



Site Management Plan

1681-1689 Main Street Site
(BCP No. C915378)
Buffalo, New York

August 2026

Prepared for:

1681-1689 Main Street LLC
9100 Centre Pointe Drive, Suite 210
West Chester OH 45069

Prepared by:

**Roux Environmental Engineering
and Geology, D.P.C.**
2558 Hamburg Turnpike, Suite 300
Buffalo, New York 14218

1681-1689 Main Street Site

ERIE COUNTY

BUFFALO, NEW YORK

SITE MANAGEMENT PLAN

NYSDEC Site Number: C915378

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2558 Hamburg Turnpike, Suite 300
Buffalo, NY 14218
716-859-0599

Revisions to Final Approved Site Management Plan:

Revision No.	Date Submitted	Summary of Revision	NYSDEC Approval Date

AUGUST 2026

Certification Statement

I, Thomas H Forbes, PE certify that I am currently a NYS registered Professional Engineer and that this August 2026 Site Management Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10) and Green Remediation (DER-31).

_____ P.E.

_____ DATE

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List of Acronyms

AS	Air Sparging
ASP	Analytical Services Protocol
BCA	Brownfield Cleanup Agreement
BCP	Brownfield Cleanup Program
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CAMP	Community Air Monitoring Plan
C/D	Construction and Demolition
CFR	Code of Federal Regulation
CLP	Contract Laboratory Program
COC	Certificate of Completion
CO2	Carbon Dioxide
CP	Commissioner Policy
DER	Division of Environmental Remediation
DUSR	Data Usability Summary Report
EC	Engineering Control
ECL	Environmental Conservation Law
ELAP	Environmental Laboratory Approval Program
ERP	Environmental Restoration Program
EWP	Excavation Work Plan
GHG	Greenhouse Gas
GWE&T	Groundwater Extraction and Treatment
HASP	Health and Safety Plan
IC	Institutional Control
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYCRR	New York Codes, Rules and Regulations
O&M	Operation and Maintenance
OM&M	Operation, Maintenance and Monitoring
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
P.E. or PE	Professional Engineer
PFAS	Per- and Polyfluoroalkyl Substances
PID	Photoionization Detector
PRP	Potentially Responsible Party
PRR	Periodic Review Report
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
QEP	Qualified Environmental Professional
RAO	Remedial Action Objective
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RP	Remedial Party
RSO	Remedial System Optimization
SAC	State Assistance Contract
SCG	Standards, Criteria and Guidelines
SCO	Soil Cleanup Objective
SMP	Site Management Plan
SOP	Standard Operating Procedures

SOW	Statement of Work
SPDES	State Pollutant Discharge Elimination System
SSD	Sub-slab Depressurization
SVE	Soil Vapor Extraction
SVI	Soil Vapor Intrusion
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leachate Procedure
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VCA	Voluntary Cleanup Agreement
VCP	Voluntary Cleanup Program

ES Executive Summary

The following provides a brief summary of the controls implemented for the Site, as well as the inspections, monitoring, and reporting activities required by this Site Management Plan:

Site Identification: Site No. C915378
1681-1689 Main Street Site, 1689 Main Street, Buffalo, NY
14208

Institutional Controls:	1. The property may be used for residential; restricted residential, commercial, and industrial use;	
	2. All ECs must be operated and maintained as specified in this SMP;	
	3. All ECs must be inspected at a frequency and in a manner defined in the SMP;	
	4. The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the Erie County Department of Health to render it safe for industrial purposes, and the user must first notify and obtain written approval to do so from the Department;	
	5. Groundwater and other environmental or public health monitoring must be performed as defined in this SMP;	
	6. Data and information pertinent to site management must be reported at the frequency and in a manner as defined in this SMP;	
	7. Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in this SMP;	
	8. Access to the site must be provided to agents, employees or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by the Environmental Easement;	
Engineering Controls:	1. TBD - Active Sub-slab Depressurization (ASD) system, if deemed necessary pending the results of the planned sampling.	
Inspections:		Frequency
1. TBD - ASD system, if deemed necessary.		Annually

Site Identification: Site No. C915378
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Monitoring:	
1. Groundwater Monitoring Wells MW-4, MW-5, MW-6, TW-1, TW-2, TW-3 and TW-4	Annually
2. TBD - ASD system, if deemed necessary	Annually
Maintenance:	
1. TBD - Active sub-slab depressurization system fan unit(s), if deemed necessary	As needed
Reporting:	
1. Periodic Review Report	Annually

Further descriptions of the above requirements are provided in detail in the latter sections of this Site Management Plan.

1.0 Introduction

1.1 General

This Site Management Plan (SMP) is a required element of the remedial program for the 1681-1689 Main Street Site located in Buffalo, New York (hereinafter referred to as the “Site”). See Figure 1. The Site is currently in the New York State (NYS) Brownfield Cleanup Program (BCP), Site No. C915378, which is administered by New York State Department of Environmental Conservation (NYSDEC or Department).

1681-1689 Main Street LLC entered into a Brownfield Cleanup Agreement (BCA) on March 14, 2022 with the NYSDEC to remediate the site. Three (3) BCA Amendments were submitted for the Site, including Amendment 1 was submitted on November 15, 2023 to expand the BCP Site boundary to include 1707 Main Street, Buffalo, NY parcel; Amendment 2 was submitted on February 12, 2024 to document the property transfer of the properties; and, Amendment 3 was submitted on May 20, 2026 to notify the Department of the combination of the parcels and updated municipal parcel information.

It should be noted that this Site Management Plan has been prepared for the Track 2 portion of the Site, which is more fully described on the metes and bounds description. A figure showing the site location and the Track 1 and Track 2 boundaries of this site is provided in Figure 2 and 3. The boundaries of the site are more fully described in the metes and bounds site description that is part of the Environmental Easement provided in Appendix A.

In accordance with the NYSDEC-approved Remedial Investigation/Interim Remedial Measures Work Plan (RI/IRMWP), the on-site soil/fill was remediated to the Part 375 Unrestricted Use Soil Cleanup Objectives (USCOs). No soil contamination is present on-site above USCOs. Residual groundwater concentrations are present onsite. Groundwater IRM injections were completed in 2025 and 2026. Post-injection groundwater monitoring has been conducted at the Site, as discussed in Sections 2.3 and 2.5, and groundwater concentrations have significantly reduced. Post COC groundwater monitoring will occur, as discussed in Section 4.4. Based on the Department’s recent policy change related to issuing Conditional Track 1 cleanup, it is expected that the Volunteer will request for enhancement of the COC to a Track 1 Unrestricted across the entire Site, once GWQS are achieved within the 5-yr post-COC timeframe.

After completion of the remedial work, some contamination was left at this site, which is hereafter referred to as “remaining contamination”. Institutional Controls (ICs) have been incorporated into the site remedy to control exposure to remaining contamination to ensure protection of public health and the environment. An Environmental Easement granted to the NYSDEC, and recorded with the Erie County Clerk, requires compliance with this SMP and all ICs placed on the site.

This SMP was prepared to manage remaining contamination at the site until the Environmental Easement is extinguished in accordance with ECL Article 71, Title 36. This plan has been approved by the NYSDEC, and compliance with this plan is required by the grantor of the Environmental Easement and the grantor’s successors and assigns. This SMP may only be revised with the approval of the NYSDEC.

It is important to note that:

- This SMP details the site-specific implementation procedures that are required by the Environmental Easement. Failure to properly implement the SMP is a violation of the

Environmental Easement, which is grounds for revocation of the Certificate of Completion (COC); and

- Failure to comply with this SMP is also a violation of Environmental Conservation Law, 6 NYCRR Part 375 and the BCA, (Index # C915378-03-22; Site #C915378) for the site, and thereby subject to applicable penalties.

All reports associated with the site can be viewed by contacting the NYSDEC or its successor agency managing environmental issues in New York State. A list of contacts for persons involved with the site is provided in Appendix B of this SMP.

This SMP was prepared by Roux Environmental Engineering and Geology, D.P.C., on behalf of 1681-1689 Main Street LLC, in accordance with the requirements of the NYSDEC's DER-10 ("Technical Guidance for Site Investigation and Remediation"), dated May 2010, and the guidelines provided by the NYSDEC. This SMP addresses the means for implementing the ICs and/or ECs that are required by the Environmental Easement for the site.

1.2 Revisions and Alterations

Revisions and alterations to this plan will be proposed in writing to the NYSDEC's project manager. The NYSDEC can also make changes to the SMP or request revisions from the remedial party. Revisions will be necessary upon, but not limited to, the following occurring: a change in media monitoring requirements, upgrades to or shutdown of a remedial system, post-remedial removal of contaminated sediment or soil, or other significant change to the site conditions. All approved alterations must conform with Article 145 Section 7209 of the Education Law regarding the application of professional seals and alterations. For example, any changes to as-built drawings must be stamped by a New York State Professional Engineer. In accordance with the Environmental Easement for the site, the NYSDEC project manager will provide a notice of any approved changes to the SMP, and append these notices to the SMP that is retained in its files.

1.3 Notifications

Notifications will be submitted by the property owner to the NYSDEC, as needed, in accordance with NYSDEC's DER – 10 for the following reasons:

1. 60-day advance notice of any proposed changes in site use that are required under the terms of the BCA, 6 NYCRR Part 375 and/or Environmental Conservation Law.
2. 7-day advance notice of any field activity associated with the remedial program.
3. 15-day advance notice of any proposed ground-intrusive activity pursuant to the Excavation Work Plan. If the ground-intrusive activity qualifies as a change of use as defined in 6 NYCRR Part 375, the above mentioned 60-day advance notice is also required.
4. Notice within 48 hours of any damage or defect to the foundation, structures or EC that reduces or has the potential to reduce the effectiveness of an EC, and likewise, any action to be taken to mitigate the damage or defect.
5. Notice within 48 hours of any non-routine maintenance activities.
6. Verbal notice by noon of the following day of any emergency, such as a fire; flood; or earthquake that reduces or has the potential to reduce the effectiveness of ECs in place at the site, with written confirmation within 7 days that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.

7. Follow-up status reports on actions taken to respond to any emergency event requiring ongoing responsive action submitted to the NYSDEC within 45 days describing and documenting actions taken to restore the effectiveness of the ECs.

Any change in the ownership of the site or the responsibility for implementing this SMP will include the following notifications:

8. At least 60 days prior to the change, the NYSDEC will be notified in writing of the proposed change. This will include a certification that the prospective purchaser/Remedial Party has been provided with a copy of the Brownfield Cleanup Agreement (BCA, and all approved work plans and reports, including this SMP.
9. Within 15 days after the transfer of all or part of the site, the new owner's name, contact representative, and contact information will be confirmed in writing to the NYSDEC.

Table 1 on the following page includes contact information for the above notifications. The information on this table will be updated as necessary to provide accurate contact information. A full listing of site-related contact information is provided in Appendix B.

Table 1: Notifications*

Name	Contact Information	Required Notification**
Matthew King NYSDEC Project Manager	716-851-7220 Matthew.King@dec.ny.gov	All Notifications
Andrea Caprio NYSDEC Project Manager's Supervisor	716-851-7220 Andrea.Caprio@dec.ny.gov	All Notifications
NYSDEC Site Control	518-402-9543 Derweb@dec.ny.gov	Notifications 1 and 8
Christine Vooris NYSDOH Project Manager]	518-402-7860 Christine.Vooris@health.ny.gov	Notifications 4, 6, and 7

* Note: Notifications are subject to change and will be updated as necessary.

** Note: Numbers in this column reference the numbered bullets in the notification list in this section.

2.0 Summary of Previous Investigations and Remedial Actions

2.1 Site Location and Description

The site is located in Buffalo, Erie County, New York and is identified as Section, Block, and Lot number 100.24-4-20.1, on the Buffalo Tax Map (see Figure 3), and addressed at 1689 Main Street, Buffalo NY 14209. The site is an approximately 2-acre area and is bounded by residential properties and vacant land to the north, East Balcom Street to the south, Masten Avenue to the east, and Main Street to the west (see Figure 2 – Site Layout Map). The boundaries of the site are more fully described in Appendix A –Environmental Easement. The owner/operator of the site parcel at the time of issuance of this SMP is/are:

- Owner/Operator – 1681-1689 Main Street LLC

2.2 Physical Setting

2.2.1 Land Use

The Site consists of three (3) newly constructed multi-family residential buildings, identified as Building A, Building B and Building C, with associated parking lots, sidewalks, and landscaped areas. The Site is zoned N-2-E, Mixed-Use Edge which allows residential use and is currently vacant pending municipal occupancy approval. The properties adjoining and surrounding the Site primarily include a mixed urban setting with commercial, residential, and vacant properties. The properties immediately south of the Site include mixed-use commercial and residential properties; the properties immediately north of the Site include commercial, residential, and vacant properties immediately east of the Site include commercial, residential properties; and the properties to the west of the Site include mixed-use commercial, residential properties.

2.2.2 Geology

The geology at the Site was investigated during the RI and is generally described as fill material ranging from an average of approximately 0 to 5 fbg consisting of varying amounts of stone, cinders, ash, brick, block, concrete, and debris. Fill material was observed in the northwest corner of the Site (1707 Main) at MW-1 from 0-10 fbg and consisted of former building debris including brick, concrete, stone, ash, and cinders. Fill material was observed overlaying sandy clay ranging from 1-14 fbg. Beneath the sandy clay layer, a grey to brown sand layer was observed ranging from 5-20 fbg.

The impacted overburden soil/fill was excavated and disposed of in a landfill as part of the remedial action, as discussed in Section 2.3.

Bedrock was not encountered during the RI-IRMs. Based on geotechnical drilling activities, completed by others, bedrock was typically encountered on site at depths ranging from approximately 50 to 60 fbg across the Site. Bedrock was described as grey limestone.

2.2.3 Hydrogeology

Based on the findings of the RI, groundwater was typically encountered at depths ranging from approximately 14 to 16 fbg. The Site hydrogeology is likely influenced by the presence of subgrade utilities offsite along Main Street, East Balcom, and Masten Avenue.

In general, localized groundwater flow was estimated to flow in a slight eastern direction. Using well installation and water level information collected during the RI, the estimated hydraulic gradient was calculated to range from 0.00064 ft/ft (MW-5 to MW-6) to 0.0021 ft/ft (MW1 to MW-2), with an average estimated hydraulic gradient of 0.0015 ft./ft.

A groundwater contour map is shown in Figure 4. Groundwater elevation data is provided in Table 2. Groundwater monitoring well construction logs are provided in Appendix C.

2.3 Investigation and Remedial History

The following narrative provides a remedial history timeline and a brief summary of the available project records to document key investigative and remedial milestones for the Site. Full titles for each of the reports referenced below are provided in Section 8.0 - References.

The following environmental reports were available for review:

- Phase I Environmental Site Assessment (ESA) prepared by Benchmark dated September 2020
- Limited Phase II Environmental Investigation prepared by Benchmark dated March 2021
- RI/IRM/AA Work Plan prepared by Benchmark/TurnKey dated December 2021, revised September 2022
- Phase I ESA prepared by Roux, dated October 2023
- Limited Phase II Environmental Investigation prepared by Roux dated October 2023
- Groundwater Interim Remedial Measures (GWIRM) Work Plan by Roux, dated December 2024.
- RI/IRM/AA Report (draft) prepared by Roux, dated February 2026.
- Groundwater Interim Remedial Measures (GWIRM) Work Plan by Roux, dated December 2024.
- Groundwater Injection Work Plan by Roux, dated March 2026, revised April 2026.

The Site has a long history of former commercial operations including automotive repair, battery service, automotive painting, commercial bakery with loading docks, and the storage of petroleum and/or solvents. Most recently, the Site has been used for automotive repair and service.

The previous investigations and RI/IRM identified fill materials containing cinders, ash, brick, and varying amounts of other man-made materials. Elevated concentrations of semi-volatile organic compounds (SVOCs), metals, and per-and polyfluoroalkyl substances (PFAS) were identified in the subsurface soil/fill at concentrations exceeding their respective USCOs. These contaminants are associated with the historical operations at the Site. Gross petroleum impacts were identified related to the underground storage tanks (USTs), and inground hydraulic lifts were identified, including beneath the former buildings.

Benzene and cis-1,2-dichloroethene were detected at MW-4 above their respective GWQS in the sample collected April 1, 2024, but were below their respective GWQS when resampled on May 23, 2024. Benzo(b)fluoranthene, phenol, and sodium were detected at concentrations exceeding their respective GWQS from the samples collected on May 23, 2024. Additionally, cyclohexane, vinyl chloride, magnesium, and sodium were detected at MW-5 above their respective GWQS from

the samples collected May 23, 2024. 1,1-dichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene, trichloroethene, vinyl chloride, magnesium, and sodium were detected at concentrations exceeding their respective GWQS from the samples collected July 10, 2024. Groundwater results are summarized on Table 3 and the groundwater exceedances are shown on Figure 5.

The completed IRMs included building demolition, excavation and removal of USTs, inground hydraulic lifts, interior floor trench and oil-water-separator, former fuel pump base and gas lamp, grossly contaminated soil/fill, collection of post-excavation confirmatory samples, and backfilling excavations.

Impacted soil/fill present at the Site was removed to the Site boundaries and achieved USCOS. There is no remaining soil contamination on the Site. Figures 6 includes the post-excavation confirmatory soil sample locations, Figure 7 includes the post-excavation confirmatory soil sample locations for the hydraulic lifts 1 and 2, and Figure 8, Figure 9, and Figure 10 includes the post-excavation confirmatory soil samples for the Tank 1, Tank 2 and Tank 3 areas, respectively, Figure 11 includes the post-excavation confirmatory soil sample locations for the auto repair area, and Figure 12 includes the Tank 4 post-excavation confirmatory soil samples. There is no remaining soil contamination at the Site.

After completion of the soil IRMs, groundwater IRMs injections were completed in 2025 and 2026 to address residual groundwater impacts related to the former tanks. Post-injection groundwater samples indicate significant decrease in VOC concentrations with remaining elevated groundwater limited to the TW-1-TW-4 area. Additional groundwater monitoring will be completed as detailed in this SMP.

2.4 Remedial Action Objectives

The Remedial Action Objectives (RAOs) for the Site as listed in the Decision Document dated [month, day, year] are as follows:

2.4.1 Groundwater

RAOs for Public Health Protection

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

RAOs for Environmental Protection

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

2.4.2 Soil

RAOs for Public Health Protection

- Prevent ingestion/direct contact with contaminated soil.

RAOs for Environmental Protection

- Prevent migration of contaminants that would result in groundwater or surface water contamination.
- Prevent impacts to biota from ingestion/direct contact with soil causing toxicity or impacts from bioaccumulation through the terrestrial food chain.

2.4.5 Soil Vapor - TBD

RAOs for Public Health Protection

- Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into buildings at a site.

2.5 Remaining Contamination

The 1681-1689 Main Street Site was remediated to a Track 1 Unrestricted Use for soils. Groundwater remedial injections have significantly decreased groundwater concentrations, though some areas with elevated VOC concentrations above GWQS are currently present.

Groundwater remedial injections were completed in accordance with the NYSDEC approved Work Plans in 2025 and 2026. Table 3 summarizes the pre- and post-injection groundwater concentrations. The post-injection groundwater results indicate that the amendment injections have been effective at reducing VOCs concentrations, including cVOC. Additional groundwater sampling will be completed in the Fall 2026, and future groundwater sampling will be completed in accordance with this SMP. It is expected that once groundwater concentrations have achieved GWQS, within the 5-yr post-COC time period, that the Volunteer will request to upgrade to a Track 1 Unrestricted cleanup.

3.0 Institutional and Engineering Control Plan

3.1 General

Since remaining contamination exists at the site, Institutional Controls (ICs) are required to protect human health and the environment. This IC Plan describes the procedures for the implementation and management of all IC at the site. The IC/EC Plan is one component of the SMP and is subject to revision by the NYSDEC project manager.

This plan provides:

- A description of all IC on the site;
- The basic implementation and intended role of each IC;
- A description of the key components of the ICs set forth in the Environmental Easement;
- A description of the controls to be evaluated during each required inspection and periodic review;
- A description of plans and procedures to be followed for implementation of ICs, and
- Any other provisions necessary to identify or establish methods for implementing the ICs required by the site remedy, as determined by the NYSDEC project manager.

3.2 Institutional Controls

A series of ICs is required by the Decision Document to: (1) prevent future exposure to remaining contamination; and, (2) limit the use of groundwater on Site. Adherence to these ICs on the site is required by the Environmental Easement and will be implemented under this SMP. ICs identified in the Environmental Easement may not be discontinued without an amendment to or extinguishment of the Environmental Easement. The IC boundaries are shown on Figures 2 and 3. These ICs are:

- The property may be used for: residential use;
- The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the Erie County Department of Health to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department;
- Groundwater and other environmental or public health monitoring must be performed as defined in this SMP;
- Data and information pertinent to site management must be reported at the frequency and in a manner as defined in this SMP;
- Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in this SMP;
- Access to the site must be provided to agents, employees or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by the Environmental Easement; and
- The potential for vapor intrusion must be evaluated for any buildings developed in the area within the IC boundaries noted on Figure [x], and any potential impacts that are identified must be monitored or mitigated;

3.3 Engineering Controls

There are no active engineering controls on Site.

3.3.2 Sub-slab Depressurization Systems;

If SVI is determined to be a concern, an ASD system design Work Plan will be prepared and provided to the Department for review.

Procedures for operating and maintaining the ASD system are documented in the Operation and Maintenance Plan (Section 5.0 of this SMP). As-built drawings, signed and sealed by a PE who is licensed and registered in New York State, are included in Appendix [X] – Operations and Maintenance Manual. Figure [x] shows the location of the ECs for the site.

3.4 Criteria for Completion of Remediation/Termination of Remedial Systems

Generally, remedial processes are considered completed when monitoring indicates that the remedy has achieved the remedial action objectives identified by the decision document. The framework for determining when remedial processes are complete is provided in Section 6.4 of NYSDEC DER-10. Unless waived by the NYSDEC, confirmation samples of applicable environmental media are required before terminating any remedial actions at the site. Confirmation samples require Category B deliverables and a Data Usability Summary Report (DUSR).

As discussed below, the NYSDEC may approve termination of a groundwater monitoring program. When a remedial party receives this approval, the remedial party will decommission all site-related monitoring, injection and recovery wells as per the NYSDEC CP-43 policy.

The remedial party will also conduct any needed site restoration activities, such as asphalt patching and decommissioning treatment system equipment. In addition, the remedial party will conduct any necessary restoration of vegetation coverage, trees and wetlands, and will comply with NYSDEC and United States Army Corps of Engineers regulations and guidance. Also, the remedial party will ensure that no ongoing erosion occurs on the site.

3.4.X Sub-Slab Depressurization (SSD) System

TBD - The SSD system will not be discontinued unless prior written approval is granted by the NYSDEC and the NYSDOH project managers. If monitoring data indicates that the SSD system may no longer be required, a work plan to discontinue the SSD system will be submitted by the remedial party to the NYSDEC and NYSDOH project managers. The work plan must include soil vapor intrusion sampling to verify that the SSD system is no longer needed and must comply with the NYSDOH Soil Vapor Intrusion Guidance.

If the NYSDEC project manager approves termination of operation and maintenance of an SSD system, the remedial party will notify the property owner and ask whether the property owner wants to keep the SSD system. If the property owner elects to keep the system, the property owner will be responsible for the operation and maintenance of the system going forward. If the property owner wants the system removed, the remedial party will remove and dispose of the system and repair any parts of the structure that were altered or modified by the SSD system, such as holes in the basement floor or walls.

3.4.x Groundwater Monitoring Wells

Groundwater monitoring activities to assess groundwater remedial injections will continue, as determined by the NYSDEC project manager in consultation with NYSDOH project manager, until residual groundwater concentrations are found to be consistently below ambient water quality standards or the site SCGs, or have become asymptotic at an acceptable level over an extended period. If monitoring data indicates that monitoring may no longer be required, a proposal to discontinue the remedy will be submitted by the remedial party. Monitoring will continue until permission to discontinue is granted in writing by the NYSDEC project manager. If groundwater contaminant levels become asymptotic at a level that is not acceptable to the NYSDEC, additional injections, treatment and/or control measures will be evaluated.

4.0 Monitoring and Sampling Plan

4.1 General

This Monitoring and Sampling Plan describes the measures for evaluating the overall performance and effectiveness of the remedy. This Monitoring and Sampling Plan may only be revised with the approval of the NYSDEC project manager. Details regarding the sampling procedures, data quality usability objectives, analytical methods, etc. for all samples collected as part of site management for the site are included in the Quality Assurance Project Plan provided in Appendix D.

This Monitoring and Sampling Plan describes the methods to be used for:

- Sampling and analysis of all appropriate media (e.g., groundwater, indoor air, soil vapor, soils);
- Assessing compliance with applicable NYSDEC standards, criteria and guidance (SCGs), particularly groundwater standards and Part 375 SCOs for soil; and
- Evaluating site information periodically to confirm that the remedy continues to be effective in protecting public health and the environment;

To adequately address these issues, this Monitoring and Sampling Plan provides information on:

- Sampling locations, protocol and frequency;
- Information on all designed monitoring systems;
- Analytical sampling program requirements;
- Inspection and maintenance requirements for monitoring wells;
- Monitoring well decommissioning procedures; and
- Annual inspection and periodic certification.

Reporting requirements are provided in Section 7.0 of this SMP.

4.2 Site-wide Inspection

Site-wide inspections will be performed at a minimum of once per year. These periodic inspections must be conducted when the ground surface is visible (i.e. no snow cover). Site-wide inspections will be performed by a qualified environmental professional as defined in 6 NYCRR Part 375, a Professional Engineer (PE) who is licensed and registered in New York State, or a qualified person who directly reports to a PE who is licensed and registered in New York State. Modification to the frequency or duration of the inspections will require approval from the NYSDEC project manager. Site-wide inspections will also be performed after all severe weather conditions that may affect ECs or monitoring devices. During these inspections, an inspection form will be completed as provided in Appendix F – Site Management Forms. The form will compile sufficient information to assess the following:

- Compliance with all ICs, including site usage;
- An evaluation of the condition and continued effectiveness of ECs;
- General site conditions at the time of the inspection;
- Whether stormwater management systems, such as basins and outfalls, are working as designed;

- The site management activities being conducted including, where appropriate, confirmation sampling and a health and safety inspection; and
- Confirm that site records are up to date.

Inspections of all remedial components installed at the site will be conducted. A comprehensive site-wide inspection will be conducted and documented according to the SMP schedule, regardless of the frequency of the Periodic Review Report. The inspections will determine and document the following:

- Whether ECs continue to perform as designed;
- If these controls continue to be protective of human health and the environment;
- Compliance with requirements of this SMP and the Environmental Easement;
- Achievement of remedial performance criteria; and
- If site records are complete and up to date.

Reporting requirements are outlined in Section 7.0 of this plan.

Inspections will also be performed in the event of an emergency. If an emergency, such as a natural disaster or an unforeseen failure of any of the ECs occurs that reduces or has the potential to reduce the effectiveness of ECs in place at the site, verbal notice to the NYSDEC project manager must be given by noon of the following day. In addition, an inspection of the site will be conducted within 5 days of the event to verify the effectiveness of the IC/ECs implemented at the site by a qualified environmental professional, as defined in 6 NYCCR Part 375. Written confirmation must be provided to the NYSDEC project manager within 7 days of the event that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public. The remedial party will submit follow-up status reports to the NYSDEC within 45 days of the event on actions taken to respond to any emergency event requiring ongoing responsive action, describing and documenting actions taken to restore the effectiveness of the ECs.

4.4 Post-Remediation Media Monitoring and Sampling

Samples shall be collected from the groundwater on a routine basis. Sampling locations, required analytical parameters and schedule are provided in Table 13 – Remedial System Sampling Requirements and Schedule below. Modification to the frequency or sampling requirements will require approval from the NYSDEC project manager.

Table 13 – Post Remediation Sampling Requirements and Schedule

Sampling Location	Analytical Parameters	Schedule
	VOCs (EPA Method 8260)	
MW-4	X	Annually.
MW-5R	X	
MW-6	X	
TW-1	X	

TW-2	X	
TW-3	X	
TW-4	X	

Detailed sample collection and analytical procedures and protocols are provided in Appendix E – Field Activities Plan and Appendix D – Quality Assurance Project Plan.

4.4.1 Groundwater Sampling

Groundwater monitoring will be performed annually to assess the performance of the remedy. Modification to the frequency or sampling requirements will require approval from the NYSDEC project manager.

The network of monitoring wells has been installed to monitor upgradient, on-site and downgradient groundwater conditions at the site. Table 14 summarizes the wells' identification numbers, as well as the purpose, location, depths, diameter and screened intervals of the wells. As part of the groundwater monitoring, six on-site wells are sampled to evaluate the effectiveness of the remedial system. The remedial party will measure depth to the water table for each monitoring well in the network before sampling.

Table 14 – Monitoring Well Construction Details

Monitoring Well ID	Well Location	Coordinates (longitude/latitude)	Well Diameter (inches)	Elevation (above mean sea level)			
				Casing	Surface	Screen Top	Screen Bottom
MW-4	On-site	42.9185038, -78.8602657	2	628.32	626.21	613.47	608.47
MW-5R		42.9183564, -78.8610231	2	633.54	628.79	613.32	608.32
MW-6		42.9181567, -78.8604188	2	629.30	629.30	615.15	610.15
TW-1		42.9184119, -078.860393	2	630.70	626.69	610.59	605.29
TW-2		42.9182671, -078.859981	2	629.50	629.50	613.25	608.25
TW-3		42.9181241, -078.860102	2	633.35	630.20	613.15	608.15
TW-4		42.918-078.86	2	630	630	613	608

Monitoring well construction details are included in Appendix C of this document.

If biofouling or silt accumulation occurs in the on-site monitoring wells, the wells will be physically agitated/surged and redeveloped. Additionally, monitoring wells will be properly decommissioned and/or replaced if an event renders the wells unusable.

Repairs and/or replacement of wells in the monitoring well network will be performed based on assessments of structural integrity and overall performance.

The NYSDEC project manager will be notified prior to any repair or decommissioning of any monitoring well for the purpose of replacement, and the repair or decommissioning and replacement process will be documented in the subsequent Periodic Review Report. Well decommissioning without replacement will be done only with the prior approval of the NYSDEC project manager. Well abandonment will be performed in accordance with NYSDEC's guidance entitled "CP-43: Groundwater Monitoring Well Decommissioning Procedures." Monitoring wells that are decommissioned because they have been rendered unusable will be replaced in kind in the nearest available location, unless otherwise approved by the NYSDEC project manager.

The sampling frequency may only be modified with the approval of the NYSDEC project manager. This SMP will be modified to reflect changes in sampling plans approved by the NYSDEC project manager.

Deliverables for the groundwater monitoring program are specified in Section 7.0 – Reporting Requirements.

4.4.7 Monitoring and Sampling Protocol

All sampling activities will be recorded in a field book and associated sampling log as provided in Appendix F - Site Management Forms. Other observations (e.g., groundwater monitoring well integrity) will be noted on the sampling log. The sampling log will serve as the inspection form for the monitoring network. Additional detail regarding monitoring and sampling protocols are provided in the site-specific Operating Procedures provided as Appendix E of this document.

5.0 Operation and Maintenance Plan

5.1 General

The site remedy does not rely on any mechanical systems, such as groundwater treatment systems, sub-slab depressurization systems or air sparge/soil vapor extraction systems to protect public health and the environment. Therefore, the operation and maintenance of such components is not included in this SMP.

5.2 – TBD – ASD System O&M

6.0 Periodic Assessments/Evaluations

6.1 Climate Change Vulnerability Assessment

Increases in both the severity and frequency of storms/weather events, an increase in sea level elevations along with accompanying flooding impacts, shifting precipitation patterns and wide temperature fluctuation, resulting from global climactic change and instability, have the potential to significantly impact the performance, effectiveness and protectiveness of a given site and associated remedial systems. Vulnerability assessments provide information so that the site and associated remedial systems are prepared for the impacts of the increasing frequency and intensity of severe storms/weather events and associated flooding.

This section provides a current vulnerability assessment that evaluates the vulnerability of the site and/or engineering controls to severe storms/weather events and associated flooding. This section also identifies vulnerability assessment updates that will be conducted for the site in Periodic Review Reports.

The Site is considered to have a very low vulnerability related to climatic conditions.

- Flood Plain: No flood zones are present on the Site.
- Sea Level Rise: The Site is not near a shoreline.
- Site Drainage and Storm Water Management: The future Site Buildings and associated hardscape (sidewalks, roadways, parking areas), will encompass the majority of the Site and will be connected to the City of Buffalo Sewer System.
- Erosion: The Site will be primarily covered by a building and hardscape pavement and is not present in a flood zone; therefore, concerns regarding erosion are minimal.
- High Wind: There are no remedial aspects of the Site that would be affected by high wind. However, power outages caused by downed trees/limbs due to high winds may occur.
- Drought: The annual precipitation in Buffalo NY is approximately 38.1 inches; therefore, drought conditions are unlikely. However, fluctuations in the amount of groundwater present in the wells will likely occur based on the time of year sampling is conducted; therefore, this will be considered when choosing sampling dates.
- Electricity: There are no remedial aspects of the Site that would be affected by power loss and/or dips/surges in voltage during severe weather events, including lightning strikes.
- Spill/Contaminant Release: No areas of the Site have been identified that may be susceptible to a spill other containment release due to storm-related damage caused by flooding, erosion, high winds, loss of power, etc.
- Wildfires: No areas of the Site have been identified that may be susceptible to wildfires.

6.2 Green Remediation Evaluation

NYSDEC's DER-31 Green Remediation requires that green remediation concepts and techniques be considered during all stages of the remedial program including site management, with the goal of improving the sustainability of the cleanup and summarizing the net environmental benefit of any implemented green technology. This section provides an environmental footprint analysis of the remedy, as implemented at the time of this SMP. This section of the SMP also provides a summary of green remediation evaluations to be completed for the site during site management and reported in Periodic Review Reports (PRRs).

If alterations are made to the ICs at the Site, reduced energy consumption, resource usage, waste generation, and water usage, etc. will be included in the PRR.

Additionally, completion of the Climate Screening Checklist- a high-level desktop review of the site and potential changes in climate hazards. If the screening identifies potential exposure to climate hazards, a Climate Vulnerability Assessment (CVA) will need to be conducted. A CVA will identify adaptation measures to account for projected climate hazard exposures. Climate Screenings must be updated during each PRR or any time the remedy or site conditions change to ensure that the remedy remains resilient and protective.

It should be noted that the onsite buildings were constructed in accordance with the NYS Homes and Community Renewal (HCR) – HCR Design Guidelines (HCR.NY.GOV) – Appendix F – Energy and Green Building Requirements, per HCR Sustainability Guidelines.

6.2.1 Timing of Green Remediation Evaluations

For major remedial system components, green remediation evaluations and corresponding modifications will be undertaken as part of a formal Remedial System Optimization (RSO), or at any time that the NYSDEC project manager feels appropriate, (e.g. during significant maintenance events or in conjunction with storm recovery activities).

Modifications resulting from green remediation evaluations will be routinely implemented and scheduled to occur during planned/routine operation and maintenance activities after approval from the DER project manager. Reporting of these modifications will be presented in the PRR.

6.2.2 Building Operations

Structures including buildings and sheds will be operated and maintained to provide for the most efficient operation of the remedy, while minimizing energy, waste generation and water consumption.

The onsite buildings were constructed in accordance with the NYS Homes and Community Renewal (HCR) – HCR Design Guidelines (HCR.NY.GOV) – Appendix F – Energy and Green Building Requirements, per HCR Sustainability Guidelines.

6.2.3 Frequency of System Checks, Sampling and Other Periodic Activities

Transportation to and from the Site, use of consumables in relation to visiting the Site in order to conduct system checks and/or collect samples, and shipping samples to a laboratory for analyses have direct and/or inherent energy costs. The schedule and/or means of these periodic activities have been prepared so that these tasks can be accomplished in a manner that does not impact remedy protectiveness but reduces expenditure of energy or resources.

Consideration shall be given to:

- Reduced sampling frequencies;
- Reduced site visits and system checks;
- Installation of remote sensing/operations and telemetry;
- Bundling routine system operation checks, inspections, periodic sampling and other site management activities with other nearby sites.
- Coordination/consolidation of activities to maximize foreman/labor time; and
- Use of mass transit for site visits, where available, and carpooling.

6.2.4 Metrics and Reporting

As discussed in Section 7.0 and as shown in Appendix F – Site Management Forms, information on energy usage, solid waste generation, transportation and shipping, water usage and land use

and ecosystems will be recorded to facilitate and document consistent implementation of green remediation during site management and to identify corresponding benefits. A set of metrics has been developed and will be evaluated over time to ensure that green remediation actions are achieving the desired results.

6.3 Remedial System Optimization

A Remedial System Optimization (RSO) study will be conducted any time that the NYSDEC project manager or the remedial party requests in writing that an in-depth evaluation of the remedy is needed. An RSO may be appropriate if any of the following occur:

- The remedial actions have not met or are not expected to meet RAOs in the time frame estimated in the Decision Document;
- The management and operation of the remedial system is exceeding the estimated costs;
- The remedial system is not performing as expected or as designed;
- Previously unidentified source material may be suspected;
- Plume shift has potentially occurred;
- Site conditions change due to development, change of use, change in groundwater use, etc.;
- There is an anticipated transfer of the site management to another remedial party or agency; and
- A new and applicable remedial technology becomes available.

An RSO will provide a critique of a site's conceptual model, give a summary of past performance, document current cleanup practices, summarize progress made toward the site's cleanup goals, gather additional performance or media specific data and information and provide recommendations for improvements to enhance the ability of the present system to reach RAOs or to provide a basis for changing the remedial strategy.

7.0. Reporting Requirements

7.1 Site Management Reports

All site management inspection, maintenance and monitoring events will be recorded on the appropriate site management forms provided in Appendix F. These forms are subject to NYSDEC revision. All site management inspection, maintenance, and monitoring events will be conducted by a qualified environmental professional as defined in 6 NYCRR Part 375, a Professional Engineer (PE) who is licensed and registered in New York State, or a qualified person who directly reports to a PE who is licensed and registered in New York State.

All applicable inspection forms and other records, including media sampling data and system maintenance reports, generated for the site during the reporting period will be provided in electronic format to the NYSDEC in accordance with the requirements of Table 15 7 and summarized in the Periodic Review Report.

Table 15: Schedule of Interim Monitoring/Inspection Reports

Task/Report	Reporting Frequency*
Groundwater Monitoring	Annually
Periodic Review Report	Annually, or as otherwise determined by the NYSDEC

* The frequency of events will be conducted as specified until otherwise approved by the NYSDEC project manager.

All interim monitoring/inspections reports will include, at a minimum:

- Date of event or reporting period;
- Name, company, and position of person(s) conducting monitoring/inspection activities;
- Description of the activities performed;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents noted (included either on the checklist/form or on an attached sheet);
- Type of samples collected (e.g., sub-slab vapor, indoor air, outdoor air);
- Copies of all field forms completed (e.g., well sampling logs, chain-of-custody documentation);
- Sampling results in comparison to appropriate standards/criteria;
- A figure illustrating sample type and sampling locations;
- Copies of all laboratory data sheets and the required laboratory data deliverables required for all points sampled (to be submitted electronically in the NYSDEC-identified format);
- Any observations, conclusions, or recommendations; and

- A determination as to whether contaminant conditions have changed since the last reporting event.

Routine maintenance event reporting forms will include, at a minimum:

- Date of event;
- Name, company, and position of person(s) conducting maintenance activities;
- Description of maintenance activities performed;
- Any modifications to the system;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents noted (included either on the checklist/form or on an attached sheet); and
- Other documentation such as copies of invoices for maintenance work, receipts for replacement equipment, etc., (attached to the checklist/form).

Non-routine maintenance event reporting forms will include, at a minimum:

- Date of event;
- Name, company, and position of person(s) conducting non-routine maintenance/repair activities;
- Description of non-routine activities performed;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents (included either on the form or on an attached sheet); and
- Other documentation such as copies of invoices for repair work, receipts for replacement equipment, etc. (attached to the checklist/form).

Data will be reported in digital format as determined by the NYSDEC. Currently, data is to be supplied electronically and submitted to the NYSDEC EQuIS™ database in accordance with the requirements found at this link <http://www.dec.ny.gov/chemical/62440.html>.

7.2 Periodic Review Report

A Periodic Review Report (PRR) will be submitted to the NYSDEC project manager beginning sixteen (16) months after the Certificate of Completion is issued. After submittal of the initial Periodic Review Report, the next PRR shall be submitted annually to the NYSDEC project manager or at another frequency as may be required by the NYSDEC project manager. In the event that the site is subdivided into separate parcels with different ownership, a single Periodic Review Report will be prepared that addresses the site described in Appendix A -Environmental Easement. The report will be prepared in accordance with NYSDEC's DER-10 and submitted within 30 days of the end of each certification period. Media sampling results will also be incorporated into the Periodic Review Report. The report will include:

- Identification, assessment and certification of all ECs/ICs required by the remedy for the site.
- Results of the required annual site inspections, fire inspections and severe condition inspections, if applicable.
- Description of any change of use, import of materials, or excavation that occurred during the certifying period.

- All applicable site management forms and other records generated for the site during the reporting period in the NYSDEC-approved electronic format, if not previously submitted.
- Identification of any wastes generated during the reporting period, along with waste characterization data, manifests, and disposal documentation.
- A summary of any discharge monitoring data and/or information generated during the reporting period, with comments and conclusions.
- Data summary tables and graphical representations of contaminants of concern by media (groundwater.), which include a listing of all compounds analyzed, along with the applicable standards, with all exceedances highlighted. These tables and figures will include a presentation of past data as part of an evaluation of contaminant concentration trends, including but not limited to:
 - Trend monitoring graphs that present groundwater contaminant levels from before the start of the remedy implementation to the most current sampling data;
 - Trend monitoring graphs depicting system influent analytical data on a per event and cumulative basis;
 - O&M data summary tables;
 - A current plume map for sites with remaining groundwater contamination; and
 - A groundwater elevation contour map for each gauging event.
- Results of all analyses, copies of all laboratory data sheets, and the required laboratory data deliverables for all samples collected during the reporting period will be submitted in digital format as determined by the NYSDEC. Currently, data is supplied electronically and submitted to the NYSDEC EQuIS™ database in accordance with the requirements found at this link: <http://www.dec.ny.gov/chemical/62440.html>.
- A site evaluation, which includes the following:
 - The compliance of the remedy with the requirements of the site-specific Remedial Action Work Plan (RAWP), ROD or Decision Document;
 - The operation and the effectiveness of all treatment units, etc., including identification of any needed repairs or modifications;
 - Any new conclusions or observations regarding site contamination based on inspections or data generated by the Monitoring and Sampling Plan for the media being monitored;
 - Recommendations regarding any necessary changes to the remedy and/or Monitoring and Sampling Plan;
 - An update to the climate change vulnerability assessment if site or external conditions have changed since the previous assessment, and recommendations to address vulnerabilities.
 - A summary of the Green Remediation evaluation, including a quantitative and qualitative overview of a site's environmental impacts and recommendations to improve the remedy's environmental footprint. The PRR will include the completed Summary of Green Remediation Metrics form provided in Appendix [x].
 - An evaluation of trends in contaminant levels in the affected media to determine if the remedy continues to be effective in achieving remedial goals as specified by the RAWP, ROD or Decision Document; and
 - The overall performance and effectiveness of the remedy.

7.2.1 Certification of Institutional Controls

Following the last inspection of the reporting period, a qualified environmental professional as defined in 6 NYCRR Part 375 or Professional Engineer licensed to practice and registered in New York State will prepare, and include in the Periodic Review Report, the following certification as per the requirements of NYSDEC DER-10:

"For each institutional or engineering control identified for the site, I certify that all of the following statements are true:

- The inspection of the site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under my direction;*
- The institutional control and/or engineering control employed at this site is unchanged from the date the control was put in place, or last approved by the Department;*
- Nothing has occurred that would impair the ability of the control to protect the public health and environment;*
- Nothing has occurred that would constitute a violation or failure to comply with any site management plan for this control;*
- Access to the site will continue to be provided to the Department to evaluate the remedy, including access to evaluate the continued maintenance of this control;*
- If a financial assurance mechanism is required under the oversight document for the site, the mechanism remains valid and sufficient for the intended purpose under the document;*
- Use of the site is compliant with the environmental easement;*
- The engineering control systems are performing as designed and are effective;*
- To the best of my knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program and generally accepted engineering practices; and*
- The information presented in this report is accurate and complete.*

I certify that all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law. I, [name], of [business address], am certifying as [Owner/Remedial Party or Owner's /Remedial Party's Designated Site Representative.]"

- No new information has come to my attention, including groundwater monitoring data from wells located at the site boundary, if any, to indicate that the assumptions made in the qualitative exposure assessment of off-site contamination are no longer valid; and*
- The assumptions made in the qualitative exposure assessment remain valid.*

The signed certification will be included in the Periodic Review Report.

The Periodic Review Report will be submitted, in electronic format, to the NYSDEC project manager and the NYSDOH project manager. The Periodic Review Report may also need to be submitted in hard-copy format if requested by the NYSDEC project manager.

7.3 Corrective Measures Work Plan

If any component of the remedy is found to have failed, or if the periodic certification cannot be provided due to the failure of an institutional or engineering control or failure to conduct site management activities, a Corrective Measures Work Plan will be submitted to the NYSDEC project

manager for approval. This plan will explain the failure and provide the details and schedule for performing work necessary to correct the failure. Unless an emergency condition exists, no work will be performed pursuant to the Corrective Measures Work Plan until it has been approved by the NYSDEC project manager.

7.4 Remedial System Optimization Report

If an RSO is to be performed (see Section 6.3), upon completion of an RSO, an RSO report must be submitted to the NYSDEC project manager for approval. A general outline for the RSO report is provided in Appendix H. The RSO report will document the research/ investigation and data gathering that was conducted, evaluate the results and facts obtained, present a revised conceptual site model and present recommendations. RSO recommendations are to be implemented upon approval from the NYSDEC. Additional work plans, design documents, HASPs etc., may still be required to implement the recommendations, based upon the actions that need to be taken. A final engineering report and update to the SMP may also be required.

The RSO report will be submitted, in electronic format, to the NYSDEC project manager and the NYSDOH project manager.

8.0 References

6 NYCRR Part 375, Environmental Remediation Programs. December 14, 2006.

NYSDEC DER-10 – “Technical Guidance for Site Investigation and Remediation”.

NYSDEC, 1998. Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1. June 1998 (April 2000 addendum).

NYSDEC, Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC’s Part 375 Remedial Programs. November 2022.

New York State Department of Health, “Guidance for Evaluating Soil Vapor Intrusion in the State of New York”. October 2006 and subsequent updates.

Phase I Environmental Site Assessment (ESA) prepared by Benchmark Environmental Engineering and Geology, P.C., dated September 2020.

Limited Phase II Environmental Investigation prepared by Benchmark Environmental Engineering and Geology, P.C., dated March 2021.

RI/IRM/AA Work Plan prepared by Benchmark Environmental Engineering and Geology, P.C./TurnKey Environmental Restoration, LLC, dated December 2021, revised September 2022.

Phase I ESA prepared by Roux Environmental Engineering and Geology, D.P.C., dated October 2023.

Limited Phase II Environmental Investigation prepared by Roux Environmental Engineering and Geology, D.P.C., dated October 2023.

Groundwater Interim Remedial Measures (GWIRM) Work Plan by Roux Environmental Engineering and Geology, D.P.C., dated December 2024.

RI/IRM/AA Report prepared by Roux Environmental Engineering and Geology, D.P.C., dated February 2026.

Groundwater Injection Work Plan by Roux Environmental Engineering and Geology, D.P.C., dated March 2026, revised April 2026.

TABLES

1. Notifications (Within Text in Section 1.3)
2. Summary of Monitoring Well Elevations & Construction Details
3. Summary of Groundwater Sample Analytical Results
4. Summary of Utility Pole IRM Post-Excavation Results
5. Summary of Hydraulic Lifts 1+2 IRM Post-Excavation Results
6. Summary of Night Club IRM Post-Excavation Results
7. Summary of Tank 1 Area Post-Excavation Results
8. Summary of Tank 2 Area Post-Excavation Results
9. Summary of Three-Story Building Post-Excavation Results
10. Summary of Tank 3 Area Post-Excavation Results
11. Summary of Auto Repair Area Post-Excavation Results
12. Summary of Tank 4 Area Post-Excavation Results
13. Summary of Post-Remediation Sampling Requirements & Schedule (Within Text in Section 4.4)
14. Inspection, Monitoring and Sampling Schedule
15. Schedule of Interim Monitoring/Inspection Reports (Within Text in Section 7.1)



TABLE 2

**MONITORING WELL ELEVATIONS & CONSTRUCTION DETAILS
SITE MANAGEMENT PLAN
1681-1689 MAIN STREET SITE
BCP SITE NO. C915378
BUFFALO, NEW YORK**

Well Identification			Well Elevations								Well Diameter (inches)	Well Screen Data						
Well Number*	Well Type	Date Completed	TOR Elevation (ft)	Stick up Height (ft)	Ground Elevation (ft)	Total Depth (fbTOR)	Bottom of Well Elevation (fmsl)	Depth to Groundwater (fbTOR)	Depth to Groundwater (fbgs)	Groundwater Elevation (ft)		Length of Well Screen (feet)	Screen Interval (fmsl)		Screen Interval (fbTOR)			
MW-3	OB	07/15/2026	631.47	5.92	625.55	23.00	608.47	17.06	11.14	614.41	2	5	613.47	to	608.47	18.00	to	23.00
MW-4	OB	04/27/2026	628.32	2.11	626.21	19.85	608.47	10.39	8.28	617.93	2	5	613.47	to	608.47	14.85	to	19.85
MW-5R	OB	04/27/2026	633.54	4.75	628.79	25.22	608.32	15.70	10.95	617.84	2	5	613.32	to	608.32	20.22	to	25.22
MW-6	OB	04/27/2026	629.30	0.00	629.30	19.15	610.15	10.91	10.91	618.39	2	5	615.15	to	610.15	14.15	to	19.15
TW-1	OB	04/27/2026	630.70	4.01	626.69	25.11	605.59	12.83	8.82	617.87	2	5	610.59	to	605.59	20.11	to	25.11
TW-2	OB	04/27/2026	629.50	0.00	629.50	21.25	608.25	11.76	11.76	617.74	2	5	613.25	to	608.25	16.25	to	21.25
TW-3	OB	04/27/2026	633.35	3.15	630.20	25.20	608.15	15.02	11.87	618.33	2	5	613.15	to	608.15	20.20	to	25.20
TW-4R	OB	04/27/2026	627.59	-0.60	628.19	22.00	605.59	9.50	10.10	618.09	2	5	610.59	to	605.59	17.00	to	22.00

Abbreviations:

DTW = depth to water

fbgs = feet below ground surface

fbTOR = feet below top of riser

fmsl = feet above mean sea level

OB = Indicates a well completed in shallow unconsolidated overburden

TOR = top of riser



TABLE 3
SUMMARY OF GROUNDWATER IRM ANALYTICAL RESULTS
SITE MANAGEMENT PLAN
1681-1689 MAIN STREET SITE
BCP SITE NO. C915378
BUFFALO, NEW YORK

Parameters ¹	Class GA GWQS/GV ^{2,3}	MW-1/1R		MW-2			MW-3					MW-4							
		4/1/2024	7/15/2025	4/1/2024	5/23/2024	7/15/2025	4/1/2024	5/23/2024	7/15/2025	4/21/2026	6/29/2026	4/1/2024	5/23/2024	3/10/2025	5/6/2025	7/14/2025	10/30/2025	4/21/2026	6/29/2026
		RI	Post-Injection 1	RI	Post-Injection 1	Post-Injection 1	RI	Post-Injection 1	Pre-Injection 2	Post-Injection 2	RI	Pre-Injection	Injection	Post-Injection	Pre-Injection 2	Post-Injection 2			
1,1-Dichloroethene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone	50	ND	ND	ND	ND	ND	ND	14	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	5	ND	ND	1.8 J	1.4 J	1.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.58 J	0.40 J	ND
1,2-Dichloroethane	0.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.15 J	ND	0.14 J	ND	ND	ND	ND
Acetone	50	ND	170	ND	5.4	ND	54	24	ND	ND	ND	4.6 J	ND	5.6	ND	6.2 J	ND	ND	ND
Benzene	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.6	0.27 J	ND	ND	ND	ND	ND	ND
Bromomethane	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.75 J	ND	ND	ND	ND	ND
Carbon disulfide	60	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloromethane	5	ND	7.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cyclohexane	--	ND	ND	ND	1.2 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl tert butyl ether (MTBE)	10	ND	ND	2.7	2.5	2.5	ND	ND	ND	ND	ND	4.1	1.3 J	2 J	0.44 J	ND	ND	ND	ND
Methyl cyclohexane	--	ND	ND	ND	1.3 J	ND	ND	1.3 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	11	1.2 J	ND	0.75 J	ND	ND	ND	ND
Toluene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,2-Dichloroethene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.5	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.7	1	0.18 J	0.40 J	ND	ND	ND	ND
Vinyl Chloride	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.6 J	0.22 J	0.16 J	0.1 J	ND	ND	ND	ND
Total VOCs	--	ND	ND	4.5	11.8	4.2	54	39.3	ND	ND	ND	27.25	3.99	8.08	2.44	6.2	0.58	0.4	ND
Total TICs	--	ND	--	ND	1.01	--	1.85	ND	--	--	--	ND	ND	ND	--	--	--	--	--

Notes:
1. Only parameters detected at a minimum of one sample location are presented in this table; all other compounds were reported as non-detected.
2. Values per NYSDEC TOGS 1.1.1 Class GA Groundwater Quality Standards/Guidance Values (GWQS/GV).
Qualifiers:
ND = Parameter not detected above laboratory detection limit.
-- = No GWQS/GV or NYSDEC Action Level available, or parameter not analyzed for.
F = The ratio of quantifier ion response to qualifier ion response falls outside of the laboratory criteria. Results are considered to be an estimated maximum concentration.
I = The lower value for the two columns has been reported due to obvious interference.
J = Estimated Value - Below calibration range.
P = The RPD between the results for the two columns exceeds the method-specified criteria.
BOLD = Result exceeds GWQS/GV



TABLE 3
SUMMARY OF GROUNDWATER IRM ANALYTICAL RESULTS
SITE MANAGEMENT PLAN
1681-1689 MAIN STREET SITE
BCP SITE NO. C915378
BUFFALO, NEW YORK

Parameters ¹	Class GA GWQS/GV ^{2,3}	Sample Location																								
		MW-5/SR						MW-6								MW-7				TW-1						
		4/4/2024	7/10/2024	3/6/2025	7/15/2025	4/21/2026	6/29/2026	4/4/2024	7/10/2024	3/10/2025	5/6/2025	10/31/2025	4/21/2026	6/29/2026	4/4/2024	7/10/2024	7/14/2025	3/6/2025	5/6/2025	7/14/2025	11/6/2025	4/21/2026	6/29/2026			
		RI		Pre-Injection	Post-Injection	Pre-Injection 2	Post-Injection 2		RI		Pre-Injection 1	Injection 1		Post-Injection 1	Pre-Injection 2	Post-Injection 2		RI		Post-Injection 1	Pre-Injection	Injection		Post-Injection 1	Pre-Injection 2	Post-Injection 2
Volatile Organic Compounds (VOCs) - ug/L																										
1,1-Dichloroethene	5	ND	ND	ND	ND	ND	ND	ND	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.2 JD	1.6 J	ND	0.52 J	ND	ND
2-Butanone	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.6 J	ND	ND	ND	ND	ND	ND	ND	ND	
1,1-Dichloroethane	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1	ND	ND	ND	ND	ND	ND	ND	ND	40	ND	ND	ND	
1,2-Dichloroethane	0.6	0.2 J	ND	0.25 J	ND	ND	ND	ND	ND	2.4	2.1	1.6	ND	0.88 J	0.87 J	ND	ND	ND	ND	26	ND	8	8.2	9.5	ND	
Acetone	50	4.5 J	ND	17	ND	ND	ND	ND	ND	4.5 J	24	7 J	ND	ND	ND	31	3.3 J	ND	ND	ND	3.6 J	ND	ND	ND	ND	
Benzene	1	0.29 J	0.18 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	28 D	7.8 D	ND	33	13	0.59 J	ND	
Bromomethane	5	ND	6.4	ND	ND	ND	ND	ND	ND	0.7 J	ND	ND	ND	ND	ND	ND	ND	ND	3.7 J	ND	ND	ND	ND	ND	ND	
Carbon disulfide	60	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	8 D	ND	ND	ND	ND	ND	ND	
Chloromethane	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Cyclohexane	--	0.65 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Methyl tert butyl ether (MTBE)	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.4 J	ND	ND	ND	
Methyl cyclohexane	--	1.1 J	ND	ND	ND	ND	ND	ND	ND	1.7 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
cis-1,2-Dichloroethene	5	ND	ND	ND	ND	ND	ND	1,300	1,600	46	7.6	3.9	ND	1.1	1.4	ND	ND	2000 D	480 D	330	280 D	360	10	ND	ND	
Toluene	5	0.71 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
trans-1,2-Dichloroethene	5	ND	ND	ND	ND	ND	ND	49 J	53	4.1 J	1.0 J	ND	ND	ND	ND	ND	ND	ND	31	22	29 D	25	ND	ND		
Trichloroethene	5	7.2	9.1	0.96	0.77 J	0.78 J	0.89 J	3,300	3,000	230	80	13	6.1	6.1	3.8	1.6	0.92	ND	41 D	720 D	550	270 D	380	15	ND	
Vinyl Chloride	2	ND	ND	ND	ND	ND	ND	79	94	4.2	0.26 J	ND	ND	ND	ND	ND	ND	ND	100 D	28	28	48 D	51	1.8	ND	
Total VOCs	--	14.65	15.68	18.21	0.77	0.78	0.89	4728	4757	292.9	115.65	25.5	7.1	8.08	6.07	32.6	7.82	2173.2	1430.7	970	673.52	837.2	36.89	1.8	ND	
Total TICs	--	4.89 J	15.1 J	--	--	--	--	ND	ND	ND	--	--	--	--	--	1.23 J	1.5 J	--	--	--	--	--	--	--	ND	

Notes:
1. Only parameters detected at a minimum of one sam;
2. Values per NYSDEC TOGS 1.1.1 Class GA Ground

Qualifiers:
ND = Parameter not detected above laboratory detector
-- = No GWQSGV or NYSDEC Action Level available.
F = The ratio of quantifier ion response to qualifier ion r
I = The lower value for the two columns has been repor
J = Estimated Value - Below calibration range.
P = The RPD between the results for the two columns i

BOLD = Result exceeds i



TABLE 3
SUMMARY OF GROUNDWATER IRM ANALYTICAL RESULTS
SITE MANAGEMENT PLAN
1681-1689 MAIN STREET SITE
BCP SITE NO. C915378
BUFFALO, NEW YORK

Parameters ¹	Class GA GWQS/GV ^{2,3}	TW-2					TW-3					TW-4/4R				
		3/6/2025	7/14/2025	11/6/2025	4/21/2026	6/29/2026	3/6/2025	7/14/2025	10/30/2025	4/21/2026	6/29/2026	8/6/2025	7/14/2025	10/30/2025	4/27/2026	6/29/2026
		Pre-Injection	Post-Injection		Pre-Injection 2	Post-Injection 2	Pre-Injection	Post-Injection		Pre-Injection 2	Post-Injection 2	Injection	Post-Injection		Pre-Injection 2	Post-Injection 2
1,1-Dichloroethene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.45 J	ND	0.35 J	ND	ND
2-Butanone	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.3 J	2 J
1,1-Dichloroethane	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	0.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetone	50	63	260	ND	ND	ND	43	8.2 J	ND	ND	ND	3.8 J	ND	ND	ND	ND
Benzene	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33 J	ND	ND	ND	ND
Bromomethane	5	ND	0.86 J	ND	ND	ND	ND	ND	ND	ND	ND	0.79 J	ND	ND	ND	ND
Carbon disulfide	60	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.31 J
Chloromethane	5	ND	4.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cyclohexane	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl tert butyl ether (MTBE)	10	ND	ND	ND	ND	0.33 J	ND	ND	ND	ND	ND	ND	ND	ND	2.4	ND
Methyl cyclohexane	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	12	8	8.7	11	7.5
Toluene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,2-Dichloroethene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	23	15	16	24	17
Trichloroethene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	13	49	20	8.5	16
Vinyl Chloride	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.44 J	ND	ND	ND	ND
Total VOCs	--	63	265.16	ND	ND	ND	43	8.2	ND	ND	ND	76.81	72	45.05	48.2	42.81
Total TICs	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Notes:
1. Only parameters detected at a minimum of one samg
2. Values per NYSDEC TOGS 1.1.1 Class GA Ground

Qualifiers:
ND = Parameter not detected above laboratory detection
-- = No GWQS/GV or NYSDEC Action Level available.
F = The ratio of quantifier ion response to qualifier ion r
J = The lower value for the two columns has been repor
J = Estimated Value - Below calibration range.
P = The RPD between the results for the two columns
BOLD = Result exceeds t



TABLE 4
SUMMARY OF UTILITY POLE IRM POST EXCAVATION SOIL/FILL ANALYTICAL RESULTS

SITE MANAGEMENT PLAN
1681-1689 MAIN STREET SITE
BCP SITE NO. C915378
BUFFALO, NEW YORK

Parameter ¹	Unrestricted Use SCOs ²	Sub-Surface Soil Sample Locations												
		B-4 (6')	B-5 (6')	B-6/6r ⁴ (6-7')	B-7 (7')	B-8 (7')	B-9 (2-3')	EW-1 (1-2')	NW-4 (4-6')	NW-5 (3-4')	NW-6 (3-4')	NW-7 (4-6')	NW-8 (4-6')	NW-9 (1-2')
		3/5/24	1/18/24		3/4/24		1/18/24		3/5/24	1/18/24		3/4/24		1/18/24
Polycyclic Aromatic Hydrocarbons (PAHs) - mg/kg														
PAHs Were not detected at concentrations above laboratory detection limits														
Metals - mg/kg														
Aluminum	--	7300	9670	13600	8100	7460	9710	9040	13000	15700	18700	8190	9440	15400
Antimony	--	ND	ND	0.349 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	13	2.57	5.33	11.1	4.43	3.78	5.01	4.44	6.65	7.72	9	2.07 J	4.8	6.32
Barium	350	73.8	86.7	107	81.2	66.4	86.2	83.9	123	130	126	79.8	85.4	127
Beryllium	7.2	0.335 J	0.474	0.694	0.393 J	0.369 J	0.446 J	0.437 J	0.654 J	0.762	0.927	0.405 J	0.512	0.762
Calcium	--	78400	64700	50000	72500	75200	73400	69900	53300	49500	9320	82900	76600	40800
Chromium	30	12.4	16.2	23.2	12.4	11.4	16.3	15.7	20	24.1	28.3	15	14.4	24.8
Cobalt	--	6.15	11.3	11.1	6.29	5.91	9.92	8.36	9.38	12.2	16.5	4.89	9.01	14.8
Copper	50	15.5	16.3	22.8	14.3	13.5	14.8	14.4	20.3	23.4	20.7	10.7	19.1	21.3
Iron	--	16600	18800	25800	16600	15400	18600	17700	24800	26600	37200	16200	19900	27000
Lead	63	16	16.4	16.8	13.8	13.1	16.7	15.9	10.7 J	14.1	15.6	14.5	14.7	12.3
Magnesium	--	29900	24000	18400	26000	26500	26300	23800	17100	16700	11600	28300	24200	13700
Manganese	1,600	459	560	344	460	456	496	419	417	486	460	426	585	532
Nickel	30	12.6	23.4	15.4	16.2	13.2	21.2	18.7	25.2	31.4	36	14.2	20.4	33.2
Potassium	--	1340	1390	1940	1440	1300	1550	1380	1430	1820	2110	1010	994	1860
Selenium	3.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sodium	--	194 J	195	224	189 J	166 J	192	151 J	206 J	179 J	165 J	160 J	139 J	194 J
Thallium	--	ND	0.311 J	ND	ND	0.756 J	ND	ND	ND	ND	ND	ND	ND	0.386 J
Vanadium	--	20	23.3	33.2	18.5	17.9	23	21.4	26.3	30.4	37.6	16.8	21.6	32.6
Zinc	109	64.4	68.6	83.6	62.1	60.4	69.6	70.4	62.2	89.4	76.4	64.9	63.4	75.7
Mercury	0.18	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Notes:

1. Only those parameters detected at a minimum of one sample location are presented in this table; all other compounds were reported as non-detect.
2. Values per NYSDEC Part 375 Soil Cleanup Objectives (SCOs) .
3. Sample results were reported by the laboratory in micograms per kilogram (ug/kg) and converted to milligram per kilogram (mg/kg) for comparison to SCOs.
4. Area overcut and resampled to achieve USCOS for nickel (B-6r).

