Site Management Plan

1827 Fillmore Avenue Site
BCP Site No. C915279
Buffalo, New York

November 2019 B0421-017-001

Prepared For:

1827 Fillmore LLC

Prepared By:

Benchmark Environmental Engineering & Science, PLLC

In Association With:

TurnKey Environmental Restoration, LLC

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BROWNFIELD CLEANUP PROGRAM

SITE MANAGEMENT PLAN

1827 FILLMORE AVENUE SITE
NYSDEC SITE NUMBER: C915279
BUFFALO, NEW YORK

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Revisions to Final Approved Site Management Plan:

Revision #	Submitted Date	Summary of Revision	DEC Approval Date

SITE MANAGEMENT PLAN
1827 FILLMORE AVENUE SITE

Certification Statement

I, Thomas H. Forbes P.E., certify that I am currently a NYS registered professional engineer and that this November 2019 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).

____________________________P.E.

11-14-19
____________________________Date

STATE OF NEW YORK
THOMAS H. FORBES
No. 70960-1
LICENSED PROFESSIONAL ENGINEER

SITE MANAGEMENT PLAN
1827 FILLMORE AVENUE SITE

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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
EC	Engineering Control
ECL	Environmental Conservation Law
ELAP	Environmental Laboratory Approval Program
ERP	Environmental Restoration Program
GHG	Green House 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	Operations and Maintenance
OM&M	Operation, Maintenance and Monitoring
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PID	Photoionization Detector
PRP	Potentially Responsible Party
PRR	Periodic Review Report
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
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

List of Acronyms

RP	Remedial Party
RSO	Remedial System Optimization
SAC	State Assistance Contract
SCG	Standards, Criteria, and Guidelines
SCO	Soil Cleanup Objective
SMP	Soil 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
SVMS	Soil Vapor Mitigation System
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

EXECUTIVE SUMMARY

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

Site Identification: 1827 Fillmore Avenue Site - C915279

Institutional Controls:	1. The property may be used for commercial and industrial use as described in 6 NYCRR Part 375-1.8(g), although land is subject to local zoning laws;
	2. All ECs must be inspected at a frequency and in a manner defined in the SMP.
	3. The use of the 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.
	4. Compliance with the Department approved Site Management Plan and Periodic Review Reporting is required.
	5. The remedial party or site owner is required to complete and submit a periodic certification of institutional and engineering controls to the Department in accordance with 6NYCRR Part 375-1.8(h)(3.)
Engineering Controls:	1. A site cover has been placed over the site in all areas exceeding applicable SCOs. The cover is either a hardscape (asphalt pavement) and/or a minimum of 12-inches of depth of material meeting the requirements as set forth in 6 NYCRR Part 375-6.7(d) for commercial use.

Inspections:	Frequency
1. Cover inspection	Annually
Monitoring:	
1. Groundwater Monitoring Wells MW-1, MW-2, MW-3, MW-5, MW-7, MW-9 and MW-10	Annually; re-evaluated annually
Reporting:	
2. 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

This Site Management Plan (SMP) is a required element of the remedial program for the 1827 Fillmore Avenue Site located in the City of Buffalo, New York (hereinafter referred to as the "Site"). The Site is currently in the New York State (NYS) Brownfield Cleanup Program (BCP), administered by New York State Department of Environmental Conservation (NYSDEC). The Site was remediated in accordance with Brownfield Cleanup Agreement (BCA) Index #C915279-10-17, which was executed on November 8, 2017, and BCA Amendment No. 1- Change in Ownership, which was executed on September 5, 2019.

1.1 General

1827 Fillmore LLC entered into a BCA with the NYSDEC to investigate and remediate the Site. Figures 1 and 2 show the Site location and boundaries. 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.

After completion of the remedial work, some contamination was left at this site, which is hereafter referred to as "remaining contamination." Institutional and Engineering Controls (ICs and ECs) 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 ECs and ICs placed on the Site.

This SMP was prepared by Benchmark Environmental Engineering and Science, PLLC (Benchmark) in association with TurnKey Environmental Restoration, LLC (TurnKey) on behalf of 1827 Fillmore LLC 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);

- Failure to comply with this SMP is also a violation of Environmental Conservation Law, 6NYCRR Part 375 and the BCA, Index #C915279-10-17; Site #C915279 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.

This SMP was prepared in accordance with the requirements of the NYSDEC's DER-10 ("Technical Guidance for Site Investigation and Remediation"), dated May 2010 (Ref. 1), 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

Revisions to this plan will be proposed in writing to the NYSDEC's project manager. Revisions will be necessary upon, but not limited to, the following occurring: a change in media monitoring requirements, post-remedial removal of contaminated soil, or other significant change to the site conditions. In accordance with the Environmental Easement for the site, the NYSDEC 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:

- 60-day advance notice of any proposed changes in site use that are required under the terms of the BCA, 6NYCRR Part 375 and/or Environmental Conservation Law.
- 7-day advance notice of any field activity associated with the remedial program.
- 15-day advance notice of any proposed ground-intrusive activity pursuant to the Excavation Work Plan.

- 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.
- 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.
- 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.

The owner of the Site parcel at the time of issuance of this SMP is:

1827 Fillmore LLC
424 Main Street, Suite 2000
Buffalo, New York 14202

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

- 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 BCA and all approved work plans and reports, including this SMP.
- 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 below includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information.

Table 1: Notifications*

Name	Contact Information
NYSDEC Project Manager Mr. David Locey	716-851-7220 David.Locey@dec.ny.gov
NYSDEC Regional HW Engineer Mr. Chad Staniszewski, P.E.	716-851-7220 Chad.Staniszewski@dec.ny.gov
NYSDEC Site Control Ms. Kelly Lewandowski, P.E.	518-402-9543 Kelly.Lewandowski@dec.ny.gov

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

2.0 SUMMARY OF PREVIOUS INVESTIGATION & REMEDIAL ACTIONS

2.1 Site Location and Description

The site is located in the City of Buffalo, Erie County, New York and is identified as S.B.L. 90.13-1-11 on the Erie County Tax Map. The site is an approximately 17.15-acre area and is bounded by the Kensington Expressway (Route 33) to the north with commercial and residential properties beyond; Buffalo Public School #89, Dr. Lydia T. Wright School of Excellence and athletic fields to the south with Appenheimer Avenue beyond; Erie County Medical Center (ECMC) and Buffalo Public School #84 to the east; and Fillmore Avenue to the west with commercial properties and the Kensington Expressway beyond (see Figure 2). The boundaries of the site are more fully described in Appendix A –Environmental Easement.

2.2 Physical Setting

2.2.1 Land Use

The Site is currently vacant land with vegetated areas, asphalt paved areas and former roadways. The Site is located within one of Buffalo's District Zones (D-C Flex Commercial) which will allow for its proposed redevelopment and use as a parking lot.

The properties adjoining the Site and in the neighborhood surrounding the Site primarily include commercial, residential, and light industrial properties. ECMC Hospital is located immediately east of the site. The properties immediately south and northeast of the Site include schools with residential properties beyond; the properties immediately north of the Site include commercial and residential properties; and the properties to the west of the Site include commercial and light industrial properties.

2.2.2 Geology

The Site is located within the Lake Erie/Niagara River Major Drainage Basin which is typified by little topographic relief and gentle slope toward Lake Erie, except in the immediate vicinity of major drainage ways.

Investigation activities characterized the overburden soil/fill as generally consisting of fill with sand, gravel, cinders, ash and/or other non-native materials, which are ubiquitous across the Site in overburden soils and range in thickness from grade to bedrock encountered at varying depths across the Site. A layer of weathered concrete was noted in former building locations at depths ranging between 1 foot below ground surface (fbgs) and 3.5 fbgs.

Based on the bedrock geologic map of Erie County, the Site is situated over the Onondaga Formation of the Middle Devonian Series. The Onondaga Formation is comprised of a varying texture from coarse to very fine crystalline with a dark gray to tan color and chert and fossils within. The unit has an approximate thickness of 110 to 160 feet. Structurally, the bedrock formations strike in an east-west direction and exhibit a regional dip that approximates 40 feet per mile (3 to 5 degrees) toward the south and southwest. Bedrock was encountered at 16 Remedial Investigation (RI) locations at varying depths across the Site with ranges between 3 and 24 fbgs. For reference purposes, borehole logs from the previous investigations (completed by Benchmark) are included electronically in Appendix B.

2.2.3 Hydrogeology

The water table in the central and eastern portions of the Site was observed during drilling between 14 fbgs and 18 fbgs, typically within an ash fill layer. No evidence of overburden groundwater was encountered on the western portion of the Site at MW-1, MW-2 and MW-3. As requested by the NYSDEC, due to the lack of overburden groundwater, bedrock wells were installed at MW-1, MW-2 and MW-3 for groundwater sampling purposes. MW-4 was dry at the time of development and sampling and MW-4 remained dry when checked during supplemental RI activities thus MW-4 could not be sampled. Groundwater at the Site generally flows in a westerly direction.

Figure 3 is a groundwater isopotential map using the groundwater elevation data from the RI. Appendix B includes monitoring well construction logs.

2.3 Investigation and Remedial History

2.3.1 Remedial Investigation

Benchmark-TurnKey completed and submitted to NYSDEC a Remedial Investigation Alternatives Analysis Report (RI/AA), dated January 2019, on behalf of 1827 Fillmore LLC (Ref. 2). The public comment period ended on March 22, 2019 and the Decision Document was issued on March 27, 2019. The RI/AA report included a detailed review of previous studies completed by others. The RI was completed in accordance with the approved RI Work Plan dated November 2017 (Ref. 3) and three approved supplemental Work Plans dated February 13, 2018 (Ref. 4), April 13, 2018 (Ref. 5), and June 18, 2018 (Ref. 6).

On-site field activities included soil boring advancement; test pit excavations (across the Site and within two soil/fill mounds); surface soil/fill sampling; overburden and bedrock monitoring well installation; and groundwater quality sample collection. Results of the RI and a historic Phase II by others are provided below.

Summary of RI & Historic Phase II Findings by Media

Surface Soil/Fill

- Individual polycyclic aromatic hydrocarbon (PAH) concentrations exceeding Commercial Soil Cleanup Objectives (CSCOs) at 12 of 15 surface soil/fill sample locations. The highest total PAH concentration was 818 milligrams per kilogram (mg/kg) at SS-13 collected in a former building location. Total PAHs exceeding 500 mg/kg were not identified at the other surface soil sample locations.
- Semi-volatile organic compound (SVOC) tentatively identified compounds (TICs) were either non-detect or at minimal concentrations.
- No metals or pesticides were identified at concentrations exceeding Part 375 CSCOs.
- Herbicides and polychlorinated biphenyls (PCBs) were non-detect.

Surface Soil/Fill

- Odors and elevated photoionization detector (PID) readings were identified during the RI at TP-8, TP-9, TP-23 and MW-8. The highest PID reading of 276 parts per million (ppm) along with unknown odors were identified at TP-9 at 10 to 12 fbgs. The highest PID reading identified during the 2012 Phase II was 37.6 ppm at SB-43. No olfactory concerns were identified during the 2012 Phase II.
- Volatile organic compounds (VOCs) were either non-detect or at concentrations significantly below CSCOs in fill samples collected as part of the historic Phase II and RI activities completed at the Site.
- Individual PAHs exceeded their respective CSCOs in fill samples collected from across the Site; however, the only area with total PAH concentrations exceeding 500 mg/kg is at the TP-25/SS-13 area (935 mg/kg at TP-25 (0-2')).
- The highest total lead concentrations from the RI and 2012 Phase II were 8,400 mg/kg at MW-6 (8-10') and 21,800 mg/kg at SB-21 (12-16'), respectively.
- Toxicity Characteristic Leachate Procedure (TCLP) lead exceeding its respective characteristic hazardous waste threshold of 5 milligrams per liter (mg/L) was identified at TP-13 (10-15'), TP-13R (15-17'), TP-13-1 (10-15'), SB-21-4 (12-16'), SB-21-7 (12-16'), and SB-21-8 (12-16'). Characteristic hazardous lead was limited in extent and localized in the TP-13 and SB-21 areas, which were addressed during the completed Remedial Action.
- The highest arsenic concentration identified during the previous Phase II was 73 mg/kg at historic boring SB-41 (8-11'). However, supplemental sampling completed in the SB-41 area, including resampling of SB-41 (8-11') indicate arsenic concentrations below its respective Unrestricted SCO (USCO) or CSCO.
- Additional metals exceeding CSCOs from the RI included copper and mercury at TP-8 (6-9') and barium at TP-9 (10-12') and MW-8 (14-16').
- No pesticides, herbicides or PCBs exceeded CSCOs.

Groundwater

- One VOC, 4-isopropyltoluene, was detected in one overburden well (MW-8) at a concentration of 9.3 micrograms per liter (ug/L), which slightly exceeded its Groundwater Quality Standards/Guidance Values (GWQS/GV) of 5.0 micrograms per liter (ug/L).
- SVOCs, pesticides, herbicides and PCBs were either non-detect or at concentrations below GWQS/GV.
- Dissolved metals were non-detect or below GWQS/GV except for naturally occurring minerals manganese and sodium.
- Low level estimated concentrations of per- and polyfluoroalkyl substances (PFAs) were detected in the overburden groundwater samples collected from groundwater wells MW-7 and MW-8.
- The unknown odors identified during overburden well development and sampling activities do not appear to be associated with groundwater impacts.
- As previously indicated, overburden groundwater generally flows in a westerly direction.

Contamination Summary/Hot Spots

While fill materials with elevated PAHs and metals above CSCOs were identified across the Site, four distinct "hot spots" were identified and designated: TP-13 Lead Area, SB-21 Lead Area, MW-6 Lead Area, and the TP-25/SS-13 PAH area, as further described below:

- TP-13 Lead Area – located on the northern portion of the Site, characteristic hazardous lead concentrations between 8 mg/L and 12.7 mg/L were identified at depths ranging between 10 fbgs and 17 fbgs.
- SB-21 Lead Area – located on the eastern portion of the Site, characteristic hazardous lead concentrations between 5.3 mg/L and 22.7 mg/L were identified at depths ranging between 12 fbgs and 16 fbgs. Relatively high total lead concentrations (6,545 mg/kg and 21,800 mg/kg) were identified in soil immediately surrounding sample location SB-21.
- MW-6 Lead Area – located on the northern portion of the Site, a relatively high total lead concentration of 8,400 mg/kg at 8 fbgs to 10 fbgs. The TCLP lead concentration

of this sample (0.057 mg/L) was significantly below the characteristic hazardous waste threshold (5 mg/L).

- TP-25/SS-13 PAH Area – located on the southeastern portion of the Site, total PAH concentrations exceeding the threshold of 500 mg/kg were identified at TP-25 (935 mg/kg) and SS-13 (818 mg/kg) at depths from the ground surface to 2 fbgs.

2.3.2 Remedial Action Activities

Based on the findings of the RI-AAR, as described above, remedial activities were completed in accordance with the Department approved May 2019 Remedial Action Work Plan (Ref. 7). Details of the completed remedial activities are presented below, and more fully documented in the FER.

Benchmark-TurnKey performed bench-scale treatability tests using soil/fill from the TP-13 and SB-21 lead areas, which indicated that blending 5% Portland cement or 0.5% phosphoric acid by weight will stabilize lead to below 5 mg/L TCLP lead. Portland cement was selected as the lead stabilization amendment for the 1827 Fillmore Avenue Site. Remedial activities included (see Figure 4):

<u>SB-21 Area Lead-Impacted Hotspot</u>

SB-21 area lead-impacted hotspot remediation and excavation activities were completed between May 15, 2019 and June 10, 2019. The remediation and excavation activities included:

- Excavation of clean overburden soil/fill from grade to a depth of 12 fbgs and staged on-Site for reuse as backfill.
- MW-8 was properly decommissioned by Benchmark on May 17, 2019 (see Appendix B).
- Approximately 1,900 cubic yards of characteristic hazardous lead soil/fill from 12-20 fbgs in the SB-21 area was treated in-situ using Portland cement for lead stabilization in accordance with the RAWP.
- Approximately 60 tons of lead-impacted soil/fill was excavated by Zoladz Construction, Inc., (Zoladz) and transported off-Site by Gernatt Asphalt Products (9A-537) and D&H Excavating (9A-834) for disposal at Waste Management commercial landfill in Chaffee, New York.

- Based on the relatively high total lead concentration observed in SB-21, approximately 160 tons of soil immediately surrounding sample location SB-21 was stabilized in-situ, excavated to meet the site-specific action level (SSAL) of 3,900 mg/kg, and transported off-Site by Mallare Enterprises (9A-738), Laraba Enterprises (9A-499), and Iroquois Bar Corp. (9A-759) for disposal at Waste Management commercial landfill in Chaffee, New York. Remaining stabilized soils meeting the SSALs of 3,900 mg/kg total lead and 5 mg/L TCLP lead were backfilled and recompacted at the bottom of the excavation as backfill.
- Collection of 6 post-treatment samples and analyzed for TCLP and total lead. All post treatment samples were below the TCLP lead characteristic hazardous waste threshold of 5 mg/L (see Table 2 and Figure 5).
- Collection of end-point samples for analysis of TCLP and total lead. End-point samples included 14 floor samples and 26 perimeter samples. All end-point samples were below the SSALs of 3,900 mg/kg for total lead and 5 mg/L for TCLP lead (see Table 3 and Figure 5).
- The remaining excavation was backfilled with staged overburden soils and approved soil from the on-Site stockpile.

<u>TP-25/SS-13 Area PAH-Impacted Hotspot</u>

TP-25/SS-13 area PAH-impacted hotspot excavation activities were completed between June 5, 2019 and June 7, 2019. The excavation activities included:

- Approximately 1,800 tons of PAH-impacted soil fill was excavated to a depth of 2 fbgs and transported off-Site by Zoladz Construction (9A-499), Dulski Construction (9A-499), Pariso Trucking (9A-826), Gernatt Asphalt Products (9A-537), Mallare Enterprises (9A-738), and Laraba Enterprises (9A-499) for disposal at Waste Management commercial landfill in Chaffee, New York.
- Collection of end-point samples for analysis of PAHs. End-point samples included 20 floor samples and 14 perimeter samples. All end-point samples were below the SSAL of 500 mg/kg for total PAHs (see Table 4 and Figure 6).
- The area was backfilled using clean approved soil from the on-Site stockpile.

TP-13 Area Lead-Impacted Hotspot

TP-13 area lead-impacted hotspot remediation and excavation activities were completed between May 28, 2019 and June 7, 2019. The remediation and excavation activities included:

- Excavation of clean overburden soil/fill from grade to a depth of 10 fbgs, which was staged on-Site for reuse as backfill.
- In-situ stabilization, using Portland cement, of approximately 1,300 cubic yards of characteristic hazardous lead soil/fill in TP-13 area from 10-17 fbgs in accordance with the RAWP.
- Collection of 4 post-treatment samples analyzed for TCLP lead; All post-treatment samples were non-detect (see Table 5 and Figure 7).
- Collection of end-point samples for analysis of TCLP and total lead. End-point samples included 6 floor samples and 6 perimeter samples. All end-point samples were below the SSALs of 3,900 mg/kg for total lead and 5 mg/L for TCLP lead (see Table 6 and Figure 7).
- Stabilized soils were backfilled and recompacted at the bottom of the excavation as backfill.
- The remaining hotspot area was backfilled using staged overburden soils and approved soil from the on-Site stockpile.

MW-6 Area Lead-Impacted Hotspot

MW-6 area lead-impacted hotspot excavation activities were completed between June 5, 2019 and June 7, 2019. The remediation and excavation activities included:

- Excavation of clean overburden soil/fill from grade to a depth of 8 fbgs and staged on-Site for reuse as backfill.
- MW-6 was properly decommissioned by Benchmark on June 21, 2019 (see Appendix B).
- Approximately 270 tons of lead-impacted soil/fill was excavated from a depth of 8-12 fbgs and transported off-Site by Gernatt Asphalt Products (9A-537) and D&H Excavating (9A-834) for disposal at Waste Management commercial landfill in Chaffee, New York.

- Collection of end-point samples for analysis of TCLP and total lead. End-point samples included 2 floor samples and 4 perimeter samples. All end-point samples were below the SSALs of 3,900 mg/kg for total lead and 5 mg/L for TCLP lead (see Table 7 and Figure 8).
- The area was backfilled using staged overburden soils and clean approved soil from the on-Site stockpile.

Details of the completed remedial activities are presented below, and more fully documented in the FER.

2.4 Remedial Action Objectives

The Remedial Action Objectives (RAOs) for the Site as listed in the Decision Document dated March 27, 2019 are as follows:

2.4.1 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.

2.4.2 Groundwater:

RAOs for Public Health Protection

- Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards.

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2.5 Remaining Contamination

The 1827 Fillmore Avenue Site was remediated to achieve a Track 4 Commercial Use cleanup, which is consistent with the intended use of the Site.

Residual contamination remaining at the Site includes soil/fill located beneath the cover system, though potential exposure is mitigated due to the depth of the contaminant, completion of the remedial activities, and placement of a Site cover system, including asphalt covered areas and vegetated soil cover areas.

2.5.1 Soil/Fill

Residual soil/fill contamination remaining on-site above Unrestricted Use SCO, includes VOCs, SVOCs (PAHs), metals, and pesticides located beneath the cover system. The cover includes hardscape (asphalt pavement) areas with most of the site covered with 12 inches of approved vegetated cover material above the demarcation layer. Details of the cover system are provided below. Tables 8, 9A, and 9B summarize the remaining on-site surface and subsurface soil/fill with constituents above USCOs, as shown on Figure 9.

Any remaining soil/fill constituents above regulatory guidelines remaining on-site are located beneath the cover system. Potential exposure to the remaining contamination is mitigated due to the depth of the remaining contamination after the completion of remedial measures, depth to on-site groundwater, and placement of a cover system.

2.5.2 Groundwater

RI monitoring wells MW-6 and MW-8 were decommissioned during remedial action activities, described above. Remaining RI groundwater results include two metals above their respective GWQS. Specifically, manganese at four locations, and sodium at four locations (see Table 10 and Figure 3).

Depth to water ranged from 9.5 to 25 fbgs during the RI. Due to the depth of groundwater and the placement of a cover system, potential exposure to the remaining contamination is unlikely.

3.0 INSTITUTIONAL & ENGINEERING CONTROL PLAN

3.1 General

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

This plan provides:

- A description of all IC/ECs on the site;
- The basic implementation and intended role of each IC/EC;
- 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 IC/ECs, such as the implementation of the Excavation Work Plan (EWP) (as provided in Appendix C) for the proper handling of remaining contamination that may be disturbed during maintenance or redevelopment work on the site; and
- Any other provisions necessary to identify or establish methods for implementing the IC/ECs required by the site remedy, as determined by the NYSDEC.

3.2 Institutional Controls

A series of ICs is required by the Decision Document to: (1) implement, maintain and monitor Engineering Control systems; (2) prevent future exposure to remaining contamination; and, (3) limit the use and development of the site to commercial and industrial uses only. 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 ICs include:

- Allows the use and development of the controlled property for commercial uses as defined by Part 375-1.8(g), although land use us subject to local zoning laws;
- Requires compliance with the Department approved SMP;
- Restricts the use of groundwater underlying the Site as a source of potable water, without necessary water quality treatment as determined by the NYS Department of Health (DOH) or the Erie County DOH;
- Data and information pertinent to site management must be reported at the frequency and in a manner as defined in this SMP;
- All future activities that will disturb remaining contaminated material must be conducted in accordance with this SMP;
- Operation, maintenance, monitoring, inspection, and reporting of any physical component of the remedy shall 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.
- Vegetable gardens and farming on the site are prohibited;

3.3 Engineering Controls

3.3.1 Cover System

Exposure to remaining contamination at the Site is prevented by a cover system placed over the site. This cover system is comprised of a minimum of 12 inches of DER-10 compliant soil/stone material over a demarcation layer, and hardscape elements of the redevelopment, including asphalt pavement. Figure 10 presents the location of the cover system and applicable demarcation layers. Construction drawings, prepared by others, related to the new parking area of the redevelopment are provided electronically in Appendix D for reference.

The Excavation Work Plan (EWP) provided in Appendix C outlines the procedures required to be implemented in the event the cover system is breached, penetrated, or temporarily removed, and any underlying remaining contamination is disturbed. Procedures for the inspection of this cover are provided in the Monitoring and Sampling Plan included in Section 4.0 of this SMP. Any work conducted pursuant to the EWP must also be conducted in accordance with the procedures defined in a Health and Safety Plan (HASP) and associated Community Air Monitoring Plan (CAMP) prepared for the site and provided in Appendix E.

3.3.2 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.

3.3.2.1 Cover System

The composite cover system is a permanent control and the quality and integrity of this system will be inspected at defined, regular intervals in accordance with this SMP.

4.0 MONITORING PLAN

4.1 General

This Monitoring Plan describes the measures for evaluating the overall performance and effectiveness of the remedy. This Monitoring Plan may only be revised with the approval of the NYSDEC.

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

- Sampling and analysis of all appropriate media (e.g., groundwater);
- Assessing compliance with applicable NYSDEC standards, criteria and guidance (SCGs), particularly groundwater standards;
- Monitoring the performance and effectiveness of the Site cover;
- A schedule of monitoring and frequency of submittals to the Department.
- 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 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 (annually), and/or at a lesser frequency as approved by the Department. Modification to the frequency or duration of the inspections will require approval from the NYSDEC. 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;
- 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 (PRR). 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; and

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 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 determined by the NYSDEC. Written confirmation must be provided to the NYSDEC 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.

4.3 Post-Remediation Media Monitoring and Sampling

Groundwater samples shall be collected from the Site. The sampling locations, required analytical parameters, and schedule are provided in Table 11 – Post Remediation Sampling Requirements and Schedule. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

Detailed sample collection and analytical procedures and protocols are provided below and in Appendix H – Field Activities Plan and Appendix I – Quality Assurance Project Plan.

4.3.1 New Monitoring Well Installation

Two (2) new overburden monitoring wells, designated MW-9 and MW-10, will be installed in the locations shown on Figure 10 with drill rig capable of advancing hollow stem augers to install 2-inch inside diameter PVC monitoring wells. Each well location will be advanced to a target minimum of five (5) feet below the first encountered groundwater or a target depth of 25 fbgs, which is the approximate depth to bedrock in the area of planned monitoring wells.

Subsequent to boring completion, a 2-inch ID diameter flush-joint Schedule 40 PVC monitoring well will be installed at each location. Each well will be constructed with a minimum 10-foot flush-joint Schedule 40 PVC, 0.010-inch machine slotted well screen. Each well screen and attached riser will be placed at the bottom of each borehole and a silica sand filter pack (size #0) will be installed from the base of the well to a minimum of two (2) feet above the top of the screen. A bentonite chip seal will then be installed and allowed to hydrate sufficiently to mitigate the potential for downhole grout contamination. The newly installed monitoring wells will be completed with stick-up casings over the riser, and lockable J-plugs with keyed-alike locks.

Upon installation, the new monitoring wells and existing monitoring wells will be surveyed to determine relative groundwater elevations and flow direction.

4.3.1.1 New Monitoring Well Development

After installation, but not within 24 hours, the newly installed monitoring wells will be developed in accordance with NYSDEC protocols. Development of the monitoring wells will be accomplished via surge and purge methodology. Field parameters including pH, temperature, turbidity, dissolved oxygen (DO), oxidation-reduction potential (ORP) and specific conductance will be measured periodically (i.e., every well volume or as necessary) during development. Field measurements will continue until they became relatively stable. Stability will be defined as variation between measurements of approximately 10 percent or less with no overall upward or downward trend in the measurements. A minimum of ten (10) well volumes will be evacuated from each monitoring well. Development water from the monitoring wells will be discharged to the ground surface in the vicinity of the monitoring well being developed. However, if light non-aqueous phase liquid (LNAPL), dense non-aqueous phase liquid (DNAPL), odors, or sheen are encountered during well development water will be containerized in NYSDOT-approved drums and labeled per monitoring well location. Based on the groundwater analytical results, it will be determined, in consultation with NYSDEC, if the containerized development water is acceptable for surface discharge, or requires subsequent on-site treatment and/or off-site disposal.

4.3.1.2 New Monitoring Well Groundwater Sample Collection

Sampling will be performed as soon as practical after purging as long as the well has recovered sufficiently to sample or within 24 hours after evacuation if the well recharges slowly. Prior to sample collection, static water levels will be measured and recorded from all on-site monitoring wells to facilitate the preparation of a Site-wide isopotential map. Following water level measurement, field personnel will purge and sample monitoring wells using a submersible pump with dedicated pump tubing following low-flow/minimal drawdown purge and sample collection procedures. In the event of pump failure or the saturated unit does not permit the proper implementation of low-flow sampling, a dedicated polyethylene bailer will be used to purge and sample the well. Groundwater will be evacuated from each well at a low-flow rate (typically less than 0.1 L/min) while maintaining a generally consistent water level. Field measurements for pH, temperature, turbidity, DO, ORP, specific conductance and water level, as well as visual and olfactory field observations will be periodically recorded and monitored for stabilization. Low-flow purging will be considered complete when pH, specific conductivity, DO, ORP, and temperature stabilize and when turbidity measurements fall below 50 Nephelometric Turbidity Units (NTU), or become stable above 50 NTU regardless of volume purged. Purging via disposable bailer, if necessary, will be considered complete following the removal of three (3) well volumes and field parameter stabilization or to well dryness, whichever occurs first. In general, stability is defined as variation between field measurements of 10 percent or less and no overall upward or downward trend in the measurements. Upon stabilization of field parameters, groundwater samples will be collected and analyzed.

Prior to, and immediately following collection of groundwater samples, field measurements for pH, specific conductance, temperature, dissolved oxygen, turbidity and water level, as well as visual and olfactory field observations will be recorded. Collected groundwater samples will be placed in pre-cleaned, pre-preserved laboratory provided sample bottles, cooled to 4°C in the field, and transported under chain-of-custody command to a NYSDOH-approved laboratory for analysis.

4.3.2 Annual 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.

Two (2) new and five (5) existing monitoring wells have been selected to monitor the groundwater conditions at the Site: existing monitoring wells MW-1, MW-2, MW-3, MW-5 and MW-7 and new monitoring wells MW-9 and MW-10.

The monitoring wells locations are shown on Figure 10 and the monitoring wells elevation and depths and included on Table 12. Monitoring well construction logs are included in Appendix B of this document.

If biofouling or silt accumulation occurs in the monitoring wells, the wells will be physically agitated/surged and redeveloped. Additionally, monitoring wells will be properly decommissioned and 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 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. 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.

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

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

Table 11 – Post Remediation Sampling Requirements and Schedule

Sampling Location	Analytical Parameters	Schedule
MW-1	Dissolved Lead	Annually
MW-2		
MW-3		
MW-5		
MW-7		
MW-9		
MW-10		

Notes:

1) Annual groundwater sampling will be subject to evaluation and recommendations after year 1.

5.0 OPERATION & MAINTENANCE PLAN

5.1 General

The site remedy does not rely on any mechanical systems to protect public health and the environment. Therefore, the operation and maintenance of such components is not included in this SMP.

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.

The subject site is considered to have low vulnerability related to climatic conditions. There are no State or Federal wetlands or floodplains located on the Site. The site will not employ any remedial systems reliant upon electrical power; the site is serviced by municipal sewer system (storm and sanitary). As such, acute cover system erosion resultant in potential exposure to remaining contamination, a minimum of 12-inches below surface, is highly unlikely.

6.2 Green Remediation Evaluation

NYSDEC's DER-31 Green Remediation (Ref. 8) 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 of the SMP provides a summary of any green remediation evaluations to be completed for the site during site management, and as reported in the PRR.

No mechanical engineering systems are included in the SMP. The only engineering control established for the Site is the cover system. Maintenance of the cover system is not anticipated to generate additional waste, use energy, produce emissions, require substantial water to promote vegetative cover growth, and/or affect any ecosystem.

6.3 Remedial System Optimization

A Remedial Site Optimization (RSO) study will not be required as there are not active remedial systems. The only engineering control at the Site is the cover system.

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 applicable inspection forms and other records will be provided in electronic format to the NYSDEC in accordance with the requirements of Table 12 and summarized in the PRR.

Table 13: Schedule of Monitoring/Inspection Reports

Task/Report	Reporting Frequency*
Groundwater Monitoring Data	Data collected annually and provided with annual Periodic Review Report
Annual Site Inspection	Annually, or as otherwise approved by the NYSDEC
Periodic Review Report	Annually, or as otherwise approved, beginning 18 months after the Certificate of Completion (COC) or equivalent document is issued.

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

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);
- Any observations, conclusions, or recommendations; and
- A determination as to whether contaminant conditions have changed since the last reporting event.

7.2 Periodic Review Report

A PRR will be submitted to the Department typically beginning approximately 18 months after the Certificate of Completion is issued. After submittal of the initial PRR, the next PRR shall be submitted annually to the Department or at another frequency as may be required by the Department. 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.

- Identification, assessment, and certification of all ECs/ICs required by the remedy for the site.
- Results of the required annual site inspections and severe condition inspections, if applicable.
- 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.
- A site evaluation, which includes the following:
    - The compliance of the remedy with the requirements of the site-specific Decision Document;
    - Any new conclusions or observations regarding site contamination based on inspections;
    - Recommendations regarding any necessary changes to the remedy and/or Monitoring Plan; and
    - The overall performance and effectiveness of the remedy.

7.2.1 Certification of Institutional and Engineering Controls

Following the last inspection of the reporting period, a qualified environmental professional or Professional Engineer (PE) licensed to practice in New York State will prepare, and include in the PRR, 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; and*
- *The information presented in this report is accurate and complete.*
- *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.*

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] for the site."

Every five years the following certification will be added:

- *The assumptions made in the qualitative exposure assessment remain valid.*

The signed certification will be included in the PRR. The PRR will be submitted, in electronic format, to the NYSDEC Central Office, Regional Office in which the site is located, and the NYSDOH Bureau of Environmental Exposure Investigation. The PRR may need to be submitted in hard-copy format, as 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, a Corrective Measures Work Plan will be submitted to the NYSDEC 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.

8.0 REFERENCES

1. New York State Department of Environmental Conservation. *DER-10/Technical Guidance for Site Investigation and Remediation*. May 2010.
2. Benchmark Environmental Engineering and Science, PLLC. *Remedial Investigation/Alternative Analysis Report, 1827 Fillmore Avenue Site, Buffalo, New York*. January 2019.
3. Benchmark Environmental Engineering and Science, PLLC. *Remedial Investigation Work Plan, 1827 Fillmore Avenue Site, Buffalo, New York*. November 2017.
4. Benchmark Environmental Engineering and Science, PLLC. *Supplemental Remedial Investigation Work Plan, 1827 Fillmore Avenue Site, Buffalo, New York*. February 2018.
5. Benchmark Environmental Engineering and Science, PLLC. *Emerging Contaminants Groundwater Sampling Work Plan, 1827 Fillmore Avenue Site, Buffalo, New York*. April 2018.
6. Benchmark Environmental Engineering and Science, PLLC. *Supplemental Remedial Investigation Work Plan for Bedrock Drilling Activities, 1827 Fillmore Avenue Site, Buffalo, New York*. June 2018.
7. Benchmark Environmental Engineering and Science, PLLC. *Remedial Action Work Plan, 1827 Fillmore Avenue Site, Buffalo, New York*. May 2019.
8. New York State Department of Environmental Conservation. *DER-31/Green Remediation*. August 11, 2010.

TABLES

TABLE 2

SUMMARY OF SB-21 AREA HOTSPOT POST-TREATMENT ANALYTICAL RESULTS

SITE MANAGEMENT PLAN

1827 FILLMORE AVENUE SITE

BUFFALO, NEW YORK

PARAMETER	Characteristic Hazardous Waste Threshold[1]					Additional Treatment	
						F-7 Area	F-12 Area
		TRT-1 (12-16')	TRT-2 (12-16')	TRT-3 (12-16')	TRT-4 (12-16')	TRT-5 (16-18')	TRT-6 (16-18')
		5/21/2019	5/23/2019	5/24/2019	5/28/2019	6/4/2019	6/5/2019
TCLP Lead - mg/L							
Lead	**5**	0.031 J	ND	ND	ND	ND	0.251 J

Notes:

1. TCLP/Haz Waste Regulatory Levels per 40 CFR 261, Appendix II, 1993 ed., as amended by 71 FR 40259, July 14, 2006.

Definitions:

ND = Parameter not detected above laboratory detection limit.

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

Exceeds Characteristic Hazardous Waste Threshold

TurnKey Environmental Restoration, LLC

Benchmark Environmental Engineering & Science, PLLC

TABLE 3
SUMMARY OF SB-21 AREA HOTSPOT END-POINT ANALYTICAL RESULTS

SITE MANAGEMENT PLAN

1827 FILLMORE AVENUE SITE
BUFFALO, NEW YORK

PARAMETER	SSAL[1]	Characteristic Hazardous Waste Threshold[2]	BOTTOM													
			F-1 (16')	F-2 (16')	F-3 (16')	F-4 (20')	F-5 (16')	F-6 (16')	F-7 (18')	F-8 (16')	F-9 (16')	F-10 (16')	F-11 (16')	F-12 (18')	F-13 (16')	F-14 (16')
			5/21/2019	5/21/2019	5/23/2019	5/30/2019	5/23/2019	5/23/2019	5/30/2019	5/23/2019	5/24/2019	5/24/2019	5/28/2019	5/31/2019	5/24/2019	5/24/2019
Total Lead - mg/kg	3900	--	22.9	93.1	2090 J	59.6	199	129	1720	47.8	228	1050	773	826	1020	27.3
TCLP Lead - mg/L	--	5	0.655	2.96	0.034 J	ND	0.194 J	ND	0.489 J	ND	ND	0.241 J	0.285 J	1.02	0.214 J	1.88

PARAMETER	SSAL[1]	Characteristic Hazardous Waste Threshold[2]	PERIMETER									
			MW-8 (14-16')	SB-21-1 (10-16')	SB-21-2 (11-16')	SB-21-3 (12-16')	SB-21-9 (12-16')	SB-21-11 (12-16')	SB-21-15 (12-16')	SB-21-17 (12-16')	SB-21-18 (12-16')	SB-21-22 (18-20')
			5/17/2019	5/20/2019	5/20/2019	5/17/2019	3/21/2019	3/21/2019	5/16/2019	5/17/2019	5/20/2019	6/5/2019
Total Lead - mg/kg	3900	--	785	161	293	487	300	556	167	622	212	14.4
			11/20/2017									
TCLP Lead - mg/L	--	5	0.799	3.5	0.99	2.5	2.88	0.209 J	0.109 J	0.476 J	0.071 J	ND

PARAMETER	SSAL[1]	Characteristic Hazardous Waste Threshold[2]	SUB AREA F-4			SUB AREA F-7				SUB AREA SB-21				SUB AREA SB-21-14				OFF-SITE
			SW-1R (16-20')	SW-2 (16-20')	SW-3 (16-20')	SW-1 (North) (16-18')	SW-2 (East) (16-18')	SW-3 (South) (16-18')	SW-4 (West) (16-18')	SB-21-R (12-16')	SB-21-19 (16-18')	SB-21-20 (16-18')	SB-21-21 (16-18')	SB-21-14R (12-16')	SB-21-14 (East) (12-16')	SB-21-14 (West) (12-16')	SB-21-14 (South) (12-16')	SB-21-16R (12-16')
			6/4/2019	5/30/2019	6/4/2019	6/4/2019	6/4/2019	6/4/2019	6/4/2019	5/17/2019	5/20/2019	5/20/2019	5/20/2019	5/21/2019	6/11/2019	6/11/2019	6/11/2019	6/5/2019
Total Lead - mg/kg	3900	--	96.3 J	2140	173	539	182	1010	895	46.3	141	514	1600	214	9.68	175	83	20.7
TCLP Lead - mg/L	--	5	ND	0.79	0.262 J	0.054 J	ND	ND	1.72	3.8	NA	NA	NA	0.292 J	NA	NA	NA	ND

Notes:

1. Values per 6NYCRR Part 375 Site-Specific Action Level (SSAL).
2. TCLP/Haz Waste Regulatory Levels per 40 CFR 261, Appendix II, 1993 ed., as amended by 71 FR 40259, July 14, 2006.

Definitions:

ND = Parameter not detected above laboratory detection limit.

NA = Sample not analyzed for parameter.

"--" = No value available for the parameter.

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

Exceeds SSAL
Exceeds Characteristic Hazardous Waste Threshold

TABLE 4
SUMMARY OF TP-25/SS-13 AREA HOTSPOT END-POINT ANALYTICAL RESULTS

SITE MANAGEMENT PLAN

1827 FILLMORE AVENUE SITE
BUFFALO, NEW YORK

PARAMETER	SSAL[1]	BOTTOM																			
		TP-25R (2-4')	SS-13R (2-24")	F-1 (2')	F-2 (2')	F-5 (2')	F-6 (2')	F-7 (2')	F-8 (2')	F-9 (2')	F-10 (2')	F-11 (2')	F-12 (2')	F-13 (2')	F-14 (2')	F-15 (2')	F-16 (3.5')	F-17 (2')	F-18 (3.5')	F-19 (2')	F-20 (3.5')
		2/22/2018		6/6/2019												6/12/2019					
Polycyclic Aromatic Hydrocarbons (PAHs) - mg/kg																					
Acenaphthene	--	ND	ND	1	1.2 J	1.3	2.1	0.29	0.7	2.9	ND	0.26	0.032 J	1.0	0.076 J	0.46	0.75	6.2	2.8	0.32	2.6
Acenaphthylene	--	ND	ND	0.24	0.27	0.26	0.62	0.19	0.25	0.19 J	ND	0.039 J	ND	0.25	0.034 J	0.18	0.13 J	0.84 J	0.54 J	0.11 J	0.25 J
Anthracene	--	0.39 J	ND	2.9	3.2 J	3.2	6.2	1	2.1	8.1	ND	0.68	0.093 J	3.7	0.2	1.3	2.0	20.0	9.2	0.86	8.2
Benzo(a)anthracene	--	1.0	0.38 J	5.6	6.2 J	5.7	12 D	2	4.7	16	0.065 J	1.3	0.2	5.7	0.45	2.7	4.2	31.0	15.0	2.0	14.0
Benzo(a)pyrene	--	0.86	0.27 J	4.6	5.3 J	4.7	8.8 D	1.7	4	12	0.058 J	1.1	0.16	4.7	0.39	2.2	3.6	23.0	11.0	1.7	12.0
Benzo(b)fluoranthene	--	1.0	0.31 J	6.3	7.1 J	6.1	11 D	2.2	5.4	15	0.082 J	1.3	0.22	6.3	0.49	3.0	4.9	29.0	14.0	2.2	15.0
Benzo(k)fluoranthene	--	0.40 J	0.39 J	1.7	2 J	2.2	3.5	0.71	1.6	5.7	ND	0.48	0.066 J	1.8	0.18	0.87	1.5	11.0	3.5	0.76	5.5
Benzo(ghi)perylene	--	0.62 J	0.29 J	2.3	2.7 J	2.4	4.2	0.96	2.2	6	0.04 J	0.57	0.096 J	2.4	0.23	1.2	1.8	12.0	5.7	0.99	5.4
Chrysene	--	1.1	ND	4.3	4.7 J	4.6	9.4 D	1.7	3.8	13	0.06 J	1	0.18	4.5	0.39	2.1	3.3	22.0	11.0	1.6	12.0
Dibenzo(a,h)anthracene	--	ND	ND	0.64	0.76 J	0.7	1.2	0.24	0.61	1.6	ND	0.14	0.027 J	0.64	0.061 J	0.31	0.53	3.2	1.4	0.26	1.4
Fluoranthene	--	2.2	0.56 J	12.0 D	14.0 D J	12.0 D	24.0 D	4.4	8.9	32	0.13	2.9	0.4	12 D	0.89	5.2	7.6 D	62.0	29.0	3.5	33.0
Fluorene	--	ND	ND	1.3	1.5 J	1.4	3.2	0.4	0.8	3.9	ND	0.27	0.037 J	1.5	0.077 J	0.52	0.85	9.2	4.1	0.40	3.6
Indeno(1,2,3-cd)pyrene	--	0.58 J	0.37 J	2.5	2.9 J	2.6	4.5	1	2.2	7.1	0.08 J	0.61	0.13 J	2.5	0.26	1.2	2.0	15.0	6.7	1.2	6.8
Naphthalene	--	0.20 J	ND	0.41	0.54	0.41	0.68	0.12 J	0.44	1.2	0.08 J	0.085 J	ND	0.31	0.084 J	0.17	0.27	2.0 J	0.75 J	0.30	1.0
Phenanthrene	--	2.6	0.29 J	9.1 D	11.0 D J	10.0 D	20.0 D	3.2	6.3	28	0.11 J	2.3	0.33	10	0.68	3.7	5.8	55.0	24.0	2.7	28.0
Pyrene	--	2.1	ND	7.7	11.0 D J	9.4 D	18.0 D	3.4	6.7	25	0.11 J	2.3	0.33	9.7	0.74	4.1	6.0	48.0	22.0	2.8	26.0
Total PAHs	**500**	13.05	2.86	62.59	74.37 J	66.97	129.40	23.51	50.70	177.69	0.81	15.33	2.30	67.00	5.23	29.21	45.23	349.44	160.69	21.70	174.75

PARAMETER	SSAL[1]	PERIMETER											
		TP-25-1 (0-2')	TP-25-2 (0-4')	TP-25-3 (0-1.5')	TP-25-4 (0-2')	SS-13-1 (0-2')	SS-13-2 (0-2')	SS-13-3 (0-2')	SS-13-4 (0-2')	SS-13-5 (0-2')	SS-13-6 (0-2')	SS-13-7 (0-2')	SS-13-8 (0-2')
		2/22/2018								6/6/2019			
Polycyclic Aromatic Hydrocarbons (PAHs) - mg/kg													
Acenaphthene	--	3.8	7.1	4.9	ND	ND	0.35 J	ND	ND	0.03 J	2.2	0.12 J	0.15 J
Acenaphthylene	--	ND	ND	ND	ND	ND	0.15 J	ND	ND	0.03 J	0.19	0.23	0.065 J
Anthracene	--	12.0	24.0	15.0	ND	ND	1.3	ND	0.58 J	0.093 J	5.1	0.49	0.4
Benzo(a)anthracene	--	19.0	41.0	21.0	ND	0.40 J	2.6	0.69 J	1.0	0.27	7.7	1.7	1
Benzo(a)pyrene	--	14.0	31.0	14.0	ND	0.32 J	1.9	0.48 J	0.74 J	0.24	6.1	1.6	0.98
Benzo(b)fluoranthene	--	17.0	35.0	18.0	0.43 J	0.38 J	2.1	0.61 J	0.85 J	0.32	8 D	2.2	1.2
Benzo(k)fluoranthene	--	7.2	20.0	8.0	ND	0.190 J	1.1	0.24 J	0.42 J	0.098 J	2.4	0.66	0.44
Benzo(ghi)perylene	--	8.8	20.0	8.5	0.45 J	0.31 J	1.3	0.47 J	0.46 J	0.15 J	3	1	0.61
Chrysene	--	18	38.0	20.0	ND	0.26	2.4	ND	0.91 J	0.24	5.9	1.5	0.9
Dibenzo(a,h)anthracene	--	ND	ND	ND	ND	ND	0.4 J	ND	ND	0.04 J	0.86	0.25	0.16
Fluoranthene	--	43.0	94 DL	46.0	0.71 J	0.80 J	5.6	1.1 J	2.1	0.5	17 D	3.2	2.1
Fluorene	--	4.8	8.7	6.3	ND	ND	0.5 J	ND	0.25 J	0.036 J	2.8	0.13 J	0.14 J
Indeno(1,2,3-cd)pyrene	--	8.1	19	8.50 J	0.43 J	0.27 J	1.1	ND	0.44 J	0.18	3.2	1	0.62
Naphthalene	--	1.10 J	2.4	2.1	ND	ND	0.17 J	ND	ND	0.043 J	1.4	0.14 J	0.094 J
Phenanthrene	--	42.0	88 DL	47.0	ND	0.52 J	5.7	0.89 J	2.4	0.36	17	1.5	1.4
Pyrene	--	32.0	66.0	35.0	ND	0.50 J	5.1	0.58 J	1.4	0.42	13	2.7	1.7
Total PAHs	**500**	230.80	494.20	254.30	2.02	3.95	31.77	5.06	11.55	3.05	95.85	18.42	11.96

Notes:

1. Values per 6NYCRR Part 375 Site-Specific Action Level (SSAL).

Definitions:

ND = Parameter not detected above laboratory detection limit.

"--" = No value available for the parameter.

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

D = Concentration of analyte was quantified from diluted analysis.

Exceeds SSAL

TABLE 5

SUMMARY OF TP-13 AREA HOTSPOT POST-TREATMENT ANALYTICAL RESULTS

SITE MANAGEMENT PLAN

1827 FILLMORE AVENUE SITE
BUFFALO, NEW YORK

PARAMETER	Characteristic Hazardous Waste Threshold[1]	TRT-1 (10-13.5')	TRT-2 (10-13.5')	TRT-3 (13.5-17')	TRT-4 (13.5-17')
		6/3/2019	6/3/2019	6/20/2019	6/20/2019
TCLP Lead - mg/L	5	ND	ND	ND	ND

Notes:

1. TCLP/Haz Waste Regulatory Levels per 40 CFR 261, Appendix II, 1993 ed., as amended by 71 FR 40259, July 14, 2006.

Definitions:

ND = Parameter not detected above laboratory detection limit.

Exceeds Characteristic Hazardous Waste Threshold

TABLE 6
SUMMARY OF TP-13 AREA HOTSPOT END-POINT ANALYTICAL RESULTS

SITE MANAGEMENT PLAN

1827 FILLMORE AVENUE SITE
BUFFALO, NEW YORK

PARAMETER	SSAL[1]	Characteristic Hazardous Waste Threshold[2]	BOTTOM					
			F-1 (17')	F-2 (17')	F-3 (17')	F-4 (17')	F-5 (17')	F-6 (17')
			5/31/2019	5/31/2019	5/31/2019	5/31/2019	5/31/2019	5/31/2019
Total Lead - mg/kg	**3900**	**--**	7.72 J	17.8 J	7.06	4.75	8.68	9.36
TCLP Lead - mg/L	**--**	**5**	ND	ND	ND	ND	ND	ND

PARAMETER	SSAL[1]	Characteristic Hazardous Waste Threshold[2]	PERIMETER					
			TP-13-2 (10-15')	TP-13-3 (10-15')	TP-13-4 (10-15')	TP-13-5 (10-15')	TP-13-6 (10-17')	TP-13-7 (10-17')
			5/30/2019	5/30/2019	5/30/2019	5/30/2019	5/30/2019	5/30/2019
Total Lead - mg/kg	**3900**	**--**	629 J	15.4	102	78.8	13.2	87
TCLP Lead - mg/L	**--**	**5**	0.016 J	0.36	0.58	0.43	ND	ND

Notes:
1. Values per 6NYCRR Part 375 Site-Specific Action Level (SSAL).
2. TCLP/Haz Waste Regulatory Levels per 40 CFR 261, Appendix II, 1993 ed., as amended by 71 FR 40259, July 14, 2006.

Definitions:

ND = Parameter not detected above laboratory detection limit.

"--" = No value available for the parameter.

Exceeds SSAL
Exceeds Characteristic Hazardous Waste Threshold

TABLE 7
SUMMARY OF MW-6 AREA HOTSPOT END-POINT ANALYTICAL RESULTS

SITE MANAGEMENT PLAN

1827 FILLMORE AVENUE SITE
BUFFALO, NEW YORK

PARAMETER	SSAL[1]	Characteristic Hazardous Waste Threshold[2]	BOTTOM	
			F-1 (12')	F-2 (12')
			6/11/2019	6/11/2019
Total Lead - mg/kg	**3900**	**--**	1010	169
TCLP Lead - mg/L	**--**	**5**	NA	NA

PARAMETER	SSAL[1]	Characteristic Hazardous Waste Threshold[2]	PERIMETER			
			MW-6-1 (8-12')	MW-6-2 (8-12')	MW-6-3 (8-12')	MW-6-4 (8-12')
			4/25/2019	4/25/2019	4/25/2019	4/25/2019
Total Lead - mg/kg	**3900**	**--**	92.9	1050	113	79.6
TCLP Lead - mg/L	**--**	**5**	NA	NA	NA	NA

Notes:

1. Values per 6NYCRR Part 375 Site-Specific Action Level (SSAL).
2. TCLP/Haz Waste Regulatory Levels per 40 CFR 261, Appendix II, 1993 ed., as amended by 71 FR 40259, July 14, 2006.

Definitions:

ND = Parameter not detected above laboratory detection limit.
NA = Sample not analyzed for parameter.
"--" = No value available for the parameter.

Exceeds SSAL
Exceeds Characteristic Hazardous Waste Threshold

TABLE 8
SUMMARY OF REMAINING ON-SITE SURFACE SOIL/FILL ABOVE USCOs

SITE MANAGEMENT PLAN

1827 FILLMORE SITE
BUFFALO, NEW YORK

Parameter [1]	Unrestricted SCOs[2] (ppm)	SS-1	SS-2	SS-3	SS-4	SS-5	SS-6	SS-7	SS-8	SS-9	SS-10	SS-11	SS-12	SS-14	SS-15
Semi-Volatile Organic Compounds (SVOCs) - mg/kg[3]															
2-Methylnaphthalene	--	ND	ND	ND	0.67 J	ND	ND	ND	ND	0.85 J	ND	ND	ND	ND	ND
Acenaphthene	20	ND	2.2	4.8 J	4.4	ND	1.3 J	1.6 J	0.47 J	8.1	0.8 J	1.7 J	0.22 J	ND	0.27 J
Acenaphthylene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	100	ND	4.1	11.0	9.4	ND	3.9	3.1 J	1.2 J	22.0	1.9 J	4.5	0.46 J	1.5 J	0.55 J
Benzo(a)anthracene	1	1.4 J	6.0	21.0	18.0	1.2 J	8.3	6.9	3.6	37.0	4.9	11.0	0.83 J	6.1	1.0 J
Benzo(a)pyrene	1	1.2 J	4.8	17.0	15.0	1.0 J	7.7	6.2	3.4	32.0	4.5	9.3	0.69 J	5.8	0.84 J
Benzo(b)fluoranthene	1	1.8	6.1	20.0	19.0	1.4 J	10.0	8.1	4.4	39.0	5.6	12.0	0.95 J	8.3	1.10 J
Benzo(g,h,i)perylene	100	0.99 J	3.0	10.0	9.0	0.76 J	4.6	3.7 J	2.1 J	17.0	2.8	5.3	0.44 J	4.1 J	0.48 J
Benzo(k)fluoranthene	0.8	0.98 J	3.6	12.0	8.6	0.64 J	4.0	4.4	2.5	21.0	3.6	5.5	0.38 J	3.5 J	0.49 J
Biphenyl	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-ethylhexyl) phthalate	--	ND	0.7 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbazole	--	ND	2.1	5.7 J	4.6	ND	1.7 J	1.5 J	0.76 J	9.1	0.91 J	1.9 J	0.21 J	1.1 J	0.27 J
Chrysene	1	1.5 J	5.8	19.0	15.0	1.1 J	7.7	6.8	4.0	32.0	5.1	9.6	0.77 J	6.4	0.96 J
Dibenzo(a,h)anthracene	0.33	ND	0.89 J	ND	2.8	ND	1.2 J	1.1 J	ND	5.4	ND	1.7 J	ND	ND	ND
Dibenzofuran	--	ND	1.3 J	2.4 J	2.2	ND	0.69 J	0.73 J	ND	4.4	0.35 J	0.85 J	ND	ND	ND
Fluoranthene	100	2.9	16.0	49.0	40.0	2.4	20.0	16.0	9.0	84.0	12.0	25.0	1.9	15.0	2.4
Fluorene	30	ND	2.1	4.6 J	4.3	ND	1.5 J	1.6 J	0.46 J	8.8	0.73 J	1.8 J	0.21 J	0.57 J	0.26 J
Indeno(1,2,3-cd)pyrene	0.5	0.83 J	2.8	9.5	8.5	0.67 J	4.4	3.2 J	1.7 J	17.0	2.6	5.1	0.39 J	3.5 J	0.45 J
Naphthalene	12	ND	0.53 J	1.8 J	1.5 J	ND	0.4 J	ND	ND	1.7 J	ND	ND	ND	ND	ND
Phenanthrene	100	1.4 J	15.0	41.0	33.0	1.5 J	14.0	12.0	6.2	67.0	7.8	17.0	1.7	8.5	2.2
Pyrene	100	2.2	12.0	37.0	31.0	1.9	16.0	13.0	7.4	67.0	9.1	19.0	1.5	12.0	1.9
Tentatively Identified Compounds (TICs)	--	ND	NA	NA	NA	NA	NA	4.0 J N	ND	NA	3.4 J N	NA	2.1 J N	NA	NA
Total SVOCs		15.2	89.02	265.8	227.0	12.57	107.39	89.93	47.19	473.35	62.69	131.25	10.65	76.37	13.17
Total PAHs		15.2	85.62	257.7	219.5	12.57	105.0	87.7	46.43	459.0	53.18	128.5	10.44	75.27	12.9
Metals - mg/kg															
Aluminum	--	4030	10800	7150	10500	12000	9520	15600	14300	7590	11800	7240	15100	5940	14500
Antimony	--	ND	1.5 J	ND	0.74 J	1.4 J	0.56 J	0.76 J	ND	ND	ND	0.77 J	ND	0.56 J	0.61 J
Arsenic	13	3.5	8.8	2.8	4.6	5.8	4.9	5.6	4.9	2.6	5.2	3.8	7.6	5.2	4.9
Barium	350	45.4	127	131	194	115	115	166 J	110	98.6	95.5	77.5	92.0	51.2	86.0
Beryllium	7.2	0.32	0.51	0.33	0.49	0.55	0.52	1.1 J-	0.57	0.43	0.55	0.35	0.62	0.34	0.59
Cadmium	2.5	0.28	0.60	0.34	0.50	0.37	0.49	0.56	0.58	0.59	1.6	0.44	0.28	0.45	0.32
Calcium	--	118000 B	29300 B	105000 B	50800 B	37400 B	54200 B	51400 J-	7190 B	137000 B	41300 B	69700 B	10000 B	21200 B	6050 B
Chromium [4]	30	7.9	26.6	11.5	17.8	20.9	17.3	21.8	25.2	11.2	23.6	12.4	21.1	12.1	20.1
Cobalt	--	2.8	7.2	3.9	6.1	6.4	4.6	6.0	6.5	3.2	8.8	3.3	7.2	4.2	6.5
Copper	50	15.5	81.2	13.1	42.0	80.0	124	49.2	30.7	17.0	35.1	34.6	19.4	31.4	19.0
Iron	--	8280	45200	9460	23200	20300	15800	17400	19800	9320	16000	14900	18200	14700	17700
Lead	63	43.8	124	36.6	109	128	115	188 J	67.3	27.1	158	74.0	48.0	62.0	38.2
Magnesium	--	6410	8570	23800	16500	9450	14700	10600	2870	39300	8950	7800	5250	5030	3560
Manganese	1600	199	700	248	493	380	386	930 J-	371	308	467	646	438	367	277
Nickel	30	10.8	21.3	10.5	16.9	21.9	18.0	18.2	19.8	8.6	19.9	10.8	20.4	12.8	20.6
Potassium	--	950	2160	1760	2420	2800	2110	3400	2420	1670	2540	1420	2550	1070	1980
Selenium	3.9	ND	0.86 J	ND	0.88 J	0.76 J	ND	0.57 J	0.78 J	ND	ND	ND	0.80 J	0.61 J	ND
Sodium	--	168	150 J	222	253	148 J	187	322	90.6 J	278	145 J	220	105 J	87.5 J	78.9 J
Vanadium	--	12.6	36.4	16.8	21.9	27.2	19.9	28.7	30.4	16.3	27.0	15.4	29.1	15.6	28.9
Zinc	109	68.4	269	153	28.5	433	154	166 J-	127	105	179	674	94.9	180	90.5
Mercury	0.18	0.036	0.12	0.091	0.073	0.10	0.075	0.10	0.10	0.15	0.24	0.092	0.098	0.098	0.088
Organochlorine Pesticides - mg/kg[3]															
4,4'-DDD	0.0033	NA	ND	NA	NA	NA	NA	ND	ND	NA	NA	NA	ND	NA	NA
4,4'-DDE	0.0033	NA	ND	NA	NA	NA	NA	ND	0.044	NA	NA	NA	0.0053 J	NA	NA
4,4'-DDT	0.0033	NA	0.033 J	NA	NA	NA	NA	0.042 J	0.047	NA	NA	NA	0.012	NA	NA
alpha-BHC	0.02	NA	ND	NA	NA	NA	NA	0.027 J B	0.0067 J B	NA	NA	NA	ND	NA	NA
alpha-Chlordane	0.094	NA	ND	NA	NA	NA	NA	ND	0.016 J	NA	NA	NA	ND	NA	NA
delta-BHC	0.04	NA	0.012 J B	NA	NA	NA	NA	ND	0.0070 J B	NA	NA	NA	ND	NA	NA
Endrin	0.014	NA	ND	NA	NA	NA	NA	ND	ND	NA	NA	NA	ND	NA	NA
Endrin aldehyde	--	NA	ND	NA	NA	NA	NA	ND	ND	NA	NA	NA	ND	NA	NA
gamma-BHC (Lindane)	0.1	NA	0.015 J	NA	NA	NA	NA	0.037 J	0.011 J	NA	NA	NA	ND	NA	NA
Heptachlor epoxide	--	NA	ND	NA	NA	NA	NA	ND	0.013 J	NA	NA	NA	ND	NA	NA
Methoxychlor	--	NA	ND	NA	NA	NA	NA	ND	ND	NA	NA	NA	0.012	NA	NA
Herbicides[1] - mg/kg															
Total Herbicides		NA	ND	NA	NA	NA	NA	ND	ND	NA	NA	NA	ND	NA	NA
PCBs[1] - mg/kg															
Total PCBs		NA	ND	NA	NA	NA	NA	ND	ND	NA	NA	NA	ND	NA	NA

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. SCOs provided for trivalent chromium

Definitions:

mg/kg = milligrams per kilogram
ND = Parameter not detected above laboratory detection limit
NA = Sample not analyzed for parameter.
"--" = No SCO available, or parameter not tested for.
B = Compound was found in the blank and sample.
J = Estimated value; result is less than the sample quantitation limit but greater than zero
J- = The analyte was positively identified; the associated numerical value is an estimated quantity that may be biased low.
DL = All compounds were identified in an analyisis at the secondary dilution factor.

Exceeds USCO

TABLE 9A
SUMMARY OF REMAINING ON-SITE SUBSURFACE SOIL/FILL ABOVE USCOs
(RI TEST PITS AND MONITORING WELLS)

SITE MANAGEMENT PLAN

1827 FILLMORE AVENUE SITE
BUFFALO, NEW YORK

Parameter [1]	Unrestricted SCOs[2] (ppm)	TP-1 (4'-6')	TP-3 (10'-14.5')	TP-5 (6'-8')	TP-6 (10'-11.5')	TP-7 (8'-10')	TP-8 (6-9')	TP-9 (10-12')	TP-10 (0'-4')	TP-12 (10'-12')	TP-14 (10'-15')	TP-16 (8'-10')	TP-17 (2.5'-4')	TP-18 (5'-9')	TP-20 (5'-10')	TP-22 (9'-12')	TP-23 (13'-15.5')	TP-26 (12'-15')	TP-27 (7'-9')	TP-28 (2'-4')	MW-1 (4'-5.4')	MW- 2 (2'-4')	MW-3 (6'-8')	MW-4 (12'-14')	MW-5 (6'-8')
Volatile Organic Compounds (VOCs) - mg/kg [3]																									
4-Isopropyltoulene	--	NA	ND	NA	ND	NA	ND	0.058	ND	NA	NA	NA	NA	NA	NA	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA
Acetone	0.05	NA	0.01 J	NA	ND	NA	0.013 J	0.0078 J	ND	NA	NA	NA	NA	NA	NA	NA	0.025 J	NA	ND	ND	NA	NA	NA	NA	NA
Carbon disulfide	--	NA	ND	NA	ND	NA	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	ND	NA	ND	0.0033 J	NA	NA	NA	NA	NA
Dichlorodifluoromethane	--	NA	ND	NA	ND	NA	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	ND	NA	ND	0.0006 J	NA	NA	NA	NA	NA
Methylene chloride[4]	0.05	NA	ND	NA	ND	NA	ND	0.0034 J	ND	NA	NA	NA	NA	NA	NA	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA
Tentatively Identified Compounds (TICs)	--	NA	NA	NA	ND	NA	ND	0.3936 J N	0.013 J N	NA	NA	NA	NA	NA	NA	NA	2.65 J N	NA	ND	NA	NA	NA	NA	NA	NA
Total VOCs		NA	0.010	NA	ND	NA	0.013	0.0692	ND	NA	NA	NA	NA	NA	NA	NA	0.025	NA	ND	0.0039	NA	NA	NA	NA	NA
Semi-Volatile Organic Compounds (SVOCs) - mg/kg [3]																									
2-Methylnaphthalene	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methylphenol	--	ND	ND	ND	ND	ND	0.83 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	20	ND	ND	ND	ND	0.54 J	ND	ND	ND	ND	ND	ND	0.51 J	ND	0.74 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	100	ND	ND	ND	ND	ND	0.92 J	ND	0.56 J	ND	ND	ND	0.30 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	100	ND	ND	ND	ND	1.4 J	2.1 J	ND	ND	ND	ND	ND	0.88 J	ND	1.5 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	1	0.47 J	**1.4 J**	**3.7 J**	ND	**2.5**	**4.2 J**	0.60 J	**2.6 J**	0.53 J	0.29 J	ND	**2.6**	ND	**2.4**	0.33 J	**2.1 J**	0.025 J	ND	0.094 J	ND	0.79 J	0.43 J	0.038 J	**4.9**
Benzo(a)pyrene	1	ND	**1.5 J**	**4.4**	ND	**2.3**	**4.2 J**	0.61 J	**2.5 J**	0.51 J	0.41 J	0.052 J	**2.1**	ND	**2.2**	0.55 J	**2.2 J**	0.048 J	0.27 J	0.14 J	ND	**1.1 J**	0.64 J	0.054 J	**8.1**
Benzo(b)fluoranthene	1	ND	**1.8 J**	**6.1**	0.033 J	**3.0**	**6.1 J**	0.73 J	**3.5 J**	0.70 J	0.56 J	0.094 J	**2.7**	ND	**2.6**	ND	**3.3 J**	0.078 J	ND	0.25	ND	**1.5 J**	ND	0.074 J	**12**
Benzo(g,h,i)perylene	100	ND	1.4 J	3.1 J	ND	1.2 J	2.9 J	0.32 J	1.7 J	0.29 J	0.28 J	0.042 J	1.2	ND	1.2 J	ND	1.1 J	0.045 J	ND	0.18	ND	0.68 J	ND	0.037 J	7.4
Benzo(k)fluoranthene	0.8	ND	**1.1 J**	**2.0 J**	ND	**1.1 J**	**2.4 J**	0.25 J	**1.6 J**	ND	0.19 J	ND	**1.1**	ND	**1.3 J**	ND	ND	ND	ND	0.085 J	ND	ND	ND	0.027 J	**5.7**
Biphenyl	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbazole	--	ND	ND	ND	ND	0.65 J	ND	ND	ND	ND	ND	ND	0.29 J	ND	0.72 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	1	ND	**1.6 J**	**4.2**	ND	**2.3**	**6.2 J**	0.52 J	**2.9 J**	0.47 J	0.33 J	0.059 J	**2.6**	ND	**2.3**	ND	**2.7 J**	ND	ND	0.13 J	ND	ND	ND	ND	**6.9**
Dibenzo(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
Dibenzofuran	--	ND	ND	ND	ND	0.37 J	0.66 J	ND	ND	ND	ND	ND	0.15 J	ND	0.66 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	100	0.81 J	2.5 J	7.8	ND	5.9	14 J	1.2	4.9	1.3	0.47 J	0.010 J	5.3	0.23 J	6.1	0.70 J	5.5	0.026 J	0.54 J	0.15 J	ND	1.2 J	0.43 J	0.052 J	5.8
Fluorene	30	ND	ND	ND	ND	0.64 J	1.7 J	ND	ND	ND	ND	ND	0.33 J	ND	0.87 J	ND	0.68 J	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	0.5	ND	**1.0 J**	**2.9 J**	ND	**1.3 J**	**2.8 J**	0.37 J	**1.8 J**	0.35 J	0.33 J	0.037 J	**1.1**	ND	**1.3 J**	ND	**1.1 J**	0.054 J	ND	0.15 J	ND	**0.92 J**	**0.63 J**	0.047 J	**6.0**
Naphthalene	12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.45 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	100	ND	1.3 J	4.1	ND	5.0	6.2 J	0.73 J	2.2 J	1.0 J	0.25 J	ND	3.1	ND	6.2	ND	4.2 J	ND	ND	0.085 J	ND	0.60 J	ND	ND	1.4 J
Pyrene	100	0.66 J	2.0 J	6.0	ND	4.3	11 J	1.0 J	4.1 J	0.97 J	0.40 J	0.089 J	4.8	0.21 J	4.7	0.67 J	5.2	ND	0.47 J	0.14 J	ND	1.0 J	0.46 J	0.046 J	5.3
Tentatively Identified Compounds (TICs)		NA	NA	NA	NA	NA	121.3 J N	4.97 J N	NA	NA	NA	NA	NA	NA	NA	NA	32.9 J N	NA	NA	NA	ND	NA	NA	NA	NA
Total SVOCs		*1.94 J*	*15.6 J*	*44.3 J*	*0.033 J*	*32.5 J*	*66.21 J*	*6.33 J*	*28.36 J*	*6.12 J*	*3.51 J*	*0.383 J*	*29.06 J*	*0.44 J*	*35.24 J*	*2.25 J*	*28.08 J*	*0.276 J*	*1.28 J*	*1.404 J*	ND	7.79	2.59	0.38	63.50
Total PAHs		*1.94 J*	*13.1 J*	*44.3 J*	*0.033 J*	*31.48 J*	*64.72 J*	*6.33 J*	*28.36 J*	*6.12 J*	*3.51 J*	*0.383 J*	*26.17 J*	*0.44 J*	*33.86 J*	*2.25 J*	*28.08 J*	*0.276 J*	*1.28 J*	*1.404 J*	ND	7.79	2.59	0.38	63.50
Metals - mg/kg																									
Aluminum	--	12300	12900	8200	3480 J	7720	6760	5820	7590	12000	7240	8800	17300	4900	6800	10600	7560	7830	6790	11700	8270 J	9430	5420	5940	5170
Antimony	--	ND	0.73 J	0.55 J	0.55 J	ND	0.68 J	ND	3.0 J	1.5 J	1.0 J	0.94 J	5.5 J	5.3 J	ND	1.2 J	1.5 J	ND	1.1 J	0.95 J	1.2 J	ND	ND	ND	ND
Arsenic	13	5.0	**13.6**	10.3	3.0	4.6	**14.8**	8.0	**17.2**	**21.0**	4.5	**14.8**	5.5	3.0	5.5	7.0	**13.6**	8.0	4.3	5.1	8.2 B	11.5	7.8	9.4	5.7
Barium	350	94.5	102	85.8	17.0	59.6	155	**430**	166	196	69.8	115	321	41.2	329	91.3	153	64.9	260	67.4	209	147	48.0	88.8	108
Beryllium	7.2	0.58	0.77	0.47	0.17 J	0.33	0.68	0.43	0.69	0.73	0.39	0.88	1.5	0.24	0.32	0.56	2	0.77	0.79	0.46	0.35	0.061	0.32	0.69	0.30
Cadmium	2.5	0.4	0.60	0.57	0.050 J	0.33	0.35	0.69	1.4	0.49	**4.1**	0.17 J	ND	0.20 J	0.52	0.33	0.36	0.077 J	0.32	ND	0.60	0.48	0.12 J	0.096 J B	0.34
Calcium	--	19300	22800 B	35200 B	2450 J	20300 B	3470 B	16900 B	20000 B	3190 B	4180 B	2860 B	51900 B	61800 J	16400 B	30400 B	4200 B	3050 B	10100 B	15500 B	92200 B	57000 B	51200 B	4150 B	2940 B
Chromium	30	15.7	27.6	**33.5**	8.1	12.9	14.6	18.7	**1300 J**	20.1	16.4	13.9	25.8	8.2	10.9	15.4	15.3	15.8	22.9	18.3	27.9 J-	13.7 B	9.8 B	10	**87.4 B**
Cobalt	--	5.5	29.1	5.9	1.8	3.3	11.8	4.4	11.6	15.5	3.9	8.9	3.3	3.2	3.4	6.6	11.3	12.8	5.6	4.9	5.9	5.9	3.8	5.5	4.7
Copper	50	42.2	**54.8**	**68.1**	6.0	19.0	**682**	29.2	**190 J**	**53.1**	38.3	37.0	44.9	19.3	20.7	**62.6**	**52.2**	**53.4**	**56.2**	43.8	36.5	**90.9**	**55.3**	32.5	**90.2**
Iron	--	14700	28100 B	17000 B	7060 F1 B	15500 B	17800	11700	20500 J	26100	24100	7640	79400	7410	13300	14200	13100	21500	9030	43700	17700	11800 B	22200 B	15000	44400 B
Lead	63	**153**	**156**	**335**	16.0	41.2	**442**	**476**	**344**	**332**	**113**	33.9	30.8	**120**	19.7	**195**	**165**	**105**	**210**	26.8	**148**	**283**	44.5	**125**	**67.8**
Magnesium	--	6700	6350	6570	1160 F2 F1	3720	521	1830	4310	573	1270	431	2480	10400 J	1880	9010	563	518	3870	902	12000	5080 B	3670 B	844	1310 B
Manganese	1600	589	**2120 B**	906	189	541 B	259 B	165 B	286 B	186 B	775 B	83.3 B	**5300 B**	247 B	545 B	241 B	120 B	155 B	92.4 B	**1690 B**	298 J-	276 B	273 B	114 B	392 B
Nickel	30	13.5	25.3	17.5	4.6 J	11.2	22.0	15.3	**189 J**	29.9	14.6	22.2	9.3 J	9.4	8.4	17.4	25.7	25.4	15.3	22.0	18.6	15.2	11.3	12.9	**52.2**
Potassium	--	1640	1900	1530	543	1370	1230 B	1480 B	1140 B	3020 B	1300 B	896	3380	1370	1070	2480	825	949	1110	1350	2120 J	1880	1010	789	867
Selenium	3.9	0.89 J	1.8 J	0.71 J	0.50 J	ND	0.74 J	0.48 J	1.30 J	**6.7**	ND	ND	1.1 J	ND	ND	0.48 J	2.6 J	ND	ND	1.2 J	ND	ND	ND	1.5 J B	ND
Silver	2	ND	ND	ND	ND	ND	ND	ND	0.56 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.48 J
Sodium	--	230 J	483	147 J	68.4 J	177	299 B	189 B	249 B	566 B	155 B	308	914	198	139 J	212 J	414	274	203	170	322	474	184	197	110 J
Thallium	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vanadium	--	25.0	48	23.7	9.8	17.6	48.4	18.4	28.1	62	15.3	31.7	46.4	14.4	16.5	24.3	25.5	26.5	18.9	24.9	23.0	24.2	14.3	22.6	12.8
Zinc	109	**172**	**238**	**174**	22.9	68.9	**199**	**278**	**222**	**312**	**137**	45.2	38.2	54.9	**201**	**201**	**226**	**110**	**184**	64.2	**174 J-**	**198**	**189**	82.2	101
Mercury	0.18	**0.19**	**0.27**	**0.50**	ND	0.05	**3.0**	**0.20**	0.17 J	**0.32**	0.11	0.017 J	0.030	**0.23**	0.072	**0.89**	0.12	0.074	**0.24**	0.10	**0.28**	0.11	0.012 J	0.081	**0.29**
Organochlorine Pesticides [1] - mg/kg [3]																									
4,4'-DDD	0.0033	ND	NA	NA	ND	NA	NA	NA	ND	NA	NA	ND	NA	NA	NA	NA	ND	NA	NA	NA	NA	ND	ND	NA	ND
4,4'-DDE	0.0033	ND	NA	NA	ND	NA	NA	NA	ND	NA	NA	ND	NA	NA	NA	NA	ND	NA	NA	NA	NA	ND	ND	NA	ND
4,4'-DDT	0.0033	**0.014 J**	NA	NA	ND	NA	NA	NA	ND	NA	NA	0.00064 J+	NA	NA	NA	NA	**0.00570 J**	NA	NA	NA	NA	ND	ND	NA	ND
alpha-BHC	0.02	ND	NA	NA	ND	NA	NA	NA	ND	NA	NA	ND	NA	NA	NA	NA	ND	NA	NA	NA	NA	ND	ND	NA	ND
beta-BHC	0.036	ND	NA	NA	ND	NA	NA	NA	ND	NA	NA	ND	NA	NA	NA	NA	ND	NA	NA	NA	NA	ND	ND	NA	ND
delta-BHC	0.04	ND	NA	NA	ND	NA	NA	NA	ND	NA	NA	ND	NA	NA	NA	NA	ND	NA	NA	NA	NA	ND	ND	NA	ND
Endosulfan sulfate	2.4	ND	NA	NA	ND	NA	NA	NA	ND	NA	NA	ND	NA	NA	NA	NA	ND	NA	NA	NA	NA	ND	ND	NA	ND
gamma-BHC (Lindane)	0.1	0.011 J	NA	NA	0.00063 J+	NA	NA	NA	ND	NA	NA	ND	NA	NA	NA	NA	ND	NA	NA	NA	NA	ND	ND	NA	ND
Methoxychlor	--	ND	NA	NA	0.00150 J+	NA	NA	NA	ND	NA	NA	ND	NA	NA	NA	NA	ND	NA	NA	NA	NA	ND	ND	NA	ND
Herbicides [1] - mg/kg																									
Total Herbicides		ND	NA	NA	ND	NA	NA	NA	ND	NA	NA	ND	NA	NA	NA	NA	ND	NA	NA	NA	NA	ND	ND	NA	ND
PCBs [1] - mg/kg																									
Total PCBs		ND	NA	NA	ND	NA	NA	NA	ND	NA	NA	ND	NA	NA	NA	NA	ND	NA	NA	NA	NA	ND	ND	NA	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. Sample results were diluted due to exceedence in calibration range

Definitions:

mg/kg = milligrams per kilogram.
ND = Parameter not detected above laboratory detection limit.
-- = Sample not analyzed for parameter.
DL = Indicates a dilution
J = Estimated value; result is less than the sample quantitation limit but greater than zero .
J+ = The analyte was positively identified; the associated numerical value is an estimated quantity that may be biased high.
J- = The analyte was positively identified; the associated numerical value is an estimated quantity that may be biased low.

Exceeds Unrestricted SCOs

TABLE 9B
SUMMARY OF REMAINING ON-SITE SUBSURFACE SOIL/FILL ABOVE USCOs
(RI SOIL BORINGS)

SITE MANAGEMENT PLAN

1827 FILLMORE AVENUE SITE
BUFFALO, NEW YORK

Parameter[1]	Unrestricted SCOs[2] (ppm)	SB-2 (4'-8')	SB-5 (8'-12')	SB-10 (8'-12')	SB-11 (12-16')	SB-18 (4'-8')	SB-19 (12'-18')	SB-22 (12'-19')	SB-27 (8'-12')	SB-37 (8'-10')	SB-39 (6'-8')	SB-41 (8'-11')	SB-41RE (8'-11')	SB-41-2 (8'-11')	SB-41-3 (8'-11')	SB-42 (14'-16')	SB-43 (6'-8')	SB-43 (10'-12')	SB-43RE (10'-12')	SB-43 (16'-20')	SB-43RE (16'-20')	SB-45 (10'-12')	SB-46 (12'-16')	SB-46RE (12'-16')
Volatile Organic Compounds (VOCs) - mg/kg[3]																								
1,2,4-Trichlorobenzene	--	ND	ND	NA	ND	ND	NA	ND	NA	ND	ND	ND	ND	NA	NA	NA	ND	ND	ND	ND	ND	NA	ND	ND
2-Butanone (MEK)	0.12	ND	ND	NA	ND	ND	NA	ND	NA	ND	ND	ND	ND	NA	NA	NA	ND	ND	ND	ND	ND	NA	ND	ND
4-Isopropyltoluene	--	ND	0.0013	NA	ND	ND	NA	ND	NA	ND	ND	ND	ND	NA	NA	NA	ND	ND	ND	ND	ND	NA	ND	ND
Acetone	0.05	0.013 J	0.035	NA	0.041	ND	NA	**0.074**	NA	0.025 J	**0.066**	0.03 J	**0.074 Q**	NA	NA	NA	0.037	**0.075**	**0.069 Q**	**0.097**	**0.056**	NA	**0.13**	**0.085 Q**
Carbon Disulfide	--	ND	ND	NA	ND	ND	NA	ND	NA	ND	ND	ND	ND	NA	NA	NA	ND	ND	ND	0.0005 J	ND	NA	0.0019 J	ND
Methylcyclohexane	--	ND	ND	NA	ND	ND	NA	ND	NA	ND	ND	ND	ND	NA	NA	NA	ND	ND	ND	ND	ND	NA	ND	ND
Toluene	0.7	ND	ND	NA	ND	ND	NA	ND	NA	ND	0.0026	ND	ND	NA	NA	NA	0.0019	ND	ND	ND	ND	NA	ND	ND
Tentatively Identified Compounds (TICs)	--	NA	NA	NA	NA	0.027 J	NA	NA	NA	NA	0.0302	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total VOCs		*0.013*	*0.0363*	*NA*	*0.041*	*ND*	*NA*	*0.074*	*NA*	*0.025*	*0.0988*	*0.03*	*0.074*	*NA*	*NA*	*NA*	*0.0389*	*0.075*	*0.069*	*0.0975*	*0.056*	*NA*	*0.1319*	*0.085*
Semi-Volatile Organic Compounds (SVOCs) - mg/kg[3]																								
1,1-Biphenyl	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	ND	ND	ND	NA	ND	NA	ND	ND	NA
3+4-Methylphenols	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	ND	ND	ND	NA	ND	NA	ND	ND	NA
Acenaphthene	20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	ND	ND	ND	NA	ND	NA	ND	ND	NA
Acenaphthylene	100	ND	ND	ND	ND	ND	ND	ND	ND	4.7	ND	0.19 J	NA	NA	NA	ND	ND	ND	NA	ND	NA	ND	ND	NA
Anthracene	100	ND	ND	ND	ND	ND	ND	ND	ND	4.1	ND	0.38 J	NA	NA	NA	ND	ND	ND	NA	ND	NA	ND	ND	NA
Benzo(a)anthracene	1	ND	ND	ND	ND	ND	ND	ND	0.53	**15**	ND	0.88	NA	NA	NA	0.16 J	ND	ND	NA	ND	NA	ND	ND	NA
Benzo(a)pyrene	1	ND	ND	ND	ND	ND	ND	ND	0.72	**18**	ND	0.91	NA	NA	NA	0.17 J	ND	ND	NA	ND	NA	ND	ND	NA
Benzo(b)fluoranthene	1	ND	ND	ND	ND	ND	ND	0.15 J	**1.1**	**22 D**	ND	**1.1**	NA	NA	NA	0.2 J	ND	ND	NA	ND	NA	ND	ND	NA
Benzo(g,h,i)perylene	100	ND	ND	ND	ND	ND	ND	ND	0.58	12	ND	0.47	NA	NA	NA	ND	ND	ND	NA	ND	NA	ND	ND	NA
Benzo(k)fluoranthene	0.8	ND	ND	ND	ND	ND	ND	ND	0.28 J	**7.9**	ND	0.37 J	NA	NA	NA	ND	ND	ND	NA	ND	NA	ND	ND	NA
Benzoic acid	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.71 J	NA	NA	NA	ND	ND	ND	NA	ND	NA	ND	ND	NA
Carbazole	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	ND	ND	ND	NA	ND	NA	ND	ND	NA
Chrysene	1	ND	ND	ND	ND	ND	ND	ND	0.64	**17**	ND	0.89	NA	NA	NA	0.17 J	ND	ND	NA	ND	NA	ND	ND	NA
Dibenzo(a,h)anthracene	0.33	ND	ND	ND	ND	ND	ND	ND	0.19 J	**3.6**	ND	ND	NA	NA	NA	ND	ND	ND	NA	ND	NA	ND	ND	NA
Dibenzofuran	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	ND	ND	ND	NA	ND	NA	ND	ND	NA
Dimethylphthalate	--	0.23 J	0.29 J	ND	0.38 J	0.37 J	0.49 J	0.35 J	0.46	ND	0.36	0.36 J	NA	NA	NA	0.31 J	0.36	ND	NA	0.42 J	NA	ND	0.42 JQ	NA
Fluoranthene	100	ND	ND	ND	ND	ND	ND	0.21 J	0.59	24 D	ND	1.7	NA	NA	NA	0.27 J	ND	ND	NA	ND	NA	ND	0.20 JQ	NA
Fluorene	30	ND	ND	ND	ND	ND	ND	ND	ND	1.4 J	ND	ND	NA	NA	NA	ND	ND	ND	NA	ND	NA	ND	ND	NA
Indeno(1,2,3-cd)pyrene	0.5	ND	ND	ND	ND	ND	ND	ND	**0.56**	**12**	ND	ND	NA	NA	NA	ND	ND	ND	NA	ND	NA	ND	ND	NA
Naphthalene	12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.29 J	NA	NA	NA	ND	ND	ND	NA	ND	NA	ND	ND	NA
Phenanthrene	100	ND	ND	ND	ND	ND	ND	0.19 J	ND	11	ND	1.3	NA	NA	NA	ND	ND	ND	NA	ND	NA	ND	ND	NA
Pyrene	100	ND	ND	ND	ND	ND	ND	0.18 J	ND	24 D	ND	1.4	NA	NA	NA	0.22 J	ND	ND	NA	ND	NA	ND	ND	NA
Tentatively Identified Compounds (TICs)	--	2.474 J	4.875 J	0.49 J	0.59 J	0.947 J	19.84 J	1.41 J	1.45 J	58.52 J	0.70 JA	3.71 JA	NA	NA	NA	1.469 JA	2.656 JA	0.92 J	NA	4.92 JA	NA	0.47 JAB	5.15 J	NA
Total SVOCs		*0.23*	*0.29*	*ND*	*0.38*	*0.37*	*0.49*	*1.08*	*5.65*	*176.7*	*0.36*	*10.95*	*NA*	*NA*	*NA*	*1.5*	*0.36*	*ND*	*NA*	*0.42*	*NA*	*ND*	*0.62*	*NA*
Total PAHs		*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*0.73*	*5.19*	*176.7*	*ND*	*9.88*	*NA*	*NA*	*NA*	*1.19*	*ND*	*ND*	*NA*	*ND*	*NA*	*ND*	*0.20*	*NA*
Metals - mg/kg																								
Aluminum	--	6300	4290	2730	3370	4890	5650	5180	2420	5290	7000	8490	NA	NA	NA	3910	5650	4210	NA	4020	NA	5350	3460	NA
Antimony	--	1.17 J	1.20 J	4.45	ND	1.96 J	0.891 J	1.61 J	3.71	0.904 J	1.63 J	42	NA	NA	NA	0.712 J	7.64	2.11 J	NA	1.05 J	NA	1.11 J	2.09 J	NA
Arsenic	13	10.2	9.0	**13.3**	**13.7**	7.35	**31.6**	5.24	11.7	12	5.37	**73**	NA	**13.4**	**13.6**	8.79	6.91	**18.7**	NA	**14.4**	NA	**23.3**	12.2	NA
Barium	350	84.4	190	252	62.8	97.1	**597**	65.9	**675**	71.4	85.9	113	NA	NA	NA	90.2	36.3	**973**	NA	174	NA	266	113	NA
Beryllium	7.2	0.207 J	0.283	0.126 J	0.146 J	ND	ND	ND	ND	0.356	ND	**16**	NA	NA	NA	0.338	ND	0.315	NA	0.537	NA	0.422	0.294	NA
Cadmium	2.5	0.432	1.31	0.948	0.48	0.849	0.814	0.315	2.04	0.452	0.459	**17**	NA	NA	NA	0.398	1.47	1.14	NA	0.284 J	NA	**82.3**	0.392	NA
Calcium	--	5970	87400	20400	10500	14800	11900	26500	9710	54000	14200	6530	NA	NA	NA	4420	30300	20600	NA	2300	NA	16200	12100	NA
Chromium	30	8.95	10.3	7.85	7.05	25.4	12.8	9.53	**46.4**	7.42	9.25	**41.1**	NA	NA	NA	8.63	7.9	6.87	NA	7.06	NA	15.2	8.07	NA
Cobalt	--	6.54	5.59	4.91	6.26	6.21	8.59	4.76	5.27	5.41	11.8	24.7	NA	NA	NA	7.89	4.24	6.07	NA	6.4	NA	7.8	6.47	NA
Copper	50	40.2	46.7	**120**	**51.5**	**54**	**110**	**89.2**	**407**	39.5	**59.2**	**62.3**	NA	NA	NA	33.1	34.1	38.4	NA	43.1	NA	**139**	47.4	NA
Iron	--	21600	9790	24900	37300	61200	20500	28900	56600	8300	35700	34600	NA	NA	NA	11200	22400	26200	NA	8690	NA	20700	8440	NA
Lead	63	**1040**	**628**	**263**	59	**96.1**	**410**	**68.1**	**1910**	**290**	27.4	**527**	NA	NA	NA	**99.5**	**63.5**	**1100**	NA	**606**	NA	**481**	**246**	NA
Magnesium	--	921	2580	884	1280	3580	1080	2200	1240	3610	1150	1360	NA	NA	NA	517	3190	536	NA	317	NA	473	1560	NA
Manganese	1600	379	143	159	255	793	**6770**	776	452	121	1500	498	NA	NA	NA	140	1390	135	NA	80.9	NA	208	142	NA
Mercury	0.18	**1.54 D**	0.132	0.15	0.13	0.022	**0.219**	0.014	**0.464**	0.091	0.024	0.145	NA	NA	NA	0.155	0.007 J	0.157	NA	0.04	NA	0.119	0.044	NA
Nickel	30	13.7	**39.8**	12.2	11.0	17.2	28.1	14	29.4	12.7	7.79	**56.4**	NA	NA	NA	13.5	8.75	15.6	NA	12.8	NA	18.1	14.4	NA
Potassium	--	488	576	397	526	733	834	624	254	593	830	1430	NA	NA	NA	553	621	446	NA	497	NA	494	359	NA
Selenium	3.9	ND	ND	1.78	ND	ND	1.45	ND	ND	ND	ND	**149**	NA	NA	NA	ND	ND	ND	NA	1.58	NA	ND	1.42	NA
Silver	2	0.561	0.213 J	0.715	0.808	1.33	1.51	0.692	1.36	0.214 J	0.92	**6.33**	NA	NA	NA	0.294 J	0.659	0.604	NA	0.328 J	NA	0.607	0.312 J	NA
Sodium	--	301	83.6 J	4930	13.7 J	42	240	ND	ND	118	ND	432	NA	NA	NA	90.4	ND	49.7	NA	988	NA	78.2 J	82 J	NA
Thallium	--	0.562 J	ND	0.804 J	1.52 J	3.28	7.02	1.24 J	3.3	ND	2.16	158	NA	NA	NA	ND	1.46 J	0.693 J	NA	ND	NA	ND	ND	NA
Vanadium	--	18.9	15.4	14.9	19.8	22	28.1	11.9	6.92	18.7	15.1	47.7	NA	NA	NA	19.9	12.2	22.1	NA	25.8	NA	29.7	20.5	NA
Zinc	109	97.1	**273**	**341**	101	101	**790**	**339**	**712**	**165**	50.3	**121**	NA	NA	NA	**128**	**1610**	**935**	NA	109	NA	NA	**169**	NA
Organochlorine Pesticides[1] - mg/kg[3]																								
Total Pesticides		*ND*	*ND*	*NA*	*ND*	*ND*	*NA*	*ND*	*NA*	*ND*	*ND*	*ND*	*NA*	*NA*	*NA*	*NA*	*ND*	*ND*	*NA*	*ND*	*NA*	*NA*	*ND*	*NA*
Herbicides[1] - mg/kg																								
Total Herbicides		*ND*	*ND*	*NA*	*ND*	*ND*	*NA*	*ND*	*NA*	*ND*	*ND*	*ND*	*NA*	*NA*	*NA*	*NA*	*ND*	*ND*	*NA*	*ND*	*NA*	*NA*	*ND*	*NA*
PCBs[1] - mg/kg																								
Total PCBs		*ND*	*ND*	*NA*	*ND*	*ND*	*NA*	*ND*	*NA*	*ND*	*ND*	*ND*	*NA*	*NA*	*NA*	*NA*	*ND*	*ND*	*ND*	*ND*	*NA*	*NA*	*ND*	*NA*

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. Sample results were diluted due to exceedence in calibration range

Definitions:
mg/kg = milligrams per kilogram.
ND = Parameter not detected above laboratory detection limit.
-- = Sample not analyzed for parameter.
DL = Indicates a dilution
J = Estimated value; result is less than the sample quantitation limit but greater than zero .
J+ = The analyte was positively identified; the associated numerical value is an estimated quantity that may be biased high.
J- = The analyte was positively identified; the associated numerical value is an estimated quantity that may be biased low.

Exceeds Unrestricted SCOs

TABLE 10

SUMMARY OF REMEDIAL INVESTIGATION GROUNDWATER ANALYTICAL RESULTS

SITE MANAGEMENT PLAN

1827 FILLMORE AVENUE SITE

BUFFALO, NEW YORK

Parameter [1]	NYSDEC Class GA GWQS[2]	MW-1	MW-2	MW-3	MW-5	MW-7
TCL Volatile Organic Compounds (VOCs) - ug/L						
2-Butanone (MEK)	**50**	ND	1.6 J	ND	ND	2.1 J
4-Isopropyltoluene	**5**	ND	ND	ND	ND	1.4
Acetone	**50**	4.1 J	ND *	ND *	ND	11
Chloroform	**7**	0.85 J	ND	0.64 J	ND	ND
Cyclohexane	**--**	ND	0.18 J	0.88 J	ND	ND
Methylcyclohexane	**--**	ND	ND	0.84 J	ND	ND
	Total VOCs	4.95	1.78	2.36	ND	14.5 J
	Total TICs	ND	ND	ND	ND	ND
TCL Semi-Volatile Organic Compounds[1] (SVOCs) - ug/L						
4-Methylphenol	**--**	ND	ND	ND	ND	0.89 J
Acenaphthene	**20**	ND	ND	ND	ND	0.59 J
Benzaldehyde	**--**	ND	ND	ND	ND	ND
Diethyl phthalate	**50**	0.62 J	ND	ND	0.53 J	ND
Fluoranthene	**50**	ND	ND	ND	ND	0.57 J
Fluorene	**50**	ND	ND	ND	ND	0.62 J
Phenanthrene	**50**	ND	ND	ND	ND	2.2 J
Total TICs	**--**	5.5 J	54.7 J JN	118 J JN	207.5 J N	230.0 J N
Semi-Volatile Organic Compounds by Method 8270 SIM (ng/L)						
1,4 - Dioxane	**--**	-	--	--	--	ND
TAL Metals - ug/L (Dissolved)						
Barium	**1000**	22 J	170 J	100 J	130.00 J	240.00 J
Cadmium	**5**	ND	ND	ND	0.50000 J	ND
Calcium	**--**	104000 J B	237000 J B	197000 J B	206000 J	212000 J
Chromium	**50**	ND	1.1 J	ND	ND	ND
Cobalt	**--**	ND	0.75 J	ND	3.2000 J	2.2000 J
Copper	**200**	2.8 J	ND	ND	2.0000 J	ND
Iron	**300**	ND	ND	ND	ND	ND
Lead	**25**	ND	ND	ND	6.2000 J	4.3000 J
Magnesium	**--**	12300 J	42400 J	36300 J	20900.0 J	45000.0 J
Manganese	**300**	18 J	**900 J**	**350 J**	**440.00 J**	**380.00 J**
Nickel	**100**	3.5 J	4.7 J	8.7000 J	9.5000 J	6.0000 J
Potassium	**--**	6100 J	16100 J	11900 J	9000.0 J	17200.0 J
Selenium	**10**	9.9 J	ND	ND	ND	ND
Sodium	**20000**	**68400 J**	**187000 J**	**100000 J**	**26400.0 J**	13600.0 J
Zinc	**5000**	15 J B	17 J B	65 J B	180.00 J	19.000 J
Organochlorine Pesticides[1] ug/L						
4,4'-DDD	**0.3**	--	--	--	0.012 J	ND
4,4'-DDT	**0.2**	--	--	--	ND	0.019 J
delta-BHC	**0.04**	--	--	--	ND	ND
Herbicides[1] ug/L						
Total Herbicides	**NA**	--	--	--	ND	ND
Polychlorinated Biphenyls[1] (PCBs) ug/L						
Total PCBs	**0.09**	--	--	--	ND	ND
Perfluorinated Alkyl Acids by Method 537 (ng/L)						
Perfluorobutanoic acid (PFBA)	**--**	--	--	--	--	2.1 B
Perfluorobutanesulfonic acid (PFBS)	**--**	--	--	--	--	0.87 J
Perfluorohexanesulfonic acid (PFHxS)	**--**	--	--	--	--	0.29 JB

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 TOGS 1.1.1 Class GA Groundwater Quality Standards (GWQS).

Definitions:

ND = Parameter not detected above laboratory detection limit.
SIM = selective ion method
ng/L = nanograms per liter; parts per trillion
"--" = No GWQS available.
B = Compound was found in the blank and sample
J = Estimated value; result is less than the sample quantitation limit but greater than zero.

Exceeds NYSDEC Class GA GWQS

TABLE 12

MONITORING WELL CONSTRUCTION DETAILS

1827 FILLMORE AVENUE SITE
BUFFALO, NEW YORK

Well Identification			Well Elevations				Well Diameter (inches)	Well Screen Data						
Well Number	Well Type	Date Completed	TOR Elevation (fmsl)	Ground Elevation (fmsl)	Total Depth (fbTOR)	Bottom of Well Elevation (fmsl)		Length of Well Screen (feet)	Screen Interval (fmsl)			Screen Interval (fbTOR)		
MW-1	BR	07/06/2018	--	--	11.87	--	2	7.5	--	to	--	4.37	to	11.87
MW-2	BR	07/06/2018	--	--	29.95	--	2	10	--	to	--	19.95	to	29.95
MW-3	BR	07/05/2018	--	--	27.77	--	2	8.8	--	to	--	18.97	to	27.77
MW-4	OB	11/23/2017	503.92	501.27	15.60	488.32	2	10	498.32	to	488.32	5.60	to	15.60
MW-5	OB	11/20/2017	500.88	497.84	18.30	482.58	2	10	492.58	to	482.58	8.30	to	18.30
MW-6	OB	11/21/2017	501.09	498.41	20.28	480.81	2	10	490.81	to	480.81	10.28	to	20.28
MW-7	OB	11/27/2017	508.01	505.59	26.83	481.18	2	10	491.18	to	481.18	16.83	to	26.83
MW-8	OB	11/20/2017	506.62	504.23	22.53	484.09	2	10	494.09	to	484.09	12.53	to	22.53
MW-9	OB	TBD												
MW-10	OB	TBD												

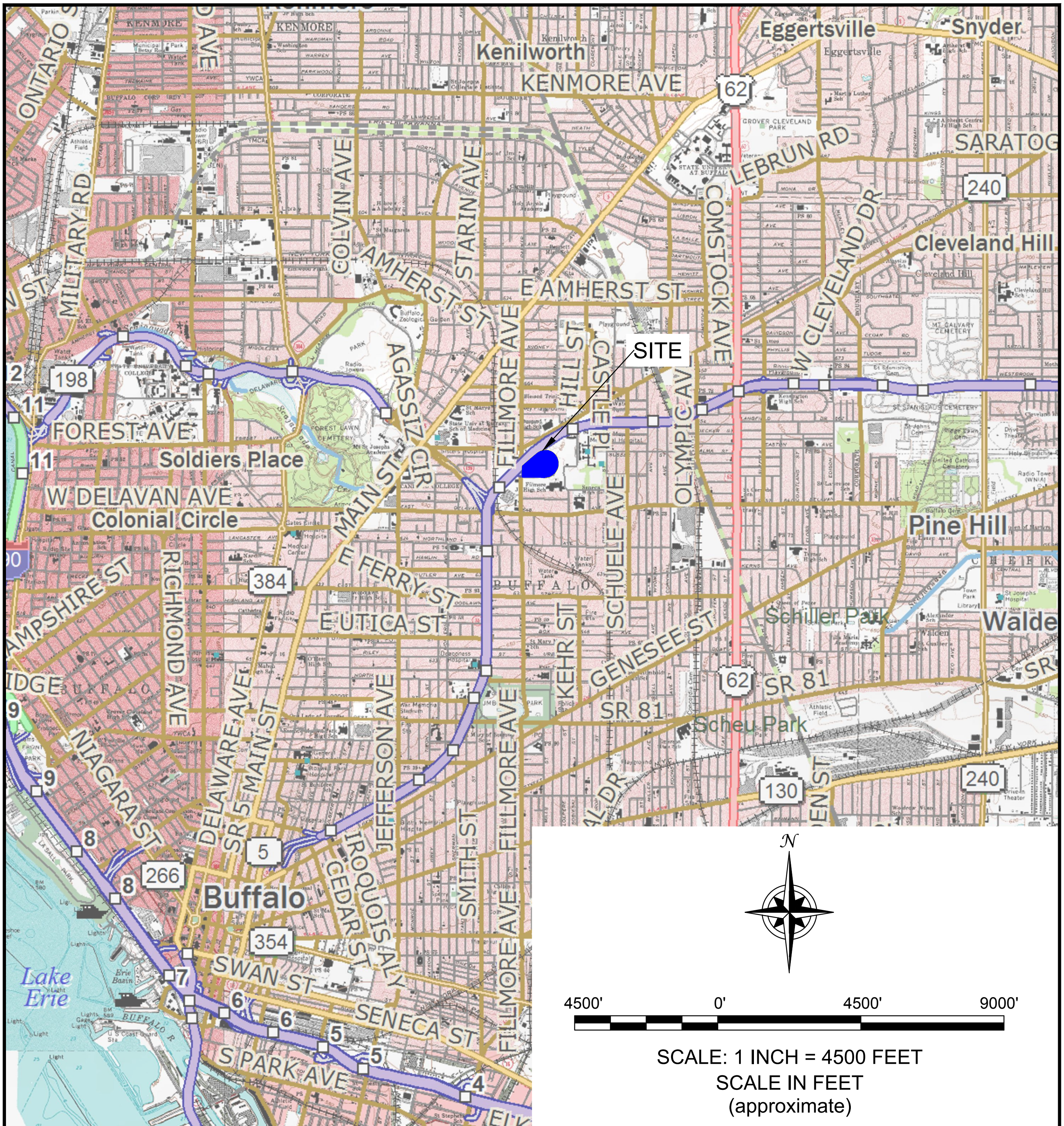
Abbreviations:

DTW = depth to water
fbgs = feet below ground surface
fbTOR = feet below top of riser
BR = Bedrock
fmsl = feet above mean sea level
OB = Indicates a well completed in shallow unconsolidated overburden
TOR = top of riser
-- = Not surveyed at this time

FIGURES

F:\CAD\Benchmark\Rupp, Baase, Pfalzgraf & Cunningham LLC\1827 Fillmore Avenue\18 - SMP\Figure 1; Site Location & Vicinity Map.dwg

FIGURE 1



BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

TURNKEY ENVIRONMENTAL RESTORATION, LLC

2558 HAMBURG TURNPIKE, SUITE 300, BUFFALO, NY 14218, (716) 856-0599

PROJECT NO.: 0421-017-001	
DATE: AUGUST 2019	
DRAFTED BY: CCB	

SITE LOCATION & VICINITY MAP

SITE MANAGEMENT PLAN

1827 FILLMORE AVENUE SITE
BCP SITE NO. C915279
BUFFALO, NEW YORK

PREPARED FOR

1827 FILLMORE LLC

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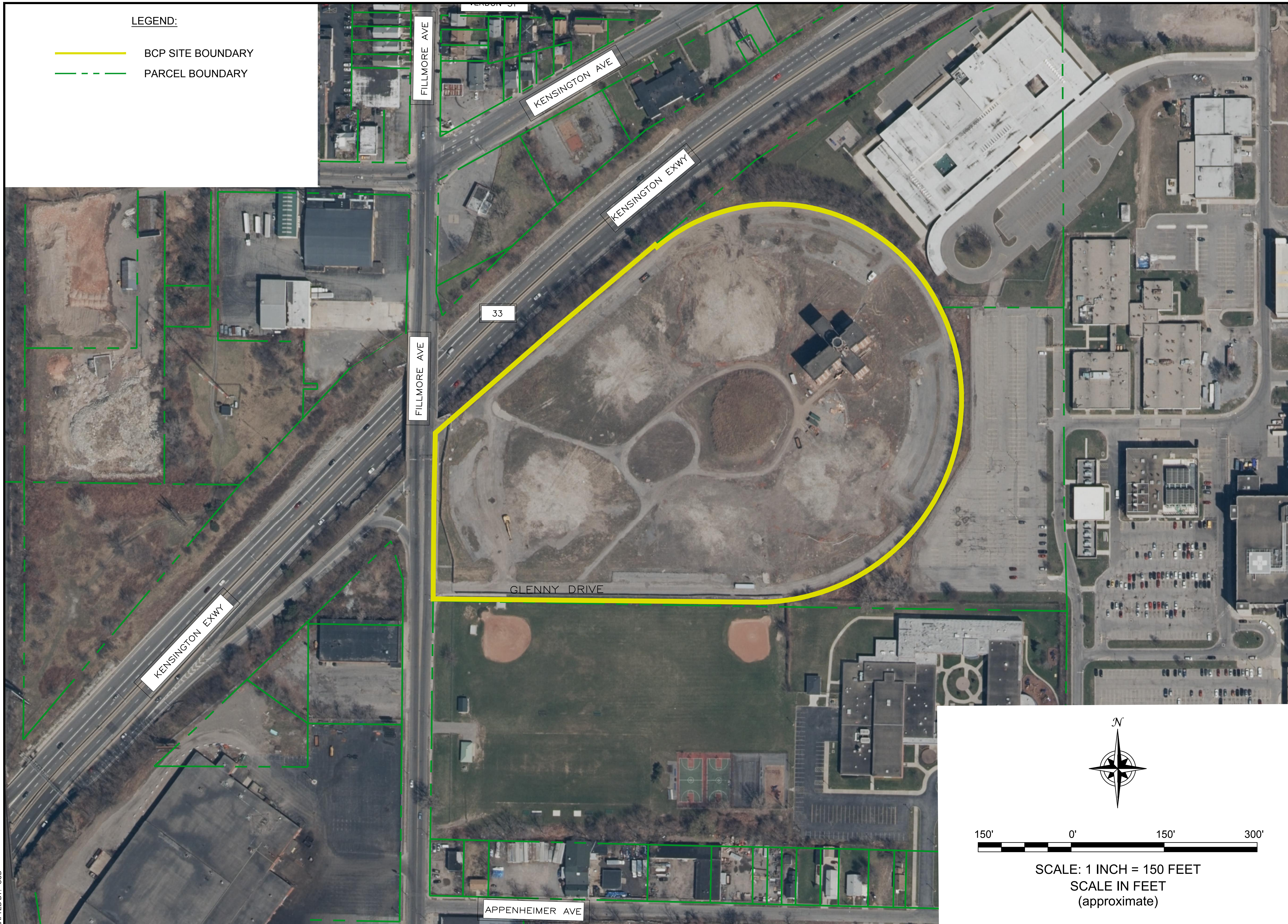

F:\CAD\Benchmark\Rupp, Baase, Pfalzgraf & Cunningham LLC\1827 Fillmore Avenue\18 - SMP\Figure 2, Site Plan (Aerial).dwg

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TURNKEY ENVIRONMENTAL RESTORATION, LLC

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JOB NO.: 0421-017-001

SITE PLAN (AERIAL)

SITE MANAGEMENT PLAN
1827 FILLMORE AVENUE SITE
BCP SITE NO. C915279
BUFFALO, NEW YORK
PREPARED FOR
1827 FILLMORE LLC

FIGURE 2

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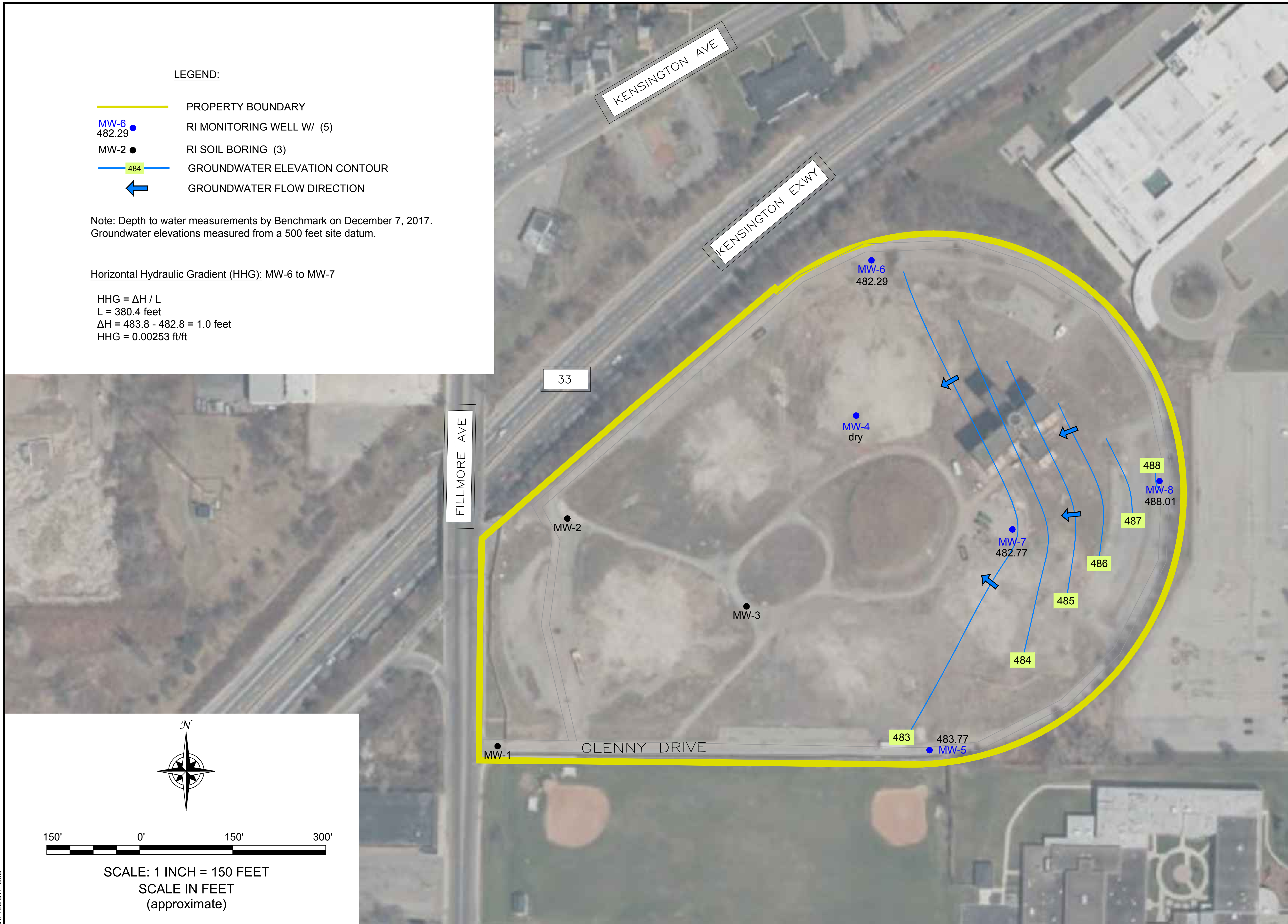

LEGEND:

- PROPERTY BOUNDARY
- MW-6 482.29 — RI MONITORING WELL W/ (5)
- MW-2 — RI SOIL BORING (3)
- 484 — GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION

Note: Depth to water measurements by Benchmark on December 7, 2017.
Groundwater elevations measured from a 500 feet site datum.

Horizontal Hydraulic Gradient (HHG): MW-6 to MW-7

HHG = ΔH / L
L = 380.4 feet
ΔH = 483.8 - 482.8 = 1.0 feet
HHG = 0.00253 ft/ft

150' 0' 150' 300'

SCALE: 1 INCH = 150 FEET
SCALE IN FEET
(approximate)

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC
2558 HAMBURG TURNPIKE
SUITE 300
BUFFALO, NY 14218
(716) 856-0599

JOB NO.: 0421-017-001

GROUNDWATER ISOPOTENTIAL MAP

SITE MANAGEMENT PLAN
1827 FILLMORE AVENUE SITE
BCP SITE NO. C915279
BUFFALO, NEW YORK
PREPARED FOR
1827 FILLMORE LLC

FIGURE 3

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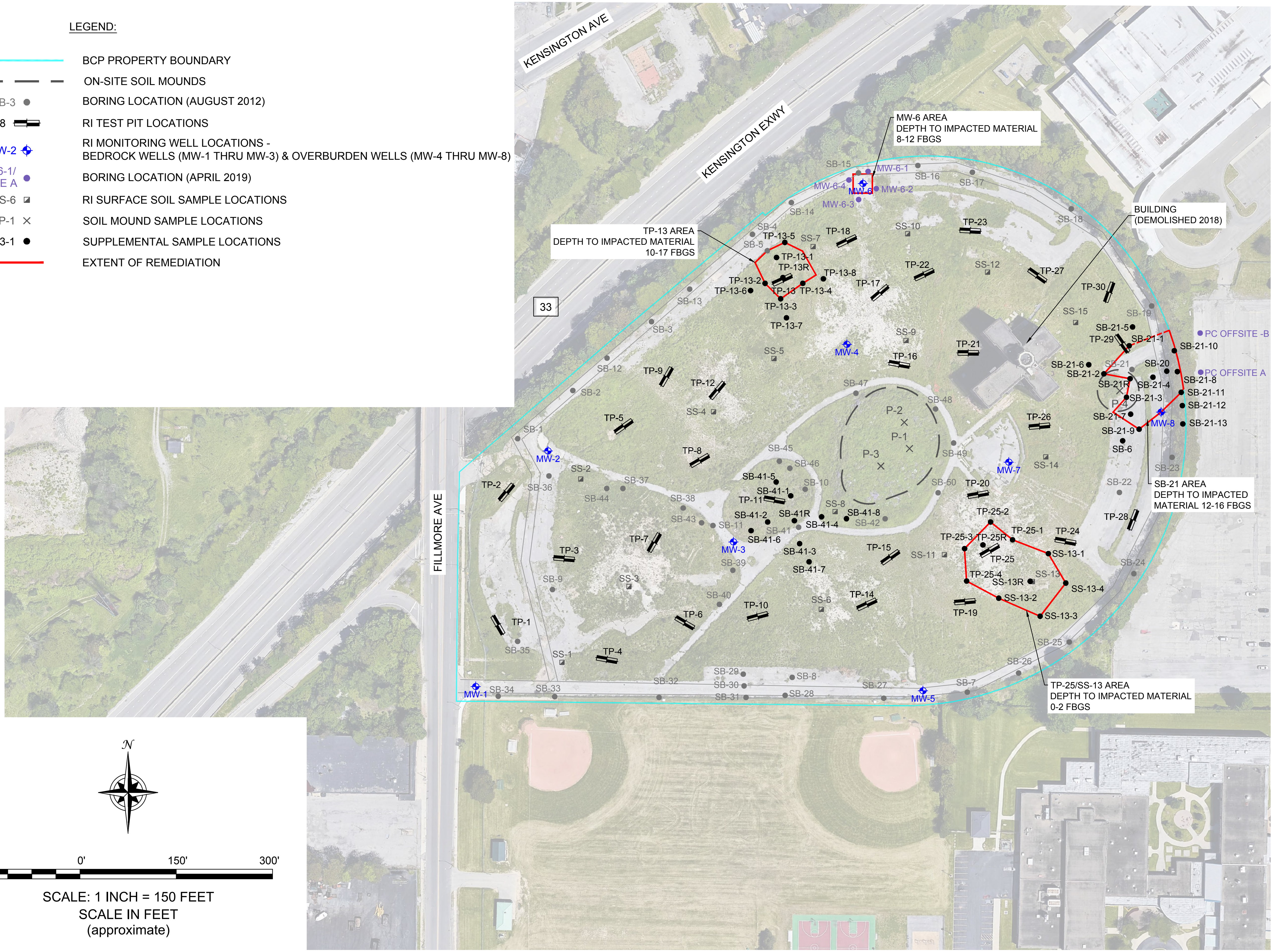
LEGEND:

- BCP PROPERTY BOUNDARY
- ON-SITE SOIL MOUNDS
- SB-3 — BORING LOCATION (AUGUST 2012)
- TP-8 — RI TEST PIT LOCATIONS
- MW-2 — RI MONITORING WELL LOCATIONS - BEDROCK WELLS (MW-1 THRU MW-3) & OVERBURDEN WELLS (MW-4 THRU MW-8)
- MW-6-1/ PC OFFSITE A — BORING LOCATION (APRIL 2019)
- SS-6 — RI SURFACE SOIL SAMPLE LOCATIONS
- P-1 — SOIL MOUND SAMPLE LOCATIONS
- TP-13-1 — SUPPLEMENTAL SAMPLE LOCATIONS
- EXTENT OF REMEDIATION



N

150' 0' 150' 300'

SCALE: 1 INCH = 150 FEET
SCALE IN FEET
(approximate)

F:\CAD\Benchmark\Rupp, Baase, Pfalzgraf & Cunningham LLC\1827 Fillmore Avenue\18 - SMP\Figure 4; Remedial Action Areas.dwg

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SUITE 300
BUFFALO, NY 14218
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JOB NO.: 0421-017-001

REMEDIAL ACTION AREAS

SITE MANAGEMENT PLAN
1827 FILLMORE AVENUE SITE
BUFFALO, NEW YORK
PREPARED FOR
1827 FILLMORE LLC

FIGURE 4

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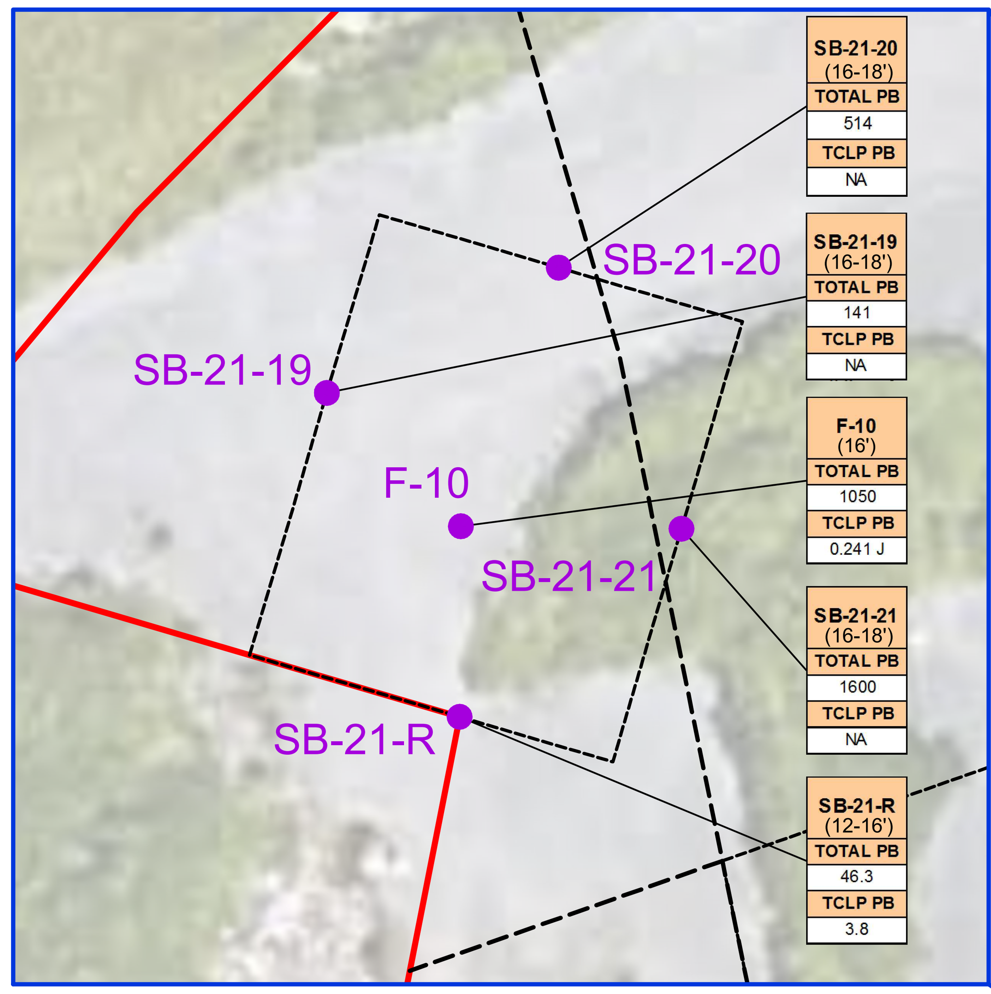
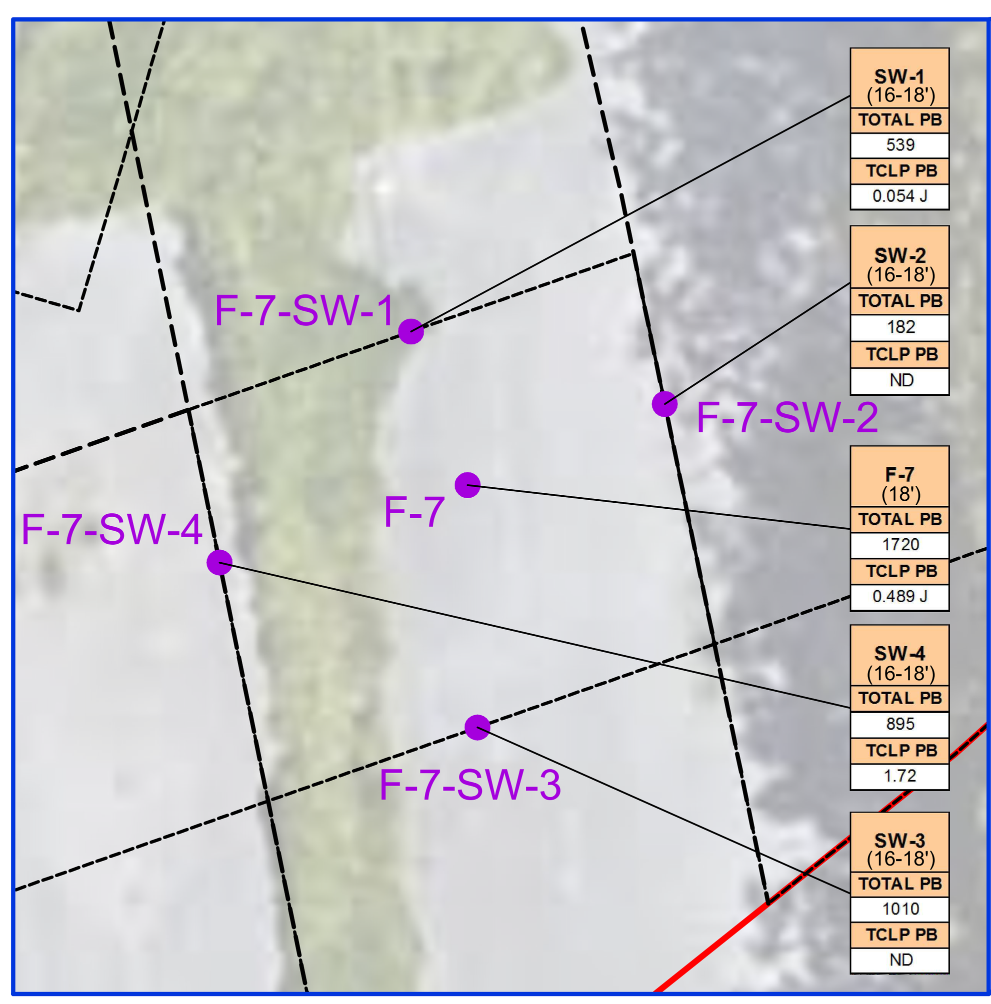


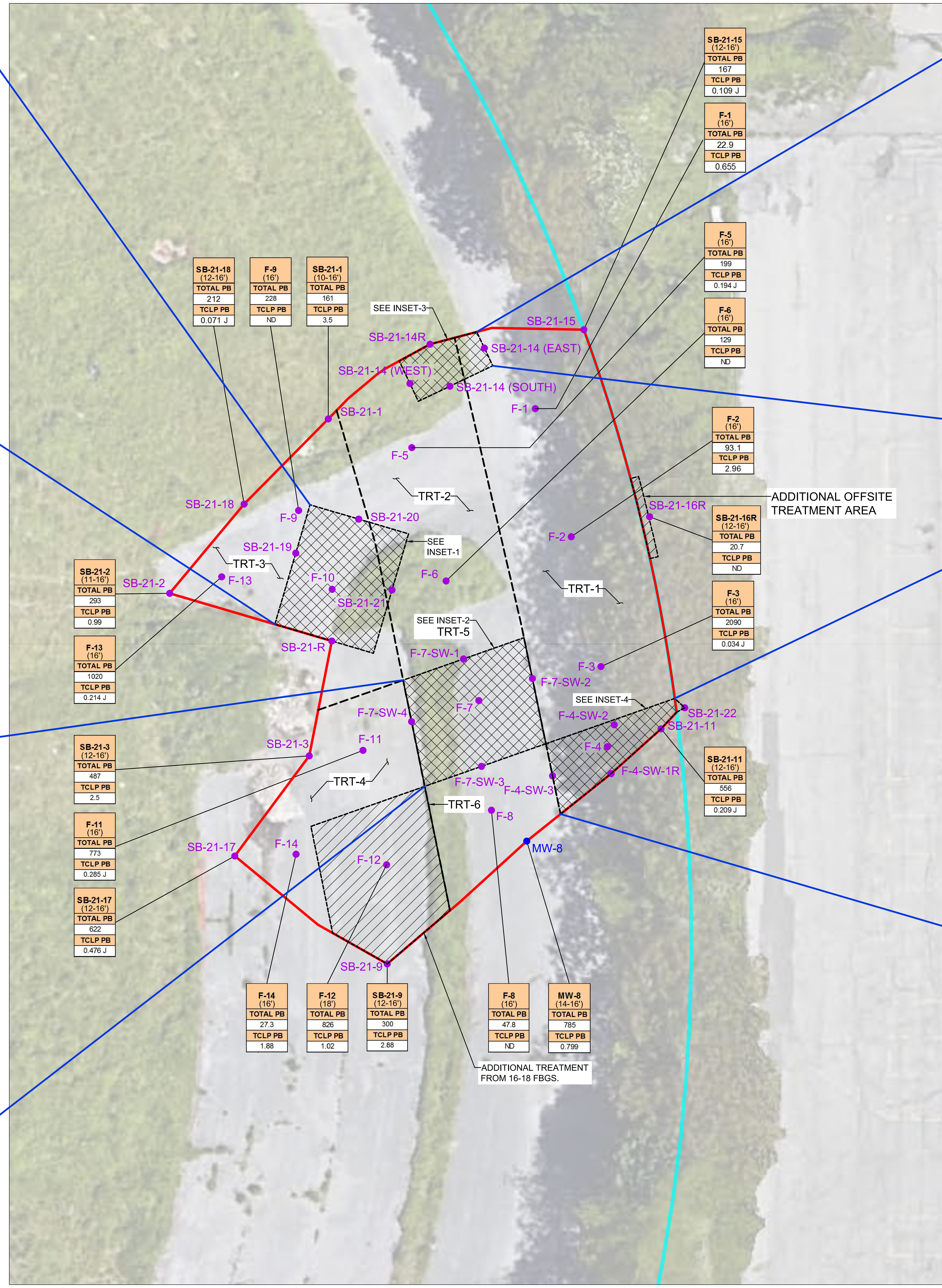
INSET-1
SB-21 AREA
SCALE: 1" = 10'
TREATMENT, EXCAVATION, AND REMOVAL BASED
ON ELEVATED TOTAL LEAD ANALYTICAL RESULTS.

HOTSPOT 1 AREA POST-TREATMENT
ANALYTICAL RESULTS

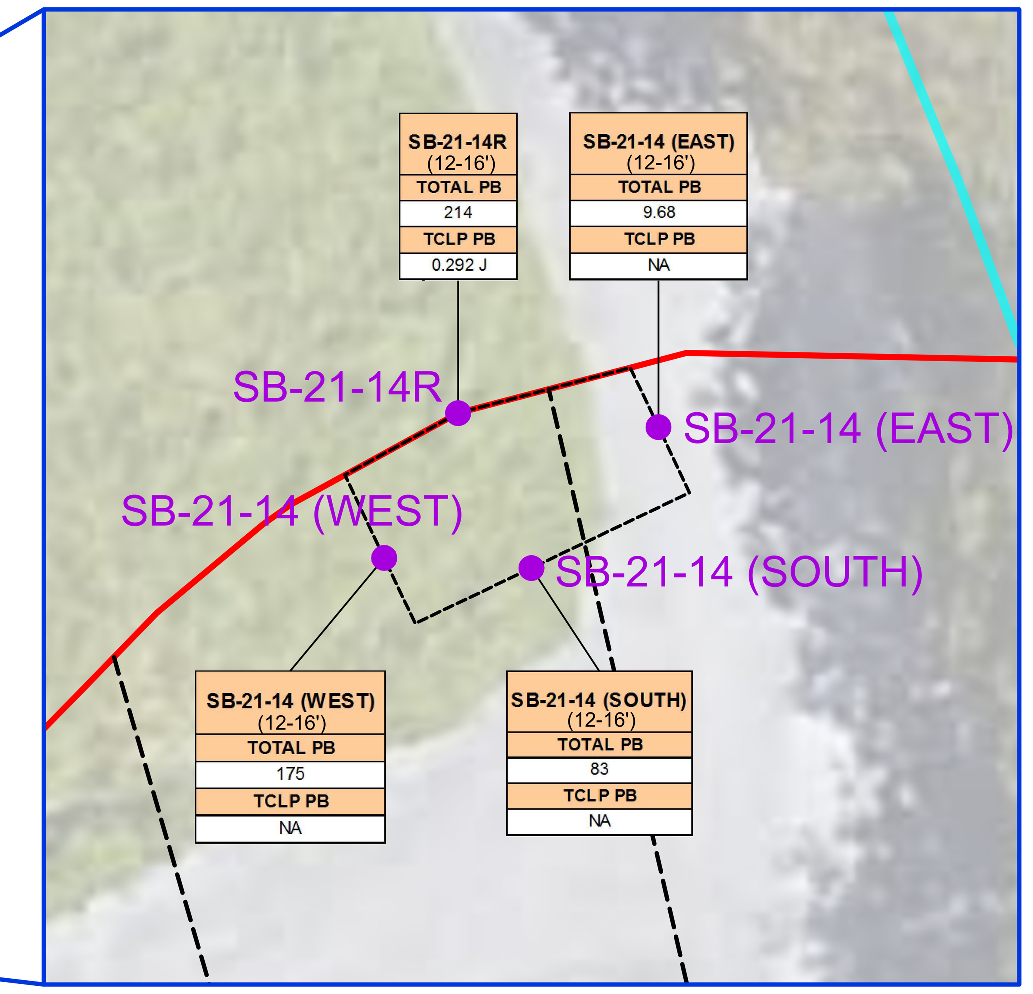
				ADDITIONAL TREATMENT	
				F-7 AREA	F-12 AREA
TRT-1 (12-16')	TRT-2 (12-16')	TRT-3 (12-16')	TRT-4 (12-16')	TRT-5 (16-18')	TRT-6 (16-18')
TCLP PB	TCLP PB	TCLP PB	TCLP PB	TCLP PB	TCLP PB
0.031 J	ND	ND	ND	ND	0.251 J



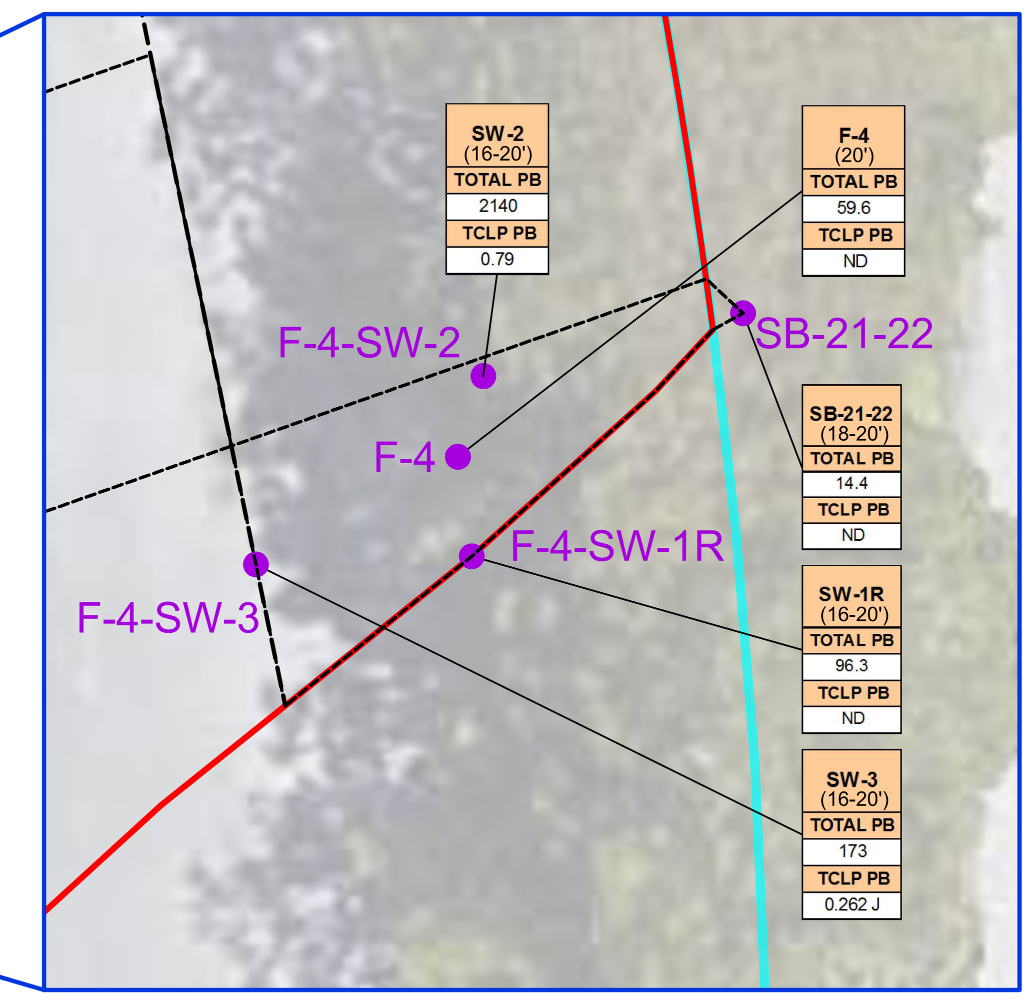
INSET-2
F-7 AREA
SCALE: 1" = 10'
2' ADDITIONAL TREATMENT, EXCAVATION, AND REMOVAL BASED
ON ELEVATED TOTAL AND TCLP LEAD ANALYTICAL RESULTS.



HOTSPOT 1 AREA
SCALE: 1" = 15'



INSET-3
SB-21-14 AREA
SCALE: 1" = 10'
EXCAVATION, AND REMOVAL BASED ON ELEVATED TOTAL LEAD ANALYTICAL RESULTS.



INSET-4
F-4 AREA
SCALE: 1" = 10'
EXCAVATION, AND REMOVAL BASED ON ELEVATED TOTAL LEAD ANALYTICAL RESULTS.

LEGEND:
- BCP PROPERTY BOUNDARY
- SB-21-1 ● PERIMETER END-POINT SAMPLE LOCATION
- SB-21 ● FLOOR END-POINT SAMPLE LOCATION
- MW-8 ● MONITORING WELL SOIL SAMPLE LOCATION
- EXTENT OF REMEDIATION
- F-1 (12-16') — SAMPLE LOCATION AND DEPTH
- TOTAL PB — PARAMETER - TOTAL OR TCLP
- 22.9 — CONCENTRATION - TOTAL (MG/KG) OR TCLP (MG/L)

N

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JOB NO.: 0421-017-001

REVISIONS

NO.	BY	DATE	REMARKS

SEAL

DRAWN BY:	CMS/CCB
DATE:	JUNE 2019
CHECKED BY:	MAL
APPROVED BY:	THF

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SB-21 AREA HOTSPOT END-POINT AND POST-TREATMENT SAMPLE RESULTS

SITE MANAGEMENT PLAN
1827 FILLMORE AVENUE SITE
BCP SITE NO. C915279
BUFFALO, NEW YORK
PREPARED FOR
1827 FILLMORE LLC

FIGURE 5

LEGEND:

BCP PROPERTY BOUNDARY

TP-25-1/22-13-1 ● SUPPLEMENTAL SAMPLE LOCATION

SS-13-5 ● PERIMETER END-POINT SAMPLE LOCATION

F-1 ● FLOOR END-POINT SAMPLE LOCATION

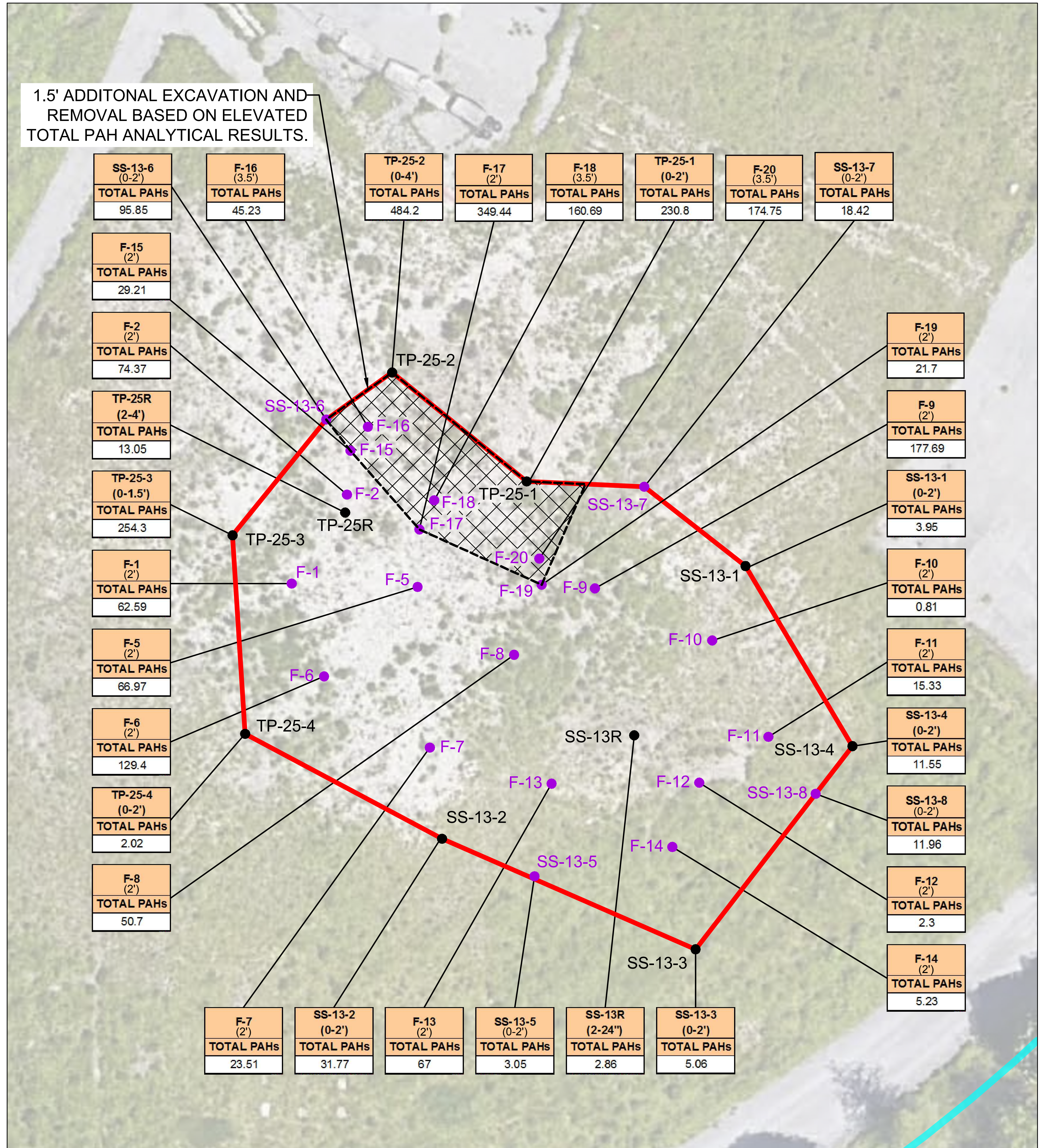
EXTENT OF REMEDIATION

SS-13-1 (0-2')
TOTAL PAHs
3.95

SAMPLE LOCATION AND DEPTH

PARAMETER

CONCENTRATION - TOTAL (MG/KG)



N

30' 0' 30' 60'

SCALE: 1 INCH = 30 FEET
SCALE IN FEET
(approximate)

DATE: AUGUST 2019
DRAFTED BY: CMS/CCB

F:\CAD\Benchmark\Rupp, Baase, Pfalzgraf & Cunningham LLC\1827 Fillmore Avenue\18 - SMP\Figure 6; TP-25SS-13 Area Hotspot End Point Sample Results.dwg

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC
2558 HAMBURG TURNPIKE
SUITE 300
BUFFALO, NY 14218
(716) 856-0599

JOB NO.: 0421-017-001

TP-25/SS13 AREA HOTSPOT END-POINT SAMPLE RESULTS

SITE MANAGEMENT PLAN

1827 FILLMORE AVENUE SITE
BCP SITE NO. C915279
BUFFALO, NEW YORK

PREPARED FOR
1827 FILLMORE LLC

FIGURE 6

DISCLAIMER:
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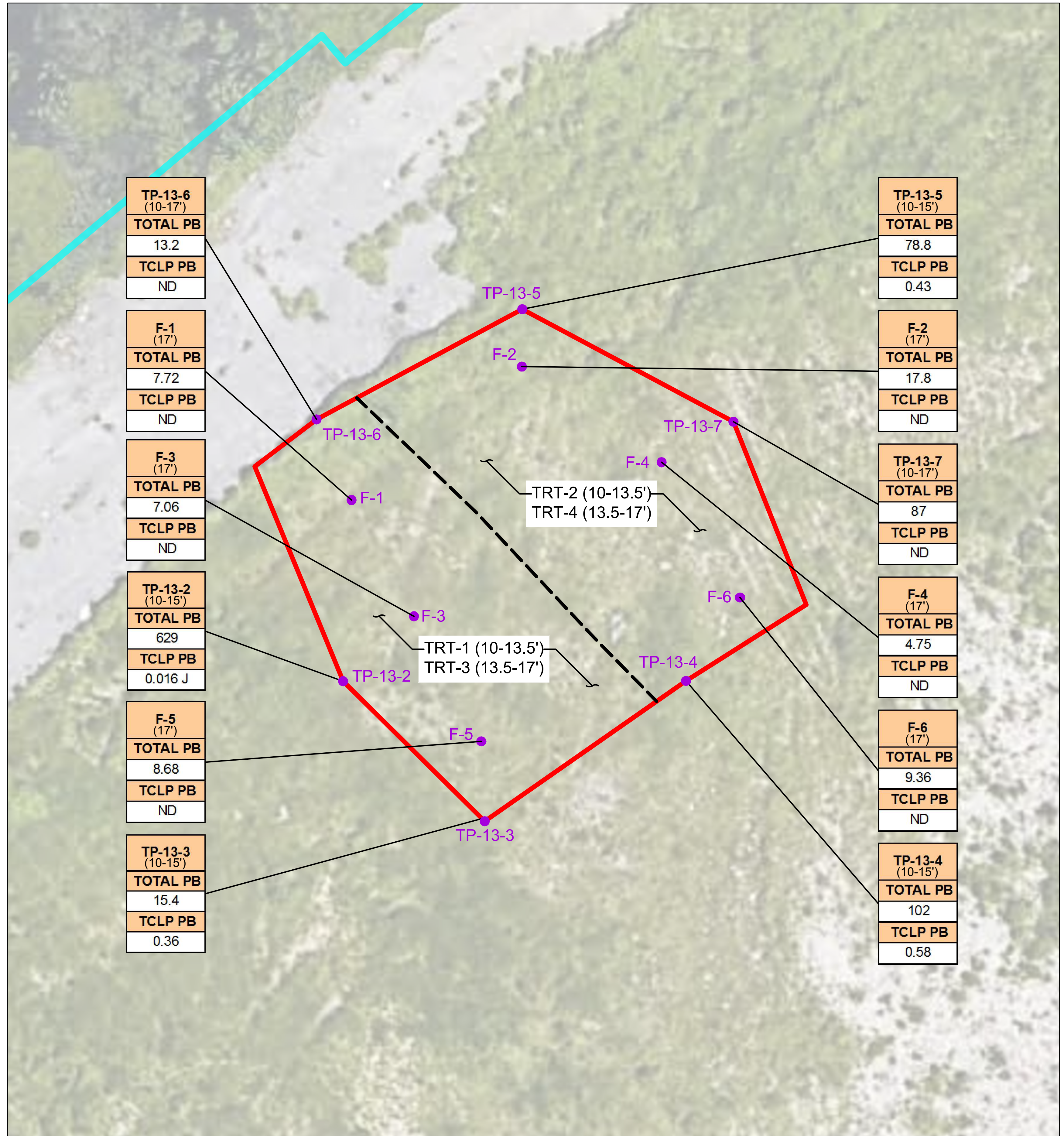
LEGEND:

- BCP PROPERTY BOUNDARY
- TP-13-2 ● PERIMETER END-POINT SAMPLE LOCATION
- F-1 ● FLOOR END-POINT SAMPLE LOCATION
- EXTENT OF REMEDIATION

TP-13-2 (2-3')	← SAMPLE LOCATION AND DEPTH
TOTAL PB	← PARAMETER - TOTAL OR TCLP
629	← CONCENTRATION - TOTAL (MG/KG) OR TCLP (MG/L)

HOTSPOT 3 AREA POST-TREATMENT ANALYTICAL RESULTS

TRT-1 (10-13.5')	TRT-2 (10-13.5')	TRT-3 (13.5-17')	TRT-4 (13.5-17')
TCLP PB	TCLP PB	TCLP PB	TCLP PB
ND	ND	ND	ND



N

20' 0' 20' 40'

SCALE: 1 INCH = 20 FEET
SCALE IN FEET
(approximate)

F:\CAD\Benchmark\Rupp, Baase, Pfalzgraf & Cunningham LLC\1827 Fillmore Avenue\18 - SMP\Figure 7; TP-13 Area Hotspot End Point and Post-Treatment Sample Results.dwg

DATE: AUGUST 2019
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2558 HAMBURG TURNPIKE
SUITE 300
BUFFALO, NY 14218
(716) 856-0599

JOB NO.: 0421-017-001

TP-13 AREA HOTSPOT END-POINT AND POST-TREATMENT SAMPLE RESULTS

SITE AMANGEMENT PLAN

1827 FILLMORE AVENUE SITE
BCP SITE NO. C915279
BUFFALO, NEW YORK
PREPARED FOR
1827 FILLMORE LLC

FIGURE 7

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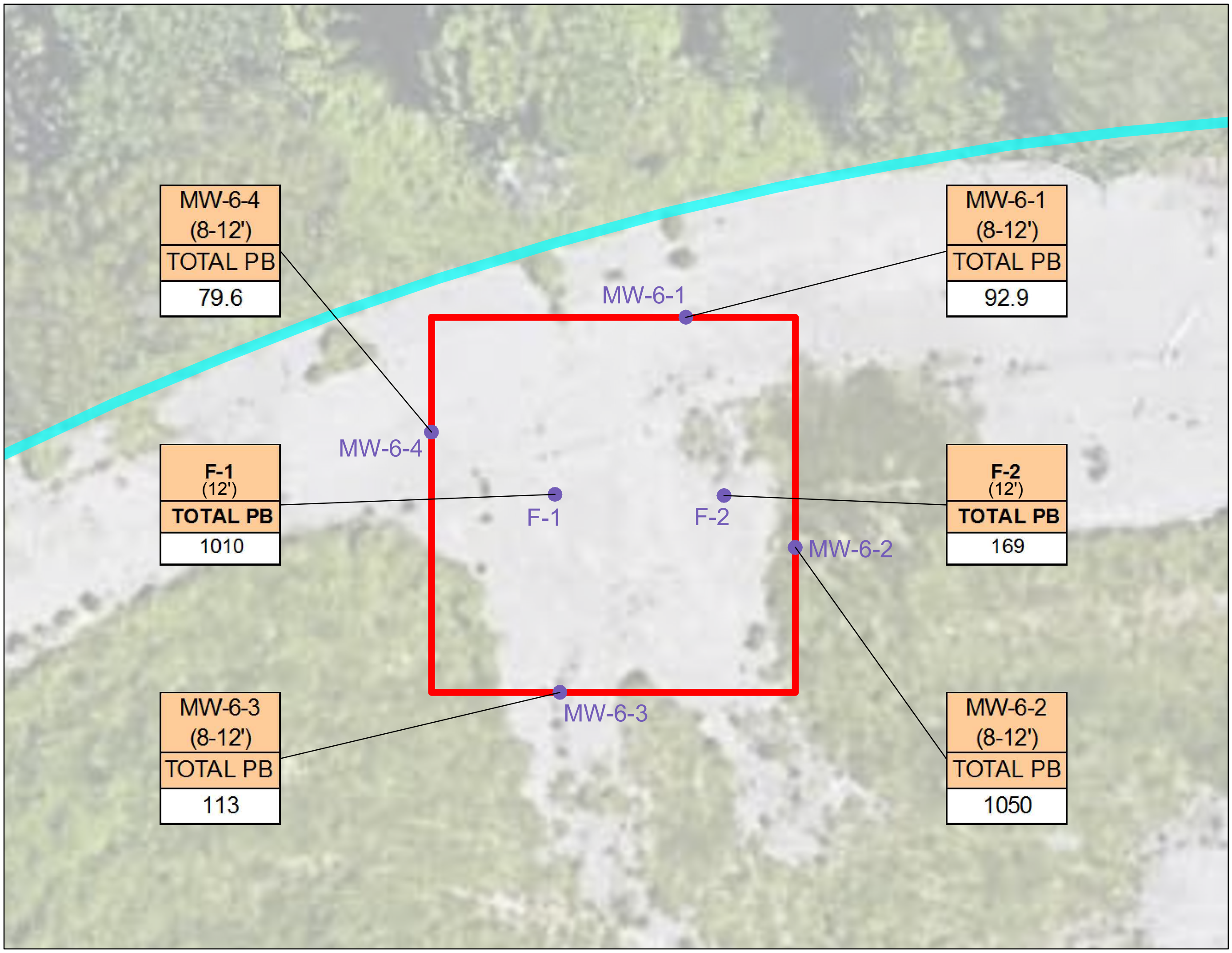
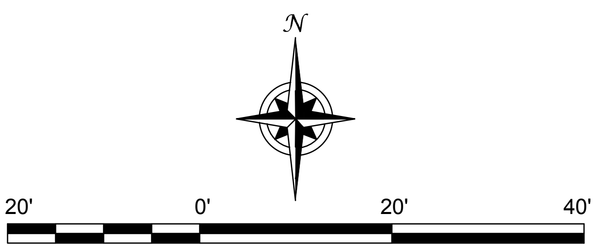
F:\CAD\Benchmark\Rupp, Baase, Pfalzgraf & Cunningham LLC\1827 Fillmore Avenue\18 - SMP\Figure 8; MW-6 Area Hotspot End Point and Post-Treatment Sample Results.dwg

FIGURE 8





SCALE: 1 INCH = 20 FEET
SCALE IN FEET
(approximate)

LEGEND:

- BCP PROPERTY BOUNDARY
- MW-6-1 ● PERIMETER END-POINT SAMPLE LOCATION
- F-1 ● FLOOR END-POINT SAMPLE LOCATION
- ESTIMATED EXTENT OF REMEDIATION

MW-6-1 (8-12')	← SAMPLE LOCATION AND DEPTH
TOTAL PB	← PARAMETER - TOTAL OR TCLP
92.9	← CONCENTRATION - TOTAL (MG/KG) OR TCLP

BENCHMARK
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2558 HAMBURG TURNPIKE
SUITE 300
BUFFALO, NY 14218
(716) 856-0599

PROJECT NO.: 0421-017-001

DATE: AUGUST 2019

DRAFTED BY: CMS/CCB

MW-6 AREA HOTSPOT END-POINT SAMPLE RESULTS

SITE MANAGEMENT PLAN

1827 FILLMORE AVENUE SITE
BCP SITE NO. C915279
BUFFALO, NEW YORK

PREPARED FOR

1827 FILLMORE LLC

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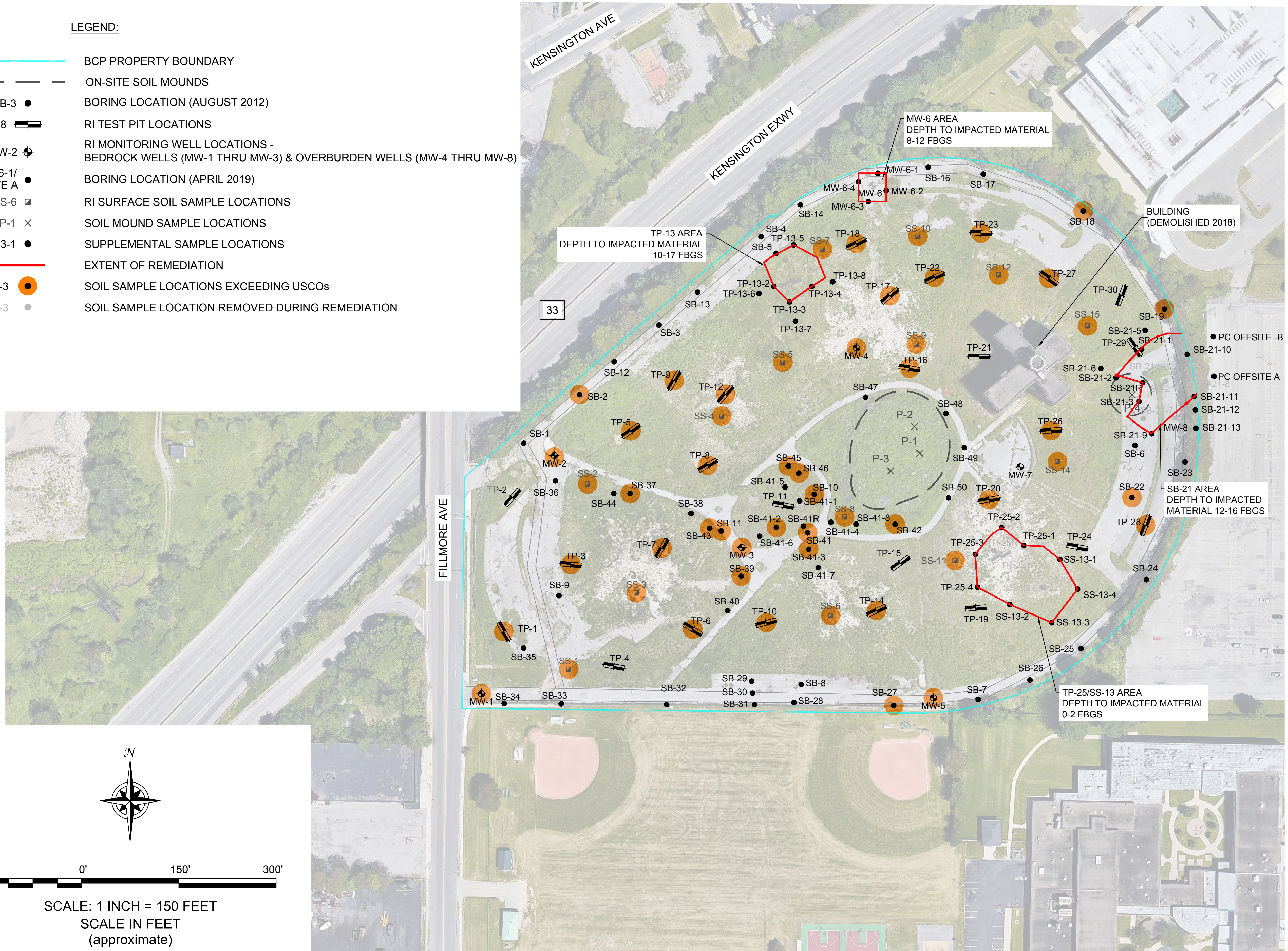
F:\CAD\Benchmark\Rupp, Baase, Pfalzgraf & Cunningham LLC\1827 Fillmore Avenue\18 - SMP\Figure 9; Remaining Soil Exceedances Above USCOs.dwg

LEGEND:

- BCP PROPERTY BOUNDARY
- ON-SITE SOIL MOUNDS
- SB-3 — BORING LOCATION (AUGUST 2012)
- TP-8 — RI TEST PIT LOCATIONS
- MW-2 — RI MONITORING WELL LOCATIONS - BEDROCK WELLS (MW-1 THRU MW-3) & OVERBURDEN WELLS (MW-4 THRU MW-8)
- MW-6-1/ PC OFFSITE A — BORING LOCATION (APRIL 2019)
- SS-6 — RI SURFACE SOIL SAMPLE LOCATIONS
- P-1 — SOIL MOUND SAMPLE LOCATIONS
- TP-13-1 — SUPPLEMENTAL SAMPLE LOCATIONS
- EXTENT OF REMEDIATION
- SB-3 — SOIL SAMPLE LOCATIONS EXCEEDING USCOs
- SB-3 — SOIL SAMPLE LOCATION REMOVED DURING REMEDIATION



N

150' 0' 150' 300'

SCALE: 1 INCH = 150 FEET
SCALE IN FEET
(approximate)

DATE: AUGUST 2019
DRAFTED BY: CCB

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

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SUITE 300
BUFFALO, NY 14218
(716) 856-0599

JOB NO.: 0421-017-001

REMAINING SOIL EXCEEDANCES ABOVE USCOs

SITE MANAGEMENT PLAN
1827 FILLMORE AVENUE SITE
BUFFALO, NEW YORK
PREPARED FOR
1827 FILLMORE LLC

FIGURE 9

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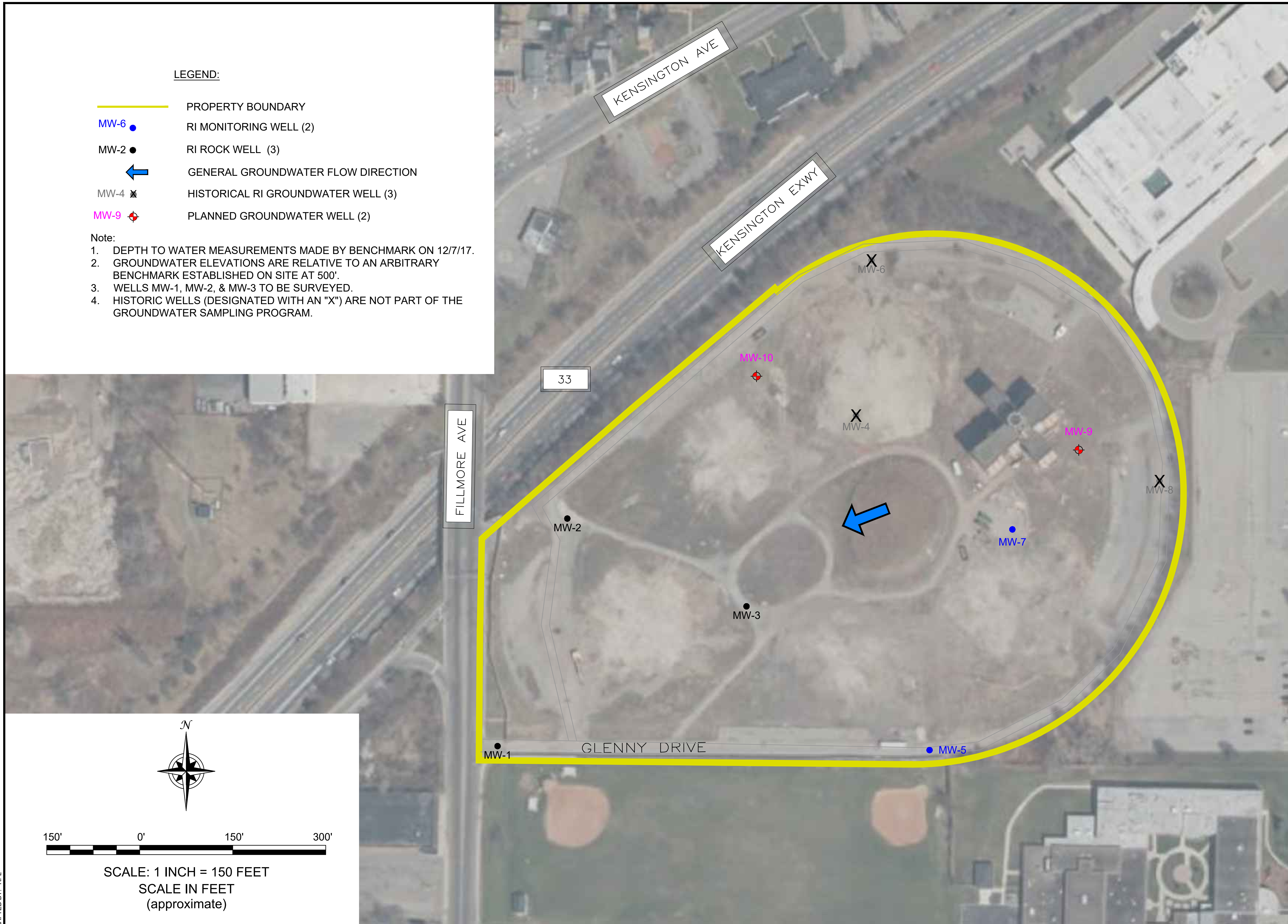
F:\CAD\Benchmark\Rupp, Baase, Pfalzgraf & Cunningham LLC\1827 Fillmore Avenue\18 - SMP\Figure 10; Groundwater Monitoring Plan.dwg, 10/16/2019 1:01:23 PM



DATE: OCTOBER 2019
DRAFTED BY: RFL

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

2558 HAMBURG TURNPIKE
SUITE 300
BUFFALO, NY 14218
(716) 856-0599

JOB NO.: 0421-017-001

GROUNDWATER MONITORING PLAN

SITE MANAGEMENT PLAN

1827 FILLMORE AVENUE SITE
BCP SITE NO. C915279
BUFFALO, NEW YORK
PREPARED FOR
1827 FILLMORE LLC

FIGURE 10

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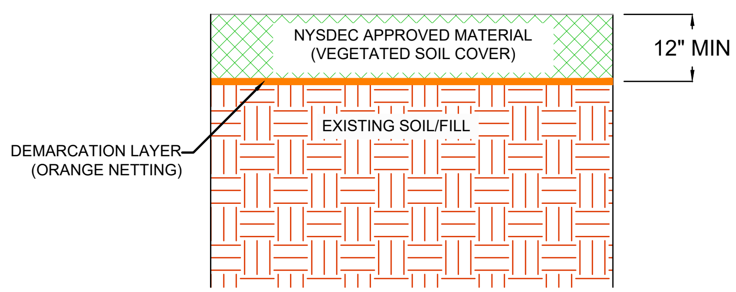
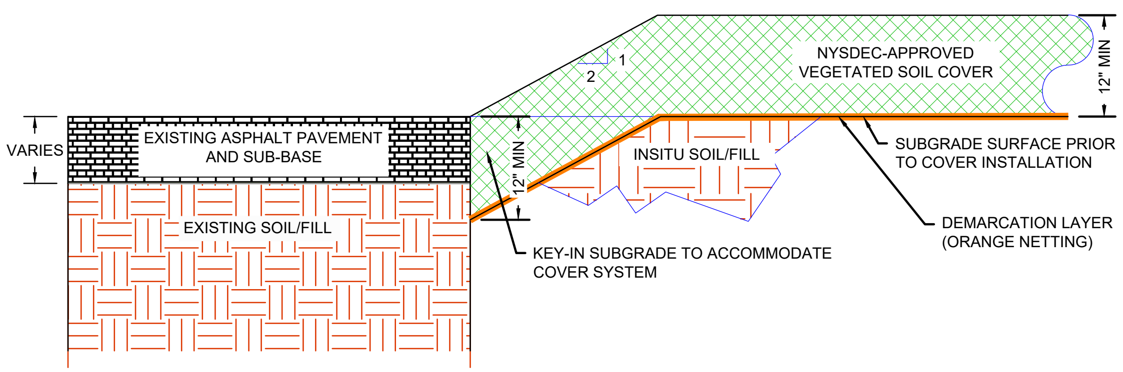
F:\CAD\Benchmark\Rupp, Baase, Pfalzgraf & Cunningham LLC\1827 Fillmore Avenue\18 - SMP\Figure 11; Cover System Layout & Detail.dwg, 10/16/2019 2:55:07 PM

LEGEND:

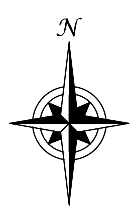
- BCP PROPERTY BOUNDARY
- PLANNED SOIL COVER SYSTEM
- EXISTING ASPHALT TO BE REPAIRED
- PROPOSED PARKING LOT AREA (BY OTHERS)
- PROPOSED ASPHALT PARKING LOT AND DRIVEWAY (BY OTHERS)



DETAIL-1
SOIL COVER SYSTEM DETAIL
NTS

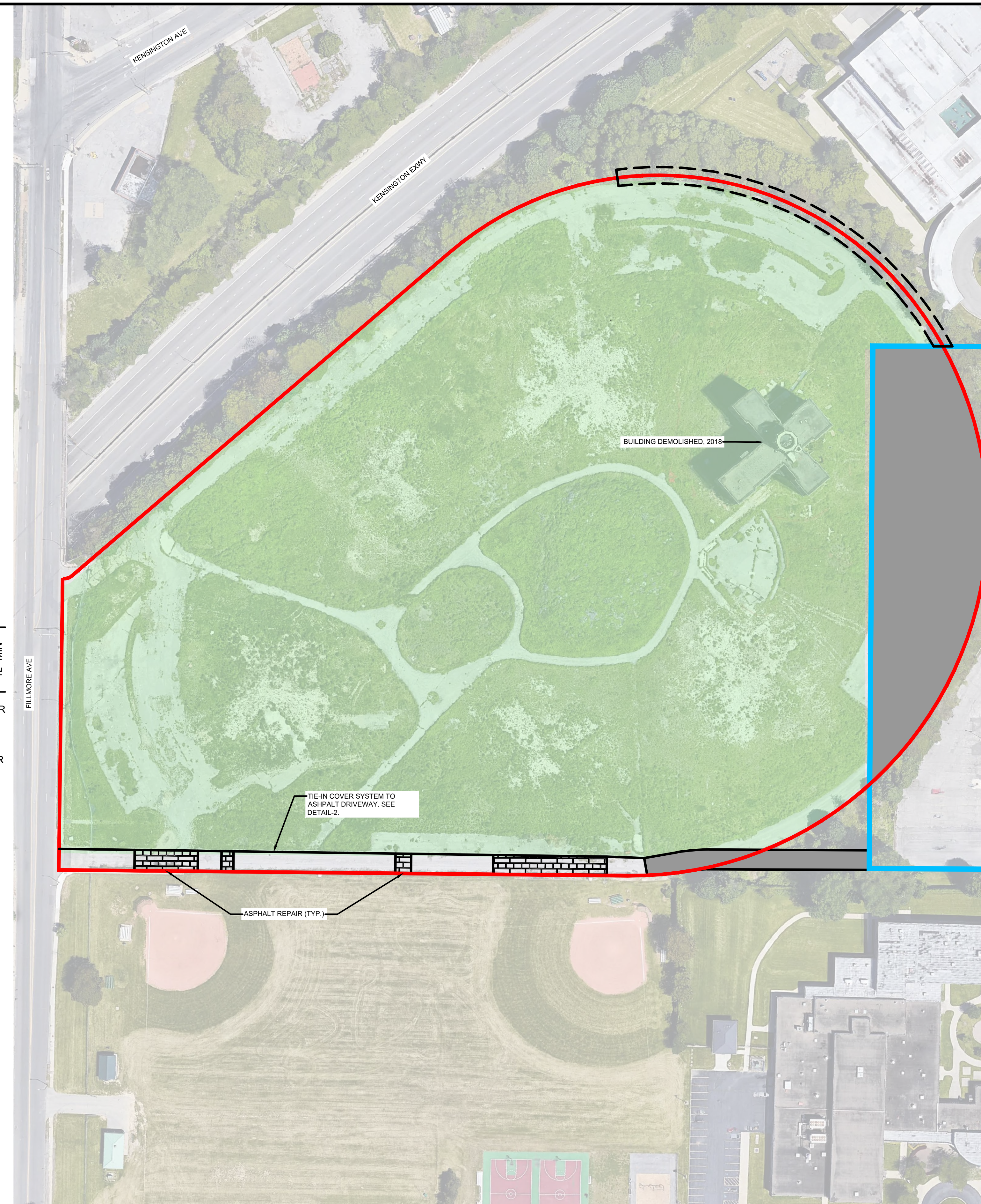


DETAIL-2
EXISTING ASPHALT &
COVER SYSTEM TIE-IN DETAIL
NTS



150' 0' 150' 300'

SCALE: 1 INCH = 150 FEET
SCALE IN FEET
(approximate)



DATE: AUGUST 2019
DRAFTED BY: RFL/CCB

2558 HAMBURG TURNPIKE
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BUFFALO, NY 14218
(716) 856-0599

BENCHMARK
ENVIRONMENTAL
ENGINEERING &
SCIENCE, PLLC

JOB NO.: 0421-017-001

COVER SYSTEM LAYOUT & DETAIL

SITE MANAGEMENT PLAN
1827 FILLMORE AVENUE SITE
BCP SITE NO. C915279
BUFFALO, NEW YORK
PREPARED FOR
1827 FILLMORE LLC

FIGURE 11

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APPENDIX A

ENVIRONMENTAL EASEMENT

 Box 108

ENVIRONMENTAL EASEMENT GRANTED PURSUANT TO ARTICLE 71, TITLE 36 OF THE NEW YORK STATE ENVIRONMENTAL CONSERVATION LAW

THIS INDENTURE made this 26th day of July, 2019, between Owner(s) 1827 Fillmore LLC, having an office at 462 Grider Street, Buffalo, New York 14215, County of Erie, State of New York (the "Grantor"), and The People of the State of New York (the "Grantee"), acting through their Commissioner of the Department of Environmental Conservation (the "Commissioner", or "NYSDEC" or "Department" as the context requires) with its headquarters located at 625 Broadway, Albany, New York 12233,

WHEREAS, the Legislature of the State of New York has declared that it is in the public interest to encourage the remediation of abandoned and likely contaminated properties ("sites") that threaten the health and vitality of the communities they burden while at the same time ensuring the protection of public health and the environment; and

WHEREAS, the Legislature of the State of New York has declared that it is in the public interest to establish within the Department a statutory environmental remediation program that includes the use of Environmental Easements as an enforceable means of ensuring the performance of operation, maintenance, and/or monitoring requirements and the restriction of future uses of the land, when an environmental remediation project leaves residual contamination at levels that have been determined to be safe for a specific use, but not all uses, or which includes engineered structures that must be maintained or protected against damage to perform properly and be effective, or which requires groundwater use or soil management restrictions; and

WHEREAS, the Legislature of the State of New York has declared that Environmental Easement shall mean an interest in real property, created under and subject to the provisions of Article 71, Title 36 of the New York State Environmental Conservation Law ("ECL") which contains a use restriction and/or a prohibition on the use of land in a manner inconsistent with engineering controls which are intended to ensure the long term effectiveness of a site remedial program or eliminate potential exposure pathways to hazardous waste or petroleum; and

WHEREAS, Grantor, is the owner of real property located at the address of 1827 Fillmore Avenue in the City of Buffalo, County of Erie and State of New York, known and designated on the tax map of the County Clerk of Erie as tax map parcel numbers: Section 90.13 Block 1 Lot 11, being the same as that property conveyed to Grantor by deed dated May 22, 2018 and recorded in the Erie County Clerk's Office in Liber and Page 11329/7689. The property subject to this Environmental Easement (the "Controlled Property") comprises approximately 17.11 +/- acres, and is hereinafter more fully described in the Land Title Survey dated June 3, 2019 prepared by Rosanne Frandina, L.L.S. of Frandina Engineering and Land Surveying, PC, which will be attached to the Site Management Plan. The Controlled Property description is set forth in and attached hereto as Schedule A; and

WHEREAS, the Department accepts this Environmental Easement in order to ensure the protection of public health and the environment and to achieve the requirements for remediation established for the Controlled Property until such time as this Environmental Easement is

785-9

extinguished pursuant to ECL Article 71, Title 36; and

NOW THEREFORE, in consideration of the mutual covenants contained herein and the terms and conditions of Brownfield Cleanup Agreement Index Number: C915279-10-17, Grantor conveys to Grantee a permanent Environmental Easement pursuant to ECL Article 71, Title 36 in, on, over, under, and upon the Controlled Property as more fully described herein ("Environmental Easement").

1. Purposes. Grantor and Grantee acknowledge that the Purposes of this Environmental Easement are: to convey to Grantee real property rights and interests that will run with the land in perpetuity in order to provide an effective and enforceable means of encouraging the reuse and redevelopment of this Controlled Property at a level that has been determined to be safe for a specific use while ensuring the performance of operation, maintenance, and/or monitoring requirements; and to ensure the restriction of future uses of the land that are inconsistent with the above-stated purpose.

2. Institutional and Engineering Controls. The controls and requirements listed in the Department approved Site Management Plan ("SMP") including any and all Department approved amendments to the SMP are incorporated into and made part of this Environmental Easement. These controls and requirements apply to the use of the Controlled Property, run with the land, are binding on the Grantor and the Grantor's successors and assigns, and are enforceable in law or equity against any owner of the Controlled Property, any lessees and any person using the Controlled Property.

A. (1) The Controlled Property may be used for:

Commercial as described in 6 NYCRR Part 375-1.8(g)(2)(iii) and Industrial as described in 6 NYCRR Part 375-1.8(g)(2)(iv)

(2) All Engineering Controls must be operated and maintained as specified in the Site Management Plan (SMP);

(3) All Engineering Controls 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 use as drinking water or 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 the SMP;

(6) Data and information pertinent to Site Management of the Controlled Property must be reported at the frequency and in a manner defined in the SMP;

(7) All future activities on the property that will disturb remaining contaminated material must be conducted in accordance with the SMP;

(8) Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in the SMP;

(9) Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical components of the remedy shall be performed as defined in the SMP;

(10) 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 this Environmental Easement.

B. The Controlled Property shall not be used for Residential or Restricted Residential purposes as defined in 6NYCRR 375-1.8(g)(2)(i) and (ii), and the above-stated engineering controls may not be discontinued without an amendment or extinguishment of this Environmental Easement.

C. The SMP describes obligations that the Grantor assumes on behalf of Grantor, its successors and assigns. The Grantor's assumption of the obligations contained in the SMP which may include sampling, monitoring, and/or operating a treatment system, and providing certified reports to the NYSDEC, is and remains a fundamental element of the Department's determination that the Controlled Property is safe for a specific use, but not all uses. The SMP may be modified in accordance with the Department's statutory and regulatory authority. The Grantor and all successors and assigns, assume the burden of complying with the SMP and obtaining an up-to-date version of the SMP from:

Site Control Section
Division of Environmental Remediation
NYSDEC
625 Broadway
Albany, New York 12233
Phone: (518) 402-9553

D. Grantor must provide all persons who acquire any interest in the Controlled Property a true and complete copy of the SMP that the Department approves for the Controlled Property and all Department-approved amendments to that SMP.

E. Grantor covenants and agrees that until such time as the Environmental Easement is extinguished in accordance with the requirements of ECL Article 71, Title 36 of the ECL, the property deed and all subsequent instruments of conveyance relating to the Controlled Property shall state in at least fifteen-point bold-faced type:

This property is subject to an Environmental Easement held by the New York State Department of Environmental Conservation pursuant to Title 36 of Article 71 of the Environmental Conservation

Law.

F. Grantor covenants and agrees that this Environmental Easement shall be incorporated in full or by reference in any leases, licenses, or other instruments granting a right to use the Controlled Property.

G. Grantor covenants and agrees that it shall, at such time as NYSDEC may require, submit to NYSDEC a written statement by an expert the NYSDEC may find acceptable certifying under penalty of perjury, in such form and manner as the Department may require, that:

(1) the inspection of the site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under the direction of the individual set forth at 6 NYCRR Part 375-1.8(h)(3).

(2) the institutional controls and/or engineering controls employed at such site:

(i) are in-place;

(ii) are unchanged from the previous certification, or that any identified changes to the controls employed were approved by the NYSDEC and that all controls are in the Department-approved format; and

(iii) that nothing has occurred that would impair the ability of such control to protect the public health and environment;

(3) the owner will continue to allow access to such real property to evaluate the continued maintenance of such controls;

(4) nothing has occurred that would constitute a violation or failure to comply with any site management plan for such controls;

(5) the report and all attachments were prepared under the direction of, and reviewed by, the party making the certification;

(6) to the best of his/her 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

(7) the information presented is accurate and complete.

3. Right to Enter and Inspect. Grantee, its agents, employees, or other representatives of the State may enter and inspect the Controlled Property in a reasonable manner and at reasonable times to assure compliance with the above-stated restrictions.

4. Reserved Grantor's Rights. Grantor reserves for itself, its assigns, representatives, and successors in interest with respect to the Property, all rights as fee owner of the Property, including:

A. Use of the Controlled Property for all purposes not inconsistent with, or limited by the terms of this Environmental Easement;

B. The right to give, sell, assign, or otherwise transfer part or all of the underlying fee interest to the Controlled Property, subject and subordinate to this Environmental Easement;

5. Enforcement

A. This Environmental Easement is enforceable in law or equity in perpetuity by Grantor, Grantee, or any affected local government, as defined in ECL Section 71-3603, against the owner of the Property, any lessees, and any person using the land. Enforcement shall not be defeated because of any subsequent adverse possession, laches, estoppel, or waiver. It is not a defense in any action to enforce this Environmental Easement that: it is not appurtenant to an interest in real property; it is not of a character that has been recognized traditionally at common law; it imposes a negative burden; it imposes affirmative obligations upon the owner of any interest in the burdened property; the benefit does not touch or concern real property; there is no privity of estate or of contract; or it imposes an unreasonable restraint on alienation.

B. If any person violates this Environmental Easement, the Grantee may revoke the Certificate of Completion with respect to the Controlled Property.

C. Grantee shall notify Grantor of a breach or suspected breach of any of the terms of this Environmental Easement. Such notice shall set forth how Grantor can cure such breach or suspected breach and give Grantor a reasonable amount of time from the date of receipt of notice in which to cure. At the expiration of such period of time to cure, or any extensions granted by Grantee, the Grantee shall notify Grantor of any failure to adequately cure the breach or suspected breach, and Grantee may take any other appropriate action reasonably necessary to remedy any breach of this Environmental Easement, including the commencement of any proceedings in accordance with applicable law.

D. The failure of Grantee to enforce any of the terms contained herein shall not be deemed a waiver of any such term nor bar any enforcement rights.

6. Notice. Whenever notice to the Grantee (other than the annual certification) or approval from the Grantee is required, the Party providing such notice or seeking such approval shall identify the Controlled Property by referencing the following information:

County, NYSDEC Site Number, NYSDEC Brownfield Cleanup Agreement, State Assistance Contract or Order Number, and the County tax map number or the Liber and Page or computerized system identification number.

Parties shall address correspondence to:

Site Number: C915279
Office of General Counsel
NYSDEC
625 Broadway
Albany New York 12233-5500

With a copy to:

Site Control Section
Division of Environmental Remediation
NYSDEC
625 Broadway
Albany, NY 12233

All notices and correspondence shall be delivered by hand, by registered mail or by Certified mail and return receipt requested. The Parties may provide for other means of receiving and communicating notices and responses to requests for approval.

7. Recordation. Grantor shall record this instrument, within thirty (30) days of execution of this instrument by the Commissioner or her/his authorized representative in the office of the

recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

8. Amendment. Any amendment to this Environmental Easement may only be executed by the Commissioner of the New York State Department of Environmental Conservation or the Commissioner's Designee, and filed with the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

9. Extinguishment. This Environmental Easement may be extinguished only by a release by the Commissioner of the New York State Department of Environmental Conservation, or the Commissioner's Designee, and filed with the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

10. Joint Obligation. If there are two or more parties identified as Grantor herein, the obligations imposed by this instrument upon them shall be joint and several.

11. Consistency with the SMP. To the extent there is any conflict or inconsistency between the terms of this Environmental Easement and the SMP, regarding matters specifically addressed by the SMP, the terms of the SMP will control.

Remainder of Page Intentionally Left Blank

IN WITNESS WHEREOF, Grantor has caused this instrument to be signed in its name.

1827 Fillmore LLC:

By: ____________________

Print Name: Stephen M. Gary

Title: Manager Date: July 11, 2019

Grantor's Acknowledgment

STATE OF NEW YORK)
) ss:
COUNTY OF)

On the 11th day of July, in the year 2019, before me, the undersigned, personally appeared Stephen M. Gary, Sr., personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their capacity(ies), and that by his/her/their signature(s) on the instrument, the individual(s), or the person upon behalf of which the individual(s) acted, executed the instrument.

Lori A. Hoffman
Notary Public - State of New York

LORI A. HOFFMAN
Notary Public, State of New York
Reg. No. 4970291
Qualified in County of Erie
Commission Expires ~~11-01-2018~~ 2022

THIS ENVIRONMENTAL EASEMENT IS HEREBY ACCEPTED BY THE PEOPLE OF THE STATE OF NEW YORK, Acting by and Through the Department of Environmental Conservation as Designee of the Commissioner,

By: ______________________________
Michael J. Ryan, Director
Division of Environmental Remediation

Grantee's Acknowledgment

STATE OF NEW YORK)
) ss:
COUNTY OF ALBANY)

On the 26th day of July, in the year 2019, before me, the undersigned, personally appeared Michael J. Ryan, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/ executed the same in his/her/ capacity as Designee of the Commissioner of the State of New York Department of Environmental Conservation, and that by his/her/ signature on the instrument, the individual, or the person upon behