.

5.4.13.1 Odor Control Plan

This odor control plan is capable of controlling emissions of nuisance odors off-site. Specific odor control methods to be used on a routine basis will include application of foam suppressants or tarps over the odorous or VOC source areas. If nuisance odors are identified, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. NYSDEC and NYSDOH will be notified of all odor events and of all other complaints about the project. Implementation of all CAMP odor monitoring, including the halt of work, will be the responsibility of the Volunteer's RE, who is responsible for certifying the FER. Application of odor controls is the responsibility of the contractor.

All necessary means will be employed to prevent on- and off-site nuisances. At a minimum, procedures will include: (a) limiting the area of open excavations; (b) shrouding open excavations with tarps and other covers; and (c) using foams to cover exposed odorous soils. If odors develop and cannot be otherwise controlled, additional means to eliminate odor nuisances will include: (d) direct load-out of soils to trucks for off-site disposal; (e) use of chemical odorants in spray or misting systems; and, (f) use of staff to monitor odors in surrounding neighborhoods.

Although not anticipated, where odor nuisances have developed during remedial work and cannot be corrected, or where the release of nuisance odors cannot otherwise be avoided due to on-Site conditions or close proximity to sensitive receptors, odor control will be achieved by sheltering excavation and handling areas under tented containment structures equipped with appropriate air venting/filtering systems.

5.4.13.2 Dust Control Plan

A dust suppression plan that addresses dust management during invasive on-site work will include, at a minimum, the items listed below:

- Use of a dedicated water distribution system, on-site water trucks, or an alternate source with suitable supply and pressure for use in dust control.
- Clearing and grubbing of larger sites will be done in stages to limit the area of exposed, soils vulnerable to dust production.
- Gravel will be used on roadways to provide a clean and dust-free road surface.
- On-site roads will be limited in total area to minimize the area required for water spraying.

5.4.13.3 Other Nuisances

A plan for rodent control will be developed and utilized by the contractor before and during site clearing and grubbing, and during all remedial work.

A plan for noise control will be developed and utilized by the contractor for all remedial work and will conform, at a minimum, to NYCDEP noise control standards.

6.0 RESIDUAL CONTAMINATION TO REMAIN ON-SITE

A Track 1 cleanup is the selected remedy and residual contaminated soil is not expected to remain beneath the development footprint after the remedy is complete. ECs and ICs will not be required to protect human health and the environment. Potential exposure pathways for groundwater and soil vapor contaminants will be eliminated through remedial excavation, SOE cutoff for regional groundwater, site-wide dewatering and treatment of dewatered liquids prior to discharge, municipal groundwater use restrictions, and construction of the building foundation. If a Track 1 is not met, the site will achieve a Track 2 cleanup and residual contamination will be managed in place using ECs (i.e. building foundation/slab cap, waterproofing/vapor barrier), ICs (i.e. use restrictions under an Environmental Easement) and development of an SMP, if required by NYSDEC, to control future work that may encounter residual contamination.

7.0 ENGINEERING AND INSTITUTIONAL CONTROLS

Following completion of the remedy, it is anticipated that the site will meet Track 1 UU SCOs; therefore, ECs or ICs will not be required as part of the remedial action. In the event that a Track 1 remedy is not achieved, the site will achieve a Track 2 remedy and may include development of an SMP to monitor the site cap (i.e. building concrete foundation/slab) and define restricted uses of the site.

7.1 Engineering Controls

7.1.1 Composite Cover System (Track 2 only)

Exposure to residual contaminated soils would be prevented by an engineered, composite cover system. The composite cover system would consist of newly-constructed concrete building slabs and foundation with a waterproofing/vapor barrier membrane.

The SMP would outline the procedures to be followed in the event that the composite cover system and underlying residual soil are disturbed after the remedial action is complete. Maintenance of this composite cover system would be described in the SMP.

7.2 Institutional Controls

The Track 1 remedy, if achieved, will not require ICs. If a Track 1 remedy is not achieved, the remedy will achieve a Track 2 cleanup and the site may require ICs including an SMP and environmental easement.

Under a potential Track 2 cleanup, an SMP would be prepared and a site-specific environmental easement would be recorded with New York County to provide an enforceable means of ensuring the continual and proper management of residual contamination and protection of public health and the environment in perpetuity or until released in writing by the NYSDEC. The easement would require that the grantor and the grantor's successors and assigns adhere to all ECs/ICs placed on this site. ICs provide restrictions on site usage and mandate operation, maintenance, monitoring and reporting measures for all ECs and ICs. The SMP would describe appropriate methods and procedures to ensure compliance with all ECs and ICs that are required by the environmental easement. Once the SMP was approved by the NYSDEC, compliance with the SMP would be required by the grantor of the environmental easement and grantor's successors and assigns.

7.2.1 Environmental Easement

An environmental easement, as defined in Article 71 Title 36 of the Environmental Conservation Law, is required when residual contamination is left on-site after the remedy is complete. If a Track 1 cleanup is not achieved as part of this remedy, an environmental easement approved by the NYSDEC would need to be filed and recorded with the New York County Office of the City

Register before the Certificate of Completion can be issued by the NYSDEC. The environmental easement would be submitted as part of the FER.

The environmental easement renders the site a Controlled Property. If required, the easement will list the ECs and ICs required under this remedy to prevent future exposure to residual contamination by controlling disturbances of the subsurface soil and restricting the use of the site to Restricted Residential, Commercial, and Industrial uses only. The ICs are generally subdivided between controls that support ECs and those that place general restrictions on site usage or other requirements. ICs in both of these groups are closely integrated with the SMP, which provides the methods and procedures to be followed to comply with this remedy.

The ICs that support ECs are:

- Compliance with the environmental easement by the grantor and the grantor's successors and adherence of all elements of the SMP is required;
- ECs must be operated and maintained as specified in the SMP;
- ECs on the Controlled Property must be inspected and certified at a frequency and in a manner defined in the SMP;
- Data and information pertinent to site management must be reported at the frequency and in a manner defined in the SMP; and
- ECs may not be discontinued without an amendment or extinguishment of the environmental easement. The EE may be extinguished only by release by the Commissioner of NYSDEC, or the Commissioner's designee, and filed with the office of the recording officer for the county or counties where the Controlled Property is situated in the manner prescribed by Article 9 of the Real Property Law.

Adherence to these ICs for the site is mandated by the environmental easement and would be implemented under the SMP (discussed in the next section). The Controlled Property (site) will also have a series of ICs in the form of site restrictions and requirements. The site restrictions that may apply to the site are:

- Vegetable gardens and farming in residual site soil on the Controlled Property are prohibited;
- Use of groundwater underlying the Controlled Property is prohibited without treatment rendering it safe for intended purpose;
- All future activities on the Controlled Property that will disturb residual contaminated material are prohibited unless they are conducted in accordance with the soil management provisions in the SMP;

- The Controlled Property may be used for restricted-residential, commercial, and industrial uses use only, provided the long-term ECs and ICs included in the SMP are employed; and
- The Controlled Property may not be used for a higher level of use without an amendment or extinguishment of this environmental easement.

Grantor agrees to submit to the NYSDEC a written statement that certifies, under penalty of perjury, that: (1) controls employed at the site are unchanged from the previous certification or that any changes to the controls were approved by the NYSDEC; and, (2) nothing has occurred that impairs the ability of the controls to protect public health and environment or that constitute a violation or failure to comply with the SMP. The NYSDEC retains the right to access the site at any time in order to evaluate the continued maintenance of any and all controls. This certification shall be submitted annually, or at a specified frequency allowed by the NYSDEC. This statement must be certified by an expert that the NYSDEC finds acceptable.

7.3 Site Management Plan

If a Track 1 remedy is not achieved, an SMP may be required for Track 2. Site Management is the last phase of remediation and begins with the approval of the FER and issuance of the Certificate of Completion for the remedy. The SMP is submitted as part of the FER, but will be written in a manner that allows its removal and use as a complete and independent document. Site management continues in perpetuity or until released in writing by the NYSDEC. The property owner is responsible to ensure that all site management responsibilities defined in the environmental easement and the SMP are performed.

The SMP is intended to provide a detailed description of the procedures required to manage residual contamination left in place at the site following completion of the remedy in accordance with the NYSDEC BCA. This includes: (1) development, implementation, and management of all ECs and ICs; (2) development and implementation of monitoring systems and a Monitoring Plan; (3) development of a plan to operate and maintain any treatment, collection, containment, or recovery systems (including, where appropriate, preparation of an Operation and Maintenance Manual); (4) submittal of Site Management Reports, performance of inspections and certification of results, and demonstration of proper communication of site information to the NYSDEC; and (5) defining criteria for termination of ECs.

To address these needs, the SMP will include four plans: (1) an Engineering and Institutional Control Plan for implementation and management of EC/ICs; (2) a Monitoring Plan for implementation of Site Monitoring; (3) an Operation and Maintenance Plan for implementation of operations and maintenance of the ECs; and (4) a Site Management Reporting Plan for submittal of data, information, recommendations, and certifications to NYSDEC. The SMP will be prepared in accordance with the requirements in NYSDEC DER-10 and the guidelines provided by the NYSDEC.

Site management activities, reporting, and EC/IC certification will be scheduled on a certification period basis. The certification period will be annual and will be due for submission to NYSDEC within 45 days of the end of the reporting period.

No exclusions for handling of residual contaminated soils will be provided in the SMP. All handling of residual contaminated material will be subject to provisions contained in the SMP.

8.0 FINAL ENGINEERING REPORT

A FER, prepared in accordance with DER-10, will be submitted to NYSDEC following implementation of the remedy defined in this RAWP. The FER provides documentation that the remedial work required under this RAWP has been completed and has been performed in compliance with this plan. The FER will include the following documentation:

1. Written and photographic documentation (via daily field reports) of the completed remedy
2. Description of any deviations from the RAWP and associated design documents
3. Account of waste material exported from the site, including waste types and volumes, waste characterization documentation, facility-signed manifests and scale tickets, facility approvals and other waste disposal documentation
4. Account of materials imported to the site
5. Tabular summary of post-excavation confirmation sampling results and other sampling and laboratory analysis completed as part of the remedial action
6. As-built drawings for remedial construction elements and ECs, manufacturer documentation (for treatment systems), certifications, manifests, bill of ladings, and commissioning test results (as necessary)
7. An itemized estimate of actual costs incurred during the remedy
8. An account of the locations and characteristics of all material removed from the site including the surveyed map(s) of all sources, as necessary.

If necessary, the FER will provide a thorough summary of all residual contamination left on the site that exceeds Track 1 UU SCOs and explanation for why the material was not removed as part of the remedy. In this case, the site would achieve a Track 2 cleanup. A table and a map that shows remaining contamination in excess of the Track 1 SCOs will be included in the FER, if necessary.

The FER will include an account of the destination of all material removed from the site, including excavated non-contaminated soil, contaminated soil, historic fill, solid waste, hazardous waste, C&D debris. Documentation associated with disposal of all material must also include records and approvals for receipt of the material. The FER will provide an account of the origin and chemical quality of all material imported onto the site.

Before approval of a FER and issuance of a Certificate of Completion, the daily reports and monthly BCP progress reports must be submitted in digital form on electronic media (i.e., PDF).

8.1 Certifications

The following certification will appear in front of the Executive Summary of the FER. The certification will be signed by the RE, Jason J. Hayes, who is a Professional Engineer registered in New York State. The certification will be appropriately signed and stamped. The certification will include the following statements:

> *I, ________________________, am currently a registered professional engineer licensed by the State of New York. I had primary direct responsibility for implementation of the remedial program for the 538-542 West 29th Street site (NYSDEC BCA Index No. [Site No. Pending]).*
>
> *I certify that the site description presented in this FER is identical to the site descriptions presented in the Brownfield Cleanup Agreement for 538-542 West 29th Street site.*
>
> *I certify that the Remedial Action Work Plan dated [month day year] and Stipulations [if any] in a letter dated [month day year] and approved by the NYSDEC were implemented and that all requirements in those documents have been substantively complied with.*
>
> *I certify that the remedial activities were observed by qualified environmental professionals under my supervision and that the remediation requirements set forth in the Remedial Action Work Plan and any other relevant provisions of ECL 27-1419 have been achieved.*
>
> *I certify that the export of all contaminated soil, fill, water or other material from the property was performed in accordance with the Remedial Action Work Plan, and were taken to facilities licensed to accept this material in full compliance with all Federal, State and local laws.*
>
> *I certify that all import of soils from off-site, including source approval and sampling, has been performed in a manner that is consistent with the methodology defined in the Remedial Action Work Plan.*
>
> *I certify that all invasive work during the remediation and all invasive development work were conducted in accordance with dust and odor suppression methodology and soil screening methodology defined in the Remedial Action Work Plan.*
>
> *I certify that all information and statements in this certification are true. I understand that a false statement made herein is punishable as Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law.*
>
> *It is a violation of Article 130 of New York State Education Law for any person to alter this document in any way without the express written verification of adoption by any New York State licensed engineer in accordance with Section 7209(2), Article 130, New York State Education Law.*

9.0 SCHEDULE

Mobilization for implementation of the RAWP is expected to take about three weeks. Once mobilization is completed, remediation activities can begin, and are anticipated to take about six to eight months. Within 90 days of completion of remedial activities at the site, an FER will be submitted to the NYSDEC for review and approval. A detailed project schedule is included in Appendix H.

TABLES

Table 1
Remedial Action Work Plan
Alternative I - Track 1 Remedial Cost Estimate

538-542 West 29th Street
New York New York
Langan Project No. 170515401

Item No.	Description of Environmental Item	Quantity		Premium Unit Price		Estimated Premium
A - REMEDIAL ACTION CONTRACTOR FEES						
A-1	Remediation Facilities, Equipment, Mobilization, Demobilization, Permits, and Site Maintenance - Remediation and decontamination facilities include trailer, truck cleaning facilities, etc.	--		Allowance		$ 250,000
A-2	Demolition of Existing Buildings and Abatement - Demolition of the existing buildings will be required to access underlying soil/fill for the site-wide excavation.	--		Allowance		$ 450,000
A-3	Excavation of Source Material - Accounts for excavation to the proposed development depth and additional excavation needed to remove all material above Unrestricted Use Soil Cleanup Objectives (SCOs), to about 15 feet below grade surface (bgs).	4,800	CY	$25	per CY	$ 120,000
A-4	Transport and Disposal of Historic Fill and Native Soil that Exceeds Unrestricted Use Soil Cleanup Objectives - Includes transport vehicles and disposal of material at a permitted facility.	5,400	Tons	$45	per Ton	$ 243,000
A-5	Transport and Disposal of Petroleum Impacted Historic Fill Material - Assumes 20% of the excavated soil will be handled as petroleum impacted.	1,440	Tons	$75	per Ton	$ 108,000
A-6	Transport and Disposal of Hazardous Soil - Assumes up to 5% of the excavated soil may contained hazardous concentrations. Includes transport vehicles and disposal of material at a hazardous materials at a permitted facility.	360	Tons	$200	per Ton	$ 72,000
A-7	Unknown Underground Storage Tank (UST) Contingency - Registration, cleaning, removal and disposal of potential USTs. Assumes up to two previously unknown tanks may be encountered during remedial excavation.	2	Tanks	$10,000	per Tank	$ 20,000
A-8	Dewatering - Assumes a dewatering treatment system will be designed and installed for temporary site dewatering during foundation construction, and accounts for permitting, operation of pumps via excavated sumps or installed wells, regular cleaning, and periodic verification sampling.	6	Months	$75,000	per Month	$ 450,000
A-9	Dust, Odor and Vapor Control - Includes odor, dust, and organic vapor control during remediation of the site. Assumes control measures will include, but not be limited to, application of odor suppressant, foam, or water.	6	Months	$10,000	per Month	$ 60,000
A-10	Support of Excavation (SOE) - Includes installation of sheet piles along the perimeter of the site to support excavation.	12,000	SF	$200	per SF	$ 2,400,000
	REMEDIAL ACTION CONTRACTOR FEES SUBTOTAL (ROUNDED)					**$ 4,173,000**
B - ENGINEERING FEES						
B-1	Waste Characterization and Supplemental Site Investigation (Driller, Sampling and Reporting) - Required to characterize material for off-site disposal.	--		Allowance		$75,000
B-2	Geotechnical Engineering (SOE Design)	--		Allowance		$ 50,000.0
B-3	Construction Documents/Bid Support	--		Allowance		$ 20,000.0
B-4	Remediation Monitoring - Includes full-time environmental oversight to document ground-intrusive work.	6	Months	$40,000	per Month	$ 240,000.0
B-5	Community Air Monitoring - Includes equipment rental fees associated with implementation of Community Air Monitoring Program (CAMP), which will be performed during excavation.	6	Months	$3,000	per Month	$ 18,000.0
B-6	Confirmation Soil Sampling - To confirm residual soil meets Part 375 Unrestricted Use Soil Cleanup Objectives (assumes removal (assumes analysis for Part 375/TCL/TAL VOCs, SVOCs, PCBs, pesticides, and metals for each sample).	14	Samples	$1,000	per Sample	$ 14,000.0
B-7	Construction Administration	6	Months	$10,000	per Month	$ 60,000.0
B-8	Regulatory Agency Required Reporting - Includes monthly progress reports, Final Engineering Report (FER), Data Validation & EQuIS submittals, citizen participation support, fact sheets	--		Allowance		$ 120,000.0
	ENGINEERING FEES SUBTOTAL					**$ 597,000**
	Remediation Contingency (10% of Contractor Fee Subtotal)					**$ 418,000**
	Total Estimated Fee					**$ 5,190,000**
	ESTIMATED REMEDIATION FEE - ALTERNATIVE I					**$ 5,200,000**

General Assumptions and Conditions:
1. This estimate has been prepared for the purposes of comparing potential remedial alternatives. The information in this cost estimate is based on the available information regarding the site investigation and the anticipated scope of the remedial alternative. Changes in cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. This cost estimate is expected to be within -30% to +50% of the actual fee. Utilization of this cost estimate information beyond the stated purpose is not recommended. Langan is not licensed to provide financial or legal consulting services; as such, this cost estimate information is not intended to be utilized for complying with financial reporting requirements associated with liability services.
2. The density used for conversion from cubic yards to tons was 1.5 tons per cubic yard.
3. Excavation volumes were calculated using remedial investigation soil sample results, field observations, and proposed development excavation.
4. A 6-month period is assumed for remediation and soil handling.
5. VOC = volatile organic compound; SVOC = semivolatile organic compound; PCBs = polychlorinated biphenyls

Contractor Fee Assumptions:
A-1 - This is an allowance for mobilization and demobilization of equipment and materials necessary to complete the remedy. The allowance includes items to support earthwork (i.e., temporary site fencing, installation of gates, mobilization, monitoring, engineered truck wash).
A-2 - This allowance is for building demolition costs associated with asbestos and hazardous material building abatement and building demolition fees.
A-3 - The unit rate provided reflects OSHA-certified construction labor.
A-4, A-5 and A-6 - The unit rate provided reflects average disposal facility fees and may vary depending on time of year and facility. Petroleum impacted soil was identified during the site investigation. Characteristic hazardous materials have not been identified but are included as a contingency.
A-7 - The fee accounts for decommissioning and removal of any encountered underground storage tanks (USTs) during excavation.
A-8 - Dewatering will be required throughout the remedial excavation to facilitate soil/fill removal and construction of the new building foundation.
A-9 - Cost estimate includes application of vapor/odor suppressing foam to open excavation and soil loaded into trucks.
A-10 - Assumes sheet piles are needed along the project perimeter to support the remedial excavation and provide cutoff for dewatering operations.
Engineering Fee Assumptions:
B-1 - Includes estimated fee to complete waste characterization and supplemental site investigation to support the remediation.
B-2 - Includes estimated fee to design a SOE system to rock to support remedial excavation and provide groundwater cutoff.
B-3 - This an allowance to support the bid leveling process and preparing environmental construction specifications.
B-4 - The assumed duration of the remedial monitoring is 6 months. This cost includes the on-site remedial documentation and daily reporting.
B-5 - The assumed duration of the community air monitoring program (CAMP) is 6 months, coinciding with the duration of the anticipated foundation construction schedule and additional time needed to remove all contaminated historic fill. Fees include full-time equipment rental to facilitate work zone and perimeter dust and VOC monitoring.
B-6 - Although excavation is anticipated to extend to bedrock, we have included an allowance if soil remains at development depth. The cost assumes the collection of the required 11 post-excavation confirmation soil samples plus quality assurance/quality control samples and 2 samples if over-excavation is required. Sample analysis will be for Part 375 VOCs, SVOCs, PCBs, pesticides, cyanide, and metals (including hexavalent and trivalent chromium). The fee includes subcontracted laboratory analysis by a NYSDOH ELAP-certified laboratory and ASP Category B deliverables.
B-7 - Includes submittal reviews/ responses, responses to Requests for Information (RFIs) and attendance at construction meetings during the remediation.
B-8 - This cost includes monthly progress reports, agency/team coordination and the Final Engineering Report, and covers the duration of the remediation.

Table 2
Remedial Action Work Plan
Alternative II - Track 2 Remedial Cost Estimate

538-542 West 29th Street
New York New York
Langan Project No. 170515401

Item No.	Description of Environmental Item	Quantity		Premium Unit Price		Estimated Premium
A - REMEDIAL ACTION CONTRACTOR FEES						
A-1	Remediation Facilities, Equipment, Mobilization, Demobilization, Permits, and Site Maintenance - Remediation and decontamination facilities include trailer, truck cleaning facilities, etc.	--		Allowance		$ 250,000
A-2	Demolition of Existing Buildings and Abatement - Demolition of the existing buildings will be required to access underlying soil/fill for the site-wide excavation.	--		Allowance		$ 450,000
A-3	Excavation of Source Material - Accounts for excavation to the proposed development depth and additional excavation needed to remove all material above Restricted Use Restricted-Residential (RURR) Soil Cleanup Objectives (SCOs), to about 15 feet below grade surface (bgs).	4,800	CY	$25	per CY	$ 120,000
A-4	Transport and Disposal of Historic Fill and Native Soil that Exceeds RURR SCOs - Includes transport vehicles and disposal of material at a permitted facility.	5,400	Tons	$45	per Ton	$ 243,000
A-5	Transport and Disposal of Petroleum Impacted Historic Fill Material - Assumes 20% of the excavated soil will be handled as petroleum impacted.	1,440	Tons	$75	per Ton	$ 108,000
A-6	Transport and Disposal of Hazardous Soil - Assumes up to 5% of the excavated soil may contained hazardous concentrations. Includes transport vehicles and disposal of material at a hazardous materials at a permitted facility.	360	Tons	$275	per Ton	$ 99,000
A-7	Unknown Underground Storage Tank (UST) Contingency - Registration, cleaning, removal and disposal of potential USTs. Assumes up to two previously unknown tanks may be encountered during remedial excavation.	2	Tanks	$12,000	per Tank	$ 24,000
A-8	Dewatering - Assumes a dewatering treatment system will be designed and installed for temporary site dewatering during foundation construction, and accounts for permitting, operation of pumps via excavated sumps or installed wells, regular cleaning, and periodic verification sampling.	6	Months	$75,000	per Month	$ 450,000
A-9	Dust, Odor and Vapor Control - Includes odor, dust, and organic vapor control during remediation of the site. Assumes control measures will include, but not be limited to, application of odor suppressant, foam, or water.	6	Months	$10,000	per Month	$ 60,000
A-10	Support of Excavation (SOE) - Includes installation of sheet piles with localized lagging along the perimeter of the excavation for the site.	12,000	SF	$200	per SF	$ 2,400,000
A-11	Waterproofing/Vapor Barrier Membrane - Assumes a continuous waterproofing membrane will be installed below the foundation slab and along vertical foundation walls up to the proposed finished development grade.	21,856	SF	$11	per SF	$ 240,416
	REMEDIAL ACTION CONTRACTOR FEES SUBTOTAL (ROUNDED)					**$ 4,445,000**
B - ENGINEERING FEES						
B-1	Waste Characterization and Supplemental Site Investigation (Driller, Sampling and Reporting) - Required to characterize material for off-site disposal.	--		Allowance		$ 75,000.0
B-2	Geotechnical Engineering (SOE Design)	--		Allowance		$ 50,000.0
B-3	Construction Documents/Bid Support	--		Allowance		$ 20,000.0
B-4	Remediation Monitoring - Includes full-time environmental oversight to document ground-intrusive work.	6	Months	$40,000	per Month	$ 240,000.0
B-5	Community Air Monitoring - Includes equipment rental fees associated with implementation of Community Air Monitoring Program (CAMP), which will be performed during excavation.	6	Months	$3,000	per Month	$ 18,000.0
B-6	Confirmation Soil Sampling - To confirm residual soil meets Part 375 Unrestricted Use Soil Cleanup Objectives (assumes removal (assumes analysis for Part 375/TCL/TAL VOCs, SVOCs, PCBs, pesticides, and metals for each sample).	14	Samples	$1,000	per Sample	$ 14,000.0
B-7	Construction Administration	6	Months	$10,000	per Month	$ 60,000.0
B-8	Regulatory Agency Required Reporting - Includes monthly progress reports, Final Engineering Report (FER), Site Management Plan (SMP), Data Validation & EQuIS submittals, citizen participation support, fact sheets, on-going compliance monitoring per	--		Allowance		$ 220,000
	ENGINEERING FEES SUBTOTAL					**$ 697,000**
	Remediation Contingency (10% of Contractor Fee Subtotal)					**$ 445,000**
	Total Estimated Fee					**$ 5,590,000**
	ESTIMATED REMEDIATION FEE - ALTERNATIVE II					**$ 5,600,000**

General Assumptions and Conditions:

1. This estimate has been prepared for the purposes of comparing potential remedial alternatives. The information in this cost estimate is based on the available information regarding the site investigation and the anticipated scope of the remedial alternative. Changes in cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. This cost estimate is expected to be within -30% to +50% of the actual fee. Utilization of this cost estimate information beyond the stated purpose is not recommended. Langan is not licensed to provide financial or legal consulting services; as such, this cost estimate information is not intended to be utilized for complying with financial reporting requirements associated with liability services.
2. The density used for conversion from cubic yards to tons was 1.5 tons per cubic yard.
3. Excavation volumes were calculated using remedial investigation soil sample results, field observations, and proposed development excavation.
4. A 6-month period is assumed for remediation and soil handling.
5. VOC = volatile organic compound; SVOC = semivolatile organic compound; PCBs = polychlorinated biphenyls; TCL = Total Compound List; TAL = Total Analyte List

Contractor Fee Assumptions:
A-1 - This is an allowance for mobilization and demobilization of equipment and materials necessary to complete the remedy. The allowance includes items to support earthwork (i.e., temporary site fencing, installation of gates, mobilization, monitoring, engineered truck wash).
A-2 - This allowance is for building demolition costs associated with asbestos and hazardous material building abatement and building demolition fees.
A-3 - The unit rate provided reflects OSHA-certified construction labor.
A-4, A-5 and A-6 - The unit rate provided reflects average disposal facility fees and may vary depending on time of year and facility. Petroleum impacted soil was identified during the site investigation. Characteristic
A-7 - The fee accounts for decommissioning and removal of any encountered underground storage tanks (USTs) during excavation.
A-8 - Dewatering will be required throughout the remedial excavation to facilitate soil/fill removal and construction of the new building foundation.
A-9 - Cost estimate includes application of vapor/odor suppressing foam to open excavation and soil loaded into trucks.
A-10 - Assumes sheet piles are needed along the project perimeter to support the remedial excavation and provide cutoff for dewatering operations.
A-11 - Assumes a waterproofing/vapor barrier will be installed along the foundation base and sidewalls to prevent vapor migration into the building.

Engineering Fee Assumptions:
B-1 - Includes estimated fee to complete waste characterization and supplemental site investigation to support the remediation.
B-2 - Includes estimated fee to design a SOE system to rock to support remedial excavation and provide groundwater cutoff.
B-3 - This an allowance to support the bid leveling process and preparing environmental construction specifications.
B-4 - The assumed duration of the remedial monitoring is 6 months. This cost includes the on-site remedial documentation and daily reporting.
B-5 - The assumed duration of the community air monitoring program (CAMP) is 6 months, coinciding with the duration of the anticipated foundation construction schedule and additional time needed to remove all contaminated historic fill. Fees include full-time equipment rental to facilitate work zone and perimeter dust and VOC monitoring.
B-6 - Although excavation is anticipated to extend to bedrock, we have included an allowance if soil remains at development depth. The cost assumes the collection of the required 11 post-excavation confirmation soil
B-7 - Includes submittal reviews/ responses, responses to Requests for Information (RFIs) and attendance at construction meetings during the remediation.
B-8 - This cost includes monthly progress reports, agency/team coordination, preparation of the FER and SMP, installation of post remedy groundwater monitoring wells and ongoing monitoring required under the SMP throughout the duration of the remediation and the first two years of monitoring.

Table 3
Remedial Action Work Plan
Track 1 - Unrestricted Use SCOs

538-542 West 29th Street
New York, New York
Langan Project No. 170515401
BCP No.: Pending

VOCs (mg/kg)	
1,1,1-Trichloroethane	0.68
1,1-Dichloroethane	0.27
1,1-Dichloroethylene	0.33
1,2,4-Trimethylbenzene	3.6
1,2-Dichlorobenzene	1.1
1,2-Dichloroethane	0.02
1,3,5-Trimethylbenzene	8.4
1,3-Dichlorobenzene	2.4
1,4-Dichlorobenzene	1.8
1,4-Dioxane	0.1
2-Butanone	0.12
Acetone	0.05
Benzene	0.06
Carbon tetrachloride	0.76
Chlorobenzene	1.1
Chloroform	0.37
cis-1,2-Dichloroethylene	0.25
Ethyl Benzene	1
Methyl tert-butyl ether (MTBE)	0.93
Methylene chloride	0.05
n-Butylbenzene	12
n-Propylbenzene	3.9
sec-Butylbenzene	11
tert-Butylbenzene	5.9
Tetrachloroethylene	1.3
Toluene	0.7
trans-1,2-Dichloroethylene	0.19
Trichloroethylene	0.47
Vinyl Chloride	0.02
Xylenes, Total	0.26

Metals (mg/kg)	
Arsenic	13
Barium	350
Beryllium	7.2
Cadmium	2.5
Chromium, hexavalent	1
Chromium, trivalent	30
Copper	50
Cyanide	27
Lead	63
Manganese	1,600
Mercury	0.18
Nickel	30
Selenium	3.9
Silver	2
Zinc	109

SVOCs (mg/kg)	
Acenaphthene	20
Acenaphthylene	100
Anthracene	100
Benzo(a)anthracene	1
Benzo(a)pyrene	1
Benzo(b)fluoranthene	1
Benzo(g,h,i)perylene	100
Benzo(k)fluoranthene	0.8
Chrysene	1
Dibenzo(a,h)anthracene	0.33
Fluoranthene	100
Fluorene	30
Indeno(1,2,3-cd)pyrene	0.5
m-Cresol	0.33
Naphthalene	12
o-Cresol	0.33
p-Cresol	0.33
Pentachlorophenol	0.8
Phenanthrene	100
Phenol	0.33
Pyrene	100

PCBs/Pesticides (mg/kg)	
2,4,5-TP Acid (Silvex)	3.8
4,4'-DDE	0.0033
4,4'-DDT	0.0033
4,4'-DDD	0.0033
Aldrin	0.005
alpha-BHC	0.02
beta-BHC	0.036
Chlordane (alpha)	0.094
delta-BHC	0.04
Dibenzofuran	7
Dieldrin	0.005
Endosulfan I	2.4
Endosulfan II	2.4
Endosulfan sulfate	2.4
Endrin	0.014
Heptachlor	0.042
Lindane	0.1
Polychlorinated biphenyls	0.1

Notes:
1. The above criteria are the Title 6 of the New York Codes, Rules and Regulations (6 NYCRR) Part 375 Unrestricted Use Soil Cleanup Objectives (i.e., the Track 1 soil cleanup objectives).
2. VOC: volatile organic compound
3. SVOC: semivolatile organic compound
4. PCBs: polychlorinated biphenyls
5. mg/kg: milligram per kilogram

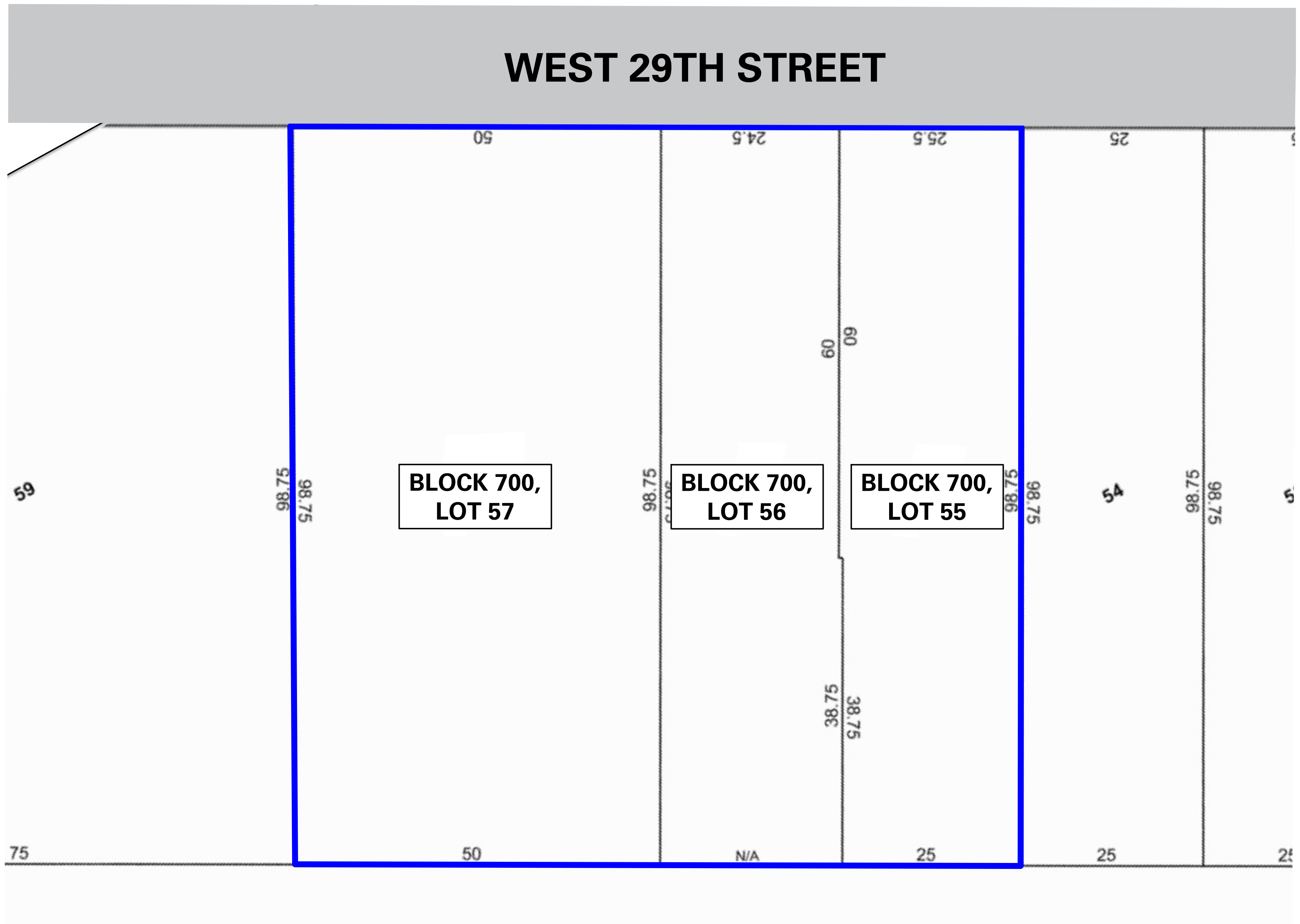
FIGURES

NOTES:
1. SITE BOUNDARY IS APPROXIMATE.
2. BASE MAP TAKEN FROM UNITED STATES GEOLOGICAL SURVEY 7.5 MINUTE TOPOGRAPHIC MAPS FOR THE BROOKLYN, CENTRAL PARK, JERSEY CITY AND WEEHAWKEN QUADRANGLES, DATED 2016.

1000 0 500 1000
SCALE IN FEET

LANGAN Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C. 21 Penn Plaza, 360 West 31st Street, 8th Floor New York, NY 10001 T: 212.479.5400 F: 212.479.5444 www.langan.com	Project 538-542 WEST 29TH STREET BLOCK No. 700, LOT Nos. 55, 56 & 57 NEW YORK NEW YORK	Figure Title SITE LOCATION MAP	Project No. 170515401 Date 10/19/2018 Drawn By KN Checked By ELS	Figure No. 1 Sheet 1 of 9

Filename: \\langan.com\data\NY\data4\170515401\Project Data\CAD\01\2D-DesignFiles\BCP RIR\Figure 1 - Site Location Map.dwg Date: 5/28/2019 Time: 13:58 User: jdonelan Style Table: Langan.stb Layout: ANSIA-BP



LEGEND:

APPROXIMATE BCP SITE BOUNDARY

NOTES:

1. BASE MAP TAKEN FROM HTTP://GIS.NYC.GOV/TAXMAP/MAP.HTM
2. BCP = BROWNFIELD CLEANUP PROGRAM

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SCALE IN FEET

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Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C. 21 Penn Plaza, 360 West 31st Street, 8th Floor New York, NY 10001 T: 212.479.5400 F: 212.479.5444 www.langan.com	538-542 WEST 29TH STREET BLOCK No. 700, LOT Nos. 55, 56, 57 NEW YORK NEW YORK	SITE PLAN	Date 10/25/2018 Drawn By KN Checked By ES	2 Sheet 2 of 9

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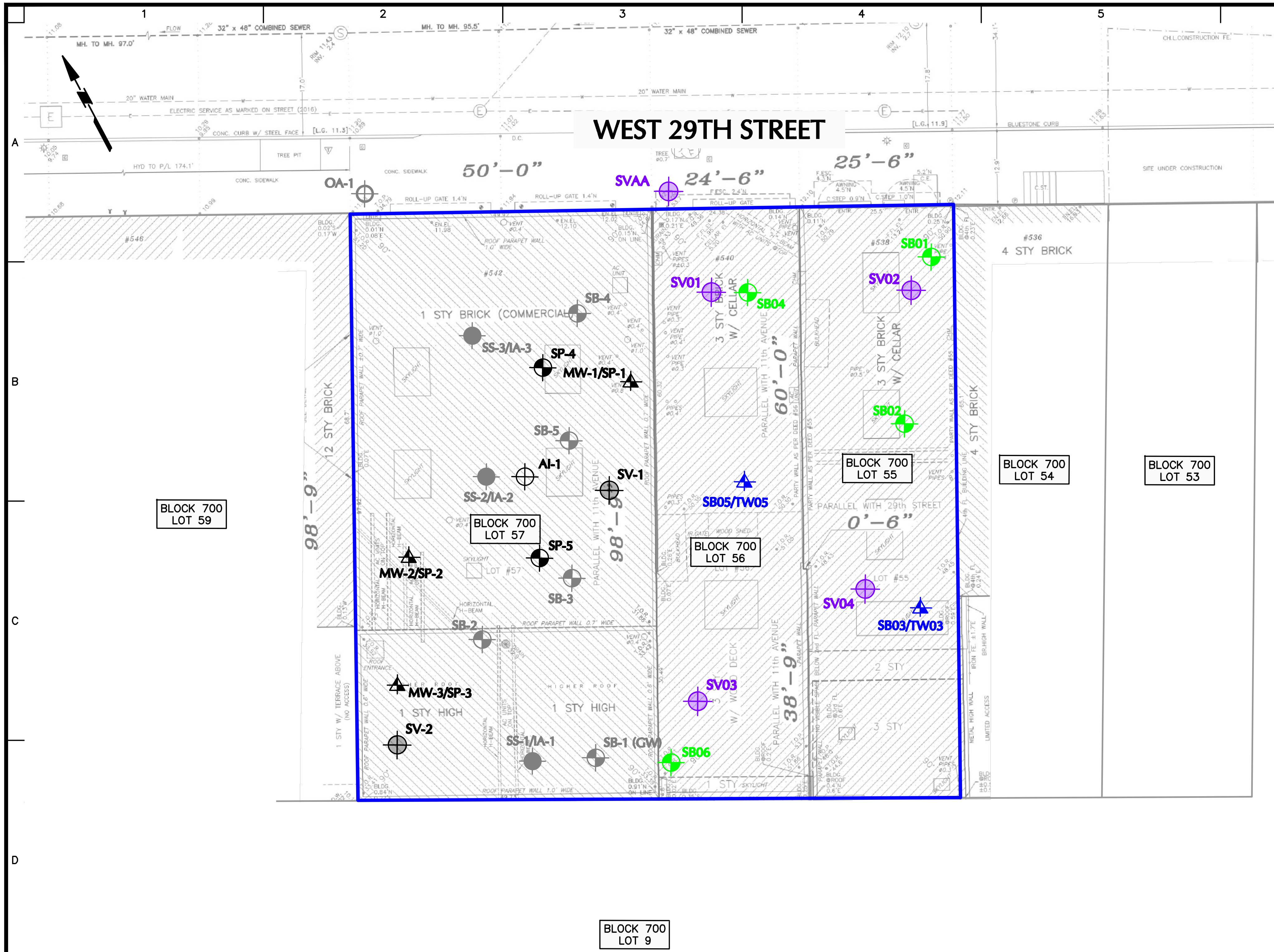
Filename: \\langan.com\data\NY\data4\170515401\Project Data\CAD\01\2D-DesignFiles\RAWP\Figure 2 - Site Plan.dwg Date: 5/28/2019 Time: 15:04 User: jdonelan Style Table: Langan.stb Layout: ANSIB-BL



20 0 5 10 20

SCALE IN FEET

LEGEND:

APPROXIMATE BCP SITE BOUNDARY

SB-4 — PREVIOUS SOIL BORING LOCATION (MAY 2014, PERFORMED BY PWGC STRATEGIC ENVIRONMENTAL AND ENGINEERING SOLUTIONS)

SS-1/IA-1 — PREVIOUS SUB-SLAB SOIL VAPOR AND INDOOR AMBIENT AIR LOCATION (MAY 2014, PERFORMED BY PWGC STRATEGIC ENVIRONMENTAL AND ENGINEERING SOLUTIONS)

OA-1 — PREVIOUS OUTDOOR AMBIENT AIR SAMPLE LOCATION (MAY 2014, PERFORMED BY PWGC STRATEGIC ENVIRONMENTAL AND ENGINEERING SOLUTIONS)

SP-4 — PREVIOUS SOIL PROBE LOCATION (APRIL 2016, PERFORMED BY HYDRO TECH ENVIRONMENTAL, DPC)

MW-1/SP-1 — PREVIOUS SOIL PROBE LOCATION WITH OVERBURDEN MONITORING WELL (APRIL 2016, PERFORMED BY HYDRO TECH ENVIRONMENTAL, DPC)

SV-1 — PREVIOUS SOIL VAPOR LOCATION (APRIL 2016, PERFORMED BY HYDRO TECH ENVIRONMENTAL, DPC)

AI-1 — PREVIOUS INDOOR AIR SAMPLE LOCATION (APRIL 2016, PERFORMED BY HYDRO TECH ENVIRONMENTAL, DPC)

SB04 — PREVIOUS SOIL BORING LOCATION (JUNE 2018, PERFORMED BY LANGAN)

SB01/TW01 — PREVIOUS SOIL BORING LOCATION WITH OVERBURDEN TEMPORARY MONITORING WELL (JUNE 2018, PERFORMED BY LANGAN)

SV01 — PREVIOUS SOIL VAPOR AND OUTDOOR AMBIENT AIR LOCATION (JUNE 2018, PERFORMED BY LANGAN)

NOTES:

1. BASE MAP IS REFERENCED FROM "ARCHITECTURAL SURVEY", PREPARED BY GEOLAND LAND SURVEYING P.C., DATED APRIL 3, 2018.
2. SUBSURFACE INVESTIGATION BORING/SAMPLE LOCATIONS ARE APPROXIMATE. PREVIOUS SAMPLE LOCATIONS WERE ESTIMATED BY REFERENCING THE MAY 2014 PHASE II ENVIRONMENTAL SITE ASSESSMENT, PREPARED BY PWGC STRATEGIC ENVIRONMENTAL AND ENGINEERING SOLUTIONS, AND THE APRIL 2016 REMEDIAL INVESTIGATION REPORT, PREPARED BY HYDROTECH ENVIRONMENTAL, DPC.
3. BCP = BROWNFIELD CLEANUP PROGRAM

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Project	Figure Title	Project No. 170515401	Figure No.
538-542 WEST 29TH STREET	SAMPLE LOCATION MAP	Date 10/29/2018	3
BLOCK No. 700, LOT Nos. 55, 56, 57		Drawn By KN	
NEW YORK NEW YORK		Checked By ELS	Sheet 3 of 9

Filename: \\langan.com\data\NY\data4\170515401\Project Data\CAD\01\2D-DesignFiles\RAWP\Figure 5 - Sample Location Map.dwg Date: 5/28/2019 Time: 16:39 User: jdonelan Style Table: Langan.stb Layout: Figure 5

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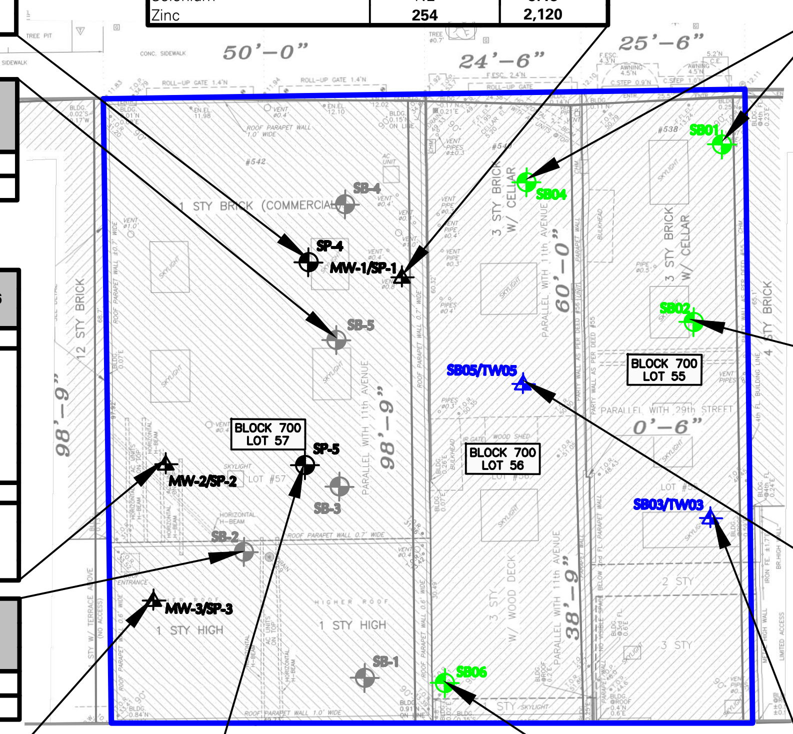

Sample ID	SP-1 (0-2)	SP-1 (4-6)
Sample Date	4/30/2016	4/30/2016
Sample Depth (feet bgs)	0-2	4-6
SVOCs (mg/kg)		
Benzo(a)anthracene	13.7 D	NE
Benzo(a)pyrene	5.32 D	NE
Benzo(b)fluoranthene	7.29 D	NE
Benzo(k)fluoranthene	3.49 D	NE
Chrysene	12.3 D	NE
Indeno(1,2,3-cd)pyrene	2.17 D	NE
Total Metals (mg/kg)		
Arsenic	NE	14.4
Barium	NE	506
Cadmium	NE	3.7
Copper	NE	4,720
Lead	292	1,820
Mercury	2.73	1.41
Nickel	NE	114
Selenium	NE	5.48
Zinc	254	2,120

Sample ID	SP-4 (0-2)	SP-4 (10-12)
Sample Date	4/23/2016	4/23/2016
Sample Depth (feet bgs)	0-2	10-12
Total Metals (mg/kg)		
Arsenic	13.5	NE
Copper	82.8	NE
Lead	434	410
Mercury	1.55	2.82
Zinc	1,270	NE

Sample ID	SB-5(6-8)
Sample Date	5/14/2014
Sample Depth (feet bgs)	6-8
VOCs (mg/kg)	
Acetone	0.066

Sample ID	SP-2 (0-2)	SP-2 (4-6)
Sample Date	4/30/2016	4/30/2016
Sample Depth (feet bgs)	0-2	4-6
SVOCs (mg/kg)		
Benzo(a)anthracene	1.86 D	NE
Benzo(a)pyrene	1.77 D	NE
Benzo(b)fluoranthene	1.22 D	NE
Benzo(k)fluoranthene	1.25 D	NE
Chrysene	1.61 D	NE
Dibenzo(a,h)anthracene	0.565 D	ND
Indeno(1,2,3-cd)pyrene	1.09 D	ND
Total Metals (mg/kg)		
Copper	58.2	NE
Lead	662	NE
Mercury	4.73	0.37
Zinc	210	NE

Sample ID	SB-2(1.5-3.5)
Sample Date	5/14/2014
Sample Depth (feet bgs)	1.5-3.5
VOCs (mg/kg)	
Acetone	74

Sample ID	SP-3 (0-2)	SP-3 (10-12)
Sample Date	4/30/2016	4/30/2016
Sample Depth (feet bgs)	0-2	10-12
SVOCs (mg/kg)		
Benzo(a)anthracene	2.34 D	NE
Benzo(b)fluoranthene	1.01 D	ND
Chrysene	2.4 D	NE
Total Metals (mg/kg)		
Arsenic	15.2	NE
Barium	587	NE
Cadmium	8.25	ND
Chromium, Hexavalent	ND	1.96
Copper	6,370	NE
Lead	1,180	NE
Mercury	2.31	ND
Zinc	1,990	NE

Sample ID	SP-5 (0-2)	SP-5 (10-12)
Sample Date	4/23/2016	4/23/2016
Sample Depth (feet bgs)	0-2	10-12
SVOCs (mg/kg)		
Benzo(k)fluoranthene	NE	0.895
Total Metals (mg/kg)		
Copper	135	NE
Lead	414	326
Mercury	0.62	7.39
Nickel	NE	30.1
Zinc	291	221

Sample ID	SB04_1-3	SB04_6-8	SB04_10-12
Sample Date	6/1/2018	6/1/2018	6/1/2018
Sample Depth (feet bgs)	1-3	6-8	10-12
VOCs (mg/kg)			
Benzene	0.66 J	ND	ND
SVOCs (mg/kg)			
Benzo(a)anthracene	NE	1.3	ND
Benzo(a)pyrene	NE	1.1	ND
Benzo(b)fluoranthene	NE	1.5	ND
Chrysene	NE	1.5	ND
Indeno(1,2,3-cd)pyrene	NE	0.71	ND
Total Metals (mg/kg)			
Copper	66.7	NE	NE
Lead	135	322 J	NE
Mercury	0.22	0.396 J	NE

Sample ID	SB01_0-2	SBDUP01_053118	SB01_3-4	SB01_8-9
Sample Date	5/31/2018	5/31/2018	5/31/2018	5/31/2018
Sample Depth (feet bgs)	0-2	0-2	3-4	8-9
SVOCs (mg/kg)				
Benzo(a)anthracene	25	21	NE	ND
Benzo(a)pyrene	16	13	NE	ND
Benzo(b)fluoranthene	19	17	NE	ND
Benzo(k)fluoranthene	4	4.4	ND	ND
Chrysene	25	21	NE	ND
Dibenzo(a,h)anthracene	2.3	1.8	ND	ND
Indeno(1,2,3-cd)pyrene	8.8	8	NE	ND
Total Metals (mg/kg)				
Lead	178 J	NE	NE	NE

Sample ID	SB02_0-2	SB02_4-6	SB02_6-8
Sample Date	5/31/2018	5/31/2018	5/31/2018
Sample Depth (feet bgs)	0-2	4-6	6-8
VOCs (mg/kg)			
Acetone	0.077	NE	NE
Total Metals (mg/kg)			
Lead	147	NE	NE

Sample ID	SB05_0-2	SB05_7-8	SB05_11-12	SBDUP02_060118
Sample Date	6/1/2018	6/1/2018	6/1/2018	6/1/2018
Sample Depth (feet bgs)	0-2	7-8	11-12	11-12
Total Metals (mg/kg)				
Lead	150 J	5,650 J	NE	NE
Mercury	NE	1.41 J	NE	NE
Zinc	NE	3,000 J	NE	NE

Sample ID	SB03_0-1	SB03_3-4	SB03_7-8
Sample Date	5/31/2018	5/31/2018	5/31/2018
Sample Depth (feet bgs)	0-1	3-4	7-8
VOCs (mg/kg)			
Benzene	0.18	0.2	NE
n-Propylbenzene	NE	8.2	NE
Xylenes, Total	0.53 J	NE	NE

Sample ID	SB06_0-2	SB06_6-8	SB06_12-14	SB06_14-16
Sample Date	6/1/2018	6/1/2018	6/1/2018	6/1/2018
Sample Depth (feet bgs)	0-2	6-8	12-14	14-16
VOCs (mg/kg)				
Acetone	ND	0.061	ND	NE
Total Metals (mg/kg)				
Lead	334 J	458 J	NE	NE
Mercury	6.28 J	0.426 J	NE	ND

LEGEND:

- APPROXIMATE BCP SITE BOUNDARY
- SB-4 — PREVIOUS SOIL BORING LOCATION (MAY 2014, PERFORMED BY PWGC STRATEGIC ENVIRONMENTAL AND ENGINEERING SOLUTIONS)
- SP-4 — PREVIOUS SOIL PROBE LOCATION (APRIL 2016, PERFORMED BY HYDRO TECH ENVIRONMENTAL, DPC)
- MW-1/SP-1 — PREVIOUS SOIL PROBE LOCATION WITH OVERBURDEN MONITORING WELL (APRIL 2016, PERFORMED BY HYDRO TECH ENVIRONMENTAL, DPC)
- SB04 — PREVIOUS SOIL BORING LOCATION (JUNE 2018, PERFORMED BY LANGAN)
- SB01/TW01 — PREVIOUS SOIL BORING LOCATION WITH OVERBURDEN TEMPORARY MONITORING WELL (JUNE 2018, PERFORMED BY LANGAN)

NOTES:

1. BASE MAP IS REFERENCED FROM "ARCHITECTURAL SURVEY", PREPARED BY GEOLAND LAND SURVEYING P.C., DATED APRIL 3, 2018.
2. SAMPLING LOCATIONS ARE APPROXIMATE.
3. SOIL SAMPLE ANALYTICAL RESULTS ARE COMPARED TO THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION (NYSDEC) TITLE 6 OF THE OFFICIAL COMPILATION OF NEW YORK CODES, RULES, AND REGULATIONS (NYCRR) PART 375 UNRESTRICTED USE, RESTRICTED USE RESTRICTED-RESIDENTIAL AND RESTRICTED COMMERCIAL USE SOIL CLEANUP OBJECTIVES (SCOs).
4. ONLY COMPOUNDS DETECTED AT CONCENTRATIONS ABOVE THEIR RESPECTIVE SCOs ARE SHOWN.
5. SOIL SAMPLES SB-1, SB-3 AND SB-4 FROM THE MAY 2014 PHASE II PERFORMED BY PWGC STRATEGIC ENVIRONMENTAL AND ENGINEERING SOLUTIONS DID NOT CONTAIN ANY DETECTED COMPOUNDS AND THEREFORE, ANALYTICAL SUMMARY DATA IS NOT SHOWN.
6. NYSDEC PART 375 UNRESTRICTED USE SCO EXCEEDANCES ARE BOLDED.
7. NYSDEC PART 375 RESTRICTED USE RESTRICTED-RESIDENTIAL SCO EXCEEDANCES ARE HIGHLIGHTED AND BOLDED.
8. NYSDEC PART 375 RESTRICTED COMMERCIAL USE SCO EXCEEDANCES ARE HIGHLIGHTED AND BOLDED RED.
9. NO DETECTIONS FROM SAMPLES **SB-4** SB-1, AND SB-3.
10. BCP = BROWNFIELD CLEANUP PROGRAM
11. VOC = VOLATILE ORGANIC COMPOUND
12. SVOC = SEMIVOLATILE ORGANIC COMPOUND
13. mg/kg = MILLIGRAM PER KILOGRAM
14. ND = NOT DETECTED
15. NE = NO EXCEEDANCE
16. J = THE ANALYTE WAS DETECTED ABOVE THE METHOD DETECTION LIMIT (MDL), BUT BELOW THE REPORTING LIMIT (RL); THEREFORE, THE RESULT IS AN ESTIMATED CONCENTRATION.
17. D = THE CONCENTRATION REPORTED IS A RESULT OF A DILUTED SAMPLE.
18. bgs = BELOW GRADE SURFACE

	New York Part 375 Unrestricted Use SCOs	New York Part 375 Restricted Use Restricted- Residential SCOs	New York Part 375 Restricted Commercial Use SCOs
VOCs (mg/kg)			
Acetone	0.05	100	500
Benzene	0.06	4.8	44
n-Propylbenzene	3.9	100	500
Xylenes, Total	0.26	100	500
SVOCs (mg/kg)			
Benzo(a)anthracene	1	1	5.6
Benzo(a)pyrene	1	1	1
Benzo(b)fluoranthene	1	1	5.6
Benzo(k)fluoranthene	0.8	3.9	56
Chrysene	1	3.9	56
Dibenzo(a,h)anthracene	0.33	0.33	0.56
Indeno(1,2,3-cd)pyrene	0.5	0.5	5.6
Total Metals (mg/kg)			
Arsenic	13	16	16
Barium	350	400	400
Cadmium	2.5	4.3	9.3
Chromium, Hexavalent	1	110	400
Copper	50	270	270
Lead	63	400	1000
Mercury	0.18	0.81	2.8
Nickel	30	310	310
Selenium	3.9	180	1500
Zinc	109	10,000	10,000

30 0 15 30

SCALE: 1 INCH = 30 FEET

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Project

538-542 WEST 29TH STREET

BLOCK No. 700, LOT Nos. 55, 56, 57

NEW YORK NEW YORK

Figure Title

SOIL SAMPLE ANALYTICAL RESULTS MAP

Project No. 170515401

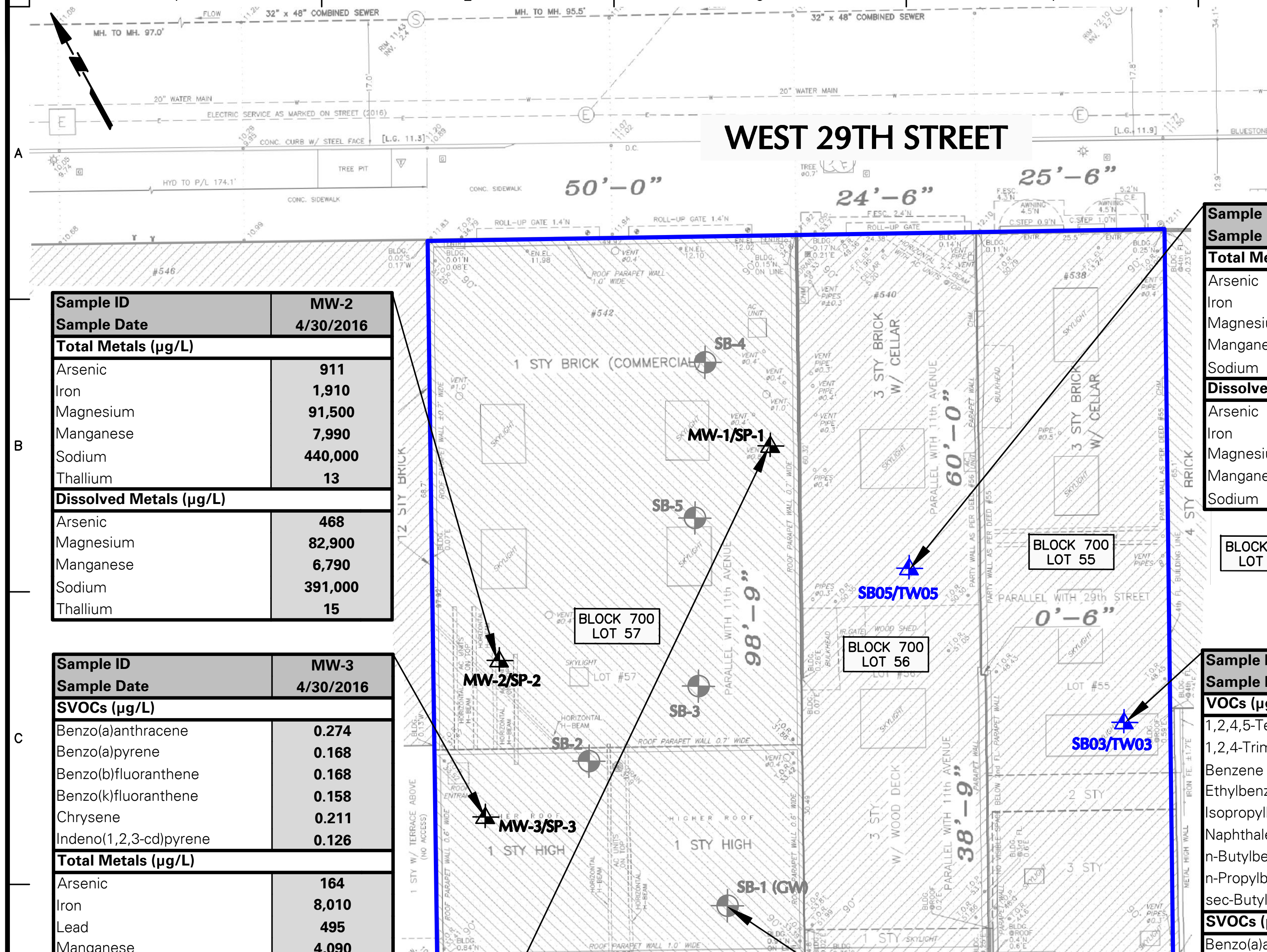
Date 10/26/2018

Drawn By MMP

Checked By ELS

Figure No. 4

Sheet 4 of 9



Sample ID	MW-2
Sample Date	4/30/2016
Total Metals (µg/L)	
Arsenic	911
Iron	1,910
Magnesium	91,500
Manganese	7,990
Sodium	440,000
Thallium	13
Dissolved Metals (µg/L)	
Arsenic	468
Magnesium	82,900
Manganese	6,790
Sodium	391,000
Thallium	15

Sample ID	MW-3
Sample Date	4/30/2016
SVOCs (µg/L)	
Benzo(a)anthracene	0.274
Benzo(a)pyrene	0.168
Benzo(b)fluoranthene	0.168
Benzo(k)fluoranthene	0.158
Chrysene	0.211
Indeno(1,2,3-cd)pyrene	0.126
Total Metals (µg/L)	
Arsenic	164
Iron	8,010
Lead	495
Manganese	4,090
Sodium	438,000
Thallium	6
Dissolved Metals (µg/L)	
Arsenic	111
Manganese	1,830
Selenium	12
Sodium	391,000

Sample ID	MW-1
Sample Date	4/30/2016
Total Metals (µg/L)	
Arsenic	420
Copper	229
Iron	4,660
Lead	177
Magnesium	77,500
Manganese	6,460
Selenium	16
Sodium	450,000
Thallium	11
Dissolved Metals (µg/L)	
Arsenic	230
Magnesium	78,100
Manganese	6,130
Selenium	17
Sodium	454,000
Thallium	11

Sample ID	SB-1(GW)
Sample Date	5/14/2014
VOCs (µg/L)	
Benzene	1.4
Methyl tert butyl ether	11

Sample ID	TW05_060118	TWDUP01_060118
Sample Date	6/1/2018	6/1/2018
Total Metals (µg/L)		
Arsenic	177.3	183
Iron	4,860	4,890
Magnesium	69,600	71,400
Manganese	10,960	10,770
Sodium	618,000	600,000
Dissolved Metals (µg/L)		
Arsenic	221	193.8
Iron	5,070	4,370
Magnesium	70,800	71,300
Manganese	11,740	10,870
Sodium	602,000	591,000

Sample ID	TW03_060118	
Sample Date	6/1/2018	
VOCs (µg/L)		
1,2,4,5-Tetramethylbenzene	55	
1,2,4-Trimethylbenzene	49	
Benzene	46	
Ethylbenzene	13	
Isopropylbenzene	34	
Naphthalene	32	
n-Butylbenzene	11	
n-Propylbenzene	79	
sec-Butylbenzene	8.5	
SVOCs (µg/L)		
Benzo(a)anthracene	0.05	J
Chrysene	0.05	J
Total Metals (µg/L)		
Iron	22,600	
Manganese	2,882	
Dissolved Metals (µg/L)		
Iron	14,800	J
Manganese	2,263	

LEGEND:

APPROXIMATE BCP SITE BOUNDARY

SB-1 (GW) — PREVIOUS SOIL BORING LOCATION WITH MONITORING WELL (MAY 2014, PERFORMED BY PWGC STRATEGIC ENVIRONMENTAL AND ENGINEERING SOLUTIONS)

MW-1/SP-1 — PREVIOUS SOIL PROBE LOCATION WITH OVERBURDEN MONITORING WELL (APRIL 2016, PERFORMED BY HYDRO TECH ENVIRONMENTAL, DPC)

SB03/TW03 — PREVIOUS SOIL BORING LOCATION WITH OVERBURDEN TEMPORARY MONITORING WELL (JUNE 2018, PERFORMED BY LANGAN)

NOTES:

1. BASE MAP IS REFERENCED FROM "ARCHITECTURAL SURVEY", PREPARED BY GEOLAND LAND SURVEYING P.C., DATED APRIL 3, 2018.
2. SAMPLING LOCATIONS ARE APPROXIMATE.
3. GROUNDWATER SAMPLE ANALYTICAL RESULTS ARE COMPARED TO THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION (NYSDEC) TECHNICAL AND OPERATIONAL GUIDANCE SERIES (TOGS) 1.1.1 AMBIENT WATER QUALITY STANDARDS (AWQS) AND GUIDANCE VALUES FOR DRINKING WATER (CLASS GA).
4. ONLY COMPOUNDS DETECTED AT CONCENTRATIONS ABOVE THEIR RESPECTIVE AWQS ARE SHOWN.
5. GROUNDWATER SAMPLES SB-3 (GW), SB-4 (GW), AND SB-5 (GW) FROM THE APRIL 2014 PHASE II PERFORMED BY PWGC STRATEGIC ENVIRONMENTAL AND ENGINEERING SOLUTIONS DID NOT CONTAIN ANY DETECTED COMPOUNDS AND THEREFORE, ANALYTICAL SUMMARY DATA IS NOT SHOWN.
6. RESULTS IN EXCEEDANCE OF NYSDEC TOGS AWQS ARE SHADED AND BOLDED.
7. BCP = BROWNFIELD CLEANUP PROGRAM
8. VOC = VOLATILE ORGANIC COMPOUND
9. SVOC = SEMIVOLATILE ORGANIC COMPOUND
10. µg/L = MICROGRAM PER LITER
11. J = THE ANALYTE WAS DETECTED ABOVE THE METHOD DETECTION LIMIT (MDL), BUT BELOW THE REPORTING LIMIT (RL); THEREFORE, THE RESULT IS AN ESTIMATED CONCENTRATION.

NYSDEC TOGS SGVs	
VOCs (µg/L)	
1,2,4,5-Tetramethylbenzene	5
1,2,4-Trimethylbenzene	5
Benzene	1
Ethylbenzene	5
Isopropylbenzene	5
Methyl tert butyl ether	10
Naphthalene	10
n-Butylbenzene	5
n-Propylbenzene	5
sec-Butylbenzene	5
SVOCs (µg/L)	
Benzo(a)anthracene	0.002
Benzo(a)pyrene	0.002
Benzo(b)fluoranthene	0.002
Benzo(k)fluoranthene	0.002
Chrysene	0.002
Total Metals (µg/L)	
Arsenic	25
Copper	200
Lead	25
Iron	300
Magnesium	35,000
Manganese	300
Selenium	10
Sodium	20,000
Thallium	0.5

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Project: 538-542 WEST 29TH STREET
BLOCK No. 700, LOT Nos. 55, 56, 57
NEW YORK NEW YORK

Figure Title: GROUNDWATER SAMPLE ANALYTICAL RESULTS MAP

Project No. 170515401
Date 10/26/2018
Drawn By MMP
Checked By ELS

Figure No. 5

Filename: \\langan.com\data\NY\data4\170515401\Project Data\CAD\01\2D-DesignFiles\RAWP\Figure 5 - Sample Location Map.dwg Date: 5/28/2019 Time: 14:21 User: jdonelan Style Table: Langan.stb Layout: GW Sample Analytical Results Map

WEST 29TH STREET

Sample ID	SS-3
Sampling Date	5/14/2014
Matrix	Soil Vapor
VOCs (µg/m³)	
1,1,1-Trichloroethane	12
1,1-Dichloroethane	1.07
1,2,4-Trimethylbenzene	2.52
1,3-Butadiene	1.84
2,2,4-Trimethylpentane	1.14
2-Butanone	10.9
2-Hexanone	2.21
Acetone	401
Benzene	2.72
Carbon disulfide	4.86
Chloroform	27
Cyclohexane	1.96
Dichlorodifluoromethane	3.29
Ethylbenzene	2.75
Heptane	2.15
n-Hexane	2.36
o-Xylene	3.16
p/m-Xylene	9.56
Tetrahydrofuran	0.885
Toluene	13.9
Trichloroethene (TCE)	2.78
Trichlorofluoromethane	7.19
Total VOCs (µg/m³)	116

Sample ID	OA-1
Sampling Date	5/14/2014
Matrix	Ambient Air
VOCs (µg/m³)	
1,2,4-Trimethylbenzene	1.03
1,3-Butadiene	1.04
2,2,4-Trimethylpentane	1.63
2-Butanone	1.42
Acetone	10.9
Benzene	1.68
Bromoform	2.07
Carbon tetrachloride	0.415
Chloromethane	1.44
cis-1,2-Dichloroethene	0.266
Dichlorodifluoromethane	1.86
Ethyl Alcohol	27.7
Heptane	0.869
iso-Propyl Alcohol	2.56
n-Hexane	1.62
o-Xylene	0.895
p/m-Xylene	2.26
Tetrachloroethene (PCE)	0.814
Toluene	3.58
Trichlorofluoromethane	1.7
Total VOCs (µg/m³)	54.8

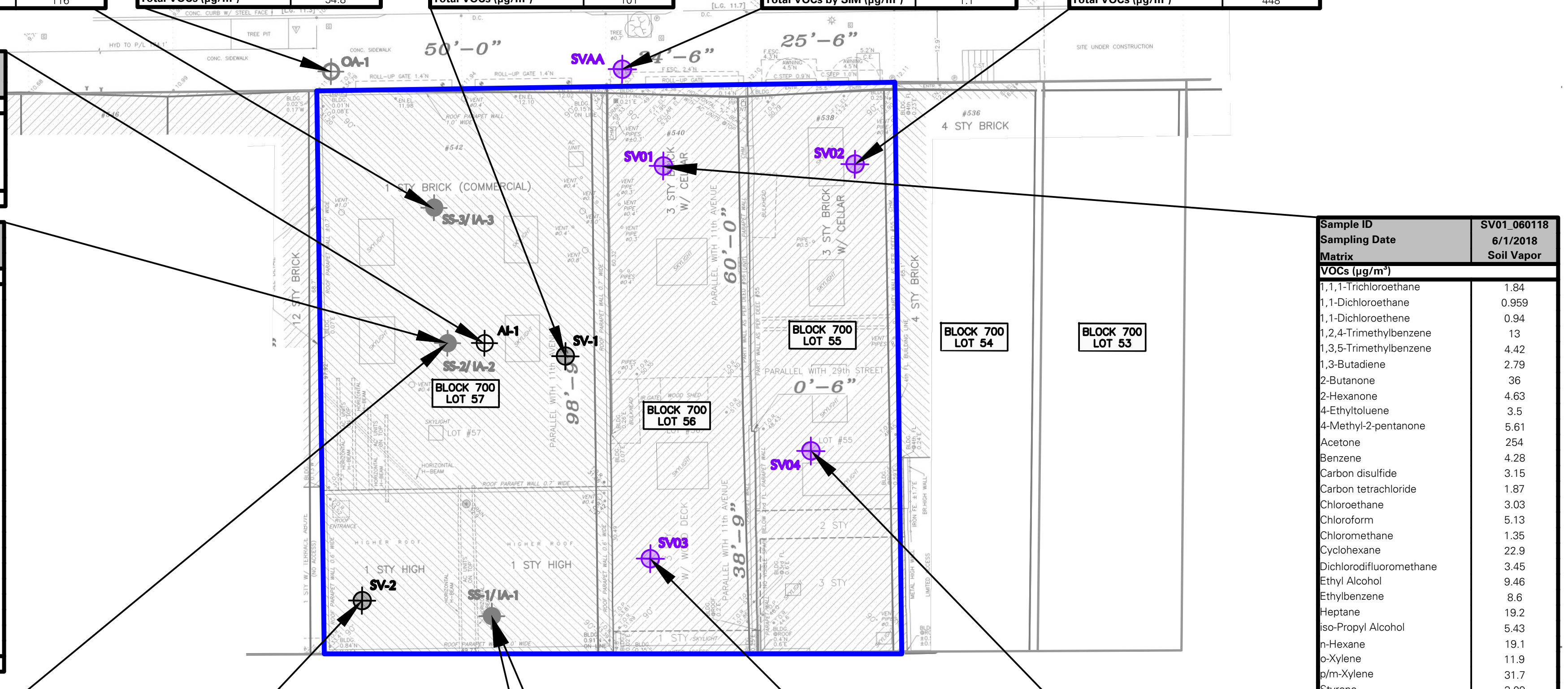
Sample ID	SV-1
Sampling Date	5/7/2016
Matrix	Soil Vapor
VOCs (µg/m³)	
1,1,1-Trichloroethane	9.9
1,1-Dichloroethane	3
2-Butanone	0.48
Acetone	3.9
Acrylonitrile	4.6
Bromodichloromethane	1.1
Carbon tetrachloride	0.88
Chloroform	28
cis-1,2-Dichloroethene	3.2
Dichlorodifluoromethane	2.8
Methylene chloride	4.2
Tetrachloroethene (PCE)	10
Trichloroethene (TCE)	6.9
Trichlorofluoromethane	26
Total VOCs (µg/m³)	101

Sample ID	SVAA_060118
Sampling Date	6/1/2018
Matrix	Ambient Air
VOCs (µg/m³)	
2,2,4-Trimethylpentane	1.57
2-Butanone	1.47
Acetone	20.6
Benzene	1.23
Carbon tetrachloride	0.403
Chloromethane	1.13
Dichlorodifluoromethane	2.18
Ethyl Alcohol	23.9
Heptane	0.926
iso-Propyl Alcohol	4.74
n-Hexane	1.16
o-Xylene	0.99
p/m-Xylene	2.6
Tetrachloroethene (PCE)	0.678
Toluene	3.88
Trichlorofluoromethane	1.22
Total VOCs (µg/m³)	48.1
VOCs by SIM (µg/m³)	
Carbon tetrachloride	0.403
Tetrachloroethene (PCE)	0.678
Total VOCs by SIM (µg/m³)	1.1

Sample ID	SV02_060118
Sampling Date	6/1/2018
Matrix	Soil Vapor
VOCs (µg/m³)	
1,2,4-Trimethylbenzene	15.5
1,3,5-Trimethylbenzene	5.21
2-Butanone	8.46
4-Ethyltoluene	4.63
Acetone	40.1
Benzene	10.1
Carbon disulfide	5.48
Chloroform	2.99
Cyclohexane	56.8
Dichlorodifluoromethane	2.22
Ethylbenzene	16.3
Heptane	44.3
iso-Propyl Alcohol	1.95
n-Hexane	93
o-Xylene	15.8
p/m-Xylene	35.8
Styrene	8.3
tert-Butyl Alcohol	1.62
Tetrachloroethene	38.1
Tetrahydrofuran	15.1
Toluene	65.2
Trichlorofluoromethane	1.16
Total VOCs (µg/m³)	448

Sample ID	AI-1
Sampling Date	5/7/2016
Matrix	Indoor Air
VOCs (µg/m³)	
Acetone	19
Benzene	11
Chloroform	12
Propylene	17
Toluene	9
Total VOCs (µg/m³)	49

Sample ID	SS-2
Sampling Date	5/14/2014
Matrix	Soil Vapor
VOCs (µg/m³)	
1,1,1-Trichloroethane	3.18
1,2,4-Trimethylbenzene	4.29
1,3,5-Trimethylbenzene	1.25
2,2,4-Trimethylpentane	3.95
2-Butanone	6.69
2-Hexanone	0.943
4-Ethyltoluene	1.33
Acetone	344
Benzene	10.7
Carbon disulfide	1.86
Chloroform	10.7
Chloromethane	0.535
Cyclohexane	6.54
Dichlorodifluoromethane	2.36
Ethylbenzene	3.83
Heptane	4.26
n-Hexane	6.24
o-Xylene	4.17
p/m-Xylene	11.3
Styrene	1.18
Tetrachloroethene (PCE)	1.48
Tetrahydrofuran	0.985
Toluene	19.2
Trichlorofluoromethane	5.73
Total VOCs (µg/m³)	112.7



Sample ID	SV01_060118
Sampling Date	6/1/2018
Matrix	Soil Vapor
VOCs (µg/m³)	
1,1,1-Trichloroethane	1.84
1,1-Dichloroethane	0.959
1,1-Dichloroethene	0.94
1,2,4-Trimethylbenzene	13
1,3,5-Trimethylbenzene	4.42
1,3-Butadiene	2.79
2-Butanone	36
2-Hexanone	4.63
4-Ethyltoluene	3.5
4-Methyl-2-pentanone	5.61
Acetone	254
Benzene	4.28
Carbon disulfide	3.15
Carbon tetrachloride	1.87
Chloroethane	3.03
Chloroform	5.13
Chloromethane	1.35
Cyclohexane	22.9
Dichlorodifluoromethane	3.45
Ethyl Alcohol	9.46
Ethylbenzene	8.6
Heptane	19.2
iso-Propyl Alcohol	5.43
n-Hexane	19.1
o-Xylene	11.9
p/m-Xylene	31.7
Styrene	3.09
tert-Butyl Alcohol	15.5
Tetrachloroethene	15.6
Tetrahydrofuran	7.73
Toluene	112
Trichlorofluoromethane	2.01
Vinyl chloride	1.39
Total VOCs (µg/m³)	382

Sample ID	IA-2
Sampling Date	5/14/2014
Matrix	Indoor Air
VOCs (µg/m³)	
1,2,4-Trimethylbenzene	8.65
1,3,5-Trimethylbenzene	2.57
2,2,4-Trimethylpentane	6.63
2-Butanone	3.8
4-Ethyltoluene	2.45
Benzene	19.6
Bromodichloromethane	2.13
Carbon tetrachloride	0.491
Chloroform	18.2
Chloromethane	0.964
cis-1,2-Dichloroethene	0.25
Cyclohexane	8.23
Dichlorodifluoromethane	2.79
Ethylbenzene	5.3
Heptane	5.82
n-Hexane	9.55
o-Xylene	5.73
p/m-Xylene	14.4
Tetrachloroethene (PCE)	2.82
Tetrahydrofuran	0.864
Toluene	20.1
Trichloroethene (TCE)	0.709
Trichlorofluoromethane	7.42
Vinyl chloride	0.077
Total VOCs (µg/m³)	149.5

Sample ID	SV-2
Sampling Date	5/7/2016
Matrix	Soil Vapor
VOCs (µg/m³)	
Acetone	30
Dichlorodifluoromethane	10
Methylene chloride	110
n-Hexane	28
Trichlorofluoromethane	89
Total VOCs (µg/m³)	237

Sample ID	SS-1
Sampling Date	5/14/2014
Matrix	Soil Vapor
VOCs (µg/m³)	
Acetone	297
Trichlorofluoromethane	663
Total VOCs (µg/m³)	663

Sample ID	IA-1
Sampling Date	5/14/2014
Matrix	Indoor Air
VOCs (µg/m³)	
1,2,4-Trimethylbenzene	9.88
1,3,5-Trimethylbenzene	2.93
2,2,4-Trimethylpentane	7.52
2-Butanone	4.81
4-Ethyltoluene	2.71
Benzene	24.2
Bromodichloromethane	2.36
Carbon tetrachloride	0.465
Chloroform	20.9
Chloromethane	1.01
cis-1,2-Dichloroethene	0.198
Cyclohexane	9.67
Dichlorodifluoromethane	4.78
Ethyl Acetate	2.34
Ethylbenzene	5.99
Heptane	7.01
n-Hexane	10.2
o-Xylene	6.17
p/m-Xylene	15.6
Styrene	2.16
Tetrachloroethene (PCE)	2.67
Tetrahydrofuran	1.02
Toluene	22
Trichloroethene (TCE)	0.715
Trichlorofluoromethane	7.42
Vinyl chloride	0.087
Total VOCs (µg/m³)	175

Sample ID	SV03_060118
Sampling Date	6/1/2018
Matrix	Soil Vapor
VOCs (µg/m³)	
1,2,4-Trimethylbenzene	11
1,3-Butadiene	4.8
2-Butanone	24.3
Acetone	105
Benzene	8.72
Carbon disulfide	12.6
Cyclohexane	1440
Ethylbenzene	8.77
Heptane	47.5
iso-Propyl Alcohol	6.34
n-Hexane	684
o-Xylene	11.3
p/m-Xylene	28.7
tert-Butyl Alcohol	13.1
Tetrachloroethene	13
Toluene	101
Trichlorofluoromethane	15.2
Total VOCs (µg/m³)	2,430

Sample ID	SV04_060118
Sampling Date	6/1/2018
Matrix	Soil Vapor
VOCs (µg/m³)	
2,2,4-Trimethylpentane	255,000
Benzene	20,100
Cyclohexane	62,600
Ethylbenzene	2,530
Heptane	124,000
Methyl tert butyl ether	9,090
n-Hexane	34,000
p/m-Xylene	2,870
Tetrachloroethene (PCE)	317
Toluene	8,740
Total VOCs (µg/m³)	519,247

LEGEND:

APPROXIMATE BCP SITE BOUNDARY

SS-1/IA-1 — PREVIOUS SUB-SLAB SOIL VAPOR AND INDOOR AMBIENT AIR LOCATION (MAY 2014, PERFORMED BY PWGC STRATEGIC ENVIRONMENTAL AND ENGINEERING SOLUTIONS)

OA-1 — PREVIOUS OUTDOOR AMBIENT AIR SAMPLE LOCATION (MAY 2014, PERFORMED BY PWGC STRATEGIC ENVIRONMENTAL AND ENGINEERING SOLUTIONS)

SV-1 — PREVIOUS SOIL VAPOR LOCATION (APRIL 2016, PERFORMED BY HYDRO TECH ENVIRONMENTAL, DPC)

AI-1 — PREVIOUS INDOOR AIR SAMPLE LOCATION (APRIL 2016, PERFORMED BY HYDRO TECH ENVRIONMENTAL, DPC)

SV01 — PREVIOUS SOIL VAPOR AND OUTDOOR AMBIENT AIR LOCATION (JUNE 2018, PERFORMED BY LANGAN)

NOTES:

1. BASE MAP IS REFERENCED FROM "ARCHITECTURAL SURVEY", PREPARED BY GEOLAND LAND SURVEYING P.C., DATED APRIL 3, 2018.
2. SAMPLING LOCATIONS ARE APPROXIMATE.
3. NO STANDARD CURRENTLY EXISTS FOR SOIL VAPOR SAMPLES IN NEW YORK STATE.
4. ONLY DETECTED VOLATILE ORGANIC COMPOUND (VOC) ARE SHOWN.
5. ACETONE IS NOT INCLUDED IN THE TOTAL VOC CALCULATION. ACETONE IS A COMMON LABORATORY CONTAMINANT.
6. ACCORDING TO LAB REPORT NO. L1410518 OF PWGC STRATEGIC ENVIRONMENTAL AND ENGINEERING SOLUTIONS' PHASE II ENVIRONMENTAL SITE ASSESSMENT, THE SAMPLE DESIGNATED IA-3 HAD A FINAL PRESSURE OF -29 INCHES OF MERCURY, WHICH INDICATES THAT NO SAMPLE WAS COLLECTED.
7. BCP = BROWNFIELD CLEANUP PROGRAM
8. µg/m³ = MICROGRAM PER CUBIC METER

30 0 15 30

SCALE: 1 INCH = 30 FEET

LANGAN
Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C.
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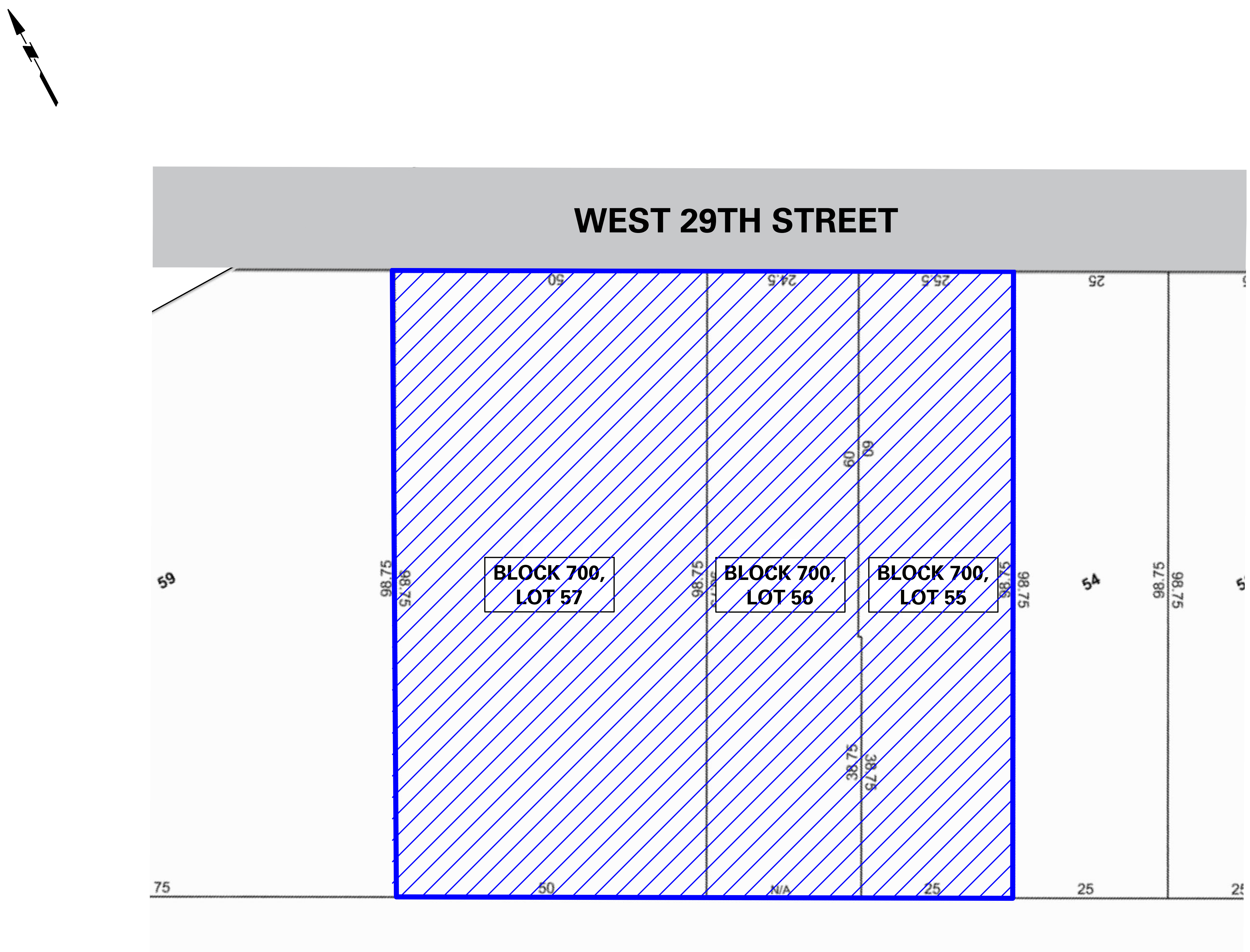
Project	Figure Title	Project No. 170515401	Figure No.
538-542 WEST 29TH STREET	SOIL VAPOR SAMPLE ANALYTICAL RESULTS MAP	Date 10/26/2018	6
BLOCK No. 700, LOT Nos. 55, 56, 57		Drawn By MMP	
NEW YORK NEW YORK		Checked By ELS	Sheet 6 of 9



LEGEND:

APPROXIMATE BCP SITE BOUNDARY

DEVELOPMENT EXCAVATION TO ABOUT 30 FEET BGS

NOTES:

1. BASE MAP TAKEN FROM HTTP://GIS.NYC.GOV/TAXMAP/MAP.HTM
2. BCP = BROWNFIELD CLEANUP PROGRAM
3. BGS = BELOW GRADE SURFACE

20 0 10 20
SCALE IN FEET

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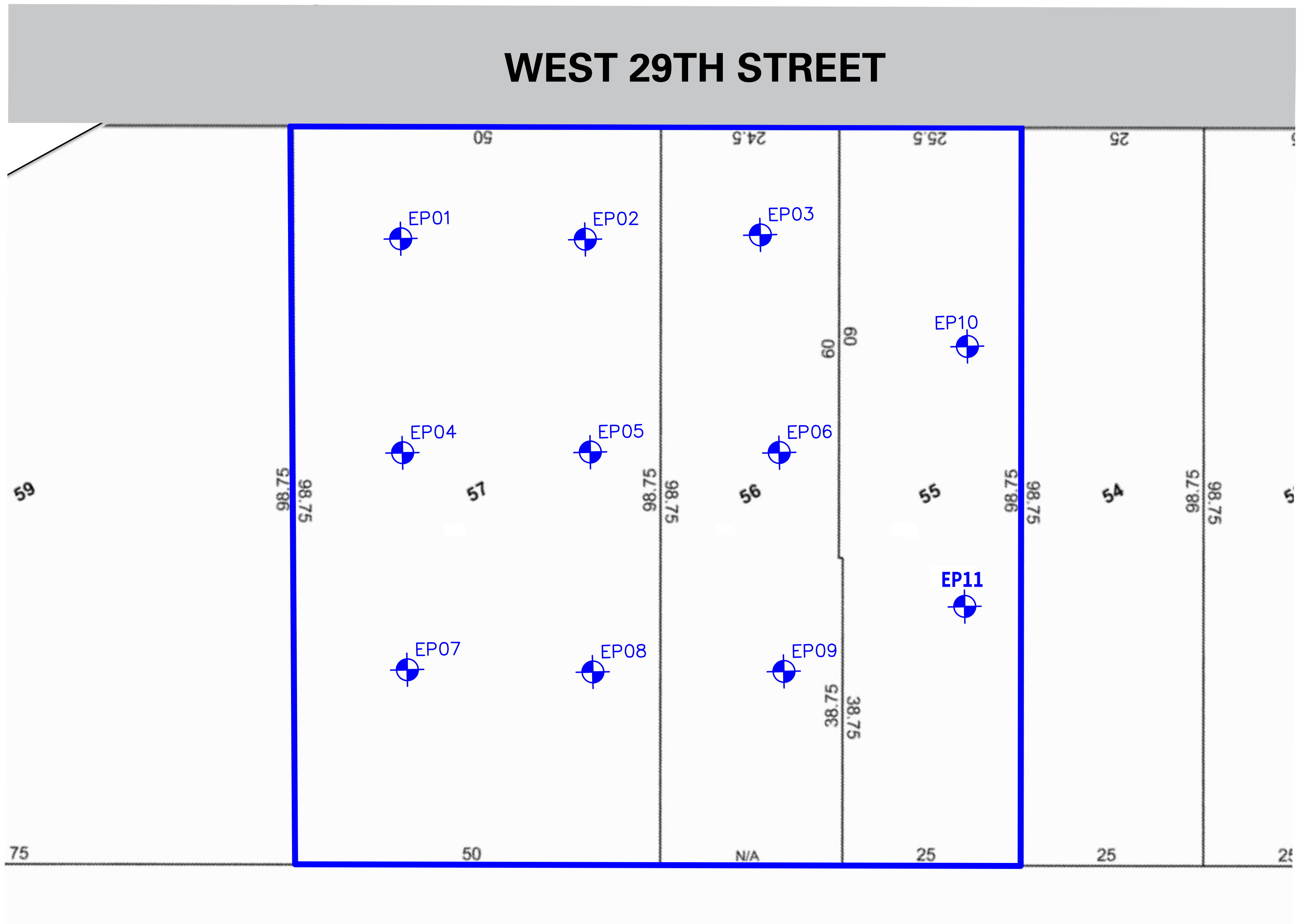
Project
538-542 WEST 29TH STREET
BLOCK No. 700, LOT Nos. 55, 56, 57
NEW YORK NEW YORK

Figure Title
REMEDIAL EXCAVATION PLAN

Project No. 170515401
Date 3/21/2019
Drawn By MT
Checked By KN

Figure No.
7
Sheet 7 of 9

Filename: \\langan.com\data\NY\data4\170515401\Project Data\CAD\01\2D-DesignFiles\RAWP\Figure 7 - Remedial Excavation Plan.dwg Date: 5/28/2019 Time: 15:03 User: jdonelan Style Table: Langan.stb Layout: ANSIB-BL



LEGEND:

APPROXIMATE BCP SITE BOUNDARY

EP01 PROPOSED CONFIRMATION SOIL SAMPLE LOCATIONS

NOTES:

1. BASE MAP TAKEN FROM HTTP://GIS.NYC.GOV/TAXMAP/MAP.HTM
2. BCP = BROWNFIELD CLEANUP PROGRAM

20 0 10 20

SCALE IN FEET

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Project
538-542 WEST 29TH STREET
BLOCK No. 700, LOT Nos. 55, 56, 57
NEW YORK NEW YORK

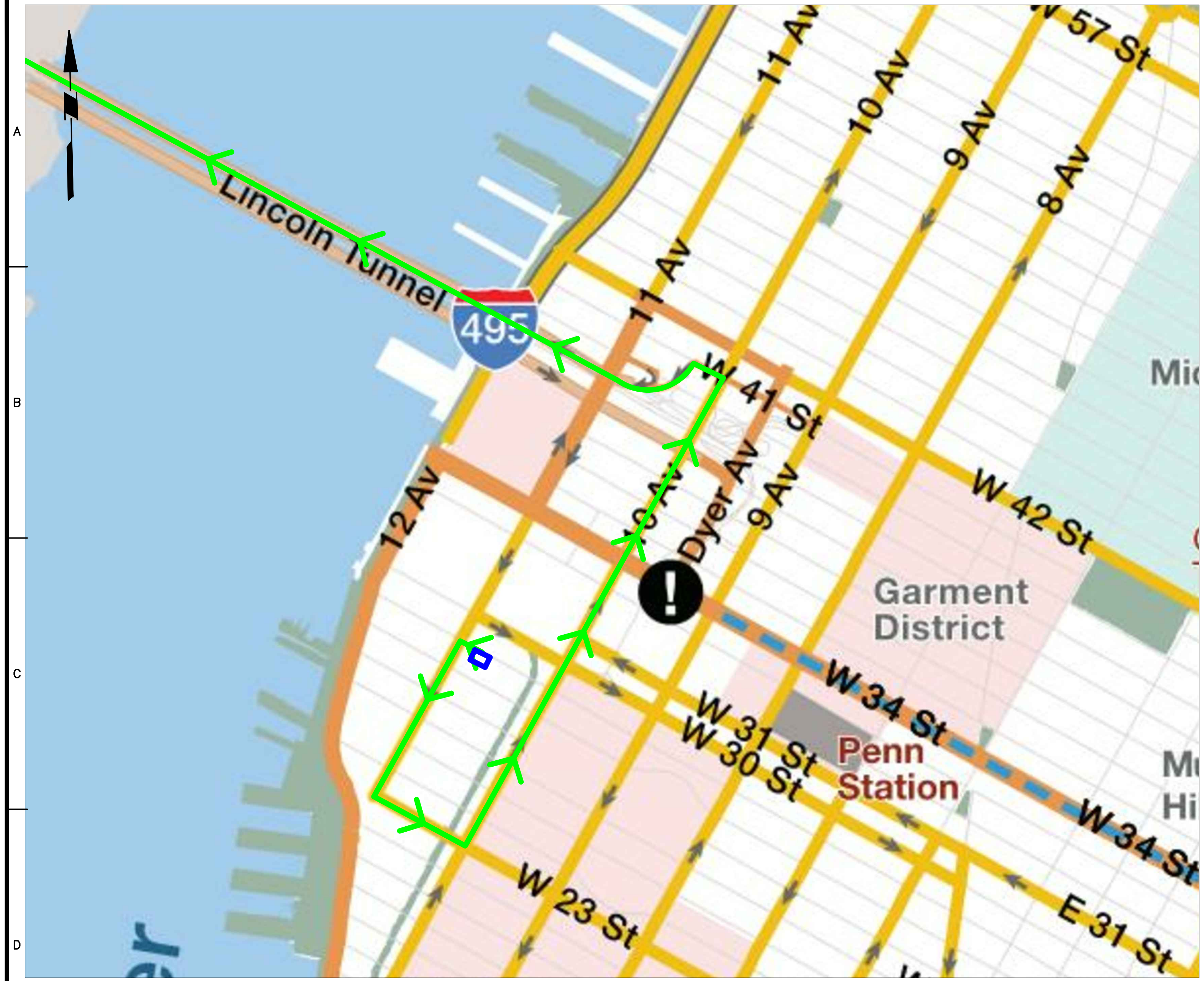
Figure Title
ENDPOINT SAMPLE LOCATION PLAN

Project No. 170515401
Date 3/21/2019
Drawn By MT
Checked By KN

Figure No. 8

Sheet 8 of 9

Filename: \\langan.com\data\NY\data4\170515401\Project Data\CAD\01\2D-DesignFiles\RAWP\Figure 8 - Endpoint Sample Location Plan_05.28.19.dwg Date: 5/28/2019 Time: 15:25 User: jdonelan Style Table: Langan.stb Layout: ANSIB-BL



AERIAL REFERENCE

Legend

	Local Truck Route		Industrial Business Zones (IBZ)
	Limited Local Truck Route Some of the roadways in Staten Island are designated as Limited Local Truck Routes. These roadways serve as Local Truck Routes but are limited to trucks with two axles and six tires.		Parks and Open Spaces
		29A	Highway Exit
	Through Truck Route		
	Through Truck Route on Expressway		Commercial Vehicles Prohibited

LEGEND:

APPROXIMATE BCP SITE BOUNDARY

TRUCK ROUTE

SITE ENTRANCE

NOTES:

1. TRUCK ROUTE MAP ADAPTED FROM NEW YORK CITY DEPARTMENT OF TRANSPORTATION (NYC DOT) 2015 TRUCK ROUTE MAP.
2. LOCATION OF SITE ACCESS IS SUBJECT TO CHANGE, PENDING CONSTRUCTION LOGISTICS.
3. BCP = BROWNFIELD CLEANUP PROGRAM

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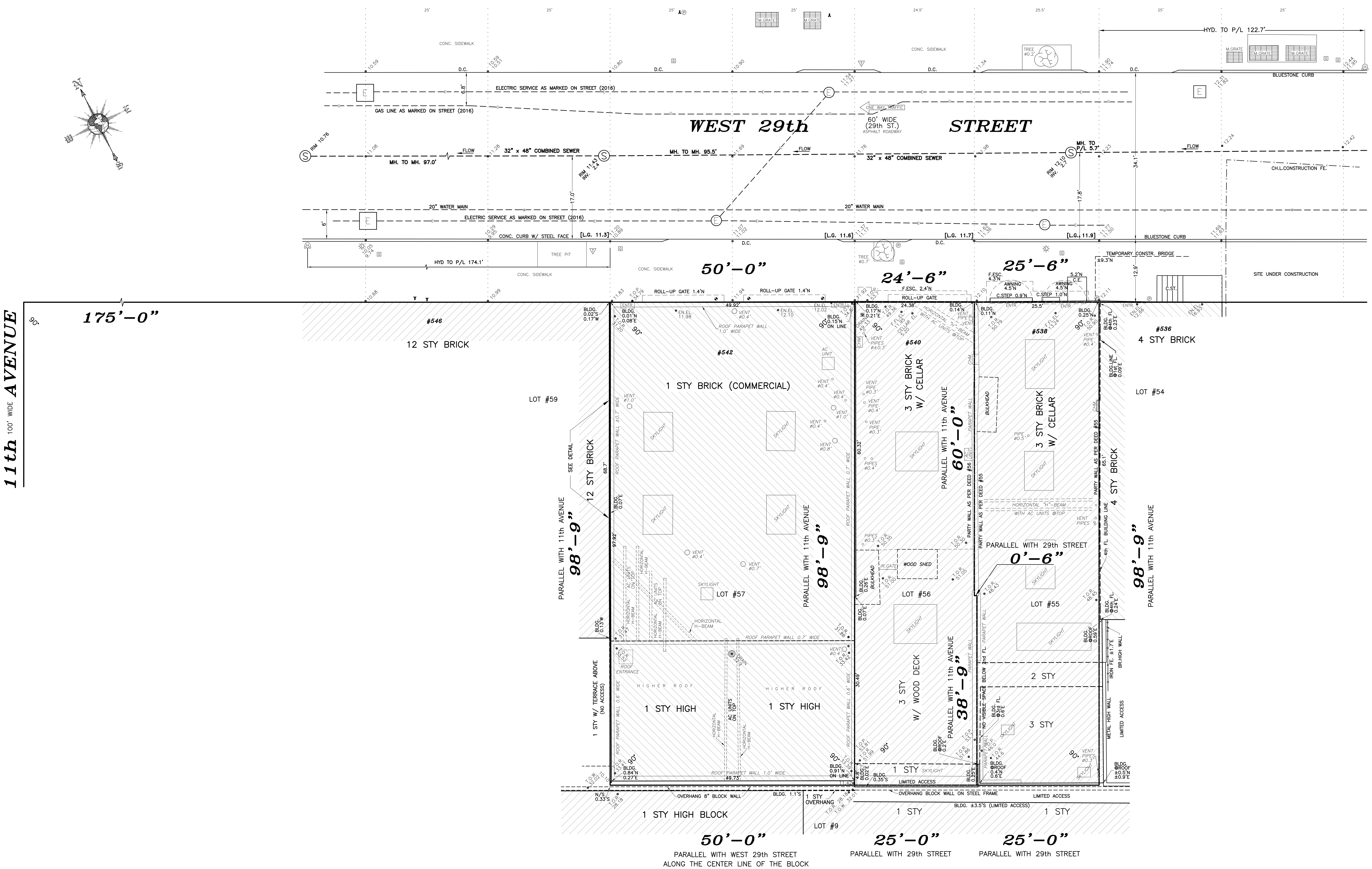
Project	Figure Title	Project No. 170515401	Figure No.
538-542 WEST 29TH STREET BLOCK No. 700, LOT Nos. 55, 56, 57 NEW YORK NEW YORK	TRUCK MAP	Date 3/22/2019 Drawn By MT Checked By ES	9 Sheet 9 of 9

Filename: \\langan.com\data\NY\data4\170515401\Project Data\CAD\01\2D-DesignFiles\RAWP\Figure 9 - Truck Map.dwg Date: 5/28/2019 Time: 15:44 User: jdonelan Style Table: Langan.stb Layout: ANSIB-BL

APPENDIX A

BOUNDARY SURVEY



LEGEND

#575	BLDG. NUMBER	G	GAS VALVE – ROUND
TR	TRAFFIC BOX	W	WATER VALVE – ROUND
CTV	CABLE TV MANHOLE	V	UNKNOWN VALVE
E	ELECTRIC MANHOLE	O	OIL FILL
S	SEWER MANHOLE	P	VENT PIPE
G	GAS MANHOLE	G	GAS VALVE – SQUARE
F	FIRE DEPT. MANHOLE	W	WATER VALVE – SQUARE
W	WATER MANHOLE	H	HYDRANT
T	TELEPHONE MANHOLE	H	HYDRANT W/GUARD POLE
CB	CATCH BASIN		AUTOMATIC SPRINKLER
	EXISTING TREE	U	UTILITY POLE
	TELEPHONE BOOTH	L	LIGHT POLE
F	FIRE ALARM BOX	T	TRAFFIC LIGHT
		T	TRAFFIC SIGN
		M	PARKING METER
		MB	MAIL BOX
			METAL GUARD POLE
			DRAIN INLET

CHM – CHIMNEY	RO – ROOF OVER	STY – STORY
DC – DROP CURB	BL. – BLOCK	R.O. – ROOF OVER
AW – AREAWAY	L.G. –LEGAL GRADE	N/S – NORTH SIDE

C.E. – CELLAR ENTRANCE	C.STEPS – CONCRETE STEPS
RET.WALL – RETAINING WALL	B.STEPS – BRICK STEPS
C., CONC. – CONCRETE	M.STEPS – METAL STEPS
FND.WALL – FOUNDATION WALL	IR.FE. – IRON FENCE
CH.L.FE. – CHAIN LINK FENCE	M.WELL – MONITORING WELL
F.S.M. – FINAL SECTION MAP	F.ESC. – FIRE ESCAPE
TEMP.CONSTR.FE. – TEMPORARY CONSTRUCTION FENCE	
OH.COMM. – OVERHANG COMMERCIAL	IRR. – IRREGULAR
INV. – SEWER INVERT ELEVATION	ST. – STEPS
EN.EL. – ENTRANCE ELEVATION	O/L – ON LINE
T.O.R. – TOP OF ROOF ELEVATION	EXTN. – EXTENSION
T.O.W. – TOP OF WALL ELEVATION	FE. – FENCE
T.O.P – TOP OF ROOF PARAPET ELEVATION	
T.O.C – TOP OF CURB ELEVATION	
B.O.C. – BOTTOM OF CURB ELEVATION	

GENERAL NOTES:

1. TOTAL AREA OF LOT #55 = 2498.75 SQ. FT.
#56 = 2438.75 SQ. FT.
#57 = 4937.50 SQ. FT.

2. THE SUBJECT PROPERTY SHOWS NO EVIDENCE OF SITE USE A SOLID WASTE DUMP, SUMP OR SANITARY LANDFILL,

3. THIS IS TO CERTIFY THAT THERE ARE NO STREAMS OR NATURAL WATER COURSES IN THE PROPERTY AS SHOWN ON THE SURVEY,

4. THIS SURVEY WAS PREPARED WITHOUT BENEFIT OF A TITLE COMMITMENT REPORT AND IS SUBJECT TO THE COVENANTS, RESTRICTIONS AND EASEMENT THAT MAY BE CONTAINED THEREIN,

5. THE LOCATION AND EXTENTS OF UNDERGROUND VAULTS, IF ANY EXIST, HAVE NOT BEEN DETERMINED BY THE SURVEYOR.

6. THE LOCATIONS OF UNDERGROUND UTILITIES SHOWN ARE BASED ON VISIBLE ABOVE GROUND STRUCTURES, MARK OUT BY OTHERS, AND RECORD UTILITY DRAWINGS. ADDITIONAL BURIED UTILITIES AND STRUCTURES MAY BE ENCOUNTERED.

ALL SUBSURFACE UTILITY LOCATIONS AND DEPTH SHOULD BE RECHECKED AND LEGAL GRADES SHOULD BE VERIFIED WITH THE TOPOGRAPHICAL BUREAU, PREFERABLY IN WRITING BEFORE COMMENCING FINAL DESIGN OR CONSTRUCTION.

REFER TO ARTICLE 36 OF THE GENERAL BUSINESS LAW AND THE PROVISIONS OF INDUSTRIAL CODE PART (RULE NO. 53) BEFORE ANY EXCAVATION OR DEMOLITION IS COMMENCED. THESE LAWS REQUIRE EACH EXCAVATOR TO GIVE ADVANCE NOTICE TO ALL OPERATORS OF UNDERGROUND FACILITIES OF HIS INTENT TO PERFORM EXCAVATION OR DEMOLITION WORK IN THE SPECIFIED AREAS.

LEGAL GRADES ARE REFERRED TO THE TOP OF CURB.

ALL ELEVATIONS SHOWN ARE REFERRED TO THE NAVD88.

FLOOD HAZARD NOTE:

CURRENT MAP:
BY GRAPHIC PLOTTING ONLY, SUBJECT PROPERTY IS PARTIALLY LOCATED IN ZONE X (AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN) AND PARTIALLY LOCATED IN ZONE X (AREAS OF 0.2% ANNUAL CHANCE FLOOD) AS SHOWN ON THE FLOOD INSURANCE RATE MAP FOR COMMUNITY PANEL NUMBER 3604970069F WHICH BEARS AN EFFECTIVE DATE OF SEPTEMBER 5, 2007,

PRELIMINARY MAP:
BY GRAPHIC PLOTTING ONLY, SUBJECT PROPERTY IS LOCATED IN ZONE X (AREAS OF 0.2% ANNUAL CHANCE FLOOD) AS SHOWN ON THE FLOOD INSURANCE RATE MAP FOR COMMUNITY PANEL NUMBER 3604970069G PRELIMINARY DECEMBER 5, 2013.

ELEVATION CONVERSION:

ALL ELEVATIONS SHOWN ARE REFERRED TO NAVD88 DATUM
FOR NGVD29 DATUM ADD 1.08'
FOR MANHATTAN DATUM SUBTRACT 1.67'

EXAMPLE:
10.00' (MANHATTAN DATUM) = 12.75' (NGVD29) = 11.67' (NAVD88)

AREA LOT #55: 2498.75 SQ.FT.
AREA LOT #56: 2438.75 SQ.FT.
AREA LOT #57: 4937.5 SQ.FT.

CONVERSION TABLE	
DECIMAL	INCHES
0.08'	1"
0.17'	2"
0.25'	3"
0.33'	4"
0.42'	5"
0.50'	6"
0.58'	7"
0.67'	8"
0.75'	9"
0.83'	10"
0.92'	11"
1.00'	12"

GeoLand
LAND SURVEYING P.C.
Phone: (718) 701-5030 www.GeoLandCorp.com
Fax: (718) 701-2265 Email: info@geolandcorp.com
1317 Park Ave, New Hyde Park, NY 11040

REVISIONS DESCRIPTION	DATE	JOB NO.
1. ARCHITECTURAL SURVEY	04-03-2018	GLS18145
2. UPDATING OF ARCHITECTURAL SURVEY	11-29-2018	GLS18546

PROJECT ADDRESS:
#538 & 540 & 542 WEST 29th STREET
MANHATTAN, NEW YORK CO., NEW YORK
BLOCK ... 700 LOTS ... 57, 56 & 55

DRAWN BY: J.P.
SCALE: 1" = 10'
SURVEYED FOR:
LARGO INVESTMENTS

CERTIFIED TO:
1. MADISON TITLE AGENCY, LLC
2. STEWART TITLE INSURANCE COMPANY

TITLE NO.: MTANY – 132941

PAWEL KOPCINSKI, N.Y.S. L.L.S. 050881

APPENDIX B

PREVIOUS ENVIRONMENTAL REPORTS

(SEPARATE ATTACHMENT)

APPENDIX C

CONSTRUCTION HEALTH AND SAFETY PLAN

CONSTRUCTION HEALTH AND SAFETY PLAN

FOR

538-542 WEST 29TH STREET
NEW YORK, NEW YORK

Prepared For

W29 Owner LLC
148 Madison Avenue, 16th Floor
New York, New York 10016

Prepared By:

Langan Engineering, Environmental, Surveying
Landscape Architecture, and Geology, D.P.C.
21 Penn Plaza
360 West 31st Street, 8th Floor
New York, New York 10001

June 24, 2019
Langan Project No. 170515401

LANGAN

TABLE OF CONTENTS

Page No.

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

***** Items to be posted prominently on site, or made readily available to personnel.

1.0 INTRODUCTION

1.1 General

This CONSTRUCTION HEALTH AND SAFETY PLAN (CHASP) was developed to address disturbance of known and reasonably anticipated subsurface contaminants and comply with Occupational Safety and Health Administration (OSHA) Standard 29 CFR 1910.120(b)(4), *Hazardous Waste Operations and Emergency Response* during anticipated site work at 538-542 West 29th Street, in the borough of Manhattan, New York (Tax Map Block 700 Lots 55, 56, and 57) ("the Site"). This CHASP provides the minimum requirements for implementing site operations during future possible remedial measure activities. All contractors performing work on this site shall implement their own CHASP that, at a minimum, adheres to this CHASP. The contractor is responsible for their own health and safety and that of their subcontractors. Langan personnel will implement this CHASP while onsite.

The management of the day-to-day site activities and implementation of this CHASP in the field is the responsibility of the site Langan Field Team Leader (FTL). Assistance in the implementation of this CHASP can also be obtained from the site Langan Health and Safety Officer (HSO) and the Langan Health and Safety Manager (HSM). Contractors operating on the site shall designate their own FTL, HSO and HSM. The content of this CHASP may change or undergo revision based upon additional information made available to health and safety personnel, monitoring results, or changes in the work plan.

1.2 Site Location and Background

The site is located at 538-542 West 29th Street in the Chelsea neighborhood of New York, New York and is identified as Block 700, Lots 55, 56, and 57 on the New York City Tax Map. The site occupies a footprint of about 9,900 square feet and is improved with one three-story commercial building (Lot 55), one three-story mixed-use commercial and residential building (Lot 56), and one two-story warehouse (Lot 57). All of the buildings are currently vacant. The site is bounded by West 29th Street to the north, mixed-use residential and commercial buildings followed by the elevated High Line and Tenth Avenue to the east, a multi-story residential apartment building followed by West 28th Street to the south, and a multi-story mixed-use residential and commercial building followed by Eleventh Avenue to the west. The No. 7 subway southern extension runs north-south below Eleventh Avenue, which is about 200 feet to the west of the site.

The site and surrounding area have been developed since the early 1800's. The site was developed prior to 1890 with two unspecified use buildings which were demolished between 1899 and 1922. Lot 57 was formerly used as a lumber storage yard (1909-1944) and various auto repair facilities over a span of about 50 years (1945-1994). In 1995, the Lot 57 was purchased by Gotham Seafood Corporation, a seafood wholesaler. Sanborn maps indicate that Lots 55 and 56 were improved with mixed use-residential and commercial developments from about 1890 to 2005. Certificates of Occupancy (CO) provided by the New York City Department of Buildings (NYCDOB) identified an auto repair shop within Lot 56 in 1924 and 2012. In addition, available CO's for Lot 55 dated 1970 and 1987 identified manufacturing and a heating plant with potential fuel storage. Currently, all of the lots are vacant.

Adjoining properties were historically used for residential, commercial, industrial and manufacturing operations.

A site location map is included as Figure 1.

1.3 Summary of Work Tasks

1.3.1 Excavation and Soil Screening

As part of future excavation activities, Langan personnel will screen excavated material for visual, olfactory, and instrumental indicators suggestive of a potential chemical or petroleum release. Instrument screening for the presence of volatile organic compounds (VOCs) may be performed with a calibrated photoionization detector (PID). Contractors will excavate for utilities, foundation components and potential grading using heavy equipment and hand tools. Contractors will notify Langan personnel if they identify indications suggestive of a potential chemical or petroleum release. Contaminated material shall be handled and property disposed in accordance with federal, state and city regulations, criteria and guidelines.

1.3.2 Soil Screening

As part of future excavation activities, Langan personnel will report when they have observed visual and olfactory indications of possible soil impact. When necessary, Langan personnel will also report concentrations of volatile organic vapors (VOCs) above background using a properly calibrated hand held photoionization detector (PID, or equivalent).

1.3.3 Stockpiling

As part of future excavation activities, potentially impacted soil may be stockpiled pending laboratory analysis and determining proper off-site disposal. Visibly contaminated soil, if encountered, shall be segregated and stockpiled on at least 10 millimeters of plastic sheeting; reusable soil and fill shall be segregated and stockpiled separately from unusable fill, concrete and other debris; the stockpiles shall be kept covered with 6 millimeters thick plastic sheeting; the plastic sheeting covering the stockpiles shall be anchored firmly in place by weights, stakes, or both; the Contractor shall maintain the plastic sheeting.

1.3.4 Soil Sampling

Soil samples (waste characterization, excavation endpoint, delineation, or quality assurance/quality control [QA/QC]) may be collected during construction, as required. Langan personnel will coordinate with the contractor in sampling soil (in accordance with the SMP, where applicable). If stockpile soil sampling is required from above ground level, suitable excavation equipment (i.e., excavator, front end loader) should be used to collect the sample. Soil samples for excavation endpoint or delineation sampling (along with QA/QC samples) may be collected into laboratory-supplied batch-certified clean glassware and submitted to a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP).

1.3.5 Characterization of Excavated Material

When required by the work plan, Langan personnel will characterize excavated soil or clean backfill in accordance with Langan standards.

1.3.6 Excavation Backfill

Areas of the site that were over-excavated may be backfilled to development grade (i.e., the grade required to complete construction of the foundation and sidewalk extension). Imported material will consist of clean fill that meets the 6 New York Codes, Rules and Regulations (NYCRR) Part 375-6.8(a) Unrestricted Use Soil Cleanup Objectives (UU SCOs) or other acceptable fill material such as virgin stone from a permitted mine or quarry or recycled concrete aggregate (RCA), from a New York State Department of Environmental Conservation (NYSDEC)-registered facility in compliance with 6 NYCRR Part 360 registration and permitting requirements for the period of RCA acquisition. Imported RCA must be derived from recognizable and uncontaminated concrete. RCA is not acceptable for, and will not be used as, site cover or drainage material.

1.3.7 Decommissioning and Removal of On-Site Underground Storage Tanks

If an underground storage tank (UST) is encountered, a UST decommissioning and removal contractor shall furnish all labor and materials, equipment and incidentals required for the proper decontamination, removal and closure of any UST in accordance with federal, state and local regulations. Langan personnel will monitor VOCs with a calibrated PID downwind from the UST excavation and record the PID readings.

1.3.8 Construction Dewatering

The dewatering contractor shall be responsible for handling contaminated dewatering fluids in accordance with federal, state and local regulations. Dewatering fluids are to be discharged to the local sanitary sewer system after treatment and under approved regulatory permit.

Alternatively, the contractor may provide containerized storage to allow for testing of groundwater prior to, and after, treatment and before disposal. If required, Langan field personnel may sample dewatering treatment system liquids from either a discharge standpipe or a storage tank. Dewatering samples will be submitted to an ELAP-certified laboratory for analysis.

1.3.9 Construction Activity Inspections and Observations

Langan may observe construction activities including the installation of piles, caissons and rock anchors. In addition, Langan may observe and record data from a lateral load test. These activities are to be done in accordance with the work plan. The installation and assembly activities performed by the contractor in accordance with the construction documents, remedial plan, and special inspection requirements administered by the New York City Department of Buildings. Materials used for construction will be inspected by Langan for conformance to the design documents.

1.3.10 Installation of Waterproofing and Vapor Barrier

A properly licensed contractor will install the waterproofing membrane and vapor barrier system in accordance with specifications outlined in the work plan. Langan or other authorized personnel, as specified in the contract documents, may inspect and document the waterproofing and vapor barrier installation and in accordance with the specification outlined in the work plan.

1.3.11 Installation of a Composite or Concrete Cap System

The contractor shall furnish all labor and materials, equipment and incidentals required for the proper installation of the composite or concrete cap system, if installed Langan personnel may document the cap installation.

1.3.12 Drum Sampling

Excess or impacted soil and water that is drummed during activities must be labeled in accordance with the Langan Drum Labeling Standard Operating Procedure (SOP-#9). Langan personnel may collect drum samples, if required, prior to off-site drum disposal. If collected, samples will be placed into laboratory-supplied batch-certified clean glassware and submitted to a NYSDOH ELAP-certified laboratory.

2.0 IDENTIFICATION OF KEY PERSONNEL/HEALTH AND SAFETY PERSONNEL

The following briefly describes the health and safety (H&S) designations and general responsibilities that may be employed for this site. The titles have been established to accommodate the project needs and requirements and ensure the safe conduct of site activities. The H&S personnel requirements for a given work location are based upon the proposed site activities.

2.1 Langan Project Manager

The Langan Environmental Project Managers (PM) is Emily Snead. The Geotechnical Project Manager is Saul Shapiro. Their responsibilities include:

- Ensuring that this CHASP is developed, current, and approved prior to on-site activities.
- Ensuring that all the tasks in the project are performed in a manner consistent with Langan's comprehensive *Health and Safety Program for Hazardous Waste Operations* and this CHASP.

2.2 Langan Corporate Health and Safety Manager

The Langan Corporate Health and Safety Manager (HSM) is Tony Moffa. His responsibilities include:

- Updating the *Construction Health and Safety Program for Hazardous Waste Operations*.
- Assisting the site Health and Safety Officer (HSO) with development of the CHASP, updating CHASP as dictated by changing conditions, jobsite inspection results, etc. and approving changes to this CHASP.
- Assisting the HSO in the implementation of this CHASP and conducting Jobsite Safety Inspections and assisting with communication of results and correction of shortcomings found.
- Maintaining records on personnel (medical evaluation results, training and certifications, accident investigation results, etc.).

2.3 Langan Site Health & Safety Officer

The Langan site HSO is William Bohrer. His responsibilities include:

- Participating in the development and implementation of this CHASP.
- When on-site, assisting the Langan Field Team Leader in conducting Tailgate Safety Meetings and Jobsite Safety Inspections and correcting any shortcomings in a timely manner.
- Ensuring that proper PPE is available, worn by employees, and properly stored and maintained.
- Controlling entry into and exit from the site contaminated areas or zones.
- Monitoring employees for signs of stress, such as heat stress, fatigue, and cold exposure.
- Monitoring site hazards and conditions.

- Knowing (and ensuring that all site personnel also know) emergency procedures, evacuation routes, and the telephone numbers of the ambulance, local hospital, poison control center, fire department, and police department.
- Resolving conflicts that may arise concerning safety requirements and working conditions.
- Reporting all incidents, injuries and near misses to the Langan Incident/Injury Hotline immediately and the client representative.

2.4 Langan Field Team Leader Responsibilities

The Langan Field Team Leader (FTL) is to be determined prior to the start of the start of field activities. The Field Team Leader's responsibilities include:

- The management of the day-to-day site activities and implementation of this CHASP in the field.
- Participating in and/or conducting Tailgate Safety Meetings and Jobsite Safety Inspections and correcting any shortcomings in a timely manner.
- When a Community Air Monitoring Operating Program (CAMP) is part of the scope, the FTL will set up and maintaining community air monitoring activities and instructing the responsible contractor to implement organic vapor or dust mitigation when necessary.
- Overseeing the implementation of activities specified in the work plan.

2.5 Contractor Responsibilities

The contractor shall develop and implement their own CHASP for their employees, lower-tier subcontractors, and consultants. The contractor is responsible for their own health and safety and that of their subcontractors. Contractors operating on the site shall designate their own FTL, HSO and HSM. The contractor's CHASP will be at least as stringent as this Langan CHASP. The contractor must be familiar with and abide by the requirements outlined in their own CHASP. A contractor may elect to adopt Langan's CHASP as its own provided that it has given written notification to Langan, but where Langan's CHASP excludes provisions pertinent to the contractor's work (i.e., confined space entry); the contractor must provide written addendums to this CHASP. Additionally, the contractor must:

- Ensure their employees are trained in the use of all appropriate PPE for the tasks involved;
- Notify Langan of any hazardous material brought onto the job site or site related area, the hazards associated with the material, and must provide a material safety data sheet (MSDS) or safety data sheet (SDS) for the material;
- Have knowledge of, understand, and abide by all current federal, state, and local health and safety regulations pertinent to the work;

- Ensure their employees handling hazardous materials, if identified at the Site, have received current training in the appropriate levels of 29 CFR 1910.120, *Hazardous Waste Operations and Emergency Response* (HAZWOPER) if hazardous waste is identified at the Site;
- Ensure their employees handling hazardous materials, if identified at the Site, have been fit-tested within the year on the type respirator they will wear; and
- Ensure all air monitoring is in place pertaining to the health and safety of their employees as required by OSHA 1910.120; and
- All contractors must adherer to all federal, state, and local regulatory requirements.

3.0 TASK/OPERATION SAFETY AND HEALTH RISK ANALYSES

A Task-Hazard Analysis (Table 1) was completed for general construction hazards that may be encountered at the Site. The potential contaminants that might be encountered during the field activities and the exposure limits are listed in Table 2 complete inventory of MSDS/SDS for chemical products used on site is included as Attachment E.

3.1 Specific Task Safety Analysis

3.1.1 Soil Screening and Sampling

Sampling the soil requires the donning of chemical resistant gloves in addition to the standard PPE. Langan personnel are not to operate drilling or excavation equipment nor open sampling devices (acetate liners, sonic sample bags, etc.). These tasks are to be completed by the driller or excavation contractor.

3.1.2 Indoor Drilling and Excavation

The work scope may require indoor work or work in locations where there may not be adequate ventilation sufficient to safely operate any rig or excavation equipment powered by an internal combustion engine. Where possible, all such work should be done by equipment powered by electricity. If such equipment is used and must be directly wired to the buildings electrical system or to an independent system, this work must be completed by a licensed electrician in accordance with all electrical codes applicable to the work.

Indoor work which is to be completed with equipment powered by an internal combustion engine must incorporate air monitoring of carbon monoxide (CO) using calibrated air monitoring equipment (MultiRAE or equivalent). In addition, the work plan should incorporate mitigation for venting engine exhaust fumes directly to the outdoors and for circulating fresh air into the work area.

The OSHA Time Weighted Average (TWA) Permissible Exposure Limit (PEL) for CO from 50 to

35 parts per million (ppm). Langan will monitor CO with a suitable monitoring device. If CO levels exceed 5 ppm, Langan will instruct contractors to begin mitigation measures. These measures are at a minimum:

- Increase air circulation using industrial size fans to bring additional fresh air into the building or vent exhaust to the outside;
- Modify the passive exhaust method being used to increase venting circulation by using wider diameter tubing or sealing tubing connections; or
- Modify the work schedule where the rig is turned off to allow time for CO levels to fall back to background

All work must cease if CO levels reach 35 ppm. The Langan engineer is to report to the PM and H&S officer when an action level is reached.

3.1.3 Stockpile Sampling

The Langan personnel are not to scale or otherwise climb stockpiles. If the soil sampling plan requires sampling from the stockpile above ground level, samples are to be obtained using suitable excavation equipment operated by the contractor (i.e. front end loader).

3.1.4 Removal of Underground Storage Tank

If UST excavation and removal activity is initiated, Langan personnel will conduct air monitoring for lower explosion limit (LEL) conditions within the UST excavation itself. This task is to be performed using calibrated air monitoring equipment designed to sound an audio alarm when atmospheric concentrations of VOC are within 10% of the LEL. In normal atmospheric oxygen concentrations, the LEL monitoring may be done with a Wheatstone bridge/catalytic bead type sensor (i.e. MultiRAE). However in oxygen depleted atmospheres (confined space), only an LEL designed to work in low oxygen environments may be used. Best practices require that the LEL monitoring unit be equipped with a long sniffer tube to allow the LEL unit to remain outside the UST excavation. Langan personnel are not to enter the UST excavation nor enter an excavated UST.

In addition to monitoring LEL, Langan personnel will monitor atmospheric VOC concentrations directly downwind of the UST excavation in accordance with standard CAMP procedures using calibrated air monitoring equipment.

3.1.5 Construction Dewatering

Langan may sample dewatering treatment system liquids from either the direct discharge standpipe or from a sample port or valve built into the storage tank, Langan will don the necessary PPE including nitrile gloves and if necessary, facial splash guard. Sample ports and valves may only be sampled if they are accessible at ground level. Sampling from heights over 6 feet is prohibited unless Langan field personnel are fully accredited in fall protection and is wearing approved fall protection safety apparatus. The discharge samples will be submitted to an ELAP-certified laboratory for analysis in accordance with the work plan.

3.3.6 Backfilling of Excavated Areas to Development Grade

The backfilling contractor will provide their employees with equivalent PPE to protect them from the specific hazards likely to be encountered on-site. Selection of the appropriate PPE must take into consideration: (1) identification of the hazards or suspected hazards; (2) potential exposure routes; and, (3) the performance of the PPE construction (materials and seams) in providing a barrier to these hazards. Langan personnel may survey backfilling material with a calibrated PID; however, as they are not permitted to climb the material delivery truck, the contractor must provide samples from each truck as required.

3.1.7 Construction Activity Inspection

The contractor will operate equipment used to install sheet piles, caissons and rock anchors. In addition, the contractor will assemble and install the equipment to perform lateral load-test. Langan personnel will inspect in accordance with specification in the work plan and record the data the work plan requires. The installation of the sheet piles, caissons and rock anchors is to be done exclusively by the contractor following their own health and safety specifications outlined in their HASPs. Other activities assigned to Langan as part of construction activities are limited to inspection and observations as specified in the work pan. Langan personnel are not to operate or assist in the operation of equipment used in construction activities unless defined as part of an inspection or observation in the work plan.

3.1.8 Installation of Waterproofing and Vapor Barrier

Langan personnel are there only to observe and record the data required in the work plan for the installation of waterproofing and vapor barrier. Installation and assemblage of the waterproofing and vapor barrier are to be completed in accordance with the work plan, manufacturer specification and by the contractor following their own health and safety specifications outlined in their HASPs.

3.1.9 Installation of Composite or Concrete Cap System

The composite or concrete cap contractor will provide their employees with equivalent PPE to protect them from the specific hazards likely to be encountered on-site. Selection of the appropriate PPE must take into consideration: (1) identification of the hazards or suspected hazards; (2) potential exposure routes; and, (3) the performance of the PPE construction (materials and seams) in providing a barrier to these hazards. Langan personnel are not to assist in the physical installation of the composite cover system.

3.1.10 Drum Sampling

Drilling fluid, rinse water, grossly-contaminated soils samples and cuttings may be containerized in 55-gallon drums for transport and disposal off site. Each drum must be labeled in accordance with the Langan Drum Labeling Standard Operating Procedure (SOP #9). Langan may collect drum samples, as required, prior to off-site drum disposal. Samples will be placed into laboratory-supplied batch-certified clean glassware and submitted to a NYSDOH ELAP-certified laboratory.

Langan employees and contractors are not to move or open any orphaned (unlabeled) drum found on the site without approval of the project manager.

3.2 Radiation Hazards

No radiation hazards are known or expected at the site.

3.3 Physical Hazards

Physical hazards, which may be encountered during site operations for this project, are detailed in Table 1.

3.3.1 Explosion

No explosion hazards are expected for the scope of work at this site.

3.3.2 Heat Stress

The use of Level C protective equipment, or greater, may create heat stress. Monitoring of personnel wearing personal protective clothing should commence when the ambient temperature is 72^{O}F or above. Table 6 presents the suggested frequency for such monitoring. Monitoring frequency should increase as ambient temperature increases or as slow recovery rates are observed. Refer to the Table 7 to assist in assessing when the risk for heat related illness is likely. To use this table, the ambient temperature and relative humidity must be obtained (a regional weather report should suffice). Heat stress monitoring should be performed by the HSO or the FTL, who shall be able to recognize symptoms related to heat stress.

To monitor the workers, be familiar with the following heat-related disorders and their symptoms:

- **Heat Cramps:** Painful spasm of arm, leg or abdominal muscles, during or after work
- **Heat Exhaustion:** Headache, nausea, dizziness; cool, clammy, moist skin; heavy sweating; weak, fast pulse; shallow respiration, normal temperature
- **Heat Stroke**: Headache, nausea, weakness, hot dry skin, fever, rapid strong pulse, rapid

deep respirations, loss of consciousness, convulsions, coma. *This is a life threatening condition***.**

Do not permit a worker to wear a semi-permeable or impermeable garment when they are showing signs or symptoms of heat-related illness.

To monitor the worker, measure:

- **Heart rate:** Count the radial pulse during a 30-second period as early as possible in the rest period. If the heart rate exceeds 100 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third and keep the rest period the same. If the heart rate still exceeds 100 beats per minute at the next rest period, shorten the following work cycle by one-third. A worker cannot return to work after a rest period until their heart rate is below 100 beats per minute.
- **Oral temperature:** Use a clinical thermometer (3 minutes under the tongue) or similar device to measure the oral temperature at the end of the work period (before drinking). If oral temperature exceeds 99.6^{O}F (37.6^{O}C), shorten the next work cycle by one-third without changing the rest period. A worker cannot return to work after a rest period until their oral temperature is below 99.6^{O}F. If oral temperature still exceeds 99.6^{O}F (37.6^{O}C) at the beginning of the next rest period, shorten the following cycle by one-third. Do not permit a worker to wear a semi-permeable or impermeable garment when oral temperature exceeds 100.6^{O}F (38.1^{O}C).

Prevention of Heat Stress - Proper training and preventative measures will aid in averting loss of worker productivity and serious illness. Heat stress prevention is particularly important because once a person suffers from heat stroke or heat exhaustion, that person may be predisposed to additional heat related illness. To avoid heat stress the following steps should be taken:

- Adjust work schedules.
- Mandate work slowdowns as needed.
- Perform work during cooler hours of the day if possible or at night if adequate lighting can be provided.
- Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods.
- Maintain worker's body fluids at normal levels. This is necessary to ensure that the cardiovascular system functions adequately. Daily fluid intake must approximately equal the amount of water lost in sweat, id., eight fluid ounces (0.23 liters) of water must be ingested for approximately every eight ounces (0.23 kg) of weight lost. The normal thirst mechanism is not sensitive enough to ensure that enough water will be drunk to replace lost sweat. When heavy sweating occurs, encourage the worker to drink more. The following strategies may be useful:

- Maintain water temperature 50^{O} to 60^{O}F (10^{O} to 16.6^{O}C).
- Provide small disposal cups that hold about four ounces (0.1 liter).
- Have workers drink 16 ounces (0.5 liters) of fluid (preferably water or dilute drinks) before beginning work.
- Urge workers to drink a cup or two every 15 to 20 minutes, or at each monitoring break. A total of 1 to 1.6 gallons (4 to 6 liters) of fluid per day are recommended, but more may be necessary to maintain body weight.
- Train workers to recognize the symptoms of heat related illness.

3.3.3 Cold-Related Illness

If work on this project begins in the winter months, thermal injury due to cold exposure can become a problem for field personnel. Systemic cold exposure is referred to as hypothermia. Local cold exposure is generally called frostbite.

- **Hypothermia -** Hypothermia is defined as a decrease in the patient core temperature below 96^{O}F. The body temperature is normally maintained by a combination of central (brain and spinal cord) and peripheral (skin and muscle) activity. Interference with any of these mechanisms can result in hypothermia, even in the absence of what normally is considered a "cold" ambient temperature. Symptoms of hypothermia include: shivering, apathy, listlessness, sleepiness, and unconsciousness.
- **Frostbite -** Frostbite is both a general and medical term given to areas of local cold injury. Unlike systemic hypothermia, frostbite rarely occurs unless the ambient temperatures are less than freezing and usually less than 20^{O}F. Symptoms of frostbite are: a sudden blanching or whitening of the skin; the skin has a waxy or white appearance and is firm to the touch; tissues are cold, pale, and solid.

Prevention of Cold-Related Illness - To prevent cold-related illness:

- Educate workers to recognize the symptoms of frostbite and hypothermia
- Identify and limit known risk factors:
- Assure the availability of enclosed, heated environment on or adjacent to the site.
- Assure the availability of dry changes of clothing.
- Assure the availability of warm drinks.
- Start (oral) temperature recording at the job site:
- At the FSO or Field Team Leader's discretion when suspicion is based on changes in a worker's performance or mental status.
- At a worker's request.
- As a screening measure, two times per shift, under unusually hazardous conditions (e.g., wind-chill less than 20^{O}F, or wind-chill less than 30^{O}F with precipitation).
- As a screening measure whenever anyone worker on the site develops hypothermia.

Any person developing moderate hypothermia (a core temperature of 92^{O}F) cannot return to work for 48 hours.

3.3.4 Noise

Work activities during the proposed activities may be conducted at locations with high noise levels from the operation of equipment. Hearing protection will be used as necessary.

3.3.5 Hand and Power Tools

The use of hand and power tools can present a variety of hazards, including physical harm from being struck by flying objects, being cut or struck by the tool, fire, and electrocution. All hand and power tools should be inspected for health and safety hazards prior to use. If deemed unserviceable/un-operable, notify supervisor and tag equipment out of service. Ground Fault Circuit Interrupters (GFCIs) are required for all power tools requiring direct electrical service.

3.3.6 Slips, Trips and Fall Hazards

Care should be exercised when walking at the site, especially when carrying equipment. The presence of surface debris, uneven surfaces, pits, facility equipment, and soil piles contribute to tripping hazards and fall hazards. To the extent possible, all hazards should be identified and marked on the site, with hazards communicated to all workers in the area.

3.3.7 Utilities (Electrocution and Fire Hazards)

The possibility of encountering underground utilities poses fire, explosion, and electrocution hazards. All excavation work will be preceded by review of available utility drawings and by notification of the subsurface work to the N.Y. One –Call--Center. Potential adverse effects of electrical hazards include burns and electrocution, which could result in death.

3.4 Biological Hazards

3.4.1 Animals

No animals are expected to be encountered during site operations.

3.4.2 Insects

Insects are not expected to be encountered during site operations.

3.5 Additional Safety Analysis

3.5.1 Presence of Non-Aqueous Phase Liquids (NAPL)

There is potential for exposure to NAPL at this site. Special care and PPE should be considered when NAPL is observed as NAPL is a typically flammable fluid and releases VOCs known to be toxic and/or carcinogenic. If NAPL is present in a monitoring well, vapors from the well casing may contaminate the work area breathing zone with concentrations of VOCs potentially exceeding health and safety action levels. In addition, all equipment used to monitor or sample NAPL (or ground water from wells containing NAPL) must be intrinsically safe. Equipment that directly contacts NAPL must also be resistant to organic solvents.

At a minimum, a PID should be used to monitor for VOCs when NAPL is observed. If NAPL is expected to be observed in an excavation or enclosed area, air monitoring must be started using calibrated air monitoring equipment designed to sound an audio alarm when atmospheric concentrations of VOC are within 10% of the LEL. In normal atmospheric oxygen concentrations, the LEL monitoring may be done with a Wheatstone bridge/catalytic bead type sensor (i.e. MultiRAE). However in oxygen depleted atmospheres (confined space), only an LEL designed to work in low oxygen environments may be used. Best practices require that the LEL monitoring unit be equipped with a long sniffer tube to allow the LEL unit to remain outside the UST excavation.

When NAPL is present, Langan personnel are required to use disposable nitrile gloves at all times to prevent skin contact with contaminated materials. They should also consider having available a respirator and protective clothing (Tyvek® overalls), especially if NAPL is in abundance and there are high concentrations of VOCs.

All contaminated disposables including PPE and sampling equipment must be properly disposed of in labeled 55-gallong drums

3.6 Job Safety Analysis

A Job Safety Analysis (JSA) is a process to identify existing and potential hazards associated with each job or task so these hazards can be eliminated, controlled or minimized. A JSA will be performed at the beginning of each work day, and additionally whenever an employee begins a new task or moves to a new location. All JSAs must be developed and reviewed by all parties involved. A blank JSA form and documentation of completed JSAs are in Attachment G.

4.0 PERSONNEL TRAINING

4.1 Basic Training

Completion of an initial 40-hour HAZWOPER training program as detailed in OSHA's 29 CFR 1910.120(e) is required for all employees working on a site engaged in hazardous substance removal or other activities which expose or potentially expose workers to hazardous substances, health hazards, or safety hazards as defined by 29 CFR 1910.120(a). Annual 8-hour refresher training is also required to maintain competencies to ensure a safe work environment. In addition to these training requirements, all employees must complete the OSHA 10 hour Construction Safety and Health training and supervisory personnel must also receive eight additional hours of specialized management training. Training records are maintained by the HSM.

4.2 Initial Site-Specific Training

Training will be provided to specifically address the activities, procedures, monitoring, and equipment for site operations at the beginning of each field mobilization and the beginning of each discrete phase of work. The training will include the site and facility layout, hazards, and emergency services at the site, and will detail all the provisions contained within this CHASP. For a HAZWOPER operation, training on the site must be for a minimum of 3 days. Specific issues that will be addressed include the hazards described in Section 3.0.

4.3 Tailgate Safety Briefings

Before starting work each day or as needed, the Langan HSO will conduct a brief tailgate safety meeting to assist site personnel in conducting their activities safely. Tailgate meetings will be documented in Attachment H. Briefings will include the following:

- Work plan for the day;
- Review of safety information relevant to planned tasks and environmental conditions;
- New activities/task being conducted;
- Results of Jobsite Safety Inspection Checklist;
- Changes in work practices;
- Safe work practices; and
- Discussion and remedies for noted or observed deficiencies.

5.0 MEDICAL SURVEILLANCE

All personnel who will be performing field work involving potential exposure to toxic and hazardous substances (defined by 29 CFR 1910.120(a)) will be required to have passed an initial baseline medical examination, with follow-up medical exams thereafter, consistent with 29 CFR 1910.120(f). Medical evaluations will be performed by, or under the direction of, a physician board-certified in occupational medicine.

Additionally, personnel who may be required to perform work while wearing a respirator must receive medical clearance as required under CFR 1910.134(e), *Respiratory Protection*. Medical evaluations will be performed by, or under the direction of, a physician board-certified in occupational medicine. Results of medical evaluations are maintained by the HSM.

6.0 PERSONAL PROTECTIVE EQUIPMENT

6.1 Levels of Protection

Langan will provide PPE to Langan employees to protect them from the specific hazards they are likely to encounter on-site. Direct hired contractors will provide their employees with equivalent PPE to protect them from the specific hazards likely to be encountered on-site. Selection of the appropriate PPE must take into consideration: (1) identification of the hazards or suspected hazards; (2) potential exposure routes; and, (3) the performance of the PPE construction (materials and seams) in providing a barrier to these hazards.

Based on anticipated site conditions and the proposed work activities to be performed at the site, Level D protection will be used. The upgrading/downgrading of the level of protection will be based on continuous air monitoring results as described in Section 6.0 (when applicable). The decision to modify standard PPE will be made by the site HSO or FTL after conferring with the PM. The levels of protection are described below.

Level D Protection (as needed)

- Safety glasses with side shields or chemical splash goggles
- Safety boots/shoes
- Coveralls (Tyvek® or equivalent)
- Hard hat
- Long sleeve work shirt and work pants
- Nitrile gloves
- Hearing protection
- Reflective safety vest

Level D Protection (Modified, as needed)

- Safety glasses with sideshields or chemical splash goggles
- Safety boots/shoes (toe-protected)
- Disposable chemical-resistant boot covers
- Coveralls (polycoated Tyvek or equivalent to be worn when contact with wet contaminated soil, groundwater, or non-aqueous phase liquids is anticipated)
- Hard hat
- Long sleeve work shirt and work pants
- Nitrile gloves

- Hearing protection (as needed)
- Personal floatation device (for work within 5 ft of the water)
- Reflective traffic vest

Level C Protection (as needed)

- Full or Half face, air-purifying respirator, with NIOSH approved HEPA filter
- Inner (latex) and outer (nitrile) chemical-resistant gloves
- Safety glasses with side shields or chemical splash goggles
- Chemical-resistant safety boots/shoes
- Hard hat
- Long sleeve work shirt and work pants
- Coveralls (Tyvek® or equivalent)
- Hearing protection (as needed)
- Reflective safety vest

The action levels used in determining the necessary levels of respiratory protection and upgrading to Level C are summarized in Table 4. The written Respiratory Protection Program is maintained by the HSM and is available if needed. The monitoring procedures and equipment are outlined in Section 6.0 (when applicable).

6.2 Respirator Fit-Test

All Langan employees who may be exposed to hazardous substances at the work site are in possession of a full or half face-piece, air-purifying respirator and have been successfully fit-tested within the past year. Fit-test records are maintained by the HSM.

6.3 Respirator Cartridge Change-Out Schedule

Respiratory protection is required to be worn when certain action levels (table 2) are reached. A respirator cartridge change-out schedule has been developed in order to comply with 29 CFR 1910.134. The respirator cartridge change-out schedule for this project is as follows:

- Cartridges shall be removed and disposed of at the end of each shift, when cartridges become wet or wearer experiences breakthrough, whichever occurs first.
- If the humidity exceeds 85%, then cartridges shall be removed and disposed of after 4 hours of use.

Respirators shall not be stored at the end of the shift with contaminated cartridges left on. Cartridges shall not be worn on the second day, no matter how short the time period was the previous day they were used.

7.0 AIR QUALITY MONITORING AND ACTIONS LEVELS

7.1 Monitoring During Site Operations

Atmospheric air monitoring results may be collected and used to provide data to determine when exclusion zones need to be established and when certain levels of personal protective equipment are required. For all instruments there are Site-specific action level criteria which are used in making field health and safety determinations. Other data, such as the visible presence of contamination or the steady state nature of air contaminant concentration, are also used in making field health and safety decisions. Therefore, the HSO may establish an exclusion zone or require a person to wear a respirator even though atmospheric air contaminant concentrations are below established CHASP action levels.

During site work involving disturbance of petroleum-impacted or fill material, real time air monitoring may be conducted for volatile organic compounds (VOCs). A photoionization detector (PID) and/or flame ionization detector (FID) will be used to monitor concentrations of VOCs at personnel breathing-zone height. Air monitoring will be the responsibility of the HSO or designee. Air monitoring may be conducted during intrusive activities associated with the completion of excavation, debris removal, and soil grading. All manufacturers' instructions for instrumentation and calibration will be available onsite.

Subcontractors' air monitoring plans must be equal or more stringent as the Langan plan.

An air monitoring calibration log is provided in Attachment D of this CHASP.

7.1.1 Volatile Organic Compounds

Monitoring with a PID, such as a MiniRAE 2000 (10.6v) or equivalent may occur during intrusive work in the AOCs. Colormetric Indicator Tubes for benzene may be used as backup for the PID, if measurements remain above background monitor every 2 hours. The HSO will monitor the employee breathing zone <u>at least</u> every 30 minutes, or whenever there is any indication that concentrations may have changed (odors, visible gases, etc.) since the last measurement. If VOC levels are observed above 5 ppm for longer than 5 minutes or if the site PPE is upgraded to Level C, the HSO will begin monitoring the site perimeter at a location downwind of the AOC every 30 minutes in addition to the employee breathing zone. Instrument action levels for monitored gases are provided in Table 4.

7.1.2 Metals

Based upon the site historical fill, there is a potential for the soils to contain PAHs and metals. During invasive procedures which have the potential for creating airborne dust, such as excavation of dry soils, a real time airborne dust monitor such as a Mini-Ram may be used to monitor for air particulates. The HSO will monitor the employee breathing zone <u>at least</u> every 30 minutes, or whenever there is any indication that concentrations may have changed (appearance of visible dust) since the last measurement. If dust levels are observed to be greater than 0.100 mg/m^3 or visible dust is observed for longer than 15 minutes or if the site PPE is upgraded to Level C, the HSO will begin monitoring the site perimeter at a location downwind of the AOC every 30 minutes in addition to the employee breathing zone. Instrument action levels for dust monitoring are provided in Table 4.

7.2 Monitoring Equipment Calibration and Maintenance

Instrument calibration shall be documented and included in a dedicated safety and health logbook or on separate calibration pages of the field book. All instruments shall be calibrated before and after each shift. Calibration checks may be used during the day to confirm instrument accuracy. Duplicate readings may be taken to confirm individual instrument response.

All instruments shall be operated in accordance with the manufacturers' specifications. Manufacturers' literature, including an operations manual for each piece of monitoring equipment will be maintained on site by the HSO for reference.

7.3 Determination of Background Levels

Background (BKD) levels for VOCs and dust will be established prior to intrusive activities within the AOC at an upwind location. A notation of BKD levels will be referenced in the daily monitoring log. BKD levels are a function of prevailing conditions. BKD levels will be taken in an appropriate upwind location as determined by the HSO.

Table 4 lists the instrument action levels.

8.0 COMMUNITY AIR MONITORING PROGRAM

Community air monitoring may be conducted in compliance with the NYSDOH Generic CAMP outlined below:

Monitoring for dust and odors will be conducted during all ground intrusive activities by the FTL. Continuous monitoring on the perimeter of the work zones for odor, VOCs, and dust may be required for all ground intrusive activities such as soil excavation and handling activities. The work zone is defined as the general area in which machinery is operating in support of remediation activities. A portable PID will be used to monitor the work zone and for periodic monitoring for VOCs during activities such as soil and groundwater sampling and .soil excavation. The site perimeter will be monitored for fugitive dust emissions by visual observations as well as instrumentation measurements (if required). When required, particulate or dust will be monitored continuously with real-time field instrumentation that will meet, at a minimum, the performance standards from DER-10 Appendix 1B.

If VOC monitoring is required, the following actions will be taken based on VOC levels measured:

- If total VOC levels exceed 5 ppm above background for the 15-minute average at the perimeter, work activities will be temporarily halted and monitoring continued. If levels readily decrease (per instantaneous readings) below 5 ppm above background, work activities will resume with continued monitoring.
- If total VOC levels at the downwind perimeter of the hot zone persist at levels in excess of 5 ppm above background but less than 25 ppm, work activities will be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps work activities will resume provided that the total organic vapor level 200 feet downwind of the hot 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 above background for the 15-minute average.
- If the total VOC level is above 25 ppm at the perimeter of the hot zone, activities will be shut down.

If dust monitoring with field instrumentation is required, the following actions will be taken based on instrumentation measurements:

- If the downwind particulate level is 100 micrograms per cubic meter ($\mu g/m^3$) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression must be employed. Work may continue with dust suppression techniques provided that downwind PM10 levels do not exceed 150 $\mu g/m^3$ above the background level and provided that no visible dust is migrating from the work area.
- If, after implementation of dust suppression techniques, downwind PM10 levels are greater than 150 $\mu g/m^3$ above the background 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 PM10 concentration to within 150 $\mu g/m^3$ of the upwind level and in preventing visible dust migration.

8.1 Vapor Emission Response Plan

This section applies if VOC monitoring is required. If the ambient air concentration of organic vapors exceeds 5 ppm above background at the perimeter of the hot zone, boring and well installation, and excavation activities will be halted or odor controls will be employed, and monitoring continued. When work shut-down occurs, downwind air monitoring as directed by the HSO or FTL will be implemented to ensure that vapor emission does not impact the nearest residential or commercial structure at levels exceeding those specified in the Major Vapor Emission section.

If the organic vapor level decreases below 5 ppm above background, sampling and boring and well installation can resume, provided:

- The organic vapor level 200 feet downwind of the hot zone or half the distance to the nearest residential or commercial structure, whichever is less, is below 1 ppm over background, and
- More frequent intervals of monitoring, as directed by the HSO or FTL, are conducted.

8.2 Major Vapor Emission

This section applies if VOC monitoring is required. If any organic levels greater than 5 ppm over background are identified 200 feet downwind from the work site, or half the distance to the nearest residential or commercial property, whichever is less, all work activities must be halted or odor controls must be implemented.

If, following the cessation of the work activities, or as the result of an emergency, organic levels persist above 5 ppm above background 200 feet downwind or half the distance to the nearest residential or commercial property from the hot zone, then the air quality must be monitored within 20 feet of the perimeter of the nearest residential or commercial structure (20 Foot Zone).

If either of the following criteria is exceeded in the 20 Foot Zone, then the Major Vapor Emission Response Plan shall automatically be implemented.

- Sustained organic vapor levels approaching 5 ppm above background for a period of more than 30 minutes, or
- Organic vapor levels greater than 5 ppm above background for any time period.

8.3 Major Vapor Emission Response Plan

Upon activation, the following activities will be undertaken:

- The local police authorities will immediately be contacted by the HSO or FTL and advised of the situation;
- Frequent air monitoring will be conducted at 30-minute intervals within the 20 Foot Zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the HSO or FTL; and
- All Emergency contacts will go into effect as appropriate.

8.4 Dust Suppression Techniques

Preventative measures for dust generation may include wetting site fill and soil, construction of an engineered construction entrance with gravel pad, a truck wash area, covering soils with tarps, and limiting vehicle speeds to five miles per hour.

Work practices to minimize odors and vapors include limiting the time that the excavations remain open, minimizing stockpiling of contaminated-source soil, and minimizing the handling of contaminated material. Offending odor and organic vapor controls may include the application of foam suppressants or tarps over the odor or VOC source areas. Foam suppressants may include biodegradable foams applied over the source material for short-term control of the odor and VOCs.

If odors develop and cannot be otherwise controlled, additional means to eliminate odor nuisances will include: direct load-out of soils to trucks for off-site disposal; use of chemical odorants in spray or misting systems; and, use of staff to monitor odors in surrounding neighborhoods.

Where odor nuisances have developed during remedial work and cannot be corrected, or where the release of nuisance odors cannot otherwise be avoided due to on-site conditions or close proximity to sensitive receptors, odor control will be achieved by sheltering excavation and handling areas under tented containment structures equipped with appropriate air venting/filtering systems.

9.0 WORK ZONES AND DECONTAMINATION

9.1 Site Control

Work zones are intended to control the potential spread of contamination throughout the site and to assure that only authorized individuals are permitted into potentially hazardous areas.

Any person working in an area where the potential for exposure to site contaminants exists will only be allowed access after providing the HSO with proper training and medical documentation.

Exclusion Zone (EZ) - All activities which may involve exposure to site contaminants, hazardous materials and/or conditions should be considered an EZ. Decontamination of field equipment will also be conducted in the Contaminant Reduction Zone (CRZ) which will be located on the perimeter of the EZ. The EZ and the CRZ will be clearly delineated by cones, tapes or other means. The HSO may establish more than one EZ where different levels of protection may be employed or different hazards exist. The size of the EZ shall be determined by the HSO allowing adequate space for the activity to be completed, field members and emergency equipment.

9.2 Contamination Zone

9.2.1 Personnel Decontamination Station

Personal hygiene, coupled with diligent decontamination, will significantly reduce the potential for exposure.

9.2.2 Minimization of Contact with Contaminants

During completion of all site activities, personnel should attempt to minimize the chance of contact with contaminated materials. This involves a conscientious effort to keep "clean" during site activities. All personnel should minimize kneeling, splash generation, and other physical contact with contamination as PPE is intended to minimize accidental contact. This may ultimately minimize the degree of decontamination required and the generation of waste materials from site operations.

Field procedures will be developed to control over spray and runoff and to ensure that unprotected personnel working nearby are not affected.

9.2.3 Personnel Decontamination Sequence

Decontamination may be performed by removing all PPE used in EZ and placing it in drums/trash cans at the CRZ. Baby wipes should be available for wiping hands and face. Drums/trash cans- will be labeled by the field crews in accordance with all local, state, and federal requirements. Management plans for contaminated PPE, and tools are provided below.

9.2.4 Emergency Decontamination

If circumstances dictate that contaminated clothing cannot be readily removed, then remove gross contamination and wrap injured personnel with clean garments/blankets to avoid contaminating other personnel or transporting equipment. If the injured person can be moved, he/she will be decontaminated by site personnel as described above before emergency responders handle the victim. If the person cannot be moved because of the extent of the injury (a back or neck injury), provisions shall be made to ensure that emergency response personnel will be able to respond to the victim without being exposed to potentially hazardous atmospheric conditions. If the potential for inhalation hazards exist, such as with open excavation, this area will be covered with polyethylene sheeting to eliminate any potential inhalation hazards. All emergency personnel are to be immediately informed of the injured person's condition, potential contaminants, and provided with all pertinent data.

9.2.5 Hand-Held Equipment Decontamination

Hand-held equipment includes all monitoring instruments as stated earlier, samples, hand tools, and notebooks. The hand-held equipment is dropped at the first decontamination station to be decontaminated by one of the decontamination team members. These items must be decontaminated or discarded as waste prior to removal from the CRZ.

To aid in decontamination, monitoring instruments can be sealed in plastic bags or wrapped in polyethylene. This will also protect the instruments against contaminants. The instruments will be wiped clean using wipes or paper towels if contamination is visually evident. Sampling equipment, hand tools, etc. will be cleaned with non-phosphorous soap to remove any potentially contaminated soil, and rinsed with deionized water. All decontamination fluids will be containerized and stored on-site pending waste characterization sampling and appropriate off-site disposal.

9.2.6 Heavy Equipment Decontamination

All heavy equipment and vehicles arriving at the work site will be free from contamination from offsite sources. Any vehicles arriving to work that are suspected of being impacted will not be permitted on the work site. Potentially contaminated heavy equipment will not be permitted to leave the EZ unless it has been thoroughly decontaminated and visually inspected by the HSO or his designee.

9.3 Support Zone

The support zone or cold zone will include the remaining areas of the job site. Break areas and support facilities (include equipment storage and maintenance areas) will be located in this zone. No equipment or personnel will be permitted to enter the cold zone from the hot zone without passing through the decontamination station in the warm zone (if necessitated). Eating, smoking, and drinking will be allowed only in this area.

9.4 Communications

The following communications equipment will be utilized as appropriate.

- Telephones - A cellular telephone will be located with the HSO for communication with the HSM and emergency support services/facilities.
- Hand Signals - Hand signals shall be used by field teams, along with the buddy system. The entire field team shall know them before operations commence and their use covered during site-specific training. Typical hand signals are the following:

Hand Signal	Meaning
Hand gripping throat	Out of air; cannot breathe
Grip partners wrists or place both hands around waist	Leave immediately without debate
Hands on top of head	Need assistance
Thumbs up	OK; I'm alright; I understand
Thumbs down	No; negative
Simulated "stick" break with fists	Take a break; stop work

9.5 The Buddy System

When working in teams of two or more, workers will use the "buddy system" for all work activities to ensure that rapid assistance can be provided in the event of an emergency. This requires work groups to be organized such that workers can remain close together and maintain visual contact with one another. Workers using the "buddy system" have the following responsibilities:

- Provide his/her partner with assistance.
- Observe his/her partner for signs of chemical or heat exposure.
- Periodically check the integrity of his/her partner's PPE.
- Notify the HSO or other site personnel if emergency service is needed.

10.0 NEAREST MEDICAL ASSISTANCE

The address and telephone number of the nearest hospital:

Bellevue Hospital Center
462 First Avenue
New York, New York
212-562-4141

Map with directions to the hospital are shown in Figure 2. This information will either be posted prominently at the site or will be available to all personnel all of the time. Further, all field personnel, including the HSO & FTL, will know the directions to the hospital.

11.0 STANDING ORDERS/SAFE WORK PRACTICES

The standing orders, which consist of a description of safe work practices that must always be followed while on-site by Langan employees and contractors, are shown in Attachment A. The site HSO and FTL each have the responsibility for enforcing these practices. The standing orders will be posted prominently at the site, or are made available to all personnel at all times. Those who do not abide by these safe work practices will be removed from the site.

12.0 SITE SECURITY

No unauthorized personnel shall be permitted access to the work areas.

13.0 UNDERGROUND UTILITIES

As provided in Langan's Underground Utility Clearance Guidelines, the following safe work practices should be followed by Langan personnel and the contractor before and during subsurface work in accordance with federal, state and local regulations:

- Obtain available utility drawings from the property owner/client or operator.
- Provide utility drawings to the project team.
- In the field, mark the proposed area of subsurface disturbance (when possible).
- Ensure that the utility clearance system has been notified.
- Ensure that utilities are marked before beginning subsurface work.
- Discuss subsurface work locations with the owner/client and contractors.
- Obtain approval from the owner/client and operators for proposed subsurface work locations.
- Use safe digging procedures when applicable.
- Stay at least 10 feet from all equipment performing subsurface work.

14.0 SITE SAFETY INSPECTION

The Langan HSO or alternate will check the work area daily, at the beginning and end of each work shift or more frequently to ensure safe work conditions. The HSO or alternate must complete the Jobsite Safety Inspection Checklist, found in Attachment F. Any deficiencies shall be shared with the FTL, HSM and PM and will be discussed at the daily tailgate meeting.

15.0 HAND AND POWER TOOLS

All hand- and electric-power tools and similar equipment shall be maintained in a safe operating condition. All electric-power tools must be inspected before initial use. Damaged tools shall be removed immediately from service or repaired. Tools shall be used only for the purpose for which they were designed. All users must be properly trained in their safe operation.

16.0 EMERGENCY RESPONSE

16.1 General

This section establishes procedures and provides information for use during a project emergency. Emergencies happen unexpectedly and quickly, and require an immediate response; therefore, contingency planning and advanced training of staff is essential. Specific elements of emergency support procedures that are addressed in the following subsections include communications, local emergency support units, preparation for medical emergencies, first aid for injuries incurred on site, record keeping, and emergency site evacuation procedures. In case of emergency, in addition to 911 the Langan Incident/Injury Hotline ***(800) 9-LANGAN*** (800-952-6426) extension 4699 should be called as soon as possible.

16.2 Responsibilities

16.2.1 Health and Safety Officer (HSO)

The HSO is responsible for ensuring that all personnel are evacuated safely and that machinery and processes are shut down or stabilized in the event of a stop work order or evacuation. The HSO is responsible for ensuring the HSM are notified of all incidents, all injuries, near misses, fires, spills, releases or equipment damage. The HSO is required to immediately notify the HSM of any fatalities or catastrophes (three or more workers injured and hospitalized) so that the HSM can notify OSHA within the required time frame.

16.2.2 Emergency Coordinator

The HSO or their designated alternate will serve as the Emergency Coordinator. The Emergency Coordinator is responsible for ensuring that all personnel are evacuated safely and that machinery and processes are shut down or stabilized in the event of a stop work order or evacuation. They are also responsible for ensuring the HSM are notified of all incidents, all injuries, near misses, fires, spills, releases or equipment damage. The Emergency Coordinator is required to immediately notify the HSM of any fatalities or catastrophes (three or more workers injured and hospitalized.

The Emergency Coordinator shall locate emergency phone numbers and identify hospital routes prior to beginning work on the sites. The Emergency Coordinator shall make necessary arrangements to be prepared for any emergencies that could occur.

The Emergency Coordinator is responsible for implementing the Emergency Response Plan.

16.2.3 Site Personnel

Project site personnel are responsible for knowing the Emergency Response Plan and the procedures contained herein. Personnel are expected to notify the Emergency Coordinator of situations that could constitute a site emergency. Project site personnel, including all subcontractors will be trained in the Emergency Response Plan.

16.3 Communications

Once an emergency situation has been stabilized, or as soon as practically possible, the HSO will contact the Langan Incident/Injury Hotline (1-800-952-6426) or (973-560-4699) and Project Manager of identify any emergency situation.

16.4 Local Emergency Support Units

In order to be able to deal with any emergency that might occur during investigative activities at the site, the Emergency Notification Numbers (Table 5) will be posted and provided to all personnel conducting work within the EZ.

Figure 2 shows the hospital route map. Outside emergency number 911 and local ambulance should be relied on for response to medical emergencies and transport to emergency rooms. Always contact first responders when there are serious or life threatening emergencies on the site. Project personnel are instructed not to drive injured personnel to the Hospital. In the event of an injury, provide first aid and keep the injured party calm and protected from the elements and treat for shock when necessary.

16.5 Pre-Emergency Planning

Langan will communicate directly with administrative personnel from the emergency room at the hospital in order to determine whether the hospital has the facilities and personnel needed to treat cases of trauma resulting from any of the contaminants expected to be found on the site. Instructions for finding the hospital will be posted conspicuously in the site office and in each site vehicle.

16.6 Emergency Medical Treatment

The procedures and rules in this CHASP are designed to prevent employee injury. However, should an injury occur, no matter how slight, it will be reported to the HSO immediately. First-aid equipment will be available on site at the following locations:

- First Aid Kit: Contractor Mobile Office or Vehicles
- Emergency Eye Wash: Contractor Mobile office or Vehicles

During the site safety briefing, project personnel will be informed of the location of the first aid station(s) that has been set up. Some injuries, such as severe cuts and lacerations or burns, may require immediate treatment. Any first aid instructions that can be obtained from doctors or paramedics, before an emergency-response squad arrives at the site or before the injured person can be transported to the hospital, will be followed closely.

16.7 Personnel with current first aid and CPR certification will be identified.

Only in non-emergency situations may an injured person be transported to an urgent care facility. Due to hazards that may be present at the site and the conditions under which operations are conducted, it is possible that an emergency situation may develop. Emergency situations can be characterized as injury or acute chemical exposure to personnel, fire or explosion, environmental release, or hazardous weather conditions.

16.8 Emergency Site Evacuation Routes and Procedures

All project personnel will be instructed on proper emergency response procedures and locations of emergency telephone numbers during the initial site safety meeting. If an emergency occurs as a result of the site investigation activities, including but not limited to fire, explosion or significant release of toxic gas into the atmosphere, the Langan Project Manager will be verbally notified immediately. All heavy equipment will be shut down and all personnel will evacuate the work areas and assemble at the nearest intersection to be accounted for and to receive further instructions.

16.9 Fire Prevention and Protection

In the event of a fire or explosion, procedures will include immediately evacuating the site and notification of the Langan Project Manager of the investigation activities. Portable fire extinguishers will be provided at the work zone. The extinguishers located in the various locations should also be identified prior to the start of work. No personnel will fight a fire beyond the stage where it can be put out with a portable extinguisher (incipient stage).

16.9.1 Fire Prevention

Fires will be prevented by adhering to the following precautions:

- Good housekeeping and storage of materials.
- Storage of flammable liquids and gases away from oxidizers.

- Shutting off engines to refuel.
- Grounding and bonding metal containers during transfer of flammable liquids.
- Use of UL approved flammable storage cans.
- Fire extinguishers rated at least 10 pounds ABC located on all heavy equipment, in all trailers and near all hot work activities.

The person responsible for the control of fuel source hazards and the maintenance of fire prevention and/or control equipment is the HSO.

16.10 Significant Vapor Release

Based on the proposed tasks, the potential for a significant vapor release is low. However, if a release occurs, the following steps will be taken:

- Move all personnel to an upwind location. All non-essential personnel shall evacuate.
- Upgrade to Level C Respiratory Protection.
- Downwind perimeter locations shall be monitored for volatile organics..
- If the release poses a potential threat to human health or the environment in the community, the Emergency Coordinator shall notify the Langan Project Manager.
- Local emergency response coordinators will be notified.

16.11 Overt Chemical Exposure

The following are standard procedures to treat chemical exposures. Other, specific procedures detailed on the Material Safety Data Sheet (MSDS) will be followed, when necessary.

SKIN AND EYE: Use copious amounts of soap and water from eye-wash kits and portable hand wash stations.

CONTACT: Wash/rinse affected areas thoroughly, then provide appropriate medical attention. Skin shall also be rinsed for 15 minutes if contact with caustics, acids or hydrogen peroxide occurs. Affected items of clothing shall also be removed from contact with skin.

Providing wash water and soap will be the responsibility of each individual contractor or subcontractor on-site.

16.12 Decontamination During Medical Emergencies

If emergency life-saving first aid and/or medical treatment is required, normal decontamination procedures may need to be abbreviated or omitted. The HSO or designee will accompany contaminated victims to the medical facility to advice on matters involving decontamination when necessary. The outer garments can be removed if they do not cause delays, interfere with treatment or aggravate the problem. Respiratory equipment must always be removed. Protective clothing can be cut away. If the outer contaminated garments cannot be safely removed on site, a plastic barrier placed between the injured individual and clean surfaces should be used to help prevent contamination of the inside of ambulances and/or medical personnel. Outer garments may then be removed at the medical facility. No attempt will be made to wash or rinse the victim if his/her injuries are life threatening, unless it is known that the individual has been contaminated with an extremely toxic or corrosive material which could also cause severe injury or loss of life to emergency response personnel. For minor medical problems or injuries, the normal decontamination procedures will be followed.

16.13 Adverse Weather Conditions

In the event of adverse weather conditions, the HSO will determine if work will continue without potentially risking the safety of all field workers. Some of the items to be considered prior to determining if work should continue are:

- Potential for heat stress and heat-related injuries.
- Potential for cold stress and cold-related injuries.
- Treacherous weather-related working conditions (hail, rain, snow, ice, high winds).
- Limited visibility (fog).
- Potential for electrical storms.
- Earthquakes.
- Other major incidents.

Site activities will be limited to daylight hours, or when suitable artificial light is provided, and acceptable weather conditions prevail. The HSO will determine the need to cease field operations or observe daily weather reports and evacuate, if necessary, in case of severe inclement weather conditions.

16.14 Spill Control and Response

All small spills/environmental releases shall be contained as close to the source as possible. Whenever possible, the MSDS will be consulted to assist in determining proper waste characterization and the best means of containment and cleanup. For small spills, sorbent materials such as sand, sawdust or commercial sorbents should be placed directly on the substance to contain the spill and aid recovery. Any acid spills should be diluted or neutralized carefully prior to attempting recovery. Berms of earthen or sorbent materials can be used to contain the leading edge of the spills. All spill containment materials will be properly disposed. An exclusion zone of 50 to 100 feet around the spill area should be established depending on the size of the spill.

All contractor vehicles shall have spill kits on them with enough material to contain and absorb the worst-case spill from that vehicle. All vehicles and equipment shall be inspected prior to be admitted on site. Any vehicle or piece of equipment that develops a leak will be taken out of service and removed from the job site.

The following seven steps shall be taken by the Emergency Coordinator:

1. Determine the nature, identity and amounts of major spills.
2. Make sure all unnecessary persons are removed from the spill area.
3. Notify the HSO immediately.
4. Use proper PPE in consultation with the HSO.
5. If a flammable liquid, gas or vapor is involved, remove all ignition sources and use non-sparking and/or explosion-proof equipment to contain or clean up the spill (diesel-only vehicles, air-operated pumps, etc.)
6. If possible, try to stop the leak with appropriate material.
7. Remove all surrounding materials that can react or compound with the spill.

In addition to the spill control and response procedures described in this CHASP, Langan personnel will coordinate with the designated project manager relative to spill response and control actions. Notification to the Project Manager must be immediate and, to the extent possible, include the following information:

- Time and location of the spill.
- Type and nature of the material spilled.
- Amount spilled.
- Whether the spill has affected or has a potential to affect a waterway or sewer.
- A brief description of affected areas/equipment.
- Whether the spill has been contained.
- Expected time of cleanup completion. If spill cleanup cannot be handled by Langan's on-site personnel alone, such fact must be conveyed to the Project Manager immediately.

Langan shall not make any notification of spills to outside agencies. The client will notify regulatory agencies as per their reporting procedures.

16.15 Emergency Equipment

The following minimum emergency equipment shall be kept and maintained on site:

- Industrial first aid kit.
- Fire extinguishers (one per site).

16.16 Restoration and Salvage

After an emergency, prompt restoration of utilities, fire protection equipment, medical supplies and other equipment will reduce the possibility of further losses. Some of the items that may need to be addressed are:

- Refilling fire extinguishers.
- Refilling medical supplies.
- Recharging eyewashes and/or showers.
- Replenishing spill control supplies.

16.17 Documentation

Immediately following an incident or near miss, unless emergency medical treatment is required, either the employee or a coworker must contact the Langan Incident/Injury Hotline at 1-(800)-9-LANGAN (ext. #4699) and the client representative to report the incident or near miss. For emergencies involving personnel injury and/or exposure, the HSO and affected employee will complete and submit an Employee Exposure/Injury Incident Report (Attachment C) to the Langan Corporate Health and Safety Manager as soon as possible following the incident.

17.0 RECORDKEEPING

The following is a summary of required health and safety logs, reports and recordkeeping.

17.1 Field Change Authorization Request

Any changes to the work to be performed that is not included in the CHASP will require an addendum that is approved by the Langan project manager and Langan HSM to be prepared. Approved changes will be reviewed with all field personnel at a safety briefing.

17.2 Medical and Training Records

Copies or verification of training (40-hour, 8-hour, supervisor, site-specific training, documentation of three-day OJT, and respirator fit-test records) and medical clearance for site work and respirator use will be maintained in the office and available upon request. Records for all subcontractor employees must also be available upon request. All employee medical records will be maintained by the HSM.

17.3 Onsite Log

A log of personnel on site each day will be kept by the HSO or designee.

17.4 Daily Safety Meetings ("Tailgate Talks")

Completed safety briefing forms will be maintained by the HSO.

17.5 Exposure Records

All personal monitoring results, laboratory reports, calculations and air sampling data sheets are part of an employee exposure record. These records will be maintained by the HSO during site work. At the end of the project they will be maintained according to 29 CFR 1910.1020.

17.6 Hazard Communication Program/MSDS-SDS

Material safety data sheets (MSDS) of Safety Data Sheets (SDS) have been obtained for applicable substances and are included in this CHASP (Attachment E). Langan's written hazard communication program, in compliance with 29 CFR 1910.1200, is maintained by the HSM.

17.7 Documentation

Immediately following an incident or near miss, unless emergency medical treatment is required, either the employee or a coworker must contact the Langan incident/injury hotline at 1-800-952-6426, extension 4699 and the Project Manager to report the incident or near miss. The Project Manager will contact the client or client representative. A written report must be completed and submitted HSM within 24 hours of the incident. For emergencies involving personnel injury and/or exposure, employee will complete and submit the Langan incident/injury report to the Langan corporate health and safety manager as soon as possible following the incident. Accidents will be investigated in-depth to identify all causes and to recommend hazard control measures.

18.0 CONFINED SPACE ENTRY

Confined spaces are not anticipated at the site during planned construction activities. If confined spaces are identified, the contractor must implement their own confined space program that all applicable federal, state and local regulations. Confined spaces **will not** be entered by Langan personnel.

19.0 CHASP ACKNOWLEDGEMENT FORM

All Langan personnel and contractors will sign this CHASP Compliance Agreement indicating that they have become familiar with this CHASP and that they understand it and agree to abide by it.

Printed Name	Signature	Company	Date

Printed Name	Signature	Company	Date

Printed Name	Signature	Company	Date

Printed Name	Signature	Company	Date

Printed Name	Signature	Company	Date

Printed Name	Signature	Company	Date

TABLES

TABLE 1
TASK HAZARD ANALYSES

Task	Hazard	Description	Control Measures	First Aid
1.3.1 – 1.3.11	Contaminated Soil or Groundwater-Dermal Contact	Contaminated water spills on skin, splashes in eyes; contact with contaminated soil/fill during construction activities or sampling.	Wear proper PPE; follow safe practices, maintain safe distance from construction activities	See Table 2, seek medical attention as required
1.3.1 – 1.3.11	Lacerations, abrasions, punctures	Cutting bailer twine, pump tubing, acetate liners, etc. with knife; cuts from sharp site objects or previously cut piles, tanks, etc.; Using tools in tight spaces	Wear proper PPE; follow safe practices	Clean wound, apply pressure and/or bandages; seek medical attention as required.
1.3.1 – 1.3.11	Contaminated Media Inhalation	Opening drums, tanks, wells; vapors for non-aqueous phase liquids or other contaminated site media; dust inhalation during excavation; vapor accumulation in excavation	Follow air monitoring plan; have quick access to respirator, do not move or open unlabeled drums found at the site, maintain safe distance from construction activities	See Table 2, seek medical attention as required
1.3.1 – 1.3.11	Lifting	Improper lifting/carrying of equipment and materials causing strains	Follow safe lifting techniques; Langan employees are not to carry contractor equipment or materials	Rest, ice, compression, elevation; seek medical attention as required
1.3.1 – 1.3.11	Slips, trips, and falls	Slips, trips and falls due to uneven surfaces, cords, steep slopes, debris and equipment in work areas	Good housekeeping at site; constant awareness and focus on the task; avoid climbing on stockpiles; maintain safe distance from construction activities and excavations; avoid elevated areas over six feet unless fully accredited in fall protection and wearing an approved fall protection safety apparatus	Rest, ice, compression, elevation; seek medical attention as required
1.3.1 – 1.3.11	Noise	Excavation equipment, hand tools, drilling equipment.	Wear hearing protection; maintain safe distance from construction activities	Seek medical attention as required
1.3.1 – 1.3.11	Falling objects	Soil material, tools, etc. dropping from drill rigs, front-end loaders, etc.	Hard hats to be worn at all times while in work zones; maintain safe distance from construction activities and excavations	Seek medical attention as required
1.3.1 – 1.3.11	Underground/ overhead utilities	Excavation equipment, drill rig auger makes contact with underground object; boom touches overhead utility	"One Call" before dig; follow safe practices; confirm utility locations with contractor; wear proper PPE; maintain safe distance from construction activities and excavations	Seek medical attention as required
1.3.1 – 1.3.11	Insects (bees, wasps, hornet, mosquitoes, and spider)	Sings, bites	Insect Repellent; wear proper protective clothing (work boots, socks and light colored pants);field personnel who may have insect allergies (e.g., bee sting) should provide this information to the HSO or FSO prior to commencing work, and will have allergy medication on site.	Seek medical attention as required
1.3.1 – 1.3.11	Vehicle traffic / Heavy Equipment Operation	Vehicles unable to see workers on site, operation of heavy equipment in tight spaces, equipment failure, malfunctioning alarms	Wear proper PPE, especially visibility vest; use a buddy system to look for traffic; rope off area of work with cones and caution tape or devices at points of hazard, maintain safe distance from construction activities and equipment	Seek medical attention as required

TABLE 2
CONTAMINANT HAZARDS OF CONCERN

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	1,1,1,2-Tetrachloroethane R-130a	630-20-6	NA	None None	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes (redness, pain), skin (redness, burning sensation, pain); Inhalation: jaundice, enlarged liver, headaches, tremors, dizziness, numbness, and drowsiness. Ingestion: burning sensation, headache, nausea	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	1,1,2-Trichloro-1,2,2-trifluoroethane Chlorofluorocarbon-113 CFC-113 Freon® 113 Genetron® 113 Halocarbon 113 Refrigerant 113 TTE Frigen 113 TR Freon TF Trichlorotrifluoroethane	76-13-1	PID	1000 ppm 2000 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation skin, throat, drowsiness, dermatitis; central nervous system depression; dizziness, tremor, asphyxia, unconsciousness, cardiac arrhythmias, cardiac arrest; liquid: frostbite. In animals: cardiac arrhythmias, narcosis,	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	1,1,2-Trichloroethane 1,1,2-TCA Ethane trichloride β-Trichloroethane Vinyl trichloride	79-00-5	PID	10 ppm 100 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation eyes, nose; central nervous system depression; liver, kidney damage; dermatitis	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	1,1′-Biphenyl 1,1-Biphenyl Biphenyl Phenyl benzene Diphenyl	92-52-4	None	1 mg/m^3 100 mg/m^3	Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, throat; headache, nausea, lassitude (weakness, exhaustion), numb limbs; liver damage	Eye: Irrigate immediately Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	1,1-Dichloroethane Asymmetrical dichloroethane Ethylidene chloride 1,1-Ethylidene dichloride 1,1-DCA	75-34-3	PID	100 ppm 3000 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the skin; central nervous system depression; liver, kidney, lung damage	Eye: Irrigate immediately Skin: Soap flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	1,1-Dichloropropene 1.1-Dichloro-1-propene 1,1,-Dichloropopylene 1,1-Dichloropropylene	563-58-6	NA	NA	Soil Vapor	inhalation, ingestion, skin and/or eye contact	Irritant to eyes, skin, mucous membranes and respiratory system. May be harmful by ingestion, skin absorption and inhalation	Eye: Irrigate immediately Skin: Soap flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	1,2,3-Trichlorobenzene vic-Trichlorobenzene 1,2,6-Trichlorobenzene	87-61-6	PID	None None	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, lassitude (weakness, exhaustion), dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	1,2,3-Trichloropropane Allyl trichloride Glycerol trichlorohydrin Glyceryl trichlorohydrin Trichlorohydrin	96-18-4	PID	50 ppm 100 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation eyes, nose, throat; central nervous system depression; In Animals: liver, kidney injury; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	1,2,4,5-Tetramethylbenzene	95-93-2	NA	None None	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, lassitude (weakness, exhaustion), dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	1,2,4-Trichlorobenzene Unsym-Trichlorobenzene 1,2,4-Trichlorobenzol	120-82-1	NA	None None	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation eyes, skin, mucous membrane; In Animals: liver, kidney damage; possible teratogenic effects	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	1,2,4-Trimethylbenzene	95-63-6	PID	None None	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, lassitude (weakness, exhaustion), dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	1,2-Dibromo-3-chloropropane	96-12-8	PID	None None	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation eyes, skin, nose, throat; drowsiness; nausea, vomiting; pulmonary edema; liver, kidney injury; sterility; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	1,2-Dichlorobenzene	95-50-1	PID	50 ppm 200 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eye, swelling periorbital (situated around the eye); profuse rhinitis; headache, anorexia, nausea, vomiting; weight loss, jaundice, cirrhosis; in animals: liver, kidney injury; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	1,2-Dichloroethane Ethylene dichloride 1,2-DCA DCE[1] Ethane dichloride Dutch liquid, Dutch oil Freon 150	107-06-2	PID	50 ppm 50 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin absorption, skin and/or eye contact	irritation to the eyes, skin, mucous membrane	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	1,2-Dichloroethene 1,2-Dichloroethylene 1,2-DCE Total 1,2-Dichloroethene cis-1,2-Dichloroethylene mixture of cis and trans Acetylene dichloride cis-Acetylene dichloride trans-Acetylene dichloride sym-Dichloroethylene cis- 1,2-Dichloroethene Trans-1,2-Dichloroethylene, tDCE cDCE Trans-1,2-Dichloroethene 1,1-dimethyl-;dimethyl1,1-cyclohexane trans-1,2-Dichloroethylene	156-59-2 156-60-5 540-59-0	PID	200 ppm 4000 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	Irritant to eyes, skin, mucous membranes and respiratory system. May be harmful by ingestion, skin absorption and inhalation	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	1,2-Dichlorotetrafluoroethane Dichlorotetrafluorethane 1,2-Dichloro-1,1,2,2-tetrafluoroethane Freon® 114 Genetron® 114 Halon® 242 Refrigerant 114 1,2-Dichloro-1,1,2,2-tetrafluorethane	76-14-2	PID	1000 ppm 15000 ppm	Groundwater Soil Vapor	inhalation, skin and/or eye contact (liquid)	irritation respiratory system; asphyxia; cardiac arrhythmias, cardiac arrest; liquid: frostbite	Eye: Frostbite Skin: Frostbite Breathing: Respiratory support
1.3.1 – 1.3.10	1,3,5-Trimethylbenzene Mesitylene sym-Trimethylbenzene	108-67-8	PID	None None	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, lassitude (weakness, exhaustion), dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	1,3-Butadiene Biethylene Bivinyl Butadiene Divinyl Erythrene Vinylethylene	106-99-0	PID	1 ppm 2000 ppm	Vapor	inhalation, skin and/or eye contact (liquid)	irritation to the eyes, nose, throat; drowsiness, dizziness; liquid: frostbite; teratogenic, reproductive effects; [potential occupational carcinogen]	Eye: Frostbite Skin: Frostbite Breathing: Respiratory support
1.3.1 – 1.3.10	1,3-Dichlorobenzene m-Dichlorobenzol; m-Phenylene dichloride m-dichlorobenzene	541-73-1	PID	None None	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, swelling periorbital (situated around the eye); profuse rhinitis; headache, anorexia, nausea, vomiting; weight loss, jaundice, cirrhosis; in animals: liver, kidney injury; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	1,3-Dichloropropane	142-29-9	NA	NA NA	Groundwater Soil Vapor	Inhalation, ingestion, skin and/or eye contact	Irritant to eyes, skin, mucous membranes and respiratory system. May be harmful by ingestion, skin absorption and inhalation	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	1,4-Dichlorobenzene para-Dichlorobenzene p-Dichlorobenzene p-DCB PDB Paramoth Para crystals Paracide Dichlorocide	106-46-7	PID	75 ppm 150 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, swelling periorbital (situated around the eye); profuse rhinitis; headache, anorexia, nausea, vomiting; weight loss, jaundice, cirrhosis; in animals: liver, kidney injury; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	1.2-Dibromoethane Ethylene Dibromide Ethylene bromide Glycol dibromide 1,2-Dibromoethane	106-93-4	PID	20 ppm 100 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation eyes, skin, respiratory system; dermatitis with vesiculation; liver, heart, spleen, kidney damage; reproductive effects; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	2,2,4-Trimethylpentane	540-84-1	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, lassitude (weakness, exhaustion), dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	2,2-Dichloropropane Isopropylidene dichloride	594-20-7	NA	NA NA	Groundwater Soil Vapor	Inhalation, ingestion, skin and/or eye contact	Irritant to eyes, skin, mucous membranes and respiratory system. May be harmful by ingestion, skin absorption and inhalation	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	2-Butanone Ethyl methyl ketone MEK Methyl acetone Methyl ethyl ketone	78-93-3	PID	200 ppm 3000 ppm	Soil Groundwater Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose; headache; dizziness; vomiting; dermatitis	Eye: Irrigate immediately Skin: Water wash immediately Breathing: Fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.10	2-Hexanone Butyl methyl ketone MBK Methyl butyl ketone Methyl n-butyl ketone	591-78-6	PID	100 ppm 1600 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, nose; peripheral neuropathy: lassitude (weakness, exhaustion), paresthesia; dermatitis; headache, drowsiness	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	2-Methylnaphthalene β-methylnaphthalene	91-57-6	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion or skin absorption, eye contact	irritation to the skin, eyes, mucous membranes and upper respiratory tract. It may also cause headaches, nausea, vomiting, diarrhea, anemia, jaundice, euphoria, dermatitis, visual disturbances, convulsions and comatose	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	4-Chlorotoluene p-Chlorotoluene 1-Chloro-4-methylbenzene p-Tolyl chloride	106-43-4	PID	NA NA	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation eyes, skin, mucous membrane; dermatitis; drowsiness, incoordination, anesthesia; cough; liver, kidney injury	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	4-Isopropyltoulene 1-Methyl-4-(1-methylethyl)benzene 4-Isopropyltoluene; 4-Methylcumene; 1-Methyl-4-isopropylbenzene Dolcymene Camphogen Paracymene Cymene p-Cymene p-Isopropyltoluene	99-87-6	PID	NA NA	Soil Groundwater Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; dermatitis; headache, narcosis, coma	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	4-Methyl-2-pentanone Hexone Isobutyl methyl ketone Methyl isobutyl ketone MIBK	108-10-1	PID	100 ppm 500 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; headache, narcosis, coma; dermatitis; in animals: liver, kidney damage	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Acenaphthene 1,2-Dihydroacenaphthylene 1,8-Ethylenenaphthalene peri-Ethylenenaphthalene Naphthyleneethylene Tricyclododecapentaene	83-32-9	PID	NA NA	Soil	inhalation, ingestion, skin and/or eye contact,	irritation to the skin, eyes, mucous membranes and upper respiratory tract; If ingested, it can cause vomiting	Eye: Irrigate immediately Skin: Soap wash immediately, if redness or irritation develop, seek medical attention immediately Breathing: Move to fresh air Swallow: do not induce vomiting, seek medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Acenaphthylene Cycopental(de)naphthalene, Acenaphthalene	208-96-8	PID	NA NA	Soil	inhalation, ingestion, skin and/or eye contact	irritation to the skin, eyes, mucous membranes and upper respiratory tract	Eye: Irrigate immediately, seek medical attention immediately, Skin: Soap wash immediately, if redness or irritation develop, seek medical attention immediately Breathing: Move to fresh air Swallow: do not induce vomiting, seek medical attention immediately
1.3.1 – 1.3.10	Acetone Dimethyl ketone Ketone propane 2-Propanone	67-64-1	PID	1000 ppm 2500 ppm	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, nose, throat; headache, dizziness, central nervous system depression; dermatitis	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Acrylonitrile Acrylonitrile monomer AN Cyanoethylene Propenenitrile 2-Propenenitrile VCN, Vinyl cyanide	107-13-1	PID	1 ppm 85 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; asphyxia; headache; sneezing; nausea, vomiting; lassitude (weakness, exhaustion), dizziness; skin vesiculation; scaling dermatitis; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Water wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Allyl chloride 1-Chloro-2-propene 3-Chloropropene 3-Chloropropylene	107-05-1	PID	1 ppm 250 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation eyes, skin, nose, mucous membrane; pulmonary edema; In Animals: liver, kidney injury	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Aluminum	7429-90-5	None	0.5 mg/m3 50 mg/m3	Soil	inhalation, skin and/or eye contact	irritation to the eyes, skin, respiratory system	Eye: Irrigate immediately Breathing: Fresh air
1.3.1 – 1.3.10	Anthracene	120-12-7	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Soil	inhalation, skin or eye contact, ingestion	irritation to the skin, eyes, mucous membranes and upper respiratory tract, abdominal pain if ingested.	Eye: Irrigate immediately, seek medical attention immediately, Skin: Soap wash immediately, Breathing: Move to fresh air, refer to medical attention; Swallow: refer to medical attention
1.3.1 – 1.3.10	Antimony	7440-36-0	None	0.5 mg/m^3 50 mg/m^3	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation skin, possible dermatitis; resp distress; diarrhea; muscle tremor, convulsions; possible gastrointestinal tract	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Aroclor 1242	53469-21-9	None	0.5 mg/m^3 5 mg/m^3	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, chloracne	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Aroclor 1260	11096-82-5	None	0.5 mg/m^3 5 mg/m^3	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, chloracne	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Arsenic	NA	None	0.5 mg/m^3 NA	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation skin, possible dermatitis; resp distress; diarrhea; muscle tremor, convulsions; possible gastrointestinal tract	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Barium	10022-31-8	None	0.5 mg/m^3 50 mg/m^3	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, upper respiratory system; skin burns; gastroenteritis; muscle spasm; slow pulse	Eye: Irrigate immediately Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Benzene Benzol Phenyl hydride	71-43-2	PID	3.19 mg/m^3 1,595 mg/mg^3	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; lassitude (weakness, exhaustion) [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Benzo(a)anthracene Benzanthracene Benzanthrene 1,2-Benzanthracene Benzo[b]phenanthrene Tetraphene	56-55-3	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Groundwater Soil	inhalation, skin or eye contact, ingestion	dermatitis, bronchitis, [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Benzo(a)pyrene	50-32-8	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Soil	inhalation, skin or eye contact, ingestion	dermatitis, bronchitis, [potential occupational carcinogen]	Eye: Irrigate immediately, seek medical attention Skin: Soap wash immediately; Breathing: move to fresh air; Swallow: Induce vomiting if conscious, seek medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Benzo(b)fluoranthene	205-99-2	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Soil	inhalation, skin or eye contact, ingestion	irritation to eyes and skin, respiratory irritation(dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.10	Benzo(g,h,i)perylene Benzo(ghi)perylene	191-24-2	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Soil	inhalation, skin or eye contact, ingestion	NA	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.10	Benzo(k)fluoranthene	207-08-9	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Soil	inhalation, skin or eye contact, ingestion	irritation to eyes and skin, respiratory irritation (dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Benzyl butyl phthalate Butyl benzyl phthalate Butylbenzylphthalate	86-66-7	None	NA NA	Groundwater Soil Vapor	inhalation, skin or eye contact, ingestion	irritation to eyes and skin, respiratory irritation (dizziness, weakness, fatigue, nausea, headache	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.10	Benzyl chloride Chloromethylbenzene α-Chlorotoluene	100-44-7	PID	1 ppm 10 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation eyes, skin, nose; lassitude (weakness, exhaustion); irritability; headache; skin eruption; pulmonary edema	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.10	Beryllium	7440-41-7	None	0.002 mg/m^3 4 mg/m^3	Soil	inhalation, skin and/or eye contact	berylliosis (chronic exposure): anorexia, weight loss, lassitude (weakness, exhaustion), chest pain, cough, clubbing of fingers, cyanosis, pulmonary insufficiency; irritation to the eyes; dermatitis; [potential occupational carcinogen]	Eye: Irrigate immediately Breathing: Fresh air

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid	
1.3.1 – 1.3.10	Beta-Endosulfan Beta Endosulfan Endosulfan II (beta) Endosulfan II	33213-65-9	None	None	NA NA	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation skin; nausea, confusion, agitation, flushing, dry mouth, tremor, convulsions, headache; in animals: kidney, liver injury; decreased testis weight	Eye: imme Skin: imme Breat Resp supp Swal atten imme
1.3.1 – 1.3.10	Bis(2-ethylhexyl)phthalate Di-sec octyl phthalate DEHP Di(2-ethylhexyl)phthalate Octyl phthalate	117-81-7	None	5 mg/m^3 5000 mg/m^3	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, mucous membrane; in animals: liver damage; teratogenic effects; [potential occupational carcinogen	Eye: Irrigate immediately Breathing: Respiratory support Swallow: Medical attention immediately	
1.3.1 – 1.3.10	Bromobenzene Monobromobenzene Phenyl bromide Bromobenzoi	108-86-1	PID	NA NA	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation eyes, skin, respiratory system;	Eye:Irrigate immediately Skin:Soap wash promptly Breathing:Respiratory support Swallow:Medical attention immediately	
1.3.1 – 1.3.10	Bromochloromethane Halon 1011 Methyl Chlorobromide Chlorobromoethane Fluorocarbon	74-97-5		200 ppm 2000 ppm	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation eyes, skin, throat; confusion, dizziness, central nervous system depression; pulmonary edema	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately	

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Bromodichloromethane dichlorobromomethane	75-27-4	None	NA NA	Groundwater Soil Vapor	inhalation, skin or eye contact, ingestion	irritation of the skin, eyes, mucous membranes and respiratory tract, narcosis, nausea, dizziness and headache	Eye: Irrigate immediately (liquid) Skin: Water flush immediately (liquid) Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Bromoform Methyl tribromide Tribromomethane	75-25-2	PID	0.5 ppm 850 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation eyes, skin, respiratory system; central nervous system depression; liver, kidney damage	Eye:Irrigate immediately Skin:Soap wash promptly Breathing:Respiratory support Swallow:Medical attention immediately
1.3.1 – 1.3.10	Cadmium	7440-43-9	None	0.005 mg/m^3 9 mg/m^3	Soil	inhalation, ingestion	pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (occurring beneath the sternum) pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia (loss of the sense of smell), emphysema, proteinuria, mild anemia; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Calcium	7440-70-2	None	NA	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, upper resp tract; ulcer, perforation nasal septum; pneumonitis; dermatitis	Eye: Irrigate immediately Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Carbazole 9-azafluorene Dibenzopyrrole Diphenylenimine diphenyleneimide	86-74-8	None	NA NA	Soil	inhalation, skin absorption (liquid), skin and/or eye contact	irritation to eyes and skin, respiratory irritation	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.10	Carbon disulfide	75-15-0	PID	20 ppm 500 ppm	Soil Groundwater Vapor	inhalation, skin or eye contact, ingestion	irritation to the eyes, skin, respiratory system	Eye: Irrigate immediately (liquid) Skin: Water flush immediately (liquid) Breathing: Respiratory support
1.3.1 – 1.3.10	Carbon tetrachloride Carbon chloride Carbon tet Freon® 10 Halon® 104 Tetrachloromethane	56-23-5	PID	10 ppm 200 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; central nervous system depression; nausea, vomiting; liver, kidney injury; drowsiness, dizziness, incoordination; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Chlorobenzene benzene chloride monochlorobenzene Phenyl chloride Chlorobenzol MCB	108-90-7	PID	75 ppm 1000 ppm	Groundwater Soil Vapor	inhalation, skin or eye contact, ingestion	irritation to the eyes, skin, nose; drowsiness, incoordination; central nervous system depression; in animals: liver, lung, kidney injury	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Chloroform Methane trichloride Trichloromethane	67-66-3	None	50 ppm 500 ppm	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; dizziness, mental dullness, nausea, confusion; headache, lassitude (weakness, exhaustion); anesthesia; enlarged liver; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Chromium Total Chromium	7440-47-3	None	1.0 mg/m^3 250 mg/m^3	Groundwater Soil	inhalation absorption ingestion	irritation to eye, skin, and respiratory	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Chrysene Benzo[a]phenanthrene 1,2-Benzphenanthrene	218-01-9	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Groundwater Soil	inhalation, absorption, ingestion, consumption	irritation to eye, skin, and respiratory, gastrointestinal irritation nausea, vomit, diarrhea [potential occupational carcinogen]	Eyes: Irrigate immediately Skin: Soap wash promptly. Breath: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	cis-1,2-Dichloroethene	156-59-2	PID	200 ppm 1000 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, respiratory system; central nervous system depression	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Cis-1,3-Dichlorpropene Cis-1,3-Dichlropropylene Cis-1,3-Dichloropropene cis-1,3-Dichloropropylene	10061-01-5	PID	NA NA	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, respiratory system; eye, skin burns; lacrimation (discharge of tears); headache, dizziness; in animals; liver, kidney damage; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Cobalt	7440-48-4	None	0.1mg/m^3 20 mg/m^3	Soil	inhalation, ingestion, skin and/or eye contact	Cough, dyspnea (breathing difficulty), wheezing, decreased pulmonary function; weight loss; dermatitis; diffuse nodular fibrosis; resp hypersensitivity, asthma	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Copper	7440-50-8	None	1.0 mg/m^3 100 mg/m^3	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, nose, metallic taste; dermatitis; anemia	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Cumene Cumol Isopropylbenzene 2-Phenyl propane	98-82-8	PID	50 ppm 900 ppm	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; dermatitis; headache, narcosis, coma	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Cyanide	57-12-5	None	5 mg/m^3 25 mg/m^3	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	Exposure to cyanide can cause weakness, headaches, confusion, dizziness, fatigue, anxiety, sleepiness, nausea and vomiting. Breathing can speed up then become slow and gasping. Coma and convulsions also occur. If large amounts of cyanide have been absorbed by the body, the person usually collapses and death can occur very quickly. Long-term exposure to lower levels of cyanide can cause skin and nose irritation, itching, rashes and thyroid changes.	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Cyclohexane Benzene hexahydride Hexahydrobenzene Hexamethylene Hexanaphthene	110-82-7	PID	300 ppm 1300 ppm	Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, respiratory system; drowsiness; dermatitis; narcosis, coma	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	DDE 4,4-DDE 1,1-bis-(4-chlorophenyl)-2,2-dichloroethene Dichlorodiphenyldichloroethylene	72-55-9	None	NA NA	Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	Oral ingestion of food is the primary source of exposure for the general population. Acute and chronic ingestion may cause nausea, vomiting, diarrhea, stomach pain, headache, dizziness, disorientation, tingling sensation, kidney damage, liver damage, convulsions, coma, and death. 4,4' DDE may cross the placenta and can be excreted in breast milk	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	DDT 4,4-DDT 4,4’-DDT p,p’-DDT Dichlorodiphenyltrichloroethane 1,1,1-Trichloro-2,2-bis(p-chlorophenyl)ethane	50-29-3	None	1 mg/m^3 500 mg/m^3	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; paresthesia tongue, lips, face; tremor; anxiety, dizziness, confusion, malaise (vague feeling of discomfort), headache, lassitude (weakness, exhaustion); convulsions; paresis hands; vomiting; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Dibenz(a,h)anthracene Dibenzo(a,h)anthracene	53-70-3	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Groundwater Soil	inhalation, absorption, ingestion, consumption	irritation to eyes, skin, respiratory, and digestion [potential occupational carcinogen]	Eyes: Irrigate immediately Skin: Soap wash promptly. Breath: Respiratory support PID Swallow: Medical attention immediately
1.3.1 – 1.3.10	Dibenzofuran	132-64-9	None	NA NA	Soil	inhalation, absorption	irritation to eyes, and skin	Eyes: Irrigate immediately Skin: Soap wash promptly.
1.3.1 – 1.3.10	Dibromochloromethane Dibromo(chloro)methane Chlorodibromomethane Monochlorodibromomethane	124-48-1	PID	NA NA		inhalation, skin absorption, ingestion, skin and/or eye contact	irritation eyes, skin, respiratory system; dermatitis with vesiculation; liver, heart, spleen, kidney damage; reproductive effects; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Dibromomethane Methylene bromide	74-95-3	NA	20 ppm 250 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; lassitude (weakness, exhaustion), drowsiness, dizziness; numb, tingle limbs; nausea; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Dibutyl phthalate Di-n-butyl phthalate Butyl phthalate n-Butyl phthalate 1,2-Benzenedicarboxylic acid dibutyl ester o-Benzenedicarboxylic acid dibutyl ester DBP Palatinol C, Elaol Dibutyl-1,2-benzene-dicarboxylate Di-n-butyl Phthalate Di-n-butylphthalate	84-74-2	None	5 mg/m^3 4000 mg/m^3	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, upper respiratory system, stomach	Eye: Irrigate immediately Skin: Wash regularly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Dichlorodifluoromethane Difluorodichloromethane, Fluorocarbon 12 Freon 12 Freon® 12 Genetron® 12 Halon® 122 Propellant 12 Refrigerant 12 Dichlorodifluromethane	75-71-8	None	1000 pp, 15,000 ppm	Groundwater Soil Vapor	inhalation, skin and/or eye contact (liquid)	dizziness, tremor, asphyxia, unconsciousness, cardiac arrhythmias, cardiac arrest; liquid: frostbite	Eye: Frostbite Skin: Frostbite Breathing: Respiratory support
1.3.1 – 1.3.10	Diesel Fuel automotive diesel fuel oil No. 2 distillate diesoline diesel oil diesel oil light diesel oil No. 1-D summer diesel	68334-30-5	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; burning sensation in chest; headache, nausea, lassitude (weakness, exhaustion), restlessness, incoordination, confusion, drowsiness; vomiting, diarrhea; dermatitis; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Endrin 1,2,3,4,10,10-Hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4-endo,endo-5,8-dimethanonaphthalene; Hexadrin	72-20-8	None	0.1 mg/m^3 2 mg/m^3	Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	epileptiform convulsions; stupor, headache, dizziness; abdominal discomfort, nausea, vomiting; insomnia; aggressiveness, confusion; drowsiness, lassitude (weakness, exhaustion); anorexia; in animals: liver damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Ethanol Absolute alcohol Alcohol cologne spirit drinking alcohol ethane monoxide ethylic alcohol EtOH ethyl alcohol ethyl hydrate ethyl hydroxide ethylol grain alcohol hydroxyethane methylcarbinol	64-17-5	PID	1000 ppm 3300 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose; headache, drowsiness, lassitude (weakness, exhaustion), narcosis; cough; liver damage; anemia; reproductive, teratogenic effects	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.10	Ethyl acetate Acetic ester Acetic ether Ethyl ester of acetic acid Ethyl ethanoate	141-78-6	PID	400 ppm 2000 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation eyes, skin, nose, throat; narcosis; dermatitis	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Ethyl benzene Ethylbenzene Ethylbenzol Phenylethane	100-40-4	PID	435 mg/m^3 3,472 mg/m^3	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Ethyl chloride Chloroethane Hydrochloric ether Monochloroethane Muriatic ether Hydrochloric ether	75-00-3	PID	1000 ppm 3800 ppm	Groundwater Soil Vapor	inhalation, skin absorption (liquid), ingestion (liquid), skin and/or eye contact	incoordination, inebriation; abdominal cramps; cardiac arrhythmias, cardiac arrest; liver, kidney damage	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Fluoranthene Benzo(j, k)fluorene	206-44-0	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Groundwater Soil	inhalation, skin or eye contact, ingestion	irritation to eyes and skin, respiratory irritation(dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.10	Fluorene	86-73-7	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Soil	inhalation, skin or eye contact, ingestion	irritation to eyes and skin, respiratory irritation(dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attenti

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Fuel Oil No. 2	68476-30-2	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; burning sensation in chest; headache, nausea, lassitude (weakness, exhaustion), restlessness, incoordination, confusion, drowsiness; vomiting, diarrhea; dermatitis; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Gasoline	8006-61-9	PID	NA NA	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; dermatitis; headache, lassitude (weakness, exhaustion), blurred vision, dizziness, slurred speech, confusion, convulsions; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Helium	7440-59-7	Helium Detector	NA NA	NA	inhalation	dizziness, headache, and nausea	Breathing: Respiratory support
1.3.1 – 1.3.10	Heptane n-Heptane	142-82-5	PID	500 ppm 750 ppm	Goundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	dizziness, stupor, incoordination; loss of appetite, nausea; dermatitis; chemical pneumonitis (aspiration liquid); unconsciousness	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Hexachlorobutadiene HCBD Hexachloro-1,3-butadiene 1,3-Hexachlorobutadiene Perchlorobutadiene	87-68-3	PID	NA NA	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	In animals: irritation to the eyes, skin, respiratory system; kidney damage; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Hexavalent Chromium Chromium VI	18540-29-9	None	1.0 mg/m³ 250 mg/m³	Groundwater Soil	inhalation absorption ingestion	irritation to eye, skin, and respiratory	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Indeno(1,2,3-cd)pyrene	193-39-5	None	0.2 mg/m³ 80 mg/m³ (Coal Pitch Tar)	Groundwater Soil	inhalation, absorption, ingestion, consumption	irritation to eyes, skin, respiratory, and digestion [potential occupational carcinogen]	Eyes: Irrigate immediately Skin: Soap wash promptly. Breath: Respiratory support Swallow: Medical attention immediately, wash mouth with water
1.3.1 – 1.3.10	Iron	7439-89-6	None	10 mg/m³ NA	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; abdominal pain, diarrhea, vomiting	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Isopropyl alcohol Iso-Propyl Alcohol Carbinol IPA Isopropanol 2-Propanol sec-Propyl alcohol Rubbing alcohol Isopropylalcohol	67-63-0	PID	400 ppm 2000 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, nose, throat; drowsiness, dizziness, headache; dry cracking skin; in animals: narcosis	Eye: Irrigate immediately Skin: Water flush Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Lead	7439-92-1	None	0.050 mg/m^3 100 mg/m^3	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation to the eyes; hypertension	Eye: Irrigate immediately Skin: Soap flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Magnesium	7439-95-4	None	15 mg/m^3 NA	Soil	inhalation, skin and/or eye contact	irritation to the eyes, skin, respiratory system; cough	Eye: Irrigate immediately Breathing: Fresh air
1.3.1 – 1.3.10	Manganese	7439-96-5	None	5 mg/m^3 500 mg/m^3	Groundwater Soil	inhalation, ingestion	aerosol is irritating to the respiratory tract	Eye: Irrigate immediately Skin: Soap flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	m-Cresol 4 meta-Cresol 3-Cresol m-Cresylic acid 1-Hydroxy-3-methylbenzene 3-Hydroxytoluene 3-Methylphenol	108-39-4	PID	5 ppm 250 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; central nervous system effects: confusion, depression, resp failure; dyspnea (breathing difficulty), irreg rapid resp, weak pulse; eye, skin burns; dermatitis; lung, liver, kidney, pancreas damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Mercury	7439-97-6	None	0.1 mg/m^3 10 mg/m^3	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, headache, lassitude (weakness, exhaustion); stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Methoxychlor p,p'-Dimethoxydiphenyltrichloroethane DMDT Methoxy-DDT 2,2-bis(p-Methoxyphenyl)-1,1,1-trichloroethane 1,1,1-Trichloro-2,2-bis-(p-methoxyphenyl)ethane	72-43-5	None	15 mg/m^3 5000 mg/m^3	Groundwater Soil Vapor	inhalation, ingestion	fasciculation, trembling, convulsions; kidney, liver damage; [potential occupational carcinogen]	Skin: Soap wash Breathing: Fresh air Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Methyl Bromide Bromomethane Monobromomethane	74-83-9	PID	20 ppm 250 ppm	Soil Groundwater Vapor	inhalation, skin absorption (liquid), skin and/or eye contact (liquid)	irritation to the eyes, skin, respiratory system; muscle weak, incoordination, visual disturbance, dizziness; nausea, vomiting, headache; malaise (vague feeling of discomfort); hand tremor; convulsions; dyspnea (breathing difficulty); skin vesiculation; liquid: frostbite; [potential occupational carcinogen]	Eye: Irrigate immediately (liquid) Skin: Water flush immediately (liquid) Breathing: Respiratory support
1.3.1 – 1.3.10	Methyl Chloride Chloromethane Monochloromethane	74-87-3	NA	100 ppm 2000 ppm	Groundwater Soil	inhalation, skin and/or eye contact	dizziness, nausea, vomiting; visual disturbance, stagger, slurred speech, convulsions, coma; liver, kidney damage; liquid: frostbite; reproductive, teratogenic effects; [potential occupational carcinogen]	Eye: Frostbite Skin: Frostbite Breathing: Respiratory support
1.3.1 – 1.3.10	Methyl methacrylate Methacrylate monomer Methyl ester of methacrylic acid Methyl-2-methyl-2-propenoate	80-62-6	PID	100 ppm 1000 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation eyes, skin, nose, throat; dermatitis	Eye: Irrigate immediately Skin: Water wash immediately Breathing: Fresh air Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Methyl *tert*-butyl ether MTBE Methyl tertiary-butyl ether Methyl t-butyl ether tert-Butyl methyl ether tBME tert-BuOMe	1634-04-4	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; burning sensation in chest; headache, nausea, lassitude (weakness, exhaustion), restlessness, incoordination, confusion, drowsiness; vomiting, diarrhea; dermatitis; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Methylene Chloride Dichloromethane Methylene dichloride	75-09-2	PID	25 ppm 2300 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; lassitude (weakness, exhaustion), drowsiness, dizziness; numb, tingle limbs; nausea; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	m-Xylenes 1,3-Dimethylbenzene m-Xylol Metaxylene	108-38-3	PID	100 ppm 900 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; nausea, vomiting, abdominal pain; dermatitis	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Naphthalene Naphthalin Tar camphor White tar	91-20-3	PID	50 mg/m^3 250 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes; headache, confusion, excitement, malaise (vague feeling of discomfort); nausea, vomiting, abdominal pain; irritation bladder; profuse sweating; hematuria (blood in the urine); dermatitis, optical neuritis	Eye: Irrigate immediately Skin: Molten flush immediately/solid-liquid soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	n-Butylbenzene	104-51-8	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin; dry nose, throat; headache; low blood pressure, tachycardia, abnormal cardiovascular system stress; central nervous system, hematopoietic depression; metallic taste; liver, kidney injury	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	n-Hexane Hexane, Hexyl hydride, normal-Hexane	110-54-3	PID	500 ppm 1100 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, nose; nausea, headache; peripheral neuropathy: numb extremities, muscle weak; dermatitis; dizziness; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Nickel	7440-02-0	None	NA 10 mg/m^3	Groundwater Soil	ion, ingestion, skin and/or eye contact	sensitization dermatitis, allergic asthma, pneumonitis; [potential occupational carcinogen]	Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Non-Flammable Gas Mixture CALGAS (Equipment Calibration Gas : Oxygen Methane Hydrogen Sulfide Carbon Monoxide Nitrogen	 7782-44-7 74-82-8 7783-08-4 830-08-0 7727-37-9	Multi-Gas PID	 NA/NA NA/NA 10/100 ppm 50/1200 ppm NA/NA	NA	inhalation	dizziness, headache, and nausea	Breathing: Respiratory support
1.3.1 – 1.3.10	Non-Flammable Gas Mixture CALGAS (Equipment Calibration Gas : Oxygen Isobutylene Nitrogen	 7782-44-7 115-11-7 7727-37-9	PID	 NA/NA NA/NA NA/NA	NA	inhalation	dizziness, headache, and nausea	Breathing: Respiratory support
1.3.1 – 1.3.10	n-Propylbenzene Isocumene Propylbenzene 1-Phenylpropane 1-Propylbenzene Phenylpropane	103-65-1	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin; dry nose, throat; headache; low blood pressure, tachycardia, abnormal cardiovascular system stress; central nervous system, hematopoietic depression; metallic taste; liver, kidney injury	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	o-Chlorotoluene 1-Chloro-2-methylbenzene 2-Chloro-1-methylbenzene 2-Chlorotoluene o-Tolyl chloride	95-49-8	PID	NA NA	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation eyes, skin, mucous membrane; dermatitis; drowsiness, incoordination, anesthesia; cough; liver, kidney injury	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	o-Xylenes 1,2-Dimethylbenzene ortho-Xylene o-Xylol	95-47-6	PID	100 ppm 900 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; nausea, vomiting, abdominal pain; dermatitis	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	p-Cresol para-Cresol 4-Cresol p-Cresylic acid 1-Hydroxy-4-methylbenzene 4-Hydroxytoluene 4-Methylphenol	106-44-5	PID	5 ppm 250 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; central nervous system effects: confusion, depression, resp failure; dyspnea (breathing difficulty), irreg rapid resp, weak pulse; eye, skin burns; dermatitis; lung, liver, kidney, pancreas damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	p-Diethylbenzene 1,4-Diethylbenzene 1,4-Diethyl benzene	105-05-5	PID	None None	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, respiratory system; skin burns; in animals: central nervous system depression	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	p-Ethyltoluene 4-Ethyltoluene 1-ethyl-4-methyl-benzene 1-methyl-4-ethylbenzene	622-96-8	NA	NA NA	Soil	ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Phenanthrene	85-01-8	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Groundwater Soil	inhalation, skin or eye contact, ingestion	irritation to eyes and skin, respiratory irritation(dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.10	Phenol Carbolic acid Hydroxybenzene, Monohydroxybenzene Phenyl alcohol Phenyl hydroxide	108-95-2	PID	5 ppm 250 ppm	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, nose, throat; anorexia, weight loss; lassitude (weakness, exhaustion), muscle ache, pain; dark urine, skin burns; dermatitis; tremor, convulsions, twitching	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Potassium	7440-09-7	None	NA NA	Soil	inhalation, skin absorption, ingestion, skin and/or eye contact inhalation, ingestion, skin and/or eye contact	eye: Causes eye burns. Skin: Causes skin burns. Reacts with moisture in the skin to form potassium hydroxide and hydrogen with much heat. ingestion: Causes gastrointestinal tract burns. inhalation: May cause irritation of the respiratory tract with burning pain in the nose and throat, coughing, wheezing, shortness of breath and pulmonary edema. Causes chemical burns to the respiratory tract. inhalation may be fatal as a result of spasm, inflammation, edema of the larynx and bronchi, chemical pneumonitis and pulmonary edema.	Eyes: Get medical aid immediately Skin: Get medical aid immediately. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Ingestion: If victim is conscious and alert, give 2-4 full cups of milk or water. Get medical aid immediately. inhalation: Get medical aid immediately.
1.3.1 – 1.3.10	Propylene Propene Methyl ethylene	115-07-1	PID	NA NA	Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, nose, throat, skin burns asphyxiation	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Propylene dichloride Dichloro-1,2-propane 1,2-Dichloropropane	78-87-5	PEL	75 ppm 400 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, respiratory system; drowsiness, dizziness; liver, kidney damage; in animals: central nervous system depression; [potential occupational carcinogen]	irritation to the eyes, skin, respiratory system; drowsiness, dizziness; liver, kidney damage; in animals: central nervous system depression; [potential occupational carcinogen]
1.3.1 – 1.3.10	p-Xylenes 1,4-Dimethylbenzene para-Xylene p-Xylol	106-42-3	PID	100 ppm 900 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; nausea, vomiting, abdominal pain; dermatitis	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	sec-Butylbenzene	135-98-8	PID	10 ppm 100 ppm	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, nose, throat; inhalation: nausea or vomiting	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Selenium	7782-49-2	None	1 mg/m^3 0.2 mg/m^3	Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; visual disturbance; headache; chills, fever; dyspnea (breathing difficulty), bronchitis; metallic taste, garlic breath, gastrointestinal disturbance; dermatitis; eye, skin burns; in animals: anemia; liver necrosis, cirrhosis; kidney, spleen damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Silver	7440-22-4	None	0.01 mg/m^3 10 mg/m^3	Soil	inhalation, ingestion, skin and/or eye contact	blue-gray eyes, nasal septum, throat, skin; irritation, ulceration skin; gastrointestinal disturbance	Eye: Irrigate immediately Skin: Water flush Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Sodium	7440-23-5	None	NA NA	Groundwater Soil	ion, ingestion, skin and/or eye contact	sensitization dermatitis, allergic asthma, pneumonitis; [potential occupational carcinogen]	Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Styrene Ethenyl benzene Phenylethylene Styrene monomer Styrol Vinyl benzene	100-42-5	PID	100 ppm 700 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, nose, respiratory system; headache, lassitude (weakness, exhaustion), dizziness, confusion, malaise (vague feeling of discomfort), drowsiness, unsteady gait; narcosis; defatting dermatitis; possible liver injury; reproductive effects	Eye: Irrigate immediately Skin: Water flush Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Tert-Butyl Alcohol Tertiary Butyl Alcohol Tert-Butanol Butyl alcohol 2-Methyl-2-propanol Trimethyl carbinol TBA	75-65-0	PID	100 ppm 1600 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; drowsiness, narcosis	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	tert-Butylbenzene *t*-Butylbenzene 2-Methyl-2-phenylpropane Pseudobutylbenzene	98-06-6	PID	10 ppm NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	eye, skin irritation; dry nose, throat; headaches; low blood pressure, tachycardia; abnormal cardiovascular system; central nervous system depression; hematopoietic depression	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Tetrachloroethane 1,1,2,2-Tetrachloroethane Acetylene tetrachloride Symmetrical tetrachloroethane	79-34-5	PID	5 ppm 100 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	nausea, vomiting, abdominal pain; tremor fingers; jaundice, hepatitis, liver tenderness; dermatitis; leukocytosis (increased blood leukocytes); kidney damage; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Tetrachloroethylene Perchlorethylene Perchloroethylene PCE Perk Tetrachlorethylene Tetrachloroethene	127-18-4	PID	100 ppm 150 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema (skin redness); liver damage; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Tetrahydrofuran Diethylene oxide 1,4-Epoxybutane Tetramethylene oxide THF	109-99-9	PID	200 ppm 2000 ppm	Groundwater Soil Vapor	inhalation, skin and/or eye contact, ingestion	irritation to the eyes, upper respiratory system; nausea, dizziness, headache, central nervous system depression	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immedi

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Thallium	7440-28-0	None	0.1 mg/m^3 15 mg/m^3	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	nausea, diarrhea, abdominal pain, vomiting; ptosis, strabismus; peri neuritis, tremor; retrosternal (occurring behind the sternum) tightness, chest pain, pulmonary edema; convulsions, chorea, psychosis; liver, kidney damage; alopecia; paresthesia legs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Toluene Methyl benzene Methyl benzol Phenyl methane Toluol	108-88-3	PID	200 ppm 500 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, nose; lassitude (weakness, exhaustion), confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, paresthesia; dermatitis	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Total PCBs Chlorodiphenyl (42% chlorine) Aroclor® 1242 PCB Polychlorinated biphenyl	53469-21-9	None	0.5 mg/m^3 5 mg/m^3	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, chloracne	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Total Xylenes Dimethylbenzene Xylol	1330-20-7	PID	100 ppm 900 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; nausea, vomiting, abdominal pain; dermatitis	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	trans-1,3-Dichloropropene	10061-02-6	PID	NA NA	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, respiratory system; eye, skin burns; lacrimation (discharge of tears); headache, dizziness; in animals; liver, kidney damage; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Trans-1,3-dichloropropylene trans-1,3-Dichloropropene Propene 1,3-dichloro- (E) (E)-1,3-Dichloropropene trans-1,3-Dichloro-1-Propene trans-1,3-Dichloropropene trans-1,3-Dichloropropylene (1E)-1,3-Dichloro-1-propene	10061-02-6	None	Na NA	Groundwater Soil Vapor	inhalation, ingestion, skin absorption, skin and/or eye contact	irritation to the eyes, skin, mucous membrane	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Trichloroethylene Ethylene trichloride TCE Trichloroethene Trilene	79-01-6	PID	100 ppm 1000 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Trichlorofluoromethane Fluorotrichloromethane Freon® 11 Monofluorotrichloromethane Refrigerant 11 Trichloromonofluoromethane	75-69-4	PID	1000 ppm 2000 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	incoordination, tremor; dermatitis; cardiac arrhythmias, cardiac arrest; asphyxia; liquid: frostbite	Eye: Irrigate immediately Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Trivalent Chromium Chromium III	NA	None	1.0 mg/m^3 250 mg/m^3	Groundwater Soil	inhalation absorption ingestion	irritation to eye, skin, and respiratory	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Vanadium	7440-62-2	None	0.1 mg/m3 15 mg/m3	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	nausea, diarrhea, abdominal pain, vomiting; ptosis, strabismus; peri neuritis, tremor; retrosternal (occurring behind the sternum) tightness, chest pain, pulmonary edema; convulsions, chorea, psychosis; liver, kidney damage; alopecia; paresthesia legs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Vinyl acetate 1-Acetoxyethylene Ethenyl acetate Ethenyl ethanoate VAC Vinyl acetate monomer Vinyl ethanoate	108-05-4	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; hoarseness, cough; loss of smell; eye burns, skin blisters	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Vinyl bromide Bromoethene Bromoethylene Monobromoethylene	593-60-2	PID	NA NA	Soil Vapor	inhalation, ingestion (liquid), skin and/or eye contact	irritation eyes, skin; dizziness, confusion, incoordination, narcosis, nausea, vomiting; liquid: frostbite; [potential occupational carcinogen]	Eye: Irrigate immediately (liquid) Skin: Water flush immediately (liquid) Breathing: Respiratory support Swallow: Medical attention immediately (liquid)

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.10	Vinyl Chloride Chloroethene Chloroethylen Ethylene monochloride Monochloroethene Monochloroethylene VC Vinyl chloride monomer (VCM)	75-01-4	PID	1 ppm NA	Groundwater Soil Vapor	inhalation, skin and/or eye contact (liquid)	lassitude (weakness, exhaustion); abdominal pain, gastrointestinal bleeding; enlarged liver; pallor or cyanosis of extremities; liquid: frostbite; [potential occupational carcinogen]	Eye: Frostbite Skin: Frostbite Breathing: Respiratory support
1.3.1 – 1.3.10	Vinylidene chloride 1,1-DCE 1,1-Dichloroethene 1,1-Dichloroethylene VDC Vinylidene chloride monomer Vinylidene dichloride	75-35-4	PID	NA NA	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, throat; dizziness, headache, nausea, dyspnea (breathing difficulty); liver, kidney disturbance; pneumonitis; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.10	Zinc	7440-62-2	None	15 mg/m^3 500 mg/m^3	Groundwater Soil	inhalation	chills, muscle ache, nausea, fever, dry throat, cough; lassitude (weakness, exhaustion); metallic taste; headache; blurred vision; low back pain; vomiting; malaise (vague feeling of discomfort); chest tightness; dyspnea (breathing difficulty), rales, decreased pulmonary function	Breathing: Respiratory support`

EXPLANATION OF ABBREVIATIONS

PID = Photoionization Detector
PEL = Permissible Exposure Limit (8-hour Time Weighted Average)
IDLH = Immediately Dangerous to Life and Health
ppm = part per million
mg/m^3 = milligrams per cubic meter
500 mg/m^3

TABLE 3
Summary of Monitoring Equipment

Instrument	Operation Parameters
Photoionization Detector (PID)	**Hazard Monitored:** Many organic and some inorganic gases and vapors. **Application:** Detects total concentration of many organic and some inorganic gases and vapors. Some identification of compounds is possible if more than one probe is measured. **Detection Method:** Ionizes molecules using UV radiation; produces a current that is proportional to the number of ions. **General Care/Maintenance:** Recharge or replace battery. Regularly clean lamp window. Regularly clean and maintain the instrument and accessories. **Typical Operating Time:** 10 hours. 5 hours with strip chart recorder.
Oxygen Meter	**Hazard Monitored:** Oxygen (O_2). **Application:** Measures the percentage of O_2 in the air. **Detection Method:** Uses an electrochemical sensor to measure the partial pressure of O_2 in the air, and converts the reading to O_2 concentration. **General Care/Maintenance:** Replace detector cell according to manufacturer's recommendations. Recharge or replace batteries prior to explanation of the specified interval. If the ambient air is less than 0.5% C O_2, replace the detector cell frequently. **Typical Operating Time:** 8 – 12 hours.
Additional equipment (if needed, based on site conditions)	
Combustible Gas Indicator (CGI)	**Hazard Monitored:** Combustible gases and vapors. **Application:** Measures the concentration of combustible gas or vapor. **Detection Method:** A filament, usually made of platinum, is heated by burning the combustible gas or vapor. The increase in heat is measured. Gases and vapors are ionized in a flame. A current is produced in proportion to the number of carbon atoms present. **General Care/Maintenance:** Recharge or replace battery. Calibrate immediately before use. **Typical Operating Time:** Can be used for as long as the battery lasts, or for the recommended interval between calibrations, whichever is less.
Flame Ionization Detector (FID) with Gas Chromatography Option *(i.e., Foxboro Organic Vapor Analyzer (OVA))*	**Hazard Monitored:** Many organic gases and vapors (approved areas only). **Application:** In survey mode, detects the concentration of many organic gases and vapors. In gas chromatography (GC) mode, identifies and measures specific compounds. In survey mode, all the organic compounds are ionized and detected at the same time. In GC mode, volatile species are separated. **General Care/Maintenance:** Recharge or replace battery. Monitor fuel and/or combustion air supply gauges. Perform routine maintenance as described in the manual. Check for leaks. **Typical Operating Time:** 8 hours; 3 hours with strip chart recorder.
Potable Infrared (IR) Spectrophotometer	**Hazard Monitored:** Many gases and vapors. **Application:** Measures concentration of many gases and vapors in air. Designed to quantify one or two component mixtures. **Detection Method:** Passes different frequencies of IR through the sample. The frequencies absorbed are specific for each compound. **General Care/Maintenance:** As specified by the manufacturer.

Instrument	Operation Parameters
Direct Reading Colorimetric Indicator Tube	**Hazard Monitored:** Specific gas and vapors. **Application:** Measures concentration of specific gases and vapors. **Detection Method:** The compound reacts with the indicator chemical in the tube, producing a stain whose length or color change is proportional to the compound's concentration. **General Care/Maintenance:** Do not use a previously opened tube even if the indicator chemical is not stained. Check pump for leaks before and after use. Refrigerate before use to maintain a shelf life of about 2 years. Check expiration dates of tubes. Calibrate pump volume at least quarterly. Avoid rough handling which may cause channeling.
Aerosol Monitor	**Hazard Monitored:** Airborne particulate (dust, mist, fume) concentrations **Application:** Measures total concentration of semi-volatile organic compounds, PCBs, and metals. **Detection Method:** Based on light-scattering properties of particulate matter. Using an internal pump, air sample is drawn into the sensing volume where near infrared light scattering is used to detect particles. **General Care/Maintenance:** As specified by the mfr. Also, the instrument must be calibrated with particulates of a size and refractive index similar to those to be measured in the ambient air.
Monitox	**Hazard Monitored:** Gases and vapors. **Application:** Measures specific gases and vapors. **Detection Method:** Electrochemical sensor relatively specific for the chemical species in question. **General Care/Maintenance:** Moisten sponge before use; check the function switch; change the battery when needed.
Gamma Radiation Survey Instrument	**Hazard Monitored:** Gamma Radiation. **Application:** Environmental radiation monitor. **Detection Method:** Scintillation detector. **General Care/Maintenance:** Must be calibrated annually at a specialized facility. **Typical Operating Time:** Can be used for as long as the battery lasts, or for the recommended interval between calibrations, whichever is less.

TABLE 4
INSTRUMENTATION ACTION LEVELS

Photoionization Detector Action Levels	Action Required
Background to 5 ppm	No respirator; no further action required
> 1 ppm but < 5 ppm for > 5 minutes	1. Temporarily discontinue all activities and evaluate potential causes of the excessive readings. If these levels persist and cannot be mitigated (i.e., by slowing drilling or excavation activities), contact HSO to review conditions and determine source and appropriate response action. 2. If PID readings remain above 1 ppm, temporarily discontinue work and upgrade to Level C protection. 3. If sustained PID readings fall below 1 ppm, downgrading to Level D protection may be permitted.
> 5 ppm but < 150 ppm for > 5 minutes	1. Discontinue all work; all workers shall move to an area upwind of the jobsite. 2. Evaluate potential causes of the excessive readings and allow work area to vent until VOC concentrations fall below 5 ppm. 3. Level C protection will continue to be used until PID readings fall below 1 ppm.
> 150 ppm	Evacuate the work area

Notes:
1. 1 ppm level based on OSHA Permissible Exposure Limit (PEL) for benzene.
2. 5 ppm level based on OSHA Short Term Exposure Limit (STEL) maximum exposure for benzene for any 15 minute period.
3. 150 ppm level based on NIOSH Immediately Dangerous to Life and Health (IDLH) for tetrachloroethylene.

TABLE 5
EMERGENCY NOTIFICATION LIST

ORGANIZATION	CONTACT	TELEPHONE
Local Police Department	NYPD	911
Local Fire Department	NYFD	911
Ambulance/Rescue Squad	NYFD	911
Hospital	Bellevue Hospital Center	911 or 212-562-4141
Langan Incident / Injury Hotline		800-952-6426 ex 4699
Langan Environmental Project Manager Langan Geotechnical Project Manager	Emily Snead Saul Shapiro	508-918-8558 (cell) 646-763-1437 (cell)
Langan Health and Safety Manager (HSM)	Tony Moffa	215-756-2523 (cell)
Langan Health & Safety Officer (HSO)	William Bohrer	410-984-3068 (cell)
Langan Field Team Leader (FTL)	To Be Determined	
Client's Representative	Michael Zampetti	646-330-5005
National Response Center (NRC)		800-424-8802
Chemical Transportation Emergency Center (Chemtrec)		800-424-9300
Center for Disease Control (CDC)		404-639-3534
EPA (RCRA Superfund Hotline)		800-424-9346
TSCA Hotline		202-554-1404
Poison Control Center		800-222-1222

Immediately following an incident or near miss, unless emergency medical treatment is required, either the employee or a coworker must contact the Langan Incident/Injury Hotline at 1-(800)-9-LANGAN (ext. #4699).

TABLE 6
SUGGESTED FREQUENCY OF PHYSIOLOGICAL MONITORING FOR FIT AND ACCLIMATED WORKERS[A]

Adjusted Temperature[b]	Normal Work Ensemble[c]	Impermeable Ensemble
90°F or above (32.2°C) or above	After each 45 min. of work	After each 15 min. of work
87.5°F (30.8°-32.2°C)	After each 60 min. of work	After each 30 min. of work
82.5°-87.5°F (28.1°-30.8°C)	After each 90 min. of work	After each 60 min. of work
77.5°-82.5°F (25.3°-28.1°C)	After each 120 min. of work	After each 90 min. of work
72.5°-77.5°F (22.5°-25.3°C)	After each 150 min. of work	After each 120 min. of work

a For work levels of 250 kilocalories/hour.

b Calculate the adjusted air temperature (ta adj) by using this equation: ta adj ^{O}F = ta ^{O}F + (13 x % sunshine). Measure air temperature (ta) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow. (100 percent sunshine = no cloud cover and a sharp, distinct shadow; 0 percent sunshine = no shadows.)

c A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.

TABLE 7

HEAT INDEX

RELATIVE HUMIDITY	ENVIRONMENTAL TEMPERATURE (Fahrenheit) 70	75	80	85	90	95	100	105	110	115	120
	APPARENT TEMPERATURE*										
0%	64	69	73	78	83	87	91	95	99	103	107
10%	65	70	75	80	85	90	95	100	105	111	116
20%	66	72	77	82	87	93	99	105	112	120	**130**
30%	67	73	78	84	90	96	104	113	123	**135**	**148**
40%	68	74	79	86	93	101	110	123	**137**	**151**	
50%	69	75	81	88	96	107	120	**135**	**150**		
60%	70	76	82	90	100	114	**132**	**149**			
70%	70	77	85	93	106	124	**144**				
80%	71	78	86	97	113	**136**					
90%	71	79	88	102	122						
100%	72	80	91	108							

*Combined Index of Heat and Humidity...what it "feels like" to the body
Source: National Oceanic and Atmospheric Administration

How to use Heat Index:
1. Across top locate Environmental Temperature
2. Down left side locate Relative Humidity
3. Follow across and down to find Apparent Temperature
4. Determine Heat Stress Risk on chart at right

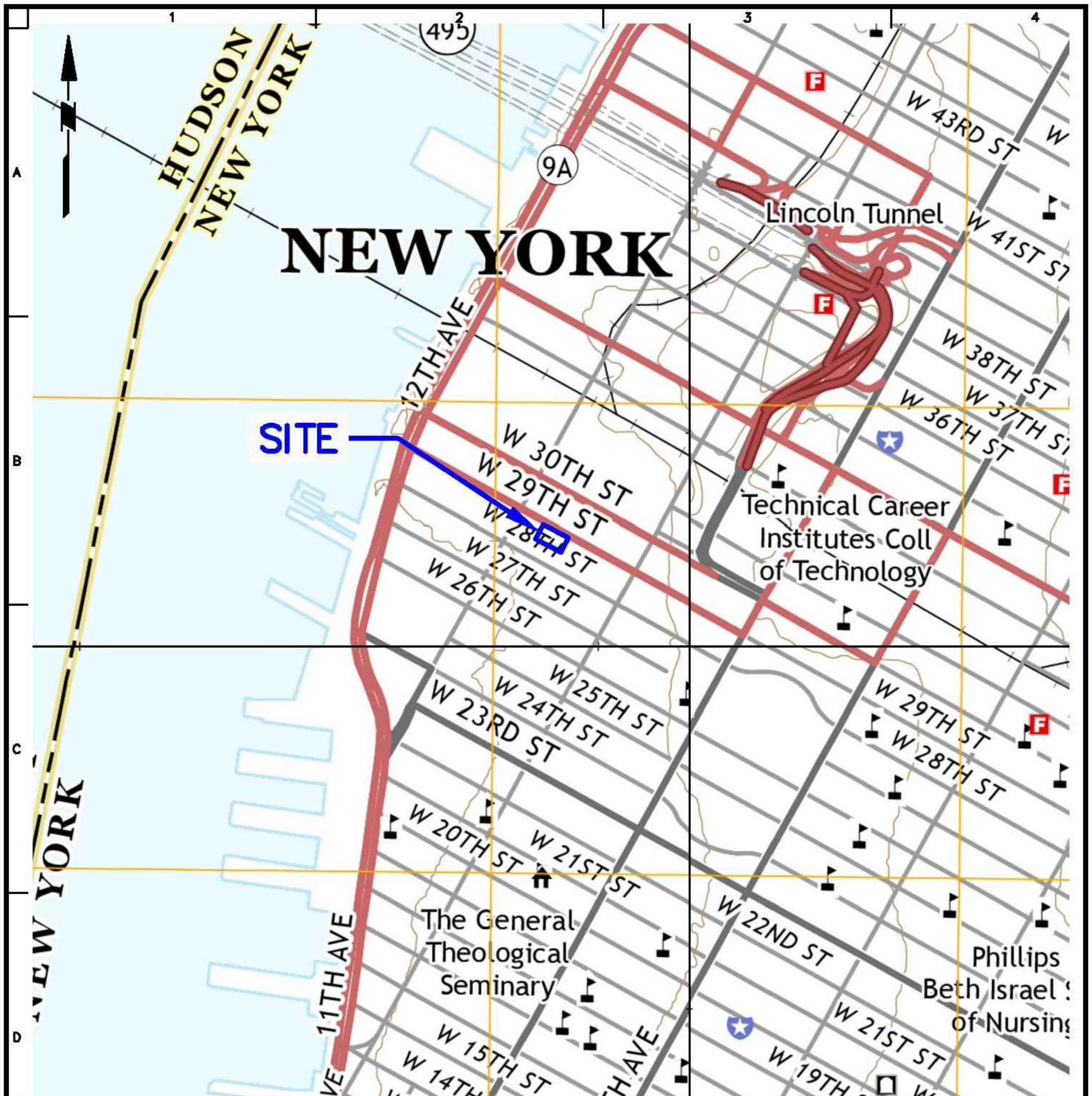
Note: Exposure to full sunshine can increase Heat Index values by up to 15 degrees F.

Apparent Temperature	Heat Stress Risk with Physical Activity and/or Prolonged Exposure
90-105	Heat Cramps or Heat Exhaustion Possible
105-130	Heat Cramps or Heat Exhaustion Likely, Heat Stroke Possible
>130	Heatstroke Highly Likely

FIGURES

FIGURE 1

Site Location Map



NOTES:
1. SITE BOUNDARY IS APPROXIMATE.
2. BASE MAP TAKEN FROM UNITED STATES GEOLOGICAL SURVEY 7.5 MINUTE TOPOGRAPHIC MAPS FOR THE BROOKLYN, CENTRAL PARK, JERSEY CITY AND WEEHAWKEN QUADRANGLES, DATED 2016.

WARNING: IT IS A VIOLATION OF THE NYS EDUCATION LAW ARTICLE 145 FOR ANY PERSON, UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER THIS ITEM IN ANY WAY.

1000 0 500 1000
SCALE IN FEET

LANGAN Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C. 21 Penn Plaza, 360 West 31st Street, 8th Floor New York, NY 10001 T: 212.479.5400 F: 212.479.5444 www.langan.com	Project **538-542 WEST 29TH STREET** BLOCK No. 700, LOT Nos. 55, 56 & 57 NEW YORK NEW YORK	Figure Title **SITE LOCATION MAP**	Project No. 170515401 Date 05/29/2018 Drawn By NEK Checked By ELS	Figure No. **1** Sheet 1 of 1

Filename: \\langan.com\data\NY\data4\170515401\Project Data\CAD\01\2D-DesignFiles\Limited Subsurface Investigation\Figure 1 - Site Location Map.dwg Date: 5/29/2018 Time: 18:26 User: nkung Style Table: Langan.stb Layout: ANSIA-BP

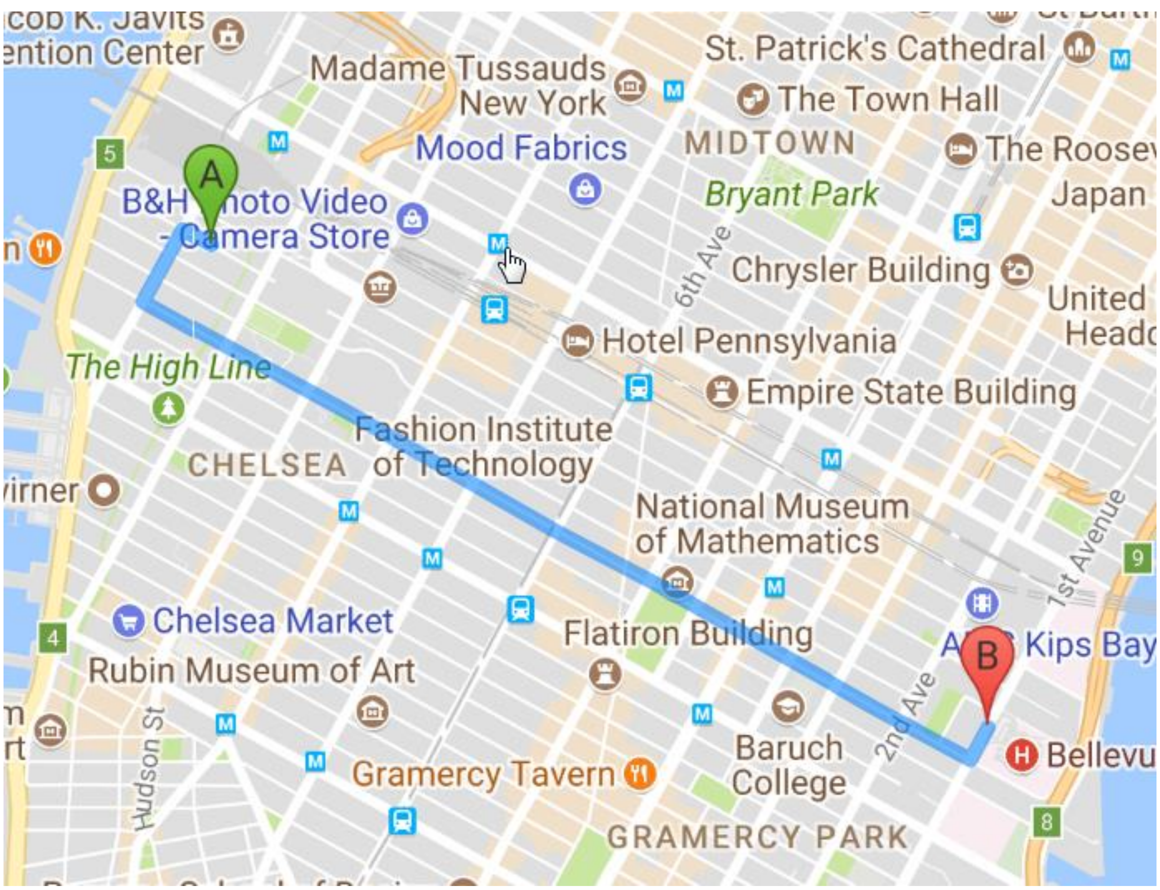
FIGURE 2
HOSPITAL ROUTE PLAN

Hospital Location: **Bellevue Hospital Center**
462 First Avenue
New York, New York
212-562-4141

START: 538 West 29th Street, New York, NY

1. Head northwest on West 29th Street toward 11th Avenue
2. Turn left at the 1st cross street onto 11th Avenue
3. Turn left at the 3rd cross street onto West 26th Street
4. Turn left onto 1st Avenue, destination will be on the right.

END: Bellevue Hospital Center, 462 First Street, New York, NY



ATTACHMENT A

STANDING ORDERS

STANDING ORDERS

GENERAL

- No smoking, eating, or drinking in this work zone.
- Upon leaving the work zone, personnel will thoroughly wash their hands and face.
- Minimize contact with contaminated materials through proper planning of work areas and decontamination areas, and by following proper procedures. Do not place equipment on the ground. Do not sit on contaminated materials.
- No open flames in the work zone.
- Only properly trained and equipped personnel are permitted to work in potentially contaminated areas.
- Always use the appropriate level of personal protective equipment (PPE).
- Maintain close contact with your buddy in the work zone
- Contaminated material will be contained in the Exclusion Zone (EZ).
- Report any unusual conditions.
- Work areas will be kept clear and uncluttered. Debris and other slip, trip, and fall hazards will be removed as frequently as possible.
- The number of personnel and equipment in the work zone will be kept to an essential minimum.
- Be alert to the symptoms of fatigue and heat/cold stress, and their effects on the normal caution and judgment of personnel.
- Conflicting situations which may arise concerning safety requirements and working conditions must be addressed and resolved quickly by the site HSO.

TOOLS AND HEAVY EQUIPMENT

- Do not, under any circumstances, enter or ride in or on any backhoe bucket, materials hoist, or any other device not specifically designed to carrying passengers.
- Loose-fitting clothing or loose long hair is prohibited around moving machinery.
- Ensure that heavy equipment operators and all other personnel in the work zone are using the same hand signals to communicate.
- Drilling/excavating within 10 feet in any direction of overhead power lines is prohibited.
- The locations of all underground utilities must be identified and marked out prior to initiating any subsurface activities.
- Check to insure that the equipment operator has lowered all blades and buckets to the ground before shutting off the vehicle.
- If the equipment has an emergency stop device, have the operator show all personnel its location and how to activate it.
- Help the operator ensure adequate clearances when the equipment must negotiate in tight quarters; serve as a signalman to direct backing as necessary.
- Ensure that all heavy equipment that is used in the Exclusion Zone is kept in that zone until the job is done, and that such equipment is completely decontaminated before moving it into the clean area of the work zone.
- Samplers must not reach into or get near rotating equipment such as the drill rig. If personnel must work near any tools that could rotate, the equipment operator must completely shut down the rig prior to initiating such work. It may be necessary to use a remote sampling device.

ATTACHMENT B

DECONTAMINATION PROCEDURES

PERSONNEL DECONTAMINATION

LEVEL C DECONTAMINATION

Station 1:	Equipment Drop	1. Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, cool down stations may be set up within this area.
Station 2:	Outer Garment, Boots, and Gloves Wash and Rinse	2. Scrub outer boots, outer gloves and chemical-resistant splash suit with decon solution or detergent and water. Rinse off using copious amounts of water.
Station 3:	Outer Boot and Glove Removal	3. Remove outer boots and gloves. Deposit in container with plastic liner.
Station 4:	Canister or Mask Change	4. If worker leaves Exclusion Zone to change canister (or mask), this is the last step in the decontamination procedure. Worker's canister is exchanged, new outer gloves and boot covers donned, joints taped, and worker returns to duty.
Station 5:	Boot, Gloves and Outer Garment Removal	5. Boots, chemical-resistant splash suit, inner gloves removed and deposited in separate containers lined with plastic.
Station 6:	Face piece Removal	6. Face piece is removed (avoid touching face with fingers). Face piece deposited on plastic sheets.
Station 7:	Field Wash	7. Hands and face are thoroughly washed. Shower as soon as possible.

LEVEL D DECONTAMINATION

Station 1:	Equipment Drop	1. Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, cool down stations may be set up within this area.
Station 2:	Outer Garment, Boots, and Gloves Wash and Rinse	2. Scrub outer boots, outer gloves and chemical-resistant splash suit with decon solution or detergent and water. Rinse off using copious amounts of water.
Station 3:	Outer Boot and Glove Removal	3. Remove outer boots and gloves. Deposit in container with plastic liner.
Station 4:	Boot, Gloves and Outer Garment Removal	4. Boots, chemical-resistant splash suit, inner gloves removed and deposited in separate containers lined with plastic.
Station 5:	Field Wash	5. Hands and face are thoroughly washed. Shower as soon as possible.

EQUIPMENT DECONTAMINATION

GENERAL:

Equipment to be decontaminated during the project may include tools, monitoring equipment, respirators, sampling containers, laboratory equipment and drilling equipment.

All decontamination will be done by personnel in protective gear, appropriate for the level of decontamination, as determined by the site HSO. The decontamination work tasks will be split or rotated among support and work crews.

Depending on site conditions, backhoe and pumps may be decontaminated over a portable decontamination pad to contain wash water; or, wash water may be allowed to run off into a storm sewer system. Equipment needed may include a steam generator with high-pressure water, empty drums, screens, screen support structures, and shovels. Drums will be used to hold contaminated wash water pumped from the lined pit. These drums will be labeled as such.

Miscellaneous tools and equipment will be dropped into a plastic pail, tub, or other container. They will be brushed off and rinsed with a detergent solution, and finally rinsed with clean water.

MONITORING EQUIPMENT:

Monitoring equipment will be protected as much as possible from contamination by draping, masking, or otherwise covering as much of the instruments as possible with plastic without hindering the operation of the unit. The PID, HNu or OVA meter, for example, can be placed in a clear plastic bag, which allows reading of the scale and operation of knobs. The probes can be partially wrapped keeping the sensor tip and discharge port clear.

The contaminated equipment will be taken from the drop area and the protective coverings removed and disposed in the appropriate containers. Any dirt or obvious contamination will be brushed or wiped with a disposable paper wipe.

RESPIRATORS:

Respirators will be cleaned and disinfected after every use. Taken from the drop area, the masks (with the cartridges removed and disposed of with other used disposable gear) will be immersed in a cleaning solution and scrubbed gently with a soft brush, followed by a rinse in plain warm water, and then allowed to air dry. In the morning, new cartridges will be installed. Personnel will inspect their own masks for serviceability prior to donning them. And, once the mask is on, the wearer will check the respirator for leakage using the negative and positive pressure fit check techniques.

ATTACHMENT C

EMPLOYEE EXPOSURE/ INJURY INCIDENT REPORT

EMPLOYEE INCIDENT/INJURY REPORT
LANGAN ENGINEERING & ENVIRONMENTAL SERVICES

(Complete and return to Tony Moffa in the Doylestown Office)

Affected Employee Name: ______________________________ Date: ______________________________

Incident type: ☐ Injury ☐ Report Only/No Injury
☐ Near Miss ☐ Other: ______________________________

EMPLOYEE INFORMATION (Person completing Form)

Employee Name: ______________________________ Employee No: ______________________________

Title: ______________________________ Office Location: ______________________________

Length of time employed or date of hire: ______________________________

Mailing address: ______________________________

____

Sex: M ☐ F ☐ Birth date: ______________

Business phone & extension: ______________ Residence/cell phone: ______________________________

ACCIDENT INFORMATION

Project: ______________________________ Project #: ______________________________

Date & time of incident: ______________ Time work started & ended: ______________________________

Site location: ______________________________

Incident Type: Possible Exposure ☐ Exposure ☐ Physical Injury ☐

Names of person(s) who witnessed the incident:____

____

Exact location incident occurred:

____

____

Describe work being done:____________________________________

____

____

____

Describe what affected employee was doing prior to the incident occurring:

____

____

____

Describe in detail how the incident occurred:

____

____

____

____

Nature of the incident (List the parts of the body affected):

____

____

____

____

Person(s) to whom incident was reported (Time and Date):

____

____

List the names of other persons affected during this incident:

____

____

Possible causes of the incident (equipment, unsafe work practices, lack of PPE, etc.):

____

____

____

Weather conditions during incident:

____

MEDICAL CARE INFORMATION

Did affected employee receive medical care? Yes ☐ No ☐

If Yes, when and where was medical care received:____________________________________

____

Provide name of facility (hospital, clinic, etc.):

____

____

Length of stay at the facility?

____

Did the employee miss any work time? Yes ☐ No ☐ Undetermined ☐

Date employee last worked: __________________________ Date employee returned to work:____

Has the employee returned to work? Yes ☐ No ☐

Does the employee have any work limitations or restrictions from the injury? : Yes ☐ No ☐

If Yes, please describe:

____

____

Did the exposure/injury result in permanent disability? Yes ☐ No ☐ Unknown ☐

If Yes, please describe:

____

HEALTH & SAFETY INFORMATION

Was the operation being conducted under an established site specific CONSTRUCTION CONSTRUCTION HEALTH AND SAFETY PLAN?

Yes ☐ No ☐ Not Applicable: ☐

Describe protective equipment and clothing used by the employee:

____

____

____

Did any limitations in safety equipment or protective clothing contribute to or affect exposure / injury? If so, explain:

____

____

____

____

Employee Signature Date

____

Langan Representative Date

ATTACHMENT D

CALIBRATION LOG

DATE:__________________　　　　**PROJECT:______________________**

CALIBRATION LOG

Date & Time	Inst Type	Inst #	Media	Initial Reading	Span #	Calibrat. Reading	Performed By:

DATE:________________ PROJECT:____________________

CALIBRATION LOG

Date & Time	Inst Type	Inst #	Media	Initial Reading	Span #	Calibrat. Reading	Performed By:

DATE:________________ PROJECT:____________________

CALIBRATION LOG

Date & Time	Inst Type	Inst #	Media	Initial Reading	Span #	Calibrat. Reading	Performed By:

DATE:________________ **PROJECT:____________________**

CALIBRATION LOG

Date & Time	Inst Type	Inst #	Media	Initial Reading	Span #	Calibrat. Reading	Performed By:

ATTACHMENT E

MATERIAL SAFETY DATA SHEETS

SAFETY DATA SHEETS

All Langan Field Personnel Completing This Work Plan Are To Have Real Time Accessibility To Material Safety Data Sheet (MSDs) or Safety Data Sheet (SDSs) Through Their Smart Phone.

The link is http://www.msds.com/
The login name is "drapehead"
The password is "2angan987"

If You Are Unable To Use the Smart Phone App, You Are To Bring Printed Copies of the MSDs/SDSs to the Site

ATTACHMENT F

JOBSITE SAFETY INSPECTION CHECKLIST

Jobsite Safety Inspection Checklist

Date: ______________________ **Inspected By:** ______________________

Location: ______________________ **Project #:** ______________________

Check one of the following: **A:** Acceptable **NA**: Not Applicable **D**: Deficiency

	A	NA	D	Remark
1. CHASP available onsite for inspection?				
2. Health & Safety Compliance agreement (in CHASP) appropriately signed by Langan employees and contractors?				
3. Hospital route map with directions posted on site?				
4. Emergency Notification List posted on site?				
5. First Aid kit available and properly stocked?				
6. Personnel trained in CPR/First Aid on site?				
7. MSDSs readily available, and all workers knowledgeable about the specific chemicals and compounds to which they may be exposed?				
8 Appropriate PPE being worn by Langan employees and contractors?				
9. Project site safe practices ("Standing Orders") posted?				
10. Project staff have 40-hr./8-hr./Supervisor HAZWOPER training?				
11. Project staff medically cleared to work in hazardous waste sites and fit-tested to wear respirators, if needed?				
12. Respiratory protection readily available?				
13. Health & Safety Incident Report forms available?				
14. Air monitoring instruments calibrated daily and results recorded on the Daily Instrument Calibration check sheet?				
15. Air monitoring readings recorded on the air monitoring data sheet/field log book?				
16. Subcontract workers have received 40-hr./8-hr./Spvsr. HAZWOPER training, as appropriate?				
17. Subcontract workers medically cleared to work on site, and fit-tested for respirator wear?				
18. Subcontract workers have respirators readily available?				
19. Mark outs of underground utilities done prior to initiating any subsurface activities?				
20. Decontamination procedures being followed as outlined in CHASP?				
21. Are tools in good condition and properly used?				
22. Drilling performed in areas free from underground objects including utilities?				

23. Adequate size/type fire extinguisher supplied?				
24. Equipment at least 20 feet from overhead powerlines?				
25. Evidence that drilling operator is responsible for the safety of his rig.				
26. Trench sides shored, layer back, or boxed?				
27. Underground utilities located and authorities contacted before digging?				
28. Ladders in trench (25-foot spacing)?				
29. Excavated material placed more than 2 feet away from excavation edge?				
30. Public protected from exposure to open excavation?				
31. People entering the excavation regarding it as a permit-required confined space and following appropriate procedures?				
32. Confined space entry permit is completed and posted?				
33. All persons knowledgeable about the conditions and characteristics of the confined space?				
34. All persons engaged in confined space operations have been trained in safe entry and rescue (non-entry)?				
35. Full body harnesses, lifelines, and hoisting apparatus available for rescue needs?				
36. Attendant and/or supervisor certified in basic first aid and CPR?				
37. Confined space atmosphere checked before entry and continuously while the work is going on?				
38. Results of confined space atmosphere testing recorded?				
39. Evidence of coordination with off-site rescue services to perform entry rescue, if needed?				
40. Are extension cords rated for this work being used and are they properly maintained?				
41. Are GFCIs provided and being used?				

Unsafe Acts: ______________________________

____

____

____

Notes: ______________________________

____

____

____

ATTACHMENT G

JOB SAFETY ANALYSIS FORM

LANGAN	Job Safety Analysis (JSA) Health and Safety
JSA TITLE: **JSA NUMBER:**	**DATE CREATED:** **CREATED BY:** **REVISION DATE:** **REVISED BY:**

Langan employees must review and revise the Job Safety Analysis (JSA) as needed to address the any site specific hazards not identified. Employees must provide their signatures on the last page of the JSA indicating they have review the JSA and are aware the potential hazards associated with this work and will follow the provided preventive or corrective measures.

PERSONAL PROTECTIVE EQUIPMENT REQUIRED: (PPE): ■ Required ☒ As Needed		
☐ Steel-toed boots	☐ Nitrile gloves	☐ Dermal Protection (Specify)
☐ Long-sleeved shirt	☐ Leather/ Cut-resistant gloves	☐ High visibility vest/clothing
☐ Safety glasses	☐Face Shield	☐ Hard hat
ADDITIONAL PERSONAL PROTECTIVE EQUIPMENT NEEDED (Provide specific type(s) or descriptions)		
☐ Air Monitoring:	☐ Respirators:	☐ Other:

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE OR CORRECTIVE ACTION
1.	1. 2.	1a. 1b. 2a. 2b.
2.	1.	1
Additional items identified in the field.		
Additional Items.		

If additional items are identified during daily work activities, please notify all relevant personnel about the change and document on this JSA.

LANGAN	**Job Safety Analysis (JSA)** **Health and Safety**

JSA Title: **Subsurface Investigation**

JSA Number: **JSA030-01**

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions.

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):

☒ Safety Shoes	☒ Long Sleeves	☒ Safety Vest (Class 2)	☒ Hard Hat	☒ Hearing Protection
☒ Safety Glasses	☒ Safety Goggles	☐ Face Shield	☐ Nitrile Gloves	☐ PVC Gloves
☒ Leather Gloves	☒ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☐ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☐ Traffic Cones/Signs	☐ Life Vest/Jacket	

☒ Other: Dielectric Overshoes, Sun Block

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
1. Transport equipment to work area	1. Back/strain 2. Slip/Trip/Falls 3. Traffic 4. Cuts/abrasions/contusions from equipment 5. Accidents due to vehicle operations	1. Use proper lifting techniques/Use wheeled transport 2. Minimize distance to work area/unobstructed path to work area/follow good housekeeping procedures 3. Wear proper PPE (high visibility vest or clothing) 4. Wear proper PPE (leather gloves, long sleeves, Langan approved safety shoes) 5. Observe posted speed limits/ Wear seat belts at all times
2. Traffic	1. Hit by moving vehicle	1. Use traffic cones and signage/ Use High visibility traffic vests and clothing/ Caution tape when working near active roadways.
3. Field Work (drilling, resistivity testing, and inspection)	1. Biological Hazards: insects, rats, snakes, poisonous plants, and other animals 2. Heat stress/injuries 3. Cold Stress/injuries 4. High Energy Transmission Lines 5. Underground Utilities 6. Electrical (soil resistivity testing)	1. Inspect work area to identify biological hazards. Wear light colored long sleeve shirt and long pants/ Use insect repellant as necessary/ Beware of tall grass, bushes, woods and other areas where ticks may live/ Avoid leaving garbage on site to prevent attracting animals/ Identify and avoid contact with poisonous plants/Beware of rats, snakes, or stray animals. 2. Wear proper clothing (light colored)/ drink plenty of water/ take regular breaks/use sun block 3. Wear proper clothing/ dress in layers/ take regular breaks. 4. Avoid direct contact with high energy transmission lines/ position equipment at least 15 feet or as required by PSE&G from the transmission lines/ wear proper PPE (dielectric overshoes 15 kV minimum rating). 5. Call one-call service before performing intrusive field work/ Review utility mark-outs and available utility drawings (with respect to proposed work locations)/ Follow Underground Utility Guidelines

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
		6. See AGI Sting R1 operating manual for specific concerns during operating instrument
4. All activities	1. Slips/ Trips/ Falls 2. Hand injuries, cuts or lacerations during manual handling of materials 3. Foot injuries 4. Back injuries 5. Traffic 6. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 7. High Noise levels 8. Overhead hazards 9. Heat Stress/ Cold Stress 10. Eye Injuries	7. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 8. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 9. Wear Langan approved safety shoes 10. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 11. Wear high visibility clothing & vest / Use cones or signs to designate work area 12. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 13. Wear proper hearing protection 14. Wear hard hat / Avoid areas were overhead hazards exist. 15. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 16. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	**Sign Name**	**Date**
Prepared by:		
Reviewed by:		

LANGAN	Job Safety Analysis (JSA) Health and Safety

JSA Title: Field Sampling

JSA Number: JSA022-01

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions.

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):

☒ Safety Shoes	☒ Long Sleeves	☐ Safety Vest (Class 2)	☒ Hard Hat	☒ Hearing Protection
☒ Safety Glasses	☐ Safety Goggles	☐ Face Shield	☒ Nitrile Gloves	☐ PVC Gloves
☒ Leather Gloves	☐ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☐ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☒ Traffic Cones/Signs	☐ Life Vest/Jacket	
☐ Other:				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
5. Unpack/Transport equipment to work area.	6. Back Strains 7. Slip/Trips/Falls 8. Cuts/Abrasions from equipment 9. Contusions from dropped equipment	6. Use proper lifting techniques/Use wheeled transport 7. Minimize distance to work area/Unobstructed path to work area/follow good housekeeping procedures. Mark slip/trip/fall hazards with orange safety cones. 8. Wear proper PPE (leather gloves, long sleeves). 9. Wear proper PPE (Langan approved safety shoes).
6. Initial Site Arrival-Site Assessment	1. Traffic	1. Situational awareness (be alert of your surroundings). Secure area from through traffic.
7. Surface Water Sampling	1. Contaminated media. Skin/eye contact with biological agents and/or chemicals.	1. Wear appropriate PPE (Safety glasses, appropriate gloves). Review (M)SDS for all chemicals being.
8. Sampling from bridges	1. Struck by vehicles	1. Wear appropriate PPE (Safety Vest). Use buddy system and orange safety cones.
9. Icing of Samples/ Transporting coolers/equipment from work area.	11. Back Strains 12. Slips/Trips/Falls 13. Cuts/Abrasions from equipment 14. Pinch/Crushing Hazards.	17. Drain coolers of water. Use proper lifting techniques. Use wheeled transport. 18. Have unobstructed path from work area. Aware of surroundings. 19. Wear proper PPE (Leather gloves, long sleeves) 20. Wear proper PPE (Leather gloves, long sleeves)
10. Site Departure	1. Contaminated PPE/Vehicle	1. Contaminated PPE should be disposed of on-site. Remove boots and soiled clothing for secure storage in trunk. Wash hands promptly.
11. All activities	1. Slips/ Trips/ Falls 2. Hand injuries, cuts or lacerations during manual handling of materials	1. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
	3. Foot injuries 4. Back injuries 15. Traffic 16. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 17. High Noise levels 18. Overhead hazards 19. Heat Stress/ Cold Stress 20. Eye Injuries	2. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 3. Wear Langan approved safety shoes 4. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 21. Wear high visibility clothing & vest / Use cones or signs to designate work area 22. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 23. Wear hearing protection 24. Wear hard hat / Avoid areas were overhead hazards exist. 25. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 26. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	**Sign Name**	**Date**
Prepared by:		
Reviewed by:		

LANGAN	Job Safety Analysis (JSA) Health and Safety

JSA Title: **Equipment Transportation and Set-Up**

JSA Number: **JSA012-01**

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions.

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):

☒ Safety Shoes	☒ Long Sleeves	☒ Safety Vest (Class 2)	☒ Hard Hat	☒ Hearing Protection
☒ Safety Glasses	☐ Safety Goggles	☐ Face Shield	☐ Nitrile Gloves	☐ PVC Gloves
☒ Leather Gloves	☐ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☐ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☐ Traffic Cones/Signs	☐ Life Vest/Jacket	
☐ Other:				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
12.Transport equipment to work area	10.Back Strain 11.Slips/ Trips/ Falls 12.Traffic 13.Cuts/abrasions from equipment 14.Contusions from dropped equipment	1. Use proper lifting techniques / Use wheeled transport 2. Minimize distance to work area / Have unobstructed path to work area / Follow good housekeeping procedures 3. Wear proper PPE (high visibility vest or clothing) 4. Wear proper PPE (leather gloves, long sleeves) 5. Wear proper PPE (safety shoes)
13.Moving equipment to its planned location	2. Pinch Hazard 3. Slips/ Trips/ Falls	1. Wear proper PPE (leather gloves) 2. Be aware of potential trip hazards / Practice good housekeeping procedures / Mark significant below-grade hazards (i.e. holes, trenches) with safety cones or spray paint
14.Equipment Set-up	2. Pinch Hazard 3. Cuts/abrasions to knuckles/hands 4. Back Strain	1. Wear proper PPE (leather gloves) 2. Wear proper PPE (leather gloves) 3. Use proper lifting techniques / Use wheeled transport
15. All activities	21. Slips/ Trips/ Falls 22. Hand injuries, cuts or lacerations during manual handling of materials 23. Foot injuries 24. Back injuries 25. Traffic 26. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 27. High Noise levels 28. Overhead hazards 29. Heat Stress/ Cold Stress 30. Eye Injuries	27. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 28. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 29. Wear Langan approved safety shoes 30. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 31. Wear high visibility clothing & vest / Use cones or signs to designate work area

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
4. All activities (cont'd)		32. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 33. Wear hearing protection 34. Wear hard hat / Avoid areas were overhead hazards exist. 35. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 36. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	**Sign Name**	**Date**
Prepared by:		
Reviewed by:		

LANGAN	Job Safety Analysis (JSA) Health and Safety

JSA Title: 55-gallon Drum Sampling

JSA Number: JSA043-01

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions.

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):

☒ Safety Shoes	☒ Long Sleeves	☒ Safety Vest (Class 2)	☒ Hard Hat	☐ Hearing Protection
☒ Safety Glasses	☒ Safety Goggles	☒ Face Shield	☒ Nitrile Gloves	☒ PVC Gloves
☒ Leather Gloves	☐ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☐ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☐ Traffic Cones/Signs	☐ Life Vest/Jacket	

☒ Other: All Drums are required to be labeled. Langan employees do not open or move undocumented drums or unlabeled drums without proper project manager authorization.

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
16.Unpack/Transport equipment to work area.	15.Back Strains 16.Slip/Trips/Falls 17.Cuts/Abrasions from equipment 4. Contusions from dropped equipment	10. Use proper lifting techniques/Use wheeled transport 11. Minimize distance to work area/Unobstructed path to work area/follow good housekeeping procedures. Mark slip/trip/fall hazards with orange safety cones. 12. Wear proper PPE (leather gloves, long sleeves). 4. Wear proper PPE (Langan approved safety shoes).
17.Open Drums	1. Hand Injuries, cuts or lacerations when untightening drum locking bolt, removing drum lid strap, or removing lid. 2. Pressure from drums.	1. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves. Use non-metallic mallet and non-sparking tools/wrenches. 2. Open drum slowly to relieve pressure. Wear proper PPE: face shield and goggles; correct gloves; and over garments.
18.Collecting Soil/Fluid Sample	4. Irritation to eye from vapor, soil dust, or splashing 5. Irritation to exposed skin	2. Wear proper eye protection including safety glasses/ face shield/googles and when necessary, splash guard. If dust or vapor phase is present, wear appropriate safety breathing gear (1/2 mask or full face mask with correct filter) 3. Wear proper skin protection including nitrile gloves.
19.Closing Drums	1. Hand Injuries, cuts or lacerations when untightening drum locking bolt, removing drum lid strap, or removing lid.	2. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves. Use non-metallic mallet and non-sparking tools/wrenches.
20.Moving Drums	2. Hand Injuries, cuts or lacerations when untightening drum locking bolt, removing drum lid strap, or removing lid. 3. Back Strains	2. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves. Use non-metallic mallet and non-sparking tools/wrenches. 3. Use proper lifting techniques/Use wheeled transport

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
21. All activities	31. Slips/ Trips/ Falls 32. Hand injuries, cuts or lacerations during manual handling of materials 33. Foot injuries 34. Back injuries 35. Traffic 36. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 37. High Noise levels 38. Overhead hazards 39. Heat Stress/ Cold Stress 40. Eye Injuries	37. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 38. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 39. Wear Langan approved safety shoes 40. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 41. Wear high visibility clothing & vest / Use cones or signs to designate work area 42. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 43. Wear hearing protection 44. Wear hard hat / Avoid areas were overhead hazards exist. 45. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 46. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	**Sign Name**	**Date**
Prepared by:		
Reviewed by:		

LANGAN	**Job Safety Analysis (JSA)** **Health and Safety**

JSA Title: **Direct-Push Soil Borings**
JSA Number: **JSA004-01**

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions.

PERSONAL PROTECTIVE EQUIPMENT REQUIRED:				
☒ Safety Shoes	☒ Long Sleeves	☒ Safety Vest (Class 2)	☒ Hard Hat	☒ Hearing Protection
☒ Safety Glasses	☐ Safety Goggles	☐ Face Shield	☒ Nitrile Gloves	☐ PVC Gloves
☒ Leather Gloves	☒ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☐ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☐ Traffic Cones/Signs	☐ Life Vest/Jacket	
☒ Other: Half-face respirator, dust cartridges, PID (if applicable)				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
22.Move equipment to work site	18.Back strain when lifting equipment 19.Slips/ Trips/ Falls while moving equipment 20.Traffic (if applicable) 21.Pinched fingers or running over toes during geoprobe set-up 22.Overturn drilling rig while transporting to loading dock on flat-bed tow truck	13. Use proper lifting technique (use legs for bending and lifting and not the back)/ Use wheeled transport for heavy equipment / Get assistance when handling loads greater than 50 lbs. / Minimize distance to vehicle 14. Use proper lifting technique (use legs for bending and lifting and not the back) / Use wheeled transport for heavy equipment / Get assistance when handling loads greater than 50 lbs. / Minimize distance to vehicle / Have unobstructed path to vehicle or collection point / Do not lift/walk with boxes that are heavy/difficult to lift 15. Wear high visibility safety vests or clothing / Exercise caution 16. Wear proper PPE (cut-resistant gloves) / Stay alert, be aware of geoprobe rig at all times 17. Drill rig should be parked in center of flat-bed tow truck / Emergency brake shall be used at all times during transport on the flat-bed truck/ All unnecessary personnel should stay away from the flat-bed truck during moving activities
23.Calibration of monitoring equipment	6. Skin or eye contact with calibration chemicals 7. Pinch fingers in monitoring equipment	4. Wear proper PPE (safety glasses/ goggles) 5. Wear proper PPE (leather gloves)
24.Set-up geoprobe rig	5. Geoprobe rig movement	3. All field personnel should stay clear of the geoprobe rig while moving / Use a spotter when backing up the geoprobe
25.Advance geoprobe rods below ground surface to desired depth	4. Underground utilities 5. High noise levels	4. Clean all subsurface soil borings to a minimum of 5 feet below grade 5. Wear proper PPE (hearing protection)
26. Remove and open acetate liner	41. Pinched fingers while removing macrocore 42. Cuts/lacerations when cutting acetate liner open 43. Exposure to hazardous vapors	1. Wear proper PPE (nitrile gloves, cut-resistant or leather gloves 2. Wear proper PPE (cut-resistant or leather gloves) 3. Do not place face over acetate liner when opening / Monitor hazardous vapors in air with PID / Upgrade PPE as necessary based on levels contained in the Health and Safety Plan

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
5. Remove and open acetate liner (cont'd)	44. Skin contact with contaminated soil	4. Wear proper PPE (nitrile gloves)
27. Sample Collections a) Monitor parameters b) Prepare sample containers and labels	1. Contact with potentially contaminated soil 2. Lacerations from broken sample bottles 3. Back strain while transporting full coolers 4. Internal exposure to contaminants and metals through inhalation of dust 5. Slips/ Trips/ Falls	1. Use monitoring devices / Wear proper PPE (safety glasses, nitrile gloves) 2. Do not over-tighten bottle caps / Handle bottles safely to prevent breakage 6. Use proper lifting techniques / Do not lift heavy loads without assistance 7. Avoid creating dust / If necessary, wear a half mask respirator with applicable dust cartridge / Inspect respirator for damage and cleanliness prior to use / Clean respirator after each use and store in a clean, secure location 8. Be alert / Follow good housekeeping procedures
28. Remove excess soil from acetate liner and place in 55-gallon drum (IF NOT PERFORMED BY LANGAN, REMOVE!)	1. Cuts/lacerations from acetate liner 2. Pinched fingers/hand while opening/closing drum 3. Skin contact with contaminated soil 4. Soil debris in eyes	1. Wear proper PPE (cut-resistant or leather gloves) 2. Wear proper PPE (cut-resistant or leather gloves) 3. Wear proper PPE (nitrile gloves) 4. Wear proper PPE (safety glasses)
8. Transport drums to central staging location (IF NOT PERFORMED BY LANGAN, REMOVE!)	1. Back, arm or shoulder strain from moving drums 2. Pinch fingers/hand in drum cart when moving drums 3. Pinch fingers/hand when operating lift-gate on vehicle 4. Contact with potentially contaminated groundwater when moving improperly sealed drums 5. Slips when moving drums 6. Drop drum on feet/toes	47. Use drum cart for moving drums / Use proper lifting techniques / Do not lift heavy loads without assistance 48. Wear proper PPE (cut-resistant or leather gloves) 49. Wear proper PPE (cut-resistant or leather gloves) 50. Wear proper PPE (nitrile gloves underneath work gloves) 51. Follow good housekeeping procedures / Ensure route to move drum and storage space is free from obstructions 52. Wear proper PPE (safety shoes) / Work in a safe manner to prevent dropped drum
9. All activities	1. Slips/ Trips/ Falls 2. Hand injuries, cuts or lacerations during manual handling of materials 3. Foot injuries 4. Back injuries 5. Traffic 6. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 7. High Noise levels 8. Overhead hazards 9. Heat Stress/ Cold Stress	1. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 2. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 3. Wear Langan approved safety shoes 4. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 5. Wear high visibility clothing & vest / Use cones or signs to designate work area 6. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 7. Wear hearing protection 8. Wear hard hat / Avoid areas were overhead hazards exist. 9. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
9. All activities (cont'd)	10. Eye Injuries	10. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	Sign Name	Date
Prepared by:		
Reviewed by:		

LANGAN	Job Safety Analysis (JSA) Health and Safety

JSA Title: Site Inspection

JSA Number: JSA024-01

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions.

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):				
☒ Safety Shoes	☒ Long Sleeves	☒ Safety Vest (Class 2)	☒ Hard Hat	☒ Hearing Protection
☒ Safety Glasses	☐ Safety Goggles	☐ Face Shield	☒ Nitrile Gloves	☐ PVC Gloves
☒ Leather Gloves	☐ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☒ Rubber Boots
☒ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☒ Traffic Cones/Signs	☐ Life Vest/Jacket	
☐ Other:				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
29.Jobsite Pre-briefing	23.None	18. Review JSA, SOP's, and discuss hazards that may be present and control measures for present hazards while on-site.
2. Working near railroads	1. Passing Trains. 2. Slip/Trips/Falls.	1. Wear reflective vest/ Stay away from tracks/ Do not cross tracks within 10 ft. of train car or when there is a train within view/listen for train horn. 2. Be aware of tripping hazards/ Follow good housekeeping procedures/ Mark significant hazards with spray paint or cones.
3. Walking around site	6. Uneven terrain 7. Wildlife: Stray animals, mice/rats, vectors (i.e. mosquitoes, bees, etc.) 8. Weather: Heat/cold stress 9. Slip/Trips/Falls 10. Foot injuries 11. Eye injuries	9. Pay attention to surrounding area (puddles, wet, frozen, uneven areas); Mark with cones or spray paint. 10. Use bug spray/ Avoid stray animals/Use repellant when needed. 11. Dress for the correct weather situation/ Use sunscreen or protective clothing in sunlight, layers in cold weather/ Drink plenty of fluids/ Take breaks when needed. 4. Be aware of tripping hazards/ Follow good housekeeping procedures/ Mark significant hazards with spray paint or cones. 5. Wear proper PPE (Langan approved safety shoes)/ Change wet socks during cold weather. 6. Wear proper PPE (safety glasses/goggles).
4. Working near road	1. Passing vehicles 2. Slip/Trips/Falls	1. Wear reflective vest/ Stay away from roadway/ Use buddy system/ Place signage or cones when needed. 2. Be aware of tripping hazards/ Follow good housekeeping procedures/ Mark significant hazards with spray paint or cones.
5. All activities	45. Slips/ Trips/ Falls 46. Hand injuries, cuts or lacerations during manual handling of materials 47. Foot injuries 48. Back injuries 49. Traffic	53. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 54. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 55. Wear Langan approved safety shoes

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
	50. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 51. High Noise levels 52. Overhead hazards 53. Heat Stress/ Cold Stress 54. Eye Injuries	56. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 57. Wear high visibility clothing & vest / Use cones or signs to designate work area 58. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 59. Wear hearing protection 60. Wear hard hat / Avoid areas were overhead hazards exist. 61. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 62. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	**Sign Name**	**Date**
Prepared by:		
Reviewed by:		

LANGAN	Job Safety Analysis (JSA) Health and Safety

JSA Title: **Building Construction Oversight**

JSA Number: **JSA006-01**

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions.

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):				
☒ Safety Shoes	☒ Long Sleeves	☒ Safety Vest (Class 2)	☒ Hard Hat	☒ Hearing Protection
☒ Safety Glasses	☐ Safety Goggles	☒ Face Shield	☒ Nitrile Gloves	☐ PVC Gloves
☒ Leather Gloves	☐ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☐ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☒ Traffic Cones/Signs	☐ Life Vest/Jacket	
☐ Other:				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
30. Transport equipment to work area	24. Back Strain 25. Slips/ Trips/ Falls 26. Traffic 27. Cuts/abrasions from equipment 28. Contusions from dropped equipment	6. Use proper lifting techniques / Use wheeled transport 7. Minimize distance to work area / Have unobstructed path to work area / Follow good housekeeping procedures 8. Wear proper PPE (high visibility vest or clothing) 9. Wear proper PPE (leather gloves, long sleeves) 10. Wear proper PPE (safety shoes)
31. Drilling/anchor bolt installation	8. Hazards associated with drilling, flying objects, heavy equipment, ground level hazards and dust 9. Slips/ Trips/ Falls 10. Hazards associated with concrete work	3. Maintain a safe distance from drilling operation / Wear proper PPE (hard hat, safety glasses, safety shoes, safety vest) 4. Be aware of potential trip hazards / Follow good housekeeping procedures / Mark significant below-grade hazards (i.e. holes, trenches) with safety cones or spray paint / Wear the proper PPE (safety shoes) 5. Maintain a safe distance from pouring operation
32. Steel building erection	6. Overhead hazards, falling objects 7. Pinching/crushing hazards	5. Wear proper PPE (hard had, safety glasses, safety vest) / Be aware of overhead hazards and maintain a safe distance of at least 10 ft. 6. All personnel should make others aware of moving objects or their inten to move objects / Avoid areas where pinching and crushing hazards are possible
33. All activities	55. Slips/ Trips/ Falls 56. Hand injuries, cuts or lacerations during manual handling of materials 57. Foot injuries 58. Back injuries 59. Traffic 60. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 61. High Noise levels 62. Overhead hazards	63. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 64. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 65. Wear Langan approved safety shoes 66. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
4. All activities (cont'd)	63. Heat Stress/ Cold Stress 64. Eye Injuries	67. Wear high visibility clothing & vest / Use cones or signs to designate work area 68. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 69. Wear hearing protection 70. Wear hard hat / Avoid areas were overhead hazards exist. 71. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 72. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	**Sign Name**	**Date**
Prepared by:		
Reviewed by:		

LANGAN	**Job Safety Analysis (JSA)** **Health and Safety**

JSA Title: **Geotechnical Drilling**

JSA Number: **JSA014-01**

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions.

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):				
☒ Safety Shoes	☒ Long Sleeves	☒ Safety Vest (Class 2)	☒ Hard Hat	☒ Hearing Protection
☒ Safety Glasses	☐ Safety Goggles	☒ Face Shield	☒ Nitrile Gloves	☐ PVC Gloves
☒ Leather Gloves	☐ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☐ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☐ Traffic Cones/Signs	☐ Life Vest/Jacket	
☒ Other: Nomex (as needed)				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
34. Transport equipment to work area	29. Back Strain 30. Slips/ Trips/ Falls 31. Traffic 32. Cuts/abrasions from equipment 33. Contusions from dropped equipment	11. Use proper lifting techniques / Use wheeled transport 12. Minimize distance to work area / Have unobstructed path to work area / Follow good housekeeping procedures 13. Wear proper PPE (high visibility vest or clothing) 14. Wear proper PPE (leather gloves, long sleeves) 15. Wear proper PPE (safety shoes)
35. Set-up HSA/SPT rig	11. Slips/ Trips/ Falls 12. Pinch Hazards 13. High noise levels 14. Clothing entanglement 15. Electrocution/falling equipment and debris from raising HSA/SPT rig mast 16. Carbon monoxide poisoning 17. HSA/SPT rig roll-over 18. HSA/SPT rig movement	6. Be aware of potential trip hazards / Follow good housekeeping procedures / Mark significant below-grade hazards (i.e. holes, trenches) with safety cones or spray paint 7. Wear proper PPE (leather gloves) 8. Wear proper PPE (hearing protection) 9. Wear proper attire for HSA/SPT rig (no loose clothing, strings, etc.) 10. Wear proper PPE (hard hats) / Be aware of locations at all times / Look up, down and around before raising mast / Check HSA/SPT drill rig mast for loose objects/debris before raising 11. Stand upwind of rig engine 12. Do not move rig with mast raising / Set stabilizers prior to raising mast / Inspect work area / If area appears unstable, the boring locations should be moved. 13. All field personnel should stay clear of rig while moving / Use a spotter when backing up the rig
36. Advance HSA/SPT rods, augers and casing below ground surface	8. Strain wrist/bruise palm 9. Pinched fingers 10. Back strain 11. Clothing entanglement 12. Carbon monoxide poisoning 13. Bruised/Broken toes/feet	7. Wear proper PPE (leather gloves) / Use proper technique for preparing rods / Use second person, if necessary 8. Wear proper PPE (leather gloves) 9. Use proper lifting techniques / Obtain assistance if needed 10. Wear proper attire for HSA/SPT rig (no loose clothing, strings, etc.) 11. Stand upwind of the rig

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
37. Advance HSA/SPT rods, augers and casing below ground surface (cont'd)	14. High noise levels	12. Wear proper PPE (safety shoes) 13. Wear proper PPE (hearing protection)
38. Remove and open split spoon	12. Pinched fingers 13. Cuts/lacerations 14. Skin contact with contaminated soil and groundwater	1. Wear proper PPE (nitrile and leather gloves) 2. Wear proper PPE (leather gloves) 3. Wear proper PPE (nitrile gloves, safety glasses)
39. Repeat steps 3 and 4 until desired depth is reached	1. See steps 3 and 4	1. See steps 3 and 4
40. Remove HSA/SPT rods, augers and casing and place in storage rack	1. Clothing entanglement 2. Back strain 3. Pinched fingers 4. Carbon monoxide poisoning 5. High noise levels	1. Wear proper attire for HSA/SPT rig (no loose clothing, strings, etc.) 2. Use proper lifting techniques / Obtain assistance if needed 3. Wear proper PPE (leather gloves) 4. Stand upwind of rig engine 5. Wear proper PPE (hearing protection)
41. Tremie-grout borehole with a cement-bentonite grout mixture	1. Splash cement/bentonite grout on face/eyes 2. Back strain 3. Pinched fingers	1. Wear proper PPE (safety glasses) 2. Use proper lifting techniques / Obtain assistance if needed 3. Wear proper PPE (nitrile gloves, leather gloves)
42. Decontaminate equipment	1. Contact with potentially impacted material 2. Contact with sharp pieces of equipment	1. Wear proper PPE (safety glasses, nitrile gloves) 2. Wear proper PPE (leather gloves)
43. Patch soil boring location to return to pre-existing conditions (i.e. concrete, asphalt, grass)	1. Cuts/lacerations 2. Splashed concrete on face/eyes 3. Hammer fingers/hands when patching asphalt	1. Wear proper PPE (leather gloves) / Use scissors for cutting 2. Use proper PPE (safety glasses) 3. Be aware of hands/fingers during hammering / Wear proper PPE (leather gloves)
44. All activities	65. Slips/ Trips/ Falls 66. Hand injuries, cuts or lacerations during manual handling of materials 67. Foot injuries 68. Back injuries 69. Traffic 70. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 71. High Noise levels 72. Overhead hazards 73. Heat Stress/ Cold Stress 74. Eye Injuries	73. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 74. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 75. Wear Langan approved safety shoes 76. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 77. Wear high visibility clothing & vest / Use cones or signs to designate work area 78. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 79. Wear hearing protection 80. Wear hard hat / Avoid areas were overhead hazards exist.

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
		81. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 82. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	**Sign Name**	**Date**
Prepared by:		
Reviewed by:		

ATTACHMENT H

TAILGATE SAFETY BRIEFING FORM

LANGAN TAILGATE SAFETY BRIEFING

Date:___________________________ Time: _______________________________________

Leader:________________________________ Location:____________________________________

Work Task:

____

____

SAFETY TOPICS (*provide some detail of discussion points*)

Chemical Exposure Hazards and Control:____

____

Physical Hazards and Control: ____

Air Monitoring: ____

PPE: ____

______

Communications:____

Safe Work Practices: ____

____

Emergency Response: ____

Hospital/Medical Center Location: ____

Phone Nos.: ____

Other: ____

FOR FOLLOW-UP (the issues, responsibilities, due dates, etc.)

____

____

____

ATTENDEES

PRINT NAME	COMPANY	SIGNATURE

APPENDIX D

QUALITY ASSURANCE PROJECT PLAN

QUALITY ASSURANCE PROJECT PLAN

for

538-542 WEST 29th STREET

NEW YORK, NEW YORK

Prepared For:

W29 Owner LLC
148 Madison Avenue, 16th Floor
New York, New York 10016

Prepared By:

Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C.
21 Penn Plaza
360 West 31st Street, 8th Floor
New York, New York 10001

May 13, 2019
Langan Project No. 170515401

LANGAN

TABLE OF CONTENTS

FIGURES

ATTACHMENTS

1.0 PROJECT DESCRIPTION

1.1 INTRODUCTION

This Quality Assurance Project Plan (QAPP) is for the property located at 538-542 West 29th Street in the Chelsea neighborhood of New York, New York (the site), and is identified as Tax Block 700, Lots 55, 56, and 57, on the Manhattan Borough Tax Map. The about 9,900-square-foot (0.227 acres) site is bounded by West 29th Street to the north, mixed-use residential and commercial buildings followed by the elevated High Line and Tenth Avenue to the east, a multi-story residential apartment building followed by West 28th Street to the south, and a multi-story mixed-use residential and commercial building followed by Eleventh Avenue to the west. The subway southern extension runs north-south below Eleventh Avenue, which is about 200 feet to the west of the Subject Property.

This QAPP specifies analytical methods to be used to ensure that data collected during the Remedial Investigation (RI) and implementation of the Remedial Action Work Plan (RAWP) are precise, accurate, representative, comparable, complete, and meet the sensitivity requirements of the project.

1.2 PROJECT OBJECTIVES

The environmental objectives of this RAWP are to achieve a Track 1 cleanup under the New York State Brownfield Cleanup Program which includes the following:

- Excavation as described herein and off-site disposal of soil/fill to about 30 feet below grade surface (bgs) for the building cellar and foundation, support of excavation, and will require dewatering to lower the groundwater table (encountered at about 9.2 to 11.5 feet bgs) and disposal of petroleum-impacted soil.
- Prevent ingestion and direct contact with contaminated soil.
- Prevent contact with or inhalation of volatiles from contaminated groundwater.
- Prevent inhalation of or exposure from contaminants volatilizing from contaminated soil.
- Prevent impacts to biota from ingestion and direct contact with the contaminated soil.

These objectives have been established in order to protect public health and the environment for the anticipated mixed-use development at the Site.

2.0 DATA QUALITY OBJECTIVES AND PROCESS

Data Quality Objectives (DQOs) are qualitative and quantitative statements to help ensure that data of known and appropriate quality are obtained during the project. The quality of the data must be sufficient to fulfill the overall objective of the RI. The overall objective is to investigate and characterize the nature and extent of environmental impacts on the site and emanating from the Site and to provide sufficient information to evaluate remedial alternatives, as required. The RAWP specifies the intended use of the data, the required constituents of interest, limits of detection, level of data assessment, and data deliverables. All data shall be defined as definitive data.

The DQO process is an iterative process where various options for implementing a project are explored, dissected, and recombined. The feasibility and costs of various options are estimated, and then the most advantageous option is selected and developed into project work plans that will be implemented.

DQOs for sampling activities are determined by evaluating five factors:

- Data needs and uses: The types of data required and how the data will be used after it is obtained.
- Parameters of Interest: The types of chemical or physical parameters required for the intended use.
- Level of Concern: Levels of constituents, which may require remedial actions or further investigations, based on comparison to Title 6 of the Official Compilation of New York Codes, Rules and Regulations Part 375 NYSDEC Unrestricted Use Soil Cleanup Objectives for soil samples and to the October 2006 (updated in May 2017) New York State Department of Health (NYSDOH) Guidance for Evaluating Soil Vapor Intrusion in the State of New York Air Guideline Values and Decision Matrices for soil vapor samples.
- Required Analytical Level: The level of data quality, data precision, and QA/QC documentation required for chemical analysis.
- Required Detection Limits: The detection limits necessary based on the above information.

The investigation will be evaluated using the DQO process on an individual, task-specific basis. DQOs and the required level of review will be determined during this process.

3.0 PROJECT ORGANIZATION

Lagan will arrange data analysis and reporting tasks related to the site sampling. The analytical services will be performed by an Environmental Laboratory Approval Program (ELAP)-certified laboratory. Data validation services will be performed by approved data validation contractor(s).

The required sampling will be conducted by Langan; the analytical services will be performed by Alpha Analytical, Inc. of Westborough, Massachusetts (NYSDOH ELAP certification number 11148). Data validation services will be performed by Emily Strake of Langan.

Resumes for Langan personnel can be found in Attachment B; key contacts for this project are as follows:

W29 Owner LLC	Michael Zampetti Telephone: (646) 330-5005
Langan Project Manager:	Emily Snead, PG Telephone: (212) 479-5432
Langan Health & Safety Officer:	Tony Moffa, CHMM Telephone: (215) 491-6500
Langan Quality Assurance Manager:	Michael Burke, PG, CHMM Telephone: (212) 479-5413
Langan Data Validator:	Emily Strake, CEP Telephone: (215) 491-6526
Laboratory Representative:	Alpha Analytical, Inc. Ben Rao Telephone: (201) 812-2633

4.0 QUALITY ASSURANCE OBJECTIVES FOR COLLECTION OF DATA

The overall quality assurance objective is to develop and implement procedures for sampling, laboratory analysis, field measurements, and reporting that will provide data of sufficient quality to evaluate the engineering controls on the Site. The sample set, chemical analysis results, and interpretations must be based on data that meet or exceed quality assurance objectives established for the Site. Quality assurance objectives are usually expressed in terms of precision, accuracy or bias, representativeness, completeness, comparability, and sensitivity of analysis. Variances from the quality assurance objectives at any stage of the investigation will result in the implementation of appropriate corrective measures and an assessment of the impact of corrective measures on the usability of the data.

4.1 PRECISION

Precision is a measure of the degree to which two or more measurements are in agreement. Field precision is assessed through the collection and measurement of field duplicates. Laboratory precision and sample heterogeneity also contribute to the uncertainty of field duplicate measurements. This uncertainty is taken into account during the data assessment process. The following field duplicate precision criteria will be applied:

Aqueous and Canister Air Samples

- Results greater than 5 times the laboratory reporting limit (RL) must have a relative percent difference (RPD) $\leq 30\%$.
- Results less than 5 times the RL must have an absolute difference $\leq \pm$RL.

Soil Samples

- Results greater than 5 times the laboratory RL must have a RPD $\leq 50\%$.
- Results less than 5 times the RL must have an absolute difference $\leq 2\times$ ±RL.

RLs and method detection limits (MDL) are provided in Attachment A

Laboratory precision is assessed through the analysis of matrix spike/matrix spike duplicates (MS/MSD), laboratory control sample/laboratory control sample duplicates (LCS/LCSD) and subsequent calculation of RPD. For outliers, if additional sample volume is present, the MS/MSD should be reanalyzed and the RPD recomputed. If additional volume is not present, an evaluation will be performed to determine the extent of potential matrix interference.

4.2 ACCURACY

Accuracy is the measurement of the reproducibility of the sampling and analytical methodology. It should be noted that precise data may not be accurate data. For the purpose of this QAPP, bias is defined as the constant or systematic distortion of a measurement process, which manifests itself as a persistent positive or negative deviation from the known or true value. This may be due to (but not limited to) improper sample collection, sample matrix, poorly calibrated analytical or sampling equipment, or limitations or errors in analytical methods and techniques.

Accuracy in the field is assessed through the use of field and trip blanks and through compliance to all sample handling, preservation, and holding time requirements. All field and trip blanks should be non-detect when analyzed by the laboratory. Any contaminant detected in an associated field blank will be evaluated against laboratory blanks (preparation or method) and evaluated against field samples collected on the same day to determine potential for bias.

Laboratory accuracy is assessed by evaluating the percent recoveries of MS/MSD samples, LCS/LCSD, surrogate compound recoveries, internal standard area counts, initial and continuing calibrations, and the results of method, initial and continuing calibration blanks. MS/MSD, LCS/LCSD, and surrogate percent recoveries will be compared to either method-specific control limits or laboratory-derived control limits. Sample volume permitting, samples displaying outliers should be reanalyzed. All associated method blanks should be non-detect when analyzed by the laboratory.

4.3 REPRESENTATIVENESS

Representativeness expresses the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition within a defined spatial and/or temporal boundary. Representativeness is dependent upon the adequate design of the sampling program and will be satisfied by ensuring that the scope of work is followed and that specified sampling and analysis techniques are used. This is performed by following applicable standard operating procedures (SOPs) and this QAPP. All field technicians will be given copies of appropriate documents prior to sampling events and are required to read, understand, and follow each document as it pertains to the tasks at hand.

Representativeness in the laboratory is ensured by compliance with nationally-recognized analytical methods, meeting sample holding times, and maintaining sample integrity while the samples are in the laboratory's possession. This is performed by following all applicable analytical methods, laboratory-issued SOPs, the laboratory’s Quality Assurance Manual, and this QAPP. The laboratory is required to be properly certified and accredited.

4.4 COMPLETENESS

Laboratory completeness is the ratio of total number of samples analyzed and verified as acceptable compared to the number of samples submitted to the fixed-base laboratory for analysis, expressed as a percent. Three measures of completeness are defined:

- Sampling completeness, defined as the number of valid samples collected relative to the number of samples planned for collection;
- Analytical completeness, defined as the number of valid sample measurements relative to the number of valid samples collected; and
- Overall completeness, defined as the number of valid sample measurements relative to the number of samples planned for collection.

Soil, groundwater and soil vapor data will meet a 90% completeness criterion. If the criterion is not met, sample results will be evaluated for trends in rejected and unusable data. The effect of unusable data required for a determination of compliance will also be evaluated.

4.5 COMPARABILITY

Comparability is an expression of the confidence with which one data set can be compared to another. Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the sampling plan is followed and that sampling is performed according to the SOPs or other project-specific procedures. Analytical data will be comparable when similar sampling and analytical methods are used as documented in the QAPP. Comparability will be controlled by requiring the use of specific nationally-recognized analytical methods and requiring consistent method performance criteria. Comparability is also dependent on similar quality assurance objectives. Previously collected data will be evaluated to determine whether they may be combined with contemporary data sets.

4.6 SENSITIVITY

Sensitivity is the ability of the instrument or method to detect target analytes at the levels of interest. The project manager will select, with input from the laboratory and QA personnel, sampling and analytical procedures that achieve the required levels of detection and QC acceptance limits that meet established performance criteria. Concurrently, the project manager will select the level of data assessment to ensure that only data meeting the project DQOs are used in decision-making.

Field equipment will be used that can achieve the required levels of detection for analytical measurements in the field. In addition, the field sampling staff will collect and submit full volumes of samples as required by the laboratory for analysis, whenever possible. Full volume aliquots will help ensure achievement of the required limits of detection and allow for reanalysis if necessary.

Analytical methods and quality assurance parameters associated with the sampling program are presented in Attachment C. The frequency of associated field blanks, trip blanks and duplicate samples will be based on the recommendations listed in DER-10, and as described in Section 5.3.

Site-specific MS and MSD samples will be prepared and analyzed by the analytical laboratory by spiking an aliquot of submitted sample volume with analytes of interest. An MS/MSD analysis will be analyzed at a rate of 1 out of every 20 samples, or one per analytical batch. MS/MSD samples are only required for soil and groundwater samples.

5.0 SAMPLE COLLECTION AND FIELD DATA ACQUISITION PROCEDURES

Soil and groundwater sampling will be conducted in accordance with the established NYSDEC protocols contained in DER-10/Technical Guidance for Site Investigation and Remediation (May 2010). Soil vapor sampling will be conducted in accordance with NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York (October 2006). The following sections describe procedures to be followed for specific tasks.

5.1 FIELD DOCUMENTATION PROCEDURES

Field documentation procedures will include summarizing field data in field books and proper sample labeling. These procedures are described in the following sections.

5.1.1 Field Data and Notes

Field notebooks contain the documentary evidence regarding procedures conducted by field personnel. Hard cover, bound field notebooks will be used because of their compact size, durability, and secure page binding. The pages of the notebook will not be removed.

Entries will be made in waterproof, permanent blue or black ink. No erasures will be allowed. If an incorrect entry is made, the information will be crossed out with a single strike mark and the change initialed and dated by the team member making the change. Each entry will be dated. Entries will be legible and contain accurate and complete documentation of the individual or sampling team's activities or observations made. The level of detail will be sufficient to explain and reconstruct the activity conducted. Each entry will be signed by the person(s) making the entry.

The following types of information will be provided for each sampling task, as appropriate:

- Project name and number
- Reasons for being on-site or taking the sample(s)
- Date and time of activity
- Sample identification number(s)
- Geographical location of sampling points with references to the Site, other facilities or a map coordinate system; sketches will be made in the field logbook when appropriate
- Physical location of sampling locations such as depth below ground surface

- Description of the method of sampling including procedures followed, equipment used and any departure from the specified procedures

- Description of the sample including physical characteristics, odor, etc.

- Readings obtained from health and safety equipment

- Weather conditions at the time of sampling and previous meteorological events that may affect the representative nature of a sample

- Photographic information including a brief description of what was photographed, the date and time, the compass direction of the picture and the number of the picture on the camera

- Other pertinent observations such as the presence of other persons on the Site, actions by others that may affect performance of site tasks, etc.

- Names of sampling personnel and signature of persons making entries

Field records will also be collected on field data sheets including boring logs, which will be used for geologic and drilling data during soil boring activities. Field data sheets will include the project-specific number and stored in the field project files when not in use. At the completion of the field activities, the field data sheets will be maintained in the central project file.

5.1.2 Sample Labeling

Each sample collected will be assigned a unique identification number and abbreviation in accordance with the sample nomenclature guidance provided in the following table and the Standard Operating Procedure provided in Attachment D.

Sample Nomenclature Summary	
AA	Ambient Air
DUP	Field Duplicate
EB	Environmental Boring
FB	Field Blank
MW	Monitoring Well
SV	Soil Vapor
TB	Trip Blank
(#-#)	Depth Interval
MMDDYY	Date of Sampling

Each sample container will have a sample label affixed to the outside with the date and time of sample collection and project name. In addition, the label will contain the sample identification number, analysis required and chemical preservatives added, if any. All documentation will be completed in waterproof ink.

5.2 EQUIPMENT CALIBRATION AND PREVENTATIVE MAINTENANCE

A PID will be used during the sampling activities to evaluate work zone action levels, screen soil samples, and collect monitoring well headspace readings. Field calibration and/or field checking of the PID will be the responsibility of the field team leader and the Site Health & Safety Officer, and will be accomplished by following the procedures outlined in the operating manual for the instrument. At a minimum, field calibration and/or field equipment checking will be performed once daily, prior to use. Field calibration will be documented in the field notebook. Entries made into the logbook regarding the status of field equipment will include the following information:

- Date and time of calibration
- Type of equipment serviced and identification number (such as serial number)
- Reference standard used for calibration
- Calibration and/or maintenance procedure used
- Other pertinent information

A water quality meter (Horiba U-52 or similar) will be used during purging of groundwater to measure pH, specific conductance, temperature, dissolved oxygen, turbidity and oxidation-reduction-potential (ORP), every five minutes, or, depending on pump flow rate, after at least one full volume of the water quality meter flow through cell has passed through. A portable turbidity meter (LaMotte or similar) may also be used to measure turbidity. Water-quality meters should be calibrated and the results documented before use each day using standardized field calibration procedures and calibration checks.

Equipment that fails calibration or becomes inoperable during use will be removed from service and segregated to prevent inadvertent utilization. The equipment will be properly tagged to indicate that it is out of calibration. Such equipment will be repaired and recalibrated to the manufacturer’s specifications by qualified personnel. Equipment that cannot be repaired will be replaced.

Off-site calibration and maintenance of field instruments will be conducted as appropriate throughout the duration of project activities. All field instrumentation, sampling equipment and accessories will be maintained in accordance with the manufacturer’s recommendations and specifications and established field equipment practice. Off-site calibration and maintenance will be performed by qualified personnel. A logbook will be kept to document that established calibration and maintenance procedures have been followed. Documentation will include both scheduled and unscheduled maintenance.

5.3 SAMPLE COLLECTION

Soil Samples

Soil samples will be visually classified and field screened using a PID to assess potential impacts from VOCs and for health and safety monitoring. Soil samples collected for analysis of VOCs will be collected using either En Core® or Terra Core® sampling equipment. For analysis of non-volatile parameters, samples will be homogenized and placed into glass jars. Samples will be collected with unused sterile sampling scoops or spoons and homogenized in unused sterile polyethylene zipper bags. After collection, all sample jars will be capped and securely tightened, and placed in iced coolers and maintained at 4°C ±2°C until they are transferred to the laboratory for analysis, in accordance with the procedures outlined in Sections 5.4 and 5.6. Analysis and/or extraction and digestion of collected soil samples will meet the holding times required for each analyte as specified in Attachment C. In addition, analysis of collected soil samples will meet all quality assurance criteria set forth by this QAPP and DER-10.

Groundwater Samples

Groundwater sampling, as required, will be conducted using low-flow sampling procedures following USEPA guidance ("Low Stress [low flow] Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells", EQASOP-GW4, dated September 19, 2017).

During purging, field parameters should be measured, including: water level drawdown, purge rate, pH, specific conductance, temperature, dissolved oxygen, turbidity and oxidation-reduction-potential (ORP), every five minutes using a water quality meter (YSI 6820 or similar) and a depth-to-water interface probe that should be decontaminated between wells. Samples should generally not be collected until the field parameters have stabilized. Field parameters will be considered stable once three sets of measurements are within ±0.1 standard units for pH, ±3% for conductivity and temperature, ±10 millivolts for ORP, and ±10% for turbidity and dissolved oxygen. Purge rates should be adjusted to keep the drawdown in the well to less than 0.3 feet, as practical. Additionally, an attempt should be made to achieve a stable turbidity reading of less than 10 Nephelometric Turbidity Units (NTU) prior to sampling. If the turbidity reading does not stabilize at reading of less than 10 NTU for a given well, then both filtered and unfiltered samples should be collected from that well. If necessary, field filtration should be performed using a 0.45 micron disposable in-line filter. Groundwater samples should be collected after parameters have stabilized as noted above or the readings are within the precision of the meter. Deviations from the stabilization and drawdown criteria, if any, should be noted on the sampling logs.

Samples should be collected directly into laboratory-supplied jars. After collection, all sample jars will be capped and securely tightened, and placed in iced coolers and maintained at 4°C ±2°C until they are transferred to the laboratory for analysis, in accordance with the procedures outlined in Sections 5.4 and 5.6. Analysis and/or extraction and digestion of collected groundwater samples will meet the holding times required for each analyte as specified in Attachment C. In addition, analysis of collected groundwater samples will meet all quality assurance criteria set forth by this QAPP and DER-10.

Soil Vapor and Ambient Air Samples

As required, prior to soil vapor and ambient air sample collection, a pre-sampling inspection will be conducted to document chemicals and potential subsurface pathways at the Site. The pre-sampling inspection will assess the potential for impacts from any chemical or petroleum storage within the on-site buildings. Air samples will be collected into laboratory-supplied, batch certified-clean Summa® canisters calibrated for a sampling rate of two hours. The pressure gauges on each calibrated flow controller should be monitored throughout sample collection. Sample collection should be stopped when the pressure reading reaches -4 mmHg.

Sample Field Blanks, Trip Blanks and Duplicates

Field blanks will be collected for quality assurance purposes at a rate of one per 20 investigative samples per matrix (soil and groundwater only). Field blanks will be obtained by pouring laboratory-demonstrated analyte-free water on or through a decontaminated sampling device following use and implementation of decontamination protocols. The water will be collected off of the sampling device into a laboratory-provided sample container for analysis. Field blank samples will be analyzed for the complete list of analytes on the day of sampling. To assess contamination resulting from sample transport, trip blanks will be collected at a rate of one per day if soil or groundwater samples are analyzed for VOCs during that day.

Duplicate soil and groundwater samples will be collected and analyzed for quality assurance purposes. Duplicate samples will be collected at a frequency of 1 per 20 investigative samples per matrix and will be submitted to the laboratory as "blind" samples. If less than 20 samples are collected during a particular sampling event, one duplicate sample will be collected.

5.4 SAMPLE CONTAINERS AND HANDLING

Certified, commercially clean sample containers will be obtained from the analytical laboratory. If soil samples or groundwater are being collected, the laboratory will also prepare and supply the required trip blanks and field blank sample containers and reagent preservatives. Sample bottle containers, including the field blank containers, will be placed into plastic coolers by the laboratory. These coolers will be received by the field sampling team within 24 hours of their preparation in the laboratory. Prior to the commencement of field work, Langan field personnel will fill the plastic coolers with ice in Ziploc® bags (or equivalent) to maintain a temperature of 4° ±2° C.

Soil and/or groundwater samples collected in the field for laboratory analysis will be placed directly into the laboratory-supplied sample containers. Samples will then be placed and stored on-ice in laboratory provided coolers until shipment to the laboratory. The temperature in the coolers containing samples and associated field blanks will be maintained at a temperature of 4°±2°C while on-site and during sample shipment to the analytical laboratory.

As required, groundwater sampling for per- and polyfluoroalkyl substances (PFAS) will be collected in accordance with EPA Method 537 Field Sampling Guidelines. PFAS samples will be collected first in High Density Polyethylene (HDPE)/polypropylene containers using sampling equipment either made with stainless steel, HDPE, or polypropylene. Food and beverages will be prohibited near the sampling equipment. Additionally, no cosmetics, moisturizers, hand cream, sun screen or clothing materials containing Gore-Tex™ or Tyvek® will be worn during sampling.

Possession of samples collected in the field will be traceable from the time of collection until they are analyzed by the analytical laboratory or are properly disposed. Chain-of-custody procedures, described in Section 5.9, will be followed to maintain and document sample possession. Samples will be packaged and shipped as described in Section 5.6.

5.5 SAMPLE PRESERVATION

Sample preservation measures will be used in an attempt to prevent sample decomposition by contamination, degradation, biological transformation, chemical interactions and other factors during the time between sample collection and analysis. Preservation will commence at the time of sample collection and will continue until analyses are performed. Should chemical preservation be required, the analytical laboratory will add the preservatives to the appropriate sample containers before shipment to the office or field. Samples will be preserved according to the requirements of the specific analytical method selected, as shown in Attachment C.

5.6 SAMPLE SHIPMENT

5.6.1 Packaging

Soil and groundwater sample containers will be placed in plastic coolers. Ice in Ziploc® bags (or equivalent) will be placed around sample containers. Cushioning material will be added around the sample containers if necessary. Chains-of-custody and other paperwork will be placed in a Ziploc® bag (or equivalent) and placed inside the cooler. The cooler will be taped closed and custody seals will be affixed to one side of the cooler at a minimum. If the samples are being shipped by an express delivery company (e.g. FedEx) then laboratory address labels will be placed on top of the cooler.

5.6.2 Shipping

Standard procedures to be followed for shipping environmental samples to the analytical laboratory are outlined below.

- All environmental samples will be transported to the laboratory by a laboratory-provided courier under the chain-of-custody protocols described in Section 5.9.

- Prior notice will be provided to the laboratory regarding when to expect shipped samples. If the number, type or date of shipment changes due to site constraints or program changes, the laboratory will be informed.

5.7 DECONTAMINATION PROCEDURES

Decontamination procedures will be used for non-dedicated sampling equipment. Decontamination of field personnel is discussed in the site-specific sample Construction Health and Safety Plan (CHASP) included in Appendix C of the RAWP. Field sampling equipment that is to be reused will be decontaminated in the field in accordance with the following procedures:

1. Laboratory-grade glassware detergent and tap water scrub to remove visual contamination
2. Generous tap water rinse
3. Distilled/de-ionized water rinse

5.8 RESIDUALS MANAGEMENT

Debris (e.g., paper, plastic and disposable personal protective equipment) will be collected in plastic garbage bags and disposed of as non-hazardous industrial waste. Soil cuttings with no apparent staining, odors, or elevated PID readings will be used to backfill boring holes. Soil to be disposed off-site will be placed in 55-gallon, UN/Department of Transportation (DOT) approved drums. Decontamination and well development/purging fluids will be placed in DOT-approved fluid drums with closed tops. All drums will be properly labeled, sealed, and characterized as necessary.

If initial analytical data is insufficient to gain disposal facility acceptance, waste characterization samples will be analyzed for parameters that are typically required by disposal facilities, such as target compounds list (TCL) VOCs, semivolatile organic compounds (SVOCs), Resource Conservation and Recovery Act (RCRA) metals, polychlorinated biphenyls (PCBs), pesticides, herbicides, Toxicity Characteristic Leaching Procedure (TCLP) VOCs, TCLP SVOCs, TCLP metals, ignitability, corrosivity, reactivity, and paint filter. Additional sampling and analyses may be required based on the selected disposal facility.

Samples will be collected in accordance with the selected disposal facility's requirements and will be collected to be representative of the material requiring disposal at a frequency consistent with disposal facility requirements. It is anticipated that all drummed material will be transported off-site and disposed of at a permitted facility.

5.9 CHAIN OF CUSTODY PROCEDURES

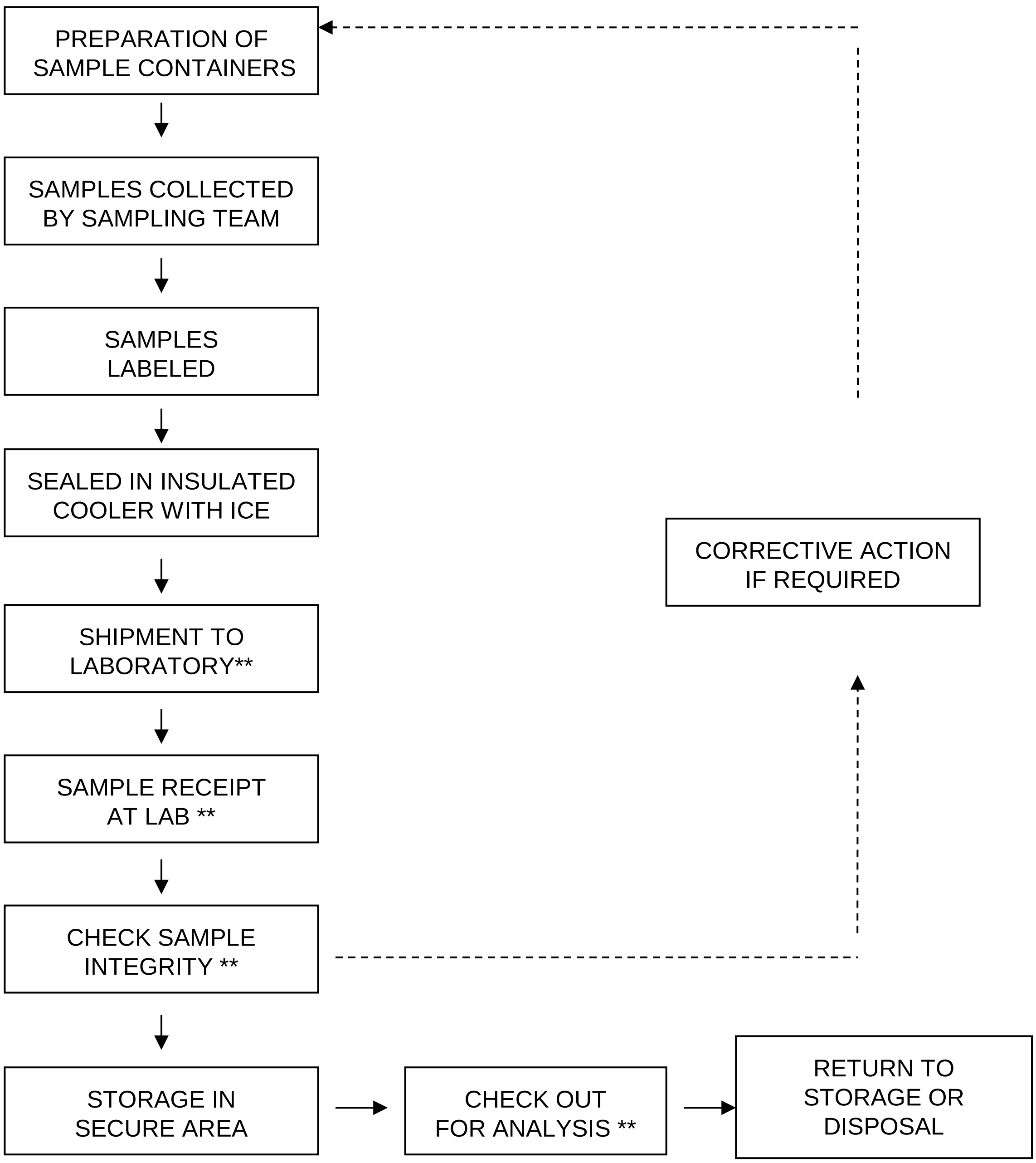
A chain-of-custody protocol has been established for collected samples that will be followed during sample handling activities in both field and laboratory operations. The primary purpose of the chain-of-custody procedures is to document the possession of the samples from collection through shipping, storage and analysis to data reporting and disposal. Chain-of-custody refers to actual possession of the samples. Samples are considered to be in custody if they are within sight of the individual responsible for their security or locked in a secure location. Each person who takes possession of the samples, except the shipping courier, is responsible for sample integrity and safe keeping. Chain-of-custody procedures are provided below:

- Chain-of-custody will be initiated by the laboratory supplying the pre-cleaned and prepared sample containers. Chain-of-custody forms will accompany the sample containers.
- Following sample collection, the chain-of-custody form will be completed for the sample collected. The sample identification number, date and time of sample collection, analysis requested and other pertinent information (e.g., preservatives) will be recorded on the form. All entries will be made in waterproof, permanent blue or black ink.
- Langan field personnel will be responsible for the care and custody of the samples collected until the samples are transferred to another party, dispatched to the laboratory, or disposed. The sampling team leader will be responsible for enforcing chain-of-custody procedures during field work.
- When the form is full or when all samples have been collected that will fit in a single cooler, the sampling team leader will check the form for possible errors and sign the chain-of-custody form. Any necessary corrections will be made to the record with a single strike mark, dated, and initialed.

When soil and groundwater samples are collected, sample coolers will be accompanied by the chain-of-custody form, sealed in a Ziploc® bag (or equivalent) and placed on top of the samples or taped to the inside of the cooler lid. If applicable, a shipping bill will be completed for each cooler and the shipping bill number recorded on the chain-of-custody form.

Samples will be packaged for shipment to the laboratory with the appropriate chain-of-custody form. A copy of the form will be retained by the sampling team for the project file and the original will be sent to the laboratory with the samples. Bills of lading will also be retained as part of the documentation for the chain-of-custody records, if applicable. When transferring custody of the samples, the individuals relinquishing and receiving custody of the samples will verify sample numbers and condition and will document the sample acquisition and transfer by signing and dating the chain-of-custody form. This process documents sample custody transfer from the sampler to the analytical laboratory. A flow chart showing a sample custody process is included as Figure 5.1, and chain-of-custody forms from the laboratory are included as Figure 5.2 and 5.3.

Figure 5.1 Sample Custody



** REQUIRES SIGN-OFF ON CHAIN-OF-CUSTODY FORM

Figure 5.2 Sample Chain-of-Custody Form – Soil and Groundwater Samples

NEW YORK CHAIN OF CUSTODY

Service Centers
Mahwah, NJ 07430: 35 Whitney Rd, Suite 5
Albany, NY 12205: 14 Walker Way
Tonawanda, NY 14150: 275 Cooper Ave, Suite 105

Page
of

Date Rec'd in Lab

ALPHA Job #

Westborough, MA 01581
8 Walkup Dr.
TEL: 508-898-9220
FAX: 508-898-9193

Mansfield, MA 02048
320 Forbes Blvd
TEL: 508-822-9300
FAX: 508-822-3288

Project Information
Project Name:
Project Location:
Project #
(Use Project name as Project #) ☐
Project Manager:
ALPHAQuote #:

Turn-Around Time
Standard ☐ Due Date:
Rush (only if pre approved) ☐ # of Days:

Client Information
Client:
Address:
Phone:
Fax:
Email:

Deliverables
☐ ASP-A ☐ ASP-B
☐ EQuIS (1 File) ☐ EQuIS (4 File)
☐ Other

Regulatory Requirement
☐ NY TOGS ☐ NY Part 375
☐ AWQ Standards ☐ NY CP-51
☐ NY Restricted Use ☐ Other
☐ NY Unrestricted Use
☐ NYC Sewer Discharge

Billing Information
☐ Same as Client Info
PO #

Disposal Site Information
Please identify below location of applicable disposal facilities.
Disposal Facility:
☐ NJ ☐ NY
☐ Other:

These samples have been previously analyzed by Alpha ☐

Other project specific requirements/comments:

Please specify Metals or TAL.

ANALYSIS

Sample Filtration
☐ **Done**
☐ **Lab to do**
Preservation
☐ **Lab to do**

(Please Specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials									Sample Specific Comments	Total Bottle

Preservative Code:
A = None
B = HCl
C = HNO_3
D = H_2SO_4
E = NaOH
F = MeOH
G = $NaHSO_4$
H = $Na_2S_2O_3$
K/E = Zn Ac/NaOH
O = Other

Container Code
P = Plastic
A = Amber Glass
V = Vial
G = Glass
B = Bacteria Cup
C = Cube
O = Other
E = Encore
D = BOD Bottle

Westboro: Certification No: MA935
Mansfield: Certification No: MA015

Container Type								
Preservative								

Relinquished By:	Date/Time	Received By:	Date/Time

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. BY EXECUTING THIS COC, THE CLIENT HAS READ AND AGREES TO BE BOUND BY ALPHA'S TERMS & CONDITIONS. (See reverse side.)

Form No: 01-25 HC (rev. 30-Sept-2013)

Figure 5.3 Sample Chain-of-Custody Form – Soil Vapor and Ambient Air Samples

ALPHA ANALYTICAL

AIR ANALYSIS

CHAIN OF CUSTODY

PAGE_______ OF _______

Date Rec'd in Lab:

ALPHA Job #:

320 Forbes Blvd, Mansfield, MA 02048
TEL: 508-822-9300 FAX: 508-822-3288

Client Information

Client:

Address:

Phone:

Fax:

Email:

❑ These samples have been previously analyzed by Alpha

Project Information

Project Name:

Project Location:

Project #:

Project Manager:

ALPHA Quote #:

Turn-Around Time

❑ Standard ❑ RUSH *(only confirmed if pre-approved!)*

Date Due: **Time:**

Report Information - Data Deliverables

❑ FAX
❑ ADEx
Criteria Checker: ____________
(Default based on Regulatory Criteria Indicated)
Other Formats: ____________
❑ EMAIL (standard pdf report)
❑ Additional Deliverables:

Report to: (if different than Project Manager)

Billing Information

❑ Same as Client info | PO #:

Regulatory Requirements/Report Limits

State/Fed	*Program*	*Res / Comm*

Other Project Specific Requirements/Comments:

Project-Specific Target Compound List: ❑

All Columns Below Must Be Filled Out

ALPHA Lab ID (Lab Use Only)	Sample ID	COLLECTION End Date	Start Time	End Time	Initial Vacuum	Final Vacuum	Sample Matrix*	Sampler's Initials	Can Size	I D Can	I D - Flow Controller	ANALYSIS TO-15	TO-15 SIM	APH Subtract Non-petroleum HCs ❑	Fixed Gases	Sulfides & Mercaptans by TO-15			Sample Comments (i.e. PID)

*SAMPLE MATRIX CODES
AA = Ambient Air (Indoor/Outdoor)
SV = Soil Vapor/Landfill Gas/SVE
Other = Please Specify

Container Type

Relinquished By:	Date/Time	Received By:	Date/Time:

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

Form No: 101-02 Rev: (25-Sep-15)

Laboratory chain-of-custody will be maintained throughout the analytical processes as described in the laboratory's Quality Assurance Manual. The analytical laboratory will provide a copy of the chain-of-custody in the analytical data deliverable package. The chain-of-custody becomes the permanent record of sample handling and shipment.

5.10 LABORATORY SAMPLE STORAGE PROCEDURES

The subcontracted laboratory will use a laboratory information management system to track and schedule samples upon receipt by the analytical laboratories. Any sample anomalies identified during sample log-in must be evaluated on individual merit for the impact upon the results and the data quality objectives of the project. When irregularities do exist, the environmental consultant must be notified to discuss recommended courses of action and documentation of the issue must be included in the project file.

For samples requiring thermal preservation, the temperature of each cooler will be immediately recorded. Each sample and container will be will be assigned a unique laboratory identification number and secured within the custody room walk-in coolers designated for new samples. Samples will be, as soon as practical, disbursed in a manner that is functional for the operational team. The temperature of all coolers and freezers will be monitored and recorded using a certified temperature sensor. Any temperature excursions outside of acceptance criteria (i.e., below 2°C or above 6°C) will initiate an investigation to determine whether any samples may have been affected. Samples for VOCs will be maintained in satellite storage areas within the VOC laboratory. Following analysis, the laboratory's specific procedures for retention and disposal will be followed as specified in the laboratory's SOPs and/or QA manual.

5.11 SPECIAL CONSIDERATIONS FOR PFAS SAMPLE COLLECTION

Groundwater samples collected for analysis of PFAS will be collected in accordance with the specialized protocol outlined in this section. Groundwater samples collected from select wells will be analyzed for 1,4-dioxane with a detection limit no higher than 0.35 micrograms per liter, and for PFAS with a detection limit no higher than 2 nanograms per liter in accordance with the procedure outlined in Attachment E.

The following special considerations apply to the collection of groundwater samples for PFAS analysis to prevent cross-contamination:

- Field equipment will not contain Teflon®
- All sampling material will be made from stainless steel, HDPE, acetate, silicon, or polypropylene
- No waterproof field books will be used
- No plastic clipboards, binders, or spiral hard cover notebooks will be used

- No adhesives will be used
- No sharpies or permanent markers will be used; ball point pens are acceptable
- Aluminum foil will not be used
- PFAS samples will be kept in a separate cooler from other sampling containers
- Coolers will be filled only with regular ice

PFAS compound sampling protocol is provided in Attachment E.

5.12 PFAS TARGET ANALYTE LIST

DER has developed a PFAS target analyte list. At minimum, the laboratory will report the following PFAS target compounds:

Group	Analyte Name	Abbreviation	CAS #
Perfluoroalkyl carboxylates	Perfluorobutanoic acid	PFBA	375-22-4
	Perfluoropentanoic acid	PFPeA	2706-90-3
	Perfluorohexanoic acid	PFHxA	307-24-4
	Perfluoroheptanoic acid	PFHpA	375-85-9
	Perfluorooctanoic acid	PFOA	335-67-1
	Perfluorononanoic acid	PFNA	375-95-1
	Perfluorodecanoic acid	PFDA	335-76-2
	Perfluoroundecanoic acid	PFUA/PFUdA	2058-94-8
	Perfluorododecanoic acid	PFDoA	307-55-1
	Perfluorotridecanoic acid	PFTriA/PFTrDA	72629-94-8
	Perfluorotetradecanoic acid	PFTA/PFTeDA	376-06-7
Perfluoroalkyl sulfonates	Perfluorobutanesulfonic acid	PFBS	375-73-5
	Perfluorohexanesulfonic acid	PFHxS	355-46-4
	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
	Perfluorooctanessulfonic acid	PFOS	1763-23-1
	Perfluorodecanesulfonic acid	PFDS	335-77-3
Fluorinated Telomer Sulfonates	6:2 Fluorotelomer sulfonate	6:2 FTS	27619-97-2
	8:2 Fluorotelomer sulfonate	8:2 FTS	39108-34-4
Perfluorooctane-sulfonamides	Perfluroroctanesulfonamide	FOSA	754-91-6
Perfluorooctane-sulfonamidoacetic acids	N-methyl perfluorooctanesulfonamidoacetic acid	N-MeFOSAA	2355-31-9
	N-ethyl perfluorooctanesulfonamidoacetic acid	N-EtFOSAA	2991-50-6

6.0 DATA REDUCTION, VALIDATION, AND REPORTING

6.1 INTRODUCTION

Data collected during the field investigation will be reduced and reviewed by the laboratory QA personnel, and a report on the findings will be tabulated in a standard format. The criteria used to identify and quantify the analytes will be those specified for the applicable methods in the USEPA SW-846 and subsequent updates. The data package provided by the laboratory will contain all items specified in the USEPA SW-846 methodology appropriate for the analyses to be performed, and be reported in standard format.

The completed copies of the chain-of-custody records (both external and internal) accompanying each sample from time of initial bottle preparation to completion of analysis shall be attached to the analytical reports.

6.2 DATA REDUCTION

The Analytical Services Protocol (ASP) Category B data packages and an electronic data deliverable (EDD) will be provided by the laboratory after receipt of a complete sample delivery group. The Project Manager will immediately arrange for archiving the results and preparation of result tables. These tables will form the database for assessment of the site contamination condition.

Each EDD deliverable must be formatted using a Microsoft Windows operating system and the NYSDEC data deliverable format for EQuIS. To avoid transcription errors, data will be loaded directly into the ASCII format from the laboratory information management system. If this cannot be accomplished, the consultant should be notified via letter of transmittal indicating that manual entry of data is required for a particular method of analysis. All EDDs must also undergo a QC check by the laboratory before delivery. The original data, tabulations, and electronic media are stored in a secure and retrievable fashion.

The Project Manager or Task Manager will maintain close contact with the QA reviewer to ensure all non-conformance issues are acted upon prior to data manipulation and assessment routines. Once the QA review has been completed, the Project Manager may direct the Team Leaders or others to initiate and finalize the analytical data assessment.

6.3 DATA VALIDATION

Data validation will be performed in accordance with the USEPA Region 2 validation guidelines for organic and inorganic data review. Validation will include the following:

- Verification of the QC sample results;
- Verification of the identification of sample results (both positive hits and non-detects);
- Recalculation of 10% of all investigative sample results; and
- Preparation of Data Usability Summary Reports (DUSR).

A DUSR will be prepared by the data validator and reviewed by the QAM before issuance. The DUSR will present the results of data validation, including a summary assessment of laboratory data packages, sample preservation and chain-of-custody procedures, and a summary assessment of precision, accuracy, representativeness, comparability, and completeness for each analytical method. A detailed assessment of each sample delivery group will follow. For each of the organic analytical methods, the following will be assessed:

- Holding times;
- Instrument tuning;
- Instrument calibrations;
- Blank results;
- System monitoring compounds or surrogate recovery compounds (as applicable);
- Internal standard area counts (if applicable);
- MS and MSD recoveries and RPDs
- LCS and LCSD recoveries and RPDs
- Endrin/DDT Breakdown (if applicable);
- Dual Column Analysis (if applicable);
- Target compound identification;
- Chromatogram quality;
- Pesticide cleanup (if applicable);
- Compound quantitation and reported detection limits;
- Overall system performance; and
- Results verification.

For each of the inorganic compounds, the following will be assessed:

- Holding times;
- Calibrations;
- Blank results;
- Interference check sample;
- Laboratory control samples;
- Laboratory Duplicates;
- Matrix Spike;
- Furnace atomic absorption analysis QC;
- Contract Required Detection Limit standards;
- ICP serial dilutions; and
- Results verification and reported detection limits.

Based on the results of data validation, the validated analytical results reported by the laboratory will be assigned one of the following usability flags:

- "U" - Not detected. The associated number indicates the approximate sample concentration necessary to be detected significantly greater than the level of the highest associated blank;
- "UJ" - Not detected. Quantitation limit may be inaccurate or imprecise;
- "J" - Analyte is present. Reported value may be associated with a higher level of uncertainty than is normally expected with the analytical method
- "R" – Unreliable result; data is rejected or unusable. Analyte may or may not be present in the sample; and
- No Flag - Result accepted without qualification.

7.0 QUALITY ASSURANCE PERFORMANCE AUDITS AND SYSTEM AUDITS

7.1 INTRODUCTION

Quality assurance audits may be performed by the project quality assurance group under the direction and approval of the Quality Assurance Manager (QAM). These audits will be implemented to evaluate the capability and performance of project and subcontractor personnel, items, activities, and documentation of the measurement system(s). Functioning as an independent body and reporting directly to corporate quality assurance management, the QAM may plan, schedule, and approve system and performance audits based upon procedures customized to the project requirements. At times, the QAM may request additional personnel with specific expertise from company and/or project groups to assist in conducting performance audits. However, these personnel will not have responsibility for the project work associated with the performance audit.

7.2 SYSTEM AUDITS

System audits may be performed by the QAM or designated auditors, and encompass a qualitative evaluation of measurement system components to ascertain their appropriate selection and application. In addition, field and laboratory quality control procedures and associated documentation may be system audited. These audits may be performed once during the performance of the project. Additional audits may occur if conditions adverse to quality are detected or at the request of the Project Manager.

7.3 PERFORMANCE AUDITS

The laboratory may be required to conduct an analysis of Performance Evaluation samples or provide proof that Performance Evaluation samples submitted by USEPA or a state agency have been analyzed within the past twelve months.

7.4 FORMAL AUDITS

Formal audits refer to any system or performance audit that is documented and implemented by the QA group. These audits encompass documented activities performed by qualified lead auditors to a written procedure or checklists to objectively verify that quality assurance requirements have been developed, documented, and instituted in accordance with contractual and project criteria. Formal audits may be performed on project and subcontractor work at various locations.

Audit reports will be written by auditors who have performed the site audit after gathering and evaluating all data. Items, activities, and documents determined by lead auditors to be in noncompliance shall be identified at exit interviews conducted with the involved management.

Non-compliances will be logged, and documented through audit findings, which are attached to and are a part of the integral audit report. These audit-finding forms are directed to management to satisfactorily resolve the noncompliance in a specified and timely manner.

The Project Manager has overall responsibility to ensure that all corrective actions necessary to resolve audit findings are acted upon promptly and satisfactorily. Audit reports must be submitted to the Project Manager within fifteen days of completion of the audit. Serious deficiencies will be reported to the Project Manager within 24 hours. All audit checklists, audit reports, audit findings, and acceptable resolutions are approved by the QAM prior to issue. Verification of acceptable resolutions may be determined by re-audit or documented surveillance of the item or activity. Upon verification acceptance, the QAM will close out the audit report and findings.

8.0 CORRECTIVE ACTION

8.1 INTRODUCTION

The following procedures have been established to ensure that conditions adverse to quality, such as malfunctions, deficiencies, deviations, and errors, are promptly investigated, documented, evaluated, and corrected.

8.2 PROCEDURE DESCRIPTION

When a significant condition adverse to quality is noted at a site, laboratory, or subcontractor location, the cause of the condition will be determined and corrective action will be taken to preclude repetition. Condition identification, cause, reference documents, and corrective action planned to be taken will be documented and reported to the QAM, Project Manager, Field Team Leader and involved contractor management, at a minimum. Implementation of corrective action is verified by documented follow-up action.

All project personnel have the responsibility, as part of the normal work duties, to promptly identify, solicit approved correction, and report conditions adverse to quality. Corrective actions will be initiated as follows:

- When predetermined acceptance standards are not attained;
- When procedure or data compiled are determined to be deficient;
- When equipment or instrumentation is found to be faulty;
- When samples and analytical test results are not clearly traceable;
- When quality assurance requirements have been violated;
- When designated approvals have been circumvented;
- As a result of system and performance audits;
- As a result of a management assessment;
- As a result of laboratory/field comparison studies; and
- As required by USEPA SW-846, and subsequent updates, or by the NYSDEC ASP.

Project management personnel, field investigation teams, remedial response planning personnel, and laboratory groups monitor ongoing work performance during the normal course of daily responsibilities. Work may be audited at project sites, laboratories, or contractor locations. Activities, or documents ascertained to be noncompliant with quality assurance requirements will be documented. Corrective actions will be mandated through audit finding sheets attached to the audit report. Audit findings are logged, maintained, and controlled by the Task Manager.

Personnel assigned to quality assurance functions will have the responsibility to issue and control Corrective Action Request (CAR) Forms (Figure 8.1 or similar by email). The CAR identifies the out-of-compliance condition, reference document(s), and recommended corrective action(s) to be administered. The CAR is issued to the personnel responsible for the affected item or activity. A copy is also submitted to the Project Manager. The individual to whom the CAR is addressed returns the requested response promptly to the QA personnel, affixing his/her signature and date to the corrective action block, after stating the cause of the conditions and corrective action to be taken. The QA personnel maintain the log for status of CARs, confirms the adequacy of the intended corrective action, and verifies its implementation. CARs will be retained in the project file for the records.

Any project personnel may identify noncompliance issues; however, the designated QA personnel are responsible for documenting, numbering, logging, and verifying the close out action. The Project Manager will be responsible for ensuring that all recommended corrective actions are implemented, documented, and approved.

Figure 8.1

CORRECTIVE ACTION REQUEST Number: ______________________ Date: __________
TO: ______________________________ You are hereby requested to take corrective actions indicated below and as otherwise determined by you to (a) resolve the noted condition and (b) to prevent it from recurring. Your written response is to be returned to the project quality assurance manager by ____________
CONDITION:
REFERENCE DOCUMENTS:
RECOMMENDED CORRECTIVE ACTIONS:
________ _____ ________ _______ _________ _______ Originator Date Approval Date Approval Date
RESPONSE
CAUSE OF CONDITION
CORRECTIVE ACTION (A) RESOLUTION (B) PREVENTION (C) AFFECTED DOCUMENTS
C.A. FOLLOWUP: CORRECTIVE ACTION VERIFIED BY: ______________________ DATE:__________

9.0 REFERENCES

NYSDEC. Division of Environmental Remediation. DER-10/Technical Guidance for Site Investigation and Remediation, dated May 3, 2010.

USEPA, 2014. "Test Method for Evaluating Solid Waste," Update V dated July 2014 U.S. Environmental Protection Agency, Washington, D.C.

USEPA, 2016. Low/Medium Volatile Data Validation. SOP No. HW-33A, Revision 1, dated September 2016. USEPA Region II.

USEPA, 2015. PCB Aroclor Data Validation. SOP No. HW-37A, Revision 0, dated July 2015. USEPA Region II.

USEPA, 2016. ICP-AES Data Validation. SOP No. HW-3a, Revision 1, dated September 2016. USEPA Region II.

USEPA, 2016. Mercury and Cyanide Data Validation. SOP No. HW-3c, Revision 1, dated September 2016. USEPA Region II.

USEPA, 2016. Pesticide Data Validation. SOP No. HW-36A, Revision 1, dated October 2016. USEPA Region II.

USEPA, 2016. Semivolatile Data Validation. SOP No. HW-35A, Revision 1, dated September 2016. USEPA Region II.

USEPA, 2016. Analysis of Volatile Organic Compounds in Air Contained in Canisters by Method TO-15, Revision 6, dated September 2016. USEPA Region II.

ATTACHMENT A

LABORATORY REPORTING LIMITS AND METHOD DETECTION LIMITS

Date Created: 07/27/18
Created By: Ben Rao
File: PM5251-1
Page: 1

Langan Engineering & Environmental

TCL Volatiles - EPA 8260C/5035 High&Low (SOIL)

Holding Time: 14 days
Container/Sample Preservation: 1 - 1 Vial MeOH/2 Vial Water

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Methylene chloride	75-09-2	5	2.29	ug/kg	70-130	30	70-130	30	30			
1,1-Dichloroethane	75-34-3	1	0.145	ug/kg	70-130	30	70-130	30	30			
Chloroform	67-66-3	1.5	0.14	ug/kg	70-130	30	70-130	30	30			
Carbon tetrachloride	56-23-5	1	0.23	ug/kg	70-130	30	70-130	30	30			
1,2-Dichloropropane	78-87-5	1	0.125	ug/kg	70-130	30	70-130	30	30			
Dibromochloromethane	124-48-1	1	0.14	ug/kg	70-130	30	70-130	30	30			
1,1,2-Trichloroethane	79-00-5	1	0.267	ug/kg	70-130	30	70-130	30	30			
Tetrachloroethene	127-18-4	0.5	0.196	ug/kg	70-130	30	70-130	30	30			
Chlorobenzene	108-90-7	0.5	0.127	ug/kg	70-130	30	70-130	30	30			
Trichlorofluoromethane	75-69-4	4	0.695	ug/kg	70-139	30	70-139	30	30			
1,2-Dichloroethane	107-06-2	1	0.257	ug/kg	70-130	30	70-130	30	30			
1,1,1-Trichloroethane	71-55-6	0.5	0.167	ug/kg	70-130	30	70-130	30	30			
Bromodichloromethane	75-27-4	0.5	0.109	ug/kg	70-130	30	70-130	30	30			
trans-1,3-Dichloropropene	10061-02-6	1	0.273	ug/kg	70-130	30	70-130	30	30			
cis-1,3-Dichloropropene	10061-01-5	0.5	0.158	ug/kg	70-130	30	70-130	30	30			
1,3-Dichloropropene, Total	542-75-6	0.5	0.158	ug/kg				30	30			
1,3-Dichloropropene, Total	542-75-6	0.5	0.158	ug/kg				30	30			
1,1-Dichloropropene	563-58-6	0.5	0.159	ug/kg	70-130	30	70-130	30	30			
Bromoform	75-25-2	4	0.246	ug/kg	70-130	30	70-130	30	30			
1,1,2,2-Tetrachloroethane	79-34-5	0.5	0.166	ug/kg	70-130	30	70-130	30	30			
Benzene	71-43-2	0.5	0.166	ug/kg	70-130	30	70-130	30	30			
Toluene	108-88-3	1	0.543	ug/kg	70-130	30	70-130	30	30			
Ethylbenzene	100-41-4	1	0.141	ug/kg	70-130	30	70-130	30	30			
Chloromethane	74-87-3	4	0.932	ug/kg	52-130	30	52-130	30	30			
Bromomethane	74-83-9	2	0.581	ug/kg	57-147	30	57-147	30	30			
Vinyl chloride	75-01-4	1	0.335	ug/kg	67-130	30	67-130	30	30			
Chloroethane	75-00-3	2	0.452	ug/kg	50-151	30	50-151	30	30			
1,1-Dichloroethene	75-35-4	1	0.238	ug/kg	65-135	30	65-135	30	30			
trans-1,2-Dichloroethene	156-60-5	1.5	0.137	ug/kg	70-130	30	70-130	30	30			
Trichloroethene	79-01-6	0.5	0.137	ug/kg	70-130	30	70-130	30	30			
1,2-Dichlorobenzene	95-50-1	2	0.144	ug/kg	70-130	30	70-130	30	30			
1,3-Dichlorobenzene	541-73-1	2	0.148	ug/kg	70-130	30	70-130	30	30			
1,4-Dichlorobenzene	106-46-7	2	0.171	ug/kg	70-130	30	70-130	30	30			
Methyl tert butyl ether	1634-04-4	2	0.201	ug/kg	66-130	30	66-130	30	30			
p/m-Xylene	179601-23-1	2	0.56	ug/kg	70-130	30	70-130	30	30			
o-Xylene	95-47-6	1	0.291	ug/kg	70-130	30	70-130	30	30			
Xylene (Total)	1330-20-7	1	0.291	ug/kg				30	30			
Xylene (Total)	1330-20-7	1	0.291	ug/kg				30	30			
cis-1,2-Dichloroethene	156-59-2	1	0.175	ug/kg	70-130	30	70-130	30	30			
1,2-Dichloroethene (total)	540-59-0	1	0.137	ug/kg				30	30			
1,2-Dichloroethene (total)	540-59-0	1	0.137	ug/kg				30	30			
Dibromomethane	74-95-3	2	0.238	ug/kg	70-130	30	70-130	30	30			

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5251-1
Page: 2

Langan Engineering & Environmental

TCL Volatiles - EPA 8260C/5035 High&Low (SOIL)

Holding Time: 14 days
Container/Sample Preservation: 1 - 1 Vial MeOH/2 Vial Water

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Styrene	100-42-5	1	0.196	ug/kg	70-130	30	70-130	30	30			
Dichlorodifluoromethane	75-71-8	10	0.915	ug/kg	30-146	30	30-146	30	30			
Acetone	67-64-1	10	4.811	ug/kg	54-140	30	54-140	30	30			
Carbon disulfide	75-15-0	10	4.55	ug/kg	59-130	30	59-130	30	30			
2-Butanone	78-93-3	10	2.22	ug/kg	70-130	30	70-130	30	30			
Vinyl acetate	108-05-4	10	2.15	ug/kg	70-130	30	70-130	30	30			
4-Methyl-2-pentanone	108-10-1	10	1.28	ug/kg	70-130	30	70-130	30	30			
1,2,3-Trichloropropane	96-18-4	2	0.127	ug/kg	68-130	30	68-130	30	30			
2-Hexanone	591-78-6	10	1.18	ug/kg	70-130	30	70-130	30	30			
Bromochloromethane	74-97-5	2	0.205	ug/kg	70-130	30	70-130	30	30			
2,2-Dichloropropane	594-20-7	2	0.202	ug/kg	70-130	30	70-130	30	30			
1,2-Dibromoethane	106-93-4	1	0.279	ug/kg	70-130	30	70-130	30	30			
1,3-Dichloropropane	142-28-9	2	0.167	ug/kg	69-130	30	69-130	30	30			
1,1,1,2-Tetrachloroethane	630-20-6	0.5	0.132	ug/kg	70-130	30	70-130	30	30			
Bromobenzene	108-86-1	2	0.145	ug/kg	70-130	30	70-130	30	30			
n-Butylbenzene	104-51-8	1	0.167	ug/kg	70-130	30	70-130	30	30			
sec-Butylbenzene	135-98-8	1	0.146	ug/kg	70-130	30	70-130	30	30			
tert-Butylbenzene	98-06-6	2	0.118	ug/kg	70-130	30	70-130	30	30			
o-Chlorotoluene	95-49-8	2	0.191	ug/kg	70-130	30	70-130	30	30			
p-Chlorotoluene	106-43-4	2	0.108	ug/kg	70-130	30	70-130	30	30			
1,2-Dibromo-3-chloropropane	96-12-8	3	0.998	ug/kg	68-130	30	68-130	30	30			
Hexachlorobutadiene	87-68-3	4	0.169	ug/kg	67-130	30	67-130	30	30			
Isopropylbenzene	98-82-8	1	0.109	ug/kg	70-130	30	70-130	30	30			
p-Isopropyltoluene	99-87-6	1	0.109	ug/kg	70-130	30	70-130	30	30			
Naphthalene	91-20-3	4	0.65	ug/kg	70-130	30	70-130	30	30			
Acrylonitrile	107-13-1	4	1.15	ug/kg	70-130	30	70-130	30	30			
n-Propylbenzene	103-65-1	1	0.171	ug/kg	70-130	30	70-130	30	30			
1,2,3-Trichlorobenzene	87-61-6	2	0.322	ug/kg	70-130	30	70-130	30	30			
1,2,4-Trichlorobenzene	120-82-1	2	0.272	ug/kg	70-130	30	70-130	30	30			
1,3,5-Trimethylbenzene	108-67-8	2	0.193	ug/kg	70-130	30	70-130	30	30			
1,2,4-Trimethylbenzene	95-63-6	2	0.334	ug/kg	70-130	30	70-130	30	30			
1,4-Dioxane	123-91-1	100	35.1	ug/kg	65-136	30	65-136	30	30			
1,4-Diethylbenzene	105-05-5	2	0.177	ug/kg	70-130	30	70-130	30	30			
4-Ethyltoluene	622-96-8	2	0.384	ug/kg	70-130	30	70-130	30	30			
1,2,4,5-Tetramethylbenzene	95-93-2	2	0.191	ug/kg	70-130	30	70-130	30	30			
Ethyl ether	60-29-7	2	0.341	ug/kg	67-130	30	67-130	30	30			
trans-1,4-Dichloro-2-butene	110-57-6	5	1.42	ug/kg	70-130	30	70-130	30	30			
1,2-Dichloroethane-d4	*17060-07-0*									*70-130*		
2-Chloroethoxyethane												
Toluene-d8	*2037-26-5*									*70-130*		
4-Bromofluorobenzene	*460-00-4*									*70-130*		
Dibromofluoromethane	*1868-53-7*									*70-130*		

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5251-1
Page: 1

Langan Engineering & Environmental

NYTCL Semivolatiles - EPA 8270D (SOIL)

Holding Time: 14 days
Container/Sample Preservation: 1 - Glass 250ml/8oz unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Acenaphthene	83-32-9	133.6	17.3012	ug/kg	31-137	50	31-137	50	50			
1,2,4-Trichlorobenzene	120-82-1	167	19.1048	ug/kg	38-107	50	38-107	50	50			
Hexachlorobenzene	118-74-1	100.2	18.704	ug/kg	40-140	50	40-140	50	50			
Bis(2-chloroethyl)ether	111-44-4	150.3	22.6452	ug/kg	40-140	50	40-140	50	50			
2-Chloronaphthalene	91-58-7	167	16.5664	ug/kg	40-140	50	40-140	50	50			
1,2-Dichlorobenzene	95-50-1	167	29.9932	ug/kg	40-140	50	40-140	50	50			
1,3-Dichlorobenzene	541-73-1	167	28.724	ug/kg	40-140	50	40-140	50	50			
1,4-Dichlorobenzene	106-46-7	167	29.1582	ug/kg	28-104	50	28-104	50	50			
3,3'-Dichlorobenzidine	91-94-1	167	44.422	ug/kg	40-140	50	40-140	50	50			
2,4-Dinitrotoluene	121-14-2	167	33.4	ug/kg	40-132	50	40-132	50	50			
2,6-Dinitrotoluene	606-20-2	167	28.6572	ug/kg	40-140	50	40-140	50	50			
Fluoranthene	206-44-0	100.2	19.1716	ug/kg	40-140	50	40-140	50	50			
4-Chlorophenyl phenyl ether	7005-72-3	167	17.869	ug/kg	40-140	50	40-140	50	50			
4-Bromophenyl phenyl ether	101-55-3	167	25.4842	ug/kg	40-140	50	40-140	50	50			
Bis(2-chloroisopropyl)ether	108-60-1	200.4	28.5236	ug/kg	40-140	50	40-140	50	50			
Bis(2-chloroethoxy)methane	111-91-1	180.36	16.7334	ug/kg	40-117	50	40-117	50	50			
Hexachlorobutadiene	87-68-3	167	24.4488	ug/kg	40-140	50	40-140	50	50			
Hexachlorocyclopentadiene	77-47-4	477.62	151.302	ug/kg	40-140	50	40-140	50	50			
Hexachloroethane	67-72-1	133.6	27.0206	ug/kg	40-140	50	40-140	50	50			
Isophorone	78-59-1	150.3	21.6766	ug/kg	40-140	50	40-140	50	50			
Naphthalene	91-20-3	167	20.3406	ug/kg	40-140	50	40-140	50	50			
Nitrobenzene	98-95-3	150.3	24.716	ug/kg	40-140	50	40-140	50	50			
NitrosoDiPhenylAmine(NDPA)/DPA	86-30-6	133.6	19.0046	ug/kg	36-157	50	36-157	50	50			
n-Nitrosodi-n-propylamine	621-64-7	167	25.7848	ug/kg	32-121	50	32-121	50	50			
Bis(2-Ethylhexyl)phthalate	117-81-7	167	57.782	ug/kg	40-140	50	40-140	50	50			
Butyl benzyl phthalate	85-68-7	167	42.084	ug/kg	40-140	50	40-140	50	50			
Di-n-butylphthalate	84-74-2	167	31.6632	ug/kg	40-140	50	40-140	50	50			
Di-n-octylphthalate	117-84-0	167	56.78	ug/kg	40-140	50	40-140	50	50			
Diethyl phthalate	84-66-2	167	15.4642	ug/kg	40-140	50	40-140	50	50			
Dimethyl phthalate	131-11-3	167	35.07	ug/kg	40-140	50	40-140	50	50			
Benzo(a)anthracene	56-55-3	100.2	18.8042	ug/kg	40-140	50	40-140	50	50			
Benzo(a)pyrene	50-32-8	133.6	40.748	ug/kg	40-140	50	40-140	50	50			
Benzo(b)fluoranthene	205-99-2	100.2	28.1228	ug/kg	40-140	50	40-140	50	50			
Benzo(k)fluoranthene	207-08-9	100.2	26.72	ug/kg	40-140	50	40-140	50	50			
Chrysene	218-01-9	100.2	17.368	ug/kg	40-140	50	40-140	50	50			
Acenaphthylene	208-96-8	133.6	25.7848	ug/kg	40-140	50	40-140	50	50			
Anthracene	120-12-7	100.2	32.565	ug/kg	40-140	50	40-140	50	50			
Benzo(ghi)perylene	191-24-2	133.6	19.6392	ug/kg	40-140	50	40-140	50	50			
Fluorene	86-73-7	167	16.2324	ug/kg	40-140	50	40-140	50	50			
Phenanthrene	85-01-8	100.2	20.3072	ug/kg	40-140	50	40-140	50	50			
Dibenzo(a,h)anthracene	53-70-3	100.2	19.3052	ug/kg	40-140	50	40-140	50	50			
Indeno(1,2,3-cd)Pyrene	193-39-5	133.6	23.2798	ug/kg	40-140	50	40-140	50	50			

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5251-1
Page: 2

Langan Engineering & Environmental

NYTCL Semivolatiles - EPA 8270D (SOIL)

Holding Time: 14 days
Container/Sample Preservation: 1 - Glass 250ml/8oz unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Pyrene	129-00-0	100.2	16.5998	ug/kg	35-142	50	35-142	50	50			
Biphenyl	92-52-4	380.76	38.744	ug/kg	54-104	50	54-104	50	50			
4-Chloroaniline	106-47-8	167	30.394	ug/kg	40-140	50	40-140	50	50			
2-Nitroaniline	88-74-4	167	32.1976	ug/kg	47-134	50	47-134	50	50			
3-Nitroaniline	99-09-2	167	31.4962	ug/kg	26-129	50	26-129	50	50			
4-Nitroaniline	100-01-6	167	69.138	ug/kg	41-125	50	41-125	50	50			
Dibenzofuran	132-64-9	167	15.7982	ug/kg	40-140	50	40-140	50	50			
2-Methylnaphthalene	91-57-6	200.4	20.1736	ug/kg	40-140	50	40-140	50	50			
Acetophenone	98-86-2	167	20.6746	ug/kg	14-144	50	14-144	50	50			
2,4,6-Trichlorophenol	88-06-2	100.2	31.6632	ug/kg	30-130	50	30-130	50	50			
P-Chloro-M-Cresol	59-50-7	167	24.883	ug/kg	26-103	50	26-103	50	50			
2-Chlorophenol	95-57-8	167	19.7394	ug/kg	25-102	50	25-102	50	50			
2,4-Dichlorophenol	120-83-2	150.3	26.8536	ug/kg	30-130	50	30-130	50	50			
2,4-Dimethylphenol	105-67-9	167	55.11	ug/kg	30-130	50	30-130	50	50			
2-Nitrophenol	88-75-5	360.72	62.792	ug/kg	30-130	50	30-130	50	50			
4-Nitrophenol	100-02-7	233.8	68.136	ug/kg	11-114	50	11-114	50	50			
2,4-Dinitrophenol	51-28-5	801.6	77.822	ug/kg	4-130	50	4-130	50	50			
4,6-Dinitro-o-cresol	534-52-1	434.2	80.16	ug/kg	10-130	50	10-130	50	50			
Pentachlorophenol	87-86-5	133.6	36.74	ug/kg	17-109	50	17-109	50	50			
Phenol	108-95-2	167	25.217	ug/kg	26-90	50	26-90	50	50			
2-Methylphenol	95-48-7	167	25.885	ug/kg	30-130.	50	30-130.	50	50			
3-Methylphenol/4-Methylphenol	106-44-5	240.48	26.1522	ug/kg	30-130	50	30-130	50	50			
2,4,5-Trichlorophenol	95-95-4	167	31.9972	ug/kg	30-130	50	30-130	50	50			
Benzoic Acid	65-85-0	541.08	169.004	ug/kg	10-110	50	10-110	50	50			
Benzyl Alcohol	100-51-6	167	51.102	ug/kg	40-140	50	40-140	50	50			
Carbazole	86-74-8	167	16.2324	ug/kg	54-128	50	54-128	50	50			
2-Fluorophenol	*367-12-4*									*25-120*		
Phenol-d6	*13127-88-3*									*10-120*		
Nitrobenzene-d5	*4165-60-0*									*23-120*		
2-Fluorobiphenyl	*321-60-8*									*30-120*		
2,4,6-Tribromophenol	*118-79-6*									*10-136*		
4-Terphenyl-d14	*1718-51-0*									*18-120*		

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5251-1
Page: 1

Langan Engineering & Environmental

TCL Pesticides - EPA 8081B (SOIL)

Holding Time: 14 days
Container/Sample Preservation: 1 - Glass 250ml/8oz unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Delta-BHC	319-86-8	7.992	1.5651	ug/kg	30-150	30	30-150	50	50			
Lindane	58-89-9	3.33	1.48851	ug/kg	30-150	30	30-150	50	50			
Alpha-BHC	319-84-6	3.33	0.94572	ug/kg	30-150	30	30-150	50	50			
Beta-BHC	319-85-7	7.992	3.0303	ug/kg	30-150	30	30-150	50	50			
Heptachlor	76-44-8	3.996	1.79154	ug/kg	30-150	30	30-150	50	50			
Aldrin	309-00-2	7.992	2.81385	ug/kg	30-150	30	30-150	50	50			
Heptachlor epoxide	1024-57-3	14.985	4.4955	ug/kg	30-150	30	30-150	50	50			
Endrin	72-20-8	3.33	1.3653	ug/kg	30-150	30	30-150	50	50			
Endrin aldehyde	7421-93-4	9.99	3.4965	ug/kg	30-150	30	30-150	50	50			
Endrin ketone	53494-70-5	7.992	2.05794	ug/kg	30-150	30	30-150	50	50			
Dieldrin	60-57-1	4.995	2.4975	ug/kg	30-150	30	30-150	50	50			
4,4'-DDE	72-55-9	7.992	1.84815	ug/kg	30-150	30	30-150	50	50			
4,4'-DDD	72-54-8	7.992	2.85048	ug/kg	30-150	30	30-150	50	50			
4,4'-DDT	50-29-3	14.985	6.4269	ug/kg	30-150	30	30-150	50	50			
Endosulfan I	959-98-8	7.992	1.88811	ug/kg	30-150	30	30-150	50	50			
Endosulfan II	33213-65-9	7.992	2.67066	ug/kg	30-150	30	30-150	50	50			
Endosulfan sulfate	1031-07-8	3.33	1.58508	ug/kg	30-150	30	30-150	50	50			
Methoxychlor	72-43-5	14.985	4.662	ug/kg	30-150	30	30-150	50	50			
Toxaphene	8001-35-2	149.85	41.958	ug/kg	30-150	30	30-150	50	50			
cis-Chlordane	5103-71-9	9.99	2.78388	ug/kg	30-150	30	30-150	50	50			
trans-Chlordane	5103-74-2	9.99	2.63736	ug/kg	30-150	30	30-150	50	50			
Chlordane	57-74-9	64.935	26.4735	ug/kg	30-150	30	30-150	50	50			
2,4,5,6-Tetrachloro-m-xylene	*877-09-8*									*30-150*		
Decachlorobiphenyl	*2051-24-3*									*30-150*		

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5251-1
Page: 1

Langan Engineering & Environmental

Herbicides -EPA 8151A (SOIL)

Holding Time: 14 days
Container/Sample Preservation: 1 - Glass 250ml/8oz unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
2,4-D	94-75-7	0.1665	0.0104895	mg/kg	30-150	30	30-150	30	30			
2,4,5-T	93-76-5	0.1665	0.0051615	mg/kg	30-150	30	30-150	30	30			
2,4,5-TP (Silvex)	93-72-1	0.1665	0.0044289	mg/kg	30-150	30	30-150	30	30			
DCAA	*19719-28-9*									*30-150*		

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5251-1
Page: 1

Langan Engineering & Environmental

TCL PCBs - EPA 8082A (SOIL)

Holding Time: 14 days
Container/Sample Preservation: 1 - Glass 250ml/8oz unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Aroclor 1016	12674-11-2	33.5	3.7989	ug/kg	40-140	50	40-140	50	50			
Aroclor 1221	11104-28-2	33.5	5.0987	ug/kg	40-140	50	40-140	50	50			
Aroclor 1232	11141-16-5	33.5	3.2964	ug/kg	40-140	50	40-140	50	50			
Aroclor 1242	53469-21-9	33.5	4.1004	ug/kg	40-140	50	40-140	50	50			
Aroclor 1248	12672-29-6	33.5	3.7587	ug/kg	40-140	50	40-140	50	50			
Aroclor 1254	11097-69-1	33.5	2.7336	ug/kg	40-140	50	40-140	50	50			
Aroclor 1260	11096-82-5	33.5	3.4974	ug/kg	40-140	50	40-140	50	50			
Aroclor 1262	37324-23-5	33.5	2.7537	ug/kg	40-140	50	40-140	50	50			
Aroclor 1268	11100-14-4	33.5	2.3718	ug/kg	40-140	50	40-140	50	50			
PCBs, Total	1336-36-3	33.5	1.541	ug/kg				50	50			
PCBs, Total	1336-36-3	33.5	1.541	ug/kg				50	50			
2,4,5,6-Tetrachloro-m-xylene	*877-09-8*									*30-150*		
Decachlorobiphenyl	*2051-24-3*									*30-150*		

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Created By: Ben Rao
File: PM5251-1
Page: 1

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METALS by 6010D (SOIL)

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria	Holding Time	Container/Sample Preservation
Aluminum, Total	7429-90-5	4	1.08	mg/kg	48-151		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Antimony, Total	7440-36-0	2	0.152	mg/kg	1-208		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Arsenic, Total	7440-38-2	0.4	0.0832	mg/kg	79-121		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Barium, Total	7440-39-3	0.4	0.0696	mg/kg	83-117		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Beryllium, Total	7440-41-7	0.2	0.0132	mg/kg	83-117		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Cadmium, Total	7440-43-9	0.4	0.0392	mg/kg	83-117		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Calcium, Total	7440-70-2	4	1.4	mg/kg	81-119		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Chromium, Total	7440-47-3	0.4	0.0384	mg/kg	80-120		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Cobalt, Total	7440-48-4	0.8	0.0664	mg/kg	84-115		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Copper, Total	7440-50-8	0.4	0.1032	mg/kg	81-118		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Iron, Total	7439-89-6	2	0.3612	mg/kg	45-155		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Lead, Total	7439-92-1	2	0.1072	mg/kg	81-117		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Magnesium, Total	7439-95-4	4	0.616	mg/kg	76-124		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Manganese, Total	7439-96-5	0.4	0.0636	mg/kg	81-117		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Nickel, Total	7440-02-0	1	0.0968	mg/kg	83-117		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Potassium, Total	7440-09-7	100	5.76	mg/kg	71-129		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Selenium, Total	7782-49-2	0.8	0.1032	mg/kg	78-122		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Silver, Total	7440-22-4	0.4	0.1132	mg/kg	75-124		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Sodium, Total	7440-23-5	80	1.26	mg/kg	72-127		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Thallium, Total	7440-28-0	0.8	0.126	mg/kg	80-120		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Vanadium, Total	7440-62-2	0.4	0.0812	mg/kg	78-122		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved
Zinc, Total	7440-66-6	2	0.1172	mg/kg	82-118		75-125	20	20		180 days	Metals Only-Glass 60mL/2oz unpreserved

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5251-1
Page: 1

METALS by 7471B (SOIL)

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria	Holding Time	Container/Sample Preservation
Mercury, Total	7439-97-6	0.08	0.016896	mg/kg	72-128		80-120	20	20		28 days	Metals Only-Glass 60mL/2oz unpreserved

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Created By: Ben Rao
File: PM5251-1
Page: 1

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WETCHEM (SOIL)

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Method	Holding Time	Container/Sample Preservation
Cyanide, Reactive	57-12-5	10	10	mg/kg	30-125	40		40	40	7.3	14 days	1 - Glass 250ml/8oz unpreserved
Sulfide, Reactive	NONE	10	10	mg/kg	60-125	40		40	40	7.3	14 days	1 - Glass 250ml/8oz unpreserved
Chromium, Hexavalent	18540-29-9	0.8	0.16	mg/kg	80-120	20	75-125	20	20	7196A	30 days	1 - Glass 120ml/4oz unpreserved
Cyanide, Total	57-12-5	1	0.212	mg/kg	80-120	35	75-125	35	35	9010C/9012B	14 days	1 - Glass 250ml/8oz unpreserved
pH	12408-02-5	0		SU	99-101			5	5	9045D	24 hours	1 - Glass 250ml/8oz unpreserved

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File: PM5251-1
Page: 1

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TPH by GC-FID Quantitation Only (SOIL)

Holding Time: 14 days
Container/Sample Preservation: 1 - Glass 250ml/8oz unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
TPH	NONE	33350	3835.25	ug/kg	40-140	40	40-140	40	40			
Total Petroleum Hydrocarbons (C9-C44)	NONE	33350	3341.67	ug/kg	40-140	40	40-140	40	40			
o-Terphenyl	*84-15-1*									*40-140*		

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File: PM5251-1
Page: 1

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TPH - Gasoline Range Organics (SOIL)

Holding Time: 14 days
Container/Sample Preservation: 1 - Vial MeOH preserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Gasoline Range Organics	NONE	2500	48.15	ug/kg	80-120	20	80-120	20	20			
1,1,1-Trifluorotoluene	*98-08-8*									*70-130*		
4-Bromofluorobenzene	*460-00-4*									*70-130*		

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Created By: Ben Rao
File: PM5253-1
Page: 1

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TCL Volatiles - EPA 8260C (WATER)

Holding Time: 14 days
Container/Sample Preservation: 3 - Vial HCl preserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Methylene chloride	75-09-2	2.5	0.7	ug/l	70-130	20	70-130	20	20			
1,1-Dichloroethane	75-34-3	2.5	0.7	ug/l	70-130	20	70-130	20	20			
Chloroform	67-66-3	2.5	0.7	ug/l	70-130	20	70-130	20	20			
Carbon tetrachloride	56-23-5	0.5	0.134	ug/l	63-132	20	63-132	20	20			
1,2-Dichloropropane	78-87-5	1	0.137	ug/l	70-130	20	70-130	20	20			
Dibromochloromethane	124-48-1	0.5	0.149	ug/l	63-130	20	63-130	20	20			
1,1,2-Trichloroethane	79-00-5	1.5	0.5	ug/l	70-130	20	70-130	20	20			
Tetrachloroethene	127-18-4	0.5	0.181	ug/l	70-130	20	70-130	20	20			
Chlorobenzene	108-90-7	2.5	0.7	ug/l	75-130	20	75-130	20	20			
Trichlorofluoromethane	75-69-4	2.5	0.7	ug/l	62-150	20	62-150	20	20			
1,2-Dichloroethane	107-06-2	0.5	0.132	ug/l	70-130	20	70-130	20	20			
1,1,1-Trichloroethane	71-55-6	2.5	0.7	ug/l	67-130	20	67-130	20	20			
Bromodichloromethane	75-27-4	0.5	0.192	ug/l	67-130	20	67-130	20	20			
trans-1,3-Dichloropropene	10061-02-6	0.5	0.164	ug/l	70-130	20	70-130	20	20			
cis-1,3-Dichloropropene	10061-01-5	0.5	0.144	ug/l	70-130	20	70-130	20	20			
1,3-Dichloropropene, Total	542-75-6	0.5	0.144	ug/l				20	20			
1,3-Dichloropropene, Total	542-75-6	0.5	0.144	ug/l				20	20			
1,1-Dichloropropene	563-58-6	2.5	0.7	ug/l	70-130	20	70-130	20	20			
Bromoform	75-25-2	2	0.65	ug/l	54-136	20	54-136	20	20			
1,1,2,2-Tetrachloroethane	79-34-5	0.5	0.167	ug/l	67-130	20	67-130	20	20			
Benzene	71-43-2	0.5	0.159	ug/l	70-130	20	70-130	20	20			
Toluene	108-88-3	2.5	0.7	ug/l	70-130	20	70-130	20	20			
Ethylbenzene	100-41-4	2.5	0.7	ug/l	70-130	20	70-130	20	20			
Chloromethane	74-87-3	2.5	0.7	ug/l	64-130	20	64-130	20	20			
Bromomethane	74-83-9	2.5	0.7	ug/l	39-139	20	39-139	20	20			
Vinyl chloride	75-01-4	1	0.0714	ug/l	55-140	20	55-140	20	20			
Chloroethane	75-00-3	2.5	0.7	ug/l	55-138	20	55-138	20	20			
1,1-Dichloroethene	75-35-4	0.5	0.169	ug/l	61-145	20	61-145	20	20			
trans-1,2-Dichloroethene	156-60-5	2.5	0.7	ug/l	70-130	20	70-130	20	20			
Trichloroethene	79-01-6	0.5	0.175	ug/l	70-130	20	70-130	20	20			
1,2-Dichlorobenzene	95-50-1	2.5	0.7	ug/l	70-130	20	70-130	20	20			
1,3-Dichlorobenzene	541-73-1	2.5	0.7	ug/l	70-130	20	70-130	20	20			
1,4-Dichlorobenzene	106-46-7	2.5	0.7	ug/l	70-130	20	70-130	20	20			
Methyl tert butyl ether	1634-04-4	2.5	0.7	ug/l	63-130	20	63-130	20	20			
p/m-Xylene	179601-23-1	2.5	0.7	ug/l	70-130	20	70-130	20	20			
o-Xylene	95-47-6	2.5	0.7	ug/l	70-130	20	70-130	20	20			
Xylene (Total)	1330-20-7	2.5	0.7	ug/l				20	20			
Xylene (Total)	1330-20-7	2.5	0.7	ug/l				20	20			
cis-1,2-Dichloroethene	156-59-2	2.5	0.7	ug/l	70-130	20	70-130	20	20			
1,2-Dichloroethene (total)	540-59-0	2.5	0.7	ug/l				20	20			
1,2-Dichloroethene (total)	540-59-0	2.5	0.7	ug/l				20	20			
Dibromomethane	74-95-3	5	1	ug/l	70-130	20	70-130	20	20			

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Date Created: 07/27/18
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File: PM5253-1
Page: 2

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TCL Volatiles - EPA 8260C (WATER)

Holding Time: 14 days
Container/Sample Preservation: 3 - Vial HCl preserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
1,2,3-Trichloropropane	96-18-4	2.5	0.7	ug/l	64-130	20	64-130	20	20			
Acrylonitrile	107-13-1	5	1.5	ug/l	70-130	20	70-130	20	20			
Styrene	100-42-5	2.5	0.7	ug/l	70-130	20	70-130	20	20			
Dichlorodifluoromethane	75-71-8	5	1	ug/l	36-147	20	36-147	20	20			
Acetone	67-64-1	5	1.46	ug/l	58-148	20	58-148	20	20			
Carbon disulfide	75-15-0	5	1	ug/l	51-130	20	51-130	20	20			
2-Butanone	78-93-3	5	1.94	ug/l	63-138	20	63-138	20	20			
Vinyl acetate	108-05-4	5	1	ug/l	70-130	20	70-130	20	20			
4-Methyl-2-pentanone	108-10-1	5	1	ug/l	59-130	20	59-130	20	20			
2-Hexanone	591-78-6	5	1	ug/l	57-130	20	57-130	20	20			
Bromochloromethane	74-97-5	2.5	0.7	ug/l	70-130	20	70-130	20	20			
2,2-Dichloropropane	594-20-7	2.5	0.7	ug/l	63-133	20	63-133	20	20			
1,2-Dibromoethane	106-93-4	2	0.65	ug/l	70-130	20	70-130	20	20			
1,3-Dichloropropane	142-28-9	2.5	0.7	ug/l	70-130	20	70-130	20	20			
1,1,1,2-Tetrachloroethane	630-20-6	2.5	0.7	ug/l	64-130	20	64-130	20	20			
Bromobenzene	108-86-1	2.5	0.7	ug/l	70-130	20	70-130	20	20			
n-Butylbenzene	104-51-8	2.5	0.7	ug/l	53-136	20	53-136	20	20			
sec-Butylbenzene	135-98-8	2.5	0.7	ug/l	70-130	20	70-130	20	20			
tert-Butylbenzene	98-06-6	2.5	0.7	ug/l	70-130	20	70-130	20	20			
o-Chlorotoluene	95-49-8	2.5	0.7	ug/l	70-130	20	70-130	20	20			
p-Chlorotoluene	106-43-4	2.5	0.7	ug/l	70-130	20	70-130	20	20			
1,2-Dibromo-3-chloropropane	96-12-8	2.5	0.7	ug/l	41-144	20	41-144	20	20			
Hexachlorobutadiene	87-68-3	2.5	0.7	ug/l	63-130	20	63-130	20	20			
Isopropylbenzene	98-82-8	2.5	0.7	ug/l	70-130	20	70-130	20	20			
p-Isopropyltoluene	99-87-6	2.5	0.7	ug/l	70-130	20	70-130	20	20			
Naphthalene	91-20-3	2.5	0.7	ug/l	70-130	20	70-130	20	20			
n-Propylbenzene	103-65-1	2.5	0.7	ug/l	69-130	20	69-130	20	20			
1,2,3-Trichlorobenzene	87-61-6	2.5	0.7	ug/l	70-130	20	70-130	20	20			
1,2,4-Trichlorobenzene	120-82-1	2.5	0.7	ug/l	70-130	20	70-130	20	20			
1,3,5-Trimethylbenzene	108-67-8	2.5	0.7	ug/l	64-130	20	64-130	20	20			
1,2,4-Trimethylbenzene	95-63-6	2.5	0.7	ug/l	70-130	20	70-130	20	20			
1,4-Dioxane	123-91-1	250	60.8	ug/l	56-162	20	56-162	20	20			
1,4-Diethylbenzene	105-05-5	2	0.7	ug/l	70-130	20	70-130	20	20			
4-Ethyltoluene	622-96-8	2	0.7	ug/l	70-130	20	70-130	20	20			
1,2,4,5-Tetramethylbenzene	95-93-2	2	0.542	ug/l	70-130	20	70-130	20	20			
Ethyl ether	60-29-7	2.5	0.7	ug/l	59-134	20	59-134	20	20			
trans-1,4-Dichloro-2-butene	110-57-6	2.5	0.7	ug/l	70-130	20	70-130	20	20			
1,2-Dichloroethane-d4	*17060-07-0*									*70-130*		
Toluene-d8	*2037-26-5*									*70-130*		
4-Bromofluorobenzene	*460-00-4*									*70-130*		
Dibromofluoromethane	*1868-53-7*									*70-130*		

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5253-1
Page: 1

NYTCL Semivolatiles - EPA 8270D (WATER)

Holding Time: 7 days
Container/Sample Preservation: 2 - Amber 1000ml unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Acenaphthene	83-32-9	2	0.591	ug/l	37-111	30	37-111	30	30			
1,2,4-Trichlorobenzene	120-82-1	5	0.661	ug/l	39-98	30	39-98	30	30			
Hexachlorobenzene	118-74-1	2	0.579	ug/l	40-140	30	40-140	30	30			
Bis(2-chloroethyl)ether	111-44-4	2	0.669	ug/l	40-140	30	40-140	30	30			
2-Chloronaphthalene	91-58-7	2	0.64	ug/l	40-140	30	40-140	30	30			
1,2-Dichlorobenzene	95-50-1	2	0.732	ug/l	40-140	30	40-140	30	30			
1,3-Dichlorobenzene	541-73-1	2	0.688	ug/l	40-140	30	40-140	30	30			
1,4-Dichlorobenzene	106-46-7	2	0.708	ug/l	36-97	30	36-97	30	30			
3,3'-Dichlorobenzidine	91-94-1	5	1.39	ug/l	40-140	30	40-140	30	30			
2,4-Dinitrotoluene	121-14-2	5	0.845	ug/l	48-143	30	48-143	30	30			
2,6-Dinitrotoluene	606-20-2	5	1.12	ug/l	40-140	30	40-140	30	30			
Fluoranthene	206-44-0	2	0.568	ug/l	40-140	30	40-140	30	30			
4-Chlorophenyl phenyl ether	7005-72-3	2	0.625	ug/l	40-140	30	40-140	30	30			
4-Bromophenyl phenyl ether	101-55-3	2	0.731	ug/l	40-140	30	40-140	30	30			
Bis(2-chloroisopropyl)ether	108-60-1	2	0.696	ug/l	40-140	30	40-140	30	30			
Bis(2-chloroethoxy)methane	111-91-1	5	0.626	ug/l	40-140	30	40-140	30	30			
Hexachlorobutadiene	87-68-3	2	0.717	ug/l	40-140	30	40-140	30	30			
Hexachlorocyclopentadiene	77-47-4	20	7.84	ug/l	40-140	30	40-140	30	30			
Hexachloroethane	67-72-1	2	0.682	ug/l	40-140	30	40-140	30	30			
Isophorone	78-59-1	5	0.601	ug/l	40-140	30	40-140	30	30			
Naphthalene	91-20-3	2	0.68	ug/l	40-140	30	40-140	30	30			
Nitrobenzene	98-95-3	2	0.753	ug/l	40-140	30	40-140	30	30			
NitrosoDiPhenylAmine(NDPA)/DPA	86-30-6	2	0.644	ug/l	40-140	30	40-140	30	30			
n-Nitrosodi-n-propylamine	621-64-7	5	0.7	ug/l	29-132	30	29-132	30	30			
Bis(2-Ethylhexyl)phthalate	117-81-7	3	0.91	ug/l	40-140	30	40-140	30	30			
Butyl benzyl phthalate	85-68-7	5	1.26	ug/l	40-140	30	40-140	30	30			
Di-n-butylphthalate	84-74-2	5	0.689	ug/l	40-140	30	40-140	30	30			
Di-n-octylphthalate	117-84-0	5	1.14	ug/l	40-140	30	40-140	30	30			
Diethyl phthalate	84-66-2	5	0.628	ug/l	40-140	30	40-140	30	30			
Dimethyl phthalate	131-11-3	5	0.65	ug/l	40-140	30	40-140	30	30			
Benzo(a)anthracene	56-55-3	2	0.61	ug/l	40-140	30	40-140	30	30			
Benzo(a)pyrene	50-32-8	2	0.539	ug/l	40-140	30	40-140	30	30			
Benzo(b)fluoranthene	205-99-2	2	0.635	ug/l	40-140	30	40-140	30	30			
Benzo(k)fluoranthene	207-08-9	2	0.597	ug/l	40-140	30	40-140	30	30			
Chrysene	218-01-9	2	0.543	ug/l	40-140	30	40-140	30	30			
Acenaphthylene	208-96-8	2	0.658	ug/l	45-123	30	45-123	30	30			
Anthracene	120-12-7	2	0.645	ug/l	40-140	30	40-140	30	30			
Benzo(ghi)perylene	191-24-2	2	0.611	ug/l	40-140	30	40-140	30	30			
Fluorene	86-73-7	2	0.619	ug/l	40-140	30	40-140	30	30			
Phenanthrene	85-01-8	2	0.613	ug/l	40-140	30	40-140	30	30			
Dibenzo(a,h)anthracene	53-70-3	2	0.548	ug/l	40-140	30	40-140	30	30			
Indeno(1,2,3-cd)Pyrene	193-39-5	2	0.707	ug/l	40-140	30	40-140	30	30			

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5253-1
Page: 2

NYTCL Semivolatiles - EPA 8270D (WATER)

Holding Time: 7 days
Container/Sample Preservation: 2 - Amber 1000ml unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria
Pyrene	129-00-0	2	0.569	ug/l	26-127	30	26-127	30	30	
Biphenyl	92-52-4	2	0.757	ug/l	40-140	30	40-140	30	30	
4-Chloroaniline	106-47-8	5	0.632	ug/l	40-140	30	40-140	30	30	
2-Nitroaniline	88-74-4	5	1.14	ug/l	52-143	30	52-143	30	30	
3-Nitroaniline	99-09-2	5	1.22	ug/l	25-145	30	25-145	30	30	
4-Nitroaniline	100-01-6	5	1.3	ug/l	51-143	30	51-143	30	30	
Dibenzofuran	132-64-9	2	0.656	ug/l	40-140	30	40-140	30	30	
2-Methylnaphthalene	91-57-6	2	0.72	ug/l	40-140	30	40-140	30	30	
Acetophenone	98-86-2	5	0.847	ug/l	39-129	30	39-129	30	30	
2,4,6-Trichlorophenol	88-06-2	5	0.681	ug/l	30-130	30	30-130	30	30	
P-Chloro-M-Cresol	59-50-7	2	0.617	ug/l	23-97	30	23-97	30	30	
2-Chlorophenol	95-57-8	2	0.631	ug/l	27-123	30	27-123	30	30	
2,4-Dichlorophenol	120-83-2	5	0.769	ug/l	30-130	30	30-130	30	30	
2,4-Dimethylphenol	105-67-9	5	1.64	ug/l	30-130	30	30-130	30	30	
2-Nitrophenol	88-75-5	10	1.52	ug/l	30-130	30	30-130	30	30	
4-Nitrophenol	100-02-7	10	1.77	ug/l	10-80	30	10-80	30	30	
2,4-Dinitrophenol	51-28-5	20	5.47	ug/l	20-130	30	20-130	30	30	
4,6-Dinitro-o-cresol	534-52-1	10	2.1	ug/l	20-164	30	20-164	30	30	
Pentachlorophenol	87-86-5	10	3.43	ug/l	9-103	30	9-103	30	30	
Phenol	108-95-2	5	1.89	ug/l	12-110	30	12-110	30	30	
2-Methylphenol	95-48-7	5	1.02	ug/l	30-130	30	30-130	30	30	
3-Methylphenol/4-Methylphenol	106-44-5	5	1.11	ug/l	30-130	30	30-130	30	30	
2,4,5-Trichlorophenol	95-95-4	5	0.715	ug/l	30-130	30	30-130	30	30	
Benzoic Acid	65-85-0	50	12.9	ug/l	10-164	30	10-164	30	30	
Benzyl Alcohol	100-51-6	2	0.725	ug/l	26-116	30	26-116	30	30	
Carbazole	86-74-8	2	0.627	ug/l	55-144	30	55-144	30	30	
2-Fluorophenol	*367-12-4*									*21-120*
Phenol-d6	*13127-88-3*									*10-120*
Nitrobenzene-d5	*4165-60-0*									*23-120*
2-Fluorobiphenyl	*321-60-8*									*15-120*
2,4,6-Tribromophenol	*118-79-6*									*10-120*
4-Terphenyl-d14	*1718-51-0*									*41-149*

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5253-1
Page: 1

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NYTCL Semivolatiles -EPA 8270D-SIM (WATER)

Holding Time: 7 days
Container/Sample Preservation: 2 - Amber 1000ml unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria
Acenaphthene	83-32-9	0.1	0.035	ug/l	40-140	40	40-140	40	40	
2-Chloronaphthalene	91-58-7	0.2	0.035	ug/l	40-140	40	40-140	40	40	
Fluoranthene	206-44-0	0.1	0.038	ug/l	40-140	40	40-140	40	40	
Hexachlorobutadiene	87-68-3	0.5	0.036	ug/l	40-140	40	40-140	40	40	
Naphthalene	91-20-3	0.1	0.043	ug/l	40-140	40	40-140	40	40	
Benzo(a)anthracene	56-55-3	0.1	0.018	ug/l	40-140	40	40-140	40	40	
Benzo(a)pyrene	50-32-8	0.1	0.039	ug/l	40-140	40	40-140	40	40	
Benzo(b)fluoranthene	205-99-2	0.1	0.016	ug/l	40-140	40	40-140	40	40	
Benzo(k)fluoranthene	207-08-9	0.1	0.042	ug/l	40-140	40	40-140	40	40	
Chrysene	218-01-9	0.1	0.038	ug/l	40-140	40	40-140	40	40	
Acenaphthylene	208-96-8	0.1	0.035	ug/l	40-140	40	40-140	40	40	
Anthracene	120-12-7	0.1	0.035	ug/l	40-140	40	40-140	40	40	
Benzo(ghi)perylene	191-24-2	0.1	0.042	ug/l	40-140	40	40-140	40	40	
Fluorene	86-73-7	0.1	0.037	ug/l	40-140	40	40-140	40	40	
Phenanthrene	85-01-8	0.1	0.015	ug/l	40-140	40	40-140	40	40	
Dibenzo(a,h)anthracene	53-70-3	0.1	0.039	ug/l	40-140	40	40-140	40	40	
Indeno(1,2,3-cd)Pyrene	193-39-5	0.1	0.04	ug/l	40-140	40	40-140	40	40	
Pyrene	129-00-0	0.1	0.04	ug/l	40-140	40	40-140	40	40	
2-Methylnaphthalene	91-57-6	0.1	0.045	ug/l	40-140	40	40-140	40	40	
Pentachlorophenol	87-86-5	0.8	0.22	ug/l	40-140	40	40-140	40	40	
Hexachlorobenzene	118-74-1	0.8	0.032	ug/l	40-140	40	40-140	40	40	
Hexachloroethane	67-72-1	0.8	0.03	ug/l	40-140	40	40-140	40	40	
2-Fluorophenol	*367-12-4*									*21-120*
Phenol-d6	*13127-88-3*									*10-120*
Nitrobenzene-d5	*4165-60-0*									*23-120*
2-Fluorobiphenyl	*321-60-8*									*15-120*
2,4,6-Tribromophenol	*118-79-6*									*10-120*
4-Terphenyl-d14	*1718-51-0*									*41-149*

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5253-1
Page: 1

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TCL Pesticides - EPA 8081B (WATER)

Holding Time: 7 days
Container/Sample Preservation: 2 - Amber 120ml unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Delta-BHC	319-86-8	0.02	0.00467	ug/l	30-150	20	30-150	30	30			
Lindane	58-89-9	0.02	0.00434	ug/l	30-150	20	30-150	30	30			
Alpha-BHC	319-84-6	0.02	0.00439	ug/l	30-150	20	30-150	30	30			
Beta-BHC	319-85-7	0.02	0.0056	ug/l	30-150	20	30-150	30	30			
Heptachlor	76-44-8	0.02	0.0031	ug/l	30-150	20	30-150	30	30			
Aldrin	309-00-2	0.02	0.00216	ug/l	30-150	20	30-150	30	30			
Heptachlor epoxide	1024-57-3	0.02	0.00415	ug/l	30-150	20	30-150	30	30			
Endrin	72-20-8	0.04	0.00429	ug/l	30-150	20	30-150	30	30			
Endrin aldehyde	7421-93-4	0.04	0.0081	ug/l	30-150	20	30-150	30	30			
Endrin ketone	53494-70-5	0.04	0.00477	ug/l	30-150	20	30-150	30	30			
Dieldrin	60-57-1	0.04	0.00429	ug/l	30-150	20	30-150	30	30			
4,4'-DDE	72-55-9	0.04	0.00381	ug/l	30-150	20	30-150	30	30			
4,4'-DDD	72-54-8	0.04	0.00464	ug/l	30-150	20	30-150	30	30			
4,4'-DDT	50-29-3	0.04	0.00432	ug/l	30-150	20	30-150	30	30			
Endosulfan I	959-98-8	0.02	0.00345	ug/l	30-150	20	30-150	30	30			
Endosulfan II	33213-65-9	0.04	0.00519	ug/l	30-150	20	30-150	30	30			
Endosulfan sulfate	1031-07-8	0.04	0.00481	ug/l	30-150	20	30-150	30	30			
Methoxychlor	72-43-5	0.2	0.00684	ug/l	30-150	20	30-150	30	30			
Toxaphene	8001-35-2	0.2	0.0627	ug/l	30-150	20	30-150	30	30			
cis-Chlordane	5103-71-9	0.02	0.00666	ug/l	30-150	20	30-150	30	30			
trans-Chlordane	5103-74-2	0.02	0.00627	ug/l	30-150	20	30-150	30	30			
Chlordane	57-74-9	0.2	0.0463	ug/l	30-150	20	30-150	30	30			
2,4,5,6-Tetrachloro-m-xylene	*877-09-8*									*30-150*		
Decachlorobiphenyl	*2051-24-3*									*30-150*		

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5253-1
Page: 1

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Herbicides -EPA 8151A (WATER)

Holding Time: 7 days
Container/Sample Preservation: 2 - Amber 1000ml unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
2,4-D	94-75-7	10	0.498	ug/l	30-150	25	30-150	25	25			
2,4,5-T	93-76-5	2	0.531	ug/l	30-150	25	30-150	25	25			
2,4,5-TP (Silvex)	93-72-1	2	0.539	ug/l	30-150	25	30-150	25	25			
DCAA	*19719-28-9*									*30-150*		

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5253-1
Page: 1

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TCL PCBs - EPA 8082A (WATER)

Holding Time: 7 days
Container/Sample Preservation: 2 - Amber 1000ml unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Aroclor 1016	12674-11-2	0.083	0.019588	ug/l	40-140	50	40-140	50	50			
Aroclor 1221	11104-28-2	0.083	0.031872	ug/l	40-140	50	40-140	50	50			
Aroclor 1232	11141-16-5	0.083	0.027058	ug/l	40-140	50	40-140	50	50			
Aroclor 1242	53469-21-9	0.083	0.029548	ug/l	40-140	50	40-140	50	50			
Aroclor 1248	12672-29-6	0.083	0.022576	ug/l	40-140	50	40-140	50	50			
Aroclor 1254	11097-69-1	0.083	0.034611	ug/l	40-140	50	40-140	50	50			
Aroclor 1260	11096-82-5	0.083	0.01992	ug/l	40-140	50	40-140	50	50			
Aroclor 1262	37324-23-5	0.083	0.017098	ug/l	40-140	50	40-140	50	50			
Aroclor 1268	11100-14-4	0.083	0.027058	ug/l	40-140	50	40-140	50	50			
PCBs, Total	1336-36-3	0.083	0.017098	ug/l				50	50			
PCBs, Total	1336-36-3	0.083	0.017098	ug/l				50	50			
2,4,5,6-Tetrachloro-m-xylene	*877-09-8*									*30-150*		
Decachlorobiphenyl	*2051-24-3*									*30-150*		

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METALS by 6020B (WATER)

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria	Holding Time	Container/Sample Preservation
Aluminum, Total	7429-90-5	0.01	0.00327	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Antimony, Total	7440-36-0	0.004	0.000429	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Arsenic, Total	7440-38-2	0.0005	0.000165	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Barium, Total	7440-39-3	0.0005	0.000173	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Beryllium, Total	7440-41-7	0.0005	0.000107	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Cadmium, Total	7440-43-9	0.0002	0.0000599	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Calcium, Total	7440-70-2	0.1	0.0394	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Chromium, Total	7440-47-3	0.001	0.000178	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Cobalt, Total	7440-48-4	0.0005	0.000163	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Copper, Total	7440-50-8	0.001	0.000384	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Iron, Total	7439-89-6	0.05	0.0191	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Lead, Total	7439-92-1	0.001	0.000343	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Magnesium, Total	7439-95-4	0.07	0.0242	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Manganese, Total	7439-96-5	0.001	0.00044	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Nickel, Total	7440-02-0	0.002	0.000556	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Potassium, Total	7440-09-7	0.1	0.0309	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Selenium, Total	7782-49-2	0.005	0.00173	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Silver, Total	7440-22-4	0.0004	0.000163	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Sodium, Total	7440-23-5	0.1	0.0293	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Thallium, Total	7440-28-0	0.0005	0.000143	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Vanadium, Total	7440-62-2	0.005	0.00157	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Zinc, Total	7440-66-6	0.01	0.00341	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5253-1
Page: 1

METALS by 7470A (WATER)

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria	Holding Time	Container/Sample Preservation
Mercury, Total	7439-97-6	0.0002	0.000066	mg/l	80-120		75-125	20	20		28 days	1 - Plastic 500ml HNO3 preserved

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5253-1
Page: 1

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WETCHEM (WATER)

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Method	Holding Time	Container/Sample Preservation
Chromium, Hexavalent	18540-29-9	0.01	0.003	mg/l	85-115	20	85-115	20	20	7196A	24 hours	1 - Plastic 500ml unpreserved
Cyanide, Total	57-12-5	0.005	0.0018	mg/l	85-115	20	80-120	20	20	9010C/9012B	14 days	1 - Plastic 250ml NaOH preserved

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5253-1
Page: 1

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TPH by GC-FID Quantitation Only (WATER)

Holding Time: 7 days
Container/Sample Preservation: 2 - Amber 1000ml unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
TPH	NONE	200	42	ug/l	40-140	40	40-140	40	40			
Total Petroleum Hydrocarbons (C9-C44)	NONE	500	43.1	ug/l	40-140	40	40-140	40	40			
o-Terphenyl	*84-15-1*									*40-140*		

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5253-1
Page: 1

Langan Engineering & Environmental

TPH - Gasoline Range Organics (WATER)

Holding Time: 14 days
Container/Sample Preservation: 3 - Vial HCl preserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Gasoline Range Organics	NONE	50	3.048	ug/l	80-120	20	80-120	20	20			
1,1,1-Trifluorotoluene	*98-08-8*									*70-130*		
4-Bromofluorobenzene	*460-00-4*									*70-130*		

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5254-1
Page: 1

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1,4 Dioxane via EPA 8270D-SIM (WATER)

Holding Time: 7 days
Container/Sample Preservation: 2 - Amber 500ml unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
1,4-Dioxane	123-91-1	150	75	ng/l	40-140	30	40-140	30	30			
1,4-Dioxane-d8	*17647-74-4*									*15-110*		
1,4-Dioxane-d8 (IS)	17647-74-4			ng/l								

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5254-1
Page: 1

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NY PFAAs via EPA 537(M)-Isotope Dilution (WATER)

Holding Time: 14 days
Container/Sample Preservation: 1 - 3 Plastic Trizma/1 Plastic/1 H20+Trizma

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Perfluorobutanoic Acid (PFBA)	375-22-4	2	0.1312	ng/l	50-150	30	50-150	30	30			
Perfluoropentanoic Acid (PFPeA)	2706-90-3	2	0.0856	ng/l	50-150	30	50-150	30	30			
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	2	0.11	ng/l	50-150	30	50-150	30	30			
Perfluorohexanoic Acid (PFHxA)	307-24-4	2	0.1264	ng/l	50-150	30	50-150	30	30			
Perfluoroheptanoic Acid (PFHpA)	375-85-9	2	0.0924	ng/l	50-150	30	50-150	30	30			
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	2	0.1076	ng/l	50-150	30	50-150	30	30			
Perfluorooctanoic Acid (PFOA)	335-67-1	2	0.0504	ng/l	50-150	30	50-150	30	30			
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	2	0.194	ng/l	50-150	30	50-150	30	30			
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	2	0.1552	ng/l	50-150	30	50-150	30	30			
Perfluorononanoic Acid (PFNA)	375-95-1	2	0.1008	ng/l	50-150	30	50-150	30	30			
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	2	0.1116	ng/l	50-150	30	50-150	30	30			
Perfluorodecanoic Acid (PFDA)	335-76-2	2	0.1904	ng/l	50-150	30	50-150	30	30			
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	2	0.2908	ng/l	50-150	30	50-150	30	30			
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSA	2355-31-9	2	0.2504	ng/l	50-150	30	50-150	30	30			
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	2	0.1912	ng/l	50-150	30	50-150	30	30			
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	2	0.2224	ng/l	50-150	30	50-150	30	30			
Perfluorooctanesulfonamide (FOSA)	754-91-6	2	0.2268	ng/l	50-150	30	50-150	30	30			
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	2991-50-6	2	0.3728	ng/l	50-150	30	50-150	30	30			
Perfluorododecanoic Acid (PFDoA)	307-55-1	2	0.0916	ng/l	50-150	30	50-150	30	30			
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	2	0.0904	ng/l	50-150	30	50-150	30	30			
Perfluorotetradecanoic Acid (PFTA)	376-06-7	2	0.072	ng/l	50-150	30	50-150	30	30			
Perfluoro[13C4]Butanoic Acid (MPFBA)	*NONE*									*50-150*		
Perfluoro[13C5]Pentanoic Acid (M5PFPEA)	*NONE*									*50-150*		
Perfluoro[2,3,4-13C3]Butanesulfonic Acid (M3PFBS)	*NONE*									*50-150*		
Perfluoro[1,2,3,4,6-13C5]Hexanoic Acid (M5PFHxA)	*NONE*									*50-150*		
Perfluoro[1,2,3,4-13C4]Heptanoic Acid (M4PFHpA)	*NONE*									*50-150*		
Perfluoro[1,2,3-13C3]Hexanesulfonic Acid (M3PFHxS)	*NONE*									*50-150*		
Perfluoro[13C8]Octanoic Acid (M8PFOA)	*NONE*									*50-150*		
1H,1H,2H,2H-Perfluoro[1,2-13C2]Octanesulfonic Acid (M2-	*NONE*									*50-150*		
Perfluoro[13C9]Nonanoic Acid (M9PFNA)	*NONE*									*50-150*		
Perfluoro[13C8]Octanesulfonic Acid (M8PFOS)	*NONE*									*50-150*		
Perfluoro[1,2,3,4,5,6-13C6]Decanoic Acid (M6PFDA)	*NONE*									*50-150*		
1H,1H,2H,2H-Perfluoro[1,2-13C2]Decanesulfonic Acid (M2-	*NONE*									*50-150*		
N-Deuteriomethylperfluoro-1-octanesulfonamidoacetic Acid	*NONE*									*50-150*		
Perfluoro[1,2,3,4,5,6,7-13C7]Undecanoic Acid (M7-PFUDA)	*NONE*									*50-150*		
Perfluoro[13C8]Octanesulfonamide (M8FOSA)	*NONE*									*50-150*		
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (	*NONE*									*50-150*		
Perfluoro[1,2-13C2]Dodecanoic Acid (MPFDOA)	*NONE*									*50-150*		
Perfluoro[1,2-13C2]Tetradecanoic Acid (M2PFTEDA)	*NONE*									*50-150*		

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Date Created:	01/16/18
Created By:	Ben Rao
File:	PM4429-1
Page:	1

Langan Engineering & Environmental

Volatile Organics in Air: TO-15 (SOIL_VAPOR)

Holding Time: 30 days
Container/Sample Preservation: 1 - Canister - 2.7 Liter

Analyte	CAS #	RL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
1,1,1-Trichloroethane	71-55-6	1.09	µg/m^{3}	70-130			25	25			
1,1,2,2-Tetrachloroethane	79-34-5	1.37	µg/m^{3}	70-130			25	25			
1,1,2-Trichloroethane	79-00-5	1.09	µg/m^{3}	70-130			25	25			
1,1-Dichloroethane	75-34-3	0.809	µg/m^{3}	70-130			25	25			
1,1-Dichloroethene	75-35-4	0.793	µg/m^{3}	70-130			25	25			
1,2,3-Trimethylbenzene	526-73-8		µg/m^{3}	70-130			25	25			
1,2,4-Trichlorobenzene	120-82-1	1.48	µg/m^{3}	70-130			25	25			
1,2,4-Trimethylbenzene	95-63-6	0.983	µg/m^{3}	70-130			25	25			
1,2,4,5-Tetramethylbenzene	95-93-2		µg/m^{3}	70-130			25	25			
1,2-Dibromoethane	106-93-4	1.54	µg/m^{3}	70-130			25	25			
1,2-Dichlorobenzene	95-50-1	1.2	µg/m^{3}	70-130			25	25			
1,2-Dichloroethane	107-06-2	0.809	µg/m^{3}	70-130			25	25			
1,2-Dichloropropane	78-87-5	0.924	µg/m^{3}	70-130			25	25			
1,3,5-Trimethylbenzene	108-67-8	0.983	µg/m^{3}	70-130			25	25			
1,3-Butadiene	106-99-0	0.442	µg/m^{3}	70-130			25	25			
1,3-Dichlorobenzene	541-73-1	1.2	µg/m^{3}	70-130			25	25			
1,4-Dichlorobenzene	106-46-7	1.2	µg/m^{3}	70-130			25	25			
1,4-Dioxane	123-91-1	0.721	µg/m^{3}	70-130			25	25			
2,2,4-Trimethylpentane	540-84-1	0.934	µg/m^{3}	70-130			25	25			
2-Butanone	78-93-3	1.47	µg/m^{3}	70-130			25	25			
2-Hexanone	591-78-6	0.82	µg/m^{3}	70-130			25	25			
2-Methylthiophene	554-14-3		µg/m^{3}	70-130			25	25			
3-Methylthiophene	616-44-4		µg/m^{3}	70-130			25	25			
3-Chloropropene	107-05-1	0.626	µg/m^{3}	70-130			25	25			
2-Ethylthiophene	872-55-9		µg/m^{3}	70-130			25	25			
4-Ethyltoluene	622-96-8	0.983	µg/m^{3}	70-130			25	25			
Acetone	67-64-1	2.38	µg/m^{3}	70-130			25	25			
Benzene	71-43-2	0.639	µg/m^{3}	70-130			25	25			
Benzyl chloride	100-44-7	1.04	µg/m^{3}	70-130			25	25			
Benzothiophene	95-15-8		µg/m^{3}	70-130			25	25			
Bromodichloromethane	75-27-4	1.34	µg/m^{3}	70-130			25	25			
Bromoform	75-25-2	2.07	µg/m^{3}	70-130			25	25			
Bromomethane	74-83-9	0.777	µg/m^{3}	70-130			25	25			
Carbon disulfide	75-15-0	0.623	µg/m^{3}	70-130			25	25			
Carbon tetrachloride	56-23-5	1.26	µg/m^{3}	70-130			25	25			
Chlorobenzene	108-90-7	0.921	µg/m^{3}	70-130			25	25			
Chloroethane	75-00-3	0.528	µg/m^{3}	70-130			25	25			
Chloroform	67-66-3	0.977	µg/m^{3}	70-130			25	25			
Chloromethane	74-87-3	0.413	µg/m^{3}	70-130			25	25			
cis-1,2-Dichloroethene	156-59-2	0.793	µg/m^{3}	70-130			25	25			
cis-1,3-Dichloropropene	10061-01-5	0.908	µg/m^{3}	70-130			25	25			
Cyclohexane	110-82-7	0.688	µg/m^{3}	70-130			25	25			

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Date Created: 01/16/18
Created By: Ben Rao
File: PM4429-1

Langan Engineering & Environmental

Volatile Organics in Air: TO-15 (SOIL_VAPOR)

Holding Time: 30 days
Container/Sample Preservation: 1 - Canister - 2.7 Liter

Analyte	CAS #	RL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Dibromochloromethane	124-48-1	1.7	$\mu g/m^3$	70-130			25	25			
Dichlorodifluoromethane	75-71-8	0.989	$\mu g/m^3$	70-130			25	25			
Ethyl Alcohol	GCDAI06	9.42	$\mu g/m^3$	70-130			25	25			
Ethyl Acetate	141-78-6	1.8	$\mu g/m^3$	70-130			25	25			
Ethylbenzene	100-41-4	0.869	$\mu g/m^3$	70-130			25	25			
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	1.53	$\mu g/m^3$	70-130			25	25			
1,2-Dichloro-1,1,2,2-tetrafluoroethane	76-14-2	1.4	$\mu g/m^3$	70-130			25	25			
Hexachlorobutadiene	87-68-3	2.13	$\mu g/m^3$	70-130			25	25			
iso-Propyl Alcohol	67-63-0	1.23	$\mu g/m^3$	70-130			25	25			
Methylene chloride	75-09-2	1.74	$\mu g/m^3$	70-130			25	25			
4-Methyl-2-pentanone	108-10-1	2.05	$\mu g/m^3$	70-130			25	25			
Methyl tert butyl ether	1634-04-4	0.721	$\mu g/m^3$	70-130			25	25			
Methyl Methacrylate	80-62-6	2.05	$\mu g/m^3$	70-130			25	25			
p/m-Xylene	179601-23-1	1.74	$\mu g/m^3$	70-130			25	25			
o-Xylene	95-47-6	0.869	$\mu g/m^3$	70-130			25	25			
Xylene (Total)	1330-20-7		$\mu g/m^3$	70-130			25	25			
Heptane	142-82-5	0.82	$\mu g/m^3$	70-130			25	25			
n-Heptane	142-82-5		$\mu g/m^3$	70-130			25	25			
n-Hexane	110-54-3	0.705	$\mu g/m^3$	70-130			25	25			
Propylene	115-07-1	0.861	$\mu g/m^3$	70-130			25	25			
Styrene	100-42-5	0.852	$\mu g/m^3$	70-130			25	25			
Tetrachloroethene	127-18-4	1.36	$\mu g/m^3$	70-130			25	25			
Thiophene	110-02-1		$\mu g/m^3$	70-130			25	25			
Tetrahydrofuran	109-99-9	1.47	$\mu g/m^3$	70-130			25	25			
Toluene	108-88-3	0.754	$\mu g/m^3$	70-130			25	25			
trans-1,2-Dichloroethene	156-60-5	0.793	$\mu g/m^3$	70-130			25	25			
1,2-Dichloroethene (total)	540-59-0		$\mu g/m^3$	70-130			25	25			
trans-1,3-Dichloropropene	10061-02-6	0.908	$\mu g/m^3$	70-130			25	25			
1,3-Dichloropropene, Total	542-75-6		$\mu g/m^3$	70-130			25	25			
Trichloroethene	79-01-6	1.07	$\mu g/m^3$	70-130			25	25			
Trichlorofluoromethane	75-69-4	1.12	$\mu g/m^3$	70-130			25	25			
Vinyl acetate	108-05-4	3.52	$\mu g/m^3$	70-130			25	25			
Vinyl bromide	593-60-2	0.874	$\mu g/m^3$	70-130			25	25			
Vinyl chloride	75-01-4	0.511	$\mu g/m^3$	70-130			25	25			
Naphthalene	91-20-3	1.05	$\mu g/m^3$	70-130			25	25			
Total HC As Hexane	NONE		$\mu g/m^3$	70-130			25	25			
Total VOCs As Toluene	NONE		$\mu g/m^3$	70-130			25	25			
Propane	74-98-6	0.902	$\mu g/m^3$	70-130			25	25			
Acrylonitrile	107-13-1	1.09	$\mu g/m^3$	70-130			25	25			
Acrolein	107-02-8	1.15	$\mu g/m^3$	70-130			25	25			
1,1,1,2-Tetrachloroethane	630-20-6	1.37	$\mu g/m^3$	70-130			25	25			
Isopropylbenzene	98-82-8	0.983	$\mu g/m^3$	70-130			25	25			

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Date Created: 01/16/18
Created By: Ben Rao
File: PM4429-1
Page: 3

Langan Engineering & Environmental

Volatile Organics in Air: TO-15 (SOIL_VAPOR)

Holding Time: 30 days
Container/Sample Preservation: 1 - Canister - 2.7 Liter

Analyte	CAS #	RL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
1,2,3-Trichloropropane	96-18-4	1.21	$\mu g/m^3$	70-130			25	25			
Acetonitrile	75-05-8	0.336	$\mu g/m^3$	70-130			25	25			
Bromobenzene	108-86-1	0.793	$\mu g/m^3$	70-130			25	25			
Chlorodifluoromethane	75-45-6	0.707	$\mu g/m^3$	70-130			25	25			
Dichlorofluoromethane	75-43-4	0.842	$\mu g/m^3$	70-130			25	25			
Dibromomethane	74-95-3	1.42	$\mu g/m^3$	70-130			25	25			
Pentane	109-66-0	0.59	$\mu g/m^3$	70-130			25	25			
Octane	111-65-9	0.34	$\mu g/m^3$	70-130			25	25			
Tertiary-Amyl Methyl Ether	994-05-8	0.836	$\mu g/m^3$	70-130			25	25			
o-Chlorotoluene	95-49-8	1.04	$\mu g/m^3$	70-130			25	25			
p-Chlorotoluene	106-43-4	1.04	$\mu g/m^3$	70-130			25	25			
2,2-Dichloropropane	594-20-7	0.924	$\mu g/m^3$	70-130			25	25			
1,1-Dichloropropene	563-58-6	0.908	$\mu g/m^3$	70-130			25	25			
Isopropyl Ether	108-20-3	0.836	$\mu g/m^3$	70-130			25	25			
Ethyl-Tert-Butyl-Ether	637-92-3	0.836	$\mu g/m^3$	70-130			25	25			
1,2,3-Trichlorobenzene	87-61-6	1.48	$\mu g/m^3$	70-130			25	25			
Ethyl ether	60-29-7	0.606	$\mu g/m^3$	70-130			25	25			
n-Butylbenzene	104-51-8	1.1	$\mu g/m^3$	70-130			25	25			
sec-Butylbenzene	135-98-8	1.1	$\mu g/m^3$	70-130			25	25			
tert-Butylbenzene	98-06-6	1.1	$\mu g/m^3$	70-130			25	25			
1,2-Dibromo-3-chloropropane	96-12-8	1.93	$\mu g/m^3$	70-130			25	25			
p-Isopropyltoluene	99-87-6	1.1	$\mu g/m^3$	70-130			25	25			
n-Propylbenzene	103-65-1	0.983	$\mu g/m^3$	70-130			25	25			
1,3-Dichloropropane	142-28-9	0.924	$\mu g/m^3$	70-130			25	25			
Methanol	67-56-1	6.55	$\mu g/m^3$	70-130			25	25			
Acetaldehyde	75-07-0		$\mu g/m^3$	70-130			25	25			
Butane	106-97-8	0.475	$\mu g/m^3$	70-130			25	25			
Nonane (C9)	111-84-2	1.05	$\mu g/m^3$	70-130			25	25			
Decane (C10)	124-18-5	1.16	$\mu g/m^3$	70-130			25	25			
Undecane	1120-21-4	1.28	$\mu g/m^3$	70-130			25	25			
Indane	496-11-7		$\mu g/m^3$	70-130			25	25			
Indene	95-13-6		$\mu g/m^3$	70-130			25	25			
1-Methylnaphthalene	90-12-0		$\mu g/m^3$	70-130			25	25			
Dodecane (C12)	112-40-3	1.39	$\mu g/m^3$	70-130			25	25			
Butyl Acetate	123-86-4	2.38	$\mu g/m^3$	70-130			25	25			
tert-Butyl Alcohol	75-65-0	1.52	$\mu g/m^3$	70-130			25	25			
2-Methylnaphthalene	91-57-6		$\mu g/m^3$	70-130			25	25			
1,2-Dichloroethane-d4	*17060-07-0*								*70-130*		
Toluene-d8	*2037-26-5*								*70-130*		
Bromofluorobenzene	*460-00-4*								*70-130*		

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Date Created: 01/16/18
Created By: Ben Rao
File: PM4429-1
Page: 1

Langan Engineering & Environmental

Volatile Organics in Air by TO-15 SIM (SOIL_VAPOR)

Holding Time: 30 days
Container/Sample Preservation: 1 - Canister - 2.7 Liter

Analyte	CAS #	RL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
1,1,1-Trichloroethane	71-55-6	0.109	$\mu g/m^3$	70-130	25		25	25			
1,1,1,2-Tetrachloroethane	630-20-6	0.137	$\mu g/m^3$	70-130	25		25	25			
1,1,2,2-Tetrachloroethane	79-34-5	0.137	$\mu g/m^3$	70-130	25		25	25			
1,1,2-Trichloroethane	79-00-5	0.109	$\mu g/m^3$	70-130	25		25	25			
1,1-Dichloroethane	75-34-3	0.081	$\mu g/m^3$	70-130	25		25	25			
1,1-Dichloroethene	75-35-4	0.079	$\mu g/m^3$	70-130	25		25	25			
1,2,4-Trimethylbenzene	95-63-6	0.098	$\mu g/m^3$	70-130	25		25	25			
1,2-Dibromoethane	106-93-4	0.154	$\mu g/m^3$	70-130	25		25	25			
1,2-Dichlorobenzene	95-50-1	0.12	$\mu g/m^3$	70-130	25		25	25			
1,2-Dichloroethane	107-06-2	0.081	$\mu g/m^3$	70-130	25		25	25			
1,2-Dichloropropane	78-87-5	0.092	$\mu g/m^3$	70-130	25		25	25			
1,3,5-Trimethylbenzene	108-67-8	0.098	$\mu g/m^3$	70-130	25		25	25			
1,3-Butadiene	106-99-0	0.044	$\mu g/m^3$	70-130	25		25	25			
1,3-Dichlorobenzene	541-73-1	0.12	$\mu g/m^3$	70-130	25		25	25			
1,4-Dichlorobenzene	106-46-7	0.12	$\mu g/m^3$	70-130	25		25	25			
1,4-Dioxane	123-91-1	0.36	$\mu g/m^3$	70-130	25		25	25			
2,2,4-Trimethylpentane	540-84-1		$\mu g/m^3$	70-130	25		25	25			
2-Hexanone	591-78-6		$\mu g/m^3$	70-130	25		25	25			
3-Chloropropene	107-05-1		$\mu g/m^3$	70-130	25		25	25			
4-Ethyltoluene	622-96-8	0.098	$\mu g/m^3$	70-130	25		25	25			
Benzene	71-43-2	0.319	$\mu g/m^3$	70-130	25		25	25			
Benzyl chloride	100-44-7	1.04	$\mu g/m^3$	70-130	25		25	25			
Bromodichloromethane	75-27-4	0.134	$\mu g/m^3$	70-130	25		25	25			
Bromoform	75-25-2	0.207	$\mu g/m^3$	70-130	25		25	25			
Bromomethane	74-83-9	0.078	$\mu g/m^3$	70-130	25		25	25			
Carbon disulfide	75-15-0		$\mu g/m^3$	70-130	25		25	25			
Carbon tetrachloride	56-23-5	0.126	$\mu g/m^3$	70-130	25		25	25			
Chlorobenzene	108-90-7	0.461	$\mu g/m^3$	70-130	25		25	25			
Chloroethane	75-00-3	0.264	$\mu g/m^3$	70-130	25		25	25			
Chloroform	67-66-3	0.098	$\mu g/m^3$	70-130	25		25	25			
Chloromethane	74-87-3	0.413	$\mu g/m^3$	70-130	25		25	25			
cis-1,2-Dichloroethene	156-59-2	0.079	$\mu g/m^3$	70-130	25		25	25			
trans-1,2-Dichloroethene	156-60-5	0.079	$\mu g/m^3$	70-130	25		25	25			
1,2-Dichloroethene (total)	540-59-0		$\mu g/m^3$	70-130	25		25	25			
cis-1,3-Dichloropropene	10061-01-5	0.091	$\mu g/m^3$	70-130	25		25	25			
1,3-Dichloropropene (Total)	542-75-6		$\mu g/m^3$	70-130	25		25	25			
Cyclohexane	110-82-7		$\mu g/m^3$	70-130	25		25	25			
Dibromochloromethane	124-48-1	0.17	$\mu g/m^3$	70-130	25		25	25			
Dichlorodifluoromethane	75-71-8	0.989	$\mu g/m^3$	70-130	25		25	25			
Ethyl Alcohol	GCDAI06		$\mu g/m^3$	70-130	25		25	25			
Ethyl Acetate	141-78-6		$\mu g/m^3$	70-130	25		25	25			
Ethylbenzene	100-41-4	0.087	$\mu g/m^3$	70-130	25		25	25			

Please Note that the RL information provided in this table is calculated using a 100% Solids factor. (Soil/Solids only)
Please Note that the information provided in this table is subject to change at anytime at the discretion of Alpha Analytical, Inc.

Langan Engineering & Environmental

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Volatile Organics in Air by TO-15 SIM (SOIL_VAPOR)

Holding Time: 30 days
Container/Sample Preservation: 1 - Canister - 2.7 Liter

Analyte	CAS #	RL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	0.383	µg/m³	70-130	25		25	25			
1,2-Dichloro-1,1,2,2-tetrafluoroethane	76-14-2	0.349	µg/m³	70-130	25		25	25			
Methylene chloride	75-09-2	1.74	µg/m³	70-130	25		25	25			
Methyl tert butyl ether	1634-04-4	0.721	µg/m³	70-130	25		25	25			
Naphthalene	91-20-3	0.262	µg/m³	70-130	25		25	25			
p/m-Xylene	179601-23-1	0.174	µg/m³	70-130	25		25	25			
o-Xylene	95-47-6	0.087	µg/m³	70-130	25		25	25			
Xylene (Total)	1330-20-7		µg/m³	70-130	25		25	25			
Heptane	142-82-5		µg/m³	70-130	25		25	25			
n-Hexane	110-54-3		µg/m³	70-130	25		25	25			
Propylene	115-07-1		µg/m³	70-130	25		25	25			
Styrene	100-42-5	0.085	µg/m³	70-130	25		25	25			
Tetrachloroethene	127-18-4	0.136	µg/m³	70-130	25		25	25			
Tetrahydrofuran	109-99-9		µg/m³	70-130	25		25	25			
Toluene	108-88-3	0.188	µg/m³	70-130	25		25	25			
trans-1,3-Dichloropropene	10061-02-6	0.091	µg/m³	70-130	25		25	25			
Trichloroethene	79-01-6	0.107	µg/m³	70-130	25		25	25			
1,2,4-Trichlorobenzene	120-82-1	0.371	µg/m³	70-130	25		25	25			
Trichlorofluoromethane	75-69-4	0.281	µg/m³	70-130	25		25	25			
Vinyl acetate	108-05-4		µg/m³	70-130	25		25	25			
Vinyl bromide	593-60-2		µg/m³	70-130	25		25	25			
Hexachlorobutadiene	87-68-3	0.533	µg/m³	70-130	25		25	25			
iso-Propyl Alcohol	67-63-0		µg/m³	70-130	25		25	25			
Vinyl chloride	75-01-4	0.051	µg/m³	70-130	25		25	25			
Acrylonitrile	107-13-1	1.09	µg/m³	70-130	25		25	25			
n-Butylbenzene	104-51-8	1.1	µg/m³	70-130	25		25	25			
sec-Butylbenzene	135-98-8	1.1	µg/m³	70-130	25		25	25			
Isopropylbenzene	98-82-8	0.983	µg/m³	70-130	25		25	25			
p-Isopropyltoluene	99-87-6	1.1	µg/m³	70-130	25		25	25			
Acetone	67-64-1	2.38	µg/m³	70-130	25		25	25			
2-Butanone	78-93-3	1.47	µg/m³	70-130	25		25	25			
4-Methyl-2-pentanone	108-10-1	2.05	µg/m³	70-130	25		25	25			
Halothane	151-67-7		µg/m³	70-130	25		25	25			
1,2,3-Trichlorobenzene	87-61-6	0.371	µg/m³	70-130	25		25	25			
1,2-Dichloroethane-d4	*17060-07-0*								*70-130*		
Toluene-d8	*2037-26-5*								*70-130*		
Bromofluorobenzene	*460-00-4*								*70-130*		

Please Note that the RL information provided in this table is calculated using a 100% Solids factor. (Soil/Solids only)
Please Note that the information provided in this table is subject to change at anytime at the discretion of Alpha Analytical, Inc.

ATTACHMENT B

RESUMES

JASON J. HAYES, PE, LEED AP

PRINCIPAL/VICE PRESIDENT

ENVIRONMENTAL ENGINEERING

Mr. Hayes has experience in New York, New Jersey, Washington D.C., California, Washington, Oregon, Alaska, and Internationally. His experience includes Environmental Protection Agency (EPA), New York State (NYS) Brownfields applications, investigation, and remediation; New York City Department of Environmental Protection (NYCDEP) and New York City Office of Environmental Remediation (OER) E-designated site applications, investigations, and remediation. His expertise also includes Phase I and II Environmental Site Investigations and Assessments; contaminated building cleanup and demolition; Underground Storage Tank (UST) permitting, removal specifications, and closure reporting; soil vapor intrusion investigation and mitigation system design (depressurization systems, etc.); development of groundwater contaminant plume migration models; environmental analysis; and oversight, design and specification generation for remediation operations with contaminants of concern to include polychlorinated biphenyls (PCBs), solvents, mercury, arsenic, petroleum products, asbestos, mold and lead.

SELECTED PROJECTS

- Confidential Location (Remediation for Mercury-Contaminated Site), New York, NY
- Confidential Location (Phase II ESI and Remedial Design for Mercury Impacted Site), Brooklyn, NY
- NYC School Construction Authority (PCB Remediation), Various Locations, New York, NY
- 28-29 High Line (Phase I ESA, Phase II ESI, and Environmental Remediation), New York, NY
- Georgetown Heating Plant (Phase II ESI and Remedial Design for Mercury Impacted Site), Washington D.C.
- 268 West Street (BCP Application, RI and RIWP), New York, NY
- Confidential Multiple Mixed-Use Tower Location (BCP Application, RI, Phase I ESA, and Phase II ESI), New York, NY
- Dock 72 at Brooklyn Navy Yard, (NYS Voluntary Cleanup Program), Brooklyn, NY
- 27-21 44th Drive (BCP Application, Remedial Investigation Phase I ESA, and Phase II ESI), Long Island City, NY
- Purves Street Development, BCP Application, RAWP, and Phase II ESI, Long Island City, NY
- 267-273 West 87th Street (BCP Application, Remedial Investigation, RIWP, RAWP), New York, NY
- New York Aquarium, Shark Tank and Animal Care Facility (Environmental Remediation), Coney Island, NY
- International Leadership Charter School (Environmental Remediation), Bronx, NY
- West & Watts (BCP Application), New York, NY
- Hudson Yards Redevelopment (Phase I ESA and Phase II ESI), New York, NY

EDUCATION

M.S., Environmental Engineering Columbia University

B.S., Chemistry, Environmental Toxicology Humboldt State University

Business Administration (minor) Humboldt State University

PROFESSIONAL REGISTRATION

Professional Engineer (PE) in NY

LEED Accredited Professional (LEED AP)

Troxler Certification for Nuclear Densometer Training

CPR and First Aid Certification

OSHA 40-Hour HAZWOPER

OSHA HAZWOPER Site Supervisor

AFFILIATIONS

US Green Building Council, NYC Chapter (USGBC), Communications Committee

LANGAN

- 627 Smith Street (RI and Report), Brooklyn, NY
- Gateway Center II Retail (Phase I ESA and Phase II ESI), Brooklyn, NY
- 261 Hudson Street (Phase I ESA, Phase II ESI, BCP, and RAWP), New York, NY
- Riverside Center, Building 2 (BCP, Phase I ESA and Phase II ESI), New York, NY
- New York Police Academy, (Sub-Slab Depressurization and Vapor Barrier System), College Point, NY
- Bronx Terminal Market (BCP, RIWP, RAWP, Phase I ESA and Phase II ESI), Bronx, NY
- Jacob Javits Convention Center (Phase I ESA and Phase II ESI), New York, NY
- Yankee Stadium Development Waterfront Park (NYSDEC Spill Sites), Bronx, NY
- Bushwick Inlet Park (Phase I ESA, Approvals for NYC E-Designation), Brooklyn, NY
- Silvercup West (BCP, RIWP, RIR, RAWP, and RAA), Long Island City, NY
- 29 Flatbush, Tall Residential Building (Groundwater Studies, RIR and RAWP), Brooklyn, NY
- Gowanus Village I (BCP, RIWP and RIR), Brooklyn, NY
- Sullivan Street Hotel (Site Characterization Study and Owner Representation), New York, NY
- Riker's Island Co-Generation Plant (Soil and Soil Vapor Quality Investigations), Bronx, NY
- The Shops at Atlas Park (Sub-Slab Depressurization and Vapor Barrier Design), Glendale, NY
- Memorial Sloan-Kettering Cancer Center (Subsurface and Soil Vapor Intrusion Investigations), New York, NY
- Element West 59th Street (Oversight and Monitoring of Sub-Slab Depressurization and Vapor Barrier Systems), New York, NY
- Teterboro Airport (Delineation and Remedial Oversight of Petroleum-Contaminated Soils), Teterboro, NJ
- Proposed New York JETS Stadium (Phase I ESA), New York, NY
- Former Con Edison Manufactured Gas Plant Sites (Research Reports), New York, NY
- 7 World Trade Center (Endpoint Sampling and Final Closure Report), New York, NY
- Peter Cooper Village, Environmental Subsurface Investigations, New York, NY

SELECTED PUBLICATIONS, REPORTS, AND PRESENTATIONS

NYC Mayor's Office of Environmental Remediation – Big Apple Brownfield Workshop – Presented on Soil Vapor Intrusion Remedies (e.g., SSD Systems, Vapor Barriers, Modified HVAC)

New York City Brownfield Partnership – Presented on environmental considerations and complications of the Hudson Yards Development

Urban Land Institute (ULI), member

Commercial Real Estate Development Associations (NAIOP), member

NYC Brownfield Partnership, member

Waterfront Development Technical Course – Presented on Impacted Waterfront Planning Considerations

MICHAEL D. BURKE, PG, CHMM, LEED AP

PRINCIPAL/VICE PRESIDENT

ENVIRONMENTAL ENGINEERING AND REMEDIATION

Mr. Burke is a geologist/environmental scientist whose practice involves site investigation and remediation, transactional due diligence, environmental site assessments, in-situ remedial technology, and manufactured gas plant (MGP) site characterization and remediation. His additional services include multi-media compliance audits, sub-slab depressurization system design, non-hazardous and hazardous waste management, emergency response, community air monitoring programs, environmental and geotechnical site investigations, and health and safety monitoring. He has experience with projects in the New York State Department of Environmental Conservation (NYSDEC) and New York State Brownfield Cleanup (NYS BCP) Programs; Inactive Hazardous Waste, and Spill Programs, and New York City Office of Environmental Remediation (OER) e-designated and New York City Voluntary Cleanup Program (NYC VCP) sites.

SELECTED PROJECTS

- 227-14 North Conduit Avenue, Industrial Wastewater Compliance, Jamaica, NY
- 420 Kent Avenue, NYS Brownfield Cleanup Program, Brooklyn, NY
- 572 Eleventh Avenue, NYC VCP, New York, NY
- Monian Site A, OER E-Designated Site, New York, NY
- 537 Sackett Street, Gowanus Canal Due Diligence/MGP Site, Brooklyn, NY
- ABC Blocks 25, 26 and 27, NYS Brownfield Cleanup Program Sites, Long Island City, NY
- 432 Rodney Street, NYS Brownfield Cleanup Program, Petroleum and Chlorinated Volatile Organic Compound Investigation and Remediation, Brooklyn, NY
- 787 Eleventh Avenue, NYS Brownfield Cleanup Program Site, New York, NY
- President Street at Gowanus Canal, NYS Brownfield Cleanup Program Site, Brooklyn, NY
- 22-36 Second Avenue at Gowanus Canal, NYS Brownfield Cleanup Program Site, Brooklyn, NY
- 563 Sacket Street, NYS Brownfield Cleanup Program Site, MGP Investigation, and Remediation, Brooklyn, NY
- 156-162 Perry Street, NYS Brownfield Cleanup Program Site, New York, NY
- Christopher and Weehawken Streets, NYS Brownfield Cleanup Program, New York, NY
- Phelps Dodge Block 2529 (Lots 40, 50, and 45), Inactive Hazardous Waste Disposal Site, Maspeth NY
- 42-50 24th Street, NYS Brownfield Cleanup Program Site, Long Island City, NY
- Storage Deluxe (163 6th Street), OER E-Designation Site, New York, NY

EDUCATION

M.S., Environmental Geology
Rutgers University

B.S., Geological Sciences
Rutgers University

B.S., Environmental Science
Rutgers University

PROFESSIONAL REGISTRATION

Professional Geologist (PG) in NY

Certified Hazardous Materials Manager – CHMM No. 15998

LEED Accredited Professional (LEED AP)

OSHA Certification for Hazardous Waste Site Supervisor

OSHA 29 CFR 1910.120 Certification for Hazardous Waste Operations and Emergency Response

NJDEP Certification for Community Noise Enforcement

Troxler Certification for Nuclear Densometer Training

LANGAN

- Prospect Park Redevelopment, Landfill Reclamation, Prospect Park, NJ
- 431 Carroll Street, Gowanus Canal Due Diligence, Brooklyn, NY
- 76 4th Street Property, Gowanus Due Diligence, Brooklyn, NY
- Foxgate/MREC, Due Diligence and Solid Waste Compliance, Central Islip, NY
- 175-225 3rd Street at Gowanus Canal, NYS Brownfield Cleanup Program, Brooklyn, NY
- New York University Tandon School of Engineering, Spill Investigation/Remediation Dual Phase Recovery, and Laser Fluorescence Investigation, Brooklyn, NY
- 2420-2430 Amsterdam Avenue, NYS Brownfield Cleanup Program/Board of Standards and Appeals Variance, New York, NY
- 170 Amsterdam Avenue, NYC VCP, New York, NY
- 538-540 Hudson Street, NYS Brownfield Cleanup Program (Former Gas Station), New York, NY
- 234 Butler Street, Gowanus Canal Due Diligence, Brooklyn, NY
- 550 Clinton Street, NYS Brownfield Cleanup Program E-Designation, Brooklyn, NY
- 111 Leroy Street, OER E-Designation Site, New York, NY
- 335 Bond Street, NYS Brownfield Cleanup Program, New York, NY
- Gowanus Canal Northside, NYS BCP Former Fuel Oil Terminal, Brooklyn, NY
- Multiple Buildings, Major Oil Storage Facility, Gowanus Canal Location, Brooklyn, NY
- 197-205 Smith Street at Gowanus Canal, MGP Due Diligence, Brooklyn, NY
- 450 Union Street at Gowanus Canal, NYS Brownfield Cleanup Program, Brooklyn, NY
- 86 Fleet Place, NYC VCP E-Designation, Brooklyn, NY
- New York University College of Nursing at 433 1st Avenue, NYS BCP, Bronx, NY
- Retail Building at 225 3rd Street, Brooklyn, NY
- 29-37 41st Avenue, NYS Brownfield Cleanup Program, Long Island City, NY
- 43-01 22nd Street, NYS Brownfield Cleanup Program, Long Island City, NY
- Compliance Audit for NYU at Washington Square Park, New York, NY
- Former Watermark Locations, NYS Brownfield Cleanup Program, Chlorinated Volatile Organic Compound Investigation and Remediation; AS/SVE, Brooklyn, NY
- Former Gas Station (1525 Bedford Avenue), Brooklyn, NY
- NYS Brownfield Cleanup Program at 514 West 24th Street, New York, NY
- Gowanus Canal Due Diligence at 76 4th Street, Brooklyn, NY
- Urban Health Plan, Medical Building, NYS Brownfield Cleanup Program CVOC Investigation and Remediation, Bronx, NY
- 420 East 54th Street, NYS Spill Closure, New York, NY
- Equity Residential at 160 Riverside Boulevard, NYS Spill Closure, New York, NY
- 357-359 West Street and 156 Leroy Street, NYC VCP, New York, NY
- Emergency Spill Response at 322 West 57th Street, Investigation and Closure, New York, NY

- Hurricane Sandy, Emergency Response at 21 West Street, New York, NY
- Hurricane Sandy, Emergency Response at 71 Pine Street, New York, NY
- Greenpoint Landing, NYC E-Designation, Brooklyn, NY
- 23-01 42nd Road, NYS Brownfield Cleanup Program, Long Island City, NY
- Greenpoint Waterfront Development, NYS Brownfield Cleanup Program, Brooklyn, NY
- 125th Street and Lenox Avenue, NYC VCP, New York, NY
- Whitehead Realty Solvent Site, Inactive Hazardous Waste site, CVOC
  Investigation and Remediation, Brooklyn, NY
- SunCap Property Group Environmental On-Call Consulting, Various Locations, Nationwide
- Consolidated Edison Company of New York, Underground Storage Tank On-Call Contract, Five Boroughs of New York City, NY
- Consolidated Edison Company of New York, Appendix B Spill Sites On-Call Contract, Five Boroughs of New York City, NY
- Meeker Avenue Plume Trackdown Site, Brooklyn, NY
- Distribution Facility, Superfund Redevelopment, Long Island City, NY
- Edison Properties, West 17th Street Development Site (Former MGP Site), New York, NY
- Con Edison on Governors Island, Dielectric Fluid Spill, Investigation and Remediation, New York, NY
- 144-150 Barrow Street, NYS Brownfield Cleanup Program, New York, NY
- West 17th Street Development, NYS Brownfield Cleanup Program, MGP Investigation and Remediation, New York, NY
- Montefiore Medical Center, Emergency Response, PCB Remediation, Bronx, NY
- New York University, 4 Washington Square Village Fuel Oil Remediation, New York, NY
- NYCSCA, Proposed New York City School Construction Sites, Five Boroughs of New York City, NY
- Con Edison, East 60th Street Generating Station, New York, NY
- Residential Building at 82 Irving Place, Environmental Remediation, New York, NY
- 1113 York Avenue, Storage Tank Closures, New York, NY
- Peter Cooper Village/Stuyvesant Town, Phase I ESA, New York, NY
- Superior Ink, Waste Characterization and Remedial Action Plans, New York, NY
- Bronx Mental Health Redevelopment Project, Phase I ESA, Bronx, NY
- 2950 Atlantic Avenue, Site Characterization Investigation, Brooklyn, NY
- Con Edison, East 74th Street Generating Station, Sediment Investigation, New York, NY
- Con Edison, First Avenue Properties, New York, NY
- Queens West Development Corp. Stage II, Long Island City, NY
- Article X Project Environmental Reviews, Various New York State Electrical Generation Sites, NY
- Poletti Generating Station, Astoria, NY
- Arthur Kill Generating Station, Staten Island, NY

- Distribution Facility, Phase I & Phase II ESA and Regulatory Compliance, Bohemia, NY
- Huntington Station Superfund Due Diligence, Huntington Station, NY
- Garvies Point Bulkhead, Glen Cove, NY
- Johnson & Hoffman Metal Stamping Facility, Environmental Compliance, Carle Place, NY
- Floral Park Storage Facility, Phase I and Phase II ESA
- Garden City Phase I ESAs at two sites, including part of a Superfund Site, Garden City, NY
- Huntington Station Storage Facility, Phase I and II ESA, Huntington Station, NY

Anthony Moffa, Jr., ASP, CHMM, COSS

Associate/Corporate Health and Safety Manager

Anthony is Langan's Corporate Health & Safety Manager and is responsible for managing health and safety compliance in all Langan office locations. He has over 15 years experience in the health and safety field. He is responsible for ensuring compliance with all federal and state occupational health and safety laws and development and implementation of corporate health and safety policies. Responsibilities include reviewing and updating Langan's Corporate Health and Safety Program and assisting employees in the development of site specific Health & Safety Plans. He maintains and manages health and safety records for employees in all Langan office locations including medical evaluations, respirator fit testing, and Hazardous Waste Operations and Emergency Response training. He is also responsible for documentation and investigation of work-related injuries and incidents and sharing this information with employees to assist in the prevention of future incidents. He is also the chairman of the Corporate Health & Safety Committee and Health & Safety Leadership Team that meet periodically throughout the year. He is responsible for coordinating and providing health and safe training to Langan employees. He was formerly the Environmental, Health and Safety Coordinator at a chemical manufacturer. His experience included employee hazard communications, development of material safety data sheets for developed products, respirator fit testing and conducting required Occupational Health & Safety Association and Department of Transportation training.

Education

B.S., Physics
West Chester University

Professional Registration

Associate Safety Professional (ASP)

Certified Hazardous Material Manager (CHMM)

Certified Occupational Safety Specialist (COSS)

Affiliations

Pennsylvania Chamber of Business & Industry

Chemical Council of New Jersey

New Jersey Business & Industry Association

Geoprofessional Business Association

Certifications and Training

Hazardous Waste Operations and Emergency Response Training

OSHA Site Supervisor Training

10 & 30-Hour Construction Safety & Health Training

30-Hour Construction Safety & Health Training

10-Hour Industry Safety & Health Training

Confined Space Awareness & Entry

Competent Person in Excavations

Hazard Communications

Defensive Driving Training

LANGAN

JOSEPH GOOD, PE, LEED AP

SENIOR PROJECT MANAGER

ENVIRONMENTAL ENGINEERING

Mr. Good is an environmental engineer with experience working on both national and international projects. He has conducted environmental research on water treatment technology designed to remedy nutrient leaching from agricultural fields and to remove metals from urban stormwater. His consulting experience includes New York State Brownfield investigations and remediation, New York City Department of Environmental Protection (NYCDEP) E-designated site application, investigation, and remediations. Additional services include Phase I and II Environmental Site Assessments, remedial engineering and system design, Underground Storage Tank (UST) permitting, removal specifications, closure reporting, and soil vapor intrusion investigations. Mr. Good's field experience includes subsurface investigations, groundwater, soil, and air sampling programs, monitoring well installations, driller supervisions, subcontractor oversights, and waste characterizations.

Mr. Good was named one of the ENR's Top Young Professionals in 2019.

SELECTED PROJECTS

- Brooklyn Navy Yard Building 77, Commercial Building, Brooklyn, NY
- Brooklyn Navy Yard Dock 72, Brooklyn, NY
- Hudson Yards Redevelopment, New York, NY
- 50 Hudson Yards, Supertall Office Building, New York, NY
- 55 Hudson Yards, Tall Office Building New York, NY
- One Hudson Boulevard, Tall Office Building, New York, NY
- One Hudson Yards, Tall Office Building, New York, NY
- SUNY Downstate Advanced Learning Center, Brooklyn, NY
- 504-530 East 14th Street, Mixed-Use Residential Buildings, New York, NY
- 19 West 20th Street, Tall Residential Building, New York, NY
- New York Aquarium, Post-Superstorm Sandy Support, Coney Island, NY
- High Line 2829, Tall Mixed-Use Development, New York, NY
- Hunters Point Library, Hunters Point, NY
- 627-641 Smith Street, Commercial Redevelopment, Brooklyn, NY
- Silvercup West, Tall Residential and Film Studio Building, Long Island City, NY
- Bronx Terminal Market, Power Retail Center, Bronx, NY
- Bronx Terminal Market, Waterfront Park Development, Bronx, NY
- Bushwick Inlet Park, Brooklyn, NY
- Abraham Joshua Heschel School, New York, NY
- The Shops at Atlas Park, Lifestyle Retail Center, Glendale, NY
- Metlife Stadium, East Rutherford, NJ

EDUCATION

M.E., Civil and Natural Resource Engineering
University of Canterbury

B.S., Civil Engineering
University of Illinois

PROFESSIONAL REGISTRATION

Professional Engineer (PE) in NY, IL

LEED Accredited Professional (LEED AP)

40-Hour HAZWOPER

10-Hour OSHA

AFFILIATIONS

American Chemical Society (ACS)

United States Green Building Council (USGBC)

American Society of Civil Engineers (ASCE)

SELECTED PUBLICATIONS, REPORTS, AND PRESENTATIONS

Good, J.F., Hayes, J., Zeng, L., and Abrams, S. (2015). "Bioremediation via Soil Mixing to Address Chlorinated Ethenes and Ethanes at a Brownfield Site with High Organic and Metal Soils." Battelle- Third International Symposium on Bioremediation and Sustainable Environmental Technologies, Miami, Florida, May 18-21, 2015.

Good, J.F., O'Sullivan, A.D., Wicke, D., and Cochrane, T.A, (2013). "pH Buffering in Stormwater Infiltration Systems – Sustainable Contaminant Removal with Waste Mussel Shells." DOI: 10.1007/s11270-014-1885-1

Good, J.F., O'Sullivan, A.D., Wicke, D., and Cochrane, T.A, (2012). "Contaminant Removal and Hydraulic Conductivity of Laboratory Rain Garden Systems for Stormwater Treatment. Water Science and Technology." DOI: 10.2166/wst.2012.135. 65(12):2154-2161

Good, J.F. (2011) "Water Quality Treatment and Hydraulic Efficacy of Rain Gardens. Civil and Natural Resources Engineering," University of Canterbury, Christchurch, New Zealand. Master of Engineering in Civil Engineering.

Good, J.F., O'Sullivan, A.D., Wicke, D., and Cochrane, T.A, (2011). "Appreciating Drainage Assets in New Zealand Cities: Rain Garden Treatment and Hydraulic Performance." International Water Association-Cities of the Future Conference, 22-25 May 2011, Stockholm, Sweden.

WILLIAM BOHRER, PG

PROJECT GEOLOGIST

GEOLOGIST

Mr. Bohrer is an experienced geologist responsible for managing Langan's environmental standards and Health and Safety compliance for projects throughout New York City. His services include dissemination of environmental protocols, troubleshooting at project sites, in-house/field training, and maintenance of quality standards across the environmental discipline. Mr. Bohrer has a diverse and extensive background in geophysics, hydrogeology, mining and petroleum, and geotechnical engineering. He has developed conceptual site models for public, industrial and commercial facilities nationwide.

SELECTED PROJECTS

- NYU Poly – 122 Johnson Street, Brooklyn, NY
- Con Edison of New York at Governor's Island, NY, NY
- 535 4th Avenue, Brooklyn, NY
- 27 Wooster Street, New York, NY
- 42 West Street, Brooklyn, NY
- 455 West 19th Street, New York, NY
- Kings Plaza Mall, Brooklyn, NY
- Hudson Yards "Terra Firma", New York, NY
- Hudson Yards, Platform Special Inspection, New York, NY
- PSAC II, Bronx, NY
- 595-647 Smith Street, Brooklyn, NY
- New York University, 7-13 Washington Square North Investigation, New York, NY
- NYU 4 Washington Square Village, New York, NY
- 125th Street and Lenox Avenue, New York, NY
- Sullivan Street Development, New York, NY
- Hudson Crossing II, New York, NY
- New York Aquarium, Shark Tank & Animal Care Facility, Brooklyn, NY
- 209-219 Sullivan Street, New York, NY
- 261 Hudson Street, New York, NY
- 460 Washington Street, New York, NY
- 552 West 24th Street, New York, NY
- Brooklyn Bridge Park Pier 1, New York, NY
- International Leadership Bronx Charter School, Bronx, NY
- 203 East 92nd Street, New York, NY
- HighLine 28-29, New York, NY
- 539 Smith Street Bulkhead, Brooklyn, NY
- Willets Point, Corona, NY
- Plume Migration and Fracture Flow Aquifer Investigation, Brunswick, MD
- Plume Migration and Fracture Flow Aquifer Investigation, Fallston, MD
- Emergency Response Site Investigation & Remediation, Wappingers Falls, NY
- Emergency Response Site Investigation & Remediation, Allentown, PA

EDUCATION

Post Graduate Studies in Geophysics
Cornell University

B.S., Geology
Tufts University

PROFESSIONAL REGISTRATION

Professional Geologist (PG) in NY

40 Hour OSHA HazWOPER

OSHA Construction Safety & Health

OSHA Supervisory Certification
Credential (TWIC)

Transportation Worker Identification

NYS DEC- Protecting New York's Natural Resources with Better Construction Site Management

AFFILIATIONS

American Association of Petroleum Geologists

National Groundwater Association

Geological Society of America

LANGAN

- Emergency Response Site Investigation & Remediation, Shamokin, PA
- Bermuda International Airport, Jet Fuel Release Investigation, Bermuda
- Little Missouri River Basin, Geotechnical Site Evaluation (Horizontal Drilling Pipeline Install), ND
- Seismic Susceptibility Evaluation (Class 2 Injection Wells), Litchfield, OH
- Bedrock Mapping, Bradford and Sullivan Counties, PA
- Soil Solidification, Carteret, NJ

PA Council of Professional Geologists

Emily G. Strake

Project Chemist/ Risk Assessor
Environmental Engineering

17 years in the industry ~ 5 years with Langan

Ms. Strake has 17 years of environmental chemistry, risk assessment, auditing, and quality assurance experience. Most recently, she has focused her efforts on human health risk assessment, and has been the primary author or key contributor of risk assessment reports and screening evaluations for projects governed under RCRA, CERCLA, NJDEP, DNREC, SWRCB, DTSC, PADEP, CTDEEP, ODEQ, NYSDEC and MDE. She has experience in site-specific strategy development, which has enabled her to perform assessments to focus areas of investigation and identify risk-based alternatives for reducing remediation costs. Ms. Strake is a member of the Interstate Technology and Regulatory Council Risk Assessment Team responsible for the development and review of organizational risk assessment guidance documents and serves as a National Trainer in risk assessment for the organization.

Ms. Strake has extensive experience in environmental data validation, focused on ensuring laboratory deliverables follow specific guidelines as described by regulatory agencies and the analytical methods employed. In addition, she has experience in EQuIS chemical database management. She also has a broad range of environmental field experience and maintains current OSHA HAZWOPER certification. Ms. Strake is experienced in auditing laboratory and field-sampling activities for compliance with Quality Assurance Project Plans (QAPPs), the National Environmental Laboratory Accreditation Conference Standards Quality Systems manual, and applicable USEPA Guidance. Ms. Strake has also audited on-site laboratories in support of groundwater treatment operations and implemented corrective actions. Her responsibilities include writing reports on the value of laboratory work, writing/editing QAPPs for clients and project-specific sites, peer reviewing colleague's work, and mentoring staff within the office. She has also served as the Quality Assurance officer for several long-term projects, responsible for the achievement of all forms of Quality Control/Quality Assurance by onsite personnel relating to sampling, analysis, and data evaluation.

Selected Project Experience

Major League Soccer's San Jose Earthquakes Stadium, Santa Clara, CA
DuPont, Waynesboro, VA
PECO/Exelon, Various Locations
Texas Instruments, San Francisco, CA
Regency, Philadelphia, PA
Veteran's Affairs, Palo Alto, CA
DOW Chemical, Various Locations
Avon, Rye, NY
Golden Gate National Parks Conservancy, San Francisco, CA
Sunoco Refineries, Various Locations
Honeywell, Highland Park, NJ
Delaware City Refinery, DE

Education

MBA
The University of Scranton

B.S., Chemistry
Cedar Crest College

Professional Licenses

Board Certified Environmental Professional (CEP)

Training

40 hr. OSHA HAZWOPER Training/Nov 2002

8 hr. HAZWOPER Supervisor/June 2004

8 hr. OSHA HAZWOPER Refresher/2013

Affiliations

The Society for Risk Analysis

Interstate Technology and Regulatory Council

Occidental Chemical, Bakersfield, CA
Floreffe Terminal, Pittsburgh, PA
Ryder, Hartford, CT
Rohm and Haas, Philadelphia, PA

EMILY L. SNEAD, PG

PROJECT SCIENTIST

ENVIRONMENTAL ENGINEERING

Ms. Snead brings field experience and technical expertise to environmental investigations and remediation projects. She has independently performed Phase I and Phase II assessments and investigations, UST removals and closures, remedial excavations, vapor extractions, and ISCO injections. She excels at project research, environmental sampling, remedial oversight, proposal and report preparation. Her projects have included hospital centers, day care facilities, residential buildings, chemical plants, and commercial/industrial sites throughout New York City and the Tri-State area. Prior to her career in Environmental Consulting, Ms. Snead conducted research with NASA and performed construction oversight management in the Cayman Islands.

SELECTED PROJECTS

- Silvercup West, Brownfield Cleanup Site, Long Island City, NY
- Highline 28-29 Development, PCE-Contaminated Soil Delineation and Implementation of Bioaugmentation Remediation, New York, NY
- 295 Locust Avenue, Soil Excavation/Trucking, Monitoring Well Decommissioning, Groundwater Sampling and SMP inspections, Bronx, NY
- Hotel Trades Union (620 Fulton Street), Hazardous Lead Soil removal, UST closure and Soil Management Report Brooklyn, NY
- 743 Fifth Avenue, Soil Management Report, New York, NY
- Suncap Facility, UST Investigations and Test Pit Explorations, Yonkers, NY
- New York University (383 Lafayette Street), Hazardous Lead Soil Removal and UST Closure New York, NY
- 601 Washington Street, Remedial Excavation, Groundwater ISCO Treatment, and Installation of an Active SMD System, New York, NY
- NYC OER E-Designated site (50 Hudson Yards/2 Hudson Boulevard), Remedial Investigation, Remedial Excavation Oversight, and Closure Reporting, New York, NY
- Riverside Center Parcel 1, VCP Site Remedial Excavation, UST Closure, Spill Investigation and Closure, and Reporting, New York, NY
- Riverside Center Parcels 3 and 4, VCP Site Remedial Excavation, UST Closure, New York, NY
- Bronx Terminal Market, Triennial SMP Reporting and Annual Inspections, Bronx, NY
- 616 First Avenue, VCP Program Includes Remedial Excavation Oversight, SMP Annual Inspections, Reporting, New York, NY
- Luxury Car Dealership (787 Eleventh Avenue), Spill Investigation and UST Closure, New York, NY
- 335 Bold Street, Phase II and BCP Application, Brooklyn, NY
- President Street Properties, Phase II Investigation and BCP Application, Brooklyn, NY
- 38-01 Queens Boulevard Due Diligence, Long Island City, NY

EDUCATION

B.S., Environmental Science & Geology
Northeastern University

PROFESSIONAL REGISTRATION

Professional Geologist (PG) in NY

40-Hour OSHA HAZWOPER

8-Hour OSHA HAZWOPER Refresher

10-Hour OSHA Construction Safety Training

DOT Hazardous Materials Shipping Training

First Aid/ CPR Training

AFFILIATIONS

NAIOP New York City Chapter, member

Urban Land Institute (ULI), Member

- 250 Water Street, Phase II Investigation, New York, NY
- 139 East 56th Street, Joint Geotechnical and Environmental Waste Characterization, New York, NY
- Le Soleil d'Or Boutique Hotel, Cayman Brac, Cayman Islands
- Columbia University Medical Center, Phase I and II Environmental Site Investigation Nursing School, New York, NY
- Consolidated Edison of NY, Remedial Investigation and RIR Investigation, New York, NY
- 11-09 Borden Avenue, MTA Bridges and Tunnels/Borden Avenue ISCO Remediation, Disposal of Petroleum-Impacted Soil, Long Island City, NY
- Columbia University Medical Center, Removal of a 1,000-gal UST and Closure Report, New York, NY
- Children's Aid Society (910 East 172nd Street), Oversight of the VEFR and Collection of Groundwater Samples New York, NY
- New York City Housing Authority, Community Air Monitoring Program and Environmental Oversight, Bronx, NY
- YRC Freight Newtown Creek EPA RFI, Brooklyn, NY
- 522-532 West 29th Street Redevelopment, Phase II Site Investigation and RAWP New York, NY
- Memorial Sloan-Kettering Cancer Center Ambulatory Surgery Building, Community Air Monitoring Program, New York, NY
- Keith Hilltop Terrace Apartments, Phase I and II Environmental Site Assessment, Altoona, PA
- Southern Boulevard Phase II ESA, Bronx, NY
- Former Auto Dealership, Remedial Investigation and Delineation of Polycyclic Aromatic Hydrocarbons (PAHs), Paramus, NJ
- 711 11th Avenue, Former Auto Dealership, Chrysler Group LLC, Phase I and Limited Phase II Due Diligence Investigation, New York, NY
- 37-14 36th Street, Field Investigations Silver Star-Mercedes Benz, Long Island City, NY
- Otto Pehle Park, Bergen County Health Department, Groundwater Sampling and Ecological Surveys, Paramus, NJ
- Bay Park Brownfield Redevelopment, Installation of Sub-Slab Depressurization System, Coney Island, Brooklyn, NY
- PQ Corporation, Oversight of Remedial Action Field Activities, Rahway, NJ
- Post-Graduate Center for Mental Health (304 Echo Place), Phase I and Limited Phase II Due Diligence Investigation, Bronx, NY
- Air Quality Monitoring, Sweeny & Conroy, Inc., New York, NY
- Former Auto Dealership, Chrysler Group LLC, Phase I and Limited Phase II Due Diligence Investigation, New York, NY
- New York Life Investment Management, Phase II Environmental Site Assessment, Jessup, MD
- 366 Broadway, Former Brunswick Hospital Campus, 25,000-Gallon UST Removal, Amityville, NY

KIMBERLY NAGOTKO

SENIOR STAFF GEOLOGIST

ENVIRONMENTAL ENGINEERING

Ms. Nagotko is an environmental geologist with experience in New York City. Her responsibilities include environmental and construction oversight, data and daily field report management, waste characterizations, and remedial subsurface investigations involving soil, groundwater, and soil vapor sampling.

SELECTED PROJECTS

- West 17th Street Development, Soil Boring Sampling, New York, NY
- Hudson Yards Redevelopment Tower D, environmental oversight, vapor barrier inspections, data and Daily Field Report Management, New York, NY
- Hudson Yards Redevelopment, Platform - special inspections, environmental oversight, platform special inspections, data and daily field report management, New York, NY
- 520 West 41st Street, environmental oversight, New York, NY
- International Leadership Bronx Charter School, environmental oversight, Bronx, NY
- Residential Tower (West 52nd Street), environmental oversight, truck manifestation, and reporting, New York, NY
- Greenpoint Landing, figure and table compilation, and reporting, Brooklyn, NY
- 60 West Street, soil boring, groundwater, and soil vapor sampling, vacuum test, reporting, New York, NY
- 86 Fleet Place, environmental oversight, soil sampling, truck manifestation, Brooklyn, NY
- 295 Locust Avenue, environmental oversight, Bronx, NY
- 38-01 Queens Boulevard, soil vapor, ambient air, and groundwater sampling, Long Island City, NY
- 615 10th Avenue, soil and groundwater drum manifestation, New York, NY
- 2413 3rd Avenue, soil boring, groundwater, and soil vapor sampling, Bronx, NY
- 55 Bank Street Development, environmental oversight, truck manifestation, White Plains, NY,
- 357-359 West Street & 156 Leroy Street, groundwater sampling, New York, NY
- Riverside Center Parcel 1, 3 & 4, environmental oversight, New York, NY
- Brooklyn Cultural District Apartments (aka BCD:A), environmental oversight, truck manifestation, Brooklyn, NY
- 29-37 41st Avenue, groundwater and soil vapor sampling, Long Island City, NY
- 2350 Lafayette Ave, soil vapor sampling, Bronx, NY
- Expansion of OEM Headquarters, soil drum sampling, Brooklyn, NY
- 86 Warren Street, soil boring and groundwater sampling, New York, NY

EDUCATION

B.S., Environmental Geology
Bucknell University

PROFESSIONAL REGISTRATION

10-Hour OSHA

40-Hour HAZWOPER

AFFILIATIONS

Geological Society of America-Northeastern Division

- 20 Water Grant Street – Palisades Point, Yonkers, NY, Environmental Oversight, Soil and Groundwater Sampling, Data and Daily Field Report Management

SELECTED PUBLICATIONS, REPORTS, AND PRESENTATIONS

Depositional Age Constraints and Detrital Zircon Age Populations Within the Paleoproterozoic Manzono Group, Central new Mexico What is the Provenance of "Yavapi" Age (CA 1.70-1.78) Detritus in the Manatzal Crustal Province (With D. Christopher, J. Jones and A. Luther) Geological Society of America Abstracts

ATTACHMENT C

ANALYTICAL METHODS/
QUALITY ASSURANCE SUMMARY TABLE

ATTACHMENT C

ANALYTICAL METHODS/QUALITY ASSURANCE SUMMARY TABLE

Matrix Type	Field Parameters	Laboratory Parameters	Analytical Methods	Sample Preservation	Sample Container Volume and Type	Sample Hold Time	Field Duplicate Samples	Field Blank Samples	Trip Blank Samples	Ambient Air Samples	MS/MSD Samples
Soil	Total VOCs via PID	Part 375 + TCL VOCs	EPA 8260C	Cool to 4°C	Two 40-ml VOC vials with 5ml H_2O, one with MeOH or 3 En Core Samplers (separate container for % solids)	14 days if froze to -7 C° or extruded into methanol (vials); 48 hours otherwise (En Cores)	1 per 20 samples (minimum 1)	1 per 20 samples (minimum 1)	1 per Shipment of VOC samples	NA	1 per 20 samples
		Part 375 + TCL SVOCs	EPA 8270D	Cool to 4°C	4 oz. amber glass jar	14 days extract, 40 days after extraction to analysis			NA		
		Part 375 + TAL Metals	EPA 6010D, EPA 7471B, EPA 7196A	Cool to 4°C	2 oz. amber glass jar	6 months, except mercury 28 days					
		Hexavalent Chromium	EPA 7196A	Cool to 4°C	4 oz. amber glass jar	30 days					
		Cyanide	EPA 9010C/9012B	Cool to 4°C	8 oz. amber glass jar	14 days					
		Part 375 + TCL Pesticides	EPA 8081B	Cool to 4°C	4 oz. amber glass jar	14 days extract, 40 days after extraction to analysis					
		Part 375 + TCL Herbicides	EPA 8151A	Cool to 4°C	8 oz. amber glass jar	14 days					
		Part 375 + TCL PCBs	EPA 8082A	Cool to 4°C	4 oz. amber glass jar	14 days extract, 40 days after extraction to analysis					
Groundwater	Temperature, Turbidity, pH, ORP, Conductivity	Part 375 + TCL VOCs	EPA 8260C	Cool to 4°C; HCl to pH <2; no headspace	Three 40-mL VOC vials with Teflon®-lined cap	Analyze within 14 days of collection	1 per 20 samples (minimum 1)	1 per 20 samples (minimum 1)	1 per Shipment of VOC samples	NA	1 per 20 samples
		Part 375 + TCL SVOCs	EPA 8270D and 8270D with SIM	Cool to 4°C	Two 1-Liter Amber Glass	7 days to extract; 40 days after extraction to analysis			NA		
		1,4-Dioxane as SVOC	EPA 8270D With SIM	Cool to 4°C	Two 1-Liter Amber Glass	7 days to extract; 40 days after extraction to analysis					
		Part 375 + TAL Metals	EPA 6020B, 7470A	Cool to 4°C; HNO_3 to pH <2	250 mL plastic	6 months, except Mercury 28 days					
		Hexavalent Chromium	EPA 7196A	Cool to 4°C	250 mL plastic	24 Hours					
		Cyanide	EPA 9010CB/9012B	NaOH plus 0.6g ascorbic acid	250 mL plastic	14 days					
		Part 375 + TCL Pesticides	EPA 8081B	Cool to 4°C	Two 1-Liter Amber Glass	7 days to extract; 40 days after extraction to analysis					
		Part 375 + TCL Herbicides	EPA 8151A	Cool to 4°C	Two 1-Liter Amber Glass	7 days to extract; 40 days after extraction to analysis					
		PCBs	EPA 8082A	Cool to 4°C	Two 1-Liter Amber Glass	7 days to extract; 40 days after extraction to analysis					
		PFAS	EPA 537M	Cool to 4°C; Trizma	Three 250-mL HDPE or polypropylene container	14 days to extract; 28 days after extraction to analysis					
Soil Vapor	Total VOCs, Oxygen, LEL, CO, and H_2S, with MultiGas Meter	TO-15 Listed VOCs	EPA TO-15	Ambient Temperature	2.7-Liter or 6-Liter Summa Canister	Analyze within 30 days of collection	NA	NA	NA	1 per 10 samples (minimum 1)	NA
Ambient Air	Total VOCs via PID									NA	

Notes:
1. PID - Photoionization Detector
2. VOC - Volatile organic compound
3. EPA - Environmental Protection Agency
4. TCL - Target compound list
5. TAL - Target analyte list
6. ORP - Oxidation reduction potential
7. DO - Dissolved oxygen
8. LEL - Lower explosive limit
9. CO -Carbon monoxide
10. H_2S - Hydrogen sulfide
11. NA - Not applicable

ATTACHMENT D

SAMPLE NOMENCLATURE STANDARD OPERATING PROCEDURE

LANGAN

SOP #01 – Sample Nomenclature

INTRODUCTION

The Langan Environmental Group conducts an assortment of site investigations where samples (Vapor, Solids, and Aqueous) are collected and submitted to analytical laboratories for analysis. The results of which are then evaluated and entered into a data base allowing quick submittal to the state regulatory authority (New York State Division of Environmental Conservation [NYSDEC]). In addition, Langan is linking their data management system to graphic and analytical software to enable efficient evaluation of the data as well as creating client-ready presentational material.

SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) is applicable to the general framework for labeling vapor, solid (soil) and aqueous (groundwater) samples that will be submitted for laboratory analysis. The nomenclature being introduced is designed to meet the NYSDEC EQuIS standard and has been incorporated into Langan software scripts to assist project personnel in processing the data. While this SOP is applicable to all site investigation; unanticipated conditions may arise which may require considerable flexibility in complying with this SOP. Therefore, guidance provided in this SOP is presented in terms of general steps and strategies that should be applied; but deviation from this SOP must be reported to the Project Manager (PM) immediately.

GENERAL SAMPLE IDENTIFICATION CONSIDERATIONS

Sample Labels

All sample ware must have a label. Recall that when you are using the Encore™ samples (see below); they are delivered in plastic lined foil bags. You are to label the bags[1]:

All other samples containers including Terra Cores™ must be labeled with laboratory provided self-adhesive labels.

Quick Breakdown of Sample Format

The general format for sample nomenclature is:

[1]Both Alpha and York laboratories permit the combining of the three Encore™ into a single bag. This may not be appropriate for all laboratories so please confirm with the labs themselves

LLNN_ID

Where

LL is a grouping of two (2) to four (4) letters signifying the sample media source. In older nomenclature SOPs this portion of the sample identification is commonly referred to as the *Sample Investigation Code*

NN represents a two digit number identifying the specific sample location or sample sequence number

_ ***(underscore)*** is required between the sample lettering and numeric identification and additional modifying data that determines the date of sampling or the depth of the sample interval

ID is a modifier specific to the sample type media (depth of soil sample or date of groundwater sample)

LL – Sample Investigation Code

Langan has devised a list of two to four letters to insure a quick ability to identify the sample investigation.

Code	Investigation
AA	Ambient Air
DS	Drum
EPB	Endpoint Location - Bottom (Excavation)
EPSW	Endpoint Location - Sidewall (Excavation)
FP	Free Product
IA	Indoor Air
IDW	Investigation Derived Waste (Soil Pile)
MW	Monitoring Well (Permanent)
SB	Soil Boring
SG	Staff Gauge (Stream Gauging)
SL	Sludge
SV	Soil Vapor Point
SVE	Soil Vapor Extraction Well
SW	Surface Water
TMW	Temporary Monitoring Well
TP	Test Pit (Excavated Material from Test Pit Not Associated With Sidewall or Bottom Samples)
WC	Waste Characterization Boring
COMP	Composite Sample
TB	Trip Blank (QA/QC Sampling – All Investigations)
FB	Field Blank (QA/QC Sampling – All Investigations)
DUP	Duplicate (QA/QC Sampling – All Investigations)

NN – Numeric Identifier

The two digit number that follows the sample investigation code (LL) identifies the specific sample based on the soil boring, monitoring well, endpoint or other location identification. For a subset of samples where there is no specific location identifier, the two digit number is the sequence number for the sample submitted. For example, an aqueous sample from a monitoring well identified as MW-1 would have the sample investigation code of MW and the numeric identifier as 01. Note there is no hyphen. The same can be done for soil borings, a soil sample collected from soil boring 9 (SB-9) would be have the LLNN identification of SB09 (again, no hyphen).

Note however that there is a subset of samples related to laboratory analytical quality assurance, among these includes TB, FB, and DUP. On many investigations, the Scope will require multiple collections of these types of samples, therefore the numerical number represents the sequence sample count where the first sample is 01, the second sample is 02, and the third sample is 03 and so on.

_ Underscore
The underscore is required. It separates the investigation code and numeric identifier from the modifier specific to the sample itself. Note that every effort should be made to insure that the underscore is clear on the sample label and chain of custody (COC).

ID – Modifier Specific to Type Media
Each sample investigation code and numeric identifier is further modified by an ID specific to the sample type media. In general, soil samples (soil borings or endpoint samples) use an ID that indicates the depth at which the sample was taken. Aqueous samples (groundwater or surface water samples) are identified by the date the sample was collected. Other types of samples including quality control (TB, FB, and DUP), Vapor samples (AA, IA, SV or SVE), other soil type samples (IDW, sludge, free product, drum, and others) are also identified by a date. The following rules apply to the ID when using sample depth or sample date.

Sample Depth
The sample depth must be whole numbers (no fractions) separated by a hyphen. Thus for a soil sample collected from the soil boring SB-1 from a depth of 6 feet to 8 feet, the sample would be identified as:

SB01_6-8

Unfortunately, the NYSDEC EQuIS system does not accept fractions. Therefore, if your sample interval is a fraction of a foot (6.5-7.5), round up to the larger interval (6-8).

Sample Date
The sample date is always in the format of MMDDYY. Note that the year is two digits. Thus for a groundwater sample collected on July 1, 2015 from the monitoring well MW-1, the sample would be identified as:

MW01_070115

Special Cases
There are a couple of specific sample types that require further explanation.

Endpoint Sampling
End point sidewall samples are sometimes modified by magnetic direction (N, S, E, and W). For example, the first sidewall endpoint sample from the north wall of an excavation at a depth of 5 feet would be written as:

EPSW01_N_5

Again, note that the N in the identification refers to north and is separated from the prefix investigation code/numeric identifier and ID modifier suffix by underscores.

Vapor Extraction Well Sample
As with the sidewall endpoint samples, the sample name is altered by inserting a middle modifier between the prefix and suffix of the sample name. The middle modifier is used to identify the source of the sample (inlet sample port, midpoint sample port or outlet sample port). For example the midpoint port of the vapor extraction well number 1 sampled on July 1, 2015 would be written as;

SVE01_MID_070115

Matrix Spike and Matrix Spike Duplicate
On occasion, a Langan investigation will collect a sample to be used to provide the lab with a site specific medium to spike to determine the quality of the analytical method. This special case of sampling requires additional information to be used in the sample name, specifically, a suffix specifying whether the sample is the matrix spike (MS) or the matrix spike duplicate (MSD). In the following example, the sample is collected from soil boring number 1 at a depth of 2-4 feet. For the matrix spike sample:

SB01_2-4_MS

and for the matrix spike duplicate sample:

SB01_2-4_MSD

Multiple Interval Groundwater Sampling
Although not currently a common practice, low flow sampling facilitates stratigraphic sampling of a monitoring well. If the scope requires stratigraphic sampling then groundwater samples will be labeled with a lower case letter following the well number. For example, placing the pump or sampling tube at 10 feet below surface in MW01 on July 1, 2015 would require the sample to be labeled as:

MW01a_070115

While a second sample where the pump or tubing intake is placed at 20 feet would be labeled as:

MW01b_070115

Note that it is important that you record what depth the intake for each sample represents in your field notes; as this information is going to be critical to interpreting the results.

ATTACHMENT E

PFAS SAMPLING PROTOCOL

EPA 537 Field Sampling Guidelines

Sampling for PFAAs via EPA 537 can be challenging due to the prevalence of these compounds in consumer products. The following guidelines are strongly recommended when conducting sampling.

Reference-NHDES https://www.des.nh.gov/organization/divisions/waste/hwrb/documents/pfc-stakeholder-notification-20161122.pdf

Field Clothing and PPE

- No clothing or boots containing Gore-TexTM
- All safety boots made from polyurethane and PVC
- No materials containing Tyvek®
- Do not use fabric softener on clothing to be worn in field
- Do not used cosmetics, moisturizers, hand cream, or other related products the morning of sampling
- Do not use unauthorized sunscreen or insect repellant (see reference above for acceptable products)

Sample Containers

- All sample containers made of HDPE or polypropylene
- Caps are unlined and made of HDPE or polypropylene

Wet Weather (as applicable)

Wet weather gear made of polyurethane and PVC only

Equipment Decontamination

- “PFC-free” water on-site for decontamination of sample equipment. No other water sources to be used.
- Only Alconox and Liquinox can be used as decontamination materials

Food Considerations

- No food or drink on-site with exception of bottled water and/or hydration drinks (i.e., Gatorade and Powerade) that is available for consumption only in the staging area

Other Recommendations

Sample for PFCs first! Other containers for other methods may have PFCs present on their sampling containers

Field Equipment

- Must not contain Teflon® (aka PTFE) or LDPE materials
- All sampling materials must be made from stainless steel, HDPE, acetate, silicon, or polypropylene
- No waterproof field books can be used
- No plastic clipboards, binders, or spiral hard cover notebooks can be used
- No adhesives (i.e.Post-It Notes) can be used
- Sharpies and permanent markers not allowed; regular ball point pens are acceptable
- Aluminum foil must not be used
- Keep PFC samples in separate cooler, away from sampling containers that may contain PFCs
- Coolers filled with regular ice only. Do not use chemical (blue) ice packs.

EPA Method 537 (PFAS) Sampling Instructions

Please read instructions entirely prior to sampling event.

*Sampler must wash hands before wearing nitrile gloves in order to limit contamination during sampling.

Each sample set* requires a set of containers to comply with the method as indicated below.
*sample set is composed of samples collected from the same sample site and at the same time.

Container Count	Container Type	Preservative
3 Sampling Containers - Empty	250 mL container	Pre preserved with 1.25 g Trizma
Reagent Water for Field Blank use	250 mL container	Pre preserved with 1.25 g Trizma
1 Field Blank (FRB) Container - Empty	250 mL container	Unpreserved

**** Sampling container <u>must be filled to the neck</u>. For instructional purposes a black line has been drawn to illustrate the required fill level for each of the 3 Sample containers****

Field blanks are recommended and the containers have been provided, please follow the instructions below.

Field Blank Instructions:

1. Locate the Reagent Water container from the bottle order. The Reagent Water container will be prefilled with PFAS-free water and is preserved with Trizma.
2. Locate the empty container labeled “Field Blank”.
3. Open both containers and proceed to transfer contents of the “Reagent Water” container into the “Field Blank” container.
4. If field blanks are to be analyzed, they need to be noted on COC, and will be billed accordingly as a sample.

Both the <u>empty</u> Reagent Water container and the <u>filled</u> Field Blank container must be returned to the laboratory along with the samples taken.

Sampling Instructions:

1. Each sampling event requires 3 containers to be filled to the neck of the provided containers for each sampling location.
2. Before sampling, remove faucet aerator, run water for 5 min, slow water to flow of pencil to avoid splashing and fill sample containers to neck of container (as previously illustrated) and invert 5 times.
3. Do not overfill or rinse the container.
4. Close containers securely. Place containers in sealed ZipLoc bags, and in a separate cooler (no other container types).
5. Ensure Chain-of-Custody and all labels on containers contain required information.Place sample, Field Blank and empty Reagent Blank containers in ice filled cooler (do not use blue ice) and return to the laboratory. Samples should be kept at 4°C ±2. Samples must not exceed 10°C during first 48 hours after collection. Hold time is 14 days.

Please contact your project manager with additional questions or concerns.

Collection of Groundwater Samples for Perfluorooctanoic Acid (PFOA) and Perfluorinated Compounds (PFCs) from Monitoring Wells Sample Protocol

Samples collected using this protocol are intended to be analyzed for perfluorooctanoic acid (PFOA) and other perfluorinated compounds by Modified (Low Level) Test Method 537.

The procedure used must be consistent with the NYSDEC March 1991 Sampling Guidelines and Protocols http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf with the following materials limitations.

At this time acceptable materials for sampling include: stainless steel, high density polyethylene (HDPE), PVC, silicone, acetate and polypropylene. Equipment blanks should be generated at least daily. Additional materials may be acceptable if pre-approved by NYSDEC. Requests to use alternate equipment should include clean equipment blanks. **NOTE: Grunfos pumps and bladder pumps are known to contain PFC materials (e.g. Teflon™ washers for Grunfos pumps and LDPE bladders for bladder pumps).** <u>All sampling equipment components and sample containers should not come in contact with aluminum foil, low density polyethylene (LDPE), glass or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.</u> Standard two step decontamination using detergent and clean water rinse will be performed for equipment that does come in contact with PFC materials. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFC materials must be avoided. Many food and drink packaging materials and "plumbers thread seal tape" contain PFCs.

All clothing worn by sampling personnel must have been laundered multiple times. The sampler must wear nitrile gloves while filling and sealing the sample bottles.

Pre-cleaned sample bottles with closures, coolers, ice, sample labels and a chain of custody form will be provided by the laboratory.

1. Fill two pre-cleaned 500 mL HDPE or polypropylene bottle with the sample.
2. Cap the bottles with an acceptable cap and liner closure system.
3. Label the sample bottles.
4. Fill out the chain of custody.
5. Place in a cooler maintained at 4 ± 2º Celsius.

Collect one equipment blank for every sample batch, not to exceed 20 samples.

Collect one field duplicate for every sample batch, not to exceed 20 samples.

Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, not to exceed 20 samples.

Request appropriate data deliverable (Category A or B) and an electronic data deliverable.

Groundwater Sampling for Emerging Contaminants

April 2018

Issue: NYSDEC has committed to analyzing representative groundwater samples at remediation sites for emerging contaminants (1,4-dioxane and PFAS) as described in the below guidance.

Implementation

NYSDEC project managers will be contacting site owners to schedule sampling for these chemicals. Only groundwater sampling is required. The number of samples required will be similar to the number of samples where “full TAL/TCL sampling” would typically be required in a remedial investigation. If sampling is not feasible (e.g., the site no longer has any monitoring wells in place), sampling may be waived on a site-specific basis after first considering potential sources of these chemicals and whether there are water supplies nearby.

Upon a new site being brought into any program (i.e., SSF, BCP), PFAS and 1,4-dioxane will be incorporated into the investigation of groundwater as part of the standard “full TAL/TCL” sampling. Until an SCO is established for PFAS, soil samples do not need to be analyzed for PFAS unless groundwater contamination is detected. Separate guidance will be developed to address sites where emerging contaminants are found in the groundwater. The analysis currently performed for SVOCs in soil is adequate for evaluation of 1,4-dioxane, which already has an established SCO.

Analysis and Reporting

Labs should provide a full category B deliverable, and a DUSR should be prepared by a data validator, and the electronic data submission should meet the requirements provided at: https://www.dec.ny.gov/chemical/62440.html ,

The work plan should explicitly describe analysis and reporting requirements.

PFAS sample analysis: Currently, ELAP does not offer certification for PFAS compounds in matrices other than finished drinking water. However, laboratories analyzing environmental samples (ex. soil, sediments, and groundwater) are required, by DER, to hold ELAP certification for PFOA and PFOS in drinking water by EPA Method 537 or ISO 25101.

Modified EPA Method 537 is the preferred method to use for groundwater samples due to the ability to achieve 2 ng/L (ppt) detection limits. If contract labs or work plans submitted by responsible parties indicate that they are not able to achieve similar reporting limits, the project manager should discuss this with a DER chemist. Note: Reporting limits for PFOA and PFOS should not exceed 2 ng/L.

PFAS sample reporting: DER has developed a PFAS target analyte list (below) with the intent of achieving reporting consistency between labs for commonly reportable analytes. It is expected that reported results for PFAS will include, at a minimum, all the compounds listed. This list may be updated in the future as new information is learned and as labs develop new capabilities. If lab and/or matrix specific issues are encountered for any particular compounds, the NYSDEC project manager will make case-by-case decisions as to whether particular analytes may be temporarily or permanently discontinued from analysis for each site. Any technical lab issues should be brought to the attention of a NYSDEC chemist.

Some sampling using this full PFAS target analyte list is needed to understand the nature of contamination. It may also be critical to differentiate PFAS compounds associated with a site from other sources of these chemicals. Like routine refinements to parameter lists based on investigative findings, the full PFAS target analyte list may not be needed for all sampling intended to define the extent of contamination. Project managers may approve a shorter analyte list (e.g., just the UCMR3 list) for some reporting on a case by case basis.

1,4-Dioxane Analysis and Reporting: The method detection limit (MDL) for 1,4-dioxane should be no higher than 0.28 µg/l (ppb). ELAP offers certification for both EPA Methods 8260 and 8270. In order to get the appropriate detection limits, the lab would need to run either of these methods in "selective ion monitoring" (SIM) mode. DER is advising the use of method 8270, since this method provides a more robust extraction procedure, uses a larger sample volume, and is less vulnerable to interference from chlorinated solvents (we acknowledge that 8260 has been shown to have a higher recovery in some studies).

Full PFAS Target Analyte List

Group	Chemical Name	Abbreviation	CAS Number
Perfluoroalkyl sulfonates	**Perfluorobutanesulfonic acid**	**PFBS**	**375-73-5**
	Perfluorohexanesulfonic acid	**PFHxS**	**355-46-4**
	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
	Perfluorooctanessulfonic acid	**PFOS**	**1763-23-1**
	Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluoroalkyl carboxylates	Perfluorobutanoic acid	PFBA	375-22-4
	Perfluoropentanoic acid	PFPeA	2706-90-3
	Perfluorohexanoic acid	PFHxA	307-24-4
	Perfluoroheptanoic acid	**PFHpA**	**375-85-9**
	Perfluorooctanoic acid	**PFOA**	**335-67-1**
	Perfluorononanoic acid	**PFNA**	**375-95-1**
	Perfluorodecanoic acid	PFDA	335-76-2
	Perfluoroundecanoic acid	PFUA/PFUdA	2058-94-8
	Perfluorododecanoic acid	PFDoA	307-55-1
	Perfluorotridecanoic acid	PFTriA/PFTrDA	72629-94-8
	Perfluorotetradecanoic acid	PFTA/PFTeDA	376-06-7
Fluorinated Telomer Sulfonates	6:2 Fluorotelomer sulfonate	6:2 FTS	27619-97-2
	8:2 Fluorotelomer sulfonate	8:2 FTS	39108-34-4
Perfluorooctane-sulfonamides	Perfluroroctanesulfonamide	FOSA	754-91-6
Perfluorooctane-sulfonamidoacetic acids	N-methyl perfluorooctanesulfonamidoacetic acid	N-MeFOSAA	2355-31-9
	N-ethyl perfluorooctanesulfonamidoacetic acid	N-EtFOSAA	2991-50-6

Bold entries depict the 6 original UCMR3 chemicals

Collection of Groundwater Samples for Perfluorooctanoic Acid (PFOA) and Perfluorinated Compounds (PFCs) from Monitoring Wells Sample Protocol

Samples collected using this protocol are intended to be analyzed for perfluorooctanoic acid (PFOA) and other perfluorinated compounds by Modified (Low Level) Test Method 537.

The sampling procedure used must be consistent with the NYSDEC March 1991 SAMPLING GUIDELINES AND PROTOCOLS
http://www.dec.ny.gov/regulations/2636.html with the following materials limitations.

At this time acceptable materials for sampling include: stainless steel, high density polyethylene (HDPE) and polypropylene. Additional materials may be acceptable if proven not to contain PFCs. **NOTE: Grunfos pumps and bladder pumps are known to contain PFC materials (e.g. Teflon™ washers for Grunfos pumps and LDPE bladders for bladder pumps).** All sampling equipment components and sample containers should not come in contact with aluminum foil, low density polyethylene (LDPE), glass or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer. Standard two step decontamination using detergent and clean water rinse should be considered for equipment that does come in contact with PFC materials. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFC materials must be avoided. Many food and drink packaging materials and "plumbers thread seal tape" contain PFCs.

All clothing worn by sampling personnel must have been laundered multiple times. The sampler must wear nitrile gloves while filling and sealing the sample bottles.

Pre-cleaned sample bottles with closures, coolers, ice, sample labels and a chain of custody form will be provided by the laboratory.

1. Fill two pre-cleaned 500 mL HDPE or polypropylene bottle with the sample.
2. Cap the bottles with an acceptable cap and liner closure system.
3. Label the sample bottles.
4. Fill out the chain of custody.
5. Place in a cooler maintained at 4 ± 2º Celsius.

Collect one equipment blank for every sample batch, not to exceed 20 samples.

Collect one field duplicate for every sample batch, not to exceed 20 samples.

Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, not to exceed 20 samples.

Request appropriate data deliverable (Category A or B) and an electronic data deliverable.

APPENDIX E

PROJECT PERSONNEL RESUMES

JASON J. HAYES, PE, LEED AP

PRINCIPAL/VICE PRESIDENT

ENVIRONMENTAL ENGINEERING

Mr. Hayes has experience in New York, New Jersey, Washington D.C., California, Washington, Oregon, Alaska, and Internationally. His experience includes Environmental Protection Agency (EPA), New York State (NYS) Brownfields applications, investigation, and remediation; New York City Department of Environmental Protection (NYCDEP) and New York City Office of Environmental Remediation (OER) E-designated site applications, investigations, and remediation. His expertise also includes Phase I and II Environmental Site Investigations and Assessments; contaminated building cleanup and demolition; Underground Storage Tank (UST) permitting, removal specifications, and closure reporting; soil vapor intrusion investigation and mitigation system design (depressurization systems, etc.); development of groundwater contaminant plume migration models; environmental analysis; and oversight, design and specification generation for remediation operations with contaminants of concern to include polychlorinated biphenyls (PCBs), solvents, mercury, arsenic, petroleum products, asbestos, mold and lead.

SELECTED PROJECTS

- Confidential Location (Remediation for Mercury-Contaminated Site), New York, NY
- Confidential Location (Phase II ESI and Remedial Design for Mercury Impacted Site), Brooklyn, NY
- NYC School Construction Authority (PCB Remediation), Various Locations, New York, NY
- 28-29 High Line (Phase I ESA, Phase II ESI, and Environmental Remediation), New York, NY
- Georgetown Heating Plant (Phase II ESI and Remedial Design for Mercury Impacted Site), Washington D.C.
- 268 West Street (BCP Application, RI and RIWP), New York, NY
- Confidential Multiple Mixed-Use Tower Location (BCP Application, RI, Phase I ESA, and Phase II ESI), New York, NY
- Dock 72 at Brooklyn Navy Yard, (NYS Voluntary Cleanup Program), Brooklyn, NY
- 27-21 44th Drive (BCP Application, Remedial Investigation Phase I ESA, and Phase II ESI), Long Island City, NY
- Purves Street Development, BCP Application, RAWP, and Phase II ESI, Long Island City, NY
- 267-273 West 87th Street (BCP Application, Remedial Investigation, RIWP, RAWP), New York, NY
- New York Aquarium, Shark Tank and Animal Care Facility (Environmental Remediation), Coney Island, NY
- International Leadership Charter School (Environmental Remediation), Bronx, NY
- West & Watts (BCP Application), New York, NY
- Hudson Yards Redevelopment (Phase I ESA and Phase II ESI), New York, NY

EDUCATION

M.S., Environmental Engineering Columbia University

B.S., Chemistry, Environmental Toxicology Humboldt State University

Business Administration (minor) Humboldt State University

PROFESSIONAL REGISTRATION

Professional Engineer (PE) in NY

LEED Accredited Professional (LEED AP)

Troxler Certification for Nuclear Densometer Training

CPR and First Aid Certification

OSHA 40-Hour HAZWOPER

OSHA HAZWOPER Site Supervisor

AFFILIATIONS

US Green Building Council, NYC Chapter (USGBC), Communications Committee

LANGAN

- 627 Smith Street (RI and Report), Brooklyn, NY
- Gateway Center II Retail (Phase I ESA and Phase II ESI), Brooklyn, NY
- 261 Hudson Street (Phase I ESA, Phase II ESI, BCP, and RAWP), New York, NY
- Riverside Center, Building 2 (BCP, Phase I ESA and Phase II ESI), New York, NY
- New York Police Academy, (Sub-Slab Depressurization and Vapor Barrier System), College Point, NY
- Bronx Terminal Market (BCP, RIWP, RAWP, Phase I ESA and Phase II ESI), Bronx, NY
- Jacob Javits Convention Center (Phase I ESA and Phase II ESI), New York, NY
- Yankee Stadium Development Waterfront Park (NYSDEC Spill Sites), Bronx, NY
- Bushwick Inlet Park (Phase I ESA, Approvals for NYC E-Designation), Brooklyn, NY
- Silvercup West (BCP, RIWP, RIR, RAWP, and RAA), Long Island City, NY
- 29 Flatbush, Tall Residential Building (Groundwater Studies, RIR and RAWP), Brooklyn, NY
- Gowanus Village I (BCP, RIWP and RIR), Brooklyn, NY
- Sullivan Street Hotel (Site Characterization Study and Owner Representation), New York, NY
- Riker's Island Co-Generation Plant (Soil and Soil Vapor Quality Investigations), Bronx, NY
- The Shops at Atlas Park (Sub-Slab Depressurization and Vapor Barrier Design), Glendale, NY
- Memorial Sloan-Kettering Cancer Center (Subsurface and Soil Vapor Intrusion Investigations), New York, NY
- Element West 59th Street (Oversight and Monitoring of Sub-Slab Depressurization and Vapor Barrier Systems), New York, NY
- Teterboro Airport (Delineation and Remedial Oversight of Petroleum-Contaminated Soils), Teterboro, NJ
- Proposed New York JETS Stadium (Phase I ESA), New York, NY
- Former Con Edison Manufactured Gas Plant Sites (Research Reports), New York, NY
- 7 World Trade Center (Endpoint Sampling and Final Closure Report), New York, NY
- Peter Cooper Village, Environmental Subsurface Investigations, New York, NY

SELECTED PUBLICATIONS, REPORTS, AND PRESENTATIONS

NYC Mayor's Office of Environmental Remediation – Big Apple Brownfield Workshop – Presented on Soil Vapor Intrusion Remedies (e.g., SSD Systems, Vapor Barriers, Modified HVAC)

New York City Brownfield Partnership – Presented on environmental considerations and complications of the Hudson Yards Development

Urban Land Institute (ULI), member

Commercial Real Estate Development Associations (NAIOP), member

NYC Brownfield Partnership, member

Waterfront Development Technical Course – Presented on Impacted Waterfront Planning Considerations

MICHAEL D. BURKE, PG, CHMM, LEED AP

PRINCIPAL/VICE PRESIDENT

ENVIRONMENTAL ENGINEERING AND REMEDIATION

Mr. Burke is a geologist/environmental scientist whose practice involves site investigation and remediation, transactional due diligence, environmental site assessments, in-situ remedial technology, and manufactured gas plant (MGP) site characterization and remediation. His additional services include multi-media compliance audits, sub-slab depressurization system design, non-hazardous and hazardous waste management, emergency response, community air monitoring programs, environmental and geotechnical site investigations, and health and safety monitoring. He has experience with projects in the New York State Department of Environmental Conservation (NYSDEC) and New York State Brownfield Cleanup (NYS BCP) Programs; Inactive Hazardous Waste, and Spill Programs, and New York City Office of Environmental Remediation (OER) e-designated and New York City Voluntary Cleanup Program (NYC VCP) sites.

SELECTED PROJECTS

- 227-14 North Conduit Avenue, Industrial Wastewater Compliance, Jamaica, NY
- 420 Kent Avenue, NYS Brownfield Cleanup Program, Brooklyn, NY
- 572 Eleventh Avenue, NYC VCP, New York, NY
- Monian Site A, OER E-Designated Site, New York, NY
- 537 Sackett Street, Gowanus Canal Due Diligence/MGP Site, Brooklyn, NY
- ABC Blocks 25, 26 and 27, NYS Brownfield Cleanup Program Sites, Long Island City, NY
- 432 Rodney Street, NYS Brownfield Cleanup Program, Petroleum and Chlorinated Volatile Organic Compound Investigation and Remediation, Brooklyn, NY
- 787 Eleventh Avenue, NYS Brownfield Cleanup Program Site, New York, NY
- President Street at Gowanus Canal, NYS Brownfield Cleanup Program Site, Brooklyn, NY
- 22-36 Second Avenue at Gowanus Canal, NYS Brownfield Cleanup Program Site, Brooklyn, NY
- 563 Sacket Street, NYS Brownfield Cleanup Program Site, MGP Investigation, and Remediation, Brooklyn, NY
- 156-162 Perry Street, NYS Brownfield Cleanup Program Site, New York, NY
- Christopher and Weehawken Streets, NYS Brownfield Cleanup Program, New York, NY
- Phelps Dodge Block 2529 (Lots 40, 50, and 45), Inactive Hazardous Waste Disposal Site, Maspeth NY
- 42-50 24th Street, NYS Brownfield Cleanup Program Site, Long Island City, NY
- Storage Deluxe (163 6th Street), OER E-Designation Site, New York, NY

EDUCATION

M.S., Environmental Geology
Rutgers University

B.S., Geological Sciences
Rutgers University

B.S., Environmental Science
Rutgers University

PROFESSIONAL REGISTRATION

Professional Geologist (PG) in NY

Certified Hazardous Materials Manager – CHMM No. 15998

LEED Accredited Professional (LEED AP)

OSHA Certification for Hazardous Waste Site Supervisor

OSHA 29 CFR 1910.120 Certification for Hazardous Waste Operations and Emergency Response

NJDEP Certification for Community Noise Enforcement

Troxler Certification for Nuclear Densometer Training

LANGAN

- Prospect Park Redevelopment, Landfill Reclamation, Prospect Park, NJ
- 431 Carroll Street, Gowanus Canal Due Diligence, Brooklyn, NY
- 76 4th Street Property, Gowanus Due Diligence, Brooklyn, NY
- Foxgate/MREC, Due Diligence and Solid Waste Compliance, Central Islip, NY
- 175-225 3rd Street at Gowanus Canal, NYS Brownfield Cleanup Program, Brooklyn, NY
- New York University Tandon School of Engineering, Spill Investigation/Remediation Dual Phase Recovery, and Laser Fluorescence Investigation, Brooklyn, NY
- 2420-2430 Amsterdam Avenue, NYS Brownfield Cleanup Program/Board of Standards and Appeals Variance, New York, NY
- 170 Amsterdam Avenue, NYC VCP, New York, NY
- 538-540 Hudson Street, NYS Brownfield Cleanup Program (Former Gas Station), New York, NY
- 234 Butler Street, Gowanus Canal Due Diligence, Brooklyn, NY
- 550 Clinton Street, NYS Brownfield Cleanup Program E-Designation, Brooklyn, NY
- 111 Leroy Street, OER E-Designation Site, New York, NY
- 335 Bond Street, NYS Brownfield Cleanup Program, New York, NY
- Gowanus Canal Northside, NYS BCP Former Fuel Oil Terminal, Brooklyn, NY
- Multiple Buildings, Major Oil Storage Facility, Gowanus Canal Location, Brooklyn, NY
- 197-205 Smith Street at Gowanus Canal, MGP Due Diligence, Brooklyn, NY
- 450 Union Street at Gowanus Canal, NYS Brownfield Cleanup Program, Brooklyn, NY
- 86 Fleet Place, NYC VCP E-Designation, Brooklyn, NY
- New York University College of Nursing at 433 1st Avenue, NYS BCP, Bronx, NY
- Retail Building at 225 3rd Street, Brooklyn, NY
- 29-37 41st Avenue, NYS Brownfield Cleanup Program, Long Island City, NY
- 43-01 22nd Street, NYS Brownfield Cleanup Program, Long Island City, NY
- Compliance Audit for NYU at Washington Square Park, New York, NY
- Former Watermark Locations, NYS Brownfield Cleanup Program, Chlorinated Volatile Organic Compound Investigation and Remediation; AS/SVE, Brooklyn, NY
- Former Gas Station (1525 Bedford Avenue), Brooklyn, NY
- NYS Brownfield Cleanup Program at 514 West 24th Street, New York, NY
- Gowanus Canal Due Diligence at 76 4th Street, Brooklyn, NY
- Urban Health Plan, Medical Building, NYS Brownfield Cleanup Program CVOC Investigation and Remediation, Bronx, NY
- 420 East 54th Street, NYS Spill Closure, New York, NY
- Equity Residential at 160 Riverside Boulevard, NYS Spill Closure, New York, NY
- 357-359 West Street and 156 Leroy Street, NYC VCP, New York, NY
- Emergency Spill Response at 322 West 57th Street, Investigation and Closure, New York, NY

- Hurricane Sandy, Emergency Response at 21 West Street, New York, NY
- Hurricane Sandy, Emergency Response at 71 Pine Street, New York, NY
- Greenpoint Landing, NYC E-Designation, Brooklyn, NY
- 23-01 42nd Road, NYS Brownfield Cleanup Program, Long Island City, NY
- Greenpoint Waterfront Development, NYS Brownfield Cleanup Program, Brooklyn, NY
- 125th Street and Lenox Avenue, NYC VCP, New York, NY
- Whitehead Realty Solvent Site, Inactive Hazardous Waste site, CVOC
  Investigation and Remediation, Brooklyn, NY
- SunCap Property Group Environmental On-Call Consulting, Various Locations, Nationwide
- Consolidated Edison Company of New York, Underground Storage Tank On-Call Contract, Five Boroughs of New York City, NY
- Consolidated Edison Company of New York, Appendix B Spill Sites On-Call Contract, Five Boroughs of New York City, NY
- Meeker Avenue Plume Trackdown Site, Brooklyn, NY
- Distribution Facility, Superfund Redevelopment, Long Island City, NY
- Edison Properties, West 17th Street Development Site (Former MGP Site), New York, NY
- Con Edison on Governors Island, Dielectric Fluid Spill, Investigation and Remediation, New York, NY
- 144-150 Barrow Street, NYS Brownfield Cleanup Program, New York, NY
- West 17th Street Development, NYS Brownfield Cleanup Program, MGP Investigation and Remediation, New York, NY
- Montefiore Medical Center, Emergency Response, PCB Remediation, Bronx, NY
- New York University, 4 Washington Square Village Fuel Oil Remediation, New York, NY
- NYCSCA, Proposed New York City School Construction Sites, Five Boroughs of New York City, NY
- Con Edison, East 60th Street Generating Station, New York, NY
- Residential Building at 82 Irving Place, Environmental Remediation, New York, NY
- 1113 York Avenue, Storage Tank Closures, New York, NY
- Peter Cooper Village/Stuyvesant Town, Phase I ESA, New York, NY
- Superior Ink, Waste Characterization and Remedial Action Plans, New York, NY
- Bronx Mental Health Redevelopment Project, Phase I ESA, Bronx, NY
- 2950 Atlantic Avenue, Site Characterization Investigation, Brooklyn, NY
- Con Edison, East 74th Street Generating Station, Sediment Investigation, New York, NY
- Con Edison, First Avenue Properties, New York, NY
- Queens West Development Corp. Stage II, Long Island City, NY
- Article X Project Environmental Reviews, Various New York State Electrical Generation Sites, NY
- Poletti Generating Station, Astoria, NY
- Arthur Kill Generating Station, Staten Island, NY

- Distribution Facility, Phase I & Phase II ESA and Regulatory Compliance, Bohemia, NY
- Huntington Station Superfund Due Diligence, Huntington Station, NY
- Garvies Point Bulkhead, Glen Cove, NY
- Johnson & Hoffman Metal Stamping Facility, Environmental Compliance, Carle Place, NY
- Floral Park Storage Facility, Phase I and Phase II ESA
- Garden City Phase I ESAs at two sites, including part of a Superfund Site, Garden City, NY
- Huntington Station Storage Facility, Phase I and II ESA, Huntington Station, NY

Anthony Moffa, Jr., ASP, CHMM, COSS

Associate/Corporate Health and Safety Manager

Anthony is Langan's Corporate Health & Safety Manager and is responsible for managing health and safety compliance in all Langan office locations. He has over 15 years experience in the health and safety field. He is responsible for ensuring compliance with all federal and state occupational health and safety laws and development and implementation of corporate health and safety policies. Responsibilities include reviewing and updating Langan's Corporate Health and Safety Program and assisting employees in the development of site specific Health & Safety Plans. He maintains and manages health and safety records for employees in all Langan office locations including medical evaluations, respirator fit testing, and Hazardous Waste Operations and Emergency Response training. He is also responsible for documentation and investigation of work-related injuries and incidents and sharing this information with employees to assist in the prevention of future incidents. He is also the chairman of the Corporate Health & Safety Committee and Health & Safety Leadership Team that meet periodically throughout the year. He is responsible for coordinating and providing health and safe training to Langan employees. He was formerly the Environmental, Health and Safety Coordinator at a chemical manufacturer. His experience included employee hazard communications, development of material safety data sheets for developed products, respirator fit testing and conducting required Occupational Health & Safety Association and Department of Transportation training.

Education

B.S., Physics
West Chester University

Professional Registration

Associate Safety Professional (ASP)

Certified Hazardous Material Manager (CHMM)

Certified Occupational Safety Specialist (COSS)

Affiliations

Pennsylvania Chamber of Business & Industry

Chemical Council of New Jersey

New Jersey Business & Industry Association

Geoprofessional Business Association

Certifications and Training

Hazardous Waste Operations and Emergency Response Training

OSHA Site Supervisor Training

10 & 30-Hour Construction Safety & Health Training

30-Hour Construction Safety & Health Training

10-Hour Industry Safety & Health Training

Confined Space Awareness & Entry

Competent Person in Excavations

Hazard Communications

Defensive Driving Training

LANGAN

JOSEPH GOOD, PE, LEED AP

SENIOR PROJECT MANAGER

ENVIRONMENTAL ENGINEERING

Mr. Good is an environmental engineer with experience working on both national and international projects. He has conducted environmental research on water treatment technology designed to remedy nutrient leaching from agricultural fields and to remove metals from urban stormwater. His consulting experience includes New York State Brownfield investigations and remediation, New York City Department of Environmental Protection (NYCDEP) E-designated site application, investigation, and remediations. Additional services include Phase I and II Environmental Site Assessments, remedial engineering and system design, Underground Storage Tank (UST) permitting, removal specifications, closure reporting, and soil vapor intrusion investigations. Mr. Good's field experience includes subsurface investigations, groundwater, soil, and air sampling programs, monitoring well installations, driller supervisions, subcontractor oversights, and waste characterizations.

Mr. Good was named one of the ENR's Top Young Professionals in 2019.

SELECTED PROJECTS

- Brooklyn Navy Yard Building 77, Commercial Building, Brooklyn, NY
- Brooklyn Navy Yard Dock 72, Brooklyn, NY
- Hudson Yards Redevelopment, New York, NY
- 50 Hudson Yards, Supertall Office Building, New York, NY
- 55 Hudson Yards, Tall Office Building New York, NY
- One Hudson Boulevard, Tall Office Building, New York, NY
- One Hudson Yards, Tall Office Building, New York, NY
- SUNY Downstate Advanced Learning Center, Brooklyn, NY
- 504-530 East 14th Street, Mixed-Use Residential Buildings, New York, NY
- 19 West 20th Street, Tall Residential Building, New York, NY
- New York Aquarium, Post-Superstorm Sandy Support, Coney Island, NY
- High Line 2829, Tall Mixed-Use Development, New York, NY
- Hunters Point Library, Hunters Point, NY
- 627-641 Smith Street, Commercial Redevelopment, Brooklyn, NY
- Silvercup West, Tall Residential and Film Studio Building, Long Island City, NY
- Bronx Terminal Market, Power Retail Center, Bronx, NY
- Bronx Terminal Market, Waterfront Park Development, Bronx, NY
- Bushwick Inlet Park, Brooklyn, NY
- Abraham Joshua Heschel School, New York, NY
- The Shops at Atlas Park, Lifestyle Retail Center, Glendale, NY
- Metlife Stadium, East Rutherford, NJ

EDUCATION

M.E., Civil and Natural Resource Engineering
University of Canterbury

B.S., Civil Engineering
University of Illinois

PROFESSIONAL REGISTRATION

Professional Engineer (PE) in NY, IL

LEED Accredited Professional (LEED AP)

40-Hour HAZWOPER

10-Hour OSHA

AFFILIATIONS

American Chemical Society (ACS)

United States Green Building Council (USGBC)

American Society of Civil Engineers (ASCE)

LANGAN

SELECTED PUBLICATIONS, REPORTS, AND PRESENTATIONS

Good, J.F., Hayes, J., Zeng, L., and Abrams, S. (2015). "Bioremediation via Soil Mixing to Address Chlorinated Ethenes and Ethanes at a Brownfield Site with High Organic and Metal Soils." Battelle- Third International Symposium on Bioremediation and Sustainable Environmental Technologies, Miami, Florida, May 18-21, 2015.

Good, J.F., O'Sullivan, A.D., Wicke, D., and Cochrane, T.A, (2013). "pH Buffering in Stormwater Infiltration Systems – Sustainable Contaminant Removal with Waste Mussel Shells." DOI: 10.1007/s11270-014-1885-1

Good, J.F., O'Sullivan, A.D., Wicke, D., and Cochrane, T.A, (2012). "Contaminant Removal and Hydraulic Conductivity of Laboratory Rain Garden Systems for Stormwater Treatment. Water Science and Technology." DOI: 10.2166/wst.2012.135. 65(12):2154-2161

Good, J.F. (2011) "Water Quality Treatment and Hydraulic Efficacy of Rain Gardens. Civil and Natural Resources Engineering," University of Canterbury, Christchurch, New Zealand. Master of Engineering in Civil Engineering.

Good, J.F., O'Sullivan, A.D., Wicke, D., and Cochrane, T.A, (2011). "Appreciating Drainage Assets in New Zealand Cities: Rain Garden Treatment and Hydraulic Performance." International Water Association- Cities of the Future Conference, 22-25 May 2011, Stockholm, Sweden.

WILLIAM BOHRER, PG

PROJECT GEOLOGIST

GEOLOGIST

Mr. Bohrer is an experienced geologist responsible for managing Langan's environmental standards and Health and Safety compliance for projects throughout New York City. His services include dissemination of environmental protocols, troubleshooting at project sites, in-house/field training, and maintenance of quality standards across the environmental discipline. Mr. Bohrer has a diverse and extensive background in geophysics, hydrogeology, mining and petroleum, and geotechnical engineering. He has developed conceptual site models for public, industrial and commercial facilities nationwide.

SELECTED PROJECTS

- NYU Poly – 122 Johnson Street, Brooklyn, NY
- Con Edison of New York at Governor's Island, NY, NY
- 535 4th Avenue, Brooklyn, NY
- 27 Wooster Street, New York, NY
- 42 West Street, Brooklyn, NY
- 455 West 19th Street, New York, NY
- Kings Plaza Mall, Brooklyn, NY
- Hudson Yards "Terra Firma", New York, NY
- Hudson Yards, Platform Special Inspection, New York, NY
- PSAC II, Bronx, NY
- 595-647 Smith Street, Brooklyn, NY
- New York University, 7-13 Washington Square North Investigation, New York, NY
- NYU 4 Washington Square Village, New York, NY
- 125th Street and Lenox Avenue, New York, NY
- Sullivan Street Development, New York, NY
- Hudson Crossing II, New York, NY
- New York Aquarium, Shark Tank & Animal Care Facility, Brooklyn, NY
- 209-219 Sullivan Street, New York, NY
- 261 Hudson Street, New York, NY
- 460 Washington Street, New York, NY
- 552 West 24th Street, New York, NY
- Brooklyn Bridge Park Pier 1, New York, NY
- International Leadership Bronx Charter School, Bronx, NY
- 203 East 92nd Street, New York, NY
- HighLine 28-29, New York, NY
- 539 Smith Street Bulkhead, Brooklyn, NY
- Willets Point, Corona, NY
- Plume Migration and Fracture Flow Aquifer Investigation, Brunswick, MD
- Plume Migration and Fracture Flow Aquifer Investigation, Fallston, MD
- Emergency Response Site Investigation & Remediation, Wappingers Falls, NY
- Emergency Response Site Investigation & Remediation, Allentown, PA

EDUCATION

Post Graduate Studies in Geophysics
Cornell University

B.S., Geology
Tufts University

PROFESSIONAL REGISTRATION

Professional Geologist (PG) in NY

40 Hour OSHA HazWOPER

OSHA Construction Safety & Health

OSHA Supervisory Certification
Credential (TWIC)

Transportation Worker Identification

NYS DEC- Protecting New York's Natural Resources with Better Construction Site Management

AFFILIATIONS

American Association of Petroleum Geologists

National Groundwater Association

Geological Society of America

LANGAN

- Emergency Response Site Investigation & Remediation, Shamokin, PA
- Bermuda International Airport, Jet Fuel Release Investigation, Bermuda
- Little Missouri River Basin, Geotechnical Site Evaluation (Horizontal Drilling Pipeline Install), ND
- Seismic Susceptibility Evaluation (Class 2 Injection Wells), Litchfield, OH
- Bedrock Mapping, Bradford and Sullivan Counties, PA
- Soil Solidification, Carteret, NJ

PA Council of Professional Geologists

Emily G. Strake

Project Chemist/ Risk Assessor
Environmental Engineering

17 years in the industry ~ 5 years with Langan

Ms. Strake has 17 years of environmental chemistry, risk assessment, auditing, and quality assurance experience. Most recently, she has focused her efforts on human health risk assessment, and has been the primary author or key contributor of risk assessment reports and screening evaluations for projects governed under RCRA, CERCLA, NJDEP, DNREC, SWRCB, DTSC, PADEP, CTDEEP, ODEQ, NYSDEC and MDE. She has experience in site-specific strategy development, which has enabled her to perform assessments to focus areas of investigation and identify risk-based alternatives for reducing remediation costs. Ms. Strake is a member of the Interstate Technology and Regulatory Council Risk Assessment Team responsible for the development and review of organizational risk assessment guidance documents and serves as a National Trainer in risk assessment for the organization.

Ms. Strake has extensive experience in environmental data validation, focused on ensuring laboratory deliverables follow specific guidelines as described by regulatory agencies and the analytical methods employed. In addition, she has experience in EQuIS chemical database management. She also has a broad range of environmental field experience and maintains current OSHA HAZWOPER certification. Ms. Strake is experienced in auditing laboratory and field-sampling activities for compliance with Quality Assurance Project Plans (QAPPs), the National Environmental Laboratory Accreditation Conference Standards Quality Systems manual, and applicable USEPA Guidance. Ms. Strake has also audited on-site laboratories in support of groundwater treatment operations and implemented corrective actions. Her responsibilities include writing reports on the value of laboratory work, writing/editing QAPPs for clients and project-specific sites, peer reviewing colleague’s work, and mentoring staff within the office. She has also served as the Quality Assurance officer for several long-term projects, responsible for the achievement of all forms of Quality Control/Quality Assurance by onsite personnel relating to sampling, analysis, and data evaluation.

Selected Project Experience

Major League Soccer’s San Jose Earthquakes Stadium, Santa Clara, CA
DuPont, Waynesboro, VA
PECO/Exelon, Various Locations
Texas Instruments, San Francisco, CA
Regency, Philadelphia, PA
Veteran’s Affairs, Palo Alto, CA
DOW Chemical, Various Locations
Avon, Rye, NY
Golden Gate National Parks Conservancy, San Francisco, CA
Sunoco Refineries, Various Locations
Honeywell, Highland Park, NJ
Delaware City Refinery, DE

Education

MBA
The University of Scranton

B.S., Chemistry
Cedar Crest College

Professional Licenses

Board Certified Environmental Professional (CEP)

Training

40 hr. OSHA HAZWOPER Training/Nov 2002

8 hr. HAZWOPER Supervisor/June 2004

8 hr. OSHA HAZWOPER Refresher/2013

Affiliations

The Society for Risk Analysis

Interstate Technology and Regulatory Council

Occidental Chemical, Bakersfield, CA
Floreffe Terminal, Pittsburgh, PA
Ryder, Hartford, CT
Rohm and Haas, Philadelphia, PA

EMILY L. SNEAD, PG

PROJECT SCIENTIST

ENVIRONMENTAL ENGINEERING

Ms. Snead brings field experience and technical expertise to environmental investigations and remediation projects. She has independently performed Phase I and Phase II assessments and investigations, UST removals and closures, remedial excavations, vapor extractions, and ISCO injections. She excels at project research, environmental sampling, remedial oversight, proposal and report preparation. Her projects have included hospital centers, day care facilities, residential buildings, chemical plants, and commercial/industrial sites throughout New York City and the Tri-State area. Prior to her career in Environmental Consulting, Ms. Snead conducted research with NASA and performed construction oversight management in the Cayman Islands.

SELECTED PROJECTS

- Silvercup West, Brownfield Cleanup Site, Long Island City, NY
- Highline 28-29 Development, PCE-Contaminated Soil Delineation and Implementation of Bioaugmentation Remediation, New York, NY
- 295 Locust Avenue, Soil Excavation/Trucking, Monitoring Well Decommissioning, Groundwater Sampling and SMP inspections, Bronx, NY
- Hotel Trades Union (620 Fulton Street), Hazardous Lead Soil removal, UST closure and Soil Management Report Brooklyn, NY
- 743 Fifth Avenue, Soil Management Report, New York, NY
- Suncap Facility, UST Investigations and Test Pit Explorations, Yonkers, NY
- New York University (383 Lafayette Street), Hazardous Lead Soil Removal and UST Closure New York, NY
- 601 Washington Street, Remedial Excavation, Groundwater ISCO Treatment, and Installation of an Active SMD System, New York, NY
- NYC OER E-Designated site (50 Hudson Yards/2 Hudson Boulevard), Remedial Investigation, Remedial Excavation Oversight, and Closure Reporting, New York, NY
- Riverside Center Parcel 1, VCP Site Remedial Excavation, UST Closure, Spill Investigation and Closure, and Reporting, New York, NY
- Riverside Center Parcels 3 and 4, VCP Site Remedial Excavation, UST Closure, New York, NY
- Bronx Terminal Market, Triennial SMP Reporting and Annual Inspections, Bronx, NY
- 616 First Avenue, VCP Program Includes Remedial Excavation Oversight, SMP Annual Inspections, Reporting, New York, NY
- Luxury Car Dealership (787 Eleventh Avenue), Spill Investigation and UST Closure, New York, NY
- 335 Bold Street, Phase II and BCP Application, Brooklyn, NY
- President Street Properties, Phase II Investigation and BCP Application, Brooklyn, NY
- 38-01 Queens Boulevard Due Diligence, Long Island City, NY

EDUCATION

B.S., Environmental Science & Geology
Northeastern University

PROFESSIONAL REGISTRATION

Professional Geologist (PG) in NY

40-Hour OSHA HAZWOPER

8-Hour OSHA HAZWOPER Refresher

10-Hour OSHA Construction Safety Training

DOT Hazardous Materials Shipping Training

First Aid/ CPR Training

AFFILIATIONS

NAIOP New York City Chapter, member

Urban Land Institute (ULI), Member

- 250 Water Street, Phase II Investigation, New York, NY
- 139 East 56th Street, Joint Geotechnical and Environmental Waste Characterization, New York, NY
- Le Soleil d'Or Boutique Hotel, Cayman Brac, Cayman Islands
- Columbia University Medical Center, Phase I and II Environmental Site Investigation Nursing School, New York, NY
- Consolidated Edison of NY, Remedial Investigation and RIR Investigation, New York, NY
- 11-09 Borden Avenue, MTA Bridges and Tunnels/Borden Avenue ISCO Remediation, Disposal of Petroleum-Impacted Soil, Long Island City, NY
- Columbia University Medical Center, Removal of a 1,000-gal UST and Closure Report, New York, NY
- Children's Aid Society (910 East 172nd Street), Oversight of the VEFR and Collection of Groundwater Samples New York, NY
- New York City Housing Authority, Community Air Monitoring Program and Environmental Oversight, Bronx, NY
- YRC Freight Newtown Creek EPA RFI, Brooklyn, NY
- 522-532 West 29th Street Redevelopment, Phase II Site Investigation and RAWP New York, NY
- Memorial Sloan-Kettering Cancer Center Ambulatory Surgery Building, Community Air Monitoring Program, New York, NY
- Keith Hilltop Terrace Apartments, Phase I and II Environmental Site Assessment, Altoona, PA
- Southern Boulevard Phase II ESA, Bronx, NY
- Former Auto Dealership, Remedial Investigation and Delineation of Polycyclic Aromatic Hydrocarbons (PAHs), Paramus, NJ
- 711 11th Avenue, Former Auto Dealership, Chrysler Group LLC, Phase I and Limited Phase II Due Diligence Investigation, New York, NY
- 37-14 36th Street, Field Investigations Silver Star-Mercedes Benz, Long Island City, NY
- Otto Pehle Park, Bergen County Health Department, Groundwater Sampling and Ecological Surveys, Paramus, NJ
- Bay Park Brownfield Redevelopment, Installation of Sub-Slab Depressurization System, Coney Island, Brooklyn, NY
- PQ Corporation, Oversight of Remedial Action Field Activities, Rahway, NJ
- Post-Graduate Center for Mental Health (304 Echo Place), Phase I and Limited Phase II Due Diligence Investigation, Bronx, NY
- Air Quality Monitoring, Sweeny & Conroy, Inc., New York, NY
- Former Auto Dealership, Chrysler Group LLC, Phase I and Limited Phase II Due Diligence Investigation, New York, NY
- New York Life Investment Management, Phase II Environmental Site Assessment, Jessup, MD
- 366 Broadway, Former Brunswick Hospital Campus, 25,000-Gallon UST Removal, Amityville, NY

KIMBERLY NAGOTKO

SENIOR STAFF GEOLOGIST

ENVIRONMENTAL ENGINEERING

Ms. Nagotko is an environmental geologist with experience in New York City. Her responsibilities include environmental and construction oversight, data and daily field report management, waste characterizations, and remedial subsurface investigations involving soil, groundwater, and soil vapor sampling.

SELECTED PROJECTS

- West 17th Street Development, Soil Boring Sampling, New York, NY
- Hudson Yards Redevelopment Tower D, environmental oversight, vapor barrier inspections, data and Daily Field Report Management, New York, NY
- Hudson Yards Redevelopment, Platform - special inspections, environmental oversight, platform special inspections, data and daily field report management, New York, NY
- 520 West 41st Street, environmental oversight, New York, NY
- International Leadership Bronx Charter School, environmental oversight, Bronx, NY
- Residential Tower (West 52nd Street), environmental oversight, truck manifestation, and reporting, New York, NY
- Greenpoint Landing, figure and table compilation, and reporting, Brooklyn, NY
- 60 West Street, soil boring, groundwater, and soil vapor sampling, vacuum test, reporting, New York, NY
- 86 Fleet Place, environmental oversight, soil sampling, truck manifestation, Brooklyn, NY
- 295 Locust Avenue, environmental oversight, Bronx, NY
- 38-01 Queens Boulevard, soil vapor, ambient air, and groundwater sampling, Long Island City, NY
- 615 10th Avenue, soil and groundwater drum manifestation, New York, NY
- 2413 3rd Avenue, soil boring, groundwater, and soil vapor sampling, Bronx, NY
- 55 Bank Street Development, environmental oversight, truck manifestation, White Plains, NY,
- 357-359 West Street & 156 Leroy Street, groundwater sampling, New York, NY
- Riverside Center Parcel 1, 3 & 4, environmental oversight, New York, NY
- Brooklyn Cultural District Apartments (aka BCD:A), environmental oversight, truck manifestation, Brooklyn, NY
- 29-37 41st Avenue, groundwater and soil vapor sampling, Long Island City, NY
- 2350 Lafayette Ave, soil vapor sampling, Bronx, NY
- Expansion of OEM Headquarters, soil drum sampling, Brooklyn, NY
- 86 Warren Street, soil boring and groundwater sampling, New York, NY

EDUCATION

B.S., Environmental Geology
Bucknell University

PROFESSIONAL REGISTRATION

10-Hour OSHA

40-Hour HAZWOPER

AFFILIATIONS

Geological Society of America-Northeastern Division

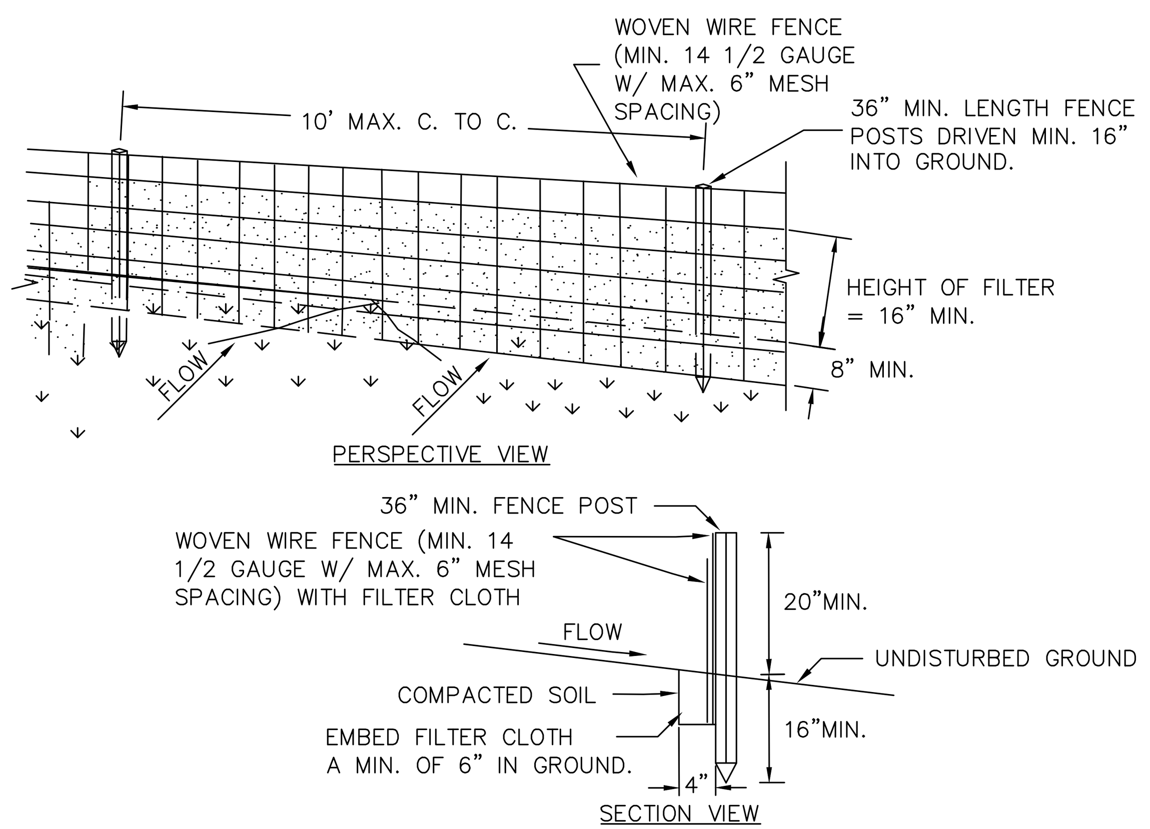
- 20 Water Grant Street – Palisades Point, Yonkers, NY, Environmental Oversight, Soil and Groundwater Sampling, Data and Daily Field Report Management

SELECTED PUBLICATIONS, REPORTS, AND PRESENTATIONS

Depositional Age Constraints and Detrital Zircon Age Populations Within the Paleoproterozoic Manzono Group, Central new Mexico What is the Provenance of "Yavapi" Age (CA 1.70-1.78) Detritus in the Manatzal Crustal Province (With D. Christopher, J. Jones and A. Luther) Geological Society of America Abstracts

APPENDIX F

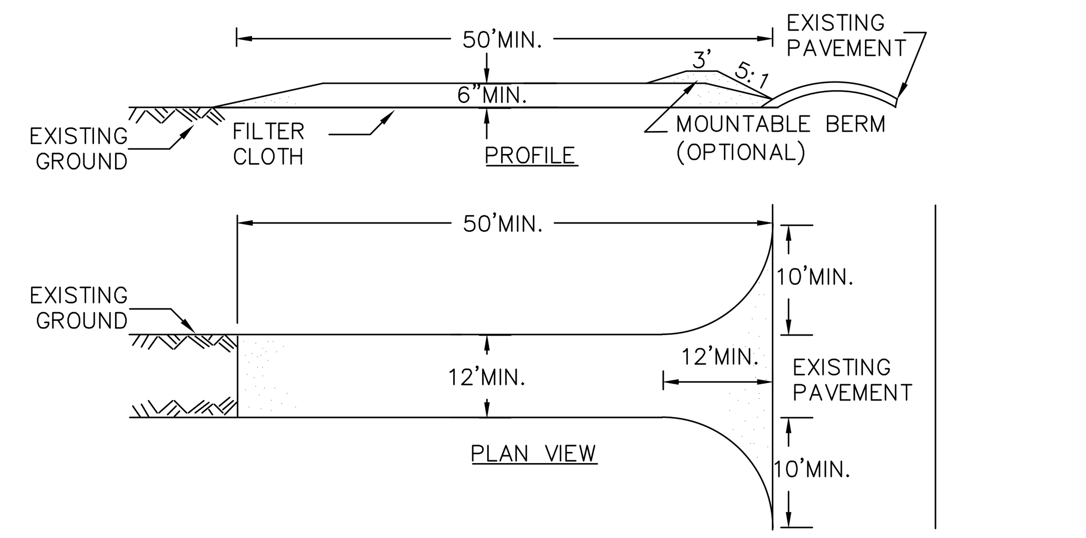
SOIL SEDIMENT AND EROSION PLAN



CONSTRUCTION SPECIFICATIONS

1. WOVEN WIRE FENCE TO BE FASTENED SECURELY TO FENCE POSTS WITH WIRE TIES OR STAPLES. POSTS SHALL BE STEEL EITHER "T" OR "U" TYPE OR HARDWOOD.
2. FILTER CLOTH TO BE TO BE FASTENED SECURELY TO WOVEN WIRE FENCE WITH TIES SPACED EVERY 24" AT TOP AND MID SECTION. FENCE SHALL BE WOVEN WIRE, 12 1/2 GAUGE, 6" MAXIMUM MESH OPENING.
3. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN EACH OTHER THEY SHALL BE OVER-LAPPED BY SIX INCHES AND FOLDED. FILTER CLOTH SHALL BE EITHER FILTER X, MIRAFI 100X, STABILENKA T140N, OR APPROVED EQUIVALENT.
4. PREFABRICATED UNITS SHALL BE MUTUAL MISF 1776 OR APPROVED EQUIVALENT.
5. MAINTENANCE SHALL BE PERFORMED AS NEEDED AND MATERIAL REMOVED WHEN "BULGES" DEVELOP IN THE SILT FENCE.

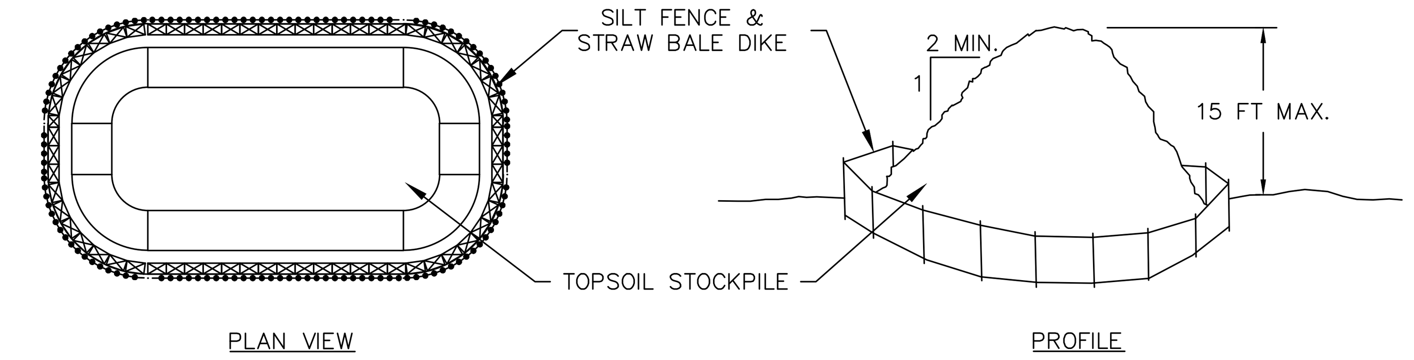
1 C-500 SILT FENCE
N.T.S.



CONSTRUCTION SPECIFICATIONS

1. STONE SIZE - USE 2" STONE, OR RECLAIMED OR RECYCLED CONCRETE EQUIVALENT.
2. LENGTH - NOT LESS THAN 50 FEET (EXCEPT ON A SINGLE RESIDENCE LOT WHERE A 30 FOOT MINIMUM LENGTH WOULD APPLY).
3. THICKNESS - NOT LESS THAN SIX (6) INCHES.
4. WIDTH - TWELVE (12) FOOT MINIMUM, BUT NOT LESS THAN THE FULL WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCURS. TWENTY-FOUR (24) FOOT IF SINGLE ENTRANCE TO SITE.
5. FILTER CLOTH - WILL BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING OF STONE.
6. SURFACE WATER - ALL SURFACE WATER FLOWING OR DIVERTED TOWARD CONSTRUCTION ENTRANCES SHALL BE PIPED ACROSS THE ENTRANCE. IF PIPING IS IMPRACTICAL, A MOUNTABLE BERM WITH 5:1 SLOPES WILL BE PERMITTED.
7. MAINTENANCE - THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS-OF-WAY, ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACTED ONTO PUBLIC RIGHTS-OF-WAY MUST BE REMOVED IMMEDIATELY.
8. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON A AREA STABILIZED WITH STONE AND WHICH DRAINS INTO AN APPROVED SEDIMENT TRAPPING DEVICE.
9. PERIODIC INSPECTION AND NEEDED MAINTENANCE SHALL BE PROVIDED AFTER EACHRAIN.

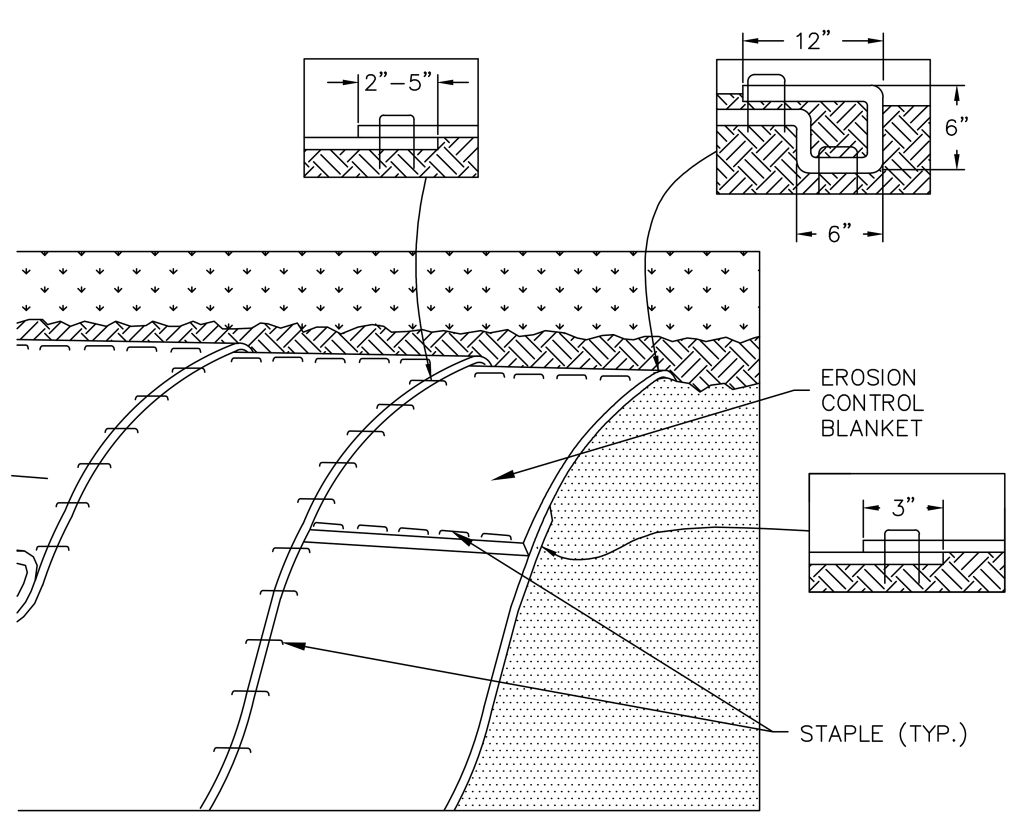
2 C-500 STABILIZED CONSTRUCTION ENTRANCE
N.T.S.



NOTES:

1. SOIL STOCKPILES SHALL BE SITUATED IN A DRY AREA ON TOP OF A LAYER OF PVC SHEETING (MINIMUM 10 MILS THICK) AS PER THE NYCDEP APPROVED REMEDIAL ACTION PLAN. ALL JOINTS IN THE UNDERLYING PVC SHEETING WILL OVERLAP WITH A MINIMUM OF 3-FT AT THE ENDS.
2. THE PVC SHEETING SHALL BE SECURED IN PLACE WITH TIE DOWNS AND/OR WEIGHTS SUCH AS SAND BAGS AT THE END OF EACH WORKDAY AND DURING ADVERSE WEATHER CONDITIONS.
3. SILT FENCE AND STRAW BALES MUST BE PLACED CONTINUOUSLY AROUND THE PERIMETER OF ALL STOCKPILES.
4. IMMEDIATELY APPLY TEMPORARY SEEDING TO ALL STOCKPILES WHICH WILL BE INACTIVE FOR 21 DAYS OR LONGER. IN LIEU OF SEEDING, STOCKPILES MAY BE COVERED WITH A SECURE TARP.
5. REFER TO SPECIFICATION.

3 C-500 TOPSOIL STOCKPILE
N.T.S.



4 C-500 EROSION CONTROL BLANKET INSTALLATION
N.T.S.

WARNING: IT IS A VIOLATION OF THE NYS EDUCATION LAW ARTICLE 145 FOR ANY PERSON, UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER THIS ITEM IN ANY WAY.

LANGAN
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New York, NY 10001
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Langan Engineering, Environmental, Surveying and Landscape Architecture, D.P.C. S.A.
Langan Engineering, Environmental, Surveying and Landscape Architecture, D.P.C.
Langan Engineering and Environmental Services, Inc.
Langan CT, Inc.
Langan International LLC
Collectively known as Langan

PROJECT

538-542 WEST 29TH STREET

BLOCK 700, LOTS 55, 56, & 57

NEW YORK NEW YORK

DRAWING TITLE

SOIL SEDIMENTATION & EROSION PLAN

Project No. 170515401	Drawing No.
Date 05/14/2019	1
Scale AS SHOWN	
Drawn By - / Checked By -	
Submission Date	Sheet 1 of 1

LANGAN
APRIL 20, 2018
170482201

Filename: \\langan.com\data\NY\data4\170515401\Project Data\CAD\01\2D-DesignFiles\SSE Plan\E&S Plan.dwg Date: 5/14/2019 Time: 12:21 User: canderson Style Table: Langan.stb Layout: DETAILS

APPENDIX G

CITIZEN PARTICIPATION PLAN

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

Brownfield Cleanup Program

Citizen Participation Plan
for
542 West 29th Street

June 2019

BCP Site No. C231136
538-542 West 29th Street
New York, New York 10001

Contents

* * * * *

Note: The information presented in this Citizen Participation Plan was current as of the date of its approval by the New York State Department of Environmental Conservation. Portions of this Citizen Participation Plan may be revised during the Site's investigation and cleanup process.

Applicant: **W29 Owner LLC ("Applicant")**
Site Name: **542 West 29th Street ("Site")**
Site Address: **538-542 West 29th Street, New York**
Site County: **New York**
Site Number: **C231136**

1. What is New York's Brownfield Cleanup Program?

New York's Brownfield Cleanup Program (BCP) works with private developers to encourage the voluntary cleanup of contaminated properties known as "brownfields" so that they can be reused and developed. These uses include recreation, housing, and business.

A *brownfield* is any real property that is difficult to reuse or redevelop because of the presence or potential presence of contamination. A brownfield typically is a former industrial or commercial property where operations may have resulted in environmental contamination. A brownfield can pose environmental, legal, and financial burdens on a community. If a brownfield is not addressed, it can reduce property values in the area and affect economic development of nearby properties.

The BCP is administered by the New York State Department of Environmental Conservation (NYSDEC) which oversees Applicants who conduct brownfield site investigation and cleanup activities. An Applicant is a person who has requested to participate in the BCP and has been accepted by NYSDEC. The BCP contains investigation and cleanup requirements, ensuring that cleanups protect public health and the environment. When NYSDEC certifies that these requirements have been met, the property can be reused or redeveloped for the intended use.

For more information about the BCP, go online at:
http://www.dec.ny.gov/chemical/8450.html.

2. Citizen Participation Activities

Why NYSDEC Involves the Public and Why It Is Important

NYSDEC involves the public to improve the process of investigating and cleaning up contaminated sites, and to enable citizens to participate more fully in decisions that affect their health, environment, and social well-being. NYSDEC provides opportunities for citizen involvement and encourages early two-way communication with citizens before decision makers form or adopt final positions.

Involving citizens affected and interested in site investigation and cleanup programs is important for many reasons. These include:

- Promoting the development of timely, effective site investigation and cleanup programs that protect public health and the environment
- Improving public access to, and understanding of, issues and information related to a particular site and that site's investigation and cleanup process
- Providing citizens with early and continuing opportunities to participate in NYSDEC's site investigation and cleanup process
- Ensuring that NYSDEC makes site investigation and cleanup decisions that benefit from input that reflects the interests and perspectives found within the affected community
- Encouraging dialogue to promote the exchange of information among the affected/interested public, State agencies, and other interested parties that strengthens trust among the parties, increases understanding of site and community issues and concerns, and improves decision making.

This Citizen Participation Plan (CPP) provides information about how NYSDEC will inform and involve the public during the investigation and cleanup of the Site identified above. The public information and involvement program will be carried out with assistance, as appropriate, from the Applicant.

Project Contacts

Appendix A identifies NYSDEC project contact(s) to whom the public should address questions or request information about the Site's investigation and cleanup program. The public's suggestions about this CPP and the citizens participation program for the site are always welcome. Interested people are encouraged to share their ideas and suggestions with the project contacts at any time.

Locations of Reports and Information

The locations of the reports and information related to the Site's investigation and cleanup program also are identified in Appendix A. These locations provide convenient access to important project documents for public review and comment. Some documents may be placed on the NYSDEC website. If this occurs, NYSDEC will inform the public in fact sheets distributed about the Site and by other means, as appropriate.

Site Contact List

Appendix B contains the Site contact list. This list has been developed to keep the community informed about, and involved in, the Site's investigation and cleanup process. The Site contact list will be used periodically to distribute fact sheets that provide updates about the status of the project. These will include notifications of upcoming activities at the site (such as fieldwork), as well as availability of project documents and announcements about public comment periods.

The Site contact list includes, at a minimum:

- Chief executive officer and planning board chairperson of each county, city, town and village in which the Site is located;
- Residents, owners, and occupants of the site and properties adjacent to the Site;
- The public water supplier which services the area in which the site is located;
- Any person who has requested to be placed on the Site contact list;
- The administrator of any school or day care facility located on or near the Site for purposes of posting and/or dissemination of information at the facility;
- Location(s) of reports and information.

The Site contact list will be reviewed periodically and updated as appropriate. Individuals and organizations will be added to the site contact list upon request. Such requests should be submitted to the NYSDEC project contact(s) identified in Appendix A. Other additions to the site contact list may be made at the discretion of the NYSDEC project manager, in consultation with other NYSDEC staff as appropriate.

Note: The first Site fact sheet (usually related to the draft Remedial Investigation Work Plan) is distributed both by paper mailing through the postal service and through DEC Delivers, its email listserv service. The fact sheet includes instructions for signing up with the appropriate county listserv to receive future notifications about the Site. See http://www.dec.ny.gov/chemical/61092.html .

Subsequent fact sheets about the Site will be distributed exclusively through the listserv, except for households without internet access that have indicated the need to continue to receive Site information in paper form. Please advise the NYSDEC Site project manager identified in Appendix A if that is the case. Paper mailings may continue during the investigation and cleanup process for some sites, based on public interest and need.

Citizen Participation Activities

The table at the end of this section identifies the citizen participation activities, at a minimum, that have been and will be conducted during the Site's investigation and cleanup program. The flowchart in Appendix D shows how these citizen participation activities integrate with the Site investigation and cleanup process. The public is informed about these citizen participation activities through fact sheets and notices distributed by the NYSDEC at significant points during the program. Elements of the investigation and cleanup process that match up with the citizen participation activities are explained briefly in Section 5.

- **Notices and fact sheets** help the interested and affected public to understand contamination issues related to a site, and the nature and progress of efforts to investigate and clean up a site.

- **Public forums, comment periods and contact with project managers** provide opportunities for the public to contribute information, opinions and perspectives that have potential to influence decisions about a site's investigation and cleanup.

The public is encouraged to contact project staff at any time during the Site's investigation and cleanup process with questions, comments, or requests for information.

This CPP may be revised due to changes in major issues of public concern identified in Section 3 or in the nature and scope of investigation and cleanup activities. Modifications may include additions to the Site contact list and changes in planned citizen participation activities.

Technical Assistance Grant

NYSDEC must determine if the Site poses a significant threat to public health or the environment. This determination generally is made using information developed during the investigation of the Site, as described in Section 5.

If the Site is determined to be a significant threat, a qualifying community group may apply for a Technical Assistance Grant (TAG). The purpose of a TAG is to provide funds to the qualifying group to obtain independent technical assistance. This assistance helps the TAG recipient to interpret and understand existing environmental information about the nature and extent of contamination related to the Site and the development/implementation of a remedy.

An eligible community group must certify that its membership represents the interests of the community affected by the Site, and that its members' health, economic well-being or enjoyment of the environment may be affected by a release or threatened release of contamination at the Site.

As of the date the declaration (page 2) was signed by the NYSDEC project manager, the significant threat determination for the Site had not yet been made.

To verify the significant threat status of the Site, the interested public may contact the NYSDEC project manager identified in Appendix A.

For more information about TAGs, go online at
http://www.dec.ny.gov/regulations/2590.html

Note: The table identifying the citizen participation activities related to the Site's investigation and cleanup program is shown on the next page:

Citizen Participation Activities	Timing of Citizen Participation Activity(ies)
Application Process:	
• Prepare Site contact list • Establish document repository(ies)	At time of preparation of application to participate in the BCP.
• Publish notice in Environmental Notice Bulletin (ENB) announcing receipt of application and 30-day public comment period • Publish above ENB content in local newspaper • Mail above ENB content to Site contact list • Conduct 30-day public comment period	When NYSDEC determines that BCP application is complete. The 30-day public comment period begins on date of publication of notice in ENB. End date of public comment period is as stated in ENB notice. Therefore, ENB notice, newspaper notice, and notice to the Site contact list should be provided to the public at the same time.
After Execution of Brownfield Site Cleanup Agreement (BCA):	
• Prepare Citizen Participation Plan	Before start of Remedial Investigation **Note:** Applicant must submit CPP to NYSDEC for review and approval within 20 days of the effective date of the BCA.
Before NYSDEC Approves Remedial Investigation Work Plan (RIWP):	
• Distribute fact sheet to Site contact list about proposed remedial investigation (RI) activities and announcing 30-day public comment period about draft RIWP • Conduct 30-day public comment period	Before NYSDEC approves RIWP. If RIWP is submitted with application, public comment periods will be combined and public notice will include fact sheet. Thirty-day public comment period begins/ends as per dates identified in fact sheet.
After Applicant Completes Remedial Investigation:	
• Distribute fact sheet to Site contact list that describes RI results	Before NYSDEC approves Remedial Investigation Report (RIR)
Before NYSDEC Approves Remedial Action Work Plan (RAWP):	
• Distribute fact sheet to Site contact list about draft RAWP and announcing 45-day public comment period • Public meeting by NYSDEC about proposed RAWP (if requested by affected community or at discretion of NYSDEC project manager) • Conduct 45-day public comment period	Before NYSDEC approves RAWP. Forty-five day public comment period begins/ends as per dates identified in fact sheet. Public meeting would be held within the 45-day public comment period.
Before Applicant Starts Cleanup Action:	
• Distribute fact sheet to Site contact list that describes upcoming cleanup action	Before the start of cleanup action.
After Applicant Completes Cleanup Action:	
• Distribute fact sheet to Site contact list that announces that cleanup action has been completed and that NYSDEC is reviewing the Final Engineering Report • Distribute fact sheet to Site contact list announcing NYSDEC approval of Final Engineering Report and issuance of Certificate of Completion (COC)	At the time the cleanup action has been completed. **Note:** The two fact sheets are combined when possible if there is not a delay in issuing the COC.

3. Major Issues of Public Concern

This section of the CPP identifies major issues of public concern that relate to the Site. Additional major issues of public concern may be identified during the course of the Site's investigation and cleanup process.

The Site is located in an Environmental Justice Area. Environmental justice is defined as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

Environmental justice efforts focus on improving the environment in communities, specifically minority and low-income communities, and addressing disproportionate adverse environmental impacts that may exist in those communities.

The following major issues of public concern were identified: air quality, health of workers, nuisance odors and noise, and construction-related traffic. These issues are of the most concern to adjacent property businesses and residents. Site contamination will be addressed by the Remedial Action Work Plan (RAWP) and community exposure concerns will be addressed by a Community Air Monitoring Program (CAMP) and site- specific Construction Health and Safety Plan (CHASP), each of which shall be approved by the NYSDEC prior to the respective phases of work.

The site was previously developed for commercial, residential and minor manufacturing uses including: a lumber yard (1930); auto repair facility (1924-2012); private garage (1950-1987); a light manufacturer (1970); and auto repair shop (1927-2005). Based on the analytical data generated during environmental investigations at the Subject Property in 2014, 2016 and 2018, there is documented soil, groundwater and soil vapor contamination at the site. Petroleum-related volatile organic compounds (VOC) and semivolatile organic compounds (SVOC) were detected in soil and groundwater concentrations exceeding regulatory criteria. Sub-slab and soil vapor analytical results identified petroleum and chlorinated solvent-related compounds beneath the existing building slabs. Contaminants are discussed in further detail in Section 4. The identified contaminants will be remediated to support the redevelopment of the Site for mixed residential/commercial use in accordance with a NYSDEC-approved RAWP.

Site information is available through the Project Contacts mentioned in Section 2 and detailed in Appendix A. The BCP Application, which includes the previous investigations at the Site, and future reports prepared for the NYSDEC will be available in the document repository discussed in Section 2 and detailed in Appendix A. The RAWP will include schedules for the planned work to make the CPP as consistent as possible with the NYSDEC Division of Environmental Remediation's (DER) Citizen Participation Handbook for Remedial Programs (DER-23). Public Affairs asks that the Handbook's "Scoping Sheet for Major Issues of Public Concern" be used by applicants/responsible parties to inform their completion of this section of the plan.

4. Site Information

Site Description

The site is located at 538-542 West 29th Street in the Chelsea neighborhood of New York, New York and is identified as Tax Block 700, Lots 55, 56 and 57 on the Manhattan Borough Tax Map. A site location map is provided in Appendix C. The site encompasses an area of about 9,900 square feet (0.227 acres) and is improved with one three-story commercial building (Lot 55), one three-story mixed-use commercial and residential building (Lot 56), and one two-story warehouse (Lot 57). All of the tenant spaces are vacant. The site is bounded by West 29th Street to the north, mixed-use residential and commercial buildings followed by the elevated High Line and Tenth Avenue to the east, a multi-story residential apartment building followed by West 28th Street to the south, and a multi-story mixed-use residential and commercial building followed by Eleventh Avenue to the west. The No. 7 subway southern extension runs north-south below Eleventh Avenue, which is about 200 feet to the west of the Subject Property. A Site Plan is provided in Appendix C.

History of Site Use, Investigation, and Cleanup

The site and surrounding area have been developed since the early 1800's. The site was developed prior to 1890 with two unspecified use buildings which were demolished between 1899 and 1922. Lot 57 was formerly used as a lumber storage yard (1909-1944) and various auto repair facilities over a span of about 50 years (1945-1994). In 1995, the Lot 57 was purchased by Gotham Seafood Corporation, a seafood wholesaler. Sanborn maps indicate that Lots 55 and 56 were improved with mixed use-residential and commercial developments from about 1890 to 2005. Certificates of Occupancy (CO) provided by the New York City Department of Buildings (NYCDOB) identified an auto repair shop within Lot 56 in 1924 and 2012. In addition, available CO's for Lot 55 dated 1970 and 1987 identified manufacturing and a heating plant with potential fuel storage. Currently, all of the lots are vacant.

Adjoining properties were historically used for residential, commercial, industrial and manufacturing operations.

Environmental investigations were completed prior to entry into the NYSDEC BCP and are summarized below:

<u>April 2, 2014 Phase I ESA, prepared by AEI Consultants</u>

The Phase I ESA was completed for 542 West 29th Street (Lot 57) in general accordance with American Society of Testing and Materials (ASTM) International Standard E1527-13 and the United States Environmental Protection (USEPA) All Appropriate Inquiries (AAI)

Rule. The following recognized environmental conditions (REC) were identified:

- Historic Site Use: The site historically operated as an auto repair facility for about 50 years (1945-1994) and was historically surrounded by auto repair facilities, commercial parking lots/garages and a former metal fabrication facility. Inadvertent releases of petroleum products, solvents, and/or other hazardous materials may have occurred associated with the historical use of the site, or may have migrated to the site from surrounding properties, and adversely impacted soil, groundwater and soil vapor.

- Documented Soil and Groundwater Impacts at the South-Adjoining Property: The Avalon West Chelsea residential development adjoins the site to the south, and subsurface contamination was reported in 2007. Elevated levels of petroleum-related compounds and chlorinated solvents were identified in soil and groundwater. The chlorinated solvents were identified on the eastern side of the Avalon West Chelsea property and determined to originate from up-gradient automotive repair operations or from an up-gradient former metal fabrication operation southeast of the site along West 28th Street. The sources of the petroleum contamination were not directly identified due to the presence of several active and historic auto repair facilities within and in the vicinity of the Avalon property.

  During the Avalon West Chelsea residential redevelopment, a test pit was excavated directly south of 542 West 29th Street (Lot 57). Strong petroleum-like odors were documented as far as 100 feet from the test pit. Subsurface sampling was conducted in January 2012 within the footprint of the Avalon West Chelsea residential development and included collection of soil samples, installation of temporary monitoring wells, and collection of groundwater samples. Petroleum contaminants were identified above NYSDEC standards in both soil and groundwater. The chlorinated solvent, cis-1,2-dichloroethene was identified in one groundwater sample above NYSDEC standards. Remediation via in situ chemical oxidation was conducted at the Avalon West Chelsea development in May 2013. Following treatment, soil samples were collected and all samples met soil cleanup objectives; however, groundwater impacts above the targeted guidelines were still identified.

- Closed Petroleum Spill at Vicinity Property: 524 West 29th Street, located about 260 feet southeast and up-gradient to the site, was listed as “Closed-Lack of Recent Info” in the New York Leaking Tanks and New York Spills databases. According to the regulatory database, a release was reported at this site on October 20, 2003 due to petroleum-contaminated soil and groundwater encountered when one 4,000-gallon and one 550-gallon gasoline underground storage tanks (UST) were removed from the property. Elevated levels of benzene, xylene, methyl tertiary-butyl ether (MTBE), and toluene were found in soil and groundwater samples collected from the UST footprints. Air Sparge/Soil Vapor Extraction (AS/SVE) remediation techniques were performed at the property from November to December 2011. Air samples were collected after four weeks and all targeted volatile organic compounds (VOC) were non-detect. Groundwater contaminant concentrations declined and the AS/SVE system reached asymptotic recovery rates. Additional remediation was not warranted or feasible. The spill case was closed on March 12, 2012. Based on the facility's close proximity to the site, residual contamination from the USTs may have impacted groundwater and soil vapor within Lot 57.

May 2014, Phase II ESA, prepared by P.W. Grosser

P.W. Grosser completed a Phase II ESA at 542 West 29th Street (Lot 57) in June 2014 to determine if subsurface soil, soil vapor and groundwater conditions at the property were impacted as a result of the findings from the April 2, 2008 Phase I ESA performed by AEI Consultants. The investigation included the advancement of five soil borings, collection of three groundwater samples from soil borings, installation and collection of three sub-slab soil vapor samples, and collection of three indoor and one outdoor air samples. Field observations and laboratory analytical results are summarized below:

- Soil: Five soil borings were advanced up to 8 feet bgs using a track-mounted GeoProbe© rig throughout the site. No evidence of petroleum impacts (e.g., staining, odors or photoionization detector [PID] readings above background) were observed during the soil boring investigation. Soil samples were analyzed for VOCs and compared to the NYSDEC Unrestricted Use (UU) Soil Cleanup Objectives (SCO). No VOCs were detected in soil samples collected with the exception of acetone. Acetone is a common laboratory reagent, and its presence in soil samples at the site is likely the result of laboratory contamination.

- Groundwater: Groundwater samples were analyzed for VOCs and analytical results were compared to the NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards and Guidance Values (SGV) for drinking water (Class GA). Two VOCs, benzene and MTBE (maximum concentrations of 1.4 micrograms per liter [µg/L] and 11 µg/L, respectively), were detected in groundwater from soil boring location SB-1 (Lot 57) at concentrations above the NYSDEC criteria. These contaminants are common gasoline constituents. Based on the lack of an on-site source, PW Grosser asserted that it appears the VOC contamination in groundwater is related to an off-site source.

- Soil Vapor: Sub-slab soil vapor and air samples were analyzed for VOCs and analytical results were compared to the Air Guideline Values (AGV) and Soil Vapor/Indoor Air Matrices specified in the New York State Department of Health (NYSDOH) Guidance for Evaluating Soil Vapor Intrusion in the State of New York, dated October 2006 and revised May 2017. Trichloroethene (TCE) was detected above AGVs at a concentration of 2.78 micrograms per cubic meter ($\mu g/m^3$) in sub-slab sample SS-3.

  NYSDOH provides decision matrices for eight chlorinated VOCs (carbon tetrachloride, 1,1-dichloroethene, cis-1,2-dichloroethene, TCE, methylene chloride, tetrachloroethene [PCE], 1,1,1-trichloroethane, and vinyl chloride). The decision matrices recommend a range of activities (e.g., monitor, mitigate) based on the sub-slab and indoor air sample results. Three of the eight VOCs that can be evaluated using the NYSDOH decision matrices were detected in sub-slab soil vapor samples (PCE, TCE, and 1,1,1-trichloroethane). Based on the concentrations reported PW Grosser concluded that no further action is recommended pursuant to the NYSDOH decision matrices.

June 2016, RIR, prepared by Hydro Tech

Hydro Tech performed a Remedial Investigation (RI) at 542 West 29th Street (Lot 57) to determine the nature and extent of contamination and to establish remedial action objectives. The investigation consisted of a site inspection, advancement of five soil borings, installation of three groundwater monitoring wells, installation of two soil vapor points and collection of ten soil, three groundwater, and two soil vapor samples and one indoor ambient air sample. Field observations and laboratory analytical results are summarized below:

- Stratigraphy: Historic fill was observed up to 12 feet bgs.
- Soil: Five soil borings were advanced up to 12 bgs using a track-mounted GeoProbe© rig. No evidence of petroleum impacts (e.g., staining, odors or PID readings above background) were observed during the soil boring investigation. Soil samples were analyzed for VOCs, semivolatile organic compounds (SVOC), polychlorinated biphenyl (PCB), pesticides, and metals and compared to the NYSDEC UU and Restricted Use Restricted-Residential (RURR) SCOs. PCBs and pesticides were not detected at concentrations exceeding SCOs. One VOC (acetone) and seven SVOCs (benzo[a]anthracene, benzo[k]fluoranthene, benzo[a]pyrene, benzo[b]fluoranthene, chrysene, dibenzo[a,h]anthracene, and

indeno[1,2,3-cd]pyrene) were detected above UU and RURR SCOs, respectively. Metals (arsenic, barium, cadmium, copper, lead, mercury, hexavalent chromium, zinc, selenium and nickel) were detected at concentrations above UU SCOs and lead, mercury, barium, copper, and cadmium were detected at concentration above RURR SCOs in both shallow and deep soil samples.

- Groundwater: Groundwater samples were analyzed for VOCs, SVOCs, PCBs, pesticides, and metals (total and dissolved) and analytical results were compared to the NYSDEC Title 6 New York City Rules and Regulation (6 NYCRR) Part 703.5 class GA Groundwater Quality Standards (GQS). Six SVOCs (benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, and indeno[1,2,3-cd]pyrene) and six dissolved metals (arsenic, magnesium, manganese, selenium, sodium, and thallium) were detected at concentrations greater than their respective GQSs. VOCs, PCBs and pesticides were not detected above GQSs.
- Soil Vapor: Soil vapor and air samples were analyzed for VOCs and analytical results were compared to the NYSDOH AGV and Soil Vapor/Indoor Air Matrices specified in the NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York, dated October 2006 and revised May 2017. The maximum total petroleum VOCs detected in soil vapor samples were lower than the total petroleum concentration for indoor air. TCE was detected above AGVs at a concentration of 6.9 $\mu g/m^3$ in soil vapor sample SV-1. Methylene chloride was detected above AGVs at a concentration of 110 $\mu g/m^3$ in soil vapor sample SV-2. Six of the eight VOCs that can be evaluated using the NYSDOH decision matrices were detected in sub-slab soil vapor samples (PCE, TCE, carbon tetrachloride, cis-1,2-dichloroethene, methylene chloride, and 1,1,1-trichloroethane). Based on the concentrations reported, Hydro Tech concluded no further action is recommended pursuant to the NYSDOH decision matrices.

April 2018 Phase I ESA, prepared by ESPL Environmental Consultants Corporation

The Phase I ESA was completed for 538-540 West 29th Street (Lots 55 and 56) in general accordance with ASTM International Standard E1527-13 and the USEPA AAI Rule. The following REC was identified:

- E-Designation: The site was listed in the New York City Department of Buildings (NYCDOB) with an environmental E-Designation (E-142) for hazardous materials, noise attenuation, and air quality.

March 11, 2019 Phase I ESA, prepared by Langan

The Phase I ESA was completed for 538-542 West 29th Street (Lots 55, 56, and 57) in accordance with ASTM International Standard E1527-13 and the USEPA AAI Rule. The following RECs and Business Environmental Risks (BER) were identified:

- <u>REC 1 - Documented Contamination at the Site</u>: The site was previously developed for commercial, residential and minor manufacturing uses including: a lumber yard (1930); auto repair facility (1924-2012); private garage (1950-1987); a light manufacturer (1970); and auto repair shop (1927 to 2005). Based on the analytical data generated during environmental investigations at the site in 2014, 2016, and 2018, there is documented soil, groundwater and soil vapor contamination at the site. Petroleum-related VOCs and SVOCs were detected in soil and groundwater at concentrations exceeding applicable regulatory criteria. Sub-slab and soil vapor analytical results identified petroleum and chlorinated solvent-related compounds beneath the existing building slabs.

  Open NYSDEC Spill Nos. 1805506 and 1805508 were reported on August 20, 2018 due to identification of petroleum impacts to soil, soil vapor and groundwater during a subsurface investigation performed at 538 and 540 West 29th Street. The petroleum impacts were observed in the southern portions of Tax Lots 55 and 56.
- <u>REC 2 - Historical Use of Adjoining and Surrounding Properties</u>: Historical uses of adjoining and surrounding properties include:
  - A gasoline filling station located at 563 West 29th Street (1930)
  - Auto repair shops/garages (516-520 West 29th Street [1938, 2002 to 2005, 2010], 522-532 West 29th Street [1930, 1963-2001], 539 West 28th Street [1930], 546 West 29th Street [1930], 548 West 29th Street [1976 to 2006], 312 Eleventh Avenue [1930 to 2005])
  - A planning mill (lumber) and box factory located at 547-557 West 28th Street (1890 to 1911)
  - A light manufacturer (1956) and chemical dying factory (1968) located at 515 West 29th Street
  - A chemical corporation located at 533 West 29th Street (1920)
  - A motor freight station at 529-537 West 29th Street (1950 to 1991)

  Multiple surrounding properties are subject to environmental regulatory oversight through the OER and NYSDEC based on historic site use or documented contamination. Adjacent and surrounding sites with environmental regulatory oversight include: Avalon West Chelsea (282 Eleventh Avenue), Midtown Center Auto (548 West 29th Street), 534 West 29th Street (VCP Site No. 14CVCP199M), 550 West 29th Street (Voluntary Cleanup Program [VCP] Site No. 15CVCP060M) and 522-532 West 29th Street (VCP Site No. 13CVCP151M). Publicly available documents associated with these sites reported petroleum and chlorinated solvent impacts in soil, groundwater and/or soil vapor that may have contributed to the documented contamination at the site.

- BER 1 – E-Designation: The site is listed with an environmental E-Designation (E-142) for hazardous materials, noise (window wall attenuation and alternative means of ventilation), and air quality resulting from the June 23, 2005 High Line/ West Chelsea rezoning (CEQR #03DCP069M). Satisfaction of the E-Designation requirements is subject to review and approval by the OER. If the site is remediated under the BCP, the OER will defer to the NYSDEC for compliance with the E-Designation for hazardous materials.

- BER 2 - Historic Fill: Based on previous subsurface investigations performed at the site in 2014, 2016, and 2018, historic fill was identified at the site. Historic fill is typical in this area of NYC. The fill layer, predominately consisting of sand with varying amounts of gravel, silt, wood, brick, asphalt, concrete, ash, slag, and coal, extends to depths ranging from about 3 to 12 feet below grade surface. The presence of this material does not trigger a regulatory reporting requirement, but will require implementation of management and off-site disposal that can carry a cost premium as compared to clean native soil during any future site redevelopment that includes excavation and off-site disposal.

March 11, 2019 Phase II ESI, prepared by Langan

- The Phase II ESI was prepared for due diligence purposes and summarizes the May/June 2018 RI, in addition to previous site investigations performed in May 2014 and June 2016 at the site.

5. Investigation and Cleanup Process

Application

The Applicant has applied for acceptance into New York's Brownfield Cleanup Program as a Volunteer. This means that an Applicant was not responsible for the disposal or discharge of the contaminants or whose ownership or operation of the Site took place after the discharge or disposal of contaminants. A Volunteer must fully characterize the nature and extent of contamination onsite, and must conduct a "qualitative exposure assessment," a process that characterizes the actual or potential exposures of people, fish and wildlife to contaminants on the Site and to contamination that has migrated from the Site.

The Applicant in its Application proposes that the Site will be used for restricted or unrestricted purposes.

To achieve this goal, the Applicant will conduct cleanup activities at the Site with oversight provided by NYSDEC. The Brownfield Cleanup Agreement (BCA) executed by NYSDEC and the Applicant sets forth the responsibilities of each party in conducting these activities at the Site.

Investigation

The Applicant has submitted a Remedial Investigation Report (RIR) with its Application for submission to NYSDEC, which will determine if the investigation goals and requirements of the BCP have been met or if additional work is needed before a remedy can be selected.

NYSDEC will use the information in the RIR to determine whether the Site poses a significant threat to public health or the environment. If the Site is a “significant threat,” it must be cleaned up using a remedy selected by NYSDEC from an analysis of alternatives prepared by the Applicant and approved by NYSDEC. If the Site does not pose a significant threat, the Applicant may select the remedy from the approved analysis of alternatives.

Interim Remedial Measures

An Interim Remedial Measure (IRM) is an action that can be undertaken at a Site when a source of contamination or exposure pathway can be effectively addressed before the Site investigation and analysis of alternatives are completed. If an IRM is likely to represent all or a significant part of the final remedy, then the NYSDEC will require a 30-day public comment period.

Remedy Selection

When investigation of the Site has been determined to be complete, the project likely would proceed in one of two directions:

1. The Applicant may recommend in its investigation report that no action is necessary at the Site. In this case, NYSDEC would make the investigation report available for public comment for 45 days. NYSDEC then would complete its review, make any necessary revisions, and, if appropriate, approve the investigation report. NYSDEC would then issue a “Certificate of Completion” (described below) to the Applicant.

or

2. The Applicant may recommend in its investigation report that action needs to be taken to address Site contamination. After NYSDEC approves the investigation

report, the Applicant may then develop a cleanup plan, officially called a “Remedial Action Work Plan”. The Remedial Work Plan (RAWP) describes the Applicant’s proposed remedy for addressing contamination related to the Site.

When the Applicant submits a draft RAWP for approval, NYSDEC would announce the availability of the draft plan for public review during a 45-day public comment period.

Cleanup Action

NYSDEC will consider public comments, and revise the draft cleanup plan if necessary, before approving the proposed remedy. The New York State Department of Health (NYSDOH) must concur with the proposed remedy. After approval, the proposed remedy becomes the selected remedy. The selected remedy is formalized in the Site Decision Document.

The Applicant may then design and perform the cleanup action to address the Site contamination. NYSDEC and NYSDOH oversee the activities. When the Applicant completes cleanup activities, it will prepare a Final Engineering Report (FER) that certifies that cleanup requirements have been achieved or will be achieved within a specific time frame. NYSDEC will review the report to be certain that the cleanup is protective of public health and the environment for the intended use of the Site.

Certificate of Completion

When NYSDEC is satisfied that cleanup requirements have been achieved or will be achieved for the Site, it will approve the FER. NYSDEC then will issue a Certificate of Completion (COC) to the Applicant. The COC states that cleanup goals have been achieved, and relieves the Applicant from future liability for Site-related contamination, subject to certain conditions. The Applicant would be eligible to redevelop the Site after it receives a COC.

Site Management

The purpose of Site management is to ensure the safe reuse of the property if contamination will remain in place. Site management is the last phase of the Site cleanup program. This phase begins when the COC is issued. Site management incorporates any institutional and engineering controls required to ensure that the remedy implemented for the Site remains protective of public health and the environment. All significant activities would be detailed in a Site Management Plan (SMP).

An *institutional control* is a non-physical restriction on use of the site, such as a deed restriction that would prevent or restrict certain uses of the property. An institutional control may be used when the cleanup action leaves some contamination that makes the site suitable for some, but not all uses.

An *engineering control* is a physical barrier or method to manage contamination. Examples include: caps, covers, barriers, fences, and treatment of water supplies.

Site management also may include the operation and maintenance of a component of the remedy, such as a system that pumps and treats groundwater. Site management continues until NYSDEC determines that it is no longer needed.

Appendix A -
Project Contacts and Locations of Reports and Information

Project Contacts

For information about the Site's investigation and cleanup program, the public may contact any of the following project staff:

New York State Department of Environmental Conservation (NYSDEC):

Michael MacCabe
Project Manager
NYSDEC
Division of Environmental Remediation,
Bureau of Technical Support
625 Broadway, 11th Floor
Albany, NY 12233-7020
Phone: (518) 588-3394
Email: michael.maccabe@dec.ny.gov

New York State Department of Health (NYSDOH):

NYSDOH
Empire State Plaza
Corning Tower Room 1787
Albany, NY 12237

Locations of Reports and Information

The facilities identified below are being used to provide the public with convenient access to important project documents:

New York Public Library – Muhlenberg Branch
209 West 23rd Street
New York, NY 10011
Phone: (212) 924-1585

Hours:

Monday to Thursday:	10 AM – 7 PM
Friday:	10 AM – 6 PM
Saturday:	10 AM – 5 PM
Sunday:	Closed

Manhattan Community Board 4
330 W 42nd Street, 26th Floor
New York, NY 10036
Phone: (212) 736-4536
Email: jbodine@cb.nyc.gov

Appendix B - Site Contact List

Government Officials

Chief Executive Officer
Hon. Bill de Blasio
City Hall
260 Broadway Avenue
New York, NY 10007

NYC Comptroller
Hon. Scott Stringer
NYC Comptroller
1 Centre Street
New York, NY 10007

NYC Public Advocate
Hon. Jumaane Williams
1 Centre Street, 15th Floor North
New York, NY 10007

NYC Council
Hon. Corey Johnson
NYC Council Speaker
224 West 30th Street, Suite 1206
New York, NY 10001

NYS Senator
Hon. Brad Hoylman
NYS Senator
322 Eighth Avenue, Suite 1700
New York, NY 10001

NYS Assembly Member
Hon. Richard N. Gottfried
NYS Assembly Member
214 West 29th Street
New York, NY 10001

U.S. Senators
Hon. Charles Schumer
780 Third Avenue, Suite 2301
New York, NY 10017

Hon. Kirsten Gillibrand
U.S. Senator
780 Third Avenue, Suite 2601
New York, NY 10017

U.S. House of Representative
Hon. Jerrold Nadler
201 Varick Street, Suite 669
New York, NY 10014

NYC Office of Environmental Remediation
Mark McIntyre, Director
100 Gold Street, 2nd Floor
New York, NY 10038

NYC Department of Environmental Protection
Vincent Sapienza, Acting Commissioner
59-17 Junction Boulevard
Flushing, New York 11373

New York City Planning Commission, Chairman
Marisa Lago
Department of City Planning
120 Broadway, 31st Floor
New York, NY 10271

Borough of Manhattan, Borough President
Hon. Gale Brewer
431 West 125th Street
New York, NY 10027

New York City Department of Transportation, Manhattan Borough Commissioner
Ed Pincar
55 Water Street, 9th Floor
New York, New York 10041

Residents, Owners, and Occupants, of the Property and Adjacent Properties

Property

Owner:
W29 Owner LLC
148 Madison Avenue,
16th Floor
New York, New York 10016

Occupants
Vacant
538 West 29th Street
New York, NY, 10001

Vacant
540 West 29th Street
New York, NY, 10001

Vacant
542 West 29th Street
New York, NY, 10001

Adjacent Properties

East Side 11th & 28th LLC
Avalon West Chelsea
539 West 28th Street
New York, NY 10001
(646) 640-2375

LK2, LLC
536 West 29th Street
New York, NY 10001
(212) 239-1563

Eric Lackawanna RLRDCO
281 11th Avenue
New York, NY 10001
Phone Number Not Provided

West 29th Street Ministorage Associates
Manhattan Mini Storage
302 11th Avenue
New York, NY 10001
(646) 786-7205

South of Hudson Yards Condos
550 West 29th Street
546 West 29th Street
New York, NY 10001
(646) 480-7665

W29 534 High Line Owners LLC
534 West 29th Street
New York, NY 10001
(212) 758-2089

Dugout Doug-One, LLC
David Nolan New York
527 West 29th Street
New York, NY 10001
(212) 925-6190

P F J LTD
LOFT 29
525 West 29th Street
New York, NY 10001
(646) 688-3343

Public Water Supplier

The responsibility for supplying water in New York City is shared between the NYC Department of Environmental Protection, the Municipal Water Finance Authority, and the New York City Water Board.

New York City Department of Environmental Protection
Vincent Sapienza, Acting Commissioner
59-17 Junction Boulevard
Flushing, New York 11373

New York City Municipal Water Finance Authority
255 Greenwich Street, 6th Floor
New York, New York 10007

New York City Water Board
NYC Department of Environmental Protection
59-17 Junction Boulevard, 8th Floor
Flushing, New York 11373

Request for Contact

We are unaware of any requests for inclusion on the contact list

Schools and Daycare Facilities

There are no schools or day care facilities located on the site. The following are schools or day care facilities located within ½ mile of the site:

Bright Horizons Day Care at Hudson Yards
(about 100 feet north of the site)
Ean Gensler, Center Director
529A West 29th Street
New York, NY 10001
(212) 643-3474

Avenues: The World School
(about 915 feet southeast of the site)
Dr. Evan Glazer, Head of School
259 10th Avenue
New York, NY 10001
(718) 937-7640

Bright Horizons Day Care at Chelsea
(about 2,700 feet southeast of the site)
Sheri Nabb, Center Director
258 West 26th Street
New York, NY 10001
(212) 366-4365

New York Public School 11
(about 2,800 feet southeast of the site)
Robert Bender, Principal
320 West 21st Street
New York, NY 10001
(718) 638-3237

New York Alternative High School
(about 2,900 feet northeast of the site)
Richard Carranza, Chancellor
269 West 35th Street
New York, NY 10001
(212) 868-7238

Keswell School
(about 2,100 feet southeast of the site)
Ivy Feldman, Executive Director
331 West 25th Street
New York, NY 10001
(212) 229-1715

City Knoll Middle School
(about 1,600 feet northeast of the site)
Kaye Kerr, Principal
425 West 33rd Street
New York, NY 10001
(212) 695-9115

Community, Civic, Religious, and other Environmental Organizations:

Consolidated Edison
281 11th Avenue
New York, NY 10001

Kevin J. Coleman, Commanding Officer
10th NYPD Police Precinct
230 West 20th Street
New York, NY 10011

Engine 1 Ladder 24
FDNY
142 West 31st Street
New York, NY 10001

Saint Peter's Church - Chelsea
346 West 20th Street
New York, NY 10011

St Columba Church
343 West 25th Street
New York, NY 10001

German Lutheran Church of St. Paul
315 West 22nd Street
New York, NY 10011

Guardian Angel Church
193 10th Avenue
New York, NY 10011

Manor Community Church
350 West 26th Street
New York, NY 10001

Saint Michael Catholic Church
424 West 34th Street
New York, NY 10001

Hillsong Church
311 West 34th Street
New York, NY 10001

Document Repository

Letters were sent to and received from the following locations certifying as a repository for public access to documents generated under the BCP program:

New York Public Library – Muhlenberg Branch
209 West 23rd Street
New York, NY 10011
(212)-924-1585

Hours:

Monday to Thursday:	10 AM – 7 PM
Friday:	10 AM – 6 PM
Saturday:	10 AM – 5 PM
Sunday:	Closed

Manhattan Community Board 4
330 West 42nd Street, #2601
New York, NY 10036
Phone: (212) 736-4536

Item 8 - Community Board

The local community board is Manhattan Community Board 4.

Manhattan Community Board 4
Burt Lazarin, Chair
330 West 42nd Street, #2601
New York, NY 10036
Phone: (212) 736-4536

Appendix C1 - Site Location Map (Topo)

LEGEND:

APPROXIMATE BCP SITE BOUNDARY

NOTES:
1. BASE MAP TAKEN FROM UNITED STATES GEOLOGICAL SURVEY 7.5 MINUTE TOPOGRAPHIC MAPS FOR THE BROOKLYN, CENTRAL PARK, JERSEY CITY AND WEEHAWKEN QUADRANGLES, DATED 2016.
2. BCP = BROWNFIELD CLEANUP PROGRAM

1000 0 500 1000

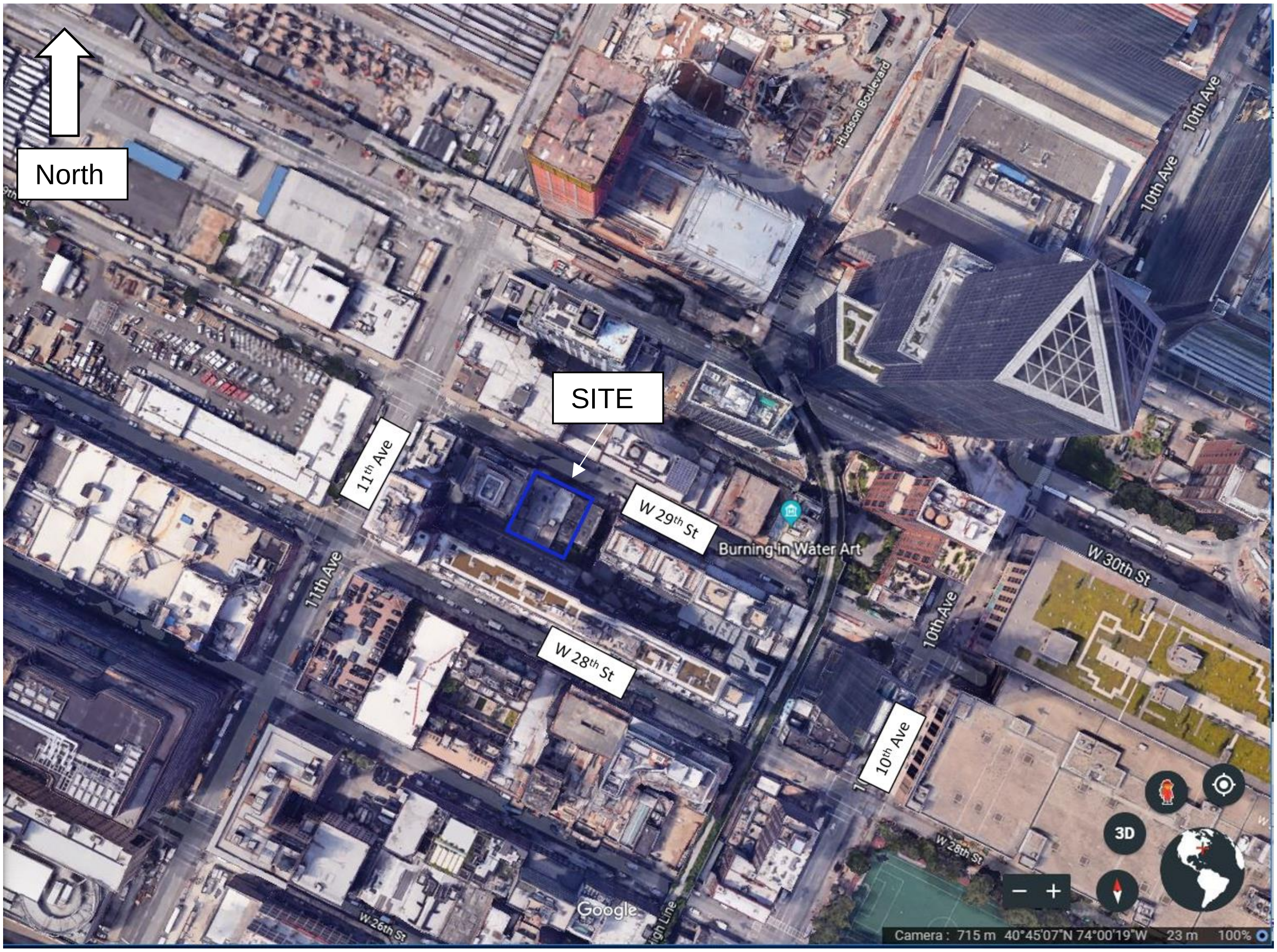
SCALE IN FEET

LANGAN
Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C.
21 Penn Plaza, 360 West 31st Street, 8th Floor
New York, NY 10001
T: 212.479.5400 F: 212.479.5444 www.langan.com

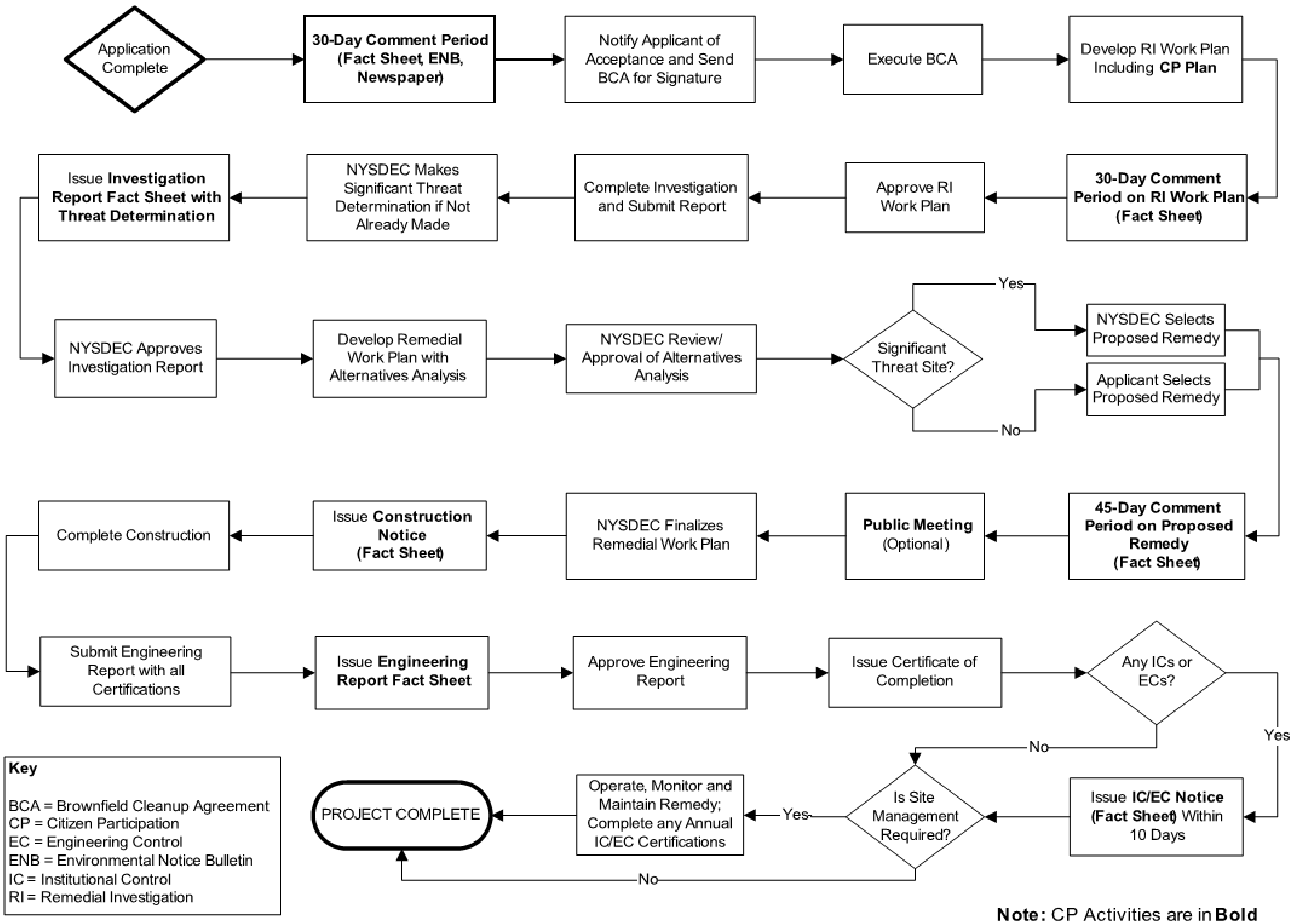
Project	Figure Title	Project No. 170515401	Figure No.
538-542 WEST 29TH STREET BLOCK No. 700, LOT Nos. 55, 56 & 57 NEW YORK NEW YORK	SITE LOCATION MAP	Date 10/19/2018 Drawn By KN Checked By ELS	1 Sheet 1 of 9

Filename: \\langan.com\data\NY\data4\170515401\Project Data\CAD\01\2D-DesignFiles\RAWP\Figure 1 - Site Location Map.dwg Date: 3/21/2019 Time: 09:28 User: mtan Style Table: Langan.stb Layout: ANSIA-BP

Appendix C2 - Site Location Map (Aerial)



Appendix D - Brownfield Cleanup Program Process



APPENDIX H

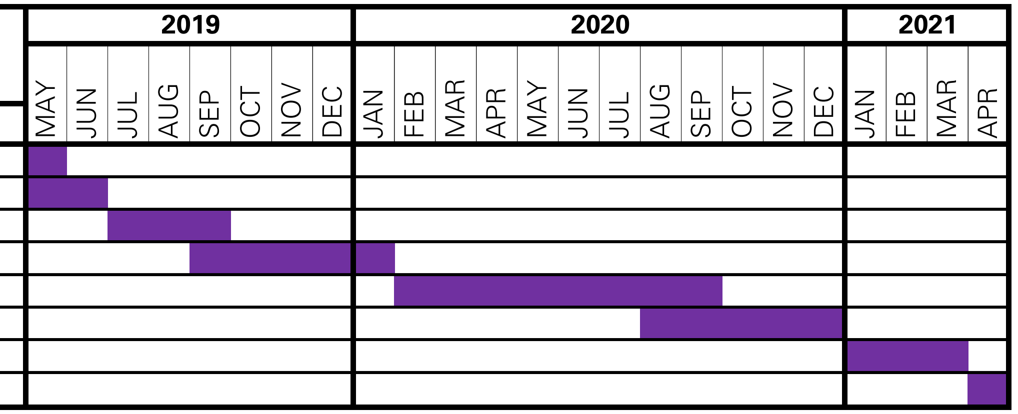
REMEDIAL ACTION CONSTRUCTION SCHEDULE

Remedial Action Work Plan
Appendix H - Remedial Action Construction Schedule

538-542 West 29th Street
New York, NY
Langan Project No. 170515401
BCP Site No. C231136

Estimated Project Schedule

Item	Action
1	BCP Application, RIR, CPP, RAWP Preparation and Submission
2	NYSDEC & NYSDOH Review of BCP Application, RIR, CPP and RAWP
3	45-Day Public Comment Period and Execute BCA
4	NYSDEC & NYSDOH Review of RAWP and Issuance of Decision Document
5	Implementation of RAWP with Engineering Oversight
6	Preparation of an Environmental Easement, FER, and SMP (if required)
7	NYSDEC & NYSDOH Review of FER (and SMP, if required)
8	NYSDEC Issues COC



Notes:
a) This is an estimated schedule; all items are subject to change.
b) Completion of Item 5 refers to the completion of remediation and not the end of overall construction.
c) BCP = Brownfield Cleanup Program
d) NYSDEC = New York State Department of Environmental Conservation
e) BCA = Brownfield Cleanup Agreement
f) CPP = Citizen Participation Plan
g) NYSDOH = New York State Department of Health
h) RIR = Remedial Investigation Report
i) RAWP = Remedial Action Work Plan
j) FER = Final Engineering Report
k) SMP = Site Management Plan
l) COC = Certificate of Completion