Definitions:

- ND = Parameter not detected above laboratory detection limit.
 NA = Sample not analyzed for parameter.
 "--" = No SCO available.
 J = Estimated value; result is less than the sample quantitation limit but greater than zero.
 F1 = MS and/or MSD Recovery is outside acceptance limits.
 F2 = MS/MSD RPD exceeds control limits.

 = Result exceeds Unrestricted Use SCOs



TABLE 5
SUMMARY OF HYDRAULIC LIFTS 1 & 2 AREA IRM POST EXCAVATION SOIL/FILL ANALYTICAL RESULTS

SITE MANAGEMENT PLAN
1681-1689 MAIN STREET SITE
BCP SITE NO. C915378
BUFFALO, NEW YORK

Parameter ¹	Unrestricted Use SCOs ²	Sub-Surface Soil Sample Locations							
		HL 1+2 B-1 (12.5')	HL 1+2 NW-1 (8-10')	HL 1+2 SW-1 (8-10')	HL 1+2 EW-1 ⁴ (8-10')	HL 1+2 WW-1 (8-10')	HL 1+2 PIPE 1 (4')	HL 1+2 PIPE 2 (4')	HL 1+2 PIPE 3 (5.5')
		4/9/24					4/11/24		
Volatile Organic Compounds (VOCs) - mg/kg									
1,1,1-Trichloroethane	0.68	ND	ND	ND	ND	0.00082	ND	ND	ND
1,1-Dichloroethane	0.27	0.00062 J	0.0006 J	ND	ND	0.00043 J	ND	ND	ND
1,2-Dichlorobenzene	1.1	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	0.02	0.0024	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	--	0.00019 J	ND	0.00065 J	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	1.8	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	3.6	ND	ND	ND	0.0051 J	ND	ND	ND	ND
1,3,5-Trimethylbenzene	8.4	ND	ND	ND	ND	ND	ND	ND	ND
Acetone	0.05	0.0079 J	0.0091 J	0.0075 J	ND	0.0052 J	ND	ND	ND
Ethylbenzene	1	ND	ND	ND	ND	ND	ND	ND	ND
Isopropylbenzene (Cumene)	--	ND	ND	ND	ND	ND	ND	ND	ND
Methylcyclohexane	--	ND	ND	ND	ND	ND	ND	ND	ND
n-Butylbenzene	12	ND	ND	ND	ND	ND	ND	ND	ND
n-Propylbenzene	3.9	ND	ND	ND	ND	ND	ND	ND	ND
p-Isopropyltoluene	--	ND	ND	ND	ND	ND	ND	ND	ND
Xylenes, Total	0.26	ND	ND	ND	ND	ND	ND	ND	ND
Semivolatile Organic Compounds (SVOCs) - mg/kg									
2-Methylnaphthalene	--	ND	ND	ND	0.5	ND	ND	ND	ND
Metals - mg/kg									
Aluminum	--	6320	7270	9730	8440	7240	--	--	--
Antimony	--	ND	ND	ND	0.976 J	ND	--	--	--
Arsenic	13	2.87	3.26	5.03	6.61	2.85	--	--	--
Barium	350	64.5	81.8	100	87.8	69.4	--	--	--
Beryllium	7.2	0.299 J	0.349 J	0.474 J	0.413 J	0.359 J	--	--	--
Cadmium	2.5	ND	ND	ND	ND	ND	--	--	--
Calcium	--	69800	74400	76300	79800	73500	--	--	--
Chromium	30	10.8	12	15.2	13.3	11.8	--	--	--
Cobalt	--	5.49	5.96	7.99	6.5	5.89	--	--	--
Copper	50	13.9	14.6	17.4	15.6	14	--	--	--
Iron	--	13700	15600	19700	17700	15300	--	--	--
Lead	63	13.1	13.7	13.6	14.6	13.3	--	--	--
Magnesium	--	29300	29500	28000	31400	28800	--	--	--
Manganese	1,600	412	451	514	444	442	--	--	--
Nickel	30	12.6	14	18.7	15.7	13.7	--	--	--
Potassium	--	1240	1370	1710	1580	1350	--	--	--
Selenium	3.9	ND	ND	ND	ND	ND	--	--	--
Silver	2	ND	ND	ND	ND	ND	--	--	--
Sodium	--	197 J	194 J	211 J	216 J	193 J	--	--	--
Thallium	--	ND	ND	ND	ND	ND	--	--	--
Vanadium	--	17	18.2	21.7	19.9	18.2	--	--	--
Zinc	109	62.7	64.7	67	61.5	65	--	--	--
Mercury	0.18	ND	ND	ND	ND	ND	--	--	--

Notes:

1. Only those parameters detected at a minimum of one sample location are presented in this table; all other compounds were reported as non-detect.

2. Values per NYSDEC Part 375 Soil Cleanup Objectives (SCOs) .

3. Sample results were reported by the laboratory in micrograms per kilogram (ug/kg) and converted to milligram per kilogram (mg/kg) for comparison to SCOs.

4. Area overcut to property boundary and resampled to achieve USCOs for VOCs.

Definitions:

ND = Parameter not detected above laboratory detection limit.

"--" = No SCO available.

J = Estimated value; result is less than the sample quantitation limit but greater than zero.

= Result exceeds Unrestricted Use SCOs



TABLE 6
SUMMARY OF FORMER NIGHT CLUB AREA IRM POST EXCAVATION SOIL/FILL ANALYTICAL RESULTS

SITE MANAGEMENT PLAN
1681-1689 MAIN STREET SITE
BCP SITE NO. C915378
BUFFALO, NEW YORK

Parameter ¹	Unrestricted Use SCOs ²															
		NC B-1 (5.5')	NC B-2 (5.5')	NC B-3 (5.5')	NC B-4 (5.5')	NC B-5 (4')	NC B-6 (4')	NC B-7 (4')	NC B-8 (4')	NC B-9 (4')	NC B-10 (4')	NC B-11 (4')	NC B-12 (4')	NC B-13 (4')		
		4/10/24						4/11/24			4/12/24					
Polycyclic Aromatic Hydrocarbons (PAHs) - mg/kg																
2-Methylnaphthalene	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.041 J	ND	ND
Anthracene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.054 J	ND	ND
Benzo(a)anthracene	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.084 J	ND	ND
Benzo(a)pyrene	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.07 J	ND	ND
Benzo(b)fluoranthene	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.089 J	ND	ND
Benzo(g,h,i)perylene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.036 J	ND	ND
Benzo(k)fluoranthene	0.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-ethylhexyl) phthalate	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbazole	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.03 J	ND	ND
Chrysene	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.074 J	ND	ND
Dibenzo(a,h)anthracene	0.33	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzofuran	7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.019 J	ND	ND
Fluoranthene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2	ND	ND
Fluorene	30	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.031 J	ND	ND
Indeno(1,2,3-cd)pyrene	0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.036 J	ND	ND
Naphthalene	12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.039 J	ND	ND	ND	ND
Phenanthrene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.17	ND	ND
Pyrene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.15	ND	ND
Metals - mg/kg																
Arsenic	13	3.88	2.67	4.15	4.02	5.18	6.06	5	4.65	4.24	6.06	3.82	4.66	4.98		
Barium	350	78.9	91.8	90.2	87.9	103	144	116	57.8	87.8	130	87.1	72.2	91.3		
Cadmium	2.5	ND	0.091 J	ND	ND	ND	ND	0.168 J	0.14 J	0.137 J	0.112 J	0.091 J	0.126 J	0.109 J		
Chromium	30	13.2	14.6	14.8	13.3	14.8	16	14.8	13.9	14.1	21.4	13.1	13	13.8		
Lead	63	13.6	16	16.4	15.9	19	15.3	18.5	17.3	19.1	20.4	39.6	16.3	16.1		
Selenium	3.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mercury	0.18	ND	ND	ND	ND	0.066 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Notes:

1. Only those parameters detected at a minimum of one sample location are presented in this table; all other compounds were reported as non-detect.
2. Values per NYSDEC Part 375 Soil Cleanup Objectives (SCOs) .
3. Sample results were reported by the laboratory in micrograms per kilogram (ug/kg) and converted to milligram per kilogram (mg/kg) for comparison to SCOs.

Definitions:

ND = Parameter not detected above laboratory detection limit.
NA = Sample not analyzed for parameter.
"--" = No SCO available.
J = Estimated value; result is less than the sample quantitation limit but greater than zero.
F1 = MS and/or MSD Recovery is outside acceptance limits.
F2 = MS/MSD RPD exceeds control limits.

= Result exceeds Unrestricted Use SCOs



TABLE 6
SUMMARY OF FORMER NIGHT CLUB AREA IRM POST EXCAVATION SOIL/FILL ANALYTICAL RESULTS
SITE MANAGEMENT PLAN
1681-1689 MAIN STREET SITE
BCP SITE NO. C915378
BUFFALO, NEW YORK

Parameter ¹	Unrestricted Use SCOs ²	NC B-14 (4')	NC B-15 (4')	NC B-16 (4')	NC B-17 (4')	NC B-18 (4')	NC B-19 (4')	NC B-20 (4')	NC B-21 (4')	NC B-22 (4')	NC B-23 (4')	NC B-24 (4')	NC NW-1 (2-3')	NC NW-2 (2-3')
		5/2/24										5/10/24		5/6/24
Polycyclic Aromatic Hydrocarbons (PAHs) - mg/kg														
2-Methylnaphthalene	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	1	ND	0.054 J	ND	ND	ND	ND	ND	0.041 J	ND	ND	ND	0.047 J	ND
Benzo(a)pyrene	1	ND	0.052 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	1	ND	0.058 J	ND	ND	ND	ND	ND	0.047 J	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	100	ND	0.035 J	ND	ND	ND	ND	ND	0.025 J	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	0.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-ethylhexyl) phthalate	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.11 J	0.1 J	ND	ND
Carbazole	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	1	ND	0.047 J	ND	ND	ND	ND	ND	0.037 J	ND	ND	ND	0.042 J	ND
Dibenzo(a,h)anthracene	0.33	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzofuran	7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	100	ND	0.14	0.027 J	ND	ND	ND	ND	0.083 J	ND	ND	ND	0.076 J	ND
Fluorene	30	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	0.5	ND	0.033 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	100	ND	0.069 J	ND	ND	ND	ND	ND	0.056 J	ND	ND	ND	0.09 J	ND
Pyrene	100	ND	0.12	0.021 J	ND	ND	ND	ND	0.065 J	ND	ND	ND	0.11 J	ND
Metals - mg/kg														
Arsenic	13	4.83	4.98	4.01	3.94	4.95	3.46	5.06	4.59	4.95	4.41	4.24	2.22	4.48
Barium	350	106	107	85.7	92	80	70.7	98.6	105	74	74.4	67.2	82.6	133
Cadmium	2.5	0.116 J	0.154 J	0.136 J	0.128 J	0.14 J	0.131 J	0.131 J	0.147 J	0.138 J	0.118 J	0.102 J	0.139 J	0.427 J
Chromium	30	14.8	14.2	14	13.8	14.3	12.1	15.6	13.5	12.7	12.5	12.1	13.2	20.8
Lead	63	15.4	30.3	22.2	14.7	20.2	13.9	21.7	20.1	16	17.7	14.2	14.7	54.9
Selenium	3.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mercury	0.18	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.06 J

Notes:

1. Only those parameters detected at a minimum of one sample lo
2. Values per NYSDEC Part 375 Soil Cleanup Objectives (SCOs)
3. Sample results were reported by the laboratory in micrograms pe

Definitions:

ND = Parameter not detected above laboratory detection limit.
NA = Sample not analyzed for parameter.
"--" = No SCO available.
J = Estimated value; result is less than the sample quantitation limit
F1 = MS and/or MSD Recovery is outside acceptance limits.
F2 = MS/MSD RPD exceeds control limits.

= Result exceed



TABLE 6
SUMMARY OF FORMER NIGHT CLUB AREA IRM POST EXCAVATION SOIL/FILL ANALYTICAL RESULTS
SITE MANAGEMENT PLAN
1681-1689 MAIN STREET SITE
BCP SITE NO. C915378
BUFFALO, NEW YORK

Parameter ¹	Unrestricted Use SCOs ²	NC NW-3 (2-3')	NC NW-4 (2-3')	NC SW-1 (3-4')	NC SW-2 (3-4')	NC SW-3 (2-3')	NC SW-4 (2-3')	NC SW-5 (2-3')	NC SW-6 (2-3')	NC SW-7 (2-3')	NC SW-8 (2-3')	NC EW-1 (3-4')	NC EW-2 (3-4')	NC EW-3 (3-4')	NC EW-4 (3-4')
		4/11/24			4/10/24		4/11/24	5/2/24		5/10/24	5/17/24	4/10/24		4/12/24	
Polycyclic Aromatic Hydrocarbons (PAHs) - mg/kg															
2-Methylnaphthalene	--	ND	ND	ND	ND	ND	ND	ND	ND	0.051 J	ND	ND	ND	ND	ND
Acenaphthene	20	ND	ND	ND	ND	ND	ND	ND	ND	0.53	0.069 J	ND	ND	ND	ND
Anthracene	100	ND	ND	ND	ND	ND	ND	ND	ND	1.1	0.12	ND	ND	ND	ND
Benzo(a)anthracene	1	ND	ND	ND	ND	ND	ND	ND	0.072 J	2.6	0.24	ND	ND	ND	ND
Benzo(a)pyrene	1	ND	ND	ND	ND	ND	ND	ND	0.065 J	2.3	0.24	ND	ND	ND	ND
Benzo(b)fluoranthene	1	ND	ND	ND	ND	ND	ND	ND	0.081 J	3.1	0.3	ND	ND	ND	ND
Benzo(g,h,i)perylene	100	ND	ND	ND	ND	ND	ND	ND	0.04 J	1.2	0.16	ND	ND	ND	ND
Benzo(k)fluoranthene	0.8	ND	ND	ND	ND	ND	ND	ND	ND	1.1	0.12	ND	ND	ND	ND
Bis(2-ethylhexyl) phthalate	--	ND	ND	ND	ND	ND	ND	ND	ND	0.14 J	ND	ND	0.065 J	0.083 J	ND
Carbazole	--	ND	ND	ND	ND	ND	ND	ND	ND	0.33	0.054 J	ND	ND	ND	ND
Chrysene	1	ND	ND	ND	ND	ND	ND	ND	0.063 J	2.6	0.25	ND	ND	ND	ND
Dibenzo(a,h)anthracene	0.33	ND	ND	ND	ND	ND	ND	ND	ND	0.35	0.034 J	ND	ND	ND	ND
Dibenzofuran	7	ND	ND	ND	ND	ND	ND	ND	ND	0.19 J	0.021 J	ND	ND	ND	ND
Fluoranthene	100	ND	ND	0.025 J	0.035 J	ND	ND	ND	0.14	5.1	0.68	ND	ND	ND	ND
Fluorene	30	ND	ND	ND	ND	ND	ND	ND	ND	0.36	0.051 J	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	0.5	ND	ND	ND	ND	ND	ND	ND	0.038 J	1.3	0.14 J	ND	ND	ND	ND
Naphthalene	12	ND	ND	ND	ND	ND	ND	ND	ND	0.057 J	0.025 J	ND	ND	ND	ND
Phenanthrene	100	ND	ND	ND	0.029 J	ND	ND	ND	0.12	3	0.52	ND	ND	ND	ND
Pyrene	100	ND	ND	0.019 J	0.025 J	ND	ND	ND	0.11	4	0.54	ND	ND	ND	ND
Metals - mg/kg															
Arsenic	13	6.95	8.23	4.08	9.03	5.35	4.39	5.26	5.98	9.2	4.03	3.46	4.79	5.75	6.5
Barium	350	126	173	92.6	160	95.4	253	138	98.2	118	66.9	89.1	92.7	161	135
Cadmium	2.5	ND	0.143 J	ND	ND	ND	ND	0.109	ND	0.239 J	0.159 J	ND	ND	0.125 J	0.154 J
Chromium	30	20.6	26.2	16.1	24.7	18.9	31.3	21.2	18	19.2	12.1	13.7	14.2	26.6	22.4
Lead	63	14.5	18.5	15	20.1	23.7	17	10.8	25.7	212	25	15	15.2	13.7	25.5
Selenium	3.9	ND	ND	ND	ND	0.332 J	ND	ND	ND	ND	0.344 J	ND	ND	ND	ND
Silver	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mercury	0.18	ND	ND	ND	ND	ND	ND	ND	ND	0.138	0.076	ND	ND	ND	ND

Notes:

- Only those parameters detected at a minimum of one sample lo
- Values per NYSDEC Part 375 Soil Cleanup Objectives (SCOs)
- Sample results were reported by the laboratory in micrograms pe

Definitions:

ND = Parameter not detected above laboratory detection limit.
NA = Sample not analyzed for parameter.
"--" = No SCO available.
J = Estimated value; result is less than the sample quantitation limit
F1 = MS and/or MSD Recovery is outside acceptance limits.
F2 = MS/MSD RPD exceeds control limits.

= Result exceed



TABLE 7
SUMMARY OF TANK 1 IRM POST EXCAVATION SOIL/FILL ANALYTICAL RESULTS

SITE MANAGEMENT PLAN
1681-1689 MAIN STREET SITE
BCP SITE NO. C915378
BUFFALO, NEW YORK

Parameter ¹	Unrestricted Use SCOs ²	Sub-Surface Soil Sample Locations												
		B-1 (18.5')	B-2 (17')	B-3 (17')	B-4 (17')	NW-1 (12-15')	NW-2 (12-15')	SW-1 (13-15')	SW-2 (12-15')	EW-1 (12-15')	EW-2 (12-15')	WW-1 (12-15')	WW-2 (12-15')	
		4/16/24	5/2/24					4/16/24	5/2/24					
Volatile Organic Compounds (VOCs) - mg/kg														
1,2,4-Trimethylbenzene	3.6	0.018	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
1,3,5-Trimethylbenzene		0.008	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
4-Isopropyltoluene	--	0.00031 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Acetone	0.05	0.0069 J	0.0054 J	ND	ND	ND	ND	ND	0.0056 J	ND	ND	ND	ND	
Benzene	0.06	0.00028 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Cyclohexane	--	0.00086 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Ethylbenzene	1	0.017	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Isopropylbenzene (Cumene)	--	0.002	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Methylcyclohexane	--	0.0013 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
n-Butylbenzene	12	0.0007 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
n-Propylbenzene	3.9	0.0058	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
sec-Butylbenzene	11	0.00034 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Xylenes, Total	0.26	0.0174	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Semivolatile Organic Compounds (SVOCs) - mg/kg														
SVOCs were not detected at concentrations above laboratory detection limits														
Metals - mg/kg														
Aluminum	--	1700	4380	3360	4700	3340	3250	7070	9230	4900	5210	3020	2940	
Antimony	--	ND	ND	ND	ND	ND	ND	0.392 J	ND	ND	ND	ND	ND	
Arsenic	13	1.58	2.28	1.76	2.31	2.06	1.97	3.86	2.06	2.22	2.29	1.63	1.8	
Barium	350	16.2	50	30.2	37.8	29.4	36.2	64.7	89.7	41.7	45.1	27.4	25	
Beryllium	7.2	0.1 J	0.218 J	0.164 J	0.231 J	0.167 J	0.162 J	0.327 J	0.416 J	0.242 J	0.256 J	0.147 J	0.144 J	
Cadmium	2.5	0.164 J	0.14 J	0.13 J	0.123 J	0.116 J	0.15 J	0.173 J	ND	0.116 J	0.11 J	0.148 J	0.14 J	
Calcium	--	53400	60900	57300	61900	57400	57300	69600	72700	64200	65600	56700	55700	
Chromium	30	3.43	7.41	6.01	8.05	5.8	5.72	10.8	13.9	8.2	8.62	5.33	5.3	
Cobalt	--	1.87	4.02	3.11	4.19	3.1	2.93	6.62	5.68	4.37	4.55	2.82	2.98	
Copper	50	6.87	10.1	8.46	11.5	8.22	9.32	14.9	12.1	11.2	11.7	8.46	7.81	
Iron	--	5780	10500	8720	10800	8630	8500	15000	15400	11200	11600	8060	7880	
Lead	63	7.91	11.1	9.21	11.8	9.84	9.49	14.7	14.8	12.1	12.2	9.02	9.5	
Magnesium	--	23100	25500	24600	25700	24700	24700	25200	26000	26300	26700	24400	24200	
Manganese	1,600	247	342	304	354	304	300	450	454	368	379	293	289	
Nickel	30	3.73	8.63	6.67	9.25	6.6	6.2	13.3	14.8	9.62	9.98	5.96	5.99	
Potassium	--	328	780	608	823	605	594	1250	1250	828	882	534	524	
Selenium	3.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Sodium	--	99.4 J	174 J	147 J	174 J	159 J	158 J	223	241 J	169 J	176	152 J	146 J	
Thallium	--	ND	ND	0.374 J	0.361 J	ND	0.283 J	ND	0.447 J	0.388 J	0.375 J	0.294 J	0.444 J	
Vanadium	--	8.13	12.7	11	13	11	11.1	17.5	16.9	13.4	14	10.4	10.2	
Zinc	109	64	62	58.1	56	51.9	64	64.8	59.7	59.8	59.8	58.5	61.1	
Mercury	0.18	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	

Notes:

1. Only those parameters detected at a minimum of one sample location are presented in this table; all other compounds were reported as non-detect.
2. Values per NYSDEC Part 375 Soil Cleanup Objectives (SCOs) .
3. Sample results were reported by the laboratory in micrograms per kilogram (ug/kg) and converted to milligram per kilogram (mg/kg) for comparison to SCOs.
4. Area overcut and resampled to achieve USCOS for nickel (B-6r).

Definitions:

ND = Parameter not detected above laboratory detection limit.
NA = Sample not analyzed for parameter.
"--" = No SCO available.
J = Estimated value; result is less than the sample quantitation limit but greater than zero.
F1 = MS and/or MSD Recovery is outside acceptance limits.
F2 = MS/MSD RPD exceeds control limits.

 = Result exceeds Unrestricted Use SCOs



**TABLE 8
SUMMARY OF TANK 2 IRM POST EXCAVATION SOIL/FILL ANALYTICAL RESULTS**

**SITE MANAGEMENT PLAN
1681-1689 MAIN STREET SITE
BCP SITE NO. C915378
BUFFALO, NEW YORK**

Parameter ¹	Unrestricted Use SCOs ²	Sub-Surface Soil Sample Locations										
		B-1 (8')	B-2 (10')	B-3 (12')	NW-1 (6-7')	NW-2 (7-9')	NW-3 (8-10')	SW-1 (6-7')	SW-2 (7-9')	SW-3 (8-10')	EW-1 (6-7')	WW-1 (8-10')
		5/10/24										
Volatile Organic Compounds (VOCs) - mg/kg												
Chloroform	0.37	0.00039 J	ND	ND	ND	ND	ND	ND	ND	ND	0.00041 J	ND
Trichloroethene	0.47	ND	ND	0.00096	ND	ND	ND	ND	ND	0.0011	ND	0.00039 J
Semivolatile Organic Compounds (SVOCs) - mg/kg												
Benzo(b)fluoranthene	1	ND	0.033 J	0.033 J	0.033 J	0.032 J	0.035 J	ND	ND	ND	0.035 J	ND
Bis(2-ethylhexyl) phthalate	--	ND	0.13 J	0.14 J	0.14 J	0.14 J	0.14 J	0.14 J	0.12 J	0.11 J	0.13 J	0.12 J
Metals - mg/kg												
Arsenic	13	1.7	2.06	1.41	2.26	1.92	2.33	1.31	1.78	1.48	1.62	1.68
Barium	350	48.7	37.4	9.61	54.8	38.7	54.1	21.6	38.9	17.6	40.4	32.2
Cadmium	2.5	0.107 J	0.125 J	0.243 J	ND	0.126 J	0.146 J	0.164 J	0.125 J	0.135 J	0.132 J	0.143 J
Chromium	30	8.88	8.03	3.25	10.8	8.14	9.73	4.95	8.25	4.35	8.96	8.5
Lead	63	12.1	11.9	7.35	12.3	11.6	13.5	10.1	12.1	10.5	12.1	12.1 J
Mercury	0.18	ND	ND	ND	ND	ND	ND	0.076	ND	ND	ND	0.059 J

Notes:

1. Only those parameters detected at a minimum of one sample location are presented in this table; all other compounds were reported as non-detect.
2. Values per NYSDEC Part 375 Soil Cleanup Objectives (SCOs) .
3. Sample results were reported by the laboratory in micrograms per kilogram (ug/kg) and converted to milligram per kilogram (mg/kg) for comparison to SCOs.
4. Area overcut and resampled to achieve USCOs for nickel (B-6r).

Definitions:

ND = Parameter not detected above laboratory detection limit.
 NA = Sample not analyzed for parameter.
 "--" = No SCO available.
 J = Estimated value; result is less than the sample quantitation limit but greater than zero.
 F1 = MS and/or MSD Recovery is outside acceptance limits.
 F2 = MS/MSD RPD exceeds control limits.

= Result exceeds Unrestricted Use SCOs



TABLE 9
SUMMARY OF FORMER THREE STORY BUILDING AREA IRM POST EXCAVATION SOIL/FILL ANALYTICAL RESULTS

SITE MANAGEMENT PLAN
1681-1689 MAIN STREET SITE
BCP SITE NO. C915378
BUFFALO, NEW YORK

Parameter ¹	Unrestricted Use SCOs ²													
		TSB B-1 (4')	TSB B-2 (4')	TSB B-3 (4')	TSB B-4 (4')	TSB B-5 (4')	TSB B-6 (4')	TSB B-7 (4')	TSB B-8 (7')	TSB B-9 (7')	TSB B-10 (7')	TSB B-11 (7')	TSB B-12 (7')	
		5/15/24							5/17/24		5/23/24		5/1	
Volatile Organic Compounds (VOCs) - mg/kg														
1,1,1-Trichloroethane	0.68	--	--	--	--	--	--	--	--	--	--	--	ND	
Acetone	0.05	--	--	--	--	--	--	--	--	--	--	--	ND	
Chloroform	0.37	--	--	--	--	--	--	--	--	--	--	--	ND	
Toluene	0.7	--	--	--	--	--	--	--	--	--	--	--	ND	
Trichloroethene	0.47	--	--	--	--	--	--	--	--	--	--	--	ND	
Xylenes, Total	0.26	--	--	--	--	--	--	--	--	--	--	--	ND	
Semivolatile Organic Comounds (SVOCs) - mg/kg														
Benzo(a)anthracene	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Benzo(b)fluoranthene	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Benzo(g,h,i)perylene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Chrysene	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Dibenzofuran	7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fluoranthene	100	ND	ND	ND	ND	0.022 J	ND	ND	ND	ND	ND	ND	ND	
Phenanthrene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Pyrene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Metals - mg/kg														
Arsenic	13	2.58	6.18	4.13	3.65	4.89	6.37	3.76	1.96	2.6	2.18	2.64	3.73	
Barium	350	81.3	126	99.4	84.2	58.4	71.4	74.6	63.2	61.7	71.5	33.8	94.8	
Cadmium	2.5	0.125 J	0.104 J	0.099 J	0.1 J	0.096 J	0.11 J	0.104 J	0.128 J	0.127 J	0.245 J	0.226 J	0.118 J	
Chromium	30	14.8	14.2	13	13.3	13.4	13	13.8	10.2	11.8	6.86	8.02	10.6	
Lead	63	14.8	15.2	14.2	14.5	15.4	14.8	14.4	13	13.5	11.2	12.6	11.6	
Selenium	3.9	ND	ND	ND	ND	ND	ND	ND	0.317 J	0.751 J	ND	ND	0.442 J	

Notes:

1. Only those parameters detected at a minimum of one sample location are presented in this table; all other compounds were reported as non-detect.
2. Values per NYSDEC Part 375 Soil Cleanup Objectives (SCOs) .
3. Sample results were reported by the laboratory in micrograms per kilogram (ug/kg) and converted to milligram per kilogram (mg/kg) for comparison to SCOs.

Definitions:

ND = Parameter not detected above laboratory detection limit.
NA = Sample not analyzed for parameter.
"--" = No SCO available.
J = Estimated value; result is less than the sample quantitation limit but greater than zero.
F1 = MS and/or MSD Recovery is outside acceptance limits.
F2 = MS/MSD RPD exceeds control limits.

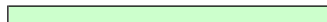
 = Result exceeds Unrestricted Use SCOs



TABLE 9
SUMMARY OF FORMER THREE STORY BUILDING AREA IRM POST EXCAVATION SOIL/FILL ANALYTICAL RESULTS

SITE MANAGEMENT PLAN
1681-1689 MAIN STREET SITE
BCP SITE NO. C915378
BUFFALO, NEW YORK

Parameter ¹	Unrestricted Use SCOs ²	TSB B-13 (7')	TSB B-14 (7')	TSB B-15 (7')	TSB B-16 (7')	TSB B-17 (7')	TSB NW-1 (3-5')	TSB NW-2 (3-5')	TSB NW-3 (3-5')	TSB NW-4 (3-5')	TSB SW-1 (3-5')	TSB SW-2 (3-5')	TSB SW-3 (3-5')
		7/24	5/20/24		5/17/24	5/20/24	5/17/24		5/20/24		5/17/24		
		Volatile Organic Compounds (VOCs) - mg/kg											
1,1,1-Trichloroethane	0.68	ND	ND	0.00022 J	ND	ND	--	--	ND	ND	--	--	--
Acetone	0.05	ND	ND	ND	ND	0.0066 J	--	--	0.0082 J	0.0059 J	--	--	--
Chloroform	0.37	ND	ND	0.0011 J	0.00017 J	ND	--	--	ND	ND	--	--	--
Toluene	0.7	ND	0.00068 J	ND	ND	ND	--	--	ND	ND	--	--	--
Trichloroethene	0.47	ND	ND	ND	ND	0.00076	--	--	ND	ND	--	--	--
Xylenes, Total	0.26	ND	ND	ND	0.00122 J	ND	--	--	ND	ND	--	--	--
Semivolatile Organic Comounds (SVOCs) - mg/kg													
Benzo(a)anthracene	1	0.00027 J	ND	ND	ND	ND	0.031 J	0.038 J	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	1	ND	ND	ND	ND	ND	0.04 J	0.033 J	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	100	0.00024 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	1	0.00024 J	ND	ND	ND	ND	0.03 J	0.034 J	ND	ND	ND	ND	ND
Dibenzofuran	7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	100	0.00043 J	ND	ND	ND	ND	0.068 J	0.068 J	ND	ND	ND	ND	ND
Phenanthrene	100	0.00031 J	ND	ND	ND	ND	0.048 J	0.077 J	ND	ND	ND	ND	ND
Pyrene	100	0.00036 J	ND	ND	ND	ND	0.054 J	0.064 J	ND	ND	ND	ND	ND
Metals - mg/kg													
Arsenic	13	4.22	2.43	2.51	2.03	3.31	3.06	3.49	2.26	5.74	5.45	4.1	4.18
Barium	350	63.6	42.5	45.5	60.1	64.8	69.6	160	61.4	64.2	73.5	65.5	67.8
Cadmium	2.5	0.133 J	0.241 J	0.2 J	0.099 J	0.233 J	0.182 J	0.206 J	0.172 J	0.176 J	0.216 J	0.19 J	0.173 J
Chromium	30	10	6.57	7.88	9.96	9.62	9.82	12.6	11.5	17.7	13.1	11.5	10.9
Lead	63	12.1	13.3	12.9	10.4	14.3	12.4	13.7	14.5	14.5	15.2	13.2	12.4
Selenium	3.9	0.275 J	ND	ND	0.701 J	ND	ND	ND	ND	ND	ND	ND	ND

Notes:

1. Only those parameters detected at a minimum of one sample lo
2. Values per NYSDEC Part 375 Soil Cleanup Objectives (SCOs) .
3. Sample results were reported by the laboratory in micrograms pe

Definitions:

ND = Parameter not detected above laboratory detection limit.
NA = Sample not analyzed for parameter.
"--" = No SCO available.
J = Estimated value; result is less than the sample quantitation lim
F1 = MS and/or MSD Recovery is outside acceptance limits.
F2 = MS/MSD RPD exceeds control limits.

= Result exceed



TABLE 10
SUMMARY OF TANK 3 IRM POST EXCAVATION SOIL/FILL ANALYTICAL RESULTS

SITE MANAGEMENT PLAN
1681-1689 MAIN STREET SITE
BCP SITE NO. C915378
BUFFALO, NEW YORK

Parameter ¹	Unrestricted Use SCOs ²	Sub-Surface Soil Sample Locations		
		B-1 (7.5')	B-2 (7.5')	TSB NW-3 (3-5')
		5/20/24		
Volatile Organic Compounds (VOCs) - mg/kg				
Acetone	0.05	ND	ND	0.0082 J
Bromodichloromethane	--	0.00021 J	ND	ND
Chloroform	0.37	0.00093 J	ND	ND
Trichloroethene	0.47	ND	ND	ND
Semivolatile Organic Compounds (SVOCs) - mg/kg				
SVOCs were not detected at concentrations above laboratory detection limits				
Metals - mg/kg				
Arsenic	13	2.72	3.31	2.26
Barium	350	68.2	42.9	61.4
Cadmium	2.5	0.249 J	0.214 J	0.172 J
Chromium	30	9.02	9.32	11.5
Lead	63	12.8	15.1	14.5

Notes:

1. Only those parameters detected at a minimum of one sample location are presented in this table; all other compounds were reported as non-detect.
2. Values per NYSDEC Part 375 Soil Cleanup Objectives (SCOs) .
3. Sample results were reported by the laboratory in micograms per kilogram (ug/kg) and converted to milligram per kilogram (mg/kg) for comparison to SCOs.
4. Area overcut and resampled to achieve USCOs for nickel (B-6r).

Definitions:

- ND = Parameter not detected above laboratory detection limit.
 "--" = No SCO available.
 J = Estimated value; result is less than the sample quantitation limit but greater than zero.

= Result exceeds Unrestricted Use SCOs

TABLE 11
SUMMARY OF FORMER AUTO REPAIR AREA IRM POST EXCAVATION SOIL/FILL ANALYTICAL RESULTS

SITE MANAGEMENT PLAN
1681-1689 MAIN STREET SITE
BCP SITE NO. C915378
BUFFALO, NEW YORK

Parameter ¹	Unrestricted Use SCOs ²	AA B-1 (7-5) 5/30/24	AA B-2 (9) 6/5/24	AA B-3 (7-5) 5/30/24	AA B-4 (7-5) 6/5/24	AA B-5 (9) 6/5/24	AA B-6 (7-5) 5/30/24	AA B-7 (7-5) 6/8/24	AA B-8 (9) 5/30/24	AA B-9 (7-5) 6/11/24	AA B-10 (9) 6/11/24	AA B-11 (14) 6/13/24	AA B-12 (9) 6/13/24	AA B-13 (9) 6/13/24	AA B-14 (15) 6/13/24	AA B-15 (15) 6/13/24	AA B-16 (6) 6/26/24	AA B-17 (6) 6/26/24	AA B-18 (4) 6/13/24	AA B-19 (4) 6/13/24	AA NW-1 (5-7) 6/5/24	AA NW-2 (5-7) 6/11/24	AA NW-3 (5-7) 6/11/24	AA NW-4 (8-10) 6/13/24	AA NW-5 (11-13) 6/13/24	AA WW-1 (3-5) 5/30/24	AA WW-2 (3-5) 5/30/24	AA WW-3 (5-7) 6/5/24			
Volatile Organic Compounds (VOCs) - mg/kg																															
1,1-Dichloroethane	0.27	ND	ND	--	ND	ND	--	ND	0.00099 J	--	ND	ND	ND	ND	ND	ND	ND	0.00013 J	ND	ND	ND	0.00045 J	ND	0.00035	0.00032 J	--	--	ND			
1,1-Dichloroethene	0.33	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	ND	ND	ND	ND	ND	0.00092 J	ND	ND	ND	ND	ND	ND	ND	--	--	ND			
1,2,3-Trichlorobenzene	--	ND	ND	--	ND	0.00032 J	--	ND	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	ND			
1,2,4-Trichlorobenzene	3.6	ND	ND	--	ND	0.00036 J	--	ND	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	ND			
1,2-Dichlorobenzene	1.1	ND	ND	--	ND	0.0066	--	ND	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	ND			
1,2-Dichloroethene	0.02	ND	ND	--	ND	ND	--	ND	0.0016	--	0.0022	0.00076 J	0.00032 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	ND			
1,3-Dichlorobenzene	2.4	ND	ND	--	ND	0.0026 J	--	ND	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	ND			
1,4-Dichlorobenzene	1.8	ND	ND	--	ND	0.0019	--	ND	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	ND			
1,2,4-Trimethylbenzene	3.6	ND	ND	--	ND	0.12	--	ND	ND	--	ND	ND	ND	0.0024 J	ND	0.00042 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	ND			
1,3,5-Trimethylbenzene	8.4	ND	ND	--	ND	0.018	--	ND	ND	--	ND	ND	ND	0.00051 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	ND			
4-Isopropyltoluene	--	ND	ND	--	ND	0.0042	--	ND	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	ND			
Acetone	0.05	ND	0.0066 J	--	ND	0.0099	--	ND	ND	--	ND	ND	ND	ND	ND	ND	0.0045 J	ND	ND	0.007 J	0.0089 J	0.0086 J	0.0093 J	ND	--	--	--	0.0063 J			
Benzene	0.06	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	ND	0.0003 J	ND	ND	0.0006	ND	ND	ND	ND	ND	ND	ND	ND	--	--	ND			
Chlorobenzene	1	ND	ND	--	ND	0.0015	--	ND	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	ND			
Chloroform	0.37	0.00044 J B	ND	--	ND	ND	--	ND	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	ND			
cis-1,2-Dichloroethene	0.25	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	0.0002 J	0.001 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	ND			
Ethylbenzene	1	ND	ND	--	ND	0.00099	--	ND	ND	--	ND	ND	ND	0.007	ND	0.00019 J	ND	ND	ND	ND	ND	ND	ND	0.0056 J	ND	--	--	0.00052 J			
Isopropylbenzene (Cumene)	--	ND	ND	--	ND	0.00095	--	ND	ND	--	ND	ND	ND	0.00016 J	ND	0.00014 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	ND			
Methylene Chloride	--	ND	ND	--	ND	ND	--	ND	0.0036 J	--	0.0041 J	0.0037 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	ND			
Methyl tert-butyl ether	0.93	ND	ND	--	ND	0.00023 J	--	ND	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00035 J	0.0011 J	ND	--	--	ND			
n-Butylbenzene	12	ND	ND	--	ND	0.0046	--	ND	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	ND			
n-Propylbenzene	3.9	ND	ND	--	ND	0.0051	--	ND	ND	--	ND	ND	ND	0.00035 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	ND			
sec-Butylbenzene	11	ND	ND	--	ND	0.0031	--	ND	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	ND			
Styrene	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	ND			
Tetrachloroethene	1.3	ND	ND	--	0.0012	0.0026	--	0.00083	ND	--	ND	ND	ND	0.00069 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	ND			
Toluene	0.7	ND	ND	--	ND	0.00075 J	--	ND	ND	--	0.00074 J	ND	ND	ND	ND	ND	0.00069 J	0.00052 J	0.00097 J	0.00054 J	ND	ND	ND	0.002	ND	--	--	0.00055 J			
trans-1,2-Dichloroethene	0.19	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	ND	0.00037 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	ND			
Trichloroethene	0.47	ND	ND	--	ND	0.0007	--	ND	ND	--	ND	ND	ND	0.0023	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	ND			
Xylenes, Total	0.26	ND	ND	--	ND	0.0076	--	ND	ND	--	ND	ND	ND	0.003	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00158 J	ND	--	--	0.00374			
Semivolatile Organic Compounds (SVOCs) - mg/kg																															
2,4-Dimethylphenol	--	ND	ND	ND	ND	0.26	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	ND		
Acenaphthylene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	0.043 J		
Anthracene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	0.047 J		
Benzo(a)anthracene	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	0.13		
Benzo(a)pyrene	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	0.13 J		
Benzo(b)fluoranthene	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	0.17		
Benzo(a,h)perylene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	0.079 J		
Benzo(k)fluoranthene	0.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	0.055 J		
Butyl benzyl phthalate	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	0.093 J		
Carbazole	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	0.045 J		
Chrysene	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	0.15		
Dibenz(a,h)anthracene	0.33	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	0.023 J		
Dibenzofuran	7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	0.026 J		
Fluoranthene	100	ND	ND	ND	0.035 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	0.33		
Fluorene	30	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	0.029 J		
Indeno(1,2,3-cd)pyrene	0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	0.079 J		
Naphthalene	12	ND	ND	ND	ND	0.052 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	0.032 J		
Phenanthrene	100	ND	ND	ND	0.03 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	0.35		
Pyrene	100	ND	ND	ND	0.028 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	0.26		
Metals - mg/kg																															
Arsenic	13	1.55	1.92	2.16	2.12	1.89	2.55	3.15	1.41	1.82	1.47	1.22	1.69	1.88	1.12	1.31	3.34	2.72	3.66	4.22	2.09	2.14	2.46	1.39	1.13	3.08	2.92	2.08			
Barium	350	44.5	36.7	47	42.2	42.8	63.7	80.6	49.1	41	33.7	26.6	39.8	43.3	19.5	14.3	65.1	66.9	44.6	99.2	48.3	49.8	60.5	35.2	28.9	78.9	60.8	52.1			
Cadmium	2.5	0.158 J	0.19 J	0.15 J	0.168 J	0.189 J	0.161 J	0.172 J	0.204 J	0.185 J	0.185 J	0.129 J	ND	0.089 J	ND	ND	ND	ND	ND	ND	0.176 J	0.182 J	0.44 J	0.205 J	ND	0.181 J	0.212 J	ND			
Chromium	30	5.52	6.66	8.51	7.83	6.5	9.33	13.5	6.25	6.31	5.67	4.53	6.03	7.7	2.94	3.31	11.3	9.53	7.2	16.7	8.88	9.77	11.6	5.25	5.29	10.3	12.3	8.32			
Copper	9.3	8.48	10.2	11.4	12.8	11.8	15.8	24.2	11.4	12.8	11.4	12.2	12.2	8.48	11.8	14.2	11.6	14.2	11.6	14.2	11.6	14.2	11.6	8.48	10.7	11.4	12.2	11.4			
Selenium	3.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	0.617 J		
Silver	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	ND		
Polychlorinated Biphenyls (PCBs) mg/kg																															
PCBs were not detected at concentrations above laboratory detection limits																															



TABLE 12
SUMMARY OF TANK 4 IRM POST EXCAVATION SOIL/FILL ANALYTICAL RESULTS

SITE MANAGEMENT PLAN
1681-1689 MAIN STREET SITE
BCP SITE NO. C915378
BUFFALO, NEW YORK

Parameter ¹	Unrestricted Use SCOs ²	Post-Excavation Confirmatory Soil Sample Locations										
		T4 Bottom South (8-10)	T4 Bottom East (8-10)	T4 Bottom West (8-10)	T4 Bottom 1/1R	T4 Bottom 2/2R	T4 Bottom 3/3R	T4 Bottom 4/4R	T4 Bottom 5/5R	T4 Bottom 6/6R	T4 Bottom 7/7R	T4 SW-1
		11/13/24										
Volatile Organic Compounds (VOCs) - mg/kg												
1,1-Dichloroethane	0.27	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00053 J	ND
1,2-Dichlorobenzene	1.1	0.049 J	0.0051	0.00037 J	ND	ND	ND	ND	ND	ND	0.00013 J	ND
1,2-Dichloroethane	0.072	0.032	0.002	ND	0.00039 J	0.00082 J	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	2.4	ND	0.00025 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	1.8	0.015 J	0.0016 J	0.00013 J	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	3.6	3.3	0.42 E	0.037	ND	ND	ND	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	8.4	0.59	0.079	0.0045	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone (MEK)	0.12	ND	0.12	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-pentanone (MIBK)	--	0.72	0.45 E	0.014	ND	ND	ND	ND	ND	ND	ND	ND
4-Isopropyltoluene	--	0.14	0.013	0.00052 J	ND	ND	ND	ND	ND	ND	ND	ND
Acetone	0.05	3	1.5 E	0.098	ND	ND	ND	0.0042 J	ND	ND	0.012	0.024
Benzene	0.06	0.014 J	0.0052	0.0038	0.00025 J	ND	ND	0.0012	ND	ND	0.017	ND
cis-1,2-Dichloroethene	0.25	ND	ND	0.00049 J	ND	ND	ND	0.00013 J	ND	ND	0.00026 J	ND
Cyclohexane	--	ND	0.0008 J	0.0006 J	ND	ND	ND	ND	ND	ND	0.0027 J	ND
Ethylbenzene	1	0.081	0.017	0.0043	ND	ND	ND	ND	ND	ND	0.0052 J	ND
Isopropylbenzene (Cumene)	--	0.03 J	0.0047	0.00091	ND	ND	ND	ND	ND	ND	0.0022	ND
Methylcyclohexane	--	ND	0.0018 J	0.0012 J	ND	ND	ND	ND	ND	ND	0.0015 J	ND
Methylene chloride	0.05	ND	0.0045	ND	ND	ND	ND	ND	ND	ND	ND	ND
n-Butylbenzene	12	0.18	0.011	0.00017 J	ND	ND	ND	ND	ND	ND	ND	ND
n-Propylbenzene	3.9	0.12	0.016	0.0032	ND	ND	ND	ND	ND	ND	ND	ND
sec-Butylbenzene	11	0.083 J	0.0078	0.00041 J	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	1.3	ND	ND	0.00065	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	0.7	ND	ND	0.0043	ND	ND	ND	ND	ND	ND	0.00053 J	ND
Trichloroethene	0.47	ND	ND	0.00072	ND	ND	ND	ND	ND	ND	0.00043 J	ND
Xylenes, Total	0.26	0.8	0.16	0.039	ND	ND	ND	0.00128 J	ND	ND	0.0214	ND
Semivolatile Organic Compounds (SVOCs) - mg/kg												
2,4-Dimethylphenol	--	ND	ND	1.2	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	--	0.03 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetophenone	--	0.04 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	12	0.095 J	ND	ND	ND	ND	ND	ND	ND	ND	0.065 J	ND
Phenanthrene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Metals - mg/kg												
Arsenic	13	4.52	0.476 J	2.32	2.64	2.01	3.25	2.01	5.04	3.5	4.11	2.54
Barium	350	73.6	8.97	55.9	58	48.2	77	43	57	67.8	84.1	51.7
Chromium	30	13.7	1.87	9.16	10.4	8.78	14.1	7.24	11.2	12.6	12.9	9.23
Lead	63	14.5	2.64 J	14.5	12.9	15.3	13.8	12.1	14.3	13.9	35.5	12.4
Selenium	3.9	ND	ND	0.311 J	ND	ND	ND	ND	ND	ND	ND	ND
Silver	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.299 J
Polychlorinated Biphenyls (PCBs) mg/kg												
PCB-1016	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1221	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1232	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1242	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1248	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1254	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1260	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1262	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND
PCB-1268	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND
Total PCBs	0.1	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND

Notes:

- Only those parameters detected at a minimum of one sample location are presented in this table; all other compounds were reported as non-detected.
- Values per NYSDEC Part 375 Soil Cleanup Objectives (SCOs).
- Sample results were reported by the laboratory in micrograms per kilogram (ug/kg) and converted to milligram per kilogram (mg/kg) for comparison to SCOs.
- Area overcut and resampled to achieve USCOS for VOCs and SVOCs (R).

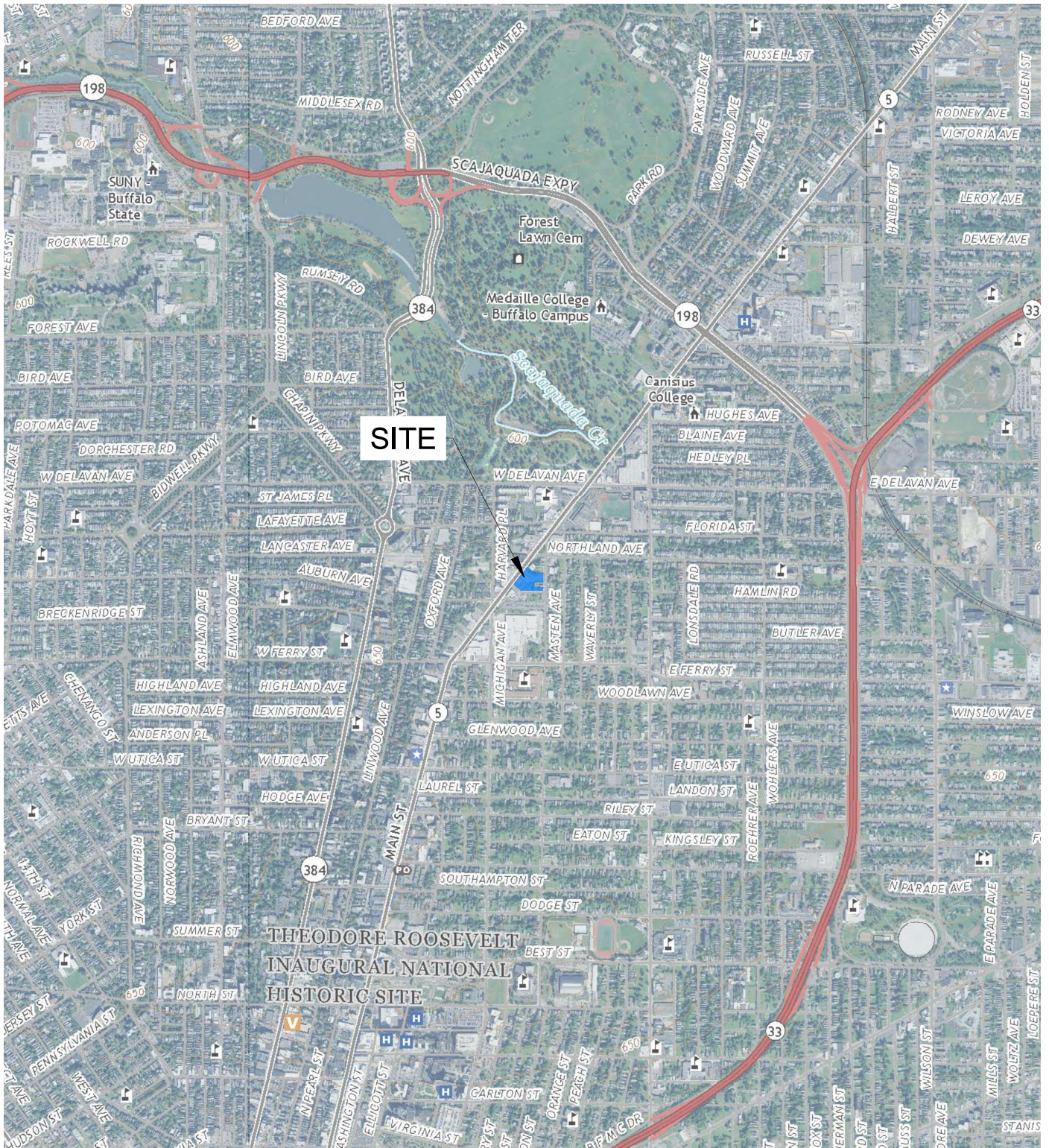
Definitions:

ND = Parameter not detected above laboratory detection limit.
NA = Sample not analyzed for parameter.
"--" = No SCO available.
J = Estimated value; result is less than the sample quantitation limit but greater than zero.

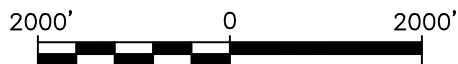
Result exceeds Unrestricted Use SCOs

FIGURES

1. Site Location and Vicinity Map
2. Site Plan (Aerial)
3. Site Plan - Cleanup Tracks
4. Groundwater Contour Map
5. RI Investigation Locations and Soil Exceedances
6. RI Groundwater Sample Locations and Exceedances
7. Post-Excavation Sample Locations
8. Hydraulic Lifts 1+2 Post-Excavation Sample Locations
9. Tank 1 Post-Excavation Sample Locations
10. Tank 2 Post-Excavation Sample Locations
11. Tank 3 Post-Excavation Sample Locations
12. Auto Repair Area Post-Excavation Sample Locations
13. Tank 4 Post-Excavation Sample Locations



QUADRANGLE LOCATION



Title:

SITE LOCATION AND VICINITY MAP
SITE MANAGEMENT PLAN
1681-1689 MAIN STREET SITE
BCP SITE NO. C915378
BUFFALO, NEW YORK

Prepared for:

1681-1689 MAIN STREET LLC



Compiled by: CEH	Date: JUNE 2024
Prepared by: CEH	Scale: AS SHOWN
Project Mgr: NTM	Project: 4461.0001B002
File: FIGURE 1 - SITE LOCATION AND VICINITY MAP.DWG	

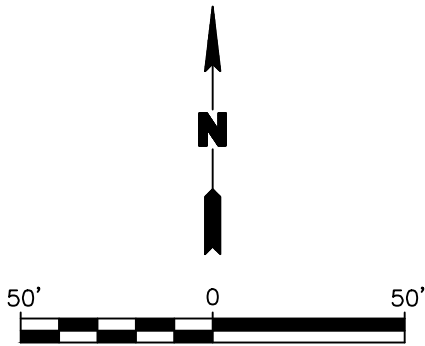
FIGURE

1

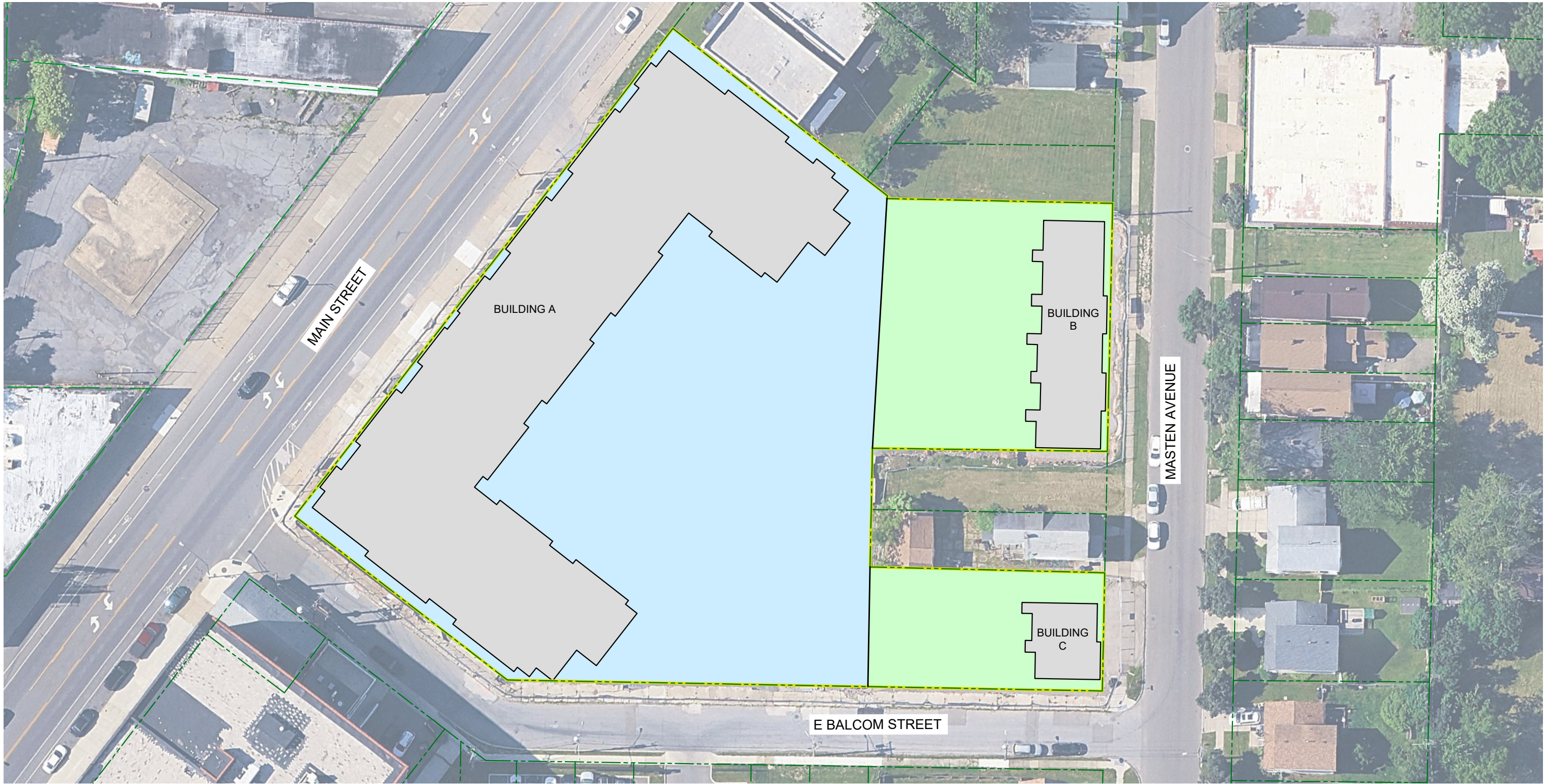


LEGEND:

- BCP BOUNDARY
- PARCEL BOUNDARY

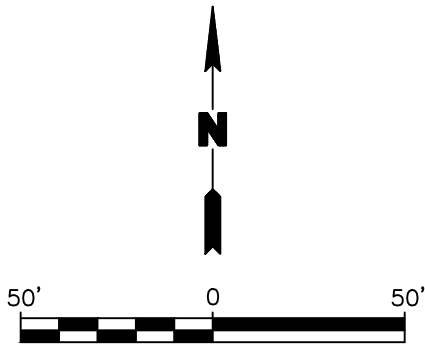


Title: SITE PLAN (AERIAL) SITE MANAGEMENT PLAN 1681-1689 MAIN STREET SITE BCP SITE NO. C915378 BUFFALO, NEW YORK			
Prepared for: 1681-1689 MAIN STREET, LLC			
	Compiled by: CEH	Date: JULY 2024	FIGURE 2
	Prepared by: CEH	Scale: AS SHOWN	
	Project Mgr: NTM	Project: 4461.001B002	
	File: FIGURE 2 - SITE PLAN (AERIAL).DWG		



LEGEND:

- BCP BOUNDARY
- PARCEL BOUNDARY
- TRACK 1 - UNRESTRICTED
- TRACK 2 - CONDITIONAL



Title:

TRACK 1 AND TRACK 2 AREAS
SITE MANAGEMENT PLAN
1681-1689 MAIN STREET SITE
BCP SITE NO. C915378
BUFFALO, NEW YORK

Prepared for:

1681-1689 MAIN STREET, LLC

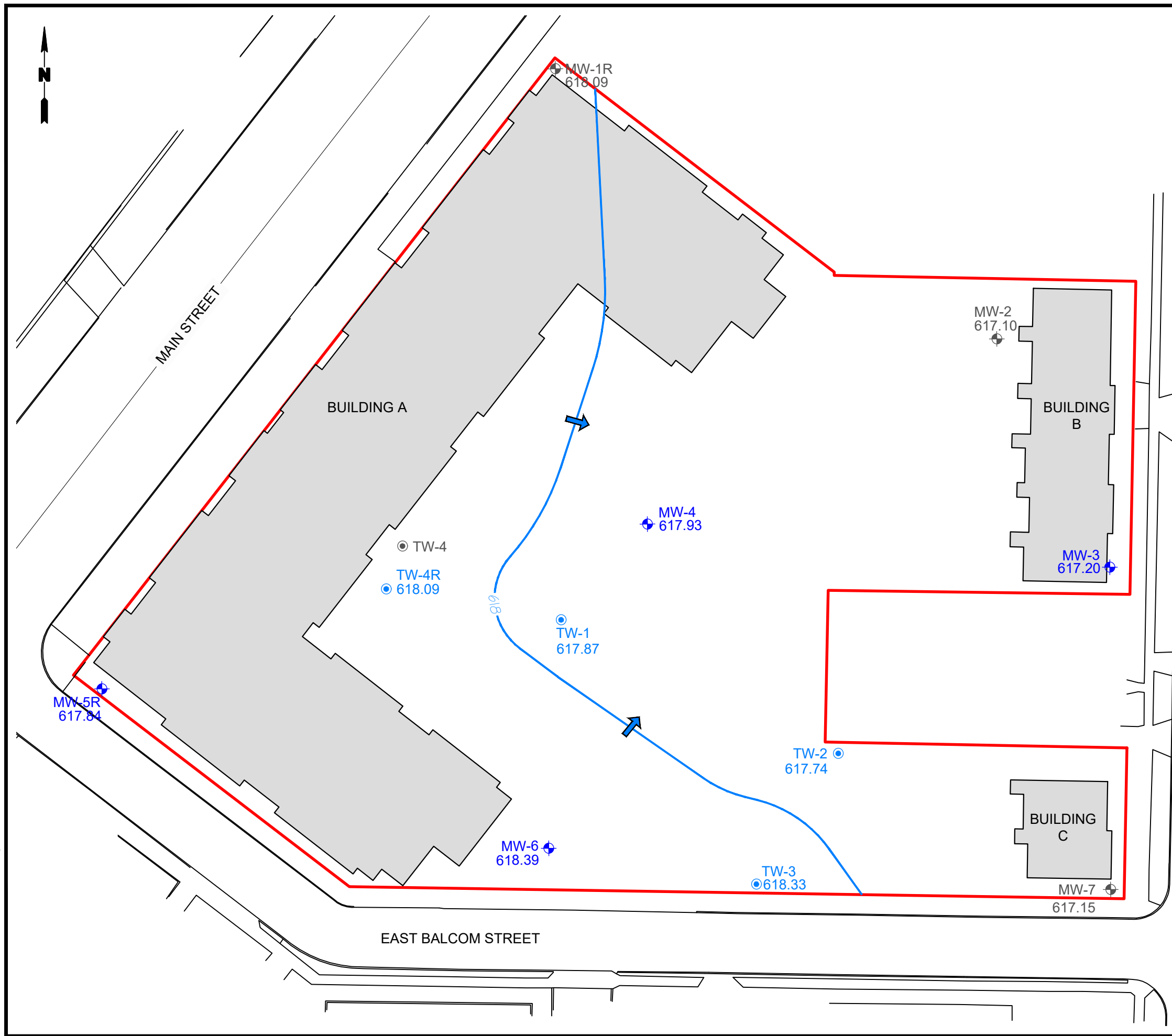
ROUX

Compiled by: CEH
Prepared by: CEH
Project Mgr: NTM
File: FIGURE 3 - TRACK 1 AND TRACK 2 AREAS.DWG

Date: AUGUST 2026
Scale: AS SHOWN
Project: 4461.001B002

FIGURE
3

F:\CAD\0-ROUX\PIVOTAL-HP\SM\FIGURE 3: GROUNDWATER CONTOUR MAP.DWG



LEGEND:

- BCP SITE BOUNDARY
- MW-2 MONITORING WELL
- MW-3 MONITORING WELL (DECOMMISSIONED)
- TW-1 MONITORING WELL
- TW-4 MONITORING WELL
- 618 GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION

GROUNDWATER ELEVATIONS COLLECTED BY ROUX ENVIRONMENTAL ENGINEERING & GEOLOGY, D.P.C. ON APRIL 27, 2026.



Title:

GROUNDWATER CONTOUR MAP
1681-1689 MAIN STREET SITE
BCP SITE NO. C915378
BUFFALO, NEW YORK

Prepared for:

1681-1689 MAIN STREET LLC



Compiled by: CMS

Prepared by: CMS

Project Mgr: NTM

File: FIGURE 3: GROUNDWATER CONTOUR MAP.DWG

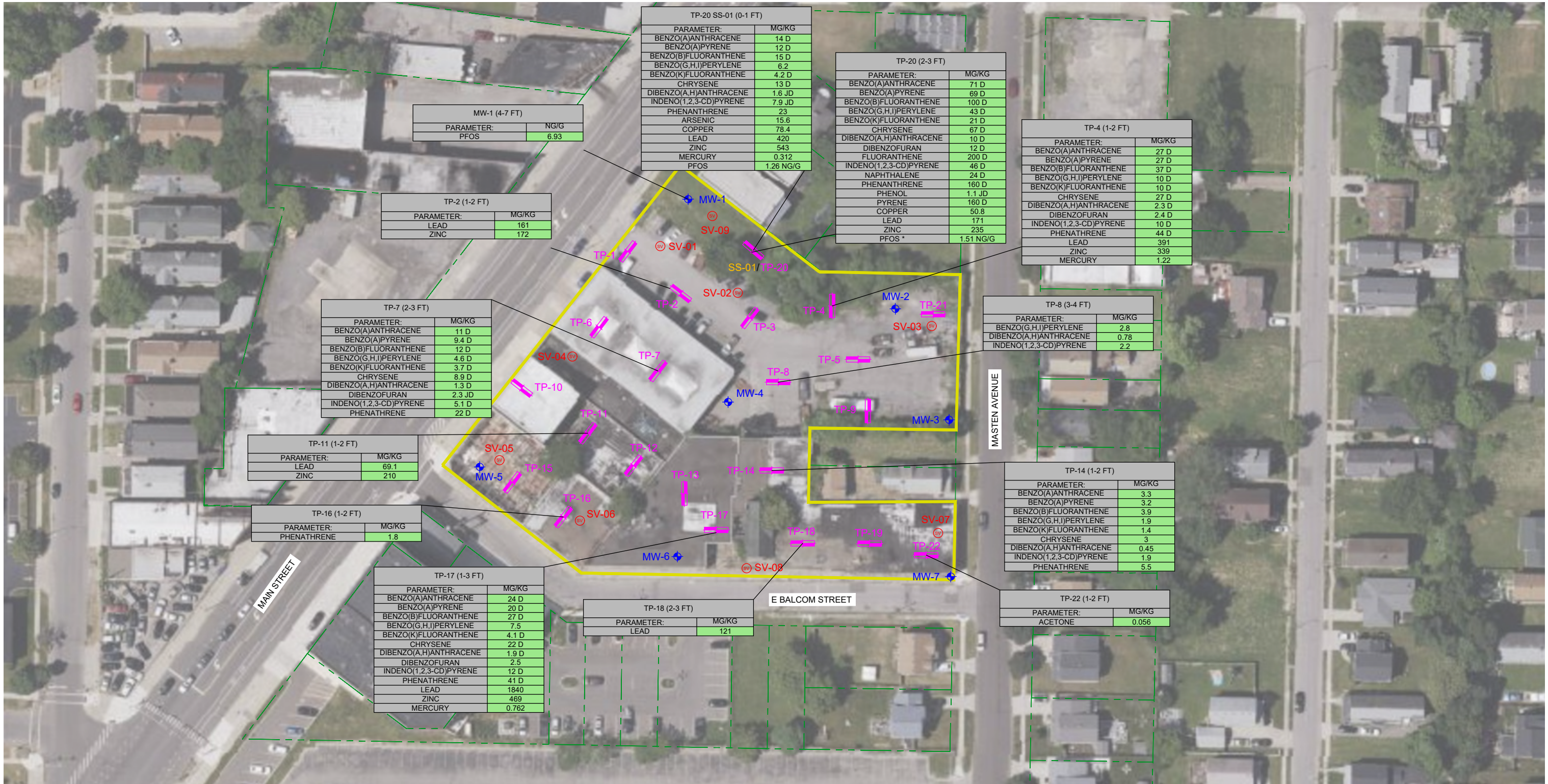
Date: JUNE 2026

Scale: AS SHOWN

Project: 4461.0001B002

FIGURE

4



LEGEND:

- BCP BOUNDARY
- PARCEL BOUNDARY
- TP-1 RI TEST PIT LOCATION
- MW-1 RI SOIL BORING/MONITORING WELL LOCATION
- SV-01 RI SOIL VAPOR SAMPLE LOCATION
- SS-01 RI SURFACE SOIL SAMPLE LOCATION

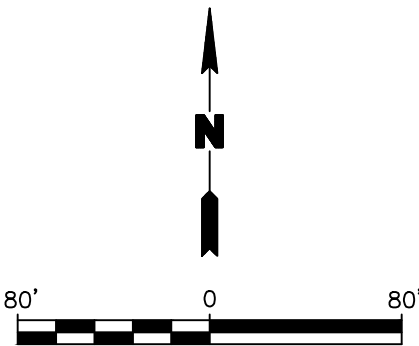
VALUES PER 6 NYCRR PART 375 SOIL CLEANUP OBJECTIVES (SCOs):

EXCEEDS PART 375 USCOs

- NOTES:
- TOTAL CONCENTRATIONS IN MG/KG
 - * FOUND AT DEPTHS 1-3 FT

DEFINITIONS:
J = ESTIMATED VALUE; RESULT IS LESS THAN THE SAMPLE QUANTITATION LIMIT BUT GREATER THAN ZERO.

D = CONCENTRATION OF ANALYTE WAS QUANTIFIED FROM DILUTED ANALYSIS.



Title:
SUMMARY OF SOIL/FILL EXCEEDANCES FROM PREVIOUS INVESTIGATIONS

SITE MANAGEMENT PLAN

1681-1689 MAIN STREET SITE

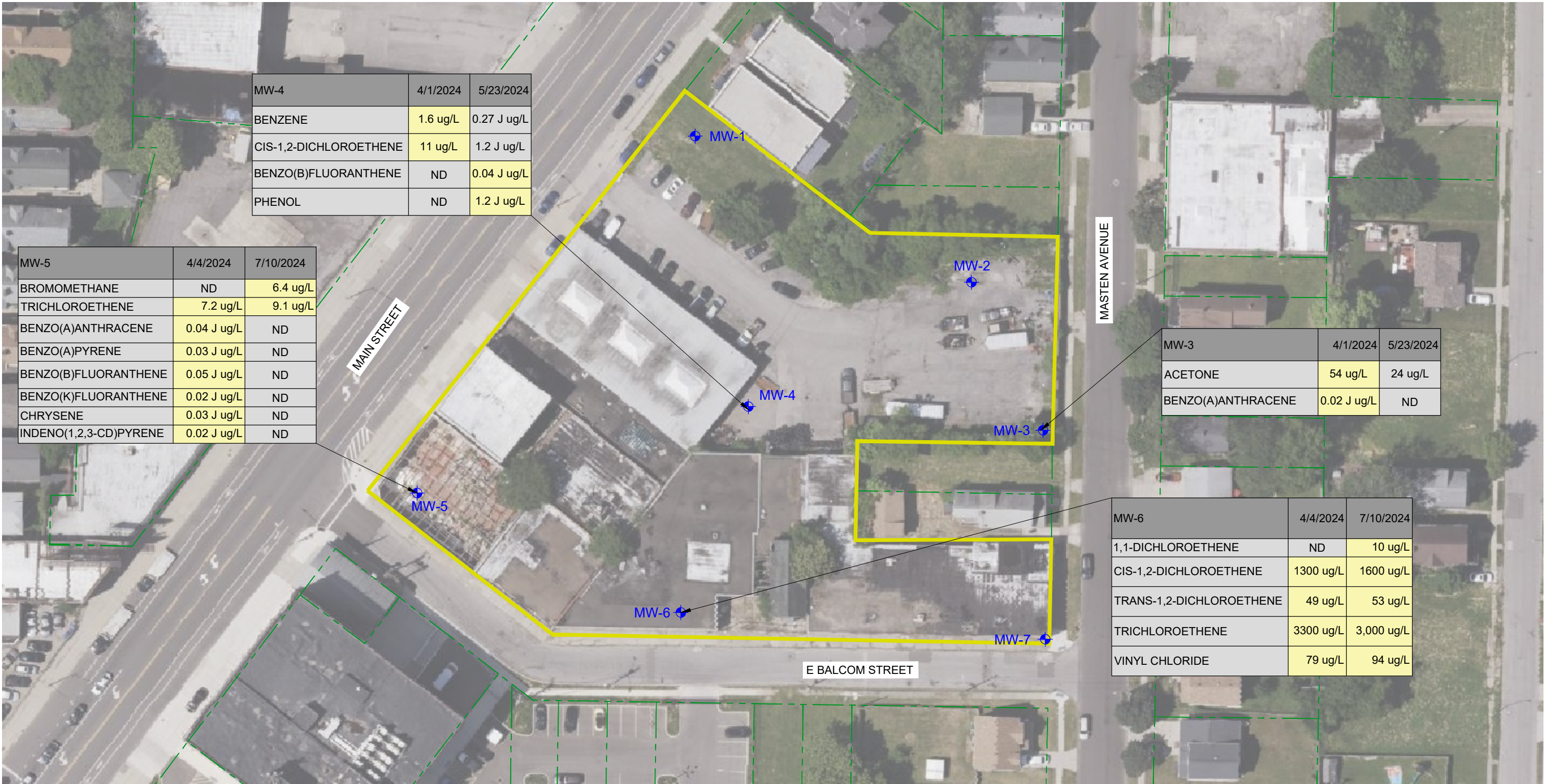
BCP SITE NO. C915378

BUFFALO, NEW YORK

Prepared for:

1681-1689 MAIN STREET, LLC

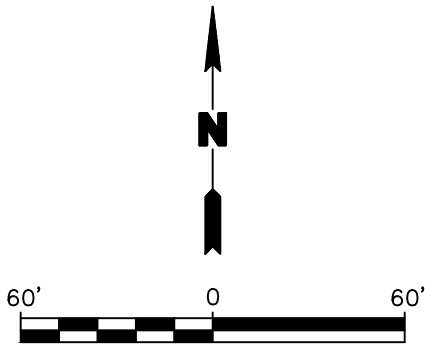
	Compiled by: JJY	Date: MARCH 2026	FIGURE 5
	Prepared by: JJY	Scale: AS SHOWN	
	Project Mgr: NTM	Project: 4461.001B002	
	File: FIGURE 5 - SUMMARY OF SOIL/FILL EXCEEDANCES FROM PREVIOUS INVESTIGATIONS.DWG		



LEGEND:

- BCP BOUNDARY
- PARCEL BOUNDARY
- RI MONITORING WELL LOCATION
- EXCEEDS NYSDEC DIVISION OF WATER AMBIENT WATER QUALITY STANDARDS AND GUIDANCE VALUES AND GROUNDWATER EFFLUENT LIMITATIONS - CLASS GA

NOTES:
ND - PARAMETER NOT DETECTED ABOVE LABORATORY DETECTION LIMIT
J - ESTIMATED VALUE - BELOW CALIBRATION RANGE



Title:
SUMMARY OF GROUNDWATER EXCEEDANCES
SITE MANAGEMENT PLAN
1681-1689 MAIN STREET SITE
BCP SITE NO. C915378
BUFFALO, NEW YORK

Prepared for:
1681-1689 MAIN STREET, LLC

Compiled by: CEH

Date: JULY 2024

Prepared by: CEH

Scale: AS SHOWN

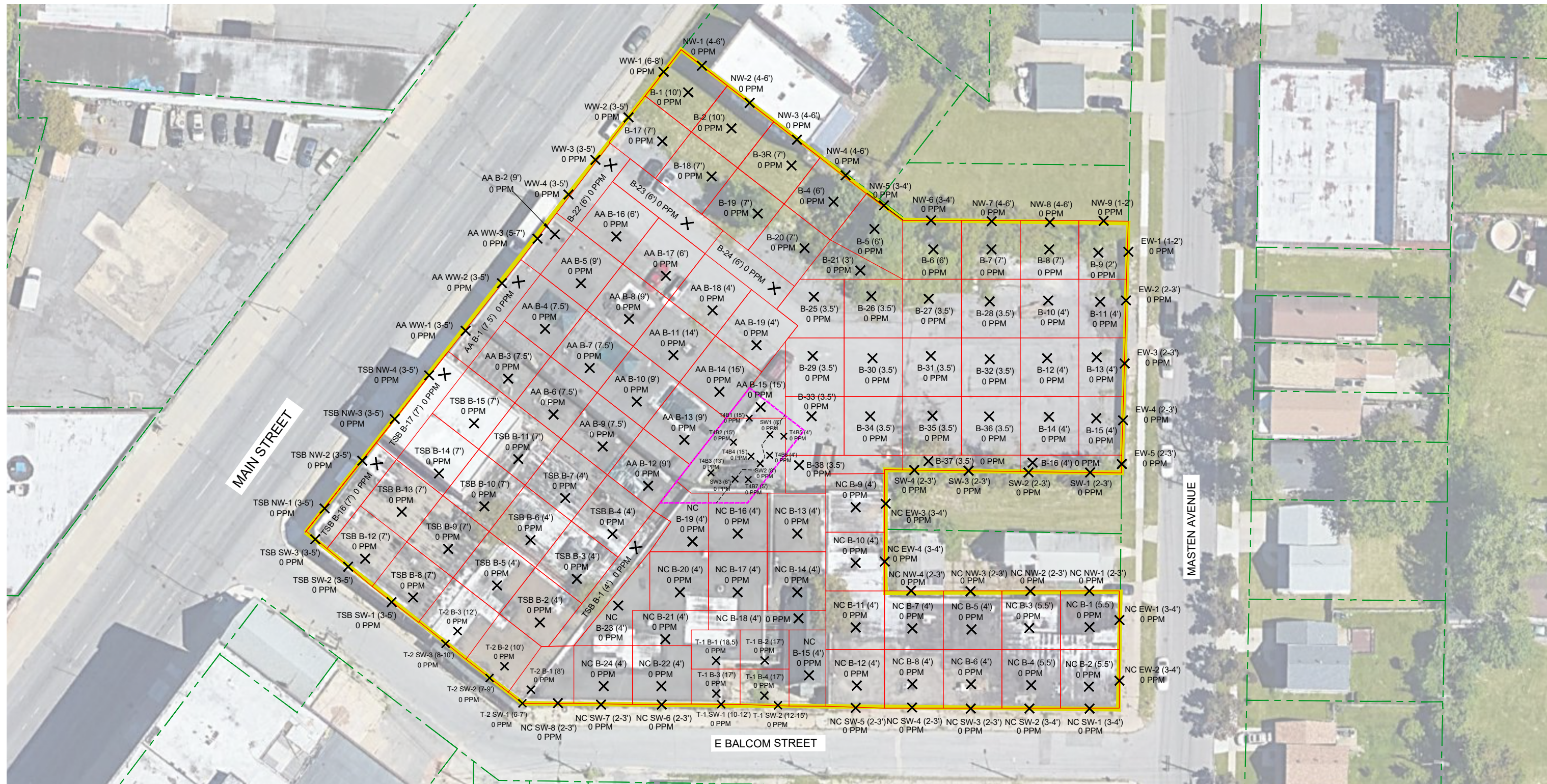
Project Mgr: NTM

Project: 4461.001B002

File: FIGURE 6 - SUMMARY OF GROUNDWATER EXCEEDANCES.DWG

FIGURE

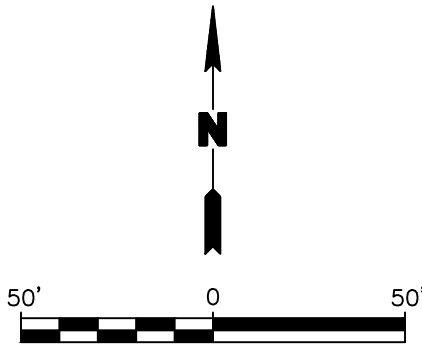
6



LEGEND:

- BCP BOUNDARY
- PARCEL BOUNDARY
- ✕ B-6 (6 FT)
- POST EXCAVATION SAMPLE LOCATION
- EXCAVATION EXTENTS
- EXCAVATION EXTENTS OF TANK 4 AREA - SEE FIGURE 14

DEFINITIONS:
AA - FORMER AUTO REPAIR AREA
NC - FORMER NIGHT CLUB AREA
TSB - FORMER THREE-STORY BUILDING AREA



Title:

**POST EXCAVATION SAMPLE LOCATIONS
SITE MANAGEMENT PLAN**

1681-1689 MAIN STREET SITE

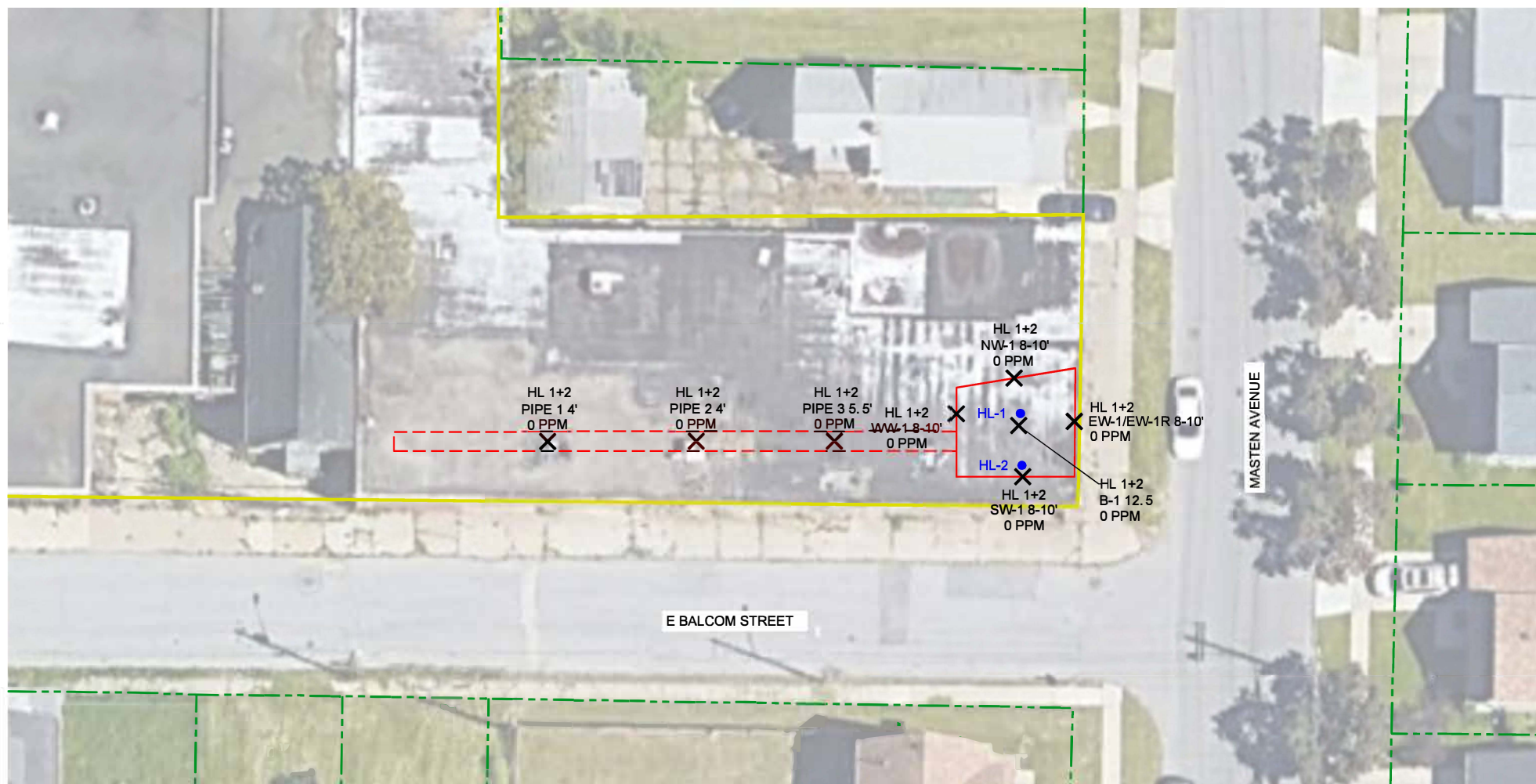
BCP SITE NO. C915378

BUFFALO, NEW YORK

Prepared for:

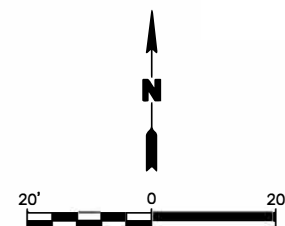
1681-1689 MAIN STREET, LLC

Compiled by: JJY	Date: MARCH 2026	FIGURE 7
Prepared by: JJY	Scale: AS SHOWN	
Project Mgr: NTM	Project: 4461.00010002	
File: FIGURE 7 - POST-EXCAVATION SAMPLE LOCATIONS.DWG		



LEGEND:

- BCP BOUNDARY
- - - - PARCEL BOUNDARY
- [] HYDRAULIC LIFTS 1&2 IRM EXCAVATION EXTENTS
- [] HYDRAULIC LIFTS 1+2 PIPE TRENCH EXCAVATION EXTENTS
- X HL 1+2 B-1 12.5 POST EXCAVATION SAMPLE LOCATION
- HL-1 FORMER HYDRAULIC LIFT LOCATION



Title: HYDRAULIC LIFTS 1&2 POST EXCAVATION
SAMPLE LOCATIONS
SITE MANAGEMENT PLAN
1681-1689 MAIN STREET SITE
BCP SITE NO. C915378
BUFFALO, NEW YORK

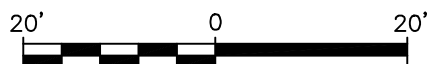
Prepared for:
1681-1689 MAIN STREET, LLC

ROUX	Compiled by: CEH	Date: APRIL 2024	FIGURE 8
	Prepared by: CEH	Scale: AS SHOWN	
	Project Mgr: NTM	Project: 4461.00010002	
File: FIGURE 8 - HYDRAULIC LIFTS 1&2 POST EXCAVATION SAMPLE LOCATIONS.DWG			



LEGEND:

- BCP BOUNDARY
- - - PARCEL BOUNDARY
- X** T-1 B-1 (18.5 FT) POST EXCAVATION SAMPLE LOCATION
- EXCAVATION EXTENTS



Title:

**TANK 1 POST EXCAVATION SAMPLE LOCATIONS
SITE MANAGEMENT PLAN
1681-1689 MAIN STREET SITE
BCP SITE NO.C915378
BUFFALO, NY**

Prepared for:

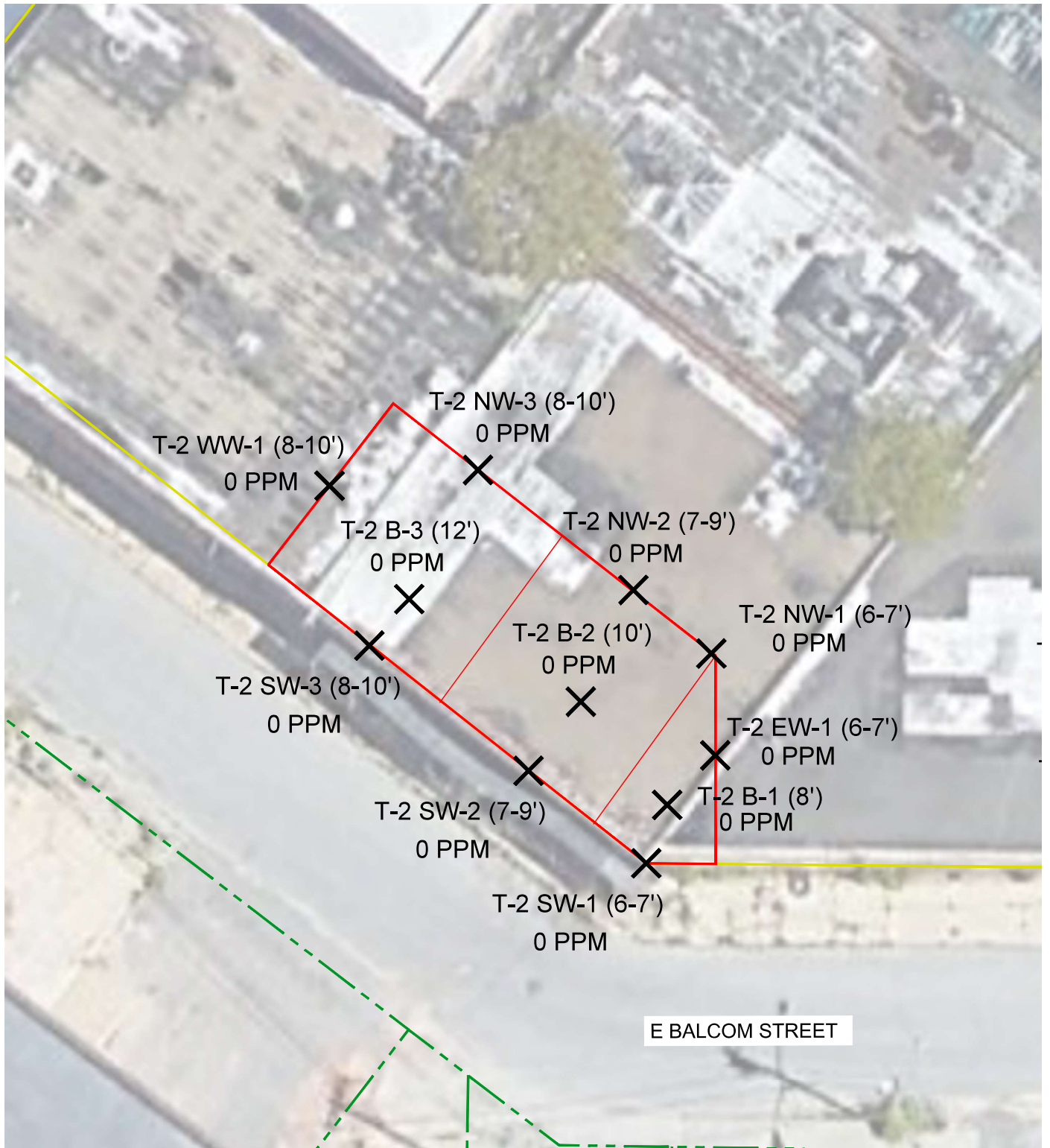
1681-1689 MAIN STREET LLC



Compiled by: CEH	Date: AUGUST 2024
Prepared by: CEH	Scale: AS SHOWN
Project Mgr: NTM	Project: 4461.0001B002
File: FIGURE 10 - TANK 1 POST EXCAVATION SAMPLE LOCATIONS.DWG	

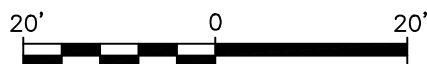
FIGURE

9



LEGEND:

- BCP BOUNDARY
- - - PARCEL BOUNDARY
- X T-2 B-1 (8')
- POST EXCAVATION SAMPLE LOCATION
- EXCAVATION EXTENTS



Title:

**TANK 2 POST EXCAVATION SAMPLE LOCATIONS
SITE MANAGEMENT PLAN
1681-1689 MAIN STREET SITE
BCP SITE NO.C915378
BUFFALO, NY**

Prepared for:

1681-1689 MAIN STREET LLC



Compiled by: CEH Date: AUGUST 2024

Prepared by: CEH Scale: AS SHOWN

Project Mgr: NTM Project: 4461.0001B002

File: FIGURE 11 - TANK 2 POST EXCAVATION SAMPLE LOCATIONS.DWG

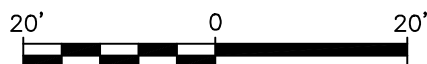
FIGURE

10



LEGEND:

- BCP BOUNDARY
- - - PARCEL BOUNDARY
- X T-3 B-1 (7.5') POST EXCAVATION SAMPLE LOCATION
- EXCAVATION EXTENTS



Title:

**TANK 3 POST EXCAVATION SAMPLE LOCATIONS
SITE MANAGEMENT PLAN**

1681-1689 MAIN STREET SITE

BCP SITE NO.C915378

BUFFALO, NY

Prepared for:

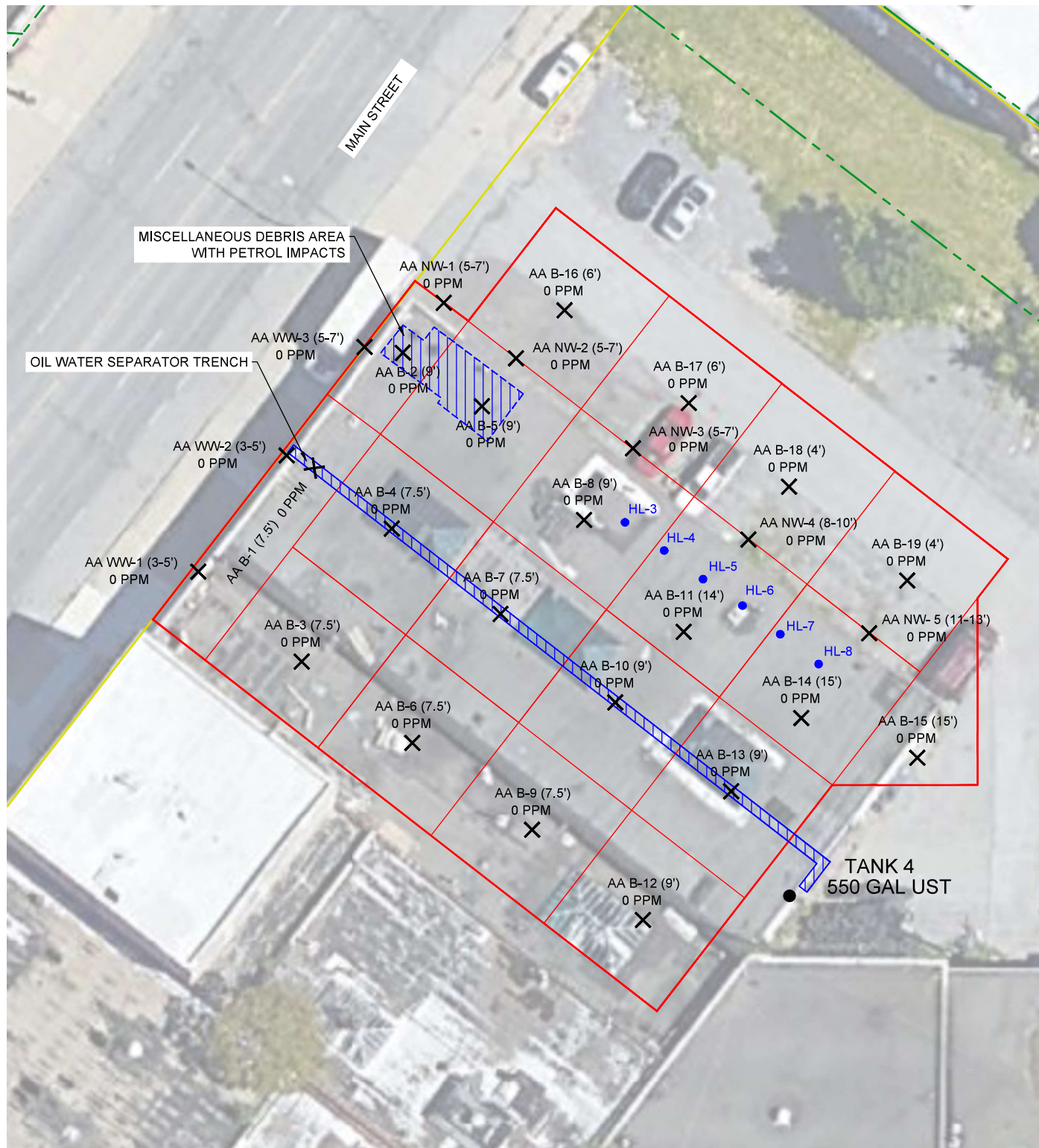
1681-1689 MAIN STREET LLC



Compiled by: CEH	Date: AUGUST 2024
Prepared by: CEH	Scale: AS SHOWN
Project Mgr: NTM	Project: 4461.0001B002
File: FIGURE 12 - TANK 3 POST EXCAVATION SAMPLE LOCATIONS.DWG	

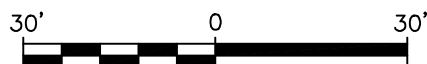
FIGURE

11



LEGEND:

- BCP BOUNDARY
- - - PARCEL BOUNDARY
- X** AA B-1 (7.5') POST EXCAVATION SAMPLE LOCATION
- EXCAVATION EXTENTS
- HL-3 FORMER HYDRAULIC LIFT LOCATION



Title:

FORMER AUTO REPAIR AREA POST EXCAVATION SAMPLE LOCATIONS SITE MANAGEMENT PLAN 1681-1689 MAIN STREET SITE BCP SITE NO.C915378 BUFFALO, NY

Prepared for:

1681-1689 MAIN STREET LLC



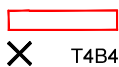
Compiled by: CEH	Date: AUGUST 2024
Prepared by: CEH	Scale: AS SHOWN
Project Mgr: NTM	Project: 4461.0001B002
File: FIGURE 13 - AUTO REPAIR AREA POST EXCAVATION SAMPLE LOCATIONS.DWG	

FIGURE

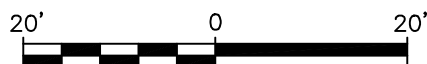
12



LEGEND:



EXCAVATION EXTENTS
POST EXCAVATION SAMPLE LOCATION



Title:

TANK 4 POST EXCAVATION SAMPLE LOCATIONS

**1681-1689 MAIN STREET SITE
BCP SITE NO. C915378
BUFFALO, NEW YORK
SITE MANAGEMENT PLAN**

Prepared for:

1681-1689 MAIN STREET, LLC



Compiled by: CMS	Date: DECEMBER 2024
Prepared by: CMS	Scale: AS SHOWN
Project Mgr: NTM	Project: 4461.0001B002
File: FIGURE XX - TANK 4 POST EXCAVATION SAMPLE LOCATIONS.DWG	

FIGURE

13

APPENDICES

- A. Environmental Easement
- B. List of Contacts (Within Text)
- C. Groundwater Elevations & Monitoring Well Construction Details
- D. Operation and Maintenance – ASD (if needed)*
- E. Quality Assurance Project Plan
- F. Field Operating Procedures
- G. Site Management Forms
- H. Climate Screening Checklist
- I. Remedial System Optimization Report

Environmental Easement

List of Contacts (Within Text)

Groundwater Elevations & Monitoring Well Construction Details



Appendix C

MONITORING WELL ELEVATIONS & CONSTRUCTION DETAILS SITE MANAGEMENT PLAN 1681-1689 MAIN STREET SITE BCP SITE NO. C915378 BUFFALO, NEW YORK

Well Identification			Well Elevations								Well Diameter (inches)	Well Screen Data						
Well Number*	Well Type	Date Completed	TOR Elevation (ft)	Stick up Height (ft)	Ground Elevation (ft)	Total Depth (fbTOR)	Bottom of Well Elevation (fmsl)	Depth to Groundwater (fbTOR)	Depth to Groundwater (fbgs)	Groundwater Elevation (ft)		Length of Well Screen (feet)	Screen Interval (fmsl)		Screen Interval (fbTOR)			
MW-3	OB	07/15/2026	631.47	5.92	625.55	23.00	608.47	17.06	11.14	614.41	2	5	613.47	to	608.47	18.00	to	23.00
MW-4	OB	04/27/2026	628.32	2.11	626.21	19.85	608.47	10.39	8.28	617.93	2	5	613.47	to	608.47	14.85	to	19.85
MW-5R	OB	04/27/2026	633.54	4.75	628.79	25.22	608.32	15.70	10.95	617.84	2	5	613.32	to	608.32	20.22	to	25.22
MW-6	OB	04/27/2026	629.30	0.00	629.30	19.15	610.15	10.91	10.91	618.39	2	5	615.15	to	610.15	14.15	to	19.15
TW-1	OB	04/27/2026	630.70	4.01	626.69	25.11	605.59	12.83	8.82	617.87	2	5	610.59	to	605.59	20.11	to	25.11
TW-2	OB	04/27/2026	629.50	0.00	629.50	21.25	608.25	11.76	11.76	617.74	2	5	613.25	to	608.25	16.25	to	21.25
TW-3	OB	04/27/2026	633.35	3.15	630.20	25.20	608.15	15.02	11.87	618.33	2	5	613.15	to	608.15	20.20	to	25.20
TW-4	OB	04/27/2026	627.59	-0.60	628.19	22.00	605.59	9.50	10.10	618.09	2	5	610.59	to	605.59	17.00	to	22.00

Abbreviations:

DTW = depth to water

fbgs = feet below ground surface

fbTOR = feet below top of riser

fmsl = feet above mean sea level

OB = Indicates a well completed in shallow unconsolidated overburden

TOR = top of riser

FIELD BOREHOLE/MONITORING INSTALLATION LOG

Project Name: 1681-1689 Main Street	LOCATION I.D.: MW-3
Project Number: 4461.0001B002	Well Type: ☒ Stick-up ☐ Flush-mount
Client: 1681-1689 Main Street LLC	Start Date: 03/20/24
Drilling Company: Trec Environmental	End Date: 03/20/24
Job Number:	Logged By: CEH
Rig Type: GeoProbe	Drilling Method: Direct Push
	Weather:

Elevation (fmsl)	Depth (fbgs)	Sample No.	Recovery (feet)	SAMPLE DESCRIPTION (ASTM D2488)	PID Scan (ppm)	Samples (y/n)	Well Construction Details
5.92'				Stick up height 5.92 feet above ground surface. 2 inch diameter well.			
0	0			ASPHALT PARKING LOT: Asphalt with stone subbase. No visual impacts/staining.	0.0	n	
-2	2	S1	4.0'	POORLY GRADED SANDY CLAY: Dry to moist sandy brown clay. Dry from 1-4 fbgs and moist from 4-12 fbgs. Medium plasticity. No visual impacts/staining.	0.0	n	
-4	4				0.0	n	
-6	6	S2	3.5'		0.0	n	
-8	8				0.0	n	
-10	10	S3	3'		0.0	y	
-12	12			POORLY GRADED SAND: Wet poorly graded fine greyish-brown sand. Measured well depth at 23.16 fbgs from top of riser.	0.0	n	
-14	14	S4	0.0'		0.0	n	
-16	16				0.0	n	
-18	18	S5	2.0'		0.0	n	
-20	20						
-22	22						

FIELD BOREHOLE/MONITORING INSTALLATION LOG

Project Name: 1681-1689 Main Street	LOCATION I.D.: MW-4
Project Number: 4461.0001B002	Well Type: ☐ Stick-up ☒ Flush-mount
Client: 1681-1689 Main Street LLC	Start Date: 03/19/24
Drilling Company: Trec Environmental	End Date: 03/19/24
Job Number:	Logged By: CEH
Rig Type: GeoProbe	Drilling Method: Direct Push
	Weather:

Elevation (fmsl)	Depth (fbgs)	Sample No.	Recovery (feet)	SAMPLE DESCRIPTION (ASTM D2488)	PID Scan (ppm)	Samples (y/n)	Well Construction Details
-0.7				Top of riser 0.66 fbgs. 2 inch diameter well.			
0	0			ASPHALT PARKING LOT: Asphalt with stone subbase. No visual impacts/staining.	0.0	n	
-2	2	S1	4.0'	POORLY GRADED SANDY CLAY: Dry to moist sandy brown clay. Dry from 1-4 fbgs and moist from 4-12 fbgs. Medium plasticity. No visual impacts/staining.	0.0	n	
-4	4				0.0	y	
-6	6	S2	3.5'		0.0	n	GROUT
-8	8				0.0	n	RISER
-10	10	S3	3'		0.0	n	
-12	12			POORLY GRADED SAND: Wet poorly graded fine greyish-brown sand. Measured well depth at 19.95 fbgs from top of riser.	0.0	n	SEAL
-14	14	S4	0.0'		0.0	n	
-16	16				0.0	n	SAND PACK
-18	18	S5	1.5'		0.0	n	SCREEN
-20	20						
-22	22						

FIELD BOREHOLE/MONITORING INSTALLATION LOG

Project Name: 1681-1689 Main Street	LOCATION I.D.: MW-5
Project Number: 4461.0001B002	Well Type: ☒ Stick-up ☐ Flush-mount
Client: 1681-1689 Main Street LLC	Start Date: 03/21/24
Drilling Company: Trec Environmental	End Date: 03/21/24
Job Number:	Logged By: CEH
Rig Type: GeoProbe	Drilling Method: Direct Push
	Weather:

Elevation (fmsl)	Depth (fbgs)	Sample No.	Recovery (feet)	SAMPLE DESCRIPTION (ASTM D2488)	PID Scan (ppm)	Samples (y/n)	Well Construction Details
2.29				Stick up height 2.29 feet above ground surface. 2 inch diameter well.			
0	0			CONCRETE WITH FILL SUBBASE: Concrete from 0-0.5 fbgs with fill material subbase from 0.5-1 fbgs. Fill material includes unknown black material, brick pieces, ash, cinders, and stone. No visual impacts/staining.	0.0	n	
-2	2	S1	4.0'	POORLY GRADED SANDY CLAY: Dry to moist sandy brown clay. Dry from 1-4 fbgs and moist from 4-10 fbgs. Medium plasticity. No visual impacts/staining.	0.0	n	
-4	4				0.0	n	
-6	6	S2	3.0'		0.0	y	GROUT
-8	8				0.0	n	RISER
-10	10	S3	2.5'	POORLY GRADED SAND: Wet poorly graded fine greyish-brown sand. Measured well depth at 22.88 fbgs from top of riser.	0.0	n	
-12	12				0.0	n	SEAL
-14	14	S4	2'		0.0	n	
-16	16				0.0	n	SAND PACK
-18	18	S5	3'		0.0	n	SCREEN
-20	20						
-22	22						

FIELD BOREHOLE/MONITORING INSTALLATION LOG

Project Name: 1681-1689 Main Street	LOCATION I.D.: MW-6
Project Number: 4461.0001B002	Well Type: ☒ Stick-up ☐ Flush-mount
Client: 1681-1689 Main Street LLC	Start Date: 03/21/24
Drilling Company: Trec Environmental	End Date: 03/21/24
Job Number:	Logged By: CEH
Rig Type: GeoProbe	Drilling Method: Direct Push
	Weather:

Elevation (fmsl)	Depth (fbgs)	Sample No.	Recovery (feet)	SAMPLE DESCRIPTION (ASTM D2488)	PID Scan (ppm)	Samples (y/n)	Well Construction Details
4.51				Stick up height 4.51 feet above ground surface. 2 inch diameter well.			
0	0			STONE: Stone subbase from former concrete. No visual impacts/staining.	0.0	n	
-2	2	S1	3.0'	POORLY GRADED SANDY CLAY: Dry to moist sandy brown clay. Dry from 1-6 fbgs and moist from 6-12 fbgs. Medium plasticity. No visual impacts/staining.	0.0	n	
-4	4				0.0	n	
-6	6	S2	3.0'		0.0	y	
-8	8				0.0	n	
-10	10	S3	2.5'		0.0	n	
-12	12			POORLY GRADED SAND: Wet poorly graded fine greyish-brown sand. Measured well depth at 22.72 fbgs from top of riser.	0.0	n	
-14	14	S4	1.5'		0.0	n	
-16	16				0.0	n	
-18	18	S5	2.0'		0.0	n	
-20	20						
-22	22						

TEMPORARY WELL COMPLETION DETAIL

Project Name: 168-1689 Main Street

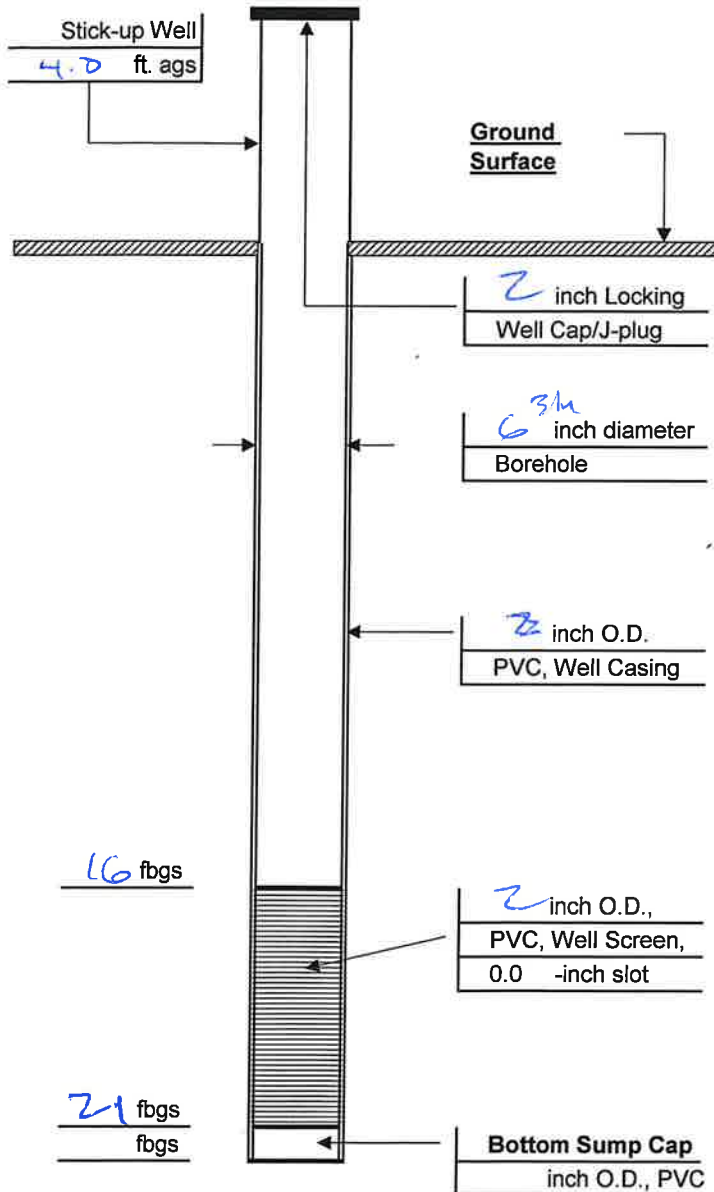
Client:

Boring Location:

WELL NUMBER: TM-1

Date Installed: 5/14/25

Project Number: 4462006/Boo2



Driller Information

Company: Tace

Driller: Eric Hamman

Helper: Chris Stockmaster

Permit Number:

Drill Rig Type: 6620 DT

Well Information

Land Surface Elevation: fmsl (approximate)

Drilling Method: Auger

Soil Sample Collection Method: N/A

Drilling Fluid: N/A

Fluid Loss During Drilling: N/A gallons (approximate)

Material of Well Construction

Casing: PVC

Screen: PVC

Sump: N/A

Sand Pack: #2 quartz sand

Annular Seal: bentonite chips

Well Development

Well Purpose:

Technique(s):

Date Completed:

BM/TK Personnel:

Total Volume Purge: gallons

Static Water Level (SWL): ftTOR

Pump Depth:

Purge Duration: minutes

Yield: gpm

Specific Capacity: gpm/ft

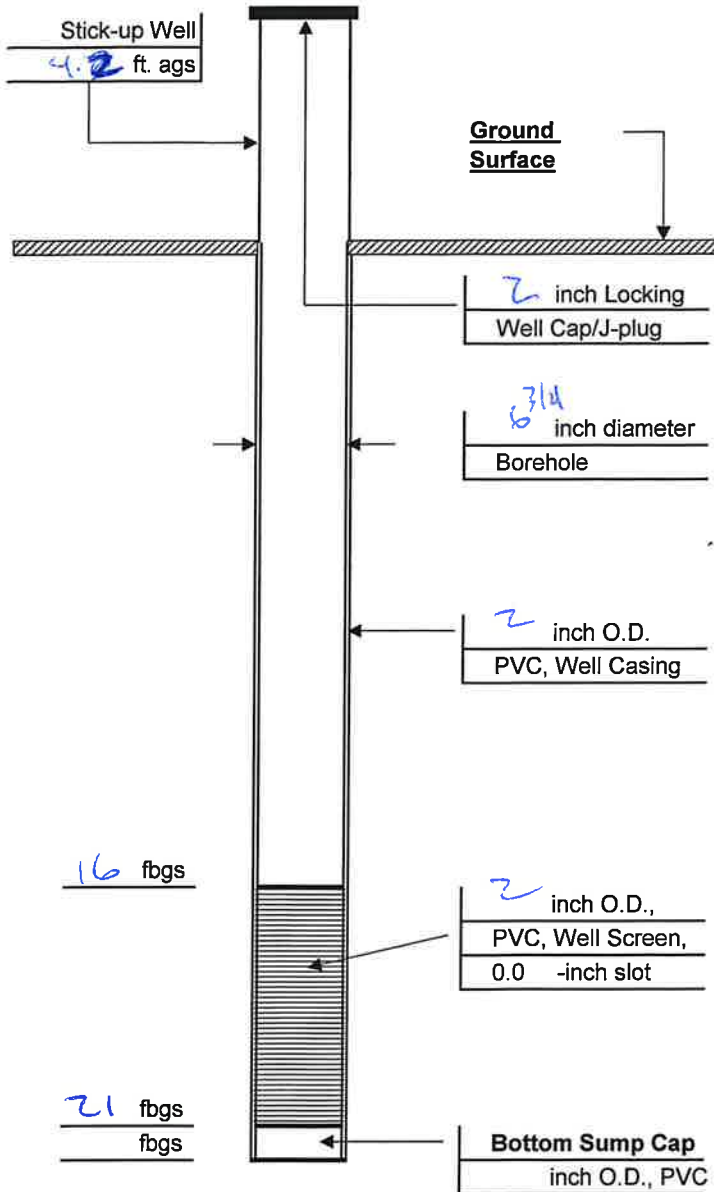
Comments: Sand pack 2' above well screen, 2' seal (bentonite)

PREPARED BY:

DATE:

Project Name: 1681-1689 Main St
 Client: 1681-1689 Main St LLC
 Boring Location: _____

WELL NUMBER: TW-2
 Date Installed: 3/3/25
 Project Number: 4461-0001 Bore2



Driller Information

Company: _____
 Driller: _____
 Helper: _____
 Permit Number: _____
 Drill Rig Type: _____

Well Information

Land Surface Elevation: _____ fmsl (approximate)
 Drilling Method: _____
 Soil Sample Collection Method: _____
 Drilling Fluid: _____
 Fluid Loss During Drilling: _____ gallons (approximate)

Material of Well Construction

Casing: _____
 Screen: _____
 Sump: _____
 Sand Pack: _____
 Annular Seal: _____

Well Development

Well Purpose: _____
 Technique(s): _____
 Date Completed: _____
 BM/TK Personnel: _____
 Total Volume Purge: _____ gallons
 Static Water Level (SWL): _____ fbTOR
 Pump Depth: _____
 Purge Duration: _____ minutes
 Yield: _____ gpm
 Specific Capacity: _____ gpm/ft

Comments: _____

PREPARED BY: _____

DATE: _____

TEMPORARY WELL COMPLETION DETAIL

Project Name:

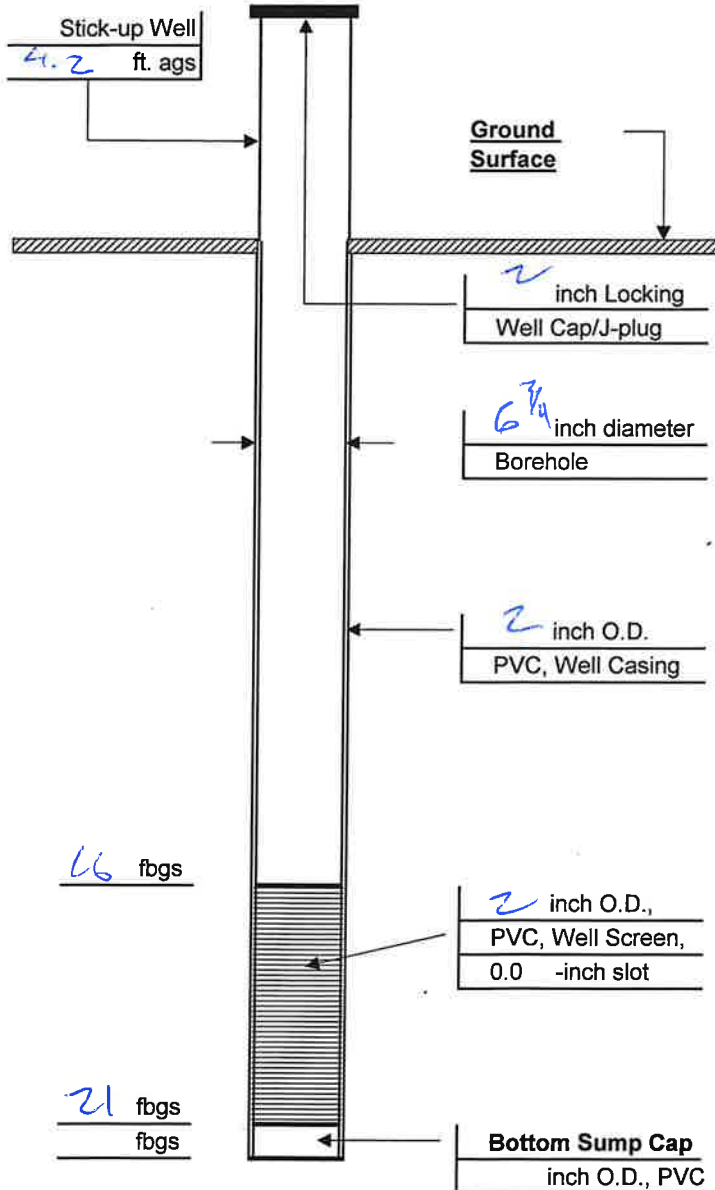
Client:

Boring Location:

WELL NUMBER: *Tw-3*

Date Installed:

Project Number:



Driller Information

Company:

Driller:

Helper:

Permit Number:

Drill Rig Type:

Well Information

Land Surface Elevation: fmsl (approximate)

Drilling Method:

Soil Sample Collection Method:

Drilling Fluid:

Fluid Loss During Drilling: gallons (approximate)

Material of Well Construction

Casing:

Screen:

Sump:

Sand Pack:

Annular Seal:

Well Development

Well Purpose:

Technique(s):

Date Completed:

BM/TK Personnel:

Total Volume Purge: gallons

Static Water Level (SWL): ftTOR

Pump Depth:

Purge Duration: minutes

Yield: gpm

Specific Capacity: gpm/ft

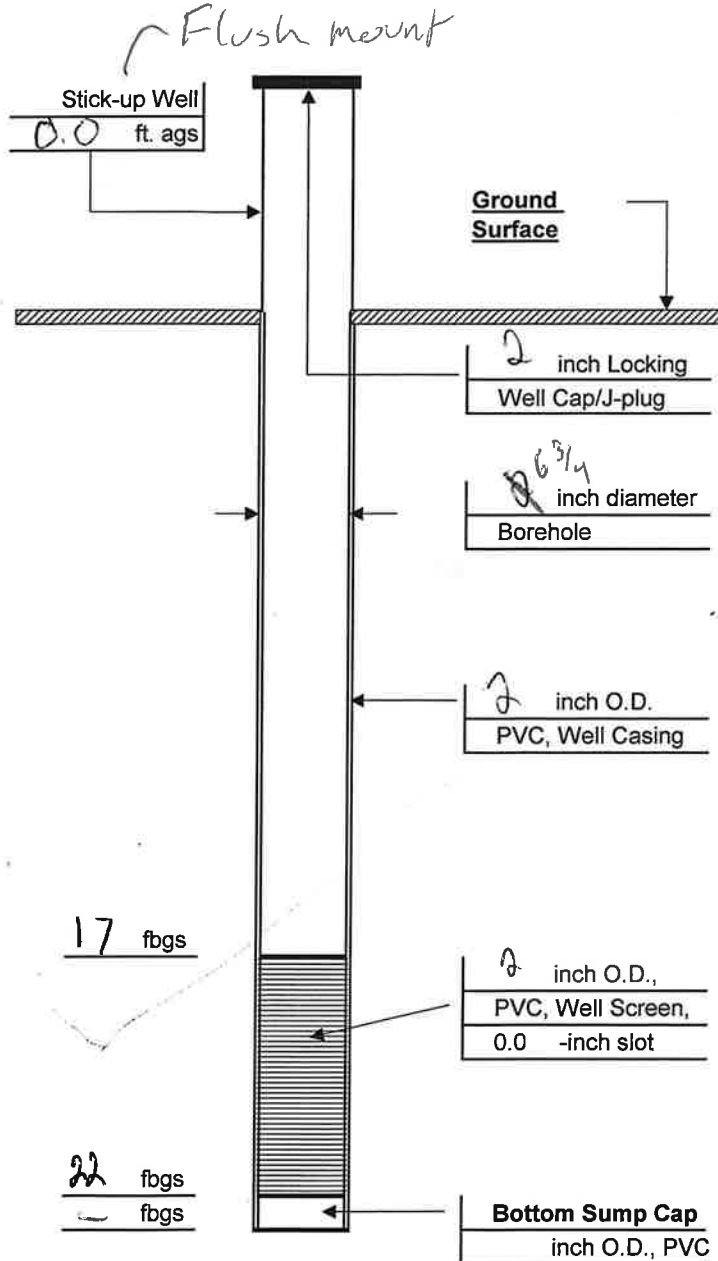
Comments:

PREPARED BY:

DATE:

Project Name: 1681-1689 Main Street
 Client: 1681-1689 Main Street LLC
 Boring Location: Flt East side of Building A

WELL NUMBER: TW-4R
 Date Installed: 4/22/26
 Project Number: 4461, 0001B002



Driller Information

Company: Tec Environmental
 Driller: Eric Harmon
 Helper: Chris Groomer
 Permit Number: N/A
 Drill Rig Type: 6620 DT

Well Information

Land Surface Elevation: fmsl (approximate)
 Drilling Method: Auger
 Soil Sample Collection Method: HF
 Drilling Fluid: N/A
 Fluid Loss During Drilling: N/A gallons (approximate)

Material of Well Construction

Casing: PVC
 Screen: PVC - Sch. 40, PVC
 Sump: N/A
 Sand Pack: #2 quartz sand
 Annular Seal: homomix chips

Well Development

Well Purpose: Monitor injected reagent & GW
 Technique(s): Bailer
 Date Completed: 4/24/26
 BM/TK Personnel: NJS
 Total Volume Purge: 20 gallons
 Static Water Level (SWL): 9.50 ftTOR
 Pump Depth: 21.30 N/A
 Purge Duration: 30 N/A minutes
 Yield: N/A gpm
 Specific Capacity: N/A gpm/ft

Comments: Sand 2' above screen interval - 7' total

PREPARED BY: NJS

DATE: 4/22/26-4/24/26

Operation and Maintenance – ASD (if necessary)

Quality Assurance Project Plan

QUALITY ASSURANCE PROJECT PLAN

**1681-1689 MAIN STREET SITE
BCP SITE No. C915378
BUFFALO, NEW YORK**

August 2024 (revised August 2026)

Prepared for:

1681-1689 Main Street LLC

Prepared by:

Roux Environmental Engineering and Geology, D.P.C.

QUALITY ASSURANCE PROGRAM PLAN

1681-1689 Main Street Site
Buffalo, New York

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QUALITY ASSURANCE PROJECT PLAN

1681-1689 Main Street Site

Buffalo, New York

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QUALITY ASSURANCE PROJECT PLAN

1681-1689 Main Street Site

Buffalo, New York

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Table 1	Sample Container, Volume, Preservative & Holding Time Requirements
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1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) is an appendix to the Site Management Plan (SMP), which is required as an element of the remedial program at the 1681-1689 Main Street Site (herein referred to as the “Site”) under the New York State (NYS) Brownfield Cleanup Program (BCP), administered by the New York State Department of Environmental Conservation (NYSDEC). The Site was remediated in accordance with the Brownfield Cleanup Agreement (BCA) Index #C915378-03-22, Site C915378, which was executed in March 2022. Three (3) BCA Amendments were submitted for the Site, including Amendment 1 was submitted on November 15, 2023 to expand the BCP Site boundary to include 1707 Main Street, Buffalo, NY parcel; Amendment 2 was submitted on February 12, 2024 to document the property transfer of the properties; and, Amendment 3 was submitted on May 20, 2026 to notify the Department of the combination of the parcels and updated municipal parcel information..

1.1 Site Location and Description

The approximately 2-acre area is identified as Section, Block, and Lot number 100.24-4-20.1, on the Buffalo Tax Map (see Figure 3), and addressed at 1689 Main Street, Buffalo NY 14209.

The Site is bordered by Main Street to the west, East Balcom Street to the south, Masten Avenue to the east, and residential and commercial properties to the north. Portions of the Site are currently occupied and used for automotive repair, auto tire storage, and commercial office space, with certain areas of the building vacant.

Several areas of the Site were formerly used for automobile repair and service from at least the 1930s to present. A portion of the Site (1689 Main) was used as a commercial bakery from the 1940s to the 1980s with associated loading docks, fuel pump, and suspected UST(s). Multiple former commercial and residential buildings were present on-site and subsequently demolished for construction of the current structures.

Previous investigations have identified environmental contamination on-site related to the above previous Site uses. Elevated petroleum related volatile organic compounds (VOCs) and polycyclic aromatic hydrocarbons (PAHs) were detected exceeding the regulatory guidelines for the planned reuse as an affordable housing development (Track 4 Restricted Residential Use, the least restrictive applicable SCOs required to be attained).

Based on the previous investigations, the remedial investigation/interim remedial measures (RI/IRM), and the remedial actions completed under the BCP, the Site was remediated to achieve Part 375 Unrestricted Soil Cleanup Objectives (USCOs). However, due to the presence of volatile organic compounds (VOCs) and chlorinated volatile organic compounds (cVOCs) above their respective groundwater quality standards in the southern portion of the Site, additional groundwater monitoring will be conducted to assess the effectiveness of the groundwater amendment injections completed as part of the remedial action.

After completion of the soil IRMs, groundwater IRMs injections were completed in 2025 and 2026 to address residual groundwater impacts related to the former tanks. Post-injection groundwater samples indicate significant decrease in VOC concentrations with remaining elevated groundwater limited to the TW-1-TW-4 area. Additional groundwater monitoring will be completed as detailed in this SMP.

1.2 Scope of the QAPP

This QAPP was prepared to provide quality assurance (QA) guidelines to be implemented post-remedial activities. The QAPP will assure the accuracy and precision of data collection during the Site characterization and data interpretation periods. The QAPP identifies procedures for sample collection to mitigate the potential for cross-contamination, as well as analytical requirements necessary to allow for independent data validation. The QAPP has been prepared in accordance with NYSDEC's DER-10 Technical Guidance for Site Investigation and Remediation (May 2010).

The QAPP provides:

- A means to communicate to the persons executing the various activities exactly what is to be done, by whom, and when.
- A culmination to the planning process that ensures that the program includes provisions for obtaining quality data (e.g., suitable methods of field operations).
- A historical record that documents the investigation in terms of the methods used, calibration standards, and frequencies planned, and auditing planned.
- A document that can be used by the Project Manager's and QA Officer to assess if the activities planned are being implemented and their importance for accomplishing the goal of quality data.

- A plan to document and track project data and results.
- Detailed descriptions of the data documentation materials and procedures, project files, and tabular and graphical reports.

The QAPP is primarily concerned with the QA/QC aspects of the procedures involved in the collection, preservation, packaging, and transportation of samples; field testing; record keeping; data management; chain-of-custody procedures; laboratory analyses; and other necessary matters to assure that sampling activities will yield data whose integrity can be defended.

QA refers to the conduct of planned and systematic actions necessary to perform satisfactorily task-specific activities and to provide information and data confidence as a result of such activities. The QA for task-specific activities includes the development of procedures, auditing, monitoring, and surveillance of the performance.

QC refers to the activity performed to determine if the work activities conform to the requirements. This includes activities such as inspections of the work activities in the field (e.g., verification that the items and materials installed conform to applicable codes and design specifications).

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

The following section provides a generic organization for sampling activities, including roles, responsibilities, and required qualifications of these organizations.

2.1 NYSDEC and NYSDOH

It is the responsibility of the NYSDEC, in conjunction with the NYSDOH, to review project documents for completeness and conformance with the site-specific cleanup objectives and to make a decision to accept or reject these documents based on this review. The NYSDEC also has the responsibility and authority to review and approve QA documentation collected during brownfield cleanup construction and to confirm that the QA Plan was followed.

2.2 Property Owner

The property owner (Owner), or holder of the certificate of completion (COC) will be responsible for complying with the QA requirements as specified herein and for monitoring and controlling the quality of the Brownfield cleanup construction either directly or through their designated developer and/or environmental consultant. The Owner will also have the authority to select Contractor(s) to assist them in fulfilling these responsibilities. The Owner is responsible for implementing the project and has the authority to commit the resources necessary to meet project objectives and requirements.

2.3 Project Manager

The Project Manager has the responsibility for ensuring that the project meets the overall project objectives, reports directly to the Owner, coordinates with the NYSDEC/NYSDOH Project Coordinators, and is responsible for technical and project oversight. The PM will:

- o Define project objectives and develop a detailed work plan schedule.
- o Establish project policy and procedures to address the specific needs of the project as a whole, as well as the objectives of each task.
- o Acquire and apply technical and corporate resources as needed to assure performance within budget and schedule constraints.

- o Develop and meet ongoing project and/or task staffing requirements, including mechanisms to review and evaluate each task product.
- o Review the work performed on each task to assure its quality, responsiveness, and timeliness.
- o Review and analyze overall task performance with respect to planned requirements and authorizations.
- o Review and approve all deliverables before their submission to NYSDEC.
- o Develop and meet ongoing project and/or task staffing requirements, including mechanisms to review and evaluate each task product.
- o Ultimately be responsible for the preparation and quality of interim and final reports.
- o Represent the project team at meetings.

2.4 Field Team Leader

The Field Team Leader (FTL) has the responsibility for implementation of specific project tasks identified at the Site and is responsible for the supervision of project field personnel, subconsultants, and subcontractors. The FTL reports directly to the Project Manager. The FTL will:

- o Define daily develop work activities.
- o Orient field staff concerning the project's special considerations.
- o Monitor and direct subcontractor personnel.
- o Review the work performed on each task to ensure its quality, responsiveness, and timeliness.
- o Assure that field activities, including sample collection and handling, are carried out in accordance with this QAPP.

2.5 Quality Assurance (QA) Officer

The QA Officer will have direct access to corporate executive staff as necessary, to resolve any QA dispute, and is responsible for auditing the implementation of the QA program in conformance with the demands of specific investigations and policies, and NYSDEC requirements. Specific function and duties include:

- o Performing QA audits on various phases of the field operations.
- o Reviewing and approving QA plans and procedures.
- o Providing QA technical assistance to project staff.
- o Reporting on the adequacy, status, and effectiveness of the QA program on a regular basis to the Project Manager for technical operations.
- o Responsible for assuring third party data review of all sample results from the analytical laboratory.

2.6 Laboratory Responsibilities

Any environmental laboratory utilized for sample analysis for this Site must be an independent, NYSDOH Environmental Laboratory Approval Program (ELAP)-certified facility approved to perform the analyses prescribed herein.

- Laboratory Director:

The Laboratory Director is a technical advisor and is responsible for summarizing and reporting overall unit performance. Responsibilities of the Laboratory Director include:

- o Provide technical, operational, and administrative leadership.
- o Allocation and management of personnel and equipment resources.
- o Quality performance of the facility.
- o Certification and accreditation activities.
- o Blind and reference sample analysis.

- Quality Assurance Manager (QA Manager):

The QA Manager has the overall responsibility for data after it leaves the laboratory. The QA Manager will be independent of the laboratory but will communicate data issues through the Laboratory Director. In addition, the QA Manager will:

- o Oversee laboratory QA.
- o Oversee QA/QC documentation.

- o Conduct detailed data review.
- o Determine whether to implement laboratory corrective actions, if required.
- o Define appropriate laboratory QA procedures.
- o Prepare laboratory SOPs.

3.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

The overall objectives and criteria for assuring quality for this effort are discussed below. This QAPP addresses how the acquisition and handling of samples and the review and reporting of data will be documented. The objectives of this QAPP are to address the following:

- The procedures to be used to collect, preserve, package, and transport groundwater samples.
- Field data collection.
- Record keeping.
- Data management.
- Chain-of-custody procedures.
- Precision, accuracy, completeness, representativeness, for sample analysis and data management under EPA analytical methods.

3.1 Level of QC Effort for Sample Parameters

Field blank, method blank, trip blank, field duplicate, laboratory duplicate, laboratory control, standard reference materials (SRM) and matrix spike samples will be analyzed to assess the quality of the data resulting from the field sampling and analytical programs. QC samples are discussed below.

- Field and trip blanks consisting of distilled water will be submitted to the analytical laboratories to provide the means to assess the quality of the data resulting from the field-sampling program. Field (equipment) blank samples are analyzed to check for procedural chemical constituents at the facility that may cause sample contamination. Trip blanks are used to assess the potential for contamination of samples due to contaminant migration during sample shipment and storage.
- Method blank samples are generated within the laboratory and used to assess contamination resulting from laboratory procedures.
- Duplicate samples are analyzed to check for sampling and analytical reproducibility.
- MS/MSD and MS/Duplicate samples provide information about the effect of the sample matrix on the digestion and measurement methodology. Depending on site-specific circumstances, one MS/MSD or MS/Duplicate should be collected for every 20 or fewer investigative samples to be analyzed for organic and inorganic chemicals of a given matrix.

The general level of QC effort will be one field (blind) duplicate and one field blank (when non-dedicated equipment is used) for every 20 or fewer investigative samples of a given matrix. Additional sample volume will also be provided to the laboratory to allow one site-specific MS/MSD or MS/Duplicate for every 20 or fewer investigative samples of a given matrix. One trip blank consisting of distilled, deionized water will be included along with each sample delivery group of aqueous VOC samples.

4.0 SAMPLE CUSTODY PROCEDURES

4.1 Field Custody Procedures

Sample custody is controlled and maintained through the chain-of-custody procedures. Chain of custody is the means by which the possession and handling of samples will be tracked from the source (field) to their final disposition, the laboratory. A sample is considered to be in a person's custody if it is in the person's possession or it is in the person's view after being in his or her possession or it was in that person's possession and that person has locked it in a vehicle or room. Sample containers will be cleaned and preserved at the laboratory before shipment to the Site.

4.1.1 Sample Storage

Samples are stored in secure limited-access areas. Sample parameter lists, holding times and sample container requirements are summarized on Table 1.

4.1.2 Sample Custody

Sample custody is defined by this document as when any of the following occur:

- It is in someone's actual possession.
- It is in someone's view after being in his or her physical possession.
- It was in someone's possession and then locked, sealed, or secured in a manner that prevents unsuspected tampering.
- It is placed in a designated and secured area.

Samples are removed from storage areas by the sample custodian or analysts and transported to secure laboratory areas for analysis. Access to the laboratory and sample storage areas is restricted to laboratory personnel and escorted visitors only; all areas of the laboratory are therefore considered secure. If required by the applicable regulatory program, internal chain-of-custody is documented in a log by the person moving the samples between laboratory and storage areas.

Laboratory documentation used to establish COC and sample identification may include the following:

- Field COC forms or other paperwork that arrives with the sample.
- The laboratory COC.

- Sample labels or tags are attached to each sample container.
- Sample custody seals.
- Sample preparation logs (i.e., extraction and digestion information) recorded in hardbound laboratory books that are filled out in legible handwriting and signed and dated by the chemist.
- Sample analysis logs (e.g., metals, GC/MS, etc.) information recorded in hardbound laboratory books that are filled out in legible handwriting and signed and dated by the chemist.
- Sample storage log (same as the laboratory COC).
- Sample disposition log, which documents sample disposal by a contracted waste disposal company.

4.1.3 Sample Tracking

All samples are maintained in the appropriate coolers prior to and after analysis. The analysts remove and return their samples as needed. Samples that require internal COC are relinquished to the analysts by the sample custodians. The analyst and sample custodian must sign the original COC relinquishing custody of the samples from the sample custodian to the analyst. When the samples are returned, the analyst will sign the original COC returning sample custody to the sample custodian. Sample extracts are relinquished to the instrumentation analysts by the preparatory analysts. Each preparation department tracks internal COC through their logbooks/spreadsheets.

Any change in the sample during the time of custody will be noted on the COC (e.g., sample breakage or depletion).

5.0 CALIBRATION PROCEDURES AND FREQUENCY

This section describes the calibration procedures and the frequency at which these procedures will be performed for both field and laboratory instruments.

5.1 Field Instrument Calibration

Quantitative field data to be obtained during groundwater sampling includes screening for water quality parameters with a groundwater quality meter.

5.2 Preventative Maintenance

Each piece of field equipment is checked according to its routine maintenance schedule and before field activities begin. Field equipment that may be used at the Site includes:

- Groundwater quality meter
- Water level meter
- Low-flow sampling equipment (i.e. submersible pumps or peristaltic pumps)

Field personnel will report all equipment maintenance and/or replacement needs to the Project QA Officer and will record the information on the daily field record.

6.0 DATA VALIDATION AND REPORTING

All data generated through field activities, or by the laboratory operation shall be reduced and validated (as required in the SMP) before reported.

6.1 Data Usability Evaluation

If requested by the NYSDEC, data evaluation will be performed by a third-party data validator using the most current methods and quality control criteria from the USEPA's Contract Laboratory Program (CLP) *National Functional Guidelines for Organic Data Review*, and Contract Laboratory Program, *National Functional Guidelines for Inorganic Data Review*.

6.1.1 Procedures Used to Evaluate Field Data Usability

The performance of all field activities, calibration checks on all field instruments at the beginning of each day of use, manual checks of field calculations, checking for transcription errors and review of field logbooks is the responsibility of the Field Team Leader.

6.1.2 Procedures Used to Evaluate Laboratory Data Usability

Data evaluation will be performed by the third-party data validator using the most current methods and quality control criteria from the USEPA's Contract Laboratory Program (CLP) *National Functional Guidelines for Organic Data Review*, and Contract Laboratory Program, *National Functional Guidelines for Inorganic Data Review*. The data review guidance will be used only to the extent that it is applicable to the SW-846 methods; SW-846 methodologies will be followed primarily and given preference over CLP when differences occur. Also, results of blanks, surrogate spikes, MS/MSDs, and laboratory control samples will be reviewed/evaluated by the data validator. All sample analytical data for each sample matrix shall be evaluated. The third-party data validation expert will also evaluate the overall completeness of the data package. Completeness checks will be administered on all data to determine whether deliverables specified in this QAPP are present. The reviewer will determine whether all required items are present and request copies of missing deliverables.

6.2 Data Reporting

6.2.1 Field Data Reporting

All field documents will be accounted for when they are completed. Accountable documents include items such as field notebooks, sample logs, field data records, photographs, data packages, computer disks, and reports.

6.2.2 Laboratory Data Reporting

Analytical data will be summarized in tabular format with such information as sample identification, sample matrix description, parameters analyzed and their corresponding detected concentrations, and the detection limit. Analytical results will be incorporated into reports as data tables, maps showing sampling locations and analytical results, and supporting text.

7.0 CORRECTIVE ACTION

Corrective action is the process of identifying, recommending, approving, and implementing measures to counter unacceptable procedures or out of quality control performance that can affect data quality. Corrective action can occur during field activities, laboratory analyses, data validation, and data assessment. All corrective action proposed and implemented should be documented in the regular quality assurance reports to management. Corrective action should be implemented only after approval by the Project Manager, or his/her designee. If immediate corrective action is required, approvals secured by telephone from the Project Manager should be documented in an additional memorandum.

7.1 Field Corrective Action

If errors in field procedures are discovered during the observation or review of field activities by the Project QA Officer or his/her designee, corrective action will be initiated. Nonconformance to the QA/QC requirements of the field operating procedures will be identified by field audits or immediately by project staff who know or suspect that a procedure is not being performed in accordance with the requirements. The Project QA Officer or his designee will be informed immediately upon discovery of all deficiencies. Timely action will be taken if corrective action is necessary.

Corrective action in the field may be needed when the sample network is changed (i.e., more/less samples, sampling locations other than those specified in the Work Plan, etc.) or when sampling procedures and/or field analytical procedures require modification due to unexpected conditions. In general, the Project Manager and QA Officer may identify the need for corrective action. The Project Manager will approve the corrective measure that will be implemented by the field team. It will be the responsibility of the Project Manager to ensure that corrective action has been implemented.

If the corrective action supplements the existing sampling using existing and approved procedures in the QAPP, corrective action approved by the Project Manager will be documented. If the corrective actions result in less samples (or analytical fractions), alternate locations, etc., which may result in non-achievement of project QA objectives, it will be necessary that all levels of project management, including the NYSDEC Project Coordinator, concur with the proposed action.

Corrective actions will be implemented and documented in the project field record book. No staff member will initiate corrective action without prior communication of findings through the proper channels. If corrective actions are insufficient, work may be stopped by the NYSDEC Project Coordinator.

If at any time a corrective action issue is identified which directly impacts project data quality objectives, the NYSDEC Project Coordinator will be notified immediately.

7.2 Laboratory Corrective Action

Corrective actions may be initiated if the quality assurance goals are not achieved. The initial step in a corrective action is to instruct the analytical laboratory to examine its procedures to assess whether analytical or computational errors caused the anomalous result. If no error in laboratory procedures or sample collection and handling procedures can be identified, then the Project Manager will assess whether reanalysis or resampling is required or whether any protocol should be modified for future sampling events.

7.3 Data Validation & Assessment Corrective Action

The need for corrective action may be identified during the data validation or assessment processes. Potential types of corrective action may include resampling by the field team, or reinjection/reanalysis of samples by the laboratory.

These actions are dependent upon the ability to mobilize the field team, whether the data to be collected is necessary to meet the QA objectives (e.g., the holding time for samples is not exceeded, etc.). If the data validator identifies a corrective action situation, the Project Manager will be responsible for approving the corrective action implementation. All required corrective actions will be documented by the laboratory Quality Assurance Coordinator.

TABLE

TABLE 1

**SAMPLE CONTAINER, VOLUME, PRESERVATION &
HOLDING TIME REQUIREMENTS
QUALITY ASSURANCE PROJECT PLAN
1681-1689 MAIN STREET SITE
BUFFALO, NEW YORK**

Matrix	Parameter ¹	Method ¹	Container Type	Minimum Volume	Preservation (Cool to 2-4 °C for all samples)	Holding Time from Sample Date
Groundwater	TCL + CP-51 VOCs	8260B	glass vial	2-40 mL	HCl to pH<2, Zero Headspace, Cool to 2-4 °C	14 days

References:

1. Test Methods for Evaluating Solid Wastes, USEPA SW-846, Update III, 1991.

Notes:

1. EPA-approved method published in Reference 1 above may be used.

Acronyms:

VOCs = Volatile Organic Compounds

Field Operating Procedures



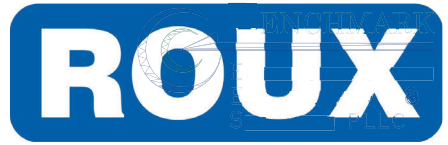
FIELD OPERATING PROCEDURES

ROUX ENVIRONMENTAL ENGINEERING AND GEOLOGY, D.P.C

FOP Number	Description
002.0	Abandonment of Monitoring Wells Procedure
004.7	Soil Vapor Sample Collection Procedure
006.0	Calibration and Maintenance of Combustible Gas/Oxygen Meter
007.0	Calibration and Maintenance of Portable Dissolved Oxygen Meter
008.0	Calibration and Maintenance of Portable Field pH/Eh Meter
009.0	Calibration and Maintenance of Portable Field Turbidity Meter
010.0	Calibration and Maintenance of Portable Flame Ionization Detector
011.1	Calibration and Maintenance of Portable Photoionization Detector
012.0	Calibration and Maintenance of Portable Specific Conductance Meter
015.0	Documentation Requirements for Drilling and Well Installation
022.0	Groundwater Level Measurement
023.1	Groundwater Purging Procedures Prior to Sample Collection
024.1	Groundwater Sample Collection Procedures
031.2	Low Flow (Minimal Drawdown) Groundwater Purging & Sampling Procedure
032.2	Management of Investigation-Derived Waste (IDW)
033.0	Monitoring Well Construction for Hollow Stem Auger Boreholes
036.0	Monitoring Well Development Procedures
040.1	Non-Disposable and Non-Dedicated Sampling Equipment Decontamination
041.0	Overburden Casing Installation Procedure
046.1	Sample Labeling, Storage and Shipment Procedures
076.0	"Before Going Into the Field" Procedure
077.0	Temporary Well (Piezometer) Construction Procedures
083.1	Active Subslab Depressurization Pre-Design Testing Procedure
085.0	Field Quality Control Procedures
090.0	Outdoor Ambient Air VOC Sample Collection Procedure

Notes:

1. FOPs are identified by the sequential FOP number and revision number. For example, FOP number 097.3 indicates FOP 97, revision 3.



FIELD OPERATING PROCEDURES

Abandonment of Monitoring Wells Procedure

ABANDONMENT OF MONITORING WELLS PROCEDURE

PURPOSE

This guideline presents a method for the abandonment and decommissioning of wells that are no longer reliable as competent monitors of formation groundwater. Well abandonment and decommissioning is required in order to remove a potential pathway for the vertical migration of impacted groundwater and/or surface water.

PROCEDURE

1. Examine the existing well to be abandoned/decommissioned and review well construction detail information (if applicable) to determine well depth,, screened interval, diameter, material of composition and other construction details. Establish appropriate equipment requirements for removal of the well.
2. Determine the most suitable seal materials as discussed in the next section.
3. Attempt to remove the well using a drilling rig, by using the following procedures:
 - Attaching the winch line to the well to see if it can be removed by pulling;
 - Using the rig's hydraulics to advance casing incrementally;
 - If a cable tool rig is available, bump back the casing using the cathead and drive block.
3. Upon removal of the well, ream the borehole by advancing the augers approximately one foot beyond the total depth of the well. Rotate the augers at a speed sufficient to remove the construction materials (i.e., filter pack, bentonite seal, etc.) from the borehole annulus (if possible). Backfill the resulting borehole with cement/bentonite grout, by tremie method, to approximately one foot below ground surface. Fill the remaining borehole to match the existing grade elevation and material of construction (i.e., clean native soil, concrete or asphalt, as necessary). Go to Step 10.

ABANDONMENT OF MONITORING WELLS PROCEDURE

4. If the well cannot be removed from the borehole over-drill the borehole and well to approximately two (2) feet below the well depth. Upon reaching the desired depth, remove the well from within the augers and go back to Step 3.
5. If the borehole cannot be reamed out using conventional drilling techniques (i.e., over-drilled), remove or puncture the base plate of the well screen using the drill rig and associated equipment by pounding with the drill rods. Upon filling the well with grout by tremie method, slowly pull the well from the ground surface to allow the grout to evacuate through the bottom of the well to fill the void space created by removal of the well casing. Continue adding grout mix to the well casing, as necessary, to fill the void space to approximately one foot below ground surface. Fill the remaining borehole to match the existing grade elevation and material of construction (i.e., clean native soil, concrete or asphalt, as necessary). Go to Step 10.

If the driller is unsuccessful at removing or puncturing the base plate of the well due, in part, to well construction materials (i.e., stainless steel or black iron), go to Step 6.

6. Insert a tremie pipe down the well to the bottom and pump a cement/bentonite grout mixture to a depth one to two feet above the top of the screen.
7. Perform a hydraulic pressure test on the portion of the well casing above the grouted screen section. Allow the grout to set up for a period not less than 72 hours before pressure testing of the grouted interval. Place a pneumatic packer a maximum of 4.5 feet above the top of the slotted screen section of the well. The infiltration pressure applied to the packer shall not exceed the pressure rating of the well casing material. If the interval between the top of the grout and the bottom of the packer is not saturated, potable water will be used to fill the interval. A gauge pressure of 5 psig at the well head shall be applied to the interval for a period of 5 minutes to allow for temperature stabilization. After 5 minutes, the pressure will be maintained at 5 psig for 30 minutes. The grout seal shall be considered acceptable if the total loss of water to the seal does not exceed 0.5 gallons over a 30-minute period.

ABANDONMENT OF MONITORING WELLS PROCEDURE

8. If the grout seal is determined to be unacceptable, tremie grout an additional 5 feet of well riser above the failing interval and retest as specified above (see Step 7).
9. If the grout seal is determined to be acceptable, tremie grout the remainder of the well until grout displaces all formation water and a grout return is visible in the well at the surface. Cut off well casing at a depth of five feet or greater below ground surface and backfill the remaining borehole to match the existing grade elevation and material of construction (i.e., clean native soil, concrete or asphalt, as necessary).
10. Record all well construction details and abandonment procedures on the **Well Abandonment/Decommissioning Log** (sample attached).

CEMENT/BENTONITE GROUT MIXTURE

The cement/bentonite grout mixture identified below is generally considered the most suitable seal material for monitoring well advancement and abandonment. Grout specifications generally have mixture ratios as follows:

Grout Slurry Composition (% Weight)

1.5 to 3.0%	-	Bentonite (Quick Gel)
40 to 60%	-	Cement (Portland Type I)
40 to 60%	-	Potable Water

MISCELLANEOUS

All removed well materials (PVC, stainless steel, steel pipe) should be decontaminated (if necessary) as per the project specific **Drilling and Excavation Equipment Decontamination FOP** and removed from the site. The project manager will determine the destination of final disposal for all well materials. All drill cuttings (depending on site protocol) should be placed in DOT-approved 55-gallon drums, labeled and sampled in

FOP 002.0

ABANDONMENT OF MONITORING WELLS PROCEDURE

accordance with Roux's field operating procedure **Management of Investigation-Derived Waste** in order to determine proper removal and disposal procedures. The drilling subcontractor will provide any potable water utilized during this field activity from a known and reliable source (see Notes section).

ATTACHMENTS

Well Abandonment/Decommissioning Log (sample)

REFERENCES

New York State Department of Environmental Conservation, July 1988, *Drilling and Monitoring Well Installation Guidance Manual*.

Driscoll, F.G., 1987, *Groundwater and Wells*, Johnson Division, St. Paul, Minnesota, p. 1089.

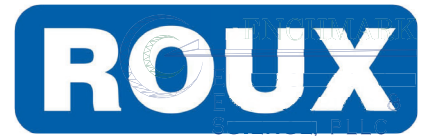
Roux FOPs:

- 018 *Drilling/Excavation Equipment Decontamination Protocols*
- 032 *Management of Investigation-Derived Waste*

NOTES

Tap water may be used from any municipal water treatment system. The use of an untreated potable water supply is not an acceptable substitute.



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FIELD OPERATING PROCEDURES

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Soil Vapor Sample Collection Procedures

**SOIL VAPOR SAMPLE
COLLECTION PROCEDURE**

BACKGROUND

In October 2006, the New York State Department of Health (NYSDOH) finalized their vapor intrusion guidance document entitled “Guidance for Evaluating Soil Vapor Intrusion in the State of New York.” (www.health.state.ny.us/nysdoh/gas/svi_guidance/), which has been guiding NYSDOH and New York State Department of Environmental Conservation (NYSDEC) decisions concerning the need for subslab vapor mitigation at sites undergoing investigation, cleanup and monitoring under formal NY State remedial programs (e.g., Brownfield Cleanup Program sites, Inactive Hazardous Waste Site Remediation Program sites, etc.). Per the most recent update, February 2024, guidance presents six (6) soil vapor/indoor air matrices to assist in interpreting the comparison of subslab and ambient air data. As of February 2024, 20 compounds have been assigned to these six (6) current matrices (i.e., “Matrix A”, “Matrix B”, “Matrix C”, “Matrix D”, “Matrix E”, and “Matrix F”) as follows:

Soil Vapor / Indoor Air Matrix	Volatile Chemical
Matrix A	Carbon tetrachloride
	1,1-Dichloroethene
	cis-1,2-Dichloroethene
	Trichloroethene
Matrix B	Methylene Chloride
	Tetrachlorethene
	1,1,1-Trichloroethane
Matrix C	Vinyl chloride
Matrix D	Benzene
	Ethylbenzene
	Naphthalene

FOP 004.7

SOIL VAPOR SAMPLE COLLECTION PROCEDURE

	Cyclohexane
	Isooctane (2,2,4-Trimethylpentane)
	1,2,4-Trimethylbenzene
	1,3,5-Trimethylbenzene
	o-Xylene
Matrix E	m,p-Xylene
	Heptane
	Hexane
Matrix F	Toluene

The matrices are attached as Figures 1 through 6.

PURPOSE

The procedures presented herein delineate the scope of additional investigation at a building on the project site to determine if volatile organic compounds (VOCs) detected in groundwater and/or soil near the building are intruding into the building airspace or have the potential, in sufficient concentrations, to adversely impact indoor air quality. The soil vapor, subslab vapor, and ambient air monitoring procedures follow the NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York (October 2006) as well as USEPA Methods TO-14 and TO-15, for volatile organic compounds (VOCs) using Summa passive canisters.

SURVEYS AND PRE-SAMPLING BUILDING PREPARATION (IF REQUIRED)

If required, a pre-sampling inspection should be performed prior to each sampling event to identify and minimize conditions that may interfere with the proposed testing. The

**SOIL VAPOR SAMPLE
COLLECTION PROCEDURE**

inspection should evaluate the type of structure, floor layout, airflows, and physical conditions of the building(s) being studied. This information, along with information on sources of potential indoor air contamination, should be identified on a building inventory form. An example of the building inventory form is attached. Items to be included in the building inventory include the following:

- Construction characteristics, including foundation cracks and utility penetrations or other openings that may serve as preferential pathways for vapor intrusion;
- Presence of an attached garage;
- Recent renovations or maintenance to the building (e.g., fresh paint, new carpet or furniture);
- Mechanical equipment that can affect pressure gradients (e.g., heating systems, clothes dryers or exhaust fans);
- Use or storage of petroleum products (e.g., fuel containers, gasoline operated equipment and unvented kerosene heaters); and
- Recent use of petroleum-based finishes or products containing volatile chemicals.

Each room on the floor of the building being tested and on lower floors, if possible, should be inspected. This is important because even products stored in another area of a building can affect the air of the room being tested.

The presence and description of odors (e.g., solvent, moldy) and portable vapor monitoring equipment readings (e.g., PIDs, ppb RAE, Jerome Mercury Vapor Analyzer, etc.) should be noted and used to help evaluate potential sources. This includes taking readings near products stored or used in the building.

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Potential interference from products or activities releasing volatile chemicals may need to be controlled. Removing the source from the indoor environment prior to testing is the most effective means of reducing interference. Ensuring that containers are tightly sealed may be acceptable. When testing for volatile organic compounds, containers should be tested with portable vapor monitoring equipment to determine whether compounds are leaking. The inability to eliminate potential interference may be justification for not testing, especially when testing for similar compounds at low levels. The investigator should consider the possibility that chemicals may adsorb onto porous materials and may take time to dissipate.

In some cases, the goal of the testing is to evaluate the impact from products used or stored in the building (e.g., pesticide misapplications, school renovation projects). If the goal of the testing is to determine whether products are an indoor volatile chemical contaminant source, the removing these sources does not apply.

Once interfering conditions are corrected (if applicable), ventilation may be needed prior to sampling to eliminate residual contamination in the indoor air. If ventilation is appropriate, it should be completed 24 hours or more prior to the scheduled sampling time. Where applicable, ventilation can be accomplished by operating the building's HVAC system to maximize outside air intake. Opening windows and doors, and operating exhaust fans may also help or may be needed if the building has no HVAC system.

Air samples are sometimes designed to represent typical exposure in a mechanically ventilated building and the operation of HVAC systems during sampling should be noted on the building inventory form (see attached sample). In general, the building's HVAC system should be operating under normal conditions. Unnecessary building ventilation should be avoided within 24 hours prior to and during sampling. During colder months, heating systems should be operating to maintain normal indoor air temperatures (i.e., 65 – 75 °F) for at least 24 hours prior to and during the scheduled sampling time.

**SOIL VAPOR SAMPLE
COLLECTION PROCEDURE**

Depending upon the goal of the indoor air sampling, some situations may warrant deviation from the above protocol regarding building ventilation. In such cases, building conditions and sampling efforts should be understood and noted within the framework and scope of the investigation.

To avoid potential interferences and dilution effects, every effort should be made to avoid the following for 24 hours prior to sampling:

- Opening any windows, fireplace dampers, openings or vents;
- Operating ventilation fans unless special arrangements are made;
- Smoking in the building;
- Painting;
- Using a wood stove, fireplace or other auxiliary heating equipment (e.g., kerosene heater);
- Operating or storing automobile in an attached garage;
- Allowing containers of gasoline or oil to remain within the house or garage area, except for fuel oil tanks;
- Cleaning, waxing or polishing furniture, floors or other woodwork with petroleum- or oil-based products;
- Using air fresheners, scented candles or odor eliminators;
- Engaging in any hobbies that use materials containing volatile chemicals;
- Using cosmetics including hairspray, nail polish, nail polish removers, perfume/cologne, etc.;
- Lawn mowing, paving with asphalt, or snow blowing;
- Applying pesticides; and
- Using building repair or maintenance products, such as caulk or roofing tar.

PRODUCT INVENTORY (IF REQUIRED)

If required, the primary objective of the product inventory is to identify potential air sampling interference by characterizing the occurrence and use of chemicals and products throughout the building, keeping in mind the goal of the investigation and site-specific

**SOIL VAPOR SAMPLE
COLLECTION PROCEDURE**

contaminants of concern. For example, it is not necessary to provide detailed information for each individual container of like items. However, it is necessary to indicate that "20 bottles of perfume" or "12 cans of latex paint" were present with containers in good condition. This information is used to help formulate an indoor environment profile.

An inventory should be provided for each room on the floor of the building being tested and on lower floors, if possible. This is important because even products stored in another area of a building can affect the air of the room being tested.

The presence and description of odors (e.g., solvent, moldy) and portable vapor monitoring equipment readings (e.g., PIDs, ppb RAE, Jerome Mercury Vapor Analyzer, etc.) should be noted and used to help evaluate potential sources. This includes taking readings near products stored or used in the building. Products in buildings should be inventoried every time air is tested to provide an accurate assessment of the potential contribution of volatile chemicals. If available, chemical ingredients of interest (e.g., analyte list) should be recorded for each product. If the ingredients are not listed on the label, record the product's exact and full name, and the manufacturer's name, address and telephone number, if available. In some cases, Material Safety Data Sheets (MSDS) may be useful for identifying confounding sources of volatile chemicals in air. Adequately documented photographs of the products and their labeled ingredients can supplement the inventory and facilitate recording the information.

SAMPLE LOCATIONS

The following are types of samples that are collected to investigate the soil vapor intrusion pathway:

- Subsurface vapor samples:

**SOIL VAPOR SAMPLE
COLLECTION PROCEDURE**

- *Soil vapor* samples (i.e., soil vapor samples not beneath the foundation or slab of a building) and
- *Sub-slab vapor* samples (i.e., soil vapor samples immediately beneath the foundation or slab of a building);
- Indoor air samples; and
- Outdoor air samples.

The types of samples that should be collected depend upon the specific objective(s) of the sampling, as described below.

- Soil vapor
Soil vapor samples are collected to determine whether this environmental medium is contaminated, characterize the nature and extent of contamination, and identify possible sources of the contamination. Soil vapor sampling results are used when evaluating the following:
 - The potential for *current* human exposures;
 - The potential for *future* human exposures (e.g., should a building be constructed); and
 - The effectiveness of measures implemented to remediate contaminated subsurface vapors.
- Sub-slab vapor
Sub-slab vapor samples are collected to characterize the nature and extent of soil vapor contamination immediately beneath a building with a basement foundation and/or a slab-on-grade. Sub-slab vapor sampling results are used when evaluating the following:
 - *Current* human exposures;
 - The potential for *future* human exposures (e.g., if the structural integrity of the building changes or the use of the building changes); and
 - Site-specific attenuation factors (i.e., the ratio of indoor air to sub-slab vapor concentrations).

Sub-slab vapor samples are collected after soil vapor characterization and/or other environmental sampling (e.g., soil and groundwater characterization) indicate a need. Subslab samples are typically collected concurrently with indoor and outdoor air samples. However, outside of the heating season, sub-slab vapor samples may be collected independently depending on the sampling objective

**SOIL VAPOR SAMPLE
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(e.g., characterize the extent of subsurface vapor contamination outside of the heating season to develop a more comprehensive, focused investigation plan for the heating season).

▪ Indoor air

Indoor air samples are collected to characterize exposures to air within a building, including those with earthen floors and crawlspaces. Indoor air sampling results are used when evaluating the following:

- *Current* human exposures;
- The potential for *future* exposures (e.g., if a currently vacant building should become occupied); and
- Site-specific attenuation factors (e.g., the ratio of indoor air to sub-slab vapor concentrations).

Indoor air samples are collected after subsurface vapor characterization and other environmental sampling (e.g., soil and groundwater characterization) indicate a need. When indoor air samples are collected, concurrent sub-slab vapor and outdoor air samples are collected to evaluate the indoor air results appropriately. However, indoor air and outdoor air samples, without sub-slab vapor samples, may be collected when confirming the effectiveness of a mitigation system.

In addition, site-specific situations may warrant collecting indoor air samples prior to characterizing subsurface vapors and/or without concurrent sub-slab sampling due to a need to examine immediate inhalation hazards. Examples of such situations may include, but are not limited to, the following:

- In response to a spill event when there is a need to qualitatively and/or quantitatively characterize the contamination;
- If high readings are obtained in a building when screening with field equipment (e.g., a photoionization detector (PID), an organic vapor analyzer, or an explosimeter) and the source is unknown;
- If significant odors are present and the source needs to be characterized; or
- If groundwater beneath the building is contaminated, the building is prone to groundwater intrusion or flooding (e.g., sump pit overflows), and subsurface vapor sampling is not feasible.

**SOIL VAPOR SAMPLE
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- Outdoor air

Outdoor air samples are collected to characterize site-specific background outdoor air conditions. These samples must be collected simultaneously with indoor air samples. They may also be collected concurrently with soil vapor samples. Outdoor air sampling results are primarily used when evaluating the extent to which outdoor sources may be influencing indoor air quality. They may also be used in the evaluation of soil vapor results (i.e., to identify potential outdoor air interferences associated with the infiltration of outdoor air into the sampling apparatus while the soil vapor sample was collected).

SOIL VAPOR SAMPLE COLLECTION PROCEDURES

Soil vapor probe installations (see Figure 4 attached) may be permanent, semi-permanent, or temporary. In general, permanent installations are preferred for data consistency reasons. Soil implants or probes should be constructed in the same manner at all sampling locations to minimize possible discrepancies. The following procedures should be included in any construction protocol:

- Soil vapor probes should be installed using direct push technology or, if necessary to attain the desired depth, using an auger;
- Porous backfill material (e.g., glass beads or coarse sand) should be used to create a sampling zone 1 to 2 feet in length;
- Soil vapor probes should be fitted with inert tubing (e.g., polyethylene, stainless steel, or Teflon®) of the appropriate size (typically 1/8 inch to 1/4 inch diameter) and of laboratory or food grade quality to the surface;
- Soil vapor probes should be sealed above the sampling zone with a bentonite slurry for a minimum distance of 3 feet to prevent outdoor air infiltration and the remainder of the borehole backfilled with clean material;

**SOIL VAPOR SAMPLE
COLLECTION PROCEDURE**

- For multiple probe depths, the borehole should be grouted with bentonite between probes to create discrete sampling zones; and
- For permanent installations, a protective casing should be set around the top of the probe tubing and grouted in place to the top of bentonite to minimize infiltration of water or outdoor air, as well as to prevent accidental damage.

Soil vapor samples should be collected in the same manner at all locations to minimize possible discrepancies. The following procedures should be included in any sampling protocol:

- At least 24 hours after the installation of permanent probes and shortly after the installation of temporary probes, one to three implant volumes (i.e., the volume of the sample probe and tube) must be purged prior to collecting the samples to ensure samples collected are representative;
- Flow rates for both purging and collecting must not exceed 0.2 liters per minute to minimize outdoor air infiltration during sampling;
- The target final field vacuum after 24 hours will be approximately -5 inches of mercury. Samples with a final field vacuum of greater than -10 inches of mercury, or equal to zero, will be flagged (usability of data will depend on sample volume and reporting limits that can be achieved).
- Samples must be collected, using conventional sampling methods, in an appropriate container — one which meets the objectives of the sampling (e.g., investigation of areas where low or high concentrations of volatile chemicals are expected; to minimize losses of volatile chemicals that are susceptible to photodegradation), meets the requirements of the sampling and analytical methods (e.g., low flow rate; Summa® canisters if analyzing by using EPA Method TO-15), and is certified clean by the laboratory;
- Sample size depends upon the volume of sample required to achieve minimum reporting limit requirements; and

**SOIL VAPOR SAMPLE
COLLECTION PROCEDURE**

- A tracer gas (e.g., helium, butane, or sulfur hexafluoride) must be used when collecting soil vapor samples to verify that adequate sampling techniques are being implemented (i.e., to verify infiltration of outdoor air is not occurring) (discussed later in this procedure). Once verified, continued use of the tracer gas may be reconsidered.

When soil vapor samples are collected, the following actions should be taken to document local conditions during sampling that may influence interpretation of the results:

- If sampling near a commercial or industrial building, uses of volatile chemicals during normal operations of the facility should be identified;
- Outdoor plot sketches should be drawn that include the site, area streets, neighboring commercial or industrial facilities (with estimated distance to the site), outdoor ambient air sample locations (if applicable), and compass orientation (north);
- Weather conditions (e.g., precipitation, outdoor temperature, barometric pressure, wind speed and direction) should be noted for the past 24 to 48 hours; and
- Any pertinent observations should be recorded, such as odors and readings from field instrumentation.

The field sampling team must maintain a sample log sheet summarizing the following:

- Sample identification,
- Date and time of sample collection,
- Sampling depth,
- Identity of samplers,
- Sampling methods and devices,
- Purge volumes,
- Volume of soil vapor extracted,
- If canisters used, the vacuum before and after samples collected,
- Apparent moisture content (dry, moist, saturated, etc.) of the sampling zone, and
- Chain of custody protocols and records used to track samples from sampling point to analysis.

**SOIL VAPOR SAMPLE
COLLECTION PROCEDURE**

SUB-SLAB VAPOR SAMPLE COLLECTION PROCEDURES

During colder months, heating systems should be operating to maintain normal indoor air temperatures (i.e., 65 – 75 °F) for at least 24 hours prior to and during the scheduled sampling time. Prior to installation of the sub-slab vapor probe, the building floor should be inspected and any penetrations (cracks, floor drains, utility perforations, sumps, etc.) should be noted and recorded. Probes should be installed at locations where the potential for ambient air infiltration via floor penetrations is minimal.

Sub-slab vapor probe installations (see Figure 5 attached) may be permanent, semi-permanent, or temporary. Sub-slab implants or probes should be constructed in the same manner at all sampling locations to minimize possible discrepancies. The following procedures should be included in any construction protocol:

- Permanent recessed probes must be constructed with brass or stainless steel tubing and fittings;
- Temporary probes must be constructed with polyethylene or Teflon® tubing of laboratory or food grade quality;
- Tubing should not extend further than 2 inches into the sub-slab material;
- Coarse sand or glass beads should be added to cover about 1 inch of the probe tip for permanent installations; and
- The soil vapor probe should be sealed to the surface with permagum grout, melted beeswax, putty or other non-VOC-containing and non-shrinking products for temporary installations or cement for permanent installations.

Sub-slab vapor samples should be collected in the following manner:

- After installation of the probes, one to three volumes (i.e., the volume of the sample probe and tube) must be purged prior to collecting the samples to ensure samples collected are representative;
- Flow rates for both purging and collecting must not exceed 0.2 liters per minute to minimize outdoor air infiltration during sampling;
- The target final field vacuum after 24 hours will be approximately -5 inches of mercury. Samples with a final field vacuum of greater than -10 inches of mercury,

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or equal to zero, will be flagged (usability of data will depend on sample volume and reporting limits that can be achieved).

- Samples must be collected, using conventional sampling methods, in an appropriate container — one which meets the objectives of the sampling (e.g., investigation of areas where low or high concentrations of volatile chemicals are expected; to minimize losses of volatile chemicals that are susceptible to photodegradation), meets the requirements of the sampling and analytical methods (e.g., low flow rate; Summa® canisters if analyzing by using EPA Method TO-15), and is certified clean by the laboratory;
- Sample size depends upon the volume of sample required to achieve minimum reporting limit requirements [Section 2.9 of the Guidance], the flow rate, and the sampling duration; and
- Ideally, samples should be collected over the same period of time as concurrent indoor and outdoor air samples.

When sub-slab vapor samples are collected, the following actions should be taken to document conditions during sampling and ultimately to aid in the interpretation of the sampling results:

- If sampling within a commercial or industrial building, uses of volatile chemicals in commercial or industrial processes and/or during building maintenance, should be identified;
- The use of heating or air conditioning systems during sampling should be noted;
- Floor plan sketches should be drawn that include the floor layout with sample locations, chemical storage areas, garages, doorways, stairways, location of basement sumps or subsurface drains and utility perforations through building foundations, HVAC system air supply and return registers, compass orientation (north), and any other pertinent information should be completed;
- If possible, photographs should accompany floor plan sketches;
- Outdoor plot sketches should be drawn that include the building site, area streets, outdoor air sample locations (if applicable), compass orientation (north), footings that create separate foundation sections, and paved areas;
- Weather conditions (e.g., precipitation, indoor and outdoor temperature, and barometric pressure) and ventilation conditions (e.g., heating system active and windows closed) should be reported;

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- Smoke tubes or other devices should be used to confirm pressure relationships and air flow patterns, especially between floor levels and between suspected contaminant sources and other areas; and
- Any pertinent observations, such as spills, floor stains, smoke tube results, odors and readings from field instrumentation (e.g., vapors via PID, ppb RAE, Jerome Mercury Vapor Analyzer, etc.), should be recorded.

The field sampling team must maintain a sample log sheet summarizing the following:

- Sample identification,
- Date and time of sample collection,
- Sampling depth,
- Identity of samplers,
- Sampling methods and devices,
- Soil vapor purge volumes,
- Volume of soil vapor extracted,
- If canisters used, the vacuum before and after samples collected,
- Apparent moisture content (dry, moist, saturated, etc.) of the sampling zone, and
- Chain of custody protocols and records used to track samples from sampling point to analysis.

The following describes the subslab air sampling procedure:

1. Canisters will be supplied by the laboratory that will be conducting the analysis.
2. Sampling will take place in accordance with the project work plan sufficiently spaced to allow locations to be modified, if necessary.
3. The number of Summa canisters required as well as the flow rate of the constant differential low volume flow controllers will be supplied by the laboratory in accordance with the project work plan.
4. The sampling program will consist of concurrently collecting and analyzing one sub-slab vapor sample and one indoor ambient air sample (discussed in

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the next section). Sample locations should be selected based on the likelihood for potential continuous human occupancy during the workday (i.e., due to the size of the areas and available infrastructure), and to account for the possibility of varying foundation depths in different areas of the building. In addition, sample locations typically are based upon the results of a subsurface investigation (i.e., soil gas survey or boring advancement) conducted prior to air sample collection activities. Canisters are typically placed in areas where the highest concentrations of soil gas were observed. Indoor air sample locations preferably should be selected near the middle of the sampled room, well away from the edges where dilution is more likely to occur.

5. Collect at least one outdoor ambient air sample from a location on the building roof or designated background area of the site positioned away from building ventilation system equipment on the highest portion of the building roof or site. See the Outdoor Ambient Air Sampling Procedure section in this procedure.
6. Field personnel should assure conservative sampling conditions prior to and throughout the sampling event. The building should be closed (windows and doors shut) and existing building ventilation systems should be turned off 12 to 24 hours before the air sampling is scheduled to begin as well as during sample collection. Any air-handling units that may induce large pressure gradients (i.e., exhaust fans, HVAC units etc.) should also be turned off.
7. Any activity being conducted by current building tenants involving volatile organic compounds, such as the use of lacquer thinner and cleaning solvents, prior to and/or during air sampling activities should be noted in the Project Field Book. These activities have the potential to bias the analytical results.
8. At each location, drill an approximately 3/4-inch diameter hole through the concrete slab (typically 6-8 inches thick) using a hand-held hammer drill.
9. Measure and record the concrete thickness in the Project Field Book.
10. Insert polyethylene or Teflon® tubing of laboratory or food grade quality into the drilled hole and no further than 2 inches into the subslab material.

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11. Seal the tubing with an appropriately sized volatile organic compound-free stopper (i.e., permagum grout, melted beeswax, putty, or other non-VOC-containing and non-shrinking product) into the concrete core hole and secure in-place making sure the fit is very snug. Supplement any visible gaps between the stopper and concrete slab with a VOC-free sealant, such as beeswax or bentonite slurry.
12. Run the tubing assembly through a shroud (plastic pail, cardboard box, or garbage bag) creating a tight seal with the surface making sure not to disturb the seal around the tubing penetration.
13. Enrich the atmosphere of the shroud with helium. Measure and record the helium concentration within the shroud.
14. Purge approximately 1 to 3 tubing volumes (i.e., the volume of the sample probe and tube) using a hand pump (or similar approved device) to ensure the collection of a representative sample.
15. Flow rates for both purging and sample collection must not exceed 0.2 liters per minute to minimize outdoor air infiltration during sampling.
16. Use a portable monitoring device to analyze a sample of soil vapor for the tracer **prior to and after** sampling for the compounds of concern. Note that the tracer gas samples can be collected via syringe, Tedlar bag etc. They need not be collected in Summa® canisters or minicans.
17. If concentrations greater than 10% of tracer gas are observed either prior to and/or after sampling, the probe seal should be enhanced to reduce the infiltration of outdoor air. Following enhancement of the seal, repeat steps 14 through 17 above until purged concentrations are less than 10% of the tracer gas within the shroud.
18. Following tubing purge and adequate seal integrity testing via helium tracer gas, immediately attach a 6-liter Summa Canister fitted with a 24-hour regulator (or approved other duration) to the opposite end of the tubing.

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Concurrent with each subslab sample location, prepare an indoor ambient air sample by staging a second Summa Canister on a ladder (approximately 2 to 5-feet above the floor) adjacent to the sub-slab sample location.

19. All Summa Canister valves should remain closed until all subslab borings are complete and all of the canisters in their respective positions.
20. Open the valves to all of the canisters for the required collection period (i.e., 24-hours). Record initial canister pressure on the Air Canister Field Record form.
21. Following sample collection and prior to closing canister valve, record final canister pressure on the Air Canister Field Record form. Close canister valve.
22. Collect all Summa Canisters and ship, under chain-of-custody command to an approved analytical laboratory for VOC analysis in accordance with USEPA Method TO-14 or TO-15.
23. Repair all concrete openings with a cement patch.
24. Analytical results submitted by the laboratory should be reported as concentrations of each VOC at each location, typically in parts per billion by volume (ppbv).

INDOOR AIR SAMPLE COLLECTION PROCEDURES

During colder months, heating systems should be operating to maintain normal indoor air temperatures (i.e., 65 – 75 °F) for at least 24 hours prior to and during the scheduled sampling time. If possible, prior to collecting indoor samples, a pre-sampling inspection, discussed earlier in this procedure, should be performed to evaluate the physical layout and conditions of the building being investigated, to identify conditions that may affect or interfere with the proposed sampling, and to prepare the building for sampling.

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In general, indoor air samples should be collected in the following manner:

- Sampling duration should reflect the exposure scenario being evaluated without compromising the detection limit or sample collection flow rate (e.g., an 8 hour sample from a workplace with a single shift versus a 24 hour sample from a workplace with multiple shifts). To ensure that air is representative of the locations sampled and to avoid undue influence from sampling personnel, samples should be collected for at least 1 hour. If the goal of the sampling is to represent average concentrations over longer periods, then longer duration sampling periods may be appropriate. Typically, 24 hour samples are collected from residential settings;
- Personnel should avoid lingering in the immediate area of the sampling device while samples are being collected;
- Sample flow rates must conform to the specifications in the sample collection method and, if possible, should be consistent with the flow rates for concurrent outdoor air and sub-slab samples;
- The target final field vacuum after 24 hours will be approximately -5 inches of mercury. Samples with a final field vacuum of greater than -10 inches of mercury, or equal to zero, will be flagged (usability of data will depend on sample volume and reporting limits that can be achieved); and
- Samples must be collected, using conventional sampling methods, in an appropriate container — one which meets the objectives of the sampling (e.g., investigation of areas where low or high concentrations of volatile chemicals are expected; to minimize losses of volatile chemicals that are susceptible to photodegradation), meets the requirements of the sampling and analytical methods (e.g., low flow rate; Summa® canisters if analyzing by using EPA Method TO-15), and is certified clean by the laboratory.

At sites with tetrachloroethene contamination, passive air monitors that are specifically analyzed for tetrachloroethene (i.e., "perc badges") are commonly used to collect indoor and outdoor air samples. If site characterization activities indicate that degradation products of

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tetrachloroethene also represent a vapor intrusion concern, perc badges may be used to indicate the likelihood of vapor intrusion (i.e., by using tetrachloroethene as a surrogate) followed, as needed, by more comprehensive sampling and laboratory analyses to quantify both tetrachloroethene and its degradation products. Perc badge samples ideally should be collected over a twenty-four hour period, but for no less than eight hours.

The following actions should be taken to document conditions during indoor air sampling and ultimately to aid in the interpretation of the sampling results:

- A product inventory survey must be completed (discussed earlier);
- The use of heating or air conditioning systems during sampling should be noted;
- Floor plan sketches should be drawn that include the floor layout with sample locations, chemical storage areas, garages, doorways, stairways, location of basement sumps or subsurface drains and utility perforations through building foundations, HVAC system supply and return registers, compass orientation (north), and any other pertinent information should be completed;
- If possible, photographs should accompany floor plan sketches;
- Outdoor plot sketches should be drawn that include the building site, area streets, outdoor air sample locations (if applicable), compass orientation (north), footings that create separate foundation sections, and paved areas;
- Weather conditions (e.g., precipitation, indoor and outdoor temperature, and barometric pressure) and ventilation conditions (e.g., heating system active and windows closed) should be reported;
- Smoke tubes or other devices should be used to confirm pressure relationships and air flow patterns, especially between floor levels and between suspected contaminant sources and other areas; and

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- Any pertinent observations, such as spills, floor stains, smoke tube results, odors and readings from field instrumentation (e.g., vapors via PID, ppb RAE, Jerome Mercury Vapor Analyzer, etc.), should be recorded.

The field sampling team must maintain a sample log sheet summarizing the following:

- Sample identification,
- Date and time of sample collection,
- Sampling height,
- Identity of samplers,
- Sampling methods and devices,
- Depending upon the method, volume of air sampled,
- If canisters used, the vacuum before and after samples collected,
- Chain of custody protocols and records used to track samples from sampling point to analysis.

The following describes the indoor air sampling procedure:

1. Canisters will be supplied by the laboratory that will be conducting the analysis.
2. Sampling will take place in accordance with the project work plan sufficiently spaced to allow locations to be modified, if necessary.
3. The number of Summa canisters required as well as the flow rate of the constant differential low volume flow controllers will be supplied by the laboratory in accordance with the project work plan. Indoor air sampling typically requires the continuous collection of samples over a 24-hour period.
4. The sampling program will consist of concurrently collecting and analyzing one sub-slab vapor sample and one indoor ambient air sample. Sample locations should be selected based on the likelihood for potential continuous human occupancy during the workday (i.e., due to the size of the areas and available infrastructure), and to account for the possibility of varying foundation depths in different areas of the building. In addition, sample locations typically are based upon the results of a subsurface investigation (i.e.,

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soil gas survey or boring advancement) conducted prior to air sample collection activities. Canisters are typically placed in areas where the highest concentrations of soil gas were observed. Indoor air sample locations preferably should be selected near the middle of the sampled room, well away from the edges where dilution is more likely to occur.

5. Collect at least one outdoor ambient air sample from a location on the building roof or designated background area of the site positioned away from building ventilation system equipment on the highest portion of the building roof or site. See the Outdoor Ambient Air Sampling Procedure presented in this procedure.
6. Field personnel should assure conservative sampling conditions prior to and throughout the sampling event. The building should be closed (windows and doors shut) and existing building ventilation systems should be turned off 12 to 24 hours before the air sampling is scheduled to begin as well as during sample collection. Any air-handling units that may induce large pressure gradients (i.e., exhaust fans, HVAC units etc.) should also be turned off.
7. Any activity being conducted by current building tenants involving volatile organic compounds, such as the use of lacquer thinner and cleaning solvents, prior to and/or during air sampling activities should be noted in the Project Field Book. These activities have the potential to bias the analytical results.
8. Concurrent with each subslab sample location, prepare an indoor ambient air sample by staging a second Summa Canister on a ladder (approximately 2 to 5-feet above the floor) adjacent to the sub-slab sample location.
9. All Summa Canister valves should remain closed until all subslab borings are complete and all of the canisters in their respective positions.
10. Open the valves to all of the canisters for the required collection period (i.e., 24-hours). Record initial canister pressure on the Air Canister Field Record form.

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11. Following sample collection and prior to closing canister valve, record final canister pressure on the Air Canister Field Record form. Close canister valve.
12. Collect all Summa Canisters and ship, under chain-of-custody command to an approved analytical laboratory for VOC analysis in accordance with USEPA Method TO-14 or TO-15.
13. Analytical results submitted by the laboratory should be reported as concentrations of each VOC at each location, typically in parts per billion by volume (ppbv).

OUTDOOR AIR SAMPLE COLLECTION PROCEDURES

Outdoor air samples must be collected simultaneously with indoor air samples and may be collected concurrently with subsurface vapor samples. Outdoor air samples must be collected in the same manner as indoor samples.

The following actions should be taken to document conditions during outdoor air sampling and ultimately to aid in the interpretation of the sampling results:

- Outdoor plot sketches should be drawn that include the building site, area streets, outdoor air sample locations (if applicable), the location of potential interferences (e.g., gasoline stations, factories, lawn movers, etc.), compass orientation (north), footings that create separate foundation sections, and paved areas;
- Weather conditions (e.g., precipitation, indoor and outdoor temperature, and barometric pressure) and ventilation conditions (e.g., heating system active and windows closed) should be reported; and
- Any pertinent observations, such as odors, readings from field instrumentation, and significant activities in the vicinity (e.g., operation of heavy equipment or dry cleaners) should be recorded.

The following describes the outdoor air sampling procedure:

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1. Canisters will be supplied by the laboratory that will be conducting the analysis.
2. Sampling will take place in accordance with the project work plan sufficiently spaced to allow locations to be modified, if necessary.
3. The number of Summa canisters required as well as the flow rate of the constant differential low volume flow controllers will be supplied by the laboratory in accordance with the project work plan.
4. Sample locations typically are collected upwind of the facility.
5. Collect at least one outdoor ambient air sample from a location on the building roof or designated background area of the site positioned away from building ventilation system equipment on the highest portion of the building roof or site. Place canisters on the ground or step ladder, with a clear plastic sheet beneath to prevent contamination. Locate the sampling inlet approximately 18-inches above the ground surface.
6. Sample collection should take place on warm, dry days. If rain or high humidity conditions develop during sampling, the sampling event should be suspended. Temperature, barometric pressure, and wind speed should be monitored during the sampling event, for use in analysis of the results.
7. The combination of sampling location, height, and meteorological conditions will assure that sampling will measure VOCs at their highest concentrations.
8. All Summa Canister valves should remain closed until all subslab borings are complete and all of the indoor and outdoor canisters in their respective positions.
9. Open the valves to all of the canisters for the required collection period (i.e., 24-hours). Record initial canister pressure on the Air Canister Field Record form.

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10. Following sample collection and prior to closing canister valve, record final canister pressure on the Air Canister Field Record form. Close canister valve.
11. Collect all Summa Canisters and ship, under chain-of-custody command to an approved analytical laboratory for VOC analysis in accordance with USEPA Method TO-14 or TO-15.
12. Air samples will be analyzed by Gas Chromatography/Mass Spectroscopy (GC/MS) in accordance with EPA Method TO-14 or TO-15.
13. Analytical results will be reported as concentrations of each VOC at each location during each sampling event, typically in parts per billion by volume (ppbv).

TRACER GAS

When collecting soil vapor samples as part of a vapor intrusion evaluation, a tracer gas serves as a quality assurance/quality control device to verify the integrity of the soil vapor probe seal. Without the use of a tracer, there is no way to verify that a soil vapor sample has not been diluted by surface air.

Depending on the nature of the contaminants of concern, a number of different compounds can be used as a tracer. Typically, sulfur hexafluoride (SF₆) or helium are used as tracers because they are readily available, have low toxicity, and can be monitored with portable measurement devices. Butane and propane (or other gases) could also be used as a tracer in some situations. The protocol for using a tracer gas is straightforward: simply enrich the atmosphere in the immediate vicinity of the area where the probe intersects the ground surface with the tracer gas, and measure a vapor sample from the probe for the presence of high concentrations (> 10%) of the tracer. A cardboard box, a plastic pail, or even a garbage bag can serve to keep the tracer gas in contact with the probe during the testing.

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There are two basic approaches to testing for the tracer gas:

- Include the tracer gas in the list of target analytes reported by the laboratory; or
- Use a portable monitoring device to analyze a sample of soil vapor for the tracer prior to and after sampling for the compounds of concern. (Note that the tracer gas samples can be collected via syringe, Tedlar bag etc. They need not be collected in Summa® canisters or minicans.)

The advantage of the second approach is that the real time tracer sampling results can be used to confirm the integrity of the probe seals prior to formal sample collection. Figure 6 (attached) depicts common methods for using tracer gas. In each of the examples, a, b and c, the tracer gas is released in the enclosure prior to initially purging the sample point. Care should be taken to avoid excessive purging prior to sample collection. Care should also be taken to prevent pressure build-up in the enclosure during introduction of the tracer gas. Inspection of the installed sample probe, specifically noting the integrity of the surface seal and the porosity of the soil in which the probe is installed, will help to determine the tracer gas setup. Figure 6(a) may be most effective at preventing tracer gas infiltration; however, it may not be required in some situations depending on site-specific conditions. Figures 6(b) and 6(c) may be sufficient for probes installed in tight soils with well-constructed surface seals. In all cases, the same tracer gas application should be used for all probes at any given site.

Because minor leakage around the probe seal should not materially affect the usability of the soil vapor sampling results, the mere presence of the tracer gas in the sample should not be a cause for alarm. Consequently, portable field monitoring devices with detection limits in the low ppm range are more than adequate for screening samples for the tracer. If high concentrations ($> 10\%$) of tracer gas are observed in a sample, the probe seal should be enhanced to reduce the infiltration of ambient air.

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During the initial stages of a soil vapor sampling program, tracer gas samples should be collected at each of the sampling probes. If the results of the initial samples indicate that the probe seals are adequate, the project manager can consider reducing the number of locations at which tracer gas samples are employed. At a minimum, at least 10% of the subsequent samples should be supported with tracer gas analyses. When using permanent soil vapor probes as part of a long-term monitoring program, annual testing of the probe integrity is recommended.

QUALITY ASSURANCE / QUALITY CONTROL (QA/QC)

Extreme care should be taken during all aspects of sample collection to ensure that sampling error is minimized and high quality data are obtained. The sampling team members should avoid actions (e.g., fueling vehicles, using permanent marking pens, and wearing freshly dry-cleaned clothing or personal fragrances), which can cause sample interference in the field. Appropriate QA/QC protocols must be followed for sample collection and laboratory analysis, such as use of certified clean sample devices, meeting sample holding times and temperatures, sample accession, chain of custody, etc. Samples should be delivered to the analytical laboratory as soon as possible after collection. In addition, laboratory accession procedures must be followed including field documentation (sample collection information and locations), chain of custody, field blanks, field sample duplicates, and laboratory duplicates, as appropriate.

Some methods require collecting samples in duplicate (e.g., indoor air sampling using passive sampling devices for tetrachloroethene) to assess errors. Duplicate and/or split samples should be collected in accordance with the requirements of the sampling and analytical methods being implemented.

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For certain regulatory programs, a Data Usability Summary Report (DUSR) may be required to determine whether or not the data, as presented, meets the site or project specific criteria for data quality and data use. This requirement may dictate the level of QC and the category of data deliverable to request from the laboratory. Guidance on preparing a DUSR is available by contacting the NYSDEC's Division of Environmental Remediation.

New York State Public Health Law requires laboratories analyzing environmental samples collected from within New York State to have current Environmental Laboratory Approval Program (ELAP) certification for the appropriate analyte and environmental matrix combinations. If ELAP certification is not currently required for an analyte (e.g., trichloroethene), the analysis should be performed by a laboratory that has ELAP certification for similar compounds in air and uses analytical methods with detection limits similar to background (e.g., tetrachloroethene via EPA Method TO-15).

The work plan must state that all samples that will be used to make decisions on appropriate actions to address exposures and environmental contamination will be analyzed by an ELAP-certified laboratory. If known, the name of the laboratory should also be provided. Similarly, the name of the laboratory that was used must be included in the report of the sampling results. For samples collected and tested in the field for screening purposes by using field testing technology, the qualifications of the field technician must be documented in the work plan.

The target final field vacuum of any sample canister after 24 hours will be approximately -5 inches of mercury. Samples with a final field vacuum of greater than -10 inches of mercury, or equal to zero, will be flagged (usability of data will depend on sample volume and reporting limits that can be achieved).

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DECISION MATRICES (FIGURES 1 THROUGH 6)

The considerations in assigning a chemical to a matrix include the following:

- Human health risks, including such factors as a chemical's ability to cause cancer, reproductive, developmental, liver, kidney, nervous system, immune system or other effects, in animals and humans and the doses that may cause those effects;
- The data gaps in its toxicological database;
- Background concentrations of volatile chemicals in indoor air [Section 3.2.4]; and
- Analytical capabilities currently available.

To use the matrices accurately as a tool in the decision-making process, the following must be noted:

- The matrices are generic. As such, it may be necessary to modify recommended actions to accommodate building-specific conditions (e.g., dirt floor in basement, crawl spaces, etc.) and/or site-specific conditions (e.g., proximity of building to identified subsurface contamination) for the protection of public health. Additionally, actions more conservative than those specified within the matrix may be implemented at any time. For example, the decision to implement more conservative actions may be based on a comparison of the costs associated with resampling or monitoring to the costs associated with installation and monitoring of a mitigation system.
- Indoor air concentrations detected in samples collected from the building's basement or, if the building has a slab-on-grade foundation, from the building's lowest occupied living space should be used.
- Actions provided in the matrix are specific to addressing human exposures. Implementation of these actions does not preclude the need to investigate possible sources of vapor contamination, nor does it preclude the need to remediate contaminated soil vapors or the source of soil vapor contamination.

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- When current exposures are attributed to sources other than vapor intrusion, the agencies must be provided documentation (e.g., applicable environmental data, completed indoor air sampling questionnaire, digital photographs, etc.) to support a proposed action other than that provided in the matrix and to support assessment and follow-up by the agencies.

RECOMMENDED ACTIONS

Actions recommended in the matrix are based on the relationship between sub-slab vapor concentrations and corresponding indoor air concentrations. They are intended to address both potential and current human exposures and include the following:

- *No further action*
When the volatile chemical is not detected in the indoor air sample and the concentration detected in the corresponding sub-slab vapor sample is not expected to substantially affect indoor air quality.
- *Identify source(s) and resample or mitigate*
Reasonable and practical actions are recommended to identify the source(s) affecting indoor air quality and that actions be implemented to reduce indoor air concentrations to within background ranges. The concentration detected in the indoor air sample is likely due to indoor and/or outdoor sources rather than soil vapor intrusion given the concentration detected in the sub-slab vapor sample. Resampling may be required in the event indoor and/or outdoor sources are not readily identified or confirmed to demonstrate SVI mitigation actions are not needed. Steps should be taken to identify potential source(s) and to reduce exposures accordingly (e.g., by keeping containers tightly capped or by storing volatile chemical-containing products in places where people do not spend much time, such as a garage or shed). Mitigation may be required if soil vapor intrusion cannot be ruled out.
- *Monitor*
Monitoring, including sub-slab vapor, basement air, lowest occupied living space air, and outdoor air sampling, is needed to determine whether concentrations in

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the indoor air or sub-slab vapor have changed. Monitoring may also be needed to determine whether existing building conditions (e.g., positive pressure HVAC systems) are maintaining the desired mitigation endpoint and to determine whether changes are needed. The type and frequency of monitoring is determined on a site-specific and building specific basis, taking into account applicable environmental data and building operating conditions.

- *Mitigate*

Mitigation is needed to minimize current or potential exposures associated with soil vapor intrusion. Methods to mitigate exposures related to soil vapor intrusion are described in Section 4 of the Guidance.

TIME OF YEAR

Sub-slab vapor samples and, unless there is an immediate need for sampling, indoor air samples are typically collected during the heating season because soil vapor intrusion is more likely to occur when a building's heating system is in operation and air is being drawn into the building. In general, heating systems are expected to be operating routinely from November 15th to March 31st throughout the state. However, this timeframe may vary depending on factors, such as the location of the site (e.g., upstate versus downstate) and the weather conditions for a particular year.

A vapor intrusion investigation may also be conducted outside of the heating season. However, the results may not be used to rule out exposures. For example, results indicating "no further action" or "monitoring required" must be verified during the heating season to ensure these actions are protective during the heating season as well.

SAMPLING ROUNDS

Investigating a soil vapor intrusion pathway usually requires more than one round of subsurface vapor, indoor air, and/or outdoor air sampling, for reasons such as the following:

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- To characterize the nature and extent of subsurface vapor contamination (similar to the delineation of groundwater contamination) and to address corresponding exposure concerns;
- To evaluate fluctuations in concentrations due to
 - Different weather conditions (e.g., seasonal effects),
 - Changes in building conditions (e.g., various operating conditions of a building's HVAC system),
 - Changes in source strength, or
 - Vapor migration or contaminant biodegradation processes (particularly when degradation products may be more toxic than the parent compounds); or
- To confirm sampling results or the effectiveness of mitigation or remedial systems.

Overall, successive rounds of sampling are conducted until the following questions can be answered:

- Are subsurface vapors contaminated? If so, what are the nature and extent of contamination? What is/are the source(s) of the contamination?
- What are the current and potential exposures to contaminated subsurface vapors?
- What actions, if any, are needed to prevent or mitigate exposures and to remediate subsurface vapor contamination?

Toward this end, multiple rounds of sampling may be required to characterize the nature and extent of subsurface vapor contamination such that

- Both potential and current exposures are adequately addressed;
- Measures can be designed to remediate subsurface vapor contamination, either directly (e.g., SVE system) or indirectly (e.g., soil excavation or groundwater remediation), given that monitoring and mitigation are considered temporary measures implemented to address exposures related to vapor intrusion until contaminated environmental media are remediated; and
- The effectiveness of remedial measures can be monitored and confirmed (e.g., endpoint sampling).

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ATTACHMENTS

- Figure 1** *Soil Vapor/Indoor Air Matrix A*
Figure 2 *Soil Vapor/Indoor Air Matrix B*
Figure 3 *Soil Vapor/Indoor Air Matrix C*
Figure 4 *Soil Vapor/Indoor Air Matrix D*
Figure 5 *Soil Vapor/Indoor Air Matrix E*
Figure 6 *Soil Vapor/Indoor Air Matrix F*
Figure 7 *Schematics of a permanent soil vapor probe and permanent nested soil vapor probes*
Figure 8 *Schematic of a sub-slab vapor probe*
Figure 9 *Schematics of tracer gas applications*

Air Canister Field Record

Indoor Air Quality Questionnaire and Building Inventory

**SOIL VAPOR SAMPLE
COLLECTION PROCEDURE**

REFERENCES

New York State Department of Health, *Guidance for Evaluating Soil Vapor Intrusion in the State of New York*, October 2006.

New York State Department of Health, *Indoor Air Sampling & Analysis Guidance*. (February 1, 2005).

Office of Solid Waste and Emergency Response (OSWER). *Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance)*. November 2002.

United States Environmental Protection Agency. *EPA Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air*. 1988

- Method TO-15, Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS). Pp. 15-1 through 15-62.
- Method TO-17, Determination of Volatile Organic Compounds in Ambient Air using Active Sampling on Sorbent Tubes. Pp. 17-1 through 17-49.
- Compendium of Methods for the Determination of Air Pollutants in Indoor Air, EPA/600/4-90-010.

SOIL VAPOR SAMPLE COLLECTION PROCEDURE

FIGURE 1

Soil Vapor/Indoor Air Matrix A

May 2017

Analytes Assigned:

Trichloroethene (TCE), *cis*-1,2-Dichloroethene (c12-DCE), 1,1-Dichloroethene (11-DCE), Carbon Tetrachloride

SUB-SLAB VAPOR CONCENTRATION of COMPOUND (mcg/m ³)	INDOOR AIR CONCENTRATION of COMPOUND (mcg/m ³)		
	< 0.2	0.2 to < 1	1 and above
< 6	1. No further action	2. No Further Action	3. IDENTIFY SOURCE(S) and RESAMPLE or MITIGATE
6 to < 60	4. No further action	5. MONITOR	6. MITIGATE
60 and above	7. MITIGATE	8. MITIGATE	9. MITIGATE

No further action: No additional actions are recommended to address human exposures.

Identify Source(s) and Resample or Mitigate: We recommend that reasonable and practical actions be taken to identify the source(s) affecting the indoor air quality and that actions be implemented to reduce indoor air concentrations to within background ranges. For example, if an indoor or outdoor air source is identified, we recommend the appropriate party implement actions to reduce the levels. In the event that indoor or outdoor sources are not readily identified or confirmed, resampling (which might include additional sub-slab vapor and indoor air sampling locations) is recommended to demonstrate that SVI mitigation actions are not needed. Based on the information available, mitigation might also be recommended when soil vapor intrusion cannot be ruled out.

Monitor: We recommend monitoring (sampling on a recurring basis), including but not necessarily limited to sub-slab vapor, basement air and outdoor air sampling, to determine whether concentrations in the indoor air or sub-slab vapor have changed and/or to evaluate temporal influences. Monitoring might also be recommended to determine whether existing building conditions (e.g., positive pressure heating, ventilation and air-conditioning systems) are maintaining the desired mitigation endpoint and to determine whether changes are needed. The type and frequency of monitoring is determined based on site-, building- and analyte-specific information, taking into account applicable environmental data and building operating conditions. Monitoring is an interim measure required to evaluate exposures related to soil vapor intrusion until contaminated environmental media are remediated.

Mitigate: We recommend mitigation to minimize current or potential exposures associated with soil vapor intrusion. The most common mitigation methods are sealing preferential pathways in conjunction with installing a sub-slab depressurization system and changing the pressurization of the building in conjunction with monitoring. The type, or combination of types, of mitigation is determined on a building-specific basis, taking into account building construction and operating conditions. Mitigation is considered a temporary measure implemented to address exposures related to soil vapor intrusion until contaminated environmental media are remediated.

These general recommendations are made with consideration being given to the additional notes on page 2.

MATRIX A Page 1 of 2

SOIL VAPOR SAMPLE
COLLECTION PROCEDURE

ADDITIONAL NOTES FOR MATRIX A

This matrix summarizes actions recommended to address current and potential exposures related to soil vapor intrusion. To use the matrix appropriately as a tool in the decision-making process, the following should be noted:

- [1] The matrix is generic. As such, it may be appropriate to modify a recommended action to accommodate analyte-specific, building-specific conditions (e.g., dirt floor in basement, crawl spaces, thick slabs, current occupancy, etc.), and/or factors provided in Section 3.2 of the guidance (e.g., current land use, environmental conditions, etc.). For example, collection of additional samples may be recommended when the matrix indicates "no further action" for a particular building, but the results of adjacent buildings (especially sub-slab vapor results) indicate a need to take actions to address exposures related to soil vapor intrusion. Mitigation might be recommended when the results of multiple contaminants indicate monitoring is recommended. Proactive actions may be proposed at any time. For example, the party implementing the actions may decide to install sub-slab depressurization systems on buildings where the matrix indicates "no further action" or "monitoring." Such an action might be undertaken for reasons other than public health (e.g., seeking community acceptance, reducing costs, etc.). However, actions implemented *in lieu* of sampling will typically be expected to be captured in the final engineering report and site management plan, and might not rule out the need for post-implementation sampling (e.g., to document effectiveness or to support terminating the action).
- [2] Actions provided in the matrix are specific to addressing human exposures. Implementation of these actions does not preclude investigating possible sources of soil vapor contamination, nor does it preclude remediating contaminated soil vapor or the source of soil vapor contamination.
- [3] Appropriate care should be taken during all aspects of sample collection to ensure that high quality data are obtained. Since the data are being used in the decision-making process, the laboratory analyzing the environmental samples must have current Environmental Laboratory Approval Program (ELAP) certification for the appropriate analyte and environmental matrix combinations. Furthermore, samples should be analyzed by methods that can achieve a minimum reporting limit of 0.20 microgram per cubic meter for indoor and outdoor air samples. For sub-slab vapor samples and dirt floor soil vapor samples, a minimum reporting limit of 1 microgram per cubic meter is recommended.
- [4] Sub-slab vapor and indoor air samples are typically collected when the likelihood of soil vapor intrusion is considered to be the greatest (i.e., worst-case conditions). If samples are collected at other times (typically, samples collected outside of the heating season), then resampling during worst-case conditions might be appropriate to verify that actions taken to address exposures related to soil vapor intrusion are protective of human health.
- [5] When current exposures are attributed to sources other than soil vapor intrusion, the agencies should be given documentation (e.g., applicable environmental data, completed indoor air sampling questionnaire, digital photographs, etc.) to support a proposed action other than that provided in the matrix box and to support agency assessment and follow-up.
- [6] The party responsible for implementing the recommended actions will differ depending upon several factors, including but not limited to the following: the identified source of the volatile chemicals, the environmental remediation program, and analyte-specific, site-specific and building-specific factors.

SOIL VAPOR SAMPLE COLLECTION PROCEDURE

FIGURE 2

Soil Vapor/Indoor Air Matrix B

May 2017

Analytes Assigned:

Tetrachloroethene (PCE), 1,1,1-Trichloroethane (111-TCA), Methylene Chloride

SUB-SLAB VAPOR CONCENTRATION of COMPOUND (mcg/m ³)	INDOOR AIR CONCENTRATION of COMPOUND (mcg/m ³)		
	< 3	3 to < 10	10 and above
< 100	1. No further action	2. No Further Action	3. IDENTIFY SOURCE(S) and RESAMPLE or MITIGATE
100 to < 1,000	4. No further action	5. MONITOR	6. MITIGATE
1,000 and above	7. MITIGATE	8. MITIGATE	9. MITIGATE

No further action: No additional actions are recommended to address human exposures.

Identify Source(s) and Resample or Mitigate: We recommend that reasonable and practical actions be taken to identify the source(s) affecting the indoor air quality and that actions be implemented to reduce indoor air concentrations to within background ranges. For example, if an indoor or outdoor air source is identified, we recommend the appropriate party implement actions to reduce the levels. In the event that indoor or outdoor sources are not readily identified or confirmed, resampling (which might include additional sub-slab vapor and indoor air sampling locations) is recommended to demonstrate that SVI mitigation actions are not needed. Based on the information available, mitigation might also be recommended when soil vapor intrusion cannot be ruled out.

Monitor: We recommend monitoring (sampling on a recurring basis), including but not necessarily limited to sub-slab vapor, basement air and outdoor air sampling, to determine whether concentrations in the indoor air or sub-slab vapor have changed and/or to evaluate temporal influences. Monitoring might also be recommended to determine whether existing building conditions (e.g., positive pressure heating, ventilation and air-conditioning systems) are maintaining the desired mitigation endpoint and to determine whether changes are needed. The type and frequency of monitoring is determined based on site-, building- and analyte-specific information, taking into account applicable environmental data and building operating conditions. Monitoring is an interim measure required to evaluate exposures related to soil vapor intrusion until contaminated environmental media are remediated.

Mitigate: We recommend mitigation to minimize current or potential exposures associated with soil vapor intrusion. The most common mitigation methods are sealing preferential pathways in conjunction with installing a sub-slab depressurization system and changing the pressurization of the building in conjunction with monitoring. The type, or combination of types, of mitigation is determined on a building-specific basis, taking into account building construction and operating conditions. Mitigation is considered a temporary measure implemented to address exposures related to soil vapor intrusion until contaminated environmental media are remediated.

These general recommendations are made with consideration being given to the additional notes on page 2.

MATRIX B Page 1 of 2

SOIL VAPOR SAMPLE
COLLECTION PROCEDURE

ADDITIONAL NOTES FOR MATRIX B

This matrix summarizes actions recommended to address current and potential exposures related to soil vapor intrusion. To use the matrix appropriately as a tool in the decision-making process, the following should be noted:

- [1] The matrix is generic. As such, it may be appropriate to modify a recommended action to accommodate analyte-specific, building-specific conditions (e.g., dirt floor in basement, crawl spaces, thick slabs, current occupancy, etc.), and/or factors provided in Section 3.2 of the guidance (e.g., current land use, environmental conditions, etc.). For example, collection of additional samples may be recommended when the matrix indicates "no further action" for a particular building, but the results of adjacent buildings (especially sub-slab vapor results) indicate a need to take actions to address exposures related to soil vapor intrusion. Mitigation might be recommended when the results of multiple contaminants indicate monitoring is recommended. Proactive actions may be proposed at any time. For example, the party implementing the actions may decide to install sub-slab depressurization systems on buildings where the matrix indicates "no further action" or "monitoring." Such an action might be undertaken for reasons other than public health (e.g., seeking community acceptance, reducing costs, etc.). However, actions implemented *in lieu* of sampling will typically be expected to be captured in the final engineering report and site management plan, and might not rule out the need for post-implementation sampling (e.g., to document effectiveness or to support terminating the action).
- [2] Actions provided in the matrix are specific to addressing human exposures. Implementation of these actions does not preclude investigating possible sources of soil vapor contamination, nor does it preclude remediating contaminated soil vapor or the source of soil vapor contamination.
- [3] Appropriate care should be taken during all aspects of sample collection to ensure that high quality data are obtained. Since the data are being used in the decision-making process, the laboratory analyzing the environmental samples must have current Environmental Laboratory Approval Program (ELAP) certification for the appropriate analyte and environmental matrix combinations. Furthermore, samples should be analyzed by methods that can achieve a minimum reporting limit of 1 microgram per cubic meter for indoor and outdoor air samples. For sub-slab vapor samples and dirt floor soil vapor samples, a minimum reporting limit of 1 microgram per cubic meter is recommended.
- [4] Sub-slab vapor and indoor air samples are typically collected when the likelihood of soil vapor intrusion is considered to be the greatest (i.e., worst-case conditions). If samples are collected at other times (typically, samples collected outside of the heating season), then resampling during worst-case conditions might be appropriate to verify that actions taken to address exposures related to soil vapor intrusion are protective of human health.
- [5] When current exposures are attributed to sources other than soil vapor intrusion, the agencies should be given documentation (e.g., applicable environmental data, completed indoor air sampling questionnaire, digital photographs, etc.) to support a proposed action other than that provided in the matrix box and to support agency assessment and follow-up.
- [6] The party responsible for implementing the recommended actions will differ depending upon several factors, including but not limited to the following: the identified source of the volatile chemicals, the environmental remediation program, and analyte-specific, site-specific and building-specific factors.

SOIL VAPOR SAMPLE COLLECTION PROCEDURE

FIGURE 3

Soil Vapor/Indoor Air Matrix C

May 2017

Analytes Assigned:
Vinyl Chloride

SUB-SLAB VAPOR CONCENTRATION of COMPOUND (mcg/m ³)	INDOOR AIR CONCENTRATION of COMPOUND (mcg/m ³)	
	< 0.2	0.2 and above
< 6	1. No further action	2. IDENTIFY SOURCE(S) and RESAMPLE or MITIGATE
6 to < 60	3. MONITOR	4. MITIGATE
60 and above	5. MITIGATE	6. MITIGATE

No further action: No additional actions are recommended to address human exposures.

Identify Source(s) and Resample or Mitigate: We recommend that reasonable and practical actions be taken to identify the source(s) affecting the indoor air quality and that actions be implemented to reduce indoor air concentrations to within background ranges. For example, if an indoor or outdoor air source is identified, we recommend the appropriate party implement actions to reduce the levels. In the event that indoor or outdoor sources are not readily identified or confirmed, resampling (which might include additional sub-slab vapor and indoor air sampling locations) is recommended to demonstrate that SVI mitigation actions are not needed. Based on the information available, mitigation might also be recommended when soil vapor intrusion cannot be ruled out.

Monitor: We recommend monitoring (sampling on a recurring basis), including but not necessarily limited to sub-slab vapor, basement air and outdoor air sampling, to determine whether concentrations in the indoor air or sub-slab vapor have changed and/or to evaluate temporal influences. Monitoring might also be recommended to determine whether existing building conditions (e.g., positive pressure heating, ventilation and air-conditioning systems) are maintaining the desired mitigation endpoint and to determine whether changes are needed. The type and frequency of monitoring is determined based on site-, building- and analyte-specific information, taking into account applicable environmental data and building operating conditions. Monitoring is an interim measure required to evaluate exposures related to soil vapor intrusion until contaminated environmental media are remediated.

Mitigate: We recommend mitigation to minimize current or potential exposures associated with soil vapor intrusion. The most common mitigation methods are sealing preferential pathways in conjunction with installing a sub-slab depressurization system and changing the pressurization of the building in conjunction with monitoring. The type, or combination of types, of mitigation is determined on a building-specific basis, taking into account building construction and operating conditions. Mitigation is considered a temporary measure implemented to address exposures related to soil vapor intrusion until contaminated environmental media are remediated.

These general recommendations are made with consideration being given to the additional notes on page 2.

MATRIX C Page 1 of 2

SOIL VAPOR SAMPLE
COLLECTION PROCEDURE

ADDITIONAL NOTES FOR MATRIX C

This matrix summarizes actions recommended to address current and potential exposures related to soil vapor intrusion. To use the matrix appropriately as a tool in the decision-making process, the following should be noted:

- [1] The matrix is generic. As such, it may be appropriate to modify a recommended action to accommodate analyte-specific, building-specific conditions (e.g., dirt floor in basement, crawl spaces, thick slabs, current occupancy, etc.), and/or factors provided in Section 3.2 of the guidance (e.g., current land use, environmental conditions, etc.). For example, collection of additional samples may be recommended when the matrix indicates "no further action" for a particular building, but the results of adjacent buildings (especially sub-slab vapor results) indicate a need to take actions to address exposures related to soil vapor intrusion. Mitigation might be recommended when the results of multiple contaminants indicate monitoring is recommended. Proactive actions may be proposed at any time. For example, the party implementing the actions may decide to install sub-slab depressurization systems on buildings where the matrix indicates "no further action" or "monitoring." Such an action might be undertaken for reasons other than public health (e.g., seeking community acceptance, reducing costs, etc.). However, actions implemented *in lieu* of sampling will typically be expected to be captured in the final engineering report and site management plan, and might not rule out the need for post-implementation sampling (e.g., to document effectiveness or to support terminating the action).
- [2] Actions provided in the matrix are specific to addressing human exposures. Implementation of these actions does not preclude investigating possible sources of soil vapor contamination, nor does it preclude remediating contaminated soil vapor or the source of soil vapor contamination.
- [3] Appropriate care should be taken during all aspects of sample collection to ensure that high quality data are obtained. Since the data are being used in the decision-making process, the laboratory analyzing the environmental samples must have current Environmental Laboratory Approval Program (ELAP) certification for the appropriate analyte and environmental matrix combinations. Furthermore, samples should be analyzed by methods that can achieve a minimum reporting limit of 0.20 microgram per cubic meter for indoor and outdoor air samples. For sub-slab vapor samples and dirt floor soil vapor samples, a minimum reporting limit of 1 microgram per cubic meter is recommended.
- [4] Sub-slab vapor and indoor air samples are typically collected when the likelihood of soil vapor intrusion is considered to be the greatest (i.e., worst-case conditions). If samples are collected at other times (typically, samples collected outside of the heating season), then resampling during worst-case conditions might be appropriate to verify that actions taken to address exposures related to soil vapor intrusion are protective of human health.
- [5] When current exposures are attributed to sources other than soil vapor intrusion, the agencies should be given documentation (e.g., applicable environmental data, completed indoor air sampling questionnaire, digital photographs, etc.) to support a proposed action other than that provided in the matrix box and to support agency assessment and follow-up.
- [6] The party responsible for implementing the recommended actions will differ depending upon several factors, including but not limited to the following: the identified source of the volatile chemicals, the environmental remediation program, and analyte-specific, site-specific and building-specific factors.

SOIL VAPOR SAMPLE COLLECTION PROCEDURE

FIGURE 4

Soil Vapor/Indoor Air Matrix D

February 2024

Analytes Assigned:

Benzene, ethylbenzene, naphthalene, cyclohexane, isooctane (2,2,4-trimethylpentane), 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, o-xylene

SUB-SLAB VAPOR CONCENTRATION of COMPOUND (mcg/m ³)	INDOOR AIR CONCENTRATION of COMPOUND (mcg/m ³)		
	< 2	2 to < 10	10 and above
< 60	1. No further action	2. No Further Action	3. IDENTIFY SOURCE(S) or RESAMPLE or MITIGATE
60 to < 600	4. No further action	5. MONITOR	6. MITIGATE
600 and above	7. MITIGATE	8. MITIGATE	9. MITIGATE

mcg/m³ = micrograms per cubic meter

No further action: No additional actions are recommended to address human exposures.

Identify Source(s) or Resample or Mitigate: We recommend that reasonable and practical actions be taken to identify the source(s) affecting the indoor air quality and that actions be implemented to reduce indoor air concentrations to within background ranges. For example, if an indoor or outdoor air source is identified, we recommend the appropriate party implement actions to reduce the levels. In the event that indoor or outdoor sources are not readily identified or confirmed, resampling (which might include additional sub-slab vapor and indoor air sampling locations) is recommended to demonstrate that SVI mitigation actions are not needed. Based on the information available, mitigation might also be recommended when soil vapor intrusion cannot be ruled out.

Monitor: We recommend monitoring (sampling on a recurring basis), including but not necessarily limited to sub-slab vapor, basement air and outdoor air sampling, to determine whether concentrations in the indoor air or sub-slab vapor have changed and/or to evaluate temporal influences. Monitoring might also be recommended to determine whether existing building conditions (e.g., positive pressure heating, ventilation, and air-conditioning systems) are maintaining the desired mitigation endpoint and to determine whether changes are needed. The type and frequency of monitoring is determined based on site-, building- and analyte-specific information, taking into account applicable environmental data and building operating conditions. Monitoring is an interim measure required to evaluate exposures related to soil vapor intrusion until contaminated environmental media are remediated.

Mitigate: We recommend mitigation to minimize current or potential exposures associated with soil vapor intrusion. The most common mitigation methods are sealing preferential pathways in conjunction with installing a sub-slab depressurization system and changing the pressurization of the building in conjunction with monitoring. The type, or combination of types, of mitigation is determined on a building -specific basis, taking into account building construction and operating conditions. Mitigation is considered a temporary measure implemented to address exposures related to soil vapor intrusion until contaminated environmental media are remediated.

These general recommendations are made with consideration being given to the additional notes on page 2.

MATRIX D Page 1 of 2

SOIL VAPOR SAMPLE
COLLECTION PROCEDURE

ADDITIONAL NOTES FOR MATRIX D

This matrix summarizes actions recommended to address current and potential exposures related to soil vapor intrusion. To use the matrix appropriately as a tool in the decision-making process, the following should be noted:

- [1] The matrix is generic. As such, it may be appropriate to modify a recommended action to accommodate analyte-specific, building-specific conditions (e.g., dirt floor in basement, crawl spaces, thick slabs, current occupancy, etc.), and/or factors provided in Section 3.2 of the guidance (e.g., current land use, environmental conditions, etc.). For example, collection of additional samples may be recommended when the matrix indicates "no further action" for a particular building, but the results of adjacent buildings (especially sub-slab vapor results) indicate a need to take actions to address exposures related to soil vapor intrusion. Mitigation might be recommended when the results of multiple contaminants indicate monitoring is recommended. Proactive actions may be proposed at any time. For example, the party implementing the actions may decide to install sub-slab depressurization systems on buildings where the matrix indicates "no further action" or "monitoring." Such an action might be undertaken for reasons other than public health (e.g., seeking community acceptance, reducing costs, etc.). However, actions implemented *in lieu* of sampling will typically be expected to be captured in the final engineering report and site management plan, and might not rule out the need for post-implementation sampling (e.g., to document effectiveness or to support terminating the action).
- [2] Actions provided in the matrix are specific to addressing human exposures. Implementation of these actions does not preclude investigating possible sources of soil vapor contamination, nor does it preclude remediating contaminated soil vapor or the source of soil vapor contamination.
- [3] Appropriate care should be taken during all aspects of sample collection to ensure that high quality data are obtained. Since the data are being used in the decision-making process, the laboratory analyzing the environmental samples must have current Environmental Laboratory Approval Program (ELAP) certification for the appropriate analyte and environmental matrix combinations. Furthermore, samples should be analyzed by methods that can achieve a minimum reporting limit of 1 microgram per cubic meter for indoor and outdoor air samples. For sub-slab vapor samples and dirt floor soil vapor samples, a minimum reporting limit of 1 microgram per cubic meter is recommended.
- [4] Sub-slab vapor and indoor air samples are typically collected when the likelihood of soil vapor intrusion to occur is considered to be the greatest (i.e., worst-case conditions). If samples are collected at other times (typically, samples collected outside of the heating season), then resampling during worst-case conditions might be appropriate to verify that actions taken to address exposures related to soil vapor intrusion are protective of human health.
- [5] When current exposures are attributed to sources other than soil vapor intrusion, the agencies should be given documentation (e.g., applicable environmental data, completed indoor air sampling questionnaire, digital photographs, etc.) to support a proposed action other than that provided in the matrix box and to support agency assessment and follow-up.
- [6] The party responsible for implementing the recommended actions will differ depending upon several factors, including but not limited to the following: the identified source of the volatile chemicals, the environmental remediation program, and analyte-specific, site-specific and building-specific factors.

MATRIX D Page 2 of 2

SOIL VAPOR SAMPLE COLLECTION PROCEDURE

FIGURE 5

Soil Vapor/Indoor Air Matrix E

February 2024

Analytes Assigned:
m,p-xylene, heptane, hexane

SUB-SLAB VAPOR CONCENTRATION of COMPOUND (mcg/m ³)	INDOOR AIR CONCENTRATION of COMPOUND (mcg/m ³)		
	< 6	6 to < 20	20 and above
< 200	1. No further action	2. No Further Action	3. IDENTIFY SOURCE(S) or RESAMPLE or MITIGATE
200 to < 2,000	4. No further action	5. MONITOR	6. MITIGATE
2,000 and above	7. MITIGATE	8. MITIGATE	9. MITIGATE

mcg/m³ = micrograms per cubic meter

No further action: No additional actions are recommended to address human exposures.

Identify Source(s) or Resample or Mitigate: We recommend that reasonable and practical actions be taken to identify the source(s) affecting the indoor air quality and that actions be implemented to reduce indoor air concentrations to within background ranges. For example, if an indoor or outdoor air source is identified, we recommend the appropriate party implement actions to reduce the levels. In the event that indoor or outdoor sources are not readily identified or confirmed, resampling (which might include additional sub-slab vapor and indoor air sampling locations) is recommended to demonstrate that SVI mitigation actions are not needed. Based on the information available, mitigation might also be recommended when soil vapor intrusion cannot be ruled out.

Monitor: We recommend monitoring (sampling on a recurring basis), including but not necessarily limited to sub-slab vapor, basement air and outdoor air sampling, to determine whether concentrations in the indoor air or sub-slab vapor have changed and/or to evaluate temporal influences. Monitoring might also be recommended to determine whether existing building conditions (e.g., positive pressure heating, ventilation, and air-conditioning systems) are maintaining the desired mitigation endpoint and to determine whether changes are needed. The type and frequency of monitoring is determined based on site-, building- and analyte-specific information, taking into account applicable environmental data and building operating conditions. Monitoring is an interim measure required to evaluate exposures related to soil vapor intrusion until contaminated environmental media are remediated.

Mitigate: We recommend mitigation to minimize current or potential exposures associated with soil vapor intrusion. The most common mitigation methods are sealing preferential pathways in conjunction with installing a sub-slab depressurization system and changing the pressurization of the building in conjunction with monitoring. The type, or combination of types, of mitigation is determined on a building -specific basis, taking into account building construction and operating conditions. Mitigation is considered a temporary measure implemented to address exposures related to soil vapor intrusion until contaminated environmental media are remediated.

These general recommendations are made with consideration being given to the additional notes on page 2.

MATRIX E Page 1 of 2

SOIL VAPOR SAMPLE
COLLECTION PROCEDURE

ADDITIONAL NOTES FOR MATRIX E

This matrix summarizes actions recommended to address current and potential exposures related to soil vapor intrusion. To use the matrix appropriately as a tool in the decision-making process, the following should be noted:

- [1] The matrix is generic. As such, it may be appropriate to modify a recommended action to accommodate analyte-specific, building-specific conditions (e.g., dirt floor in basement, crawl spaces, thick slabs, current occupancy, etc.), and/or factors provided in Section 3.2 of the guidance (e.g., current land use, environmental conditions, etc.). For example, collection of additional samples may be recommended when the matrix indicates "no further action" for a particular building, but the results of adjacent buildings (especially sub-slab vapor results) indicate a need to take actions to address exposures related to soil vapor intrusion. Mitigation might be recommended when the results of multiple contaminants indicate monitoring is recommended. Proactive actions may be proposed at any time. For example, the party implementing the actions may decide to install sub-slab depressurization systems on buildings where the matrix indicates "no further action" or "monitoring." Such an action might be undertaken for reasons other than public health (e.g., seeking community acceptance, reducing costs, etc.). However, actions implemented *in lieu* of sampling will typically be expected to be captured in the final engineering report and site management plan, and might not rule out the need for post-implementation sampling (e.g., to document effectiveness or to support terminating the action).
- [2] Actions provided in the matrix are specific to addressing human exposures. Implementation of these actions does not preclude investigating possible sources of soil vapor contamination, nor does it preclude remediating contaminated soil vapor or the source of soil vapor contamination.
- [3] Appropriate care should be taken during all aspects of sample collection to ensure that high quality data are obtained. Since the data are being used in the decision-making process, the laboratory analyzing the environmental samples must have current Environmental Laboratory Approval Program (ELAP) certification for the appropriate analyte and environmental matrix combinations. Furthermore, samples should be analyzed by methods that can achieve a minimum reporting limit of 1 microgram per cubic meter for indoor and outdoor air samples. For sub-slab vapor samples and dirt floor soil vapor samples, a minimum reporting limit of 1 microgram per cubic meter is recommended.
- [4] Sub-slab vapor and indoor air samples are typically collected when the likelihood of soil vapor intrusion to occur is considered to be the greatest (i.e., worst-case conditions). If samples are collected at other times (typically, samples collected outside of the heating season), then resampling during worst-case conditions might be appropriate to verify that actions taken to address exposures related to soil vapor intrusion are protective of human health.
- [5] When current exposures are attributed to sources other than soil vapor intrusion, the agencies should be given documentation (e.g., applicable environmental data, completed indoor air sampling questionnaire, digital photographs, etc.) to support a proposed action other than that provided in the matrix box and to support agency assessment and follow-up.
- [6] The party responsible for implementing the recommended actions will differ depending upon several factors, including but not limited to the following: the identified source of the volatile chemicals, the environmental remediation program, and analyte-specific, site-specific and building-specific factors.

MATRIX E Page 2 of 2

SOIL VAPOR SAMPLE COLLECTION PROCEDURE

FIGURE 6

Soil Vapor/Indoor Air Matrix F

February 2024

Analytes Assigned:
Toluene

SUB-SLAB VAPOR CONCENTRATION of COMPOUND (mcg/m ³)	INDOOR AIR CONCENTRATION of COMPOUND (mcg/m ³)		
	< 10	10 to < 50	50 and above
< 300	1. No Further Action	2. No Further Action	3. IDENTIFY SOURCE(S) or RESAMPLE or MITIGATE
300 to < 3,000	4. No Further Action	5. MONITOR	6. MITIGATE
3,000 and above	7. MITIGATE	8. MITIGATE	9. MITIGATE

mcg/m³ = micrograms per cubic meter

No further action: No additional actions are recommended to address human exposures.

Identify Source(s) or Resample or Mitigate: We recommend that reasonable and practical actions be taken to identify the source(s) affecting the indoor air quality and that actions be implemented to reduce indoor air concentrations to within background ranges. For example, if an indoor or outdoor air source is identified, we recommend the appropriate party implement actions to reduce the levels. In the event that indoor or outdoor sources are not readily identified or confirmed, resampling (which might include additional sub-slab vapor and indoor air sampling locations) is recommended to demonstrate that SVI mitigation actions are not needed. Based on the information available, mitigation might also be recommended when soil vapor intrusion cannot be ruled out.

Monitor: We recommend monitoring (sampling on a recurring basis), including but not necessarily limited to sub-slab vapor, basement air and outdoor air sampling, to determine whether concentrations in the indoor air or sub-slab vapor have changed and/or to evaluate temporal influences. Monitoring might also be recommended to determine whether existing building conditions (e.g., positive pressure heating, ventilation, and air-conditioning systems) are maintaining the desired mitigation endpoint and to determine whether changes are needed. The type and frequency of monitoring is determined based on site-, building- and analyte-specific information, taking into account applicable environmental data and building operating conditions. Monitoring is an interim measure required to evaluate exposures related to soil vapor intrusion until contaminated environmental media are remediated.

Mitigate: We recommend mitigation to minimize current or potential exposures associated with soil vapor intrusion. The most common mitigation methods are sealing preferential pathways in conjunction with installing a sub-slab depressurization system and changing the pressurization of the building in conjunction with monitoring. The type, or combination of types, of mitigation is determined on a building -specific basis, taking into account building construction and operating conditions. Mitigation is considered a temporary measure implemented to address exposures related to soil vapor intrusion until contaminated environmental media are remediated.

These general recommendations are made with consideration being given to the additional notes on page 2.

MATRIX F Page 1 of 2

SOIL VAPOR SAMPLE
COLLECTION PROCEDURE

ADDITIONAL NOTES FOR MATRIX F

This matrix summarizes actions recommended to address current and potential exposures related to soil vapor intrusion. To use the matrix appropriately as a tool in the decision-making process, the following should be noted:

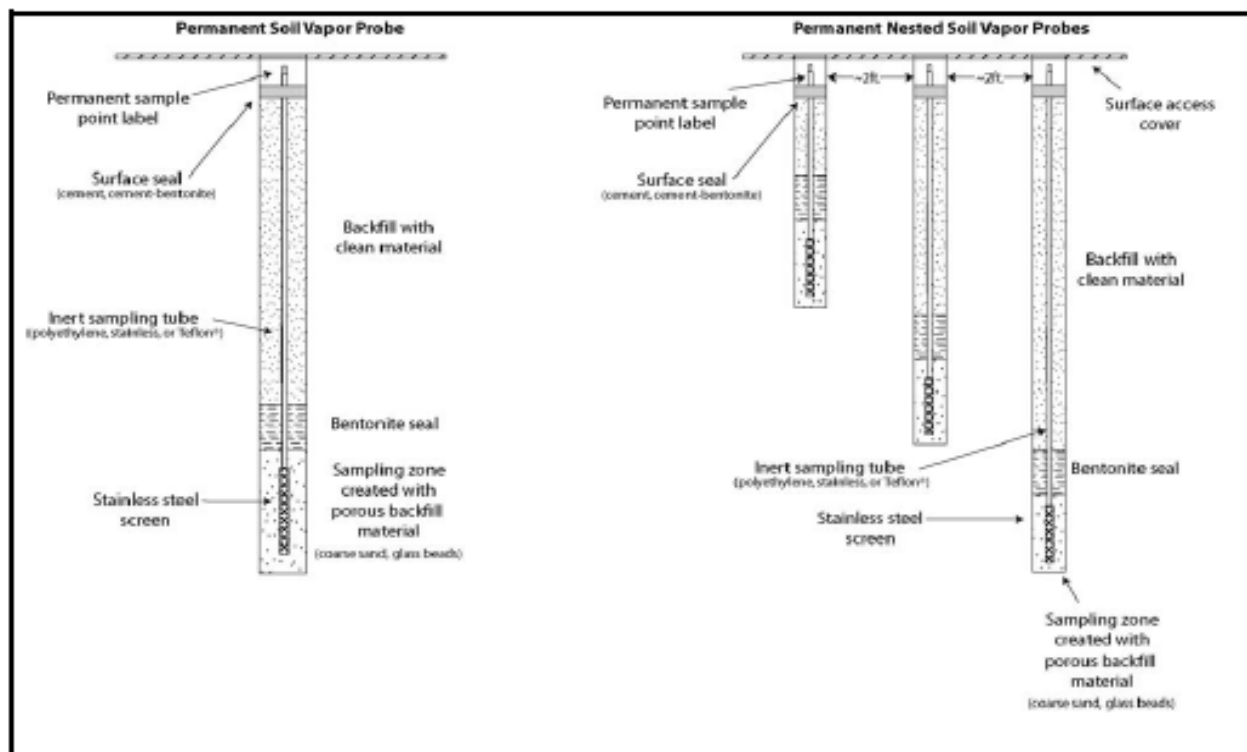
- [1] The matrix is generic. As such, it may be appropriate to modify a recommended action to accommodate analyte-specific, building-specific conditions (e.g., dirt floor in basement, crawl spaces, thick slabs, current occupancy, etc.), and/or factors provided in Section 3.2 of the guidance (e.g., current land use, environmental conditions, etc.). For example, collection of additional samples may be recommended when the matrix indicates "no further action" for a particular building, but the results of adjacent buildings (especially sub-slab vapor results) indicate a need to take actions to address exposures related to soil vapor intrusion. Mitigation might be recommended when the results of multiple contaminants indicate monitoring is recommended. Proactive actions may be proposed at any time. For example, the party implementing the actions may decide to install sub-slab depressurization systems on buildings where the matrix indicates "no further action" or "monitoring." Such an action might be undertaken for reasons other than public health (e.g., seeking community acceptance, reducing costs, etc.). However, actions implemented *in lieu* of sampling will typically be expected to be captured in the final engineering report and site management plan, and might not rule out the need for post-implementation sampling (e.g., to document effectiveness or to support terminating the action).
- [2] Actions provided in the matrix are specific to addressing human exposures. Implementation of these actions does not preclude investigating possible sources of soil vapor contamination, nor does it preclude remediating contaminated soil vapor or the source of soil vapor contamination.
- [3] Appropriate care should be taken during all aspects of sample collection to ensure that high quality data are obtained. Since the data are being used in the decision-making process, the laboratory analyzing the environmental samples must have current Environmental Laboratory Approval Program (ELAP) certification for the appropriate analyte and environmental matrix combinations. Furthermore, samples should be analyzed by methods that can achieve a minimum reporting limit of 1 microgram per cubic meter for indoor and outdoor air samples. For sub-slab vapor samples and dirt floor soil vapor samples, a minimum reporting limit of 1 microgram per cubic meter is recommended.
- [4] Sub-slab vapor and indoor air samples are typically collected when the likelihood of soil vapor intrusion to occur is considered to be the greatest (i.e., worst-case conditions). If samples are collected at other times (typically, samples collected outside of the heating season), then resampling during worst-case conditions might be appropriate to verify that actions taken to address exposures related to soil vapor intrusion are protective of human health.
- [5] When current exposures are attributed to sources other than soil vapor intrusion, the agencies should be given documentation (e.g., applicable environmental data, completed indoor air sampling questionnaire, digital photographs, etc.) to support a proposed action other than that provided in the matrix box and to support agency assessment and follow-up.
- [6] The party responsible for implementing the recommended actions will differ depending upon several factors, including but not limited to the following: the identified source of the volatile chemicals, the environmental remediation program, and analyte-specific, site-specific and building-specific factors.

MATRIX F Page 2 of 2

SOIL VAPOR SAMPLE COLLECTION PROCEDURE

FIGURE 7

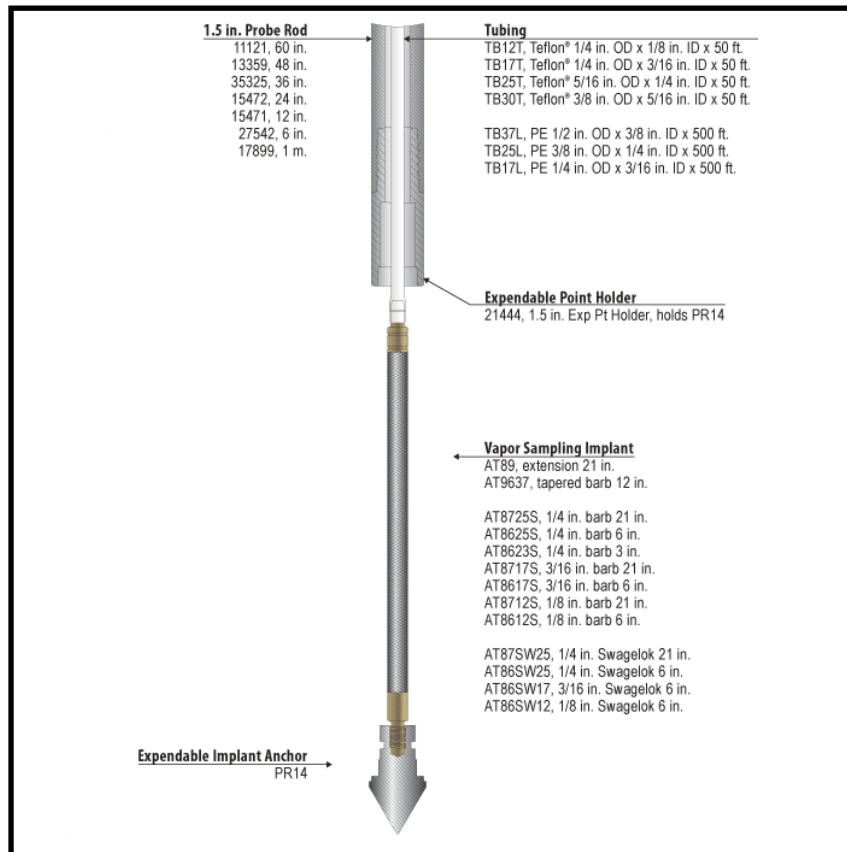
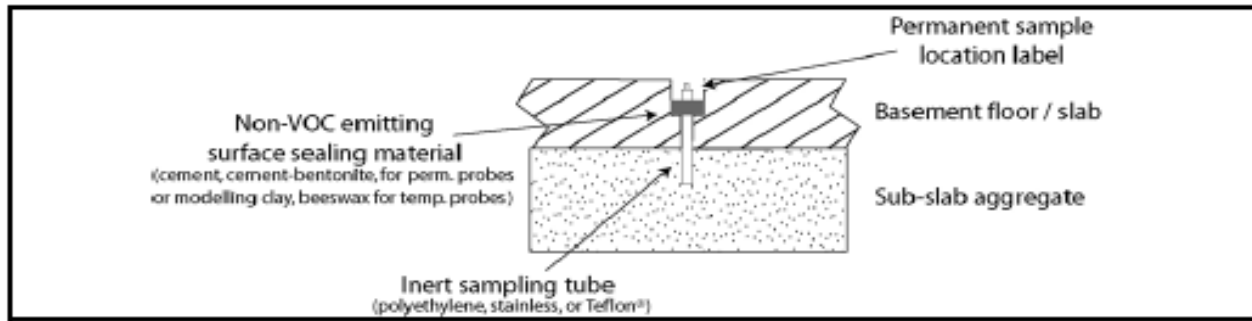
Schematics of a permanent soil vapor probe and permanent nested soil vapor probes



SOIL VAPOR SAMPLE COLLECTION PROCEDURE

FIGURE 8

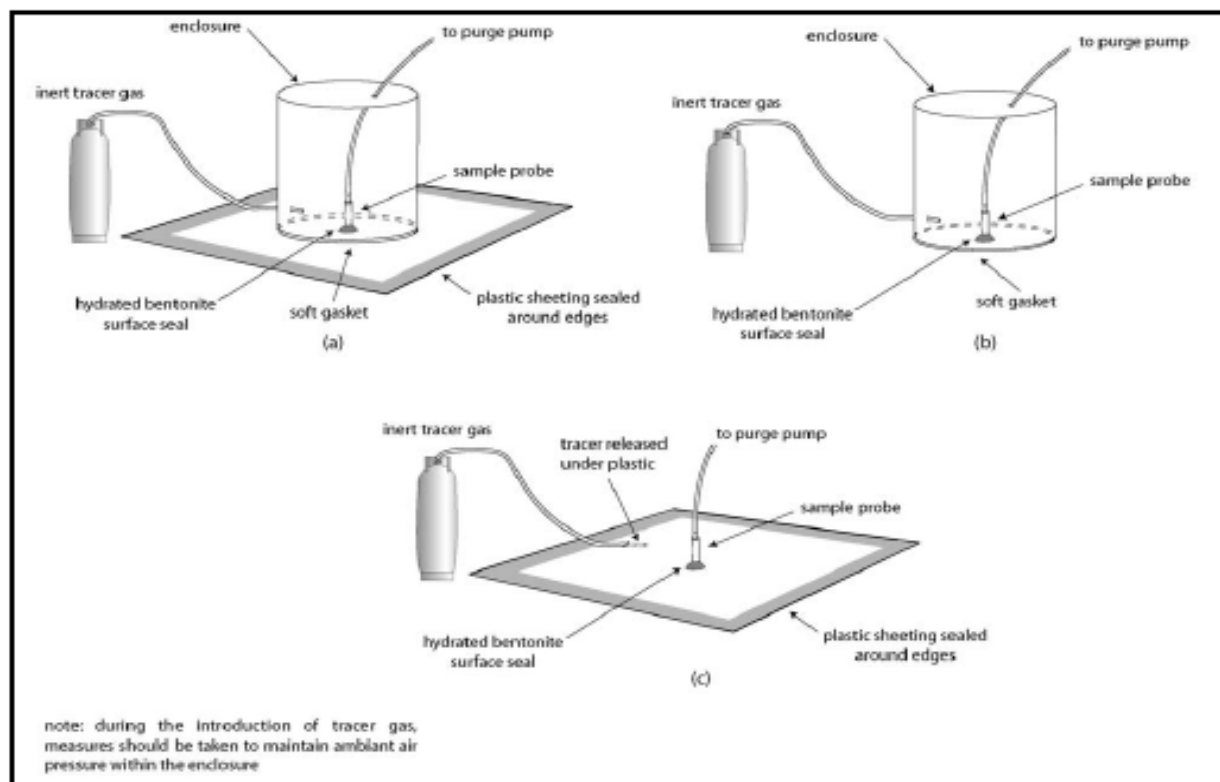
Schematic of a sub-slab vapor probe



SOIL VAPOR SAMPLE COLLECTION PROCEDURE

FIGURE 9

Schematics of tracer gas applications



SOIL VAPOR SAMPLE COLLECTION PROCEDURE



AIR CANISTER FIELD RECORD

PROJECT INFORMATION:

Project: _____

Job No: _____

Location: _____

Field Staff: _____

Client: _____

SAMPLE I.D.: _____

WEATHER CONDITIONS:

Ambient Air Temp. - A.M.: _____

Ambient Air Temp. - P.M.: _____

Wind Direction: _____

Wind Speed: _____

Precipitation: _____

Size of Canister: _____

Canister Serial No.: _____

Flow Controller No.: _____

Sample Date(s): _____

Shipping Date: _____

Sample Type: ☐ _____☐ _____

Soil Gas Probe Depth: _____

FIELD SAMPLING INFORMATION:

READING	TIME	VACUUM (inches Hg) or PRESSURE (psig)	DATE	INITIALS
Lab Vacuum (on tag)				
Field Vacuum Check ¹				
Initial Field Vacuum ²				
Final Field Vacuum ³				
Duration of Sample Collection				

LABORATORY CANISTER PRESSURIZATION:

Initial Vacuum (inches Hg and psia)	
Final Pressure (psia)	
Pressurization Gas	

SUBSLAB SHROUD:

Shroud Helium Concentration: _____

Calculated tubing volume _____ x 3 = _____

Purged Tubing Volume Concentration: _____

Is the purged volume concentration less than or equal to 10% in shroud?

☐☐

COMPOSITE TIME (hours)	FLOW RATE RANGE (ml/min)
15 Min.	316 - 333
0.5 Hours	158 - 166.7
1	79.2 - 83.3
2	39.6 - 41.7
4	19.8 - 20.8
6	13.2 - 13.9
8	9.9 - 10.4
10	7.92 - 8.3
12	6.6 - 6.9
24	3.5 - 4.0

NOTES:

1 Vacuum measured using portable vacuum gauge (provided by Lab)

2 Vacuum measured by canister gauge upon opening valve

3 Vacuum measured by canister gauge prior to closing valve

Signed: _____

SOIL VAPOR SAMPLE COLLECTION PROCEDURE

ROUX INDOOR AIR QUALITY QUESTIONNAIRE
& BUILDING INVENTORY

Project Name: _____ Project No. _____
 Project Location: _____ Client: _____
 Preparer's Name: _____ Date/Time: _____
 Preparer's Affiliation: _____ Phone No: _____

Purpose of Investigation: _____

1. OCCUPANT:
 Interviewed: ☐ yes ☐ no
 Last Name: _____ First Name: _____
 Address: _____
 County: _____
 Home Phone: _____ Office Phone: _____
 Number of Occupants/persons at this location: _____ Age of Occupants: _____

2. OWNER OR LANDLORD: (check if same as occupant)
 Interviewed: ☐ yes ☐ no
 Last Name: _____ First Name: _____
 Address: _____
 County: _____
 Home Phone: _____ Office Phone: _____

3. BUILDING CHARACTERISTICS:
 Type of Building: check appropriate response(s)
☐ Residential ☐ School ☐ Commercial/Multi-use
☐ Industrial ☐ Church ☐ Other: _____
 If the property is residential, type (check appropriate response)
☐ Single Family ☐ 3-Family
☐ Raised Ranch ☐ Split Level ☐ Colonial
☐ Cape Cod ☐ Contemporary ☐ Mobile Home
☐ Duplex ☐ Apartment House ☐ Townhouse/Condo
☐ Modular ☐ Log Home ☐ Other: _____

If multiple units, how many? _____
 If the property is commercial, type?
 Business Type(s): _____
 Does it include residences (i.e., multi-use)? ☐ yes ☐ no If yes, how many? _____

Other Characteristics:
 Number of floors: _____ Building age: _____
 Is the building insulated? ☐ yes ☐ no How air tight? ☐ tight ☐ average ☐ not tight

Page 1 of 8

ROUX INDOOR AIR QUALITY QUESTIONNAIRE
& BUILDING INVENTORY

4. AIR FLOW
 Use air current tubes or tracer smoke to evaluate air flow patterns and qualitatively describe:

Airflow between floors: _____

Airflow near source: _____

Outdoor air infiltration: _____

Infiltration into air ducts: _____

5. BASEMENT AND CONSTRUCTION DETAILS/REPAIRS (check all that apply)
 a. Above grade construction: ☐ vinyl floor ☐ concrete ☐ stone
 b. Basement type construction: ☐ full ☐ crawlspace ☐ slab
 c. Basement floor: ☐ concrete ☐ dirt ☐ stone
 d. Basement floor: ☐ covered ☐ covered with _____
 e. Concrete floor: ☐ unsealed ☐ sealed ☐ sealed with _____
 f. Foundation walls: ☐ poured ☐ block ☐ stone
 g. Foundation walls: ☐ unsealed ☐ sealed ☐ sealed with _____
 h. The basement is: ☐ wet ☐ damp ☐ dry
 i. The basement is: ☐ finished ☐ unfinished ☐ partially finished
 j. Sump present? ☐ yes ☐ no
 k. Water in Sump? ☐ yes ☐ no ☐ not applicable
 Basement/Lowest level depth below grade: _____
 Identify potential soil vapor entry points and approximate size (e.g., cracks, utility ports, drains)

Page 2 of 8

ROUX INDOOR AIR QUALITY QUESTIONNAIRE
& BUILDING INVENTORY

6. HEATING, VENTING, AND AIR CONDITIONING (check all that apply)
 Type of heating system(s) used in this building: (check all that apply - note primary)
☐ Hot air circulation ☐ Heat pump ☐ Hot water baseboard
☐ Space Heaters ☐ Steam radiation ☐ Radiant floor
☐ Electric baseboard ☐ Wood stove ☐ Outdoor wood boiler
☐ Other: _____

The primary type of fuel used is:
☐ Natural Gas ☐ Fuel oil ☐ Propane
☐ Electric ☐ Propane ☐ Coal
☐ Wood ☐ Coal ☐ Other: _____

Domestic hot water tank fueled by: _____
 Boiler/furnace located in:
☐ Basement ☐ Outdoor ☐ Attic ☐ Other: _____

Air Conditioning:
☐ Central Air ☐ Window units ☐ Open windows ☐ None

Are there air distribution ducts present? ☐ yes ☐ no

Describe the supply and cold air return openings, noting circulation where visible, including whether there is a cold air return and the tightness of each panel. Indicate the locations on the floor plan diagram.

7. OCCUPANCY
 Is basement/lowest level occupied? ☐ Full-time ☐ Occasionally ☐ Seldom ☐ Almost Never
 Level: _____ General Use of Each Floor (e.g., family room, bedroom, laundry, workshop, storage)
 Basement: _____
 First Floor: _____
 Second Floor: _____
 Third Floor: _____
 Fourth Floor: _____

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ROUX INDOOR AIR QUALITY QUESTIONNAIRE
& BUILDING INVENTORY

8. FACTORS THAT MAY INFLUENCE INDOOR AIR QUALITY

a. Is there an attached garage? ☐ yes ☐ no

b. Does the garage have a separate heating unit? ☐ yes ☐ no ☐ NA

c. Are petroleum-powered machines or vehicles stored in the garage? ☐ yes ☐ no ☐ NA
 (e.g., lawnmower, etc., car) If yes, please specify: _____

d. Has the building ever had a fire? ☐ yes ☐ no
 If yes, when? _____

e. Is a kerosene or unvented gas space heater present? ☐ yes ☐ no
 If yes, when? _____

f. Is there a workshop or hobby/craft area? ☐ yes ☐ no
 If yes, when? _____

g. Is there smoking in the building? ☐ yes ☐ no
 If yes, when? _____

h. Have cleaning products been used recently? ☐ yes ☐ no
 If yes, when? _____

i. Have cosmetics or perfumes been used recently? ☐ yes ☐ no
 If yes, when? _____

j. Has paint been standing in the last 6 months? ☐ yes ☐ no
 If yes, when? _____

k. Is there new carpet, drapes, or other textiles? ☐ yes ☐ no
 If yes, when? _____

l. Have air fresheners been used recently? ☐ yes ☐ no
 If yes, when? _____

m. Is there a kitchen exhaust fan? ☐ yes ☐ no
 If yes, when vented? _____

n. Is there a bathroom exhaust fan? ☐ yes ☐ no
 If yes, when vented? _____

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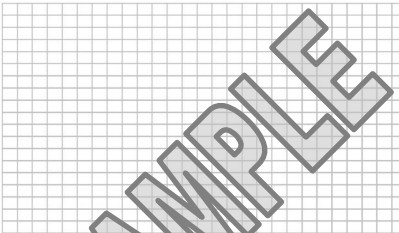
INDOOR AIR QUALITY QUESTIONNAIRE

& BUILDING INVENTORY

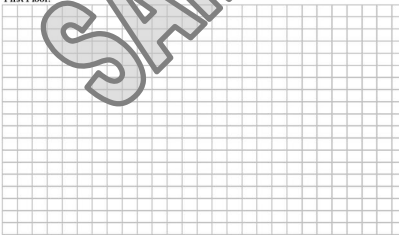
II. FLOOR PLANS

Draw a plan view sketch of the basement and first floor of the building. Indicate air sampling locations, possible indoor air pollution sources and PID meter readings. If the building does not have a basement, please note.

Basement:



First Floor:



Indoor Air Quality Questionnaire and Building Inventory

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[illegible]



FIELD OPERATING PROCEDURES

Calibration and Maintenance of Combustible Gas/Oxygen Meter

**CALIBRATION AND MAINTENANCE OF
COMBUSTIBLE GAS/OXYGEN METER**

PURPOSE

This procedure presents a method for calibration of the GasTech GT402 four-gas meter. The GasTech GT402 is a portable instrument designed primarily for detection of combustible gases and of oxygen deficiency in ambient air and confined workspaces, such as natural gas or depleted oxygen in utility manholes. The GasTech GT402 monitors an environment for hydrocarbons (LEL/ppm), oxygen (O₂), carbon monoxide (CO) and hydrogen sulfide (H₂S). The meter detects gas by a sample-drawing method utilizing up to four internal sensors plugged into assigned molded flow block receptacles. During operation, the GasTech GT402 alerts the user with visual and audible alarms whenever a monitored gas reaches the preset alarm level. The GasTech GT402 has an internal pump that continually draws the atmosphere sample into the external probe and hose, then into the monitor to the sensor(s).

The information included below is equipment manufacturer- and model-specific, however, accuracy, calibration, and maintenance procedures for this type of portable equipment are typically similar. The information below pertains to GasTech GT402. The actual equipment to be used in the field will be equivalent or similar. The unit selected for use in the field will be used to measure methane gas, hydrogen sulfide gas, Lower Explosive Limit (LEL), and percent oxygen. As always, consult the manufacturers operations manual prior to conducting this procedure to confirm accuracy.

**CALIBRATION AND MAINTENANCE OF
COMBUSTIBLE GAS/OXYGEN METER**

START-UP PROCEDURE

Perform the following steps to start up the GasTech GT402 gas monitor and adjust internal circuits to “fresh air” readings (demand zero). Read this entire section before turning on the meter.

WARNING

Perform the following start-up procedure in a “fresh air” environment only (environment known to be free of toxic gases, combustible gases, and of normal oxygen content).

1. If you are using Ni-Cd batteries, make sure the batteries are fully charged before you continue this procedure.
2. Press the **ON/OFF** button once, then release the button. The display momentarily shows the software version of your monitor and the number of data logging hours that remain in memory. During the warm-up period, the gas readings stabilize for the installed sensors. You can hear the pump operating, and the words **WARMING UP** are displayed. The red LED flashes slowly during warm-up. Allow one minute for the display to stabilize and the LED to stop flashing. The GT sounds a periodic beep, and the display shows the words **WARMUP COMPLETE** when the meter completes initial warm-up.

WARNING

Do not perform the next step in the monitoring area. This can place you in potential danger if hazardous conditions exist.

FOP 006.0

CALIBRATION AND MAINTENANCE OF COMBUSTIBLE GAS/OXYGEN METER

3. Press and hold the **ADJUST/ENTER** button to adjust the monitor to “fresh air” readings. When the display reads “**DONE. THANK YOU**”, release the button.
4. Verify that the meter displays the correct fresh air reading for each of the meter’s channels. The table below lists the correct fresh air reading for **all** channels available for the meter.

Channel	Fresh Air Reading
% LEL	000
% Oxygen	20.9
Carbon Monoxide (ppm)	000
Hydrogen Sulfide (ppm)	000

5. Exhale over the inlet of the probe. The O₂ reading decreases.
6. Continue exhaling over the probe until the O₂ reading decreases to **19.5%** or below.
7. Verify that the alarm activates when the O₂ reading decreases to **19.5%**. The buzzer sounds, the O₂ reading flashes, and the display flashes “**ALRM**” when the alarm activates.
8. Verify that the O₂ reading returns to **20.9%**. The gas reading flashes until it increases above 19.5%.
9. To turn the GT Series gas monitor off, press the **ON/OFF** button and hold it down while the GT sounds five audible beeps. The monitor automatically shuts off. Release the button.

**CALIBRATION AND MAINTENANCE OF
COMBUSTIBLE GAS/OXYGEN METER**

10. If your GT uses rechargeable Ni-Cd batteries, the batteries must be fully charged before each use. When using alkaline batteries with your GT, for best possible operation you may choose to install fresh batteries before each use.

CALIBRATION PROCEDURE

Perform the following steps to calibrate the GasTech GT402 gas monitor and adjust internal circuits to “fresh air” readings (demand zero). Read this entire section before calibrating the meter.

CAUTION

Calibrate the GasTech GT402 gas monitor in a “fresh air” environment (known to be of normal oxygen content and free of toxic or combustible gases). Do not begin calibration unless you can verify that you are in a “fresh air” environment.

1. Verify that the calibrating area contains a level surface to set the meter and calibration kit accessories.
2. Turn on the meter in accordance with the Start-Up Procedure previously discussed. Enter the Function program and verify that the Battery Capacity screen displays at least three bars. Attach the probe to the inlet fitting on the meter.
3. Carefully screw the threaded end of the regulator into the gas cylinder.
4. Attach the sample tubing over the fitting on the regulator.
5. Press the **ADJUST/ENTER** button. The display shows the main screen.
6. Press the **RESET** and **BACK LITE/-** buttons simultaneously three times. The meter displays:

**CALIBRATION AND MAINTENANCE OF
COMBUSTIBLE GAS/OXYGEN METER**

Version N.NN

Calibrate

Setting the Zero Readings

NOTE: During a zeroing operation, an exclamation point (!) may appear at the beginning of the second line of the display reading when the reading is centered in the zero range. The “!” symbol represents the optimum reading.

1. Press the ADJUST/ENTER button. The GT displays:

Zero Gas

NNN PPM H2S

2. Use the FUNC./+ or BACK LITE/- buttons to adjust the display reading to 000 PPM H2S.
3. Press the ADJUST/ENTER button to save this zero setting. The GT displays:

Zero Gas

NNNN PPM COMB

4. Use the FUNC./+ or BACK LITE/- buttons to adjust the display reading to **0000 PPM COMB**.
5. Press the ADJUST/ENTER button to save this zero setting. The GT displays:

Zero Gas

NNN PPM CO

6. Use the FUNC./+ or BACK LITE/- buttons to adjust the display reading to **000 PPM CO**.

**CALIBRATION AND MAINTENANCE OF
COMBUSTIBLE GAS/OXYGEN METER**

7. Press the **ADJUST/ENTER** button to save this zero setting. The GT displays:

Zero Gas

NN.N %VOL OXY

8. Attach the tubing from the regulator to the probe tube. The GT will draw gas from the gas cylinder.
9. Allow at least one minute, then use the **FUNC./+** or **BACK LITE/-** buttons to adjust the display reading to match the O₂ value marked on the gas cylinder.
10. Press the **ADJUST/ENTER** button to save this setting. The GT displays:

Span Gas

NNN PPM H₂S

Setting the Span Readings

1. Use the **FUNC./+** or **BACK LITE/-** buttons to adjust the display reading to match the H₂S value marked on the gas cylinder.
2. Press the **ADJUST/ENTER** button to save this span setting. The GT displays:

Span Gas

NNN %LEL COMB

3. Use the **FUNC./+** or **BACK LITE/-** buttons to adjust the display reading to match the combustible gas value marked on the gas cylinder.
4. Press the **ADJUST/ENTER** button to save this span setting. The GT displays:

Span Gas

NNN PPM CO

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CALIBRATION AND MAINTENANCE OF COMBUSTIBLE GAS/OXYGEN METER

5. Use the **FUNC./+** or **BACK LITE/-** buttons to adjust the display reading to match the CO value marked on the gas cylinder.
6. Press the **ADJUST/ENTER** button to save this span setting. The GT displays:

Span Gas

NN.N %VOL OXY

7. Disconnect the probe from the tubing leading to the regulator. The flow of gas will stop automatically.
8. Use the **FUNC./+** or **BACK LITE/-** buttons to adjust the display reading to 20.9 %VOL OXY.
9. Press the **ADJUST/ENTER** button to save this span setting.

Calibration is now complete. The GT displays:

Exit

Press any Key...

Exiting Calibration Mode

1. Press any button, except the **ON/OFF** to exit calibration mode.
2. Unscrew the regulator from the gas cylinder.
3. Store the components of the calibration kit in the storage case.
4. The GT is now ready for normal operation.
5. Record all calibration information in the Project Field Book as well as on an **Equipment Calibration Log** sheet (see attached sample).

**CALIBRATION AND MAINTENANCE OF
COMBUSTIBLE GAS/OXYGEN METER**

MAINTENANCE

The following are daily, monthly, quarterly, and “as required” preventive maintenance suggestions to ensure the reliability of the GT monitor.

Daily

BATTERIES

The GT should always contain fully charged Ni-Cd batteries or sufficiently powered alkaline batteries before each day’s use. You can verify the capacity of the batteries using the Function program. To verify battery capacity:

1. Verify that the battery slide switch is at the proper **ALK** or **NI-CAD** setting for the type of batteries in the GT.
2. Press and hold the **FUNC./+** button, for four beeps, then release the button. If the display shows less than three bars, recharge the Ni-Cd batteries or replace the alkaline batteries as described later in this chapter.
3. Press the **FUNC./+** button to return to the main display.

CALIBRATION

For **optimum** efficiency of the monitor, calibrate the GT **before** and **after** each use. If multiple calibrations over a period of days indicate that only a minimum of adjustments are required, the frequency of calibration can be changed to weekly or monthly, depending on how often the monitor is used, and how demanding the monitoring environment is.

**CALIBRATION AND MAINTENANCE OF
COMBUSTIBLE GAS/OXYGEN METER**

NOTE

At the very least, “challenge” the normal operation of the oxygen (O₂) sensor (if applicable) before every use. Exhale over the inlet of the probe as you watch the display. The O₂ reading should **decrease**. When the O₂ reading decreases to **19.5%**, the alarm should activate confirming the normal operation of the O₂

SAMPLE-DRAW SUBCOMPONENTS

Verify the proper operation of the flow alarm circuit by holding your finger over the inlet of the probe for a few seconds. The pump shuts off, the **PUMP OFF PRESS RESET** message appears on the display, and the audible alarm sounds if the flow alarm circuit is operating properly.

Monthly/Quarterly

CALIBRATION

Calibrate the sensors at least every one to three months. Calibration frequency depends on the frequency of use and also the environmental conditions in which you use the GT.

As Required

ALARM CIRCUITS

Periodically verify that all visual and audible alarms function properly.

WARNING

Verify alarm circuits in a “fresh air” environment only (environment known to be free of combustible and toxic gases and of normal oxygen content).

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CALIBRATION AND MAINTENANCE OF COMBUSTIBLE GAS/OXYGEN METER

To verify the alarm circuits, use a concentration of the proper gas sample that is greater than the preset warn or alarm levels. Verify that **WARN** or **ALRM** displays and the buzzer sounds. Also, verify that the display reading in alarm flashes during the alarm sequence.

SAMPLE-DRAW SUBCOMPONENTS

Periodically check the probe, hoses, internal filter, and tubing for obstructions that can accumulate over time. *This is especially important if you use the GT in a dusty or dirty environment.* Replace the cotton and hydrophobic filter elements if they become contaminated or discolored.

ATTACHMENTS

Equipment Calibration Log (sample)

FOP 006.0

CALIBRATION AND MAINTENANCE OF COMBUSTIBLE GAS/OXYGEN METER



EQUIPMENT CALIBRATION

PROJECT INFORMATION:

Project Name: _____

Date: _____

Project No.: _____

Client: _____

Instrument Source: ☐ Roux ☐ Rental

METER TYPE	UNITS	TIME	MAKE/MODEL	SERIAL NUMBER	CAL. BY	STANDARD	READING	SETTLE
☐ pH meter	units		Myron L. Company Ultra Meter 6P	606987		4.00		
						7.00		
						10.01		
						< 0.4		
☐ Turbidity meter	NTU		Hach 2100P Turbidimeter	970600014560		20		
						100		
						800		
☐ Sp. conductance meter	uS/mS		Myron L. Company Ultra Meter 6P	606987		uS @ 25 °C		
☐ PID	ppm		Photovac 2020 PID			open air zero		MIBK re factor :
						ppm Iso. Gas		
☐ Particulate meter	mg/m ³					zero air		
☐ Oxygen	%					open air		
☐ Hydrogen sulfide	ppm					open air		
☐ Carbon monoxide	ppm					open air		
☐ LEL	%					open air		
☐ Radiation Meter	uR/h					background area		
☐								

ADDITIONAL REMARKS:

PREPARED BY: _____

DATE: _____





FIELD OPERATING PROCEDURES

Calibration and Maintenance of Portable Dissolved Oxygen Meter

**CALIBRATION AND MAINTENANCE OF PORTABLE
DISSOLVED OXYGEN METER**

PURPOSE

This guideline describes a method for calibration of a portable dissolved oxygen meter. This meter measures the concentration of dissolved oxygen within a water sample. This parameter is of interest both as a general indicator of water quality, and because of its pertinence to fate and transport of organics and inorganics. This guideline presents a method for calibration of this meter, which is performed to verify instrument accuracy and function. All field instruments will be calibrated, verified and recalibrated at frequencies required by their respective operating manuals or manufacturer's specifications, but not less than once each day that the instrument is in use. Field personnel should have access to all operating manuals for the instruments used for the field measurements. This procedure also documents critical maintenance activities for this meter.

ACCURACY

The calibrated accuracy of the dissolved oxygen meter will be within $\pm 1\%$ of full-scale over the temperature range of 23° to 113° F (-5° to +45° C).

PROCEDURE

1. Calibrate the dissolved oxygen meter to ambient air based on probe temperature and true local atmospheric pressure conditions (or feet above sea level). Because procedures vary with different brands and models of meters, refer to the manufacturer's recommended calibration procedures.
2. In the event of a failure to adequately calibrate, follow the corrective action directed by the manufacturer.
3. If calibration cannot be achieved or maintained, obtain a replacement instrument (rental instruments) and/or order necessary repairs/adjustment.

**CALIBRATION AND MAINTENANCE OF PORTABLE
DISSOLVED OXYGEN METER**

4. Document the calibration results and related information in the Project Field Book and on an **Equipment Calibration Log** (see attached sample). Information will include, at a minimum:
- Time, date, and initials of the field team member performing the calibration
 - The unique identifier for the meter, including manufacturer, model, and serial number
 - The brand and expiration dates of calibration solutions
 - The calibration readings
 - The instrument settings (if applicable)
 - The approximate response time
 - The overall adequacy of calibration including the Pass or fail designation in accordance with the accuracy specifications presented above
 - Corrective action taken (see Step 5 above) in the event of failure to adequately calibrate

MAINTENANCE

- When not in use or between measurements, the dissolved oxygen probe will be kept immersed in or moist with deionized water.
- The meter batteries will be checked prior to each meter's use and will be replaced when the meter cannot be redline adjusted.
- The meter response time and stability will be tracked to determine the need for instrument maintenance. When response time becomes greater than two minutes, probe service is indicated.

ATTACHMENTS

Equipment Calibration Log (sample)

FOP 007.0

CALIBRATION AND MAINTENANCE OF PORTABLE
DISSOLVED OXYGEN METER

EQUIPMENT CALIBRATION

PROJECT INFORMATION:

Project Name: _____

Date: _____

Project No.: _____

Client: _____

Instrument Source: ☐ Roux ☐ Rental

METER TYPE	UNITS	TIME	MAKE/MODEL	SERIAL NUMBER	CAL. BY	STANDARD	READING	SETTLE
☐ pH meter	units		Myron L. Company Ultra Meter 6P	606987		4.00		
						7.00		
						10.01		
						< 0.4		
☐ Turbidity meter	NTU		Hach 2100P Turbidimeter	970600014560		20		
						100		
						800		
☐ Sp. conductance meter	uS/mS		Myron L. Company Ultra Meter 6P	606987		uS @ 25 °C		
☐ PID	ppm		Photovac 2020 PID			open air zero		MIBK re factor :
						ppm Iso. Gas		
☐ Particulate meter	mg/m ³					zero air		
☐ Oxygen	%					open air		
☐ Hydrogen sulfide	ppm					open air		
☐ Carbon monoxide	ppm					open air		
☐ LEL	%					open air		
☐ Radiation Meter	uR/h					background area		
☐								

ADDITIONAL REMARKS:

PREPARED BY: _____

DATE: _____





FIELD OPERATING PROCEDURES

Calibration and Maintenance of Portable Field pH/Eh Meter

**CALIBRATION AND MAINTENANCE OF PORTABLE
FIELD pH/Eh METER**

PURPOSE

This guideline describes a method for calibration of a portable pH/Eh meter. The pH/Eh meter measures the hydrogen ion concentration or acidity of a water sample (pH function), and the oxidation/reduction potential of a water sample (Eh function). Calibration is performed to verify instrument accuracy and function. All field instruments will be calibrated, verified and recalibrated at frequencies required by their respective operating manuals or manufacturer's specifications, but not less than once each day that the instrument is in use. Field personnel should have access to all operating manuals for the instruments used for the field measurements. This procedure also documents critical maintenance activities for this meter.

ACCURACY

The calibrated accuracy of the pH/Eh meter will be:

pH ± 0.2 pH unit, over the temperature range of ± 0.2 C.

Eh ± 0.2 millivolts (mV) over the range of ± 399.9 mV, otherwise ± 2 mV.

PROCEDURE

Note: Meters produced by different manufacturers may have different calibration procedures. These instructions will take precedence over the procedure provided herein. This procedure is intended to be used as a general guideline, or in the absence of available manufacturer's instructions.

1. Obtain and active the meter to be used. As stated above, initial calibrations will be performed at the beginning of each sampling day.

**CALIBRATION AND MAINTENANCE OF PORTABLE
FIELD pH/Eh METER**

2. Immerse the sensing probe in a container of certified pH 7.0 buffer solution traceable to the National Bureau of Standards.
3. Measure the temperature of the buffer solution, and adjust the temperature setting accordingly.
4. Compare the meter reading to the known value of the buffer solution while stirring. If the reading obtained by the meter does not agree with the known value of the buffer solution, recalibrate the meter according to the manufacturer's instructions until the desired reading is obtained. This typically involves accessing and turning a dial or adjustment screw while measuring the pH of the buffer solution. The meter is adjusted until the output agrees with the known solution pH.
5. Repeat Steps 2 through 5 with a pH 4.0 and 10.0 buffer solution to provide a three-point calibration. Standards used to calibrate the pH meter will be of concentrations that bracket the expected values of the samples to be analyzed, especially for two-point calibrations (see note below).

Note: Some pH meters only allow two-point calibrations. Two-point calibrations should be within the suspected range of the groundwater to be analyzed. For example, if the groundwater pH is expected to be approximately 8, the two-point calibration should bracket that value. Buffer solutions of 7 and 10 should then be used for the two-point calibration.

6. Document the calibration results and related information in the Project Field Book and on an **Equipment Calibration Log** (see attached sample). Information will include, at a minimum:
 - Time, date, and initials of the field team member performing the calibration
 - The unique identifier for the meter, including manufacturer, model, and serial number
 - The brand and expiration dates of buffer solutions
 - The instrument readings
 - The instrument settings (if applicable)

FOP 008.0

CALIBRATION AND MAINTENANCE OF PORTABLE FIELD pH/Eh METER

- Pass or fail designation in accordance with the accuracy specifications presented above
- Corrective action taken (see Maintenance below) in the event of failure to adequately calibrate

MAINTENANCE

- When not in use, or between measurements, keep the pH/Eh probe immersed in or moist with buffer solutions.
- Check the meter batteries at the end of each day and recharge or replace as needed.
- Replace the pH/Eh probe any time that the meter response time becomes greater than two minutes or the meter consistently fails to retain its calibrated accuracy for a minimum of ten sample measurements.
- If a replacement of the pH/Eh probe fails to resolve instrument response time and stability problems, obtain a replacement instrument (rental instruments) and/or order necessary repairs/adjustment.

ATTACHMENTS

Equipment Calibration Log (sample)

FOP 008.0

CALIBRATION AND MAINTENANCE OF PORTABLE FIELD pH/Eh METER



EQUIPMENT CALIBRATION

PROJECT INFORMATION:

Project Name: _____

Date: _____

Project No.: _____

Client: _____

Instrument Source: ☐ Roux ☐ Rental

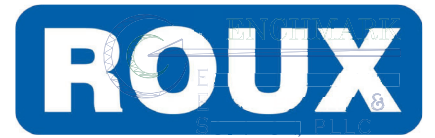
METER TYPE	UNITS	TIME	MAKE/MODEL	SERIAL NUMBER	CAL. BY	STANDARD	READING	SETTLE
☐ pH meter	units		Myron L. Company Ultra Meter 6P	606987		4.00		
						7.00		
						10.01		
						< 0.4		
☐ Turbidity meter	NTU		Hach 2100P Turbidimeter	970600014560		20		
						100		
						800		
☐ Sp. conductance meter	uS/mS		Myron L. Company Ultra Meter 6P	606987		uS @ 25 °C		
☐ PID	ppm		Photovac 2020 PID			open air zero		MIBK re factor :
						ppm Iso. Gas		
☐ Particulate meter	mg/m ³					zero air		
☐ Oxygen	%					open air		
☐ Hydrogen sulfide	ppm					open air		
☐ Carbon monoxide	ppm					open air		
☐ LEL	%					open air		
☐ Radiation Meter	uR/h					background area		
☐								

ADDITIONAL REMARKS:

PREPARED BY: _____

DATE: _____





FIELD OPERATING PROCEDURES

Calibration and Maintenance of Portable Field Turbidity Meter

**CALIBRATION AND MAINTENANCE OF PORTABLE
FIELD TURBIDITY METER**

PURPOSE

This guideline describes the method for calibration of the HACH 2100P portable field turbidity meter. Turbidity is one water quality parameter measured during purging and development of wells. Turbidity is measured as a function of the samples ability to transmit light, expressed as Nephelometric Turbidity Units (NTUs). The turbidity meter is factory calibrated and must be checked daily prior to using the meter in the field. Calibration is performed to verify instrument accuracy and function. This procedure also documents critical maintenance activities for this meter.

ACCURACY

Accuracy shall be $\pm 2\%$ of reading below 499 NTU or $\pm 3\%$ of reading above 500 NTU with resolution to 0.01 NTU in the lowest range. The range key provides for automatic or manual range selection for ranges of 0.00 to 9.99, 0.0 to 99.9 and 0 to 1000 NTU. Another key provides for selecting automatic signal averaging. Pressing the key shall toggle signal averaging on or off.

PROCEDURE

Calibration of the 2100P Turbidimeter is based on formazin, the primary standard for turbidity. The instrument's electronic and optical design provides long-term stability and minimizes the need for frequent calibration. The two-detector ratioing system compensates for most fluctuations in lamp output. **A formazin recalibration should be performed at least once every three months**, more often if experience indicates the need. During calibration, use a primary standard such as StablCal™ Stabilized Standards or formazin standards.

**CALIBRATION AND MAINTENANCE OF PORTABLE
FIELD TURBIDITY METER**

Note: Meters produced by different manufacturers may have different calibration check procedures. These manufacturers' instructions will take precedence over the procedure provided here. This procedure is intended to be used as a general guideline, or in the absence of available manufacturer's instructions.

Note: Because the turbidity meter measures light transmission, it is critical that the meter and standards be cared for as precision optical instruments. Scratches, dirt, dust, etc. can all temporarily or permanently affect the accuracy of meter readings.

Preparing StablCal Stabilized Standards in Sealed Vials

Sealed vials that have been sitting undisturbed for longer than a month must be shaken to break the condensed suspension into its original particle size. Start at *step 1* for these standards. If the standards are used on at least a weekly interval, start at *step 3*.

Note: These instructions do not apply to < 0.1 NTU StablCal Standards; < 0.1 NTU StablCal Standards should not be shaken or inverted.

1. Shake the standard vigorously for 2-3 minutes to re-suspend any particles.
2. Allow the standard to stand undisturbed for 5 minutes.
3. Gently invert the vial of StablCal 5 to 7 times.
4. Prepare the vial for measurement using traditional preparation techniques. This usually consists of oiling the vial (see *Section 2.3.2 on page 11 of the manual*)

**CALIBRATION AND MAINTENANCE OF PORTABLE
FIELD TURBIDITY METER**

and marking the vial to maintain the same orientation in the sample cell compartment (see *Section 2.3.3 on page 12 of the manual*). This step will eliminate any optical variations in the sample vial.

5. Let the vial stand for one minute. The standard is now ready for use in the calibration procedure.

Calibration Procedure

1. Turn the meter on.
2. Shake pre-mixed formazin primary standards in accordance with the above procedure.
3. Wipe the outside of the < 0.1 NTU standard and insert the sample cell in the cell compartment by aligning the orientation mark on the cell with the mark on the front of the cell compartment.
4. Close the lid and press **I/O**.
5. Press the **CAL** button. The **CAL** and **S0** icons will be displayed and the 0 will flash. The four-digit display will show the value of the **S0** standard for the previous calibration. If the blank value was forced to 0.0, the display will be blank. Press the right arrow key ($\rightarrow$) to get a numerical display.
6. Press **READ**. The instrument will count from 60 to 0, read the blank and use it to calculate a correction factor for the 20 NTU standard measurement. If the dilution water is ≥ 0.5 NTU, E 1 will appear when the calibration is calculated (see *Section 3.6.2.3 on page 31 of the manual*). The display will automatically increment to the next standard. Remove the sample cell from the cell compartment

**CALIBRATION AND MAINTENANCE OF PORTABLE
FIELD TURBIDITY METER**

Note: The turbidity of the dilution water can be “forced” to zero by pressing → rather than reading the dilution water. The display will show “S0 NTU” and the ↑ key must be pressed to continue with the next standard.

7. Repeat steps 1 through 7 for the 20, 100 and 800 standards.
8. Following the 800 NTU standard calibration, the display will increment back to the **S0** display. Remove the sample cell from the cell compartment.
9. Press **CAL** to accept the calibration. The instrument will return to measurement mode automatically.
10. Document the calibration results and related information in the Project Field Book and on an **Equipment Calibration Log** (see attached sample). Information will include, at a minimum:
 - Time, date, and initials of the field team member performing the calibration
 - The unique identifier for the meter, including manufacturer, model, and serial number
 - The brand of calibration standards
 - The instrument readings
 - The instrument settings (if applicable)
 - Pass or fail designation in accordance with the accuracy specifications presented above
 - Corrective action taken (see Maintenance below) in the event of failure to adequately calibrate.

Note: Pressing **CAL** completes the calculation of the calibration coefficients. If calibration errors occurred during calibration, error messages will appear after **CAL** is pressed. If **E 1** or **E 2** appear, check the standard preparation and review the calibration; repeat the calibration if necessary. If “**CAL?**” appears, an error may have

**CALIBRATION AND MAINTENANCE OF PORTABLE
FIELD TURBIDITY METER**

occurred during calibration. If “CAL?” is flashing, the instrument is using the default calibration.

NOTES

- If the **I/O** key is pressed during calibration, the new calibration data is lost and the old calibration will be used for measurements. Once in calibration mode, only the **READ**, **I/O**, **↑**, and **→** keys function. Signal averaging and range mode must be selected before entering the calibration mode.
- If **E 1** or **E 2** are displayed, an error occurred during calibration. Check the standard preparation and review the calibration; repeat the calibration if necessary. Press **DIAG** to cancel the error message (**E 1** or **E 2**). To continue without repeating the calibration, press **I/O** twice to restore the previous calibration. If “CAL?” is displayed, an error may have occurred during calibration. The previous calibration may not be restored. Either recalibrate or use the calibration as is.
- To review a calibration, press **CAL** and then **↑** to view the calibration standard values. As long as **READ** is never pressed and **CAL** is not flashing, the calibration will not be updated. Press **CAL** again to return to the measurement mode.

MAINTENANCE

- **Cleaning:** Keep the turbidimeter and accessories as clean as possible and store the instrument in the carrying case when not in use. Avoid prolonged exposure to sunlight and ultraviolet light. Wipe spills up promptly. Wash sample cells with non-abrasive laboratory detergent, rinse with distilled or demineralized water, and air dry. Avoid scratching the cells and wipe all moisture and fingerprints off the cells before inserting them into the instrument. Failure to do so can give inaccurate readings. See *Section 2.3.1 on page 11 of the manual* for more information about sample cell care.
- **Battery Replacement:** AA alkaline cells typically last for about 300 tests with the signal-averaging mode off, about 180 tests if signal averaging is used. The “battery” icon flashes when battery replacement is needed. Refer to *Section 1.4.2 on page 5 of the manual* for battery installation instructions. If the batteries are changed within 30

**CALIBRATION AND MAINTENANCE OF PORTABLE
FIELD TURBIDITY METER**

seconds, the instrument retains the latest range and signal average selections. If it takes more than 30 seconds, the instrument uses the default settings. If, after changing batteries, the instrument will not turn off or on and the batteries are good, remove the batteries and reinstall them. If the instrument still won't function, contact Hach Service or the nearest authorized dealer.

- **Lamp Replacement:** The procedure in *Section 4.0 on page 49 of the manual* explains lamp installation and electrical connections. Use a small screwdriver to remove and install the lamp leads in the terminal block. The instrument requires calibration after lamp replacement.

ATTACHMENTS

Equipment Calibration Log (sample)

FOP 009.0

**CALIBRATION AND MAINTENANCE OF PORTABLE
FIELD TURBIDITY METER**



EQUIPMENT CALIBRATION

PROJECT INFORMATION:

Project Name: _____

Date: _____

Project No.: _____

Client: _____

Instrument Source: ☐ Roux ☐ Rental

METER TYPE	UNITS	TIME	MAKE/MODEL	SERIAL NUMBER	CAL. BY	STANDARD	READING	SETTLE
☐ pH meter	units		Myron L. Company Ultra Meter 6P	606987		4.00		
						7.00		
						10.01		
						< 0.4		
☐ Turbidity meter	NTU		Hach 2100P Turbidimeter	970600014560		20		
						100		
						800		
☐ Sp. conductance meter	uS/mS		Myron L. Company Ultra Meter 6P	606987		uS @ 25 °C		
☐ PID	ppm		Photovac 2020 PID			open air zero		MIBK re factor :
						ppm Iso. Gas		
☐ Particulate meter	mg/m ³					zero air		
☐ Oxygen	%					open air		
☐ Hydrogen sulfide	ppm					open air		
☐ Carbon monoxide	ppm					open air		
☐ LEL	%					open air		
☐ Radiation Meter	uR/h					background area		
☐								

ADDITIONAL REMARKS: _____

PREPARED BY: _____

DATE: _____





FIELD OPERATING PROCEDURES

Calibration and Maintenance of Portable Flame Ionization Detector (FID)

FOP 010.0

CALIBRATION AND MAINTENANCE OF PORTABLE FLAME IONIZATION DETECTOR

PURPOSE

This guideline presents a general description of the method for calibration and maintenance of a portable flame ionization detector (FID). The FID detects and initially quantifies a reading of the volatile organic compound (VOC) concentration in air. The FID is used as a field-screening tool for initial evaluation of soil samples and for ambient air monitoring. In order to ensure an accurate reading, the FID must be calibrated prior to use in the field.

Although the information included below is equipment manufacturer- and model-specific, however, accuracy, calibration, and maintenance procedures for this type of portable equipment are typically similar. The information below pertains to the Sensidyne Portable Flame Ionization Detector. The actual equipment to be used in the field will be equivalent or similar.

The FID indicates total VOC concentration readings, which are normalized to a methane standard, so actual quantification of individual compounds is not provided. In addition, the FID response to compounds is highly variable, dependent on the structure of the compound and the presence or absence of other compounds. In the calibration mode, a methane standard of 200 parts per million by volume (ppmv) is used, and the desired accuracy at this concentration is ± 50 ppmv.

PROCEDURE

1. Zero the machine.
2. Calibrate all field test equipment at the beginning of each sampling day and check and recalibrate according to the manufacture's specifications.
3. Calibrate the FID meter using a compressed gas cylinder containing 200 ppmv methane in air, a 2 liter per minute flow regulator, and a tubing assembly.

**CALIBRATION AND MAINTENANCE OF PORTABLE
FLAME IONIZATION DETECTOR**

4. Assemble the calibration equipment and actuate the FID. Insert the probe into the calibration assembly and wait for a stable indication. Remove the cover over the calibration adjustment screw. Using a slotted screwdriver, turn the adjustment screw until the meter reads exactly 200 ppmv.
5. Replace the adjustment screw cover and deactivate the FID.
6. Document the calibration results and related information in the Project Field Book and on an **Equipment Calibration Log** (see attached sample), indicating the meter readings before and after instrument adjustments. This is important, not only for data validation, but also to establish maintenance schedules and component replacement. Information will include, at a minimum:
 - Time, date, and initials of the field team member performing the calibration
 - The unique identifier for the meter, including manufacturer, model, and serial number
 - The brand and expiration dates of calibration solutions
 - The calibration readings
 - The instrument settings (if applicable)
 - The approximate response time
 - The overall adequacy of calibration including the Pass or fail designation in accordance with the accuracy specifications presented above
 - Corrective action taken (see Step 5 above) in the event of failure to adequately calibrate

MAINTENANCE

- The probe and handle of the FID should be checked before and after every use for cleanliness and worn or damaged parts. Drain the water trap in the handle as needed. Remove any other condensation with a clean cloth or

FOP 010.0

CALIBRATION AND MAINTENANCE OF PORTABLE FLAME IONIZATION DETECTOR

tissue. The dust filter and hydrophobic filters should be inspected and cleaned between use.

- The FID battery must be recharged when the battery level indicator is in the red sector. It is also recommended that the battery be recharged every month the instrument is not used frequently. Replace the instrument's hydrogen carrier gas as necessary.
- Store the FID in its carrying case when not in use. Additional maintenance details related to individual components of the FID are provided in the equipment manufacturer's instruction manual. If calibration or instrument performance is not in accordance with specifications, send the instrument to the equipment manufacturer for repair.
- Maintain a log for each monitoring instrument. Record all maintenance performed on the instrument on this log with date and name of the organization performing the maintenance.

ATTACHMENTS

Equipment Calibration Log (sample)

FOP 010.0

CALIBRATION AND MAINTENANCE OF PORTABLE FLAME IONIZATION DETECTOR



EQUIPMENT CALIBRATION

PROJECT INFORMATION:

Project Name: _____

Date: _____

Project No.: _____

Client: _____

Instrument Source: ☐ Roux ☐ Rental

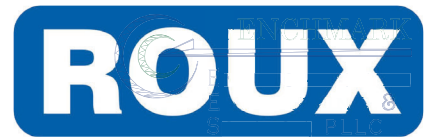
METER TYPE	UNITS	TIME	MAKE/MODEL	SERIAL NUMBER	CAL. BY	STANDARD	READING	SETTLE
☐ pH meter	units		Myron L. Company Ultra Meter 6P	606987		4.00		
						7.00		
						10.01		
						< 0.4		
☐ Turbidity meter	NTU		Hach 2100P Turbidimeter	970600014560		20		
						100		
						800		
☐ Sp. conductance meter	uS/mS		Myron L. Company Ultra Meter 6P	606987		uS @ 25 °C		
☐ PID	ppm		Photovac 2020 PID			open air zero		MIBK re
						ppm Iso. Gas		factor :
☐ Particulate meter	mg/m ³					zero air		
☐ Oxygen	%					open air		
☐ Hydrogen sulfide	ppm					open air		
☐ Carbon monoxide	ppm					open air		
☐ LEL	%					open air		
☐ Radiation Meter	uR/h					background area		
☐								

ADDITIONAL REMARKS:

PREPARED BY: _____

DATE: _____





FIELD OPERATING PROCEDURES

Calibration and Maintenance of Portable Photoionization Detector (PID)

FOP 011.1

CALIBRATION AND MAINTENANCE OF PORTABLE PHOTOIONIZATION DETECTOR

PURPOSE

This procedure describes a general method for the calibration and maintenance of a portable photoionization detector (PID). The PID detects and initially quantifies a reading of the volatile organic compound (VOC) concentration in air. The PID is used as a field-screening tool for initial evaluation of soil samples and for ambient air monitoring of compounds with ionization potentials (IP) less than the PID lamp electron voltage (eV) rating. The IP is the amount of energy required to move an electron to an infinite distance from the nucleus thus creating a positive ion plus an electron. It should be noted that all of the major components of air (i.e., carbon dioxide, methane, nitrogen, oxygen etc.) have IP's above 12 eV. As a result, they will not be ionized by the 9.8, 10.6, or 11.7 eV lamps typically utilized in field PIDs. The response of the PID will then be the sum of the organic and inorganic compounds in air that are ionized by the appropriate lamp (i.e., 9.8, 10.6 or 11.7 eV). Attached to this FOP is a table summarizing common organic compounds and their respective IPs.

Calibration is performed to verify instrument accuracy and function. All field instruments will be calibrated, verified and recalibrated at frequencies required by their respective operating manuals or manufacturer's specifications, but not less than once each day that the instrument is in use. Compound-specific calibration methods should be selected on a project-by-project basis to increase the accuracy of the instrument. The best way to calibrate a PID to different compounds is to use a standard of the gas of interest. However, correction factors have been determined that enable the user to quantify a large number of chemicals using only a single calibration gas, typically isobutylene. Field personnel should have access to all operating manuals for the instruments used for the field measurements. This procedure also documents critical maintenance activities for this meter.

FOP 011.1

CALIBRATION AND MAINTENANCE OF PORTABLE PHOTOIONIZATION DETECTOR

Note: The information included below is equipment manufacturer- and model-specific, however, accuracy, calibration, and maintenance procedures for this type of portable equipment are typically similar. The information below pertains to the MiniRAE 2000 Portable VOC Monitor equipped with a 10.6 eV lamp. The actual equipment to be used in the field will be equivalent or similar. The following information is provided for general reference; the equipment-specific manufacturer's manual should be followed with precedence over this FOP.

Note: The PID indicates total VOC concentration readings that are normalized to a calibration standard, so actual quantification of individual compounds is not provided. In addition, the PID response to compounds is highly variable, dependent on ionization potential of the compound, and the presence or absence of other compounds.

ACCURACY

The MiniRAE 2000 is accurate to ± 2 ppm or 10% of the reading for concentrations ranging from 0-2,000 ppm and $\pm 20\%$ of the reading at concentrations greater than 2,000 ppm. Response time is less than two seconds to 90 percent of full-scale. The operating temperature range is 0 to 45° C and the operating humidity range is 0 to 95 % relative humidity (non-condensing).

CALIBRATION PROCEDURE

The calibration method and correction factor, if applicable, will be selected on a project-by-project basis and confirmed with the Project Manager prior to the start of field work.

1. Calibrate all field test equipment at the beginning of each sampling day. Check and recalibrate the PID according to the manufacture's specifications.

FOP 011.1

CALIBRATION AND MAINTENANCE OF PORTABLE PHOTOIONIZATION DETECTOR

2. Calibrate the PID using a compressed gas cylinder or equivalent containing the calibration standard, a flow regulator, and a tubing assembly. In addition, a compressed gas cylinder containing zero air (“clean” air) may be required if ambient air conditions do not permit calibration to “clean air”.
3. Fill two Tedlar® bags equipped with a one-way valve with zero-air (if applicable) and the calibration standard gas.
4. Assemble the calibration equipment and actuate the PID in its calibration mode.
5. Select the appropriate calibration method. Calibration may be completed with two methods: 1) where the calibration standard gas is the same as the measurement gas (no correction factor is applied) or 2) where the calibration standard gas is not the same as the measurement gas and a correction factor will be applied. An isobutylene standard gas must be used as the calibration standard gas for the use of correction factors with the MiniRAE 2000. See below for additional instructions for calibration specific to use with or without correction factors.

Calibrating Without a Correction Factor

Navigate within the menu to select the “cal memory” for the specific calibration standard gas prior to calibration. The default gas selections for the MiniRAE 2000 are as follows:

Cal Memory #0	Isobutylene
Cal Memory #1	Hexane
Cal Memory #2	Xylene
Cal Memory #3	Benzene
Cal Memory #4	Styrene
Cal Memory #5	Toluene
Cal Memory #6	Vinyl Chloride
Cal Memory #7	Custom

FOP 011.1

CALIBRATION AND MAINTENANCE OF PORTABLE PHOTOIONIZATION DETECTOR

The calibration standard gas for Cal Memory #1-7 may be toggled for selection of any of the approximately 100 preprogrammed calibration standard gases for use without an applied correction factor (i.e., the calibration gas must be the same as the measurement gas).

Calibrating With a Correction Factor

Navigate within the menu to select the “Cal Memory”.

Select “Cal Memory #0” and toggle for selection of any of the approximately 100 preprogrammed chemicals. During calibration, the unit requests isobutylene gas and displays the isobutylene concentration immediately following calibration, but when the unit is returned to the normal reading mode, it displays the selected chemical and applies the correction factor.

If the pre-programmed list does not include the desired chemical or a user-defined measurement gas and correction factor is desired, toggle Cal Memory #0 to “user defined custom gas”. A list of approximately 300 correction factors is attached in Technical Note 106 generated by MiniRAE.

6. Once the PID settings have been verified, connect the PID probe to the zero air calibration bag (or calibrate to ambient air if conditions permit) and wait for a stable indication.
7. Connect the PID probe to the calibration standard bag. Measure an initial reading of the standard and wait for a stable indication.
8. Keep the PID probe connected to the calibration standard bag, calibrate to applicable concentration (typically 100 ppm with isobutylene) with the standard and wait for a stable indication.
9. Document the calibration results and related information in the Project Field Book and on an **Equipment Calibration Log** (see attached sample), indicating the meter readings before and after the instrument has been adjusted. This is important, not only for data validation, but also to establish

FOP 011.1

CALIBRATION AND MAINTENANCE OF PORTABLE PHOTOIONIZATION DETECTOR

maintenance schedules and component replacement. Information will include, at a minimum:

- Time, date and initials of the field team member performing the calibration
- The unique identifier for the meter, including manufacturer, model, and serial number
- The calibration standard and concentration
- Correction factors used, if any
- The brand and expiration date of the calibration standard gas
- The instrument readings: before and after calibration
- The instrument settings (if applicable)
- Pass or fail designation in accordance with the accuracy specifications presented above
- Corrective action taken (see Maintenance below) in the event of failure to adequately calibrate.

MAINTENANCE

- The probe and dust filter of the PID should be checked before and after every use for cleanliness. Should instrument response become unstable, recalibration should be performed. If this does not resolve the problem, access the photoionization bulb and clean with the manufacturer-supplied abrasive compound, then recalibrate.
- The PID battery must be recharged after each use. Store the PID in its carrying case when not in use. Additional maintenance details related to individual components of the PID are provided in the equipment manufacturer's instruction manual. If calibration or instrument performance is not in accordance with specifications, send the instrument to the equipment manufacturer for repair.
- Maintain a log for each monitoring instrument. Record all maintenance performed on the instrument on this log with date and name of the organization performing the maintenance.

FOP 011.1

CALIBRATION AND MAINTENANCE OF PORTABLE PHOTOIONIZATION DETECTOR

ATTACHMENTS

Table 1; Summary of Ionization Potentials
Equipment Calibration Log (sample)
Technical Note TN-106

CALIBRATION AND MAINTENANCE OF PORTABLE PHOTOIONIZATION DETECTOR

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	Ionization Potential (eV)	Cannot be Read by 10.6 eV PID
A		
2-Amino pyridine	8	
Acetaldehyde	10.21	
Acetamide	9.77	
Acetic acid	10.69	X
Acetic anhydride	10	
Acetone	9.69	
Acetonitrile	12.2	X
Acetophenone	9.27	
Acetyl bromide	10.55	
Acetyl chloride	11.02	X
Acetylene	11.41	X
Acrolein	10.1	
Acrylamide	9.5	
Acrylonitrile	10.91	X
Allyl alcohol	9.67	
Allyl chloride	9.9	
Ammonia	10.2	
Aniline	7.7	
Anisidine	7.44	
Anisole	8.22	
Arsine	9.89	
B		
1,3-Butadiene (butadiene)	9.07	
1-Bromo-2-chloroethane	10.63	X
1-Bromo-2-methylpropane	10.09	
1-Bromo-4-fluorobenzene	8.99	
1-Bromobutane	10.13	
1-Bromopentane	10.1	
1-Bromopropane	10.18	
1-Bromopropene	9.3	
1-Butanethiol	9.14	
1-Butene	9.58	
1-Butyne	10.18	
2,3-Butadione	9.23	
2-Bromo-2-methylpropane	9.89	
2-Bromobutane	9.98	
2-Bromopropane	10.08	

CALIBRATION AND MAINTENANCE OF PORTABLE PHOTOIONIZATION DETECTOR

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	Ionization Potential (eV)	Cannot be Read by 10.6 eV PID
2-Bromothiophene	8.63	
2-Butanone (MEK)	9.54	
3-Bromopropene	9.7	
3-Butene nitrile	10.39	
Benzaldehyde	9.53	
Benzene	9.25	
Benzenethiol	8.33	
Benzonitrile	9.71	
Benzotrifluoride	9.68	
Biphenyl	8.27	
Boron oxide	13.5	X
Boron trifluoride	15.56	X
Bromine	10.54	
Bromobenzene	8.98	
Bromochloromethane	10.77	X
Bromoform	10.48	
Butane	10.63	X
Butyl mercaptan	9.15	
cis-2-Butene	9.13	
m-Bromotoluene	8.81	
n-Butyl acetate	10.01	
n-Butyl alcohol	10.04	
n-Butyl amine	8.71	
n-Butyl benzene	8.69	
n-Butyl formate	10.5	
n-Butyraldehyde	9.86	
n-Butyric acid	10.16	
n-Butyronitrile	11.67	X
o-Bromotoluene	8.79	
p-Bromotoluene	8.67	
p-tert-Butyltoluene	8.28	
s-Butyl amine	8.7	
s-Butyl benzene	8.68	
sec-Butyl acetate	9.91	
t-Butyl amine	8.64	
t-Butyl benzene	8.68	
trans-2-Butene	9.13	
C		

CALIBRATION AND MAINTENANCE OF PORTABLE PHOTOIONIZATION DETECTOR

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	Ionization Potential (eV)	Cannot be Read by 10.6 eV PID
1-Chloro-2-methylpropane	10.66	X
1-Chloro-3-fluorobenzene	9.21	
1-Chlorobutane	10.67	X
1-Chloropropane	10.82	X
2-Chloro-2-methylpropane	10.61	X
2-Chlorobutane	10.65	X
2-Chloropropane	10.78	X
2-Chlorothiophene	8.68	
3-Chloropropene	10.04	
Camphor	8.76	
Carbon dioxide	13.79	X
Carbon disulfide	10.07	
Carbon monoxide	14.01	X
Carbon tetrachloride	11.47	X
Chlorine	11.48	X
Chlorine dioxide	10.36	
Chlorine trifluoride	12.65	X
Chloroacetaldehyde	10.61	X
α -Chloroacetophenone	9.44	
Chlorobenzene	9.07	
Chlorobromomethane	10.77	X
Chlorofluoromethane (Freon 22)	12.45	X
Chloroform	11.37	X
Chlorotrifluoromethane (Freon 13)	12.91	X
Chrysene	7.59	
Cresol	8.14	
Crotonaldehyde	9.73	
Cumene (isopropyl benzene)	8.75	
Cyanogen	13.8	X
Cyclohexane	9.8	
Cyclohexanol	9.75	
Cyclohexanone	9.14	
Cyclohexene	8.95	
Cyclo-octatetraene	7.99	
Cyclopentadiene	8.56	
Cyclopentane	10.53	
Cyclopentanone	9.26	
Cyclopentene	9.01	

FOP 011.1

CALIBRATION AND MAINTENANCE OF PORTABLE
PHOTOIONIZATION DETECTOR

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	Ionization Potential (eV)	Cannot be Read by 10.6 eV PID
Cyclopropane	10.06	
m-Chlorotoluene	8.83	
o-Chlorotoluene	8.83	
p-Chlorotoluene	8.7	
D		
1,1-Dibromoethane	10.19	
1,1-Dichloroethane	11.12	X
1,1-Dimethoxyethane	9.65	
1,1-Dimethylhydrazine	7.28	
1,2-Dibromoethane	9.45	
1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon 114)	12.2	X
1,2-Dichloroethane	11.12	X
1,2-Dichloropropane	10.87	X
1,3-Dibromopropane	10.07	
1,3-Dichloropropane	10.85	X
2,2-Dimethyl butane	10.06	
2,2-Dimethyl propane	10.35	
2,3-Dichloropropene	9.82	
2,3-Dimethyl butane	10.02	
3,3-Dimethyl butanone	9.17	
cis-Dichloroethene	9.65	
Decaborane	9.88	
Diazomethane	9	
Diborane	12	X
Dibromochloromethane	10.59	
Dibromodifluoromethane	11.07	X
Dibromomethane	10.49	
Dibutylamine	7.69	
Dichlorodifluoromethane (Freon 12)	12.31	X
Dichlorofluoromethane	12.39	X
Dichloromethane	11.35	X
Diethoxymethane	9.7	
Diethyl amine	8.01	
Diethyl ether	9.53	
Diethyl ketone	9.32	
Diethyl sulfide	8.43	
Diethyl sulfite	9.68	
Difluorodibromomethane	11.07	X

CALIBRATION AND MAINTENANCE OF PORTABLE PHOTOIONIZATION DETECTOR

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	Ionization Potential (eV)	Cannot be Read by 10.6 eV PID
Dihydropyran	8.34	
Diiodomethane	9.34	
Diisopropylamine	7.73	
Dimethoxymethane (methyal)	10	
Dimethyl amine	8.24	
Dimethyl ether	10	
Dimethyl sulfide	8.69	
Dimethylaniline	7.13	
Dimethylformamide	9.18	
Dimethylphthalate	9.64	
Dinitrobenzene	10.71	X
Dioxane	9.19	
Diphenyl	7.95	
Dipropyl amine	7.84	
Dipropyl sulfide	8.3	
Durene	8.03	
m-Dichlorobenzene	9.12	
N,N-Diethyl acetamide	8.6	
N,N-Diethyl formamide	8.89	
N,N-Dimethyl acetamide	8.81	
N,N-Dimethyl formamide	9.12	
o-Dichlorobenzene	9.06	
p-Dichlorobenzene	8.95	
p-Dioxane	9.13	
trans-Dichloroethene	9.66	
E		
Epichlorohydrin	10.2	
Ethane	11.65	X
Ethanethiol (ethyl mercaptan)	9.29	
Ethanolamine	8.96	
Ethene	10.52	
Ethyl acetate	10.11	
Ethyl alcohol	10.48	
Ethyl amine	8.86	
Ethyl benzene	8.76	
Ethyl bromide	10.29	
Ethyl chloride (chloroethane)	10.98	X
Ethyl disulfide	8.27	

FOP 011.1

CALIBRATION AND MAINTENANCE OF PORTABLE
PHOTOIONIZATION DETECTOR

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	Ionization Potential (eV)	Cannot be Read by 10.6 eV PID
Ethyl ether	9.51	
Ethyl formate	10.61	X
Ethyl iodide	9.33	
Ethyl isothiocyanate	9.14	
Ethyl mercaptan	9.29	
Ethyl methyl sulfide	8.55	
Ethyl nitrate	11.22	X
Ethyl propionate	10	
Ethyl thiocyanate	9.89	
Ethylene chlorohydrin	10.52	
Ethylene diamine	8.6	
Ethylene dibromide	10.37	
Ethylene dichloride	11.05	X
Ethylene oxide	10.57	
Ethylenimine	9.2	
Ethynylbenzene	8.82	
F		
2-Furaldehyde	9.21	
Fluorine	15.7	X
Fluorobenzene	9.2	
Formaldehyde	10.87	X
Formamide	10.25	
Formic acid	11.05	X
Freon 11 (trichlorofluoromethane)	11.77	X
Freon 112 (1,1,2,2-tetrachloro-1,2-difluoroethane)	11.3	X
Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	11.78	X
Freon 114 (1,2-dichloro-1,1,2,2-tetrafluoroethane)	12.2	X
Freon 12 (dichlorodifluoromethane)	12.31	X
Freon 13 (chlorotrifluoromethane)	12.91	X
Freon 22 (chlorofluoromethane)	12.45	X
Furan	8.89	
Furfural	9.21	
m-Fluorotoluene	8.92	
o-Fluorophenol	8.66	
o-Fluorotoluene	8.92	
p-Fluorotoluene	8.79	
H		
1-Hexene	9.46	

CALIBRATION AND MAINTENANCE OF PORTABLE PHOTOIONIZATION DETECTOR

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	Ionization Potential (eV)	Cannot be Read by 10.6 eV PID
2-Heptanone	9.33	
2-Hexanone	9.35	
Heptane	10.08	
Hexachloroethane	11.1	X
Hexane	10.18	
Hydrazine	8.1	
Hydrogen	15.43	X
Hydrogen bromide	11.62	X
Hydrogen chloride	12.74	X
Hydrogen cyanide	13.91	X
Hydrogen fluoride	15.77	X
Hydrogen iodide	10.38	
Hydrogen selenide	9.88	
Hydrogen sulfide	10.46	
Hydrogen telluride	9.14	
Hydroquinone	7.95	
I		
1-Iodo-2-methylpropane	9.18	
1-Iodobutane	9.21	
1-Iodopentane	9.19	
1-Iodopropane	9.26	
2-Iodobutane	9.09	
2-Iodopropane	9.17	
Iodine	9.28	
Iodobenzene	8.73	
Isobutane	10.57	
Isobutyl acetate	9.97	
Isobutyl alcohol	10.12	
Isobutyl amine	8.7	
Isobutyl formate	10.46	
Isobutyraldehyde	9.74	
Isobutyric acid	10.02	
Isopentane	10.32	
Isophorone	9.07	
Isoprene	8.85	
Isopropyl acetate	9.99	
Isopropyl alcohol	10.16	
Isopropyl amine	8.72	

CALIBRATION AND MAINTENANCE OF PORTABLE PHOTOIONIZATION DETECTOR

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	Ionization Potential (eV)	Cannot be Read by 10.6 eV PID
Isopropyl benzene	8.69	
Isopropyl ether	9.2	
Isovaleraldehyde	9.71	
m-Iodotoluene	8.61	
o-Iodotoluene	8.62	
p-Iodotoluene	8.5	
K		
Ketene	9.61	
L		
2,3-Lutidine	8.85	
2,4-Lutidine	8.85	
2,6-Lutidine	8.85	
M		
2-Methyl furan	8.39	
2-Methyl naphthalene	7.96	
1-Methyl naphthalene	7.96	
2-Methyl propene	9.23	
2-Methyl-1-butene	9.12	
2-Methylpentane	10.12	
3-Methyl-1-butene	9.51	
3-Methyl-2-butene	8.67	
3-Methylpentane	10.08	
4-Methylcyclohexene	8.91	
Maleic anhydride	10.8	X
Mesityl oxide	9.08	
Mesitylene	8.4	
Methane	12.98	X
Methanethiol (methyl mercaptan)	9.44	
Methyl acetate	10.27	
Methyl acetylene	10.37	
Methyl acrylate	9.9	
Methyl alcohol	10.85	X
Methyl amine	8.97	
Methyl bromide	10.54	
Methyl butyl ketone	9.34	
Methyl butyrate	10.07	
Methyl cellosolve	9.6	
Methyl chloride	11.28	X

CALIBRATION AND MAINTENANCE OF PORTABLE PHOTOIONIZATION DETECTOR

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	Ionization Potential (eV)	Cannot be Read by 10.6 eV PID
Methyl chloroform (1,1,1-trichloroethane)	11	X
Methyl disulfide	8.46	
Methyl ethyl ketone	9.53	
Methyl formate	10.82	X
Methyl iodide	9.54	
Methyl isobutyl ketone	9.3	
Methyl isobutyrate	9.98	
Methyl isocyanate	10.67	X
Methyl isopropyl ketone	9.32	
Methyl isothiocyanate	9.25	
Methyl mercaptan	9.44	
Methyl methacrylate	9.7	
Methyl propionate	10.15	
Methyl propyl ketone	9.39	
α -Methyl styrene	8.35	
Methyl thiocyanate	10.07	
Methylal (dimethoxymethane)	10	
Methylcyclohexane	9.85	
Methylene chloride	11.32	X
Methyl-n-amyl ketone	9.3	
Monomethyl aniline	7.32	
Monomethyl hydrazine	7.67	
Morpholine	8.2	
n-Methyl acetamide	8.9	
N		
1-Nitropropane	10.88	X
2-Nitropropane	10.71	X
Naphthalene	8.12	
Nickel carbonyl	8.27	
Nitric oxide, (NO)	9.25	
Nitrobenzene	9.92	
Nitroethane	10.88	X
Nitrogen	15.58	X
Nitrogen dioxide	9.78	
Nitrogen trifluoride	12.97	X
Nitromethane	11.08	X
Nitrotoluene	9.45	
p-Nitrochloro benzene	9.96	

CALIBRATION AND MAINTENANCE OF PORTABLE PHOTOIONIZATION DETECTOR

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	Ionization Potential (eV)	Cannot be Read by 10.6 eV PID
O		
Octane	9.82	
Oxygen	12.08	X
Ozone	12.08	X
P		
1-Pentene	9.5	
1-Propanethiol	9.2	
2,4-Pentanedione	8.87	
2-Pentanone	9.38	
2-Picoline	9.02	
3-Picoline	9.02	
4-Picoline	9.04	
n-Propyl nitrate	11.07	X
Pentaborane	10.4	
Pentane	10.35	
Perchloroethylene	9.32	
Pheneloic	8.18	
Phenol	8.5	
Phenyl ether (diphenyl oxide)	8.82	
Phenyl hydrazine	7.64	
Phenyl isocyanate	8.77	
Phenyl isothiocyanate	8.52	
Phenylene diamine	6.89	
Phosgene	11.77	X
Phosphine	9.87	
Phosphorus trichloride	9.91	
Phthalic anhydride	10	
Propane	11.07	X
Propargyl alcohol	10.51	
Propiolactone	9.7	
Propionaldehyde	9.98	
Propionic acid	10.24	
Propionitrile	11.84	X
Propyl acetate	10.04	
Propyl alcohol	10.2	
Propyl amine	8.78	
Propyl benzene	8.72	
Propyl ether	9.27	

CALIBRATION AND MAINTENANCE OF PORTABLE PHOTOIONIZATION DETECTOR

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	Ionization Potential (eV)	Cannot be Read by 10.6 eV PID
Propyl formate	10.54	
Propylene	9.73	
Propylene dichloride	10.87	X
Propylene imine	9	
Propylene oxide	10.22	
Propyne	10.36	
Pyridine	9.32	
Pyrrole	8.2	
Q		
Quinone	10.04	
S		
Stibine	9.51	
Styrene	8.47	
Sulfur dioxide	12.3	X
Sulfur hexafluoride	15.33	X
Sulfur monochloride	9.66	
Sulfuryl fluoride	13	X
T		
o-Terphenyls	7.78	
1,1,2,2-Tetrachloro-1,2-difluoroethane (Freon 112)	11.3	X
1,1,1-Trichloroethane	11	X
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	11.78	X
2,2,4-Trimethyl pentane	9.86	
o-Toluidine	7.44	
Tetrachloroethane	11.62	X
Tetrachloroethene	9.32	
Tetrachloromethane	11.47	X
Tetrahydrofuran	9.54	
Tetrahydropyran	9.25	
Thiolacetic acid	10	
Thiophene	8.86	
Toluene	8.82	
Tribromoethene	9.27	
Tribromofluoromethane	10.67	X
Tribromomethane	10.51	
Trichloroethene	9.45	
Trichloroethylene	9.47	
Trichlorofluoromethane (Freon 11)	11.77	X

FOP 011.1**CALIBRATION AND MAINTENANCE OF PORTABLE
PHOTOIONIZATION DETECTOR**

TABLE 1**SUMMARY OF IONIZATION POTENTIALS**

Chemical Name	Ionization Potential (eV)	Cannot be Read by 10.6 eV PID
Trichloromethane	11.42	X
Triethylamine	7.5	
Trifluoromonobromo-methane	11.4	X
Trimethyl amine	7.82	
Tripropyl amine	7.23	
V		
o-Vinyl toluene	8.2	
Valeraldehyde	9.82	
Valeric acid	10.12	
Vinyl acetate	9.19	
Vinyl bromide	9.8	
Vinyl chloride	10	
Vinyl methyl ether	8.93	
W		
Water	12.59	X
X		
2,4-Xylidine	7.65	
m-Xylene	8.56	
o-Xylene	8.56	
p-Xylene	8.45	

FOP 011.0

CALIBRATION AND MAINTENANCE OF PORTABLE PHOTOIONIZATION DETECTOR



EQUIPMENT CALIBRATION LOG

PROJECT INFORMATION:

Project Name: _____
Project No.: _____
Client: _____

Date: _____

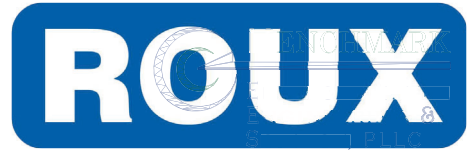
Instrument Source: ☐ Roux ☐ Rental

METER TYPE	UNITS	TIME	MAKE/MODEL	SERIAL NUMBER	CAL. BY	STANDARD	POST CAL. READING	SETTINGS
☐ pH meter	units		Myron L Company Ultra Meter 6P	606987		4.00 7.00 10.01		
☐ Turbidity meter	NTU		Hach 2100P Turbidimeter	97060001450		0.4 100 800		
☐ Sp. Cond. meter	uS mS		Myron L Company Ultra Meter 6P	606987		_____ mS @ 25 °C		
☐ PID	ppm		MinRAE 20			open air zero _____ ppm Iso. Gas		MIBK response factor = 1.0
☐ Dissolved Oxygen	ppm		YSI Model 5	97060001450				
☐ Particulate meter	mg/m ³					zero air		
☐ Oxygen	%					open air		
☐ Hydrogen sulfide	ppm					open air		
☐ Carbon monoxide	ppm					open air		
☐ LEL	%					open air		
☐ Radiation Meter	uR/H					background area		
☐								

ADDITIONAL REMARKS:

PREPARED BY: _____ DATE: _____





FIELD OPERATING PROCEDURES

Calibration and Maintenance of Portable Specific Conductance Meter

FOP 012.0

CALIBRATION AND MAINTENANCE OF PORTABLE SPECIFIC CONDUCTANCE METER

PURPOSE

This guideline describes a method for calibration of a portable specific conductance meter. This meter measures the ability of a water sample to conduct electricity, which is largely a function of the dissolved solids within the water. The instrument has been calibrated by the manufacturer according to factory specifications. This guideline presents a method for checking the factory calibration of a portable specific conductance meter. A calibration check is performed to verify instrument accuracy and function. All field test equipment will be checked at the beginning of each sampling day. This procedure also documents critical maintenance activities for this meter.

ACCURACY

The calibrated accuracy of the specific conductance meter will be within ± 1 percent of full-scale, with repeatability of ± 1 percent. The built-in cell will be automatically temperature compensated from at least 32° to 160° F (0° to 71°C).

PROCEDURE

Note: The information included below is equipment manufacturer- and model-specific, however, accuracy, calibration, and maintenance procedures for this type of portable equipment are typically similar. The information below pertains to the Myron L Company Ultrameter Model 6P. The actual equipment to be used in the field will be equivalent or similar.

**CALIBRATION AND MAINTENANCE OF PORTABLE
SPECIFIC CONDUCTANCE METER**

1. Calibrate all field test equipment at the beginning of each sampling day. Check and recalibrate the specific conductance meter according to the manufacture's specifications.
2. Use a calibration solution of known specific conductivity and salinity. For maximum accuracy, use a Standard Solution Value closest to the samples to be tested.
3. Rinse conductivity cell three times with proper standard.
4. Re-fill conductivity cell with same standard.
5. Press **COND** or **TDS**, then press **CAL/MCLR**. The "CAL" icon will appear on the display.
6. Press the **↑/MS** or **MR/↓** key to step the displayed value toward the standard's value or hold a key down to cause rapid scrolling of the reading.
7. Press **CAL/MCLR** once to confirm new value and end the calibration sequence for this particular solution type.
8. Repeat steps 1 through 7 with additional new solutions, as necessary.
9. Document the calibration results and related information in the Project Field Book and on an **Equipment Calibration Log** (see attached sample), indicating the meter readings before and after the instrument has been adjusted. This is important, not only for data validation, but also to establish maintenance schedules and component replacement. Information will include, at a minimum:
 - Time, date and initials of the field team member performing the calibration
 - The unique identifier for the meter, including manufacturer, model, and serial number
 - The brand and expiration date of the calibration standards
 - The instrument readings: before and after calibration

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CALIBRATION AND MAINTENANCE OF PORTABLE SPECIFIC CONDUCTANCE METER

- The instrument settings (if applicable)
- The overall adequacy of calibration including the Pass or fail designation in accordance with the accuracy specifications presented above.
- Corrective action taken (see Maintenance below) in the event of failure to adequately calibrate.

MAINTENANCE

NOTE: Ultrameters should be rinsed with clean water after use. Solvents should be avoided. Shock damage from a fall may cause instrument failure.

Temperature Extremes

Solutions in excess of 160°F/71°C should not be placed in the cell cup area; this may cause damage. Care should be exercised not to exceed rated operating temperature. Leaving the Ultrameter in a vehicle or storage shed on a hot day can easily subject the instrument to over 150°F voiding the warranty.

Battery Replacement

Dry Instrument THOROUGHLY. Remove the four bottom screws. Open instrument carefully; it may be necessary to rock the bottom slightly side to side to release it from the RS-232 connector. Carefully detach battery from circuit board. Replace with 9-volt alkaline battery. Replace bottom, ensuring the sealing gasket is installed in the groove of the top half of case. Re-install screws, tighten evenly and securely.

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CALIBRATION AND MAINTENANCE OF PORTABLE SPECIFIC CONDUCTANCE METER

NOTE: Because of nonvolatile EEPROM circuitry, all data stored in memory and all calibration settings are protected even during power loss or battery replacement.

Cleaning Sensors

The conductivity cell cup should be kept as clean as possible. Flushing with clean water following use will prevent buildup on electrodes. However, if very dirty samples — particularly scaling types — are allowed to dry in the cell cup, a film will form. This film reduces accuracy. When there are visible films of oil, dirt, or scale in the cell cup or on the electrodes, use a foaming non-abrasive household cleaner. Rinse out the cleaner and your Ultrameter is ready for accurate measurements.

NOTE: Maintain a log for each monitoring instrument. Record all maintenance performed on the instrument on this log with date and name of the organization performing the maintenance.

ATTACHMENTS

Equipment Calibration Log (sample)

FOP 012.0

CALIBRATION AND MAINTENANCE OF PORTABLE
SPECIFIC CONDUCTANCE METER

EQUIPMENT CALIBRATION

PROJECT INFORMATION:

Project Name: _____

Date: _____

Project No.: _____

Client: _____

Instrument Source: ☐ Roux ☐ Rental

METER TYPE	UNITS	TIME	MAKE/MODEL	SERIAL NUMBER	CAL. BY	STANDARD	READING	SETTLE
☐ pH meter	units		Myron L. Company Ultra Meter 6P	606987		4.00		
						7.00		
						10.01		
						< 0.4		
☐ Turbidity meter	NTU		Hach 2100P Turbidimeter	970600014560		20		
						100		
						800		
☐ Sp. conductance meter	uS/mS		Myron L. Company Ultra Meter 6P	606987		uS @ 25 °C		
☐ PID	ppm		Photovac 2020 PID			open air zero		MIBK re
						ppm Iso. Gas		factor :
☐ Particulate meter	mg/m ³					zero air		
☐ Oxygen	%					open air		
☐ Hydrogen sulfide	ppm					open air		
☐ Carbon monoxide	ppm					open air		
☐ LEL	%					open air		
☐ Radiation Meter	uR/h					background area		
☐								

ADDITIONAL REMARKS:

PREPARED BY: _____

DATE: _____



FOP 015.0

DOCUMENTATION REQUIREMENTS FOR DRILLING AND WELL INSTALLATION

PURPOSE

The purpose of these documentation requirements is to document the procedures used for drilling and installing wells in order to ensure the quality of the data obtained from these operations. Roux field technical personnel will be responsible for developing and maintaining documentation for quality control of field operations. At least one field professional will monitor each major operation (e.g. one person per drilling rig) to document and record field procedures for quality control. These procedures provide a description of the format and information for this documentation.

PROCEDURE

Project Field Book

Personnel assigned by the Roux Field Team Leader or Project Manager will maintain a Project Field Book for all site activities. These Field Books will be started upon initiation of any site activities to document the field investigation process. The Field Books will meet the following criteria:

- Permanently bound, with nominal 8.5-inch by 11-inch gridded pages.
- Water resistant paper.
- Pages must be pre-numbered or numbered in the field, front and back.

Notations in the field book will be in black or blue ink that will not smudge when wet. Information that may be recorded in the Field Book includes:

- Time and date of all entries.

FOP 015.0

DOCUMENTATION REQUIREMENTS FOR DRILLING AND WELL INSTALLATION

- Name and location of project site and project job number.
- Listing of key project, client and agency personnel and telephone numbers.
- Date and time of daily arrivals and departures, name of person keeping the log, names and affiliation of persons on site, purpose of visit (if applicable), weather conditions, outline of project activities to be completed.
- Details of any variations to the procedures/protocols (i.e., as presented in the Work Plan or Field Operating Procedures) and the basis for the change.
- Field-generated data relating to implementation of the field program, including sample locations, sample descriptions, field measurements, instrument calibration, etc.
- Record of all photographs taken in the field, including date, time, photographer, site location and orientation, sequential number of photograph, and roll number.

Upon completion of the site activities, all Field Books will be photocopied and both the original and photocopied versions placed in the project files. In addition, all field notes except those presented on specific field forms will be neatly transcribed into Field Activity Daily Log (FADL) forms (sample attached).

Field Borehole/Monitoring Well Installation Log Form

Examples of the Field Borehole Log and Field Borehole/Monitoring Well Installation Log forms are attached to this Field Operating Procedure. One form will be completed for every boring by the Roux field person overseeing the drilling. At a minimum, these forms will include:

- Project name, location, and number.
- Boring number.

**DOCUMENTATION REQUIREMENTS FOR DRILLING AND WELL
INSTALLATION**

- Rig type and drilling method.
- Drilling dates.
- Sampling method.
- Sample descriptions, to meet the requirements of the Unified Soil Classification System (USCS) for soils and the Unified Rock Classification System (URCS) for rock.
- Results of photoionization evaluations (scan and/or headspace determinations).
- Blow counts for sampler penetration (Standard Penetration Test, N-Value).
- Drilling rate, rig chatter, and other drilling-related information, as necessary.

All depths recorded on Boring/Monitoring Well Installation Log forms will be expressed in increments tenths of feet, and not in inches.

Well Completion Detail Form

An example of this form is attached to this Field Operating Procedure. One form will be completed for every boring by the Roux field person overseeing the well installation. At a minimum, these forms will include:

- Project name, location, and number.
- Well number.
- Installation dates.
- Dimensions and depths of the various well components illustrated in the Well Completion Detail (attached). These include the screened interval, bottom caps or plugs, centralizers, and the tops and bottoms of the various annular materials.

**DOCUMENTATION REQUIREMENTS FOR DRILLING AND WELL
INSTALLATION**

- Drilling rate, rig chatter, and other drilling related information.

All depths recorded on Field Borehole/Monitoring Well Installation Logs will be expressed in tenths of feet, and not in inches.

Daily Drilling Report Form

An example of this form is attached to this Field Operating Procedure. This form should be used to summarize all drilling activities. One form should be completed for each rig for each day. These forms will include summaries of:

- Footage drilled, broken down by diameter (e.g. 200 feet of 6-inch diameter hole, 50 feet of 10-inch diameter hole).
- Footage of well and screen installed, broken down by diameter.
- Quantities of materials used, including sand, cement, bentonite, centralizers, protective casings, traffic covers, etc. recorded by well or boring location.
- Active time (hours), and activity (drilling, decontamination, development, well installation, surface completions, etc.)
- Down-time (hours) and reason.
- Mobilizations and other events.
- Other quantities that will be the basis for drilling invoices.

The form should be signed daily by both the Roux field supervisor and the driller's representative, and provided to the Roux Field Team Leader.

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DOCUMENTATION REQUIREMENTS FOR DRILLING AND WELL INSTALLATION

Other Project Field Forms

Well purging/well development forms, test pit logs, environmental sampling field data sheets, water level monitoring forms, and well testing (slug test or pumping test) forms. Refer to specific guidelines for form descriptions.

ATTACHMENTS

- Field Activity Daily Log (FADL) (sample)
- Field Borehole Log (sample)
- Field Borehole/Monitoring Well Installation Log (sample)
- Stick-up Well/Piezometer Completion Detail (sample)
- Flush-mount Well/Piezometer Completion Detail (sample)
- Daily Drilling Report (sample)

DOCUMENTATION REQUIREMENTS FOR DRILLING AND WELL INSTALLATION



The diagram illustrates the construction of a well, showing a cross-section of the well shaft and the surrounding ground. Key components and materials are labeled as follows:

- Stick-up Well Protective Casing w/ Locking Cap**: The top section of the well casing.
- Concrete Pad**: The base of the well, labeled with dimensions: ft. by ft.
- Ground Surface**: The level of the ground above the well.
- Locking Well Cap/J-plug**: The top seal of the well casing.
- TOR = fags**: The top of rock level, indicated by a dashed line.
- inch diameter Borehole**: The diameter of the hole drilled into the ground.
- Cement/Bentonite Grout**: The material used to seal the annulus around the casing.
- inch O.D. PVC Well Casing**: The outer diameter of the well casing.
- Bentonite Seal**: A seal made of bentonite material.
- inch O.D. PVC Well Screen, 0.075 inch slot**: The screen at the bottom of the well, with a slot size of 0.075 inches.
- Sand Pack**: The material used to fill the annulus around the screen.
- grain size:**: The size of the sand grains used in the sand pack.
- Bottom Sump Cap**: The cap at the bottom of the well, labeled with dimensions: inch O.D., PVC.

The diagram also shows the well casing being installed into the ground, with the casing being sealed with grout and bentonite. The well casing is shown with a locking cap at the top and a bottom sump cap at the bottom. The well casing is shown with a screen at the bottom, which is surrounded by a sand pack. The well casing is shown with a seal at the bottom, which is made of bentonite material. The well casing is shown with a seal at the bottom, which is made of bentonite material.

Well Development	
Well Purpose:	
Tecnnique(s):	
Date Completed:	
BM/TK Personnel:	
Total Volume Purge:	gallons
Static Water Level:	ftTOR
Pump Depth:	
Purge Duration:	minutes
Yield:	gpm
Specific Capacity:	gpm/ft

PREPARED BY: _____ DATE: _____

DOCUMENTATION REQUIREMENTS FOR DRILLING AND WELL INSTALLATION



FLUSHMOUNT WELL/PIEZOMETER COMPLETION DETAIL

Project Name: _____ WELL NUMBER: _____
 Client: _____ Date Installed: _____
 Boring Location: _____ Project Number: _____

	Driller Information Company: _____ Driller: _____ Helper: _____ Permit Number: _____ Drill Rig Type: _____
	Well Information Land Surface Elevation: _____ fmsl (approximate) Drilling Method: _____ Soil Sample Collection Method: _____ Drilling Fluid: _____ Fluid Loss During Drilling: _____ gallons (approximate)
	Material of Well Construction Casing: _____ Screen: _____ Sump: _____ Sand Pack: _____ Annular Seal: _____
	Well Development Well Purpose: _____ Technique(s): _____ Date Completed: _____ BM/TK Personnel: _____ Total Volume Purge: _____ gallons Static Water Level: _____ fbTOR Pump Depth: _____ Purge Duration: _____ minutes Yield: _____ gpm Specific Capacity: _____ gpm/ft

Comments: _____

PREPARED BY: _____ DATE: _____

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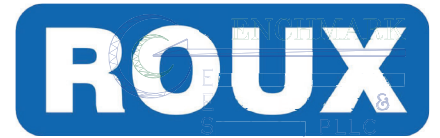
DOCUMENTATION REQUIREMENTS FOR DRILLING AND WELL INSTALLATION



DAILY DRILLING REPORT

CONTRACTOR:	DATE:
DRILLING EQUIPMENT:	PROJECT:
CREW MEMBERS:	JOB NUMBER:
SITE NAME:	BM PERSONNEL:

CATEGORY	Total Hours	a.m.												p.m.												a.m.											
		6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6											
MOB / DEMOB																																					
DRILLING																																					
WELL INSTALLATION																																					
DEVELOPMENT / TESTING																																					
GROUTING																																					
STEAM / DECON																																					
DOWN TIME (explain below)																																					
STANDBY (explain below)																																					
CLEANUP																																					
PREP FOR DRILLING																																					
LUNCH																																					
OTHER:																																					
REMARKS:																																					
DRILLING & WELL MATERIALS: Describe nature, quantity, size, etc.																																					
ITEM OR SERVICE		LOCATION				TOTALS																															
Starting depth (fbgs)																																					
Ending depth (fbgs)																																					
Total footage drilled (feet)																																					
Drilling Method (HSA, air rotary, cable etc.)																																					
Auger/Bit size																																					
CSSS starting depth (fbgs)																																					
CSSS ending depth (fbgs)																																					
Total CSSS footage																																					
-inch Schedule 40 PVC screen, slot size =																																					
-inch Schedule 40 PVC riser																																					
-inch Schedule 40 PVC screen, slot size =																																					
-inch Schedule 40 PVC riser																																					
-inch Schedule 40 PVC screen, slot size =																																					
-inch Schedule 40 PVC riser																																					
Sand pack, size =																																					
Bentonite pellets/chips, size =																																					
Cement/beentonite grout																																					
☐ Protective casing ☐ Flushmount road box																																					
Lockable J-plug																																					
Lock																																					
PERSONNEL TIME LOG:																																					
POSITION	NAME																																				
Observer																																					
Drillers																																					
DRILLER (optional):																																					
BM REP.																																					



FIELD OPERATING PROCEDURES

Groundwater Level Measurement

GROUNDWATER LEVEL MEASUREMENT

PURPOSE

This procedure describes the methods used to obtain accurate and consistent water level measurements in monitoring wells, piezometers and well points. Water levels will be measured at monitoring wells and, if practicable, in supply wells to estimate purge volumes associated with sampling, and to develop a potentiometric surface of the groundwater in order to estimate the direction and velocity of flow in the aquifer. Water levels in monitoring wells will be measured using an electronic water level indicator (e-line) that has been checked for operation prior to mobilization.

PROCEDURE

1. Decontaminate the e-line probe and a lower portion of cable following the procedures referenced in the Roux Field Operating Procedure for Non-Disposable and Non-Dedicated Sampling Equipment Decontamination. Store the e-line in a protected area until use. This may include wrapping the e-line in clean plastic until the time of use.
2. Unlock and remove the well protective cap or cover and place on clean plastic.
3. Lower the probe slowly into the monitoring well until the audible alarm sounds. This indicates the depth to water has been reached.
4. Move the cable up and down slowly to identify the depth at which the alarm just begins to sound. Measure this depth against the mark on the lip of the well riser used as a surveyed reference point (typically the north side of the riser).
5. Read depth from the graduated cable to the nearest 0.01 foot. Do not use inches. If the e-line is not graduated, use a rule or tape measure graduated in 0.01-foot increments to measure from the nearest reference mark on the e-line cable.

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GROUNDWATER LEVEL MEASUREMENT

6. Record the water level on a Water Level Monitoring Record (sample attached).
7. Remove the probe from the well slowly, drying the cable and probe with a clean paper wipe. Be sure to repeat decontamination before use in another well.
8. Replace well plug and protective cap or cover. Lock in place as appropriate.

ATTACHMENTS

Water Level Monitoring Record (sample)

REFERENCES

Roux FOPs:

040 *Non-Disposable and Non-Dedicated Sampling Equipment Decontamination*

GROUNDWATER LEVEL MEASUREMENT



Client:

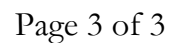
Location:

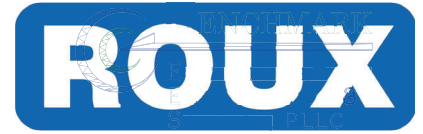
Date:

Weather:

[illegible]

DATE:





FIELD OPERATING PROCEDURES

Groundwater Purging Procedures Prior to Sample Collection

**GROUNDWATER PURGING PROCEDURES PRIOR
TO SAMPLE COLLECTION**

PURPOSE

This procedure describes the methods for monitoring well/piezometer purging prior to groundwater sample collection in order to collect representative groundwater samples. The goal of purging is to remove stagnant, non-representative groundwater from the well and/or prevent stagnant water from entering collected samples. Purging involves the removal of at least three to five volumes of water in wells with moderate yields and at least one well volume from wells with low yields (slow water level recovery).

Purge and sample wells in order of least-to-most contaminated (this is not necessary if dedicated or disposable equipment is used). If you do not know this order, sample the upgradient wells first, then the furthest down-gradient or side-gradient wells, and finally the wells closest to, but down-gradient of the most contaminated area. Sampling should commence immediately following purging or as soon as the well has adequately recharged and not more than 24-hours following end time of evacuation.

PROCEDURE

1. Prepare the electronic water level indicator (e-line) in accordance with the procedures referenced in the Roux Field Operating Procedure for Groundwater Level Measurement and decontaminate the e-line probe and a lower portion of cable following the procedures referenced in the Roux Field Operating Procedure for Non-disposable and Non-dedicated Sampling Equipment Decontamination. Store the e-line in a protected area until use. This may include wrapping the e-line in clean plastic until the time of use.
2. Inspect the interior and exterior of the well/piezometer for signs of vandalism or damage and record condition on the Groundwater Field Form and/or Groundwater Well Inspection Form (samples attached). Specifically, inspect

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GROUNDWATER PURGING PROCEDURES PRIOR TO SAMPLE COLLECTION

the integrity of the following: concrete surface seal, lock, protective casing and well cover, well riser and J-plug/cap. Report any irregular findings to the Project Manager.

3. Unlock and remove the well protective cap or cover and place on clean plastic to avoid introducing foreign material into the well.
4. Calibrate the photoionization detector (PID) in accordance with the Roux Field Operating Procedure for Calibration and Maintenance of Portable Photoionization Detector.
5. Monitor the well for organic vapors using a PID, as per the Work Plan. If a reading of greater than 5 ppm is recorded, the well should be allowed to vent until levels drop below 5 ppm before proceeding with purging.
6. Lower the e-line probe slowly into the monitoring well and record the initial water level in accordance with the procedures referenced in the Roux Field Operating Procedure for Groundwater Level Measurement.
7. Following static water level determinations, slowly lower the e-line to the bottom of the well/piezometer. Record the total depth to the nearest 0.01-foot and compare to the previous total depth measurement. If a significant discrepancy exists, re-measure the total depth. Continue with purging activities observing purge water to determine whether the well/piezometer had become silted due to inactivity or damaged (i.e., well sand within purge water). Upon confirmation of the new total depth and determination of the cause (i.e., siltation or damage), notify the Project Manager following field activities.
8. Calculate the volume of water in the well based on the water level below the top of riser and the total depth of the well using the following equation:

$$V = 0.0408[(B)^2 \times \{(A) - (C)\}]$$

Where,

**GROUNDWATER PURGING PROCEDURES PRIOR
TO SAMPLE COLLECTION**

A = Total Depth of Well (feet below measuring point)

B = Casing diameter (inches)

C = Static Water Level (feet below measuring point)

9. **For wells where the water level is 20 feet or less below the top of riser**, a peristaltic pump may be used to purge the well. Measure the purged volume using a calibrated container (i.e., graduated 5-gallon bucket) and record measurements on the attached Groundwater Well Development and Purge Log. Use new and dedicated tubing for each well. During the evacuation of shallow wells, the intake opening of the pump tubing should be positioned just below the surface of the water. As the water level drops, lower the tubing as needed to maintain flow. For higher yielding wells, the intake level should not be lowered past the top of the screen. Pumping from the top of the water column will ensure proper flushing of the well. Continue pumping until the required volumes are removed (typically three well volumes). For higher yielding wells, adjust the purging rate to maintain the water level above the screen. For lower yielding wells or wells where the screen straddles the water table, maintain purging at a rate that matches the rate of recovery of the well (well yield). If the well purges to dryness and is slow to recharge (greater than 15 minutes), terminate evacuation. **A peristaltic pump and dedicated tubing cannot be used to collect VOC or SVOC project-required samples; only non-organic compounds may be collected using this type of pump.**
10. **For wells where the water level is initially below 20 feet**, or drawn down to this level because of slow recharge rate, conduct purging using one of three devices listed below:
- Bailer – A bottom filling dedicated polyethylene bailer attached to a length of dedicated hollow-braid polypropylene rope. Purging a well utilizing a bailer should be conducted smoothly and slowly as not to agitate the groundwater or damage the well.
 - Well Wizard Purge Pump (or similar) – This pneumatic bladder pump uses compressed air to push water to the surface. Groundwater is not in contact

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GROUNDWATER PURGING PROCEDURES PRIOR TO SAMPLE COLLECTION

with the drive air during the pumping process, therefore the pump may be used for sample collection.

- Submersible Pump (12 or 24 volt, or similar) – These submersible pumps are constructed of PVC or stainless steel and are capable of pumping up to 70 feet from ground surface using a 12 volt battery (standard pump) and standard low flow controller. For depths up to 200 feet from ground surface, a high performance power booster controller is used with a 12 volt battery. Unless these pumps are dedicated to the monitoring well location, decontamination between locations is necessary and an equipment blank may be required.
- Waterra™ Pump – This manually operated pump uses dedicated polyethylene tubing and a check valve that can be used as an optional method for purging deeper wells. The pump utilizes positive pressure to evacuate the well, therefore the pump may be used for sample collection, and however over-agitation groundwater should be avoided.

Prior to use in a well, non-dedicated bailers, exterior pump bodies and pump tubing should be cleaned in accordance with the Roux Field Operating Procedure for Non-Disposable and Non-Dedicated Sampling Equipment Decontamination. Dedicated and/or disposable equipment should be contained within the sealed original manufacturers packaging and certified pre-cleaned by the manufacturer with a non-phosphate laboratory detergent and rinsed using de-ionized water.

8. Purging will continue until a predetermined volume of water has been removed (typically three well volumes) or to dryness. Measurements for pH, temperature, specific conductance, dissolved oxygen (optional), Eh (optional), and turbidity will be recorded following removal of each well volume. Purge the well to dryness or until the readings for indicator parameters listed above (or well-specific indicator parameters) stabilize within the following limits for each parameter measured:

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GROUNDWATER PURGING PROCEDURES PRIOR TO SAMPLE COLLECTION

Field Parameter	Stabilization Criteria
Dissolved Oxygen	± 0.3 mg/L
Turbidity	± 10 %
Specific Conductance	± 3 %
Eh	± 10 mV
PH	± 0.1 unit

Stabilization criteria presented within the project Work Plan will take precedence.

DOCUMENTATION AND SAMPLE COLLECTION

This section pertains to the documentation of collected field data during and following purging activities and sample collection.

1. Record all data including the final three stable readings for each indicator parameter on the attached Groundwater Well Purge & Sample Log.
2. Record, at a minimum, the “volume purged,” “purging stop-time,” “purged dry (Y/N),” “purged below sand pack (Y/N),” and any problems purging on the attached Groundwater Well Purge & Sample Log.
3. Collect groundwater samples in accordance with the Roux Field Operating Procedure for Groundwater Sample Collection. Record “sample flow rate” as an average, “time sample collected,” and any other pertinent information related to the sampling event on the attached Groundwater Well Purge & Sample Log.
4. Restore the well to its capped/covered and locked condition.

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GROUNDWATER PURGING PROCEDURES PRIOR TO SAMPLE COLLECTION

ALTERNATIVE METHODS

Alternative purging and sampling methods and equipment, other than those described herein are acceptable if they provide representative groundwater samples. The purging and sampling method and equipment must not adversely affect sample integrity, chemistry, temperature, and turbidity. In addition, alternative equipment must have minimal or no effect on groundwater geochemistry, aquifer permeability and well materials. Equipment materials must also minimize sorption and leaching. The field team is responsible for documenting and describing any alternative equipment and procedures used to purge a well and collect samples.

ATTACHMENTS

Groundwater Field Form
Groundwater Well Inspection Form

REFERENCES

Roux FOPs:

- 011 *Calibration and Maintenance of Portable Photoionization Detector*
- 022 *Groundwater Level Measurement*
- 024 *Groundwater Sample Collection Procedures*
- 040 *Non-disposable and Non-dedicated Sampling Equipment Decontamination*

GROUNDWATER PURGING PROCEDURES PRIOR TO SAMPLE COLLECTION



GROUNDWATER FIELD FORM

Project Name:

Date:

Location:

Project No.:

Field Team:

[illegible][illegible]

REMARKS:

Note: All water level measurements are in feet distance from top of riser

Note: All water level measurements are in feet, distance from top of riser.

Volume Calculation

Diam.	Vol. (g/ft)
1"	0.041
2"	0.163
4"	0.653
6"	1.469

Stabilization Criteria

Parameter	Criteria
pH	± 0.1 unit
SC	$\pm 3\%$
Turbidity	$\pm 10\%$
DO	± 0.3 mg/L
ORP	± 10 mV

PREPARED BY:



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GROUNDWATER PURGING PROCEDURES PRIOR
TO SAMPLE COLLECTION



GROUNDWATER WELL INSPECTION FORM

Project:	WELL I.D.:
Client:	
Job No.:	
Date:	
Time:	
EXTERIOR INSPECTION	
Protective Casing:	
Lock:	
Hinge/Lid:	
Concrete Surface Seal:	
Bollards:	
Label/I.D.:	
Other:	
INTERIOR INSPECTION	
Well Riser:	
Annular Space:	
Well Cap:	
Water Level (fbTOR):	
Total Depth (fbTOR):	
Other:	
Comments/Corrective Actions:	

PREPARED BY: _____

DATE: _____



GROUNDWATER SAMPLE COLLECTION PROCEDURES

PURPOSE

This procedure describes the methods for collecting groundwater samples from monitoring wells and domestic supply wells following purging and sufficient recovery. This procedure also includes the preferred collection order in which water samples are collected based on the volatilization sensitivity or suite of analytical parameters required.

PROCEDURE

Allow approximately 3 to 10 days following well development before performing purge and sample activities at any well location. Conversely, perform sampling as soon as practical after sample purging at any time after the well has recovered sufficiently to sample, or within 24 hours after evacuation, if the well recharges slowly. If the well does not yield sufficient volume for all required laboratory analytical testing (including quality control), a decision should be made to prioritize analyses based on contaminants of concern at the site. If the well takes longer than 24 hours to recharge, the Project Manager should be consulted. The following two procedures outline sample collection activities for monitoring and domestic type wells.

Monitoring Wells

1. Purge the monitoring well in accordance with the Roux FOPs for Groundwater Purging Procedures Prior to Sample Collection or Low Flow (Minimal Drawdown) Groundwater Purging & Sampling Procedures. Perform sampling as soon as practical after purging at any time after the well has recovered sufficiently to sample, or within 24 hours after evacuation, if the well recharges slowly. If the well does not yield sufficient volume for all required laboratory analytical testing (including quality control), a decision should be made to prioritize analyses based on contaminants of concern at the site. Analyses will be prioritized in the order of the parameters volatilization sensitivity. After volatile organics have been collected, field parameters

GROUNDWATER SAMPLE COLLECTION PROCEDURES

must be measured from the next sample collected. If a well takes longer than 24 hours to recharge, the Project Manager should be consulted.

2. Sampling equipment that is not disposable or dedicated to the well will be decontaminated in accordance with the Roux Field Operating Procedure for Non-Disposable and Non-Dedicated Sampling Equipment Decontamination.
3. Calibrate all field meters (i.e., pH/Eh, turbidity, specific conductance, dissolved oxygen, PID etc.) in accordance with the Roux Field Operating Procedure for Calibration and Maintenance of the specific field meter.
4. Prepare the electronic water level indicator (e-line) in accordance with the procedures referenced in the Roux Field Operating Procedure for Groundwater Level Measurement and decontaminate the e-line probe and a lower portion of cable following the procedures referenced in the Roux Field Operating Procedure for Non-disposable and Non-dedicated Sampling Equipment Decontamination. Store the e-line in a protected area until use. This may include wrapping the e-line in clean plastic until the time of use.
5. Inspect the well/piezometer for signs of vandalism or damage and record condition on the Groundwater Field Form (sample attached). Specifically, inspect the integrity of the following: concrete surface seal, lock, protective casing and well cover, well casing and J-plug/cap. Report any irregular findings to the Project Manager.
6. Unlock and remove the well protective cap or cover and place on clean plastic to avoid introducing foreign material into the well.
7. Calibrate the photoionization detector (PID) in accordance with the Roux Field Operating Procedure for Calibration and Maintenance of Portable Photoionization Detector.
8. Monitor the well for organic vapors using a PID, as per the Work Plan. If a reading of greater than 5 ppm is recorded, the well should be allowed to vent until levels drop below 5 ppm before proceeding with purging. Record PID measurements on a well-specific Groundwater Field Form (sample attached).

GROUNDWATER SAMPLE COLLECTION PROCEDURES

9. Lower the e-line probe slowly into the monitoring well and record the measurement on a well-specific Groundwater Field Form (sample attached).
10. Groundwater samples will be collected directly from the sampling valve on the flow through cell (low-flow), discharge port of a standard pump assembly (peristaltic, pneumatic, submersible, or Waterra™ pump) or bailer (stainless steel, PVC or polyethylene) into appropriate laboratory provided containers. In low-yielding wells at which the flow through cell is not used, the samples may be collected using a disposable bailer. **A peristaltic pump and dedicated tubing cannot be used to collect VOC or SVOC project-required samples; only non-organic compounds may be collected using this type of pump.**
11. If disposable polyethylene bailers are used, the bailer should be lowered *slowly* below the surface of the water to minimize agitation and volatilization. For wells that are known to produce turbid samples (values greater than 50 NTU), the bailer should be lowered and retrieved at a rate that limits surging of the well.
12. Sampling data will be recorded on a Groundwater Field Form (sample attached).
13. Pre-label all sample bottles in the field using a waterproof permanent marker in accordance with the Roux Sample Labeling, Storage, and Shipment FOP. The following information, at a minimum, should be included on the label:
 - Project Number;
 - Sample identification code (as per project specifications);
 - Date of sample collection (mm, dd, yy);
 - Time of sample collection (military time only) (hh:mm);
 - Specify “grab” or “composite” sample type;
 - Sampler initials;
 - Preservative(s) (if applicable); and
 - Analytes for analysis (if practicable).
14. Collect a separate sample of approximately 200 ml into an appropriate container prior to collecting the first and following the last groundwater sample collected to measure the following field parameters:

GROUNDWATER SAMPLE COLLECTION PROCEDURES

Parameter	Units
Dissolved Oxygen	parts per million (ppm)
Specific Conductance	μ mhos/cm or μ S or mS
pH	pH units
Temperature	°C or °F
Turbidity	NTU
Eh (<i>optional</i>)	mV
PID VOCs (<i>optional</i>)	ppm

Record all field measurements on a Groundwater Field Form (sample attached).

15. Collect samples into pre-cleaned bottles provided by the analytical laboratory with the appropriate preservative(s) added based on the volatilization sensitivity or suite of analytical parameters required, as designated in the **Sample Collection Order** section below.
16. Lower the e-line probe slowly into the monitoring well and record the measurement on a well-specific Groundwater Field Form (sample attached).
17. The samples will be labeled, stored, and shipped in accordance with the Roux Field Operating Procedure for Sample Labeling, Storage, and Shipment Procedures.

Domestic Supply Wells

1. Calculate or estimate the volume of water in the well. It is desirable to purge at least one casing volume before sampling. This is controlled, to some extent, by the depth of the well, well yield and the rate of the existing pump. If the volume of water in the well cannot be calculated, the well should be purged continuously for no less than 15 minutes.
2. Connect a sampling tap to an accessible fitting between the well and the pressure tank where practicable. A hose will be connected to the device and the hose discharge located 25 to 50 feet away. The well will be allowed to pump until the lines and one

GROUNDWATER SAMPLE COLLECTION PROCEDURES

well volume is removed. Flow rate will be measured with a container of known volume and a stopwatch.

3. Place a clean piece of polyethylene or Teflon™ tubing on the sampling port and collect the samples in the order designated below and in the sample containers supplied by the laboratory for the specified analytes. **DO NOT** use standard garden hose to collect samples.
4. Sampling results and measurements will be recorded on a Groundwater Field Form (sample attached) as described in the previous section.
5. Collect samples into pre-cleaned bottles provided by the analytical laboratory with the appropriate preservative(s) added based on the volatilization sensitivity or suite of analytical parameters required, as designated in the **Sample Collection Order** section below.
6. The samples will be labeled, stored, and shipped in accordance with the Roux Field Operating Procedure for Sample Labeling, Storage, and Shipment Procedures.

SAMPLE COLLECTION ORDER

All groundwater samples, from monitoring wells and domestic supply wells, will be collected in accordance with the following.

1. Samples will be collected preferentially in recognition of volatilization sensitivity. The preferred order of sampling if no free product is present is:
 - Field parameters
 - Volatile Organic Compounds (VOCs)
 - Purgeable organic carbons (POC)
 - Purgeable organic halogens (POH)
 - Total Organic Halogens (TOX)
 - Total Organic Carbon (TOC)
 - Extractable Organic Compounds (i.e., BNAs, SVOCs, etc.)
 - Total petroleum hydrocarbons (TPH) and oil and grease

GROUNDWATER SAMPLE COLLECTION PROCEDURES

- PCBs and pesticides
 - Total metals (Dissolved Metals)
 - Total Phenolic Compounds
 - Cyanide
 - Sulfate and Chloride
 - Turbidity
 - Nitrate (as Nitrogen) and Ammonia
 - Preserved inorganics
 - Radionuclides
 - Unpreserved inorganics
 - Bacteria
 - Field parameters
2. Document the sampling procedures and related information in the Project Field Book and on a Groundwater Field Form (sample attached).
 3. 1,4-dioxane will be analyzed via the 8270 SIM method.

DOCUMENTATION

The three words used to ensure adequate documentation for groundwater sampling are accountability, controllability, and traceability. Accountability is undertaken in the sampling plan and answers the questions who, what, where, when, and why to assure that the sampling effort meets its goals. Controllability refers to checks (including QA/QC) used to ensure that the procedures used are those specified in the sampling plan. Traceability is documentation of what was done, when it was done, how it was done, and by whom it was done, and is found in the field forms, Project Field Book, and chain-of-custody forms. At a minimum, adequate documentation of the sampling conducted in the field consists of an entry in the Project Field Book (with sewn binding), field data sheets for each well, and a chain-of-custody form.

GROUNDWATER SAMPLE COLLECTION PROCEDURES

As a general rule, if one is not sure whether the information is necessary, it should nevertheless be recorded, as it is impossible to over-document one's fieldwork. Years may go by before the documentation comes under close scrutiny, so the documentation must be capable of defending the sampling effort without the assistance or translation of the sampling crew.

The minimum information to be recorded daily with an indelible pen in the Project Field Book and/or field data sheets includes date and time(s), name of the facility, name(s) of the sampling crew, site conditions, the wells sampled, a description of how the sample shipment was handled, and a QA/QC summary. After the last entry for the day in the Project Field Book, the Field Team Leader should sign the bottom of the page under the last entry and then draw a line across the page directly under the signature.

PRECAUTIONS/RECOMMENDATIONS

The following precautions should be adhered to prior to and during sample collection activities:

- Field vehicles should be parked downwind (to avoid potential sample contamination concerns) at a minimum of 15 feet from the well and the engine turned off prior to PID vapor analysis and VOC sample collection.
- Ambient odors, vehicle exhaust, precipitation, or windy/dusty conditions can potentially interfere with obtaining representative samples. These conditions should be minimized and should be recorded in the field notes. Shield sample bottles from strong winds, rain, and dust when being filled.
- The outlet from the sampling device should discharge below the top of the sample's air/water interface, when possible. The sampling plan should specify

GROUNDWATER SAMPLE COLLECTION PROCEDURES

how the samples will be transferred from the sample collection device to the sample container to minimize sample alterations.

- The order of sampling should be from the least contaminated to the most contaminated well to reduce the potential for cross contamination of sampling equipment (see the Sampling Plan or Work Plan).
- Samples should not be transferred from one sampling container to another.
- Sampling equipment must not be placed on the ground, because the ground may be contaminated and soil contains trace metals. Equipment and supplies should be removed from the field vehicle only when needed.
- Smoking and eating should not be allowed until the well is sampled and hands are washed with soap and water, due to safety and possibly sample contamination concerns. These activities should be conducted beyond a 15-foot radius of the well.
- No heat-producing or electrical instruments should be within 15 feet of the well, unless they are intrinsically safe, prior to PID vapor analysis.
- Minimize the amount of time that the sample containers remain open.
- Do not touch the inside of sample bottles or the groundwater sample as it enters the bottle. Disposable gloves may be a source of phthalates, which could be introduced into groundwater samples if the gloves contact the sample.
- Sampling personnel should use a new pair of disposable gloves for each well sampled to reduce the potential for exposure of the sampling personnel to contaminants and to reduce sample cross contamination. In addition, sampling personnel should change disposable gloves between purging and sampling operations at the same well.
- Sampling personnel should not use perfume, insect repellent, hand lotion, etc., when taking groundwater samples. If insect repellent must be used, then sampling personnel should not allow samples or sampling equipment to contact the

FOP 024.1

GROUNDWATER SAMPLE COLLECTION PROCEDURES

repellent, and it should be noted in the documentation that insect repellent was used.

- Complete the documentation of the well. A completed assemblage of paperwork for a sampling event includes the completed field forms, entries in the Project Field Book (with a sewn binding), transportation documentation (if required), and possibly chain-of-custody forms.

ATTACHMENTS

Groundwater Field Form (sample)

REFERENCES

1. Wilson, Neal. *Soil Water and Ground Water Sampling*, 1995

Roux FOPs:

- 007 *Calibration and Maintenance of Portable Dissolved Oxygen Meter*
- 008 *Calibration and Maintenance of Portable Field pH/Eh Meter*
- 009 *Calibration and Maintenance of Portable Field Turbidity Meter*
- 011 *Calibration and Maintenance of Portable Photoionization Detector*
- 012 *Calibration and Maintenance of Portable Specific Conductance Meter*
- 022 *Groundwater Level Measurement*
- 023 *Groundwater Purging Procedures Prior to Sample Collection (optional)*
- 031 *Low Flow (Minimal Drawdown) Groundwater Purging & Sampling Procedures (optional)*
- 040 *Non-Disposable and Non-Dedicated Sampling Equipment Decontamination*
- 046 *Sample Labeling, Storage and Shipment Procedures*

GROUNDWATER SAMPLE COLLECTION PROCEDURES



GROUNDWATER FIELD FORM

Project Name:

Date:

Location:

Project No.:

Field Team:

Well No.			Diameter (inches):			Sample Time:			
Product Depth (ftTOR):			Water Column (ft):			DTW when sampled:			
DTW (static) (ftTOR):			Casing Volume:			Purpose: ☐ Development ☐ Sample			
Total Depth (ftTOR):			Purge Volume (gal):			Purge Method:			
Time	Water Level (ftTOR)	Acc. Volume (gallons)	pH (units)	Temp. (deg. C)	SC (uS)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	Appearance & Odor
0	Initial								
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
Sample Information:			Date: (if different from above)						
S1									
S2									

Well No.			Diameter (inches):			Sample Time:			
Product Depth (ftTOR):			Water Column (ft):			DTW when sampled:			
DTW (static) (ftTOR):			Casing Volume:			Purpose: ☐ Development ☐ Sample			
Total Depth (ftTOR):			Purge Volume (gal):			Purge Method:			
Time	Water Level (ftTOR)	Acc. Volume (gallons)	pH (units)	Temp. (deg. C)	SC (uS)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	Appearance & Odor
0	Initial								
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
Sample Information:			Date: (if different from above)						
S1									
S2									

REMARKS:

Note: All water level measurements are in feet, distance from top of riser.

Volume Calculation

Diam.	Vol. (g/ft)
1"	0.041
2"	0.163
4"	0.653
6"	1.469

Stabilization Criteria

Parameter	Criteria
pH	± 0.1 unit
SC	± 3%
Turbidity	± 10%
DO	± 0.3 mg/L
ORP	± 10 mV

PREPARED BY: _____

**LOW FLOW (MINIMAL DRAWDOWN) GROUNDWATER
PURGING & SAMPLING PROCEDURES**

PURPOSE

This procedure describes the methods used for performing low flow (minimal drawdown) purging, also referred to as micro-purging, at a well prior to groundwater sampling to obtain a representative sample from the water-bearing zone. This method of purging is used to minimize the turbidity of the produced water. This may increase the representativeness of the groundwater samples by avoiding the necessity of filtering suspended solids in the field prior to preservation of the sample.

Well purging is typically performed immediately preceding groundwater sampling. The sample should be collected as soon as the parameters measured in the field (i.e., pH, specific conductance, dissolved oxygen, Eh, temperature, and turbidity) have stabilized.

PROCEDURE

Allow approximately 3 to 10 days following well development for groundwater to return to static conditions before performing low-flow purge and sample activities at any well location. Conversely, perform low-flow sampling as soon as purged groundwater has stabilized. If the well does not yield sufficient volume (i.e., cannot maintain a constant water level during purging) for low-flow purge and sampling, then an alternative method must be performed in accordance with Roux's Groundwater Purging Procedures Prior to Sample Collection FOP.

1. Water samples should not be taken immediately following well development. Sufficient time should be allowed to stabilize the groundwater flow regime in the vicinity of the monitoring well. This lag time will depend on site conditions and methods of installation but may exceed one week.

FOP 031.2

LOW FLOW (MINIMAL DRAWDOWN) GROUNDWATER PURGING & SAMPLING PROCEDURES

2. Prepare the electronic water level indicator (e-line) in accordance with the procedures referenced in the Roux's Groundwater Level Measurement FOP and decontaminate the e-line probe and a lower portion of cable following the procedures referenced in the Roux's Non-disposable and Non-dedicated Sampling Equipment Decontamination FOP. Store the e-line in a protected area until use. This may include wrapping the e-line in clean plastic until the time of use.
3. Calibrate all sampling devices and monitoring equipment in accordance with manufacturer's recommendations, the site Quality Assurance Project Plan (QAPP) and/or Field Sampling Plan (FSP). Calibration of field instrumentation should be followed as specified in Roux's Calibration and Maintenance FOP for each individual meter.
4. Inspect the well/piezometer for signs of vandalism or damage and record condition on the Groundwater Field Form (sample attached). Specifically, inspect the integrity of the following: concrete surface seal, lock, protective casing and well cover, well casing and J-plug/cap. Report any irregular findings to the Project Manager.
5. Unlock and remove the well protective cap or cover and place on clean plastic to avoid introducing foreign material into the well.
6. Monitor the well for organic vapors using a PID, as per the Work Plan. If a reading of greater than 5 ppm is recorded, the well should be allowed to vent until levels drop below 5 ppm before proceeding with purging.
7. Lower the e-line probe slowly into the monitoring well and record the initial water level in accordance with the procedures referenced in Roux's Groundwater Level Measurement FOP. Refer to the construction diagram for the well to identify the screened depth.
8. Decontaminate all non-dedicated pump and tubing equipment following the procedures referenced in the Roux's Non-disposable and Non-dedicated Sampling Equipment Decontamination FOP.

**LOW FLOW (MINIMAL DRAWDOWN) GROUNDWATER
PURGING & SAMPLING PROCEDURES**

9. Lower the purge pump or tubing (i.e., low-flow electrical submersible, peristaltic, etc.) slowly into the well until the pump/tubing intake is approximately in the middle of the screened interval. Rapid insertion of the pump will increase the turbidity of well water, and can increase the required purge time. This step can be eliminated if dedicated tubing is already within the well.

Placement of the pump close to the bottom of the well will cause increased entrainment of solids, which may have settled in the well over time. Low-flow purging has the advantage of minimizing mixing between the overlying stagnant casing water and water within the screened interval. The objective of low-flow purging is to maintain a purging rate, which minimizes stress (drawdown) of the water level in the well. Low-flow refers to the velocity with which water enters the pump intake and that is imparted to the formation pore water in the immediate vicinity of the well screen.

10. Lower the e-line back down the well as water levels will be frequently monitored during purge and sample activities.
11. Begin pumping to purge the well. The pumping rate should be between 100 and 500 milliliters (ml) per minute (0.03 to 0.13 gallons per minute) depending on site hydrogeology. Periodically check the well water level with the e-line adjusting the flow rate as necessary to stabilize drawdown within the well. If possible, a steady flow rate should be maintained that results in a stabilized water level (drawdown of 0.3 feet or less). If the water level exceeds 2 feet below static and declining, slow the purge rate until the water level generally stabilizes. Record each pumping rate and water level during the event. If the water level continues to drop and will not stabilize, the monitoring location is not conducive to low-flow sampling and conventional purge and sample methods should be performed.

The low flow rate determined during purging will be maintained during the collection of analytical samples. At some sites where geologic heterogeneities

**LOW FLOW (MINIMAL DRAWDOWN) GROUNDWATER
PURGING & SAMPLING PROCEDURES**

are sufficiently different within the screened interval, high conductivity zones may be preferentially sampled.

12. Measure and record field parameters (pH, specific conductance, Eh, dissolved oxygen (DO), temperature, and turbidity) during purging activities. In lieu of measuring all of the parameters, a minimum subset could be limited to pH, specific conductance, and turbidity or DO. A reduction in the field parameter list must be approved by the Project Manager and/or the NYSDEC Project Manager.

Water quality indicator parameters should be used to determine purging needs prior to sample collection in each well. Stabilization of indicator parameters should be used to determine when formation water is first encountered during purging. In general, the order of stabilization is pH, temperature, and specific conductance, followed by Eh, DO and turbidity. Performance criteria for determination of stabilization should be based on water-level drawdown, pumping rate and equipment specifications for measuring indicator parameters. An in-line flow through cell to continuously measure the above parameters may be used. The in-line device should be disconnected or bypassed during sample collection.

13. Purging will continue until parameters of water quality have stabilized or at least a minimum of three (3) well volumes have been removed. Record measurements for field indicator parameters (including water levels) at regular intervals during purging. The stability of these parameters with time can be used to guide the decision to discontinue purging. Proper adjustments must be made to stabilize the flow rate as soon as possible.
14. Record well purging and sampling data in the Project Field Book or on the Groundwater Field Form (sample attached). Measurements should be taken approximately every three to five minutes, or as merited given the rapidity of change.
15. Purging is complete when field indicator parameters stabilize. Stabilization is achieved after all field parameters have stabilized for three successive readings.

**LOW FLOW (MINIMAL DRAWDOWN) GROUNDWATER
PURGING & SAMPLING PROCEDURES**

Three successive readings should be within ± 0.1 units for pH, $\pm 3\%$ for specific conductance, ± 10 mV for Eh, and $\pm 10\%$ for turbidity and dissolved oxygen. These stabilization guidelines are provided for rough estimates only, actual site-specific knowledge may be used to adjust these requirements higher or lower.

An in-line water quality measurement device (e.g., flow-through cell) should be used to establish the stabilization time for several field parameters on a well-specific basis. Data on pumping rate, drawdown, and volume required for parameter stabilization can be used as a guide for conducting subsequent sampling activities.

16. Collect all project-required samples from the discharge tubing at the flow rate established during purging in accordance with Roux's Groundwater Sample Collection Procedures FOP. **A peristaltic pump and dedicated tubing cannot be used to collect VOC or SVOC project-required samples; only non-organic compounds may be collected using this type of pump.** Continue to maintain a constant flow rate such that the water level is not drawn down as described above. Fill sample containers with minimal turbulence by allowing the ground water to flow from the tubing along the inside walls of the container.
17. If field filtration is recommended as a result of increased turbidity greater than 50 NTU, an in-line filter equipped with a 0.45-micron filter should be utilized. Collection of a filtered sample must be accompanied by an unfiltered sample.
18. Replace the dedicated tubing down the well taking care to avoid contact with the ground surface.
19. Restore the well to its capped/covered and locked condition.
20. Upon purge and sample collection completion, slowly lower the e-line to the bottom of the well/piezometer. Record the total depth to the nearest 0.01-foot and compare to the previous total depth measurement. If a significant discrepancy exists, re-measure the total depth. Record observations of purge

FOP 031.2

LOW FLOW (MINIMAL DRAWDOWN) GROUNDWATER PURGING & SAMPLING PROCEDURES

water to determine whether the well/piezometer had become silted due to inactivity or damaged (i.e., well sand within purge water). Upon confirmation of the new total depth and determination of the cause (i.e., siltation or damage), notify the Project Manager following project field activities.

ATTACHMENTS

Groundwater Field Form (sample)

REFERENCES

United States Environmental Protection Agency, 540/S-95/504, 1995. *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*.

Roux FOPs:

- 007 Calibration and Maintenance of Portable Dissolved Oxygen Meter
- 008 Calibration and Maintenance of Portable Field pH/Eh Meter
- 009 Calibration and Maintenance of Portable Field Turbidity Meter
- 011 Calibration and Maintenance of Portable Photoionization Detector
- 012 Calibration and Maintenance of Portable Specific Conductance Meter
- 022 Groundwater Level Measurement
- 024 Groundwater Sample Collection Procedures
- 040 Non-Disposable and Non-Dedicated Sampling Equipment Decontamination
- 046 Sample Labeling, Storage and Shipment Procedures

LOW FLOW (MINIMAL DRAWDOWN) GROUNDWATER PURGING & SAMPLING PROCEDURES



GROUNDWATER FIELD FORM

Project Name:

Date:

Location:

Project No.:

Field Team:

Well No.			Diameter (inches):			Sample Time:			
Product Depth (ftTOR):			Water Column (ft):			DTW when sampled:			
DTW (static) (ftTOR):			Casing Volume:			Purpose: ☐ Development ☐ Sample			
Total Depth (ftTOR):			Purge Volume (gal):			Purge Method:			
Time	Water Level (ftTOR)	Acc. Volume (gallons)	pH (units)	Temp. (deg. C)	SC (uS)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	Appearance & Odor
0	Initial								
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
Sample Information:			Date: (if different from above)						
	S1								
	S2								

Well No.			Diameter (inches):			Sample Time:			
Product Depth (ftTOR):			Water Column (ft):			DTW when sampled:			
DTW (static) (ftTOR):			Casing Volume:			Purpose: ☐ Development ☐ Sample			
Total Depth (ftTOR):			Purge Volume (gal):			Purge Method:			
Time	Water Level (ftTOR)	Acc. Volume (gallons)	pH (units)	Temp. (deg. C)	SC (uS)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	Appearance & Odor
0	Initial								
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									

Sample Information:		Date: (if different from above)							
S1									
S2									

REMARKS:

Note: All water level measurements are in feet, distance from top of riser

Note: All water level measurements are in feet, distance from top of riser.

Volume Calculation

Diam.	Vol. (g/ft)
1"	0.041
2"	0.163
4"	0.653
6"	1.469

Stabilization Criteria

Parameter	Criteria
pH	± 0.1 unit
SC	$\pm 3\%$
Turbidity	$\pm 10\%$
DO	± 0.3 mg/L
ORP	± 10 mV

PREPARED BY:

MANAGEMENT OF INVESTIGATION-DERIVED WASTE (IDW)

PURPOSE

The purpose of these guidelines is to ensure the proper holding, storage, transportation, and disposal of materials generated from field investigation activities that may contain hazardous wastes. Investigation-derived waste (IDW) includes the following:

- Drill cuttings, discarded soil samples, drilling mud solids, and used sample containers.
- Well development and purge waters and discarded groundwater samples.
- Decontamination waters and associated solids.
- Soiled disposable personal protective equipment (PPE).
- Used disposable sampling equipment.
- Used plastic sheeting and aluminum foil.
- Other equipment or materials that either contain or have been in contact with potentially impacted environmental media.

Because these materials may contain regulated chemical constituents, they must be managed as a solid waste. This management may be terminated if characterization analytical results indicate the absence of these constituents.

PROCEDURE

1. Contain all investigation-derived wastes in Department of Transportation (DOT)-approved 55-gallon drums, roll-off boxes, or other containers suitable for the wastes.

MANAGEMENT OF INVESTIGATION-DERIVED WASTE (IDW)

2. Contain wastes from separate borings or wells in separate containers (i.e. do not combine wastes from several borings/wells in a single container, unless it is a container used specifically for transfer purposes, or unless specific permission to do so has been provided by the Roux Field Team Leader. Unused samples from surface sample locations within a given area may be combined.
3. To the extent practicable, separate solids from drilling muds, decontamination waters, and similar liquids. Place solids within separate containers.
4. Transfer all waste containers to a staging area. Access to this area will be controlled. Waste containers must be transferred to the staging area as soon as practicable after the generating activity is complete.
5. Pending transfer, all containers will be covered and secured when not immediately attended.
6. Label all containers with regard to contents, origin, date of generation, using Roux's IDW container label (sample attached). Use indelible ink for all labeling.
7. Complete the Investigative Derived Waste Container Log (sample attached) as waste containers are labeled in order to track and inventory project waste. Leave a copy of the log with the site manager or fax copy to the owner/operator as necessary.
8. Collect samples for waste characterization purposes, or use boring/well sample analytical data for characterization.
9. For wastes determined to be hazardous in character, **be aware of accumulation time limitations**. Coordinate the disposal of these wastes with the plant manager/owner/operator, if applicable.
10. Upon NYSDEC Project Manager approval, dispose of investigation-derived wastes as follows:

MANAGEMENT OF INVESTIGATION-DERIVED WASTE (IDW)

- Soil, water, and other environmental media for which analysis does not detect organic constituents, and for which inorganic constituents are at levels that meet the Site's cleanup objectives, may be spread on the Property or otherwise treated as a non-waste material. Disposal quantity and on-site location will be documented on Project Field Books and in the project report submittal.
- Soil, water, and other environmental media in which organic compounds are detected or metals are present above the Site's cleanup objectives will be disposed off-site in accordance with applicable state and federal regulations. Disposal quantity and off-site location will be documented on Project Field Books and in the project report submittal.
- Personal protective equipment, disposable bailers, and similar equipment may be disposed as municipal waste, unless waste characterization results mandate otherwise.

WASTE STORAGE MANAGEMENT

Hazardous materials generated on site should be temporarily stored in a secure location that is under the control of the owner/operator or does not allow for vandalism (i.e., within a locked building structure or within a locked fenced in area). A waste-staging area should be designated on-site by the Project Manager in conjunction with the owner/operator.

ATTACHMENTS

Investigation Derived Waste Container Log (sample)
Investigation Derived Waste Container Label (sample)

REFERENCES

None

MANAGEMENT OF INVESTIGATION-DERIVED WASTE (IDW)

IDW Container Label (sample):


Project Name: _____
Project Number: _____
Container I.D.: _____
Contents/Matrix: _____
Estimated Quantity: _____
Date of Generation: _____
Date of Sample Collection: _____
Contact Name: _____
Contact Phone Number: _____

**MONITORING WELL CONSTRUCTION FOR
HOLLOW STEM AUGER BOREHOLES**

PURPOSE

Wells will be installed within selected boreholes for the purpose of evaluating groundwater characteristics. Well installation procedures depend upon the drilling method. This procedure describes well construction and installation for boreholes drilled using the hollow stem auger method. Refer to the Roux's Hollow Stem Auger Drilling Procedures FOP. Nominal dimensions and materials for the well are shown in the attached well construction diagram.

PROCEDURE

1. Advance borehole in accordance with the Roux's Hollow Stem Auger Drilling Procedure FOP to the required depth. The nominal inside diameter (ID) of the auger stem used should be at least 2 inches larger than the outside diameter (OD) of the riser and screen selected for the well installation. Record the monitoring well construction on the Field Borehole/Monitoring Well Installation Log (sample attached) (see Documentation Requirements for Drilling and Well Installation FOP).
2. Remove the drill rods and center bit/plug from the auger stem and verify borehole depth using weighted measuring tape.
3. In the event of an over drill (i.e. borehole depth is more than one foot greater than desired base of screen depth), use bentonite chips poured through the auger stem to seal the over drilled portion of the borehole. Be sure to note bentonite chip thickness on Field Borehole/Monitoring Well Installation Log.
4. Add a maximum of 6 inches of filter pack material through the auger stem to the base of the borehole. (Note: This step may be avoided if dense non-aqueous phase liquids are suspected to be present and it is desirable to have the screen and/or sump at the base of the borehole.)

**MONITORING WELL CONSTRUCTION FOR
HOLLOW STEM AUGER BOREHOLES**

5. Measure the length of the well string (i.e. riser and screen), and lower the well string into the well assembly to the desired depth. All measurements during the well installation process will be accurate to 0.1 foot.
6. Surface pour filter pack material into the annulus between the well and the auger stem as the augers are gradually withdrawn from the borehole. Use a weighted tape to confirm that the level of sand is maintained within the augers at all times. Record material volumes used.
7. After filter pack materials are brought to the required level, surface pour bentonite chips or pellets into the annulus between the well and the auger stem to form the filter pack seal. If necessary to avoid bridging, delayed hydration (coated) pellets may be used. Record the volume of material used.
8. Allow the bentonite chips/pellets to adequately hydrate for approximately 30 to 45-minutes. Cap or cover the well top of riser.
9. Mix cement/bentonite grout to a smooth consistency using a centrifugal or reciprocating pump. Do not hand mix. All water used must be potable quality. Record the volume of water used.
10. Fill the remaining annulus between the well and the auger stem with grout by surface pouring or pumping, and begin withdrawal of the auger string. Periodically top the auger string off with additional grout. If groundwater is present within the annulus above the bentonite chip/pellet seal, cement/bentonite grout will be pressure tremie grouted from bottom to top in order to displace groundwater from the borehole.
11. When the auger string is withdrawn, center the upper portion of the well riser within the borehole, and place drums or barricades around the well for protection while the grout cures. Place and lock a security cap (i.e., J-plug) in the opening of the well riser.
12. Leave the well undisturbed for at least 24 hours to allow the grout to cure. If excessive grout fallback occurs, top off as necessary with bentonite chips or additional grout.

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MONITORING WELL CONSTRUCTION FOR HOLLOW STEM AUGER BOREHOLES

13. Construct the surface completion as shown in the attached Typical Monitoring Well Detail (Figure 1). Select flush completions for all locations in active operational or high traffic areas, or in other areas where an above grade completion would be undesirable. Use aboveground completions in all other areas.
14. Place a dedicated lock on the well or protective casing, and keep well locked when not actively attended.
15. Permanently label the well with the appropriate well identifier as determined by the Project Manager or specified in the Work Plan.
16. Permanently mark a survey location on the north side at the top of the casing with a saw cut. Survey all wells for horizontal location and elevation, using a surveyor licensed by the State of New York. Coordinates and elevations will be provided in a coordinate system consistent with previous well surveys at the Site. Information obtained will include location (x and y) of the well, and elevation (z) of the ground surface, the pad, and the top of riser.
17. Develop the well as described in the Roux Field Operating Procedure for Monitoring Well Development.
18. Manage all waste materials generated during well installation and development as described in the Roux Field Operating Procedure for Management of Investigation Derived Waste.

ATTACHMENTS

Field Borehole/Monitoring Well Installation Log (sample)
Typical Monitoring Well Detail (Figure 1)

FOP 033.0

MONITORING WELL CONSTRUCTION FOR HOLLOW STEM AUGER BOREHOLES

REFERENCES

Roux FOPs:

- 015 *Documentation Requirements for Drilling and Well Installation*
- 026 *Hollow Stem Auger Drilling Procedures*
- 032 *Management of Investigation Derived Waste*
- 036 *Monitoring Well Development Procedures*

MONITORING WELL CONSTRUCTION FOR HOLLOW STEM AUGER BOREHOLES

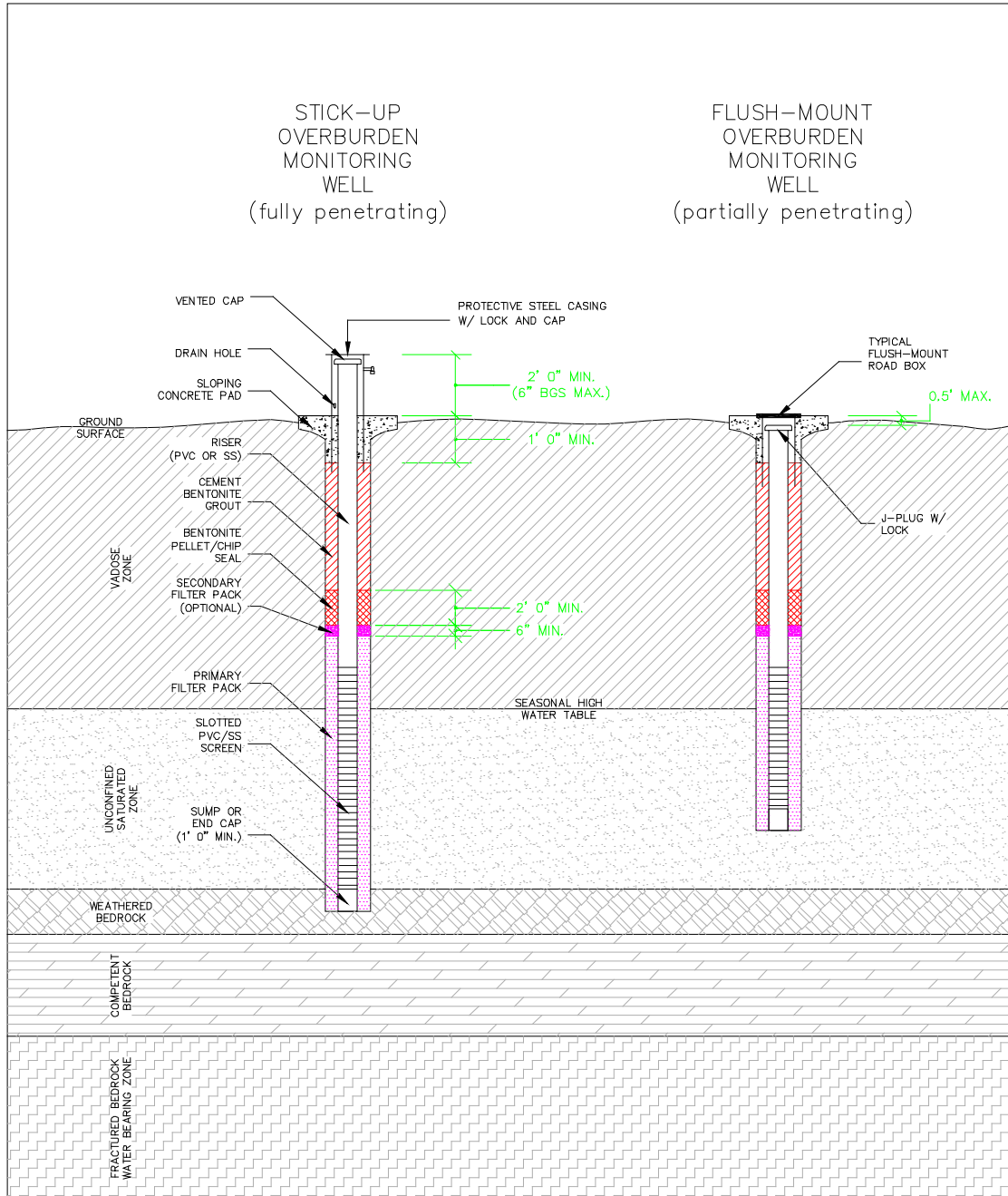


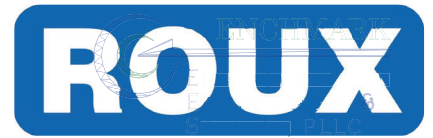
FIELD BOREHOLE/MONITORING WELL INSTALLATION LOG

[illegible]

**MONITORING WELL CONSTRUCTION FOR
HOLLOW STEM AUGER BOREHOLES**

FIGURE 1





FIELD OPERATING PROCEDURES

Monitoring Well Development Procedures

MONITORING WELL DEVELOPMENT PROCEDURES

PURPOSE

This procedure describes the methods for the development of newly installed monitoring wells and re-development of existing monitoring wells that have been inactive for an extended period of time (i.e., one year or more). Monitoring wells are developed after installation in order to remove introduced water and drilling fluids, reduce the turbidity of the water, and improve the hydraulic communication between the well and the water-bearing formation. Well development will not commence until the annular grout seal has cured, but will be performed within ten calendar days of well installation.

PROCEDURE

1. All well development will include surge blocking or false bailing with one or more of the following fluid removal methods. Well development activities may include:
 - Bailing
 - Air Lifting
 - Submersible Pumping
 - Other methods as approved by the Roux Field Team Leader.
 - The appropriate water removal method will be selected based on water level depth and anticipated well productivity.
2. Assemble and decontaminate equipment (if necessary), and place in the well. Reference the Roux Field Operating Procedure for Non-Disposable and Non-Dedicated Sampling Equipment Decontamination.
3. Alternate the use of agitation methods with water removal methods, using the former to suspend solids in the well water, and the latter to remove the turbid water. For example, use a vented surge block to agitate the well, moving up and down within the screened interval and then use a pump to clear the well. A bailer may be used for both purposes, by surging with the bailer (false

MONITORING WELL DEVELOPMENT PROCEDURES

bailing) for a period within the screened interval, then bailing a volume of water from the well.

4. When using surging methods, initiate this activity gradually, with short (2 to 3 feet) strokes. After several passes across the screened interval, increase the speed and length of the surge strokes.
5. Continue development until the following objectives are achieved:
 - Field parameters stabilize to the following criteria:
 - o Dissolved Oxygen: ± 0.3 mg/L
 - o Turbidity: $\pm 10\%$
 - o Specific Conductance: $\pm 3\%$
 - o ORP: ± 10 mV
 - o pH: ± 0.1 units
 - The well will generate non-turbid water during continued pumping typically less than 50 NTU.
 - A minimum of 10 well volumes has been evacuated from the well.
 - In the case of lost water during drilling activities, the volume of water removed exceeds twice the volume of water lost to the formation during the drilling process, as indicated by the water balance.
6. Document the development methods, volumes, field parameter measurements, and other observations on the attached Roux Groundwater Well Development Log (sample attached).

ATTACHMENTS

Groundwater Well Development Log (sample)

REFERENCES

Roux FOPs:

040 *Non-Disposable and Non-Dedicated Sampling Equipment Decontamination*

MONITORING WELL DEVELOPMENT PROCEDURES



WELL DATA:

TIME:

PURGING DATA:

START TIME:

END TIME:

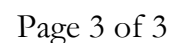
Volume Calculation

Parameter	Criteria
DO	+/- 0.3 mg/L
Turbidity	+/- 10%
SC	+/- 3%
ORP	+/- 10 mV
pH	+/- 0.1 unit

Field Personnel:

[illegible]

PREPARED BY:



FOP 040.1

NON-DISPOSABLE AND NON-DEDICATED SAMPLING EQUIPMENT DECONTAMINATION

PURPOSE

This procedure is to be used for the decontamination of non-disposable and non-dedicated equipment used in the collection of environmental samples. The purpose of this procedure is to remove chemical constituents from previous samples from the sampling equipment. This prevents these constituents from being transferred to later samples, or being transported out of controlled areas.

HEALTH AND SAFETY

Nitric acid is a strong oxidizing agent as well as being extremely corrosive to the skin and eyes. Solvents such as acetone, methanol, hexane and isopropanol are flammable liquids. Limited contact with skin can cause irritation, while prolonged contact may result in dermatitis. Eye contact with the solvents may cause irritation or temporary corneal damage. Safety glasses with protective side shields, neoprene or nitrile gloves and long-sleeve protective clothing must be worn whenever acids and solvents are being used.

PROCEDURE – GENERAL EQUIPMENT

Bailers, split-spoons, steel or brass split-spoon liners, Shelby tubes, submersible pumps, soil sampling knives, and similar equipment will be decontaminated as described below.

1. Wash equipment thoroughly with non-phosphate detergent and potable-quality water, using a brush where possible to remove any particulate matter or surface film. If the sampler is visibly coated with tars or other phase-separated hydrocarbons, pre-wash with acetone or isopropanol, or by steam cleaning. Decontamination will adhere to the following procedure:

FOP 040.1

NON-DISPOSABLE AND NON-DEDICATED SAMPLING EQUIPMENT DECONTAMINATION

- a. Rinse with potable-quality water; if the sampling equipment is very oily and use of a solvent is necessary, rinse with pesticide-grade isopropanol.
 - b. Rinse with potable-quality water;
 - c. Rinse with deionized water demonstrated analyte-free, such as distilled water;
 - d. Air dry; and
 - e. Store in a clean area or wrap in aluminum foil (shiny side out) or new plastic sheeting as necessary to ensure cleanliness.
2. All non-dedicated well evacuation equipment, such as submersible pumps and bailers, which are put into the well, must be decontaminated following the procedures listed above. All evacuation tubing must be dedicated to individual wells (i.e., tubing cannot be reused). However, if submersible pump discharge tubing must be reused, the tubing and associated sample valves or flow-through cells used in well purging or pumping tests will be decontaminated as described below:
 - a. Pump a mixture of potable water and a non-phosphate detergent through the tubing, sample valves and flow cells, using the submersible pump.
 - b. Steam clean or detergent wash the exterior of the tubing, sample valves, flow cells and pump.
 - c. Pump potable water through the tubing, sample valve, and flow cell until no indications of detergent (e.g. foaming) are observed.
 - d. Double rinse the exterior of the tubing with potable water.
 - e. Rinse the exterior of the tubing with distilled water.

FOP 040.1

NON-DISPOSABLE AND NON-DEDICATED SAMPLING EQUIPMENT DECONTAMINATION

- f. Store in a clean area or wrap the pump and tubing assembly in new plastic sheeting as necessary to ensure cleanliness until ready for use.
3. All unused sample bottles and sampling equipment must be maintained in such a manner that there is no possibility of casual contamination.
4. Manage all waste materials generated during decontamination procedures as described in the Roux Field Operating Procedure for Management of Investigation Derived Waste.

PROCEDURE – SUBMERSIBLE PUMPS

Submersible pumps used in well purging or purging tests will be decontaminated thoroughly each day before use as well as between well locations as described below:

Daily Decontamination Procedure:

1. Pre-rinse: Operate the pump in a basin containing 8 to 10 gallons of potable water for 5 minutes and flush other equipment with potable water for 5 minutes.
2. Wash: Operate the pump in 8 to 10 gallons of non-phosphate detergent solution (i.e., Alconox) for 5 minutes and flush other equipment with fresh detergent solution for 5 minutes.
3. Rinse: Operate the pump in a basin of potable water for 5 minutes and flush other equipment with potable water for 5 minutes.
4. Disassemble pump.
5. Wash pump parts with a non-phosphate detergent solution (i.e., Alconox). Scrub all pump parts with a test tube brush or similar device.

FOP 040.1

NON-DISPOSABLE AND NON-DEDICATED SAMPLING EQUIPMENT DECONTAMINATION

6. Rinse pump with potable water.
7. Rinse the inlet screen, the shaft, the suction interconnection, the motor lead assembly, and the stator housing with distilled/deionized water.
8. Rinse the impeller assembly with 1% nitric acid (HNO₃).
9. Rinse the impeller assembly with isopropanol.
10. Rinse the impeller assembly with distilled/deionized water.

Between Wells Decontamination Procedure:

1. Pre-rinse: Operate the pump in a basin containing 8 to 10 gallons of potable water for 5 minutes.
2. Wash: Operate the pump in 8 to 10 gallons of non-phosphate detergent solution (i.e., Alconox) for 5 minutes.
3. Rinse: Operate the pump in a basin of potable water for 5 minutes.
4. Final rinse the pump in distilled/deionized water.

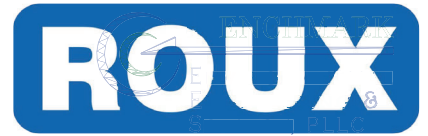
ATTACHMENTS

None

REFERENCES

Roux FOPs:

032 *Management of Investigation-Derived Waste*



FIELD OPERATING PROCEDURES

Overburden Casing Installation Procedure

OVERBURDEN CASING INSTALLATION PROCEDURES

PURPOSE

This guideline presents a method for the installation of casing to prevent downhole contamination of hazardous compounds from shallow overburden material. This method is particularly applicable where contaminated strata overlie uncontaminated strata of lower permeability. The method can be used with hollow stem auger drilling or rotary wash drilling (where temporary casing is used). This guideline also presents a method for the evaluation of the integrity of the grout seal around an overburden casing, which has been positioned into a confining layer.

CASING INSTALLATION PROCEDURE

1. Advance boring by appropriate drilling methods, through the contaminated strata a short distance (1 to 2 feet) into an underlying lower permeable unit.
2. Calculate the volume of the borehole based on the bit/auger head or steel casing diameter plus 10% and determine the volume of grout to be emplaced. Generally, the total mixed volume is the borehole volume plus 20%.
3. Identify the equipment to be used for the preparation and mixing of the grout. Ensure the volume of the tanks to be used for mixing has been measured adequately. Document these volumes on the Field Borehole/Monitoring Well Installation Log (sample attached).
4. Identify the source of the water to be used for the grout and determine its suitability for use. In particular, water with high sulfate, or chloride levels or heated water should not be used. These types of waters can cause operational difficulties or modify the set-up for the grout.
5. Identify the equipment to be used for emplacing the grout. Ensure that the pump to be used has adequate pressure to enable complete return to surface.

OVERBURDEN CASING INSTALLATION PROCEDURES

6. Identify the volumes to be pumped at each stage or in total if only one stage is to be used.
7. Begin mixing the grout to be emplaced. Grout specifications generally have mixture ratios as follows:

Grout Slurry Composition (% Weight)

1.5 to 3.0%	-	Bentonite (Quick Gel)
40 to 60 %	-	Cement (Portland Type I)
40 to 60 %	-	Potable Water

8. Record the type and amount of materials used during the mixing operation. Ensure the ratios are within specifications tolerance.
9. Begin pumping the grout through the return line bypass system to confirm all pump and surface fittings are secure.
10. Remove drill rods and center plug (or clean out temporary casing) and insert a tremie pipe to the bottom of the boring. Pump the cement/bentonite grout slurry through the tremie pipe until grout return is observed at grade and no bridging of the slurry is evident. Slowly withdraw the augers (or casing) from the boring while maintaining the grout level at grade. Record the times and volumes emplaced on the Field Borehole/Monitoring Well Installation Log (sample attached).
11. Document the return circulation of grout. This may be facilitated by using a colored dye or other tagging method if a mudded borehole condition exists prior to grout injection.
12. Place a drillable plug (preferably untreated wood) at the downhole end of black steel or other appropriate casing, insert the casing through the slurry, and seat it into the underlying formation.
13. Allow grout to set for 24 to 48 hours.

OVERBURDEN CASING INSTALLATION PROCEDURES

HYDROSTATIC TESTING OF CASING PROCEDURE

1. Following adequate setting time for the grout, drill through the grout inside the casing until the top of the confining layer has been reached (refer to Field Borehole/Monitoring Well Installation Log during casing installation).
2. Fill the casing with potable water and measure the water level within the casing with a water level indicator to the nearest 0.01-foot and record the measurement on the Pipe Leakage Testing Log (sample attached).
3. Monitor the water level for 30 minutes and record the final water level within the casing with a water level indicator to the nearest 0.01-foot and record the measurement on the Pipe Leakage Testing Log (sample attached).
4. Should the water level drop more than the allowable volume calculated using the following equation, the seal shall be regouted at the Subcontractor's expense.

$$Q_{(\text{allowable})} = 2.75 \text{ DKH}$$

Where:

$Q_{(\text{allowable})}$ = Flow rate during a 30 minute test

D = Inside diameter of overburden casing

K = Confining layer hydraulic conductivity (see Table 1)

H = Head of water applied

Note: Be sure to use consistent units of measure.

ATTACHMENTS

Field Borehole/Monitoring Well Installation Log (sample)

Pipe Leakage Testing Log (sample)

Table 1 – Range of Values of Hydraulic Conductivity and Permeability

FOP 041.0

OVERBURDEN CASING INSTALLATION PROCEDURES

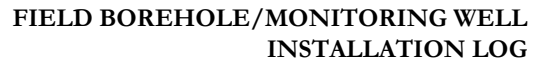
REFERENCES

Freeze, R.A. and J.A. Cherry. 1979. *Groundwater*. Prentice-Hall, Inc., Englewood, New Jersey, 604 p.

Roux FOPs:

018 *Drilling and Excavation Equipment Decontamination Protocols*

OVERBURDEN CASING INSTALLATION PRCEDEURES



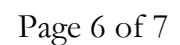
OVERBURDEN CASING INSTALLATION PRCEDEURES



Roux Personnel:

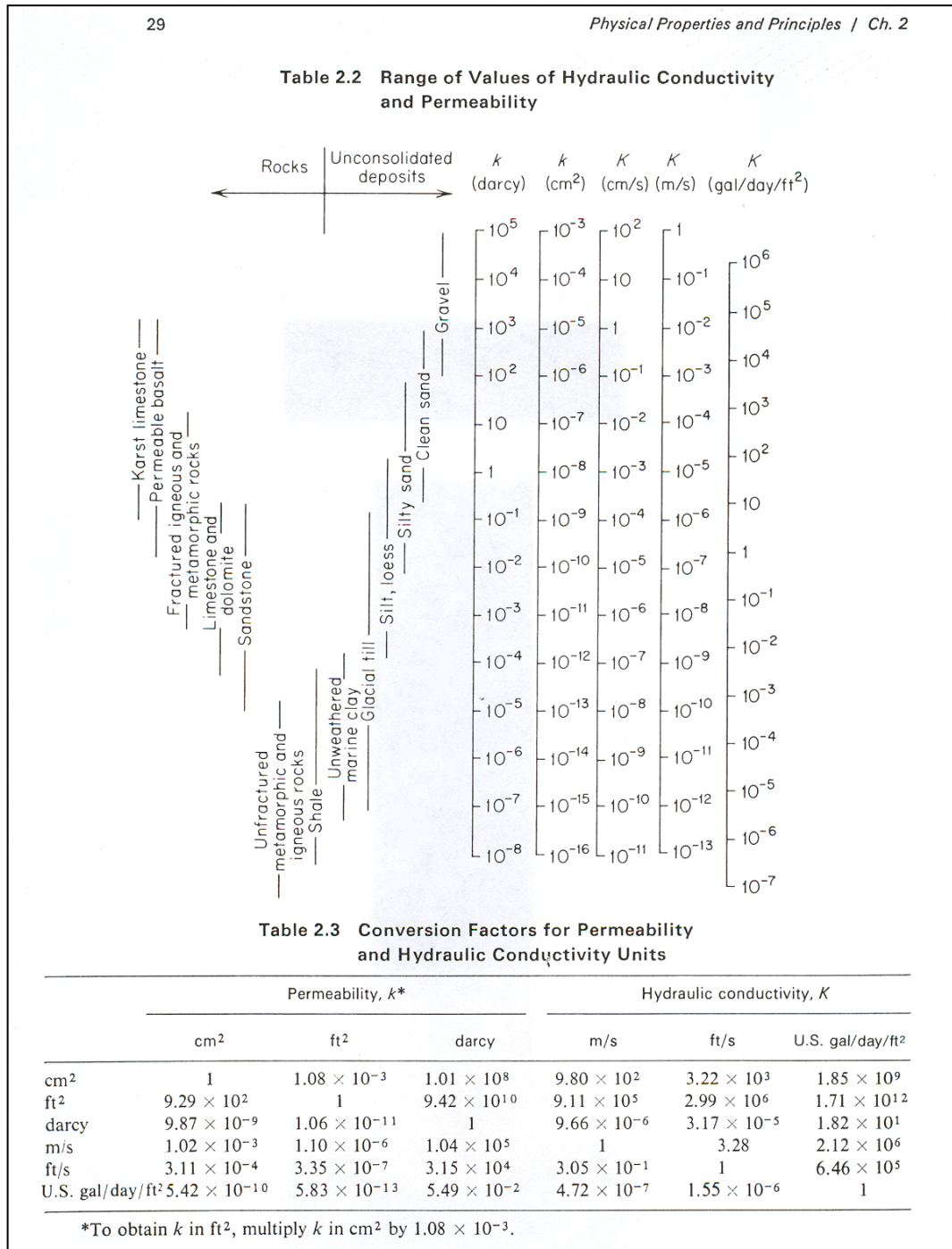
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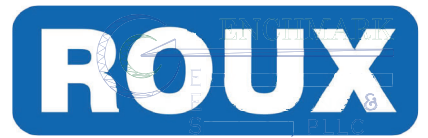
Date:



OVERBURDEN CASING INSTALLATION PROCEDURES

TABLE 1: (From Freeze and Cherry, page 29.)





FIELD OPERATING PROCEDURES

Sample Labeling, Storage, and Shipment Procedures

SAMPLE LABELING, STORAGE & SHIPMENT PROCEDURES

PURPOSE

The collection and analysis of samples of environmental media, including soils, groundwater, surface water, and sediment, are the central activities of the field investigation. These samples must be properly labeled to preserve its identity, and properly stored and shipped in a manner that preserves its integrity and chain of custody. This procedure presents methods for these activities.

SAMPLE LABELING PROCEDURE

1. Assign each sample retained for analysis a unique 9-digit alphanumeric identification code or as indicated in the Project Work Plan. Typically, this code will be formatted as follows:

Sample I.D. Example: GW051402047	
GW	Sample matrix GW = groundwater; SW = surface water; SUB = subsurface soil; SS = surface soil; SED = sediment; L = leachate; A = air
05	Month of sample collection
14	Day of sample collection
02	Year of sample collection
047	Consecutive sample number

2. Consecutive sample numbers will indicate the individual sample's sequence in the total set of samples collected during the investigation/sampling event. The sample number above, for example, would indicate the 47th sample retained for analysis during the field investigation, collected on May 14, 2002.

SAMPLE LABELING, STORAGE & SHIPMENT PROCEDURES

3. Affix a non-removable (when wet) label to each sample container. The following information will be written on the label with black or blue ink that will not smudge when wet:
 - Project number
 - Sample ID (see Step 1 above)
 - Date of sample collection
 - Time of sample collection (military time only)
 - Specify “grab” or “composite” sample with an “X”
 - Sampler initials
 - Preservative(s) (if applicable)
 - Analytes for analysis (if practicable)
4. Record all sample label information in the Project Field Book and on a Sample Summary Collection Log (see attached samples), keyed to the sample identification number. In addition, add information regarding the matrix, sample location, depth, etc. to provide a complete description of the sample.

SAMPLE STORAGE PROCEDURE

1. Immediately after collection, placement in the proper container, and labeling, place samples to be retained for chemical analysis into resealable plastic bags.
2. Place bagged samples into an ice chest filled approximately half-full of double bagged ice. Blue ice is not an acceptable substitute for ice.
3. Maintain samples in an ice chest or in an alternative location (e.g. sample refrigerator) as approved by the Roux Field Team Leader until time of shipment. Periodically drain melt-water off coolers and replenish ice as necessary.

FOP 046.1

SAMPLE LABELING, STORAGE & SHIPMENT PROCEDURES

4. Ship samples on a daily basis, unless otherwise directed by the Roux Field Team Leader.
5. Maintain appropriate custody procedures on coolers and other sample storage containers at all times. These procedures are discussed in detail in the Project Quality Assurance Project Plan, Monitoring Plan or Work Plan.
6. Samples shall be kept in a secure location locked and controlled (i.e., locked building or fenced area) so that only the Project Field Team Leader has access to the location or under the constant visual surveillance of the same.

SAMPLE SHIPPING PROCEDURE

1. Fill out the chain-of-custody form completely (see attached sample) with all relevant information. The white original goes with the samples and should be placed in a resealable plastic bag and taped inside the sample cooler lid; the sampler should retain the copy.
2. Place a layer of inert cushioning material such as bubble pack in the bottom of cooler.
3. Place each bottle in a bubble wrap sleeve or other protective wrap. To the extent practicable, then place each bottle in a resealable plastic bag.
4. Open a garbage bag (or similar) into a cooler and place sample bottles into the garbage bag (or similar) with volatile organic analysis (VOA) vials near the center of the cooler.
5. Pack bottles with ice in plastic bags. At packing completion, cooler should be at least 50 percent ice, by volume. Coolers should be completely filled, so that samples do not move excessively during shipping.
6. Duct tape (or similar) cooler drain closed and wrap cooler completely in two or more locations to secure lid, specifically covering the hinges of the cooler.

FOP 046.1

SAMPLE LABELING, STORAGE & SHIPMENT PROCEDURES

7. Place laboratory label address identifying cooler number (i.e., 1 of 4, 2 of 4 etc.) and overnight delivery waybill sleeves on cooler lid or handle sleeve (Federal Express).
8. Sign the custody seal tape with an indelible soft-tip marker and place over the duct tape across the front and back seam between the lid and cooler body.
9. Cover the signed custody seal tape with an additional wrap of transparent strapping tape.
10. Place “Fragile” and “This Side Up” labels on all four sides of the cooler. “This Side Up” labels are yellow labels with a black arrow with the arrowhead pointing toward the cooler lid.
11. For coolers shipped by overnight delivery, retain a copy of the shipping waybill, and attach to the chain-of-custody documentation.

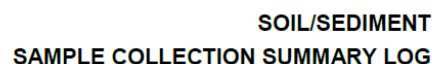
ATTACHMENTS

Soil/Sediment Sample Summary Collection Log (sample)
Groundwater/Surface Water Sample Summary Collection Log (sample)
Wipe Sample Summary Collection Log (sample)
Air Sample Summary Collection Log (sample)
Chain-Of-Custody Form (sample)

REFERENCES

None

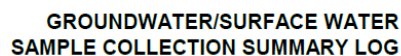
SAMPLE LABELING, STORAGE & SHIPMENT PROCEDURES

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Prepared By: _____



SAMPLE LABELING, STORAGE & SHIPMENT PROCEDURES

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FOP 046.1

SAMPLE LABELING, STORAGE & SHIPMENT PROCEDURES

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Prepared By: _____

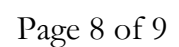
SAMPLE LABELING, STORAGE & SHIPMENT PROCEDURES

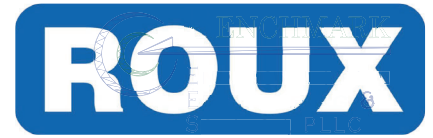


Sample Summary Collection Logs - air-REV 2025.xls

Page ____ of ____

Prepared By: _____





FIELD OPERATING PROCEDURES

Temporary Well (Piezometer) Construction Procedures

**TEMPORARY WELL (PIEZOMETER)
CONSTRUCTION PROCEDURES**

PURPOSE

Temporary wells (or piezometers) will be installed within selected geoprobe boreholes or test pits for the purpose of evaluating groundwater characteristics, such as flow direction and generally quality. This procedure describes temporary well construction and installation for boreholes drilled using direct push and test pit methodologies. Refer to Roux's Geoprobe Drilling Procedure FOP and Test Pit Excavation and Logging Procedures FOP prior to installing a temporary well. Nominal dimensions and materials for the temporary well are shown in the attached temporary well construction diagram.

GEOPROBE PROCEDURE

1. Advance borehole in accordance with Roux's Geoprobe Drilling Procedure FOP to the required depth. The nominal inside diameter (ID) of the direct-push stem used should be at least 1 inch larger than the outside diameter (OD) of the riser and screen selected for the temporary well installation.
2. Remove the direct-push rods from the borehole and verify the depth using weighted measuring tape confirming the depth to groundwater observed during sample evaluation. If the borehole annulus collapses due to non-cohesive soils (i.e., sand and gravel), additional attempts should be made by the direct push rig to clear the sloughed material. If sloughing continues and the borehole cannot remain open, discontinue temporary well installation and consult the Project Manager and/or Work Plan.
3. In the event of an over drill (i.e. borehole depth is more than one foot greater than desired base of screen depth), use bentonite chips poured through the direct-push stem to seal the over drilled portion of the borehole. Be sure to note bentonite chip thickness on Field Borehole/Monitoring Well Installation Log.

**TEMPORARY WELL (PIEZOMETER)
CONSTRUCTION PROCEDURES**

4. Due to the transient nature of the temporary well(s), a sand filter pack and well development is not required.
5. Measure the length of the 1-inch PVC temporary well string (i.e. riser and screen), and lower the temporary well string into the borehole annulus to the desired depth. All measurements during the temporary well installation process will be accurate to 0.1 foot.
6. Following well string installation, place cement bentonite chips or pellets around the surface to create a watertight seal and hydrate with potable water. A typical temporary well completion detail is attached as Figure 1.
7. Leave the uncapped temporary well undisturbed for at least 1 hour to allow the bentonite chips/pellets surface seal to adequately hydrate as well as to allow shallow groundwater within the screened formation to stabilize within the well.
8. Permanently label the temporary well with the appropriate alphanumeric identifier as determined by the Project Manager or specified in the Work Plan.
9. Permanently mark a survey location on the north side at the top of the PVC riser with a saw cut. Survey all temporary wells for horizontal location and elevation, using a surveyor licensed by the State of New York. Coordinates and elevations will be provided in a coordinate system consistent with previous surveys at the Site. Information obtained will include location (x and y) of the temporary well, and elevation (z) of the ground surface and the top of riser.
10. Place a lockable J-plug and dedicated lock on the temporary well, and keep the temporary well locked when not actively attended.
11. Manage all waste materials generated during temporary well installation as described in the Roux Field Operating Procedure for Management of Investigation Derived Waste.

FOP 077.0

TEMPORARY WELL (PIEZOMETER) CONSTRUCTION PROCEDURES

12. Record the temporary well construction details on a Field Geoprobe Borehole/Temporary Well Installation Log (sample attached) and Temporary Well Completion Detail (sample attached).
13. Refer to Roux's Documentation Requirements for Drilling and Well Installation FOP.

TEST PITTING PROCEDURE

1. Advance test pit a minimum of five feet into the shallow groundwater bearing zone in accordance with Roux's Test Pit Excavation and Logging Procedures FOP to the required depth.
2. At one end of the test pit, excavate an additional small pilot hole to place the 1-inch PVC temporary well string in a vertical position.
3. Verify the depth using weighted measuring tape confirming the depth to groundwater observed during test pit evaluation.
4. Construct the temporary well with a 1-inch diameter (minimum) PVC well screen and riser according to the observed/measured depth to groundwater. Measure the length of the temporary well string (i.e. riser and screen) and lower the string into the open test pit to the desired depth. All measurements during the temporary well installation process will be accurate to 0.1 foot.
5. Slowly backfill around the temporary well with test pit spoils, making sure to keep the well as close to vertical as possible.
6. Due to the transient nature of the temporary well(s), a sand filter pack and well development is not required.
7. Following well string installation, place cement bentonite chips or pellets around the surface to create a watertight seal and hydrate with potable water. A typical temporary well completion detail is attached as Figure 1.

**TEMPORARY WELL (PIEZOMETER)
CONSTRUCTION PROCEDURES**

8. Leave the uncapped temporary well undisturbed for at least 1 hour to allow the bentonite chips/pellets surface seal to adequately hydrate as well as to allow shallow groundwater within the screened formation to stabilize within the well.
9. Permanently label the temporary well with the appropriate alphanumeric identifier as determined by the Project Manager or specified in the Work Plan.
10. Permanently mark a survey location on the north side at the top of the PVC riser with a saw cut. Survey all temporary wells for horizontal location and elevation, using a surveyor licensed by the State of New York. Coordinates and elevations will be provided in a coordinate system consistent with previous surveys at the Site. Information obtained will include location (x and y) of the temporary well, and elevation (z) of the ground surface and the top of riser.
11. Place a lockable J-plug and dedicated lock on the temporary well, and keep the temporary well locked when not actively attended.
12. Manage all waste materials generated during temporary well installation as described in the Roux Field Operating Procedure for Management of Investigation Derived Waste.
13. Record the temporary well construction details on a Temporary Well Completion Detail (sample attached).
14. Refer to Roux's Documentation Requirements for Drilling and Well Installation FOP.

ATTACHMENTS

Figure 1 Typical Temporary Well Construction Detail (Figure 1)

Field Geoprobe Borehole/Temporary Well Installation Log (sample)
Temporary Well Completion Detail (sample)

FOP 077.0

TEMPORARY WELL (PIEZOMETER) CONSTRUCTION PROCEDURES

REFERENCES

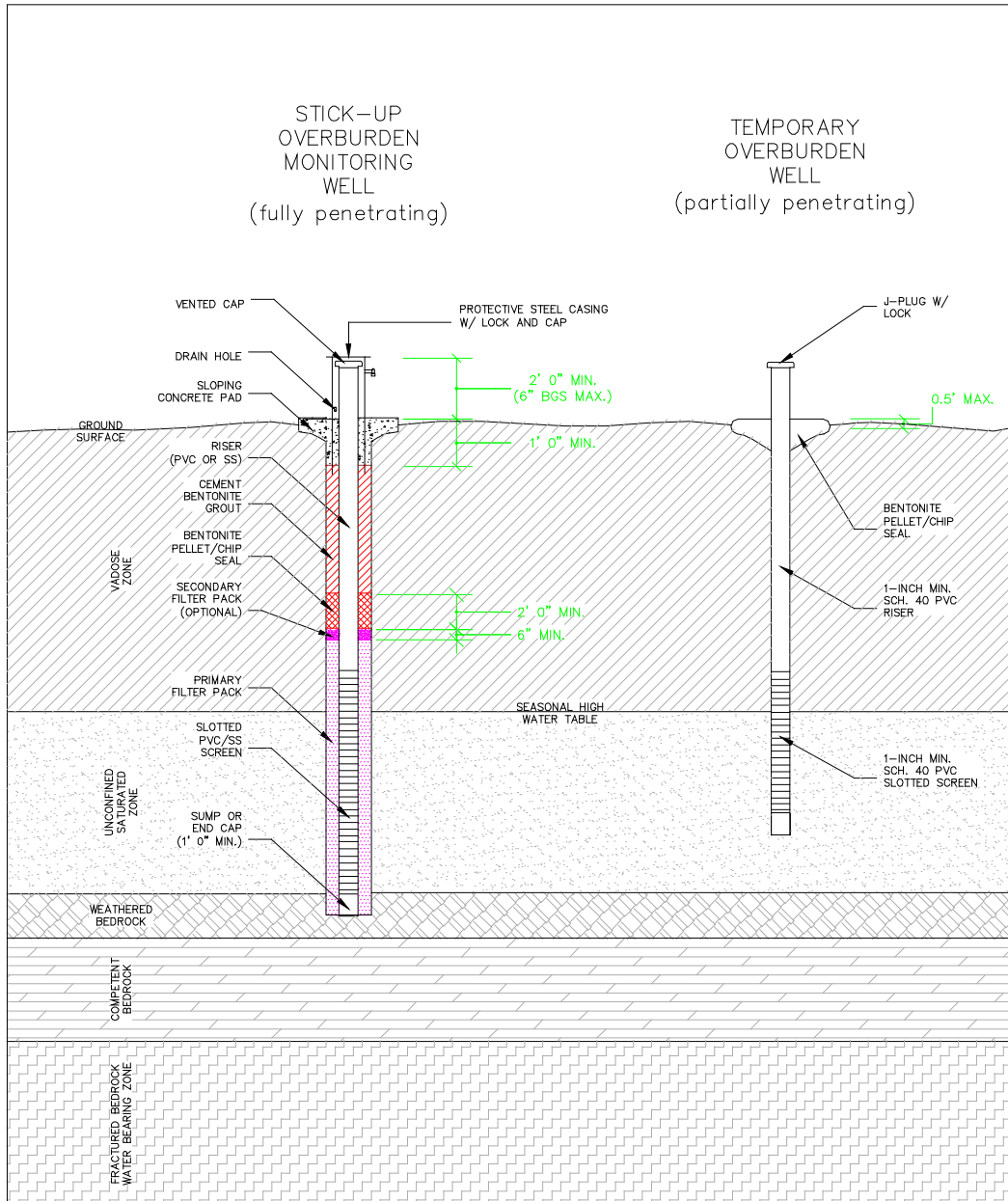
Roux FOPs:

- 015 *Documentation Requirements for Drilling and Well Installation*
- 032 *Management of Investigation Derived Waste*
- 065 *Test Pit Excavation and Logging Procedures*
- 078 *Geoprobe Drilling Procedures*

TEMPORARY WELL (PIEZOMETER) CONSTRUCTION PROCEDURES

FIGURE 1

TYPICAL TEMPORARY WELL CONSTRUCTION DETAIL



TEMPORARY WELL (PIEZOMETER) CONSTRUCTION PROCEDURES

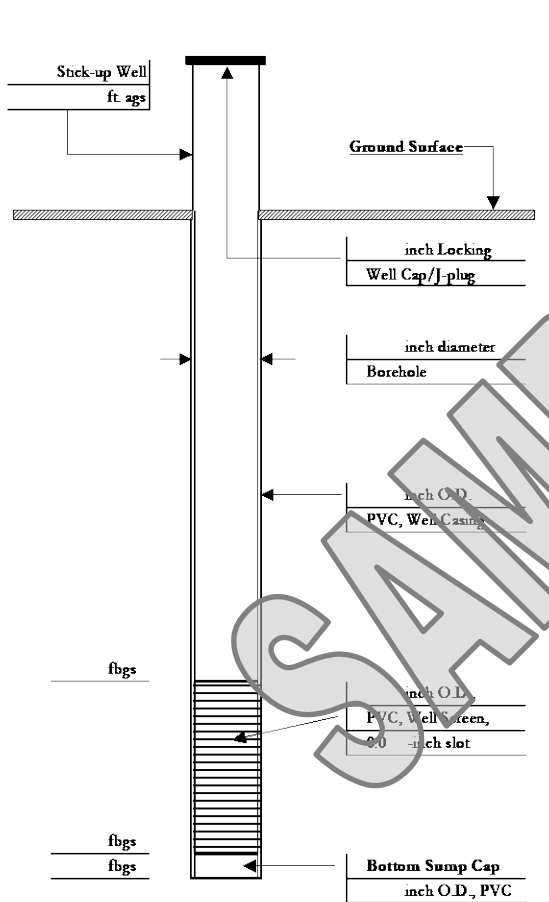


TEMPORARY WELL (PIEZOMETER) CONSTRUCTION PROCEDURES



TEMPORARY WELL COMPLETION DETAIL

Project Name:	WELL NUMBER:
Client:	Date Installed:
Boring Location:	Project Number:



Driller Information	
Company:	
Driller:	
Helper:	
Permit Number:	
Drill Rig Type:	

Well Information	
Land Surface Elevation:	fmsl (approximate)
Drilling Method:	
Soil Sample Collection Method:	
Drilling Fluid:	
Fluid Loss During Drilling:	gallons (approximate)

Material of Well Construction	
Casing:	
Screen:	
Sump:	
Sand Pack:	
Annular Seal:	

Well Development	
Well Purpose:	
Technique(s):	
Date Completed:	
BM/TK Personnel:	
Total Volume Purged:	gallons
Static Water Level:	ft TOR
Pump Depth:	
Pumping Duration:	minutes
Yield:	gpm
Specific Capacity:	gpm/ft

Comments:

PREPARED BY: _____ DATE: _____

**ACTIVE SUBSLAB DEPRESSURIZATION PRE-DESIGN
TESTING PROCEDURE**

BACKGROUND

The New York State Department of Health (NYSDOH) has published a draft document entitled “Guidance for Evaluating Soil Vapor Intrusion in the State of New York.” (www.health.state.ny.us/nysdoh/gas/svi_guidance/). As of October 2006, this document has been guiding NYSDOH and New York State Department of Environmental Conservation (NYSDEC) decisions concerning the need for subslab vapor mitigation at sites undergoing investigation, cleanup and monitoring under formal NY State remedial programs (e.g., Brownfield Cleanup Program sites, Inactive Hazardous Waste Site Remediation Program sites, etc.).

PURPOSE

This guideline presents a general description of the method for determining the number of extraction points, location and placement of these points, and the desirable sub-slab capture configuration. Extraction points are used to depressurize the subsoil in order to capture sub-slab vapors from the underlying sub-soil. This information can be used in evaluating the effectiveness of the final sub-slab depressurization and vapor capture designs.

BUILDING PREPARATION

Prior to performing the pre-design testing procedure, the building’s slab should be inspected for any cracks or deformations that may compromise the sub-slab vacuum seal. A pre-testing inspection should be performed for each test location. The inspection should evaluate the type of structure, floor layout, airflows and physical conditions of the building(s) being studied.

FOP 083.1

ACTIVE SUBSLAB DEPRESSURIZATION PRE-DESIGN TESTING PROCEDURE

PROCEDURE

1. Perform a building inspection. Seal any foundation/slab cracks, utility penetrations, and other openings that may serve as a vacuum break during the testing procedure. Turn off any equipment that may affect pressure gradients within the testing area.
2. Identify a minimum of one (1) location for the placement of simulated vacuum extraction point (TEST).
3. From the center of each TEST location, use a 100-foot tape and piece of chalk to draw concentric circled/arcs at distances of 5, 10, 15, 20, 30, 40, and 50 feet (measurement points (MP)).
4. Drill a 5 inch slab core at the TEST location. Remove as much sub-slab bedding material at the TEST location through the core hole as possible, optimally one cubic foot.
5. Insert vacuum inducing testing apparatus into 5 inch core hole at the TEST location, ensuring proper sealing.
6. Drill $\frac{3}{4}$ inch holes at each measurement point (MP) at the marked distances from the center TEST location. Pack modeling in each measurement point floor penetration.
7. Initiate simulated vacuum at the extraction point/ TEST location.
8. With all other negative pressure reading locations remaining sealed, remove the modeling clay from the each MP individually, and record the resultant.
9. Reseal the 10 foot reading location with modeling clay and repeat the pressure reading at each subsequent negative pressure reading location. Ensure that all locations not being read are sealed with modeling clay.
10. Record all pertinent field data in the Project Field Book.
11. Reseal all floor penetrations.

FOP 083.1

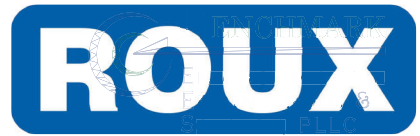
ACTIVE SUBSLAB DEPRESSURIZATION PRE-DESIGN TESTING PROCEDURE

REQUIRED EQUIPMENT

- Personal protective equipment (PPE) (if applicable)
- 100 foot tape measure
- Chalk
- 4 1/2 inch Husqvarna core drill
- 3/4 inch Hilti hammer drill
- Sufficient modeling clay
- Concrete sealant
- Vacuum inducing apparatus (patent pending)
- Micro-manometer
- Camera
- Cell phone
- Field forms
- Project Field Book

REFERENCES

New York State Department of Health, *Guidance for Evaluating Soil Vapor Intrusion in the State of New York*, October 2006.



FIELD OPERATING PROCEDURES

Field Quality Control Procedures

FIELD QUALITY CONTROL PROCEDURES

PURPOSE

In addition to traditional environmental samples (e.g., soil, groundwater, wipe, vapor etc.) described in each project work plan, site-specific field quality assurance/quality control (QA/QC) samples are typically collected and analyzed to support the required third-party data usability assessment effort of a project. Site-specific QA/QC samples generally include matrix spikes, matrix spike duplicates, blind duplicates (where appropriate), and trip blanks which accompany aqueous volatile organic compound (VOC) samples only.

The number of QA/QC field samples (blind duplicate, matrix spike/matrix spike duplicate, trip blank, field blank, or equipment blank) will be designated prior to field mobilization, but final QC sample locations will be contingent upon field conditions. This procedure outlines and discusses each QA/QC sample that may be required during a project.

PROCEDURE

A brief summary of each QA/QC sample identified above is presented below. Where appropriate, the procedure to be used to collect these samples is also presented.

- **Trip Blanks** – A sufficient number of trip blanks for VOC analysis must be prepared by the laboratory and delivered to the sampling team prior to a sampling event, typically two or three 40-ml VOA vials with organic free reagent water. One sealed blank will be carried into the field per day along with the sample containers for each day that water matrix volatile organic samples are collected. Trip blanks will be transported and handled in the same manner as the actual samples. The results of the trip blank analysis will be reviewed to evaluate if the potential for sample contamination during transportation and handling exists. The trip blanks will be analyzed for the same VOCs (and method) as the project groundwater samples.
- **Blind Duplicate** – One blind duplicate must be collected and analyzed per 20 samples collected per matrix (i.e., soil, groundwater, soil vapor, etc.). The location

FIELD QUALITY CONTROL PROCEDURES

of the sample collection point will not be disclosed to the analytical laboratory, therefore the field sample containers will be returned to the laboratory identified only as the “blind duplicate.” The well or sample location will be recorded in the Project Field Book or handheld RuggedReader® Pocket PC and on the field data sheets, and the results will be compared to review analytical precision. Sample analysis will be identical to the original sample per the project work plan. The Blind Duplicate sample must be collected simultaneously from the same source under identical conditions as the original sample.

- **Matrix Spike/Matrix Spike Duplicate (MS/MSD)** – A sufficient volume of sample will be collected at one sampling location per sampling event for MS/MSD analysis per matrix (i.e., soil and groundwater only). The laboratory will report the results of the MS/MSD analysis, which will be reviewed for sampling and analysis precision and accuracy. Sample analysis will be identical to the original sample per the project work plan. The MS/MSD sample must be collected simultaneously from the same source under identical conditions as the original sample.
- **Equipment (Rinsate) Blank** – In general, dedicated sampling equipment is used to minimize field decontamination time and avoid the need for equipment blanks; however there may be instances where the use of non-dedicated equipment cannot be avoided. An equipment blank will be collected for each day of sampling activity when non-dedicated sampling equipment is used. These equipment blank samples will be used as a QC check of the decontamination procedures for sampling equipment. Sample analysis for the equipment blank will consist of the most comprehensive parameter list used for risk assessment in which the non-dedicated equipment was used for environmental sample collection. During most projects, every effort to use dedicated sampling equipment should be made in order to minimize field decontamination time and avoid the need for equipment blanks. Equipment Blank sampling procedure is as follows:
 - Non-dedicated equipment are to be decontaminated in accordance with Roux’s Non-disposable and Non-dedicated Sampling Equipment Decontamination procedures prior to use in the field. If organic-free

FIELD QUALITY CONTROL PROCEDURES

- deionized water (generally provided by the laboratory) is not available for decontamination, equipment will be allowed to thoroughly air dry.
- Once properly rinsed or allowed to air dry, analyte-free water (provided by the laboratory) is poured appropriately over or through the decontaminated sample collection device, collected in a sample container, and returned to the laboratory as a sample.
 - **Field Blank** – A field blank is a sample of the unused final decontamination rinse water that is collected at the sampling site and returned to the laboratory as a sample. Sample analysis for the field blank will consist of the most comprehensive parameter list used during the investigation.
 - **Split Sample** – A split sample is a sample that has been portioned into two or more containers from a single sample container or sample mixing container. Samples for VOC analysis should never be mixed prior to splitting.
 - **Blank Wipe Samples** – There are two types of blank wipe samples, an equipment blank and a field blank that may be required per the project work plan, both are described below:
 - Equipment Blank – Required only if reusable templates are used for wipe sample collection. The decontaminated template is wiped with a hexane saturated swab. The swab is placed in the appropriate sample container and returned to the laboratory as a sample.
 - Field Blank – Clean disposable gloves are wiped with a hexane saturated swab. The swab is placed in the appropriate sample container and returned to the laboratory as a sample.

REFERENCES

Roux FOPs:

040 *Non-disposable and Non-dedicated Sampling Equipment Decontamination*

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FIELD OPERATING PROCEDURES

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Outdoor Ambient Air
VOC Sample
Collection Procedure

OUTDOOR AMBIENT AIR VOC SAMPLE COLLECTION PROCEDURE

PURPOSE

This procedure describes the methods for collecting outdoor ambient air samples for volatile organic compound (VOC) analysis via USEPA Method TO-15 using Summa® canisters (or approved other). Typically, outdoor air samples are collected to characterize and document site-specific VOCs that may be present in outdoor ambient air. For sample collection associated with intrusive activities that may potentially release VOCs to the ambient air, sample location(s) typically are collected downwind of the intrusive activity at the perimeter of the work area and/or exclusion zone for the Site. Upwind sample location(s) may be utilized if regional facilities (e.g. gasoline service station, factories) are located proximate to the Site to assess off-site ambient VOC contributions (background).

SAMPLE COLLECTION PROCEDURES

The following actions should be taken to document conditions during outdoor air sampling and ultimately to aid in the interpretation of the analytical results:

- A site map should be prepared to indicate the outdoor ambient air sample locations including all site improvements (e.g., buildings, access roads, etc.), public roads/streets (if applicable), the location of potential VOC contributors (e.g., gasoline stations, factories, lawn movers, etc.), compass orientation (north), and scale.
- Weather conditions (e.g., precipitation, wind speed, outdoor temperature, and barometric pressure) should be reported on the Air Canister Field Record (sample attached); and
- Any pertinent observations, such as odors, readings from field instrumentation, and significant activities in the vicinity (e.g., operation of heavy equipment or dry cleaners) should be recorded.

OUTDOOR AMBIENT AIR VOC SAMPLE COLLECTION PROCEDURE

The following describes the outdoor air sampling procedure:

1. Typically, a 6-liter, passivated (inert), stainless steel, evacuated sampling sphere (e.g., Summa canister) (or approved other) will be supplied by the laboratory that will be conducting the analysis. The canister should be received from the laboratory, certified clean, evacuated, and prepared for sampling.
2. Sampling will take place in accordance with the project work plan. Selected sample locations will be sufficiently spaced to allow location(s) to be field modified, if necessary.
3. The number of Summa canisters required as well as the flow rate of the constant differential low volume flow controllers will be supplied by the laboratory in accordance with the project work plan.
4. Prior to placement, complete an Air Canister Field Record (sample attached) of each canister, which includes: project information, field staff, weather conditions, canister serial number, flow controller number, sample date(s)/time(s), shipping date(s), canister lab vacuum, field vacuum check, initial field vacuum, final field vacuum, and duration of sample collection.
5. The pressure in the canisters must be monitored with the laboratory provided pressure gauge at the beginning and the end of the sampling period as well as before and after shipment of the canisters at the laboratory. The **target final field vacuum must be approximately 5 inches of mercury. Samples with a final field vacuum of greater than 10 inches of mercury, or equal to zero, will be flagged** and usability of the data will depend on the sample volume and reporting limits that can be achieved.
6. Canisters may be placed on the ground provided there is a clear plastic sheet beneath it to prevent cross contamination. The intake tubing, however, must be positioned at a height of approximately 3 to 5-feet above grade to collect air at an elevation representative of ambient air within the breathing zone. Typically, the canister is chained and locked to a secure step ladder with the intake tubing tethered to the ladder.

OUTDOOR AMBIENT AIR VOC SAMPLE COLLECTION PROCEDURE

7. Ship the canisters to the laboratory under chain-of-custody command within three days of sample collection so that no sample will exceed the 30-day holding time (since receipt from the lab) per USEPA TO-15.
8. Air samples will be analyzed by Gas Chromatography/Mass Spectroscopy (GC/MS) in accordance with EPA Method TO-15, or as specified. Analytical results will be reported as concentrations of each VOC at each location during each sampling event, typically in parts per billion by volume (ppbv).
9. Sample collection should take place on warm, dry days. If rain or high humidity conditions develop during sampling, the sampling event should be suspended. Temperature, barometric pressure, and wind speed should be monitored during the sampling event, for use in analysis of the results. The combination of sampling location, height, and meteorological conditions will assure that sampling will measure VOCs at their highest concentrations.

QUALITY ASSURANCE / QUALITY CONTROL (QA/QC)

Extreme care should be taken during all aspects of sample collection to ensure that sampling error is minimized and high quality data are obtained. The sampling team members should avoid actions (e.g., fueling vehicles, using permanent marking pens, and wearing freshly dry-cleaned clothing or personal fragrances), which can cause sample interference in the field. Appropriate QA/QC protocols must be followed for sample collection and laboratory analysis, such as use of certified clean sample devices, meeting sample holding times and temperatures, sample accession, chain of custody, etc. Samples should be delivered to the analytical laboratory as soon as possible after collection. In addition, laboratory accession procedures must be followed including field documentation (sample collection information and locations), chain of custody, field blanks, field sample duplicates, and laboratory duplicates, as appropriate.

OUTDOOR AMBIENT AIR VOC SAMPLE COLLECTION PROCEDURE

Some methods require collecting samples in duplicate to assess errors. Duplicate and/or split samples should be collected in accordance with the requirements of the sampling and analytical methods being implemented.

For certain regulatory programs, a Data Usability Summary Report (DUSR) may be required to determine whether or not the data, as presented, meets the site or project specific criteria for data quality and data use. This requirement may dictate the level of QC and the category of data deliverable to request from the laboratory. Guidance on preparing a DUSR is available by contacting the NYSDEC's Division of Environmental Remediation.

New York State Public Health Law requires laboratories analyzing environmental samples collected from within New York State to have current Environmental Laboratory Approval Program (ELAP) certification for the appropriate analyte and environmental matrix combinations. If ELAP certification is not currently required for an analyte (e.g., trichloroethene); then the analysis should be performed by a laboratory that has ELAP certification for similar compounds in air and uses analytical methods with detection limits similar to background (e.g., tetrachloroethene via EPA Method TO-15).

ATTACHMENTS

Air Canister Field Record (sample)

REFERENCES

United States Environmental Protection Agency. *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air*. Second Addition (EPA/625/R-96/010b). January 1999.

OUTDOOR AMBIENT AIR VOC SAMPLE COLLECTION PROCEDURE



AIR CANISTER FIELD RECORD

PROJECT INFORMATION:

Project:

Job No:

Location:

Field Staff:

Client:

SAMPLE I.D.:

WEATHER CONDITIONS:

Ambient Air Temp. - A.M.:

Ambient Air Temp. - P.M.:

Wind Direction:

Wind Speed:

Precipitation:

Size of Canister:

Canister Serial No.:

Flow Controller No.:

Sample Date(s):

Shipping Date:

Sample Type: ☐ ☐☐ ☐

Soil Gas Probe Depth:

FIELD SAMPLING INFORMATION:

READING	TIME	VACUUM (inches Hg) or PRESSURE (psig)	DATE	INITIALS
Lab Vacuum (on tag)				
Field Vacuum Check ¹				
Initial Field Vacuum ²				
Final Field Vacuum ³				
Duration of Sample Collection				

LABORATORY CANISTER PRESSURIZATION:

Initial Vacuum (inches Hg and psia)	
Final Pressure (psia)	
Pressurization Gas	

SUBSLAB SHROUD:

Shroud Helium Concentration:

Calculated tubing volume: x 3 =

Purged Tubing Volume Concentration:

Is the purged volume concentration less than or equal to 10% in shroud?

☐☐

COMPOSITE TIME (hours)	FLOW RATE RANGE (ml/min)
15 Min.	316 - 333
0.5 Hours	158 - 166.7
1	79.2 - 83.3
2	39.6 - 41.7
4	19.8 - 20.8
6	13.2 - 13.9
8	9.9 - 10.4
10	7.92 - 8.3
12	6.6 - 6.9
24	3.5 - 4.0

NOTES:¹ Vacuum measured using portable vacuum gauge (provided by Lab)² Vacuum measured by canister gauge upon opening valve³ Vacuum measured by canister gauge prior to closing valve

Signed:



Site Management Forms

Enclosure 1

Certification Instructions

I. Verification of Site Details (Box 1 and Box 2):

Answer the three questions in the Verification of Site Details Section. The Owner and/or Qualified Environmental Professional (QEP) may include handwritten changes and/or other supporting documentation, as necessary.

II. Certification of Institutional Controls/ Engineering Controls (IC/ECs)(Boxes 3, 4, and 5)

1.1.1. Review the listed IC/ECs, confirming that all existing controls are listed, and that all existing controls are still applicable. If there is a control that is no longer applicable the Owner / Remedial Party should petition the Department separately to request approval to remove the control.

2. In Box 5, complete certifications for all Plan components, as applicable, by checking the corresponding checkbox.

3. If you cannot certify "YES" for each Control listed in Box 3 & Box 4, sign and date the form in Box 5. Attach supporting documentation that explains why the **Certification** cannot be rendered, as well as a plan of proposed corrective measures, and an associated schedule for completing the corrective measures. Note that this **Certification** form must be submitted even if an IC or EC cannot be certified; however, the certification process will not be considered complete until corrective action is completed.

If the Department concurs with the explanation, the proposed corrective measures, and the proposed schedule, a letter authorizing the implementation of those corrective measures will be issued by the Department's Project Manager. Once the corrective measures are complete, a new Periodic Review Report (with IC/EC Certification) must be submitted within 45 days to the Department. If the Department has any questions or concerns regarding the PRR and/or completion of the IC/EC Certification, the Project Manager will contact you.

III. IC/EC Certification by Signature (Box 6 and Box 7):

If you certified "YES" for each Control, please complete and sign the IC/EC Certifications page as follows:

- For the Institutional Controls on the use of the property, the certification statement in Box 6 shall be completed and may be made by the property owner or designated representative.
- For the Engineering Controls, the certification statement in Box 7 must be completed by a Professional Engineer or Qualified Environmental Professional, as noted on the form.



Enclosure 2
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
Site Management Periodic Review Report Notice
Institutional and Engineering Controls Certification Form



Site Details

Box 1

Site No.

Site Name

Site Address:

City/Town:

County:

Site Acreage:

Reporting Period:

YES NO

1. Is the information above correct?

☐ ☐

If NO, include handwritten above or on a separate sheet.

2. Has some or all of the site property been sold, subdivided, merged, or undergone a tax map amendment during this Reporting Period?

☐ ☐

3. Has there been any change of use at the site during this Reporting Period (see 6NYCRR 375-1.11(d))?

☐ ☐

4. Have any federal, state, and/or local permits (e.g., building, discharge) been issued for or at the property during this Reporting Period?

☐ ☐

If you answered YES to questions 2 thru 4, include documentation or evidence that documentation has been previously submitted with this certification form.

5. Is the site currently undergoing development?

☐ ☐

Box 2

YES NO

6. Is the current site use consistent with the use(s) listed below?
Commercial and Industrial

☐ ☐

7. Are all ICs in place and functioning as designed?

☐ ☐

**IF THE ANSWER TO EITHER QUESTION 6 OR 7 IS NO, sign and date below and
DO NOT COMPLETE THE REST OF THIS FORM. Otherwise continue.**

A Corrective Measures Work Plan must be submitted along with this form to address these issues.

Signature of Owner, Remedial Party or Designated Representative

Date

SITE NO. 851054

Box 3

Description of Institutional Controls

Parcel

Owner

Institutional Control

Box 4

Description of Engineering Controls

Parcel

Engineering Control

Periodic Review Report (PRR) Certification Statements

1. I certify by checking "YES" below that:

a) the Periodic Review report and all attachments were prepared under the direction of, and reviewed by, the party making the Engineering Control certification;

b) to the best of my knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program, and generally accepted engineering practices; and the information presented is accurate and complete.

YES NO

☐☐

2. For each Engineering control listed in Box 4, I certify by checking "YES" below that all of the following statements are true:

(a) The Engineering Control(s) employed at this site is unchanged since the date that the Control was put in-place, or was last approved by the Department;

(b) nothing has occurred that would impair the ability of such Control, to protect public health and the environment;

(c) access to the site will continue to be provided to the Department, to evaluate the remedy, including access to evaluate the continued maintenance of this Control;

(d) nothing has occurred that would constitute a violation or failure to comply with the Site Management Plan for this Control; and

(e) if a financial assurance mechanism is required by the oversight document for the site, the mechanism remains valid and sufficient for its intended purpose established in the document.

YES NO

☐☐

**IF THE ANSWER TO QUESTION 2 IS NO, sign and date below and
DO NOT COMPLETE THE REST OF THIS FORM. Otherwise continue.**

A Corrective Measures Work Plan must be submitted along with this form to address these issues.

Signature of Owner, Remedial Party or Designated Representative

Date

IC CERTIFICATIONS
SITE NO. 851054

Box 6

SITE OWNER OR DESIGNATED REPRESENTATIVE SIGNATURE

I certify that all information and statements in Boxes 1,2, and 3 are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law.

I _____ at _____,
print name print business address

am certifying as _____(Owner or Remedial Party)

for the Site named in the Site Details Section of this form.

Signature of Owner, Remedial Party, or Designated Representative
Rendering Certification

Date

EC CERTIFICATIONS

Box 7

Qualified Environmental Professional Signature

I certify that all information in Boxes 4 and 5 are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law.

I _____ at _____,
print name print business address

am certifying as a Qualified Environmental Professional for the _____
(Owner or Remedial Party)

Signature of Qualified Environmental Professional, for
the Owner or Remedial Party, Rendering Certification

Stamp
(Required for PE)

Date

Climate Screening Checklist

Climate Screening Checklist

Background Information

- Project Manager: **Nathan Munley**
- Site Name: **1681-1689 Main Street**
- Site Number: **C915378**
- Site Location: **1681, 1689, 1703, and 1707 Main Street, Buffalo, NY**
- Site Elevation (average above sea level): **Approximately 629.9 feet based on elevation finder map.**
- ClimAID Region ([Responding Climate Change in New York State \(ClimAID\) - NYSERDA](#)): **Region 1 - Western New York Great Lakes Plain**
- Remedial Stage/site classification: **Site Management - Class 4**
- Contamination - Media Impacted/ Contaminants of Concern: **Groundwater/VOCs including cVOCs**
- Proposed/Current Remedy: **Remedial actions have removed soil from the Site achieving USCOs. Due to the presence of groundwater contamination above GWQS, a conditional Track 1 Certificate of Completion is anticipated for the Site. If the groundwater does not achieve the Remedial Action Objectives within 5 years, the Conditional Track 1 will default to Track 2 Residential Cleanup.**
- What is the predicted timeframe of the remedy? Will components of the remedy still be in place in 10+ years? **Predicted timeframe of the remedy is 5 years at the most.**
- Is the site in proximity to any sensitive receptors? (e.g. wetlands, waterbodies, residential properties, hospitals, schools, drinking water supplies, etc.) **Residential properties are in the vicinity of the property; however, wells downgradient of the impacted wells did not exceed GWQS.**

Is the site in a disadvantaged community (DAC) or potential environmental justice area (PEJA) (Use DECinfoLocator: [DECinfo Locator \(ny.gov\)](#))?

☒ Yes ☐ No

If the site is in a DAC or PEJA, will climate impacts be magnified? If yes, list how and why.

☐ Yes ☒ No

Should thresholds of concern be lowered to account for magnification of impacts? If yes, indicate how lower thresholds will be used in the screening.

☐ Yes ☒ No

--

Climate Screening Table*

Potential Climate Hazards	Relevant to the Site Location (Y/N/NA) ¹	Projected Change (Reference data source/Model) ³	Potential to Impact Remedy (Y/N)	Is remedy/site already resilient? (Y/N) ⁴
Precipitation	N	N/A	N/A	N/A
Temperature ² (Extreme Heat or Cold Weather Impacts)	Potentially	N/A	N/A	N/A
Sea Level Rise	No	N/A	N/A	N/A
Flooding	No	N/A	N/A	N/A
Storm Surge	No	N/A	N/A	N/A
Wildfire	No	N/A	N/A	N/A
Drought	Potentially	Average rainfall in Buffalo NY is 38.1 inches	No based on strategic sampling	N/A
Storm Severity	No	N/A	N/A	N/A
Landslides	No	N/A	N/A	N/A
Other Hazards:				

* Links to potential data sources can be found on the following page

¹ If the first column is N --> The rest of the columns will be N/A, the hazard is not applicable to the site.

² Extreme Heat: periods of three or more days above 90°F- Extreme Cold: Individual days with minimum temperatures at or below 0 degrees F (NYSERDA ClimAID report)

³ List the projected change in specific terms or units e.g. inches of rain fall, feet of sea level rise, etc.

⁴ If final column is Y, provide reasoning, if the final column is N --> Climate Vulnerability Assessment (CVA) required.

Required Next Steps (If no further action is required, provide justification):

No further actions at this time.

Potential Data Sources (not an exhaustive list)- from [Superfund Climate Resilience: Vulnerability Assessment | US EPA](#)

NYSERDA ClimAID report- [Responding Climate Change in New York State \(ClimAID\) - NYSERDA](#)

FEMA- [National Flood Hazard Layer | FEMA.gov](#)

NOAA- [National Storm Surge Risk Maps - Version 3 \(noaa.gov\)](#)

Department of Agriculture Forest Service [Wildfire Risk to Communities](#)

EPA [Climate Change Indicators in the United States](#)

EPA [Climate Resilience Evaluation & Awareness Tool \(CREAT\) | U.S. Climate Resilience Toolkit](#)

EPA [National Stormwater Calculator](#)

National Integrated Drought Information System [U.S. Drought Portal](#)

National Interagency Coordination Center [National Interagency Fire Center](#)

National Oceanic and Atmospheric Administration Coastal Services [Digital Coast](#)

- Resources to help communities assess coastal hazards, such as the [Sea Level Rise Viewer](#) for visualizing community-level impacts of flooding or sea level rise and [downloadable LIDAR data](#)

National Oceanic and Atmospheric Administration [National Centers for Environmental Information](#) website

National Oceanic and Atmospheric Administration [Sea Level Trends](#)

National Weather Service [Climate Prediction Center](#)

National Weather Service [National Hurricane Center](#)

National Weather Service [Sea, Lake, and Overland Surges from Hurricanes \(SLOSH\)](#)

National Weather Service [Storm Surge Hazard Maps](#)

U.S. Federal Government Climate Resilience Toolkit: [The Climate Explorer](#)

U.S. Army Corps of Engineers [Climate Preparedness and Resilience](#)

U.S. Geological Survey [Coastal Change Hazards Portal](#)

U.S. Geological Survey [Landslide Hazards Program](#)

U.S. Geological Survey [National Ground-water Monitoring Network Data Portal](#)

U.S. Geological Survey [National Climate Change Viewer](#)

U.S. Geological Survey [National Water Dashboard](#)

U.S. Geological Survey [StreamStats](#)

NYS Department of State- [Assess | Department of State \(ny.gov\)](#)

NYSERDA NY Costal Floodplain Mapper- [Home Page \(ny.gov\)](#)

NYSDEC Costal Erosion Hazards- [Coastal Areas Regulated By The CEHA Permit Program - NYDEC](#)

NYSDOH Heat Index- [health.ny.gov/environmental/weather/vulnerability_index/county_maps.htm](#)

Remedial System Optimization TOC

REMEDIAL SYSTEM OPTIMIZATION FOR 1681-1689 Main Street Site

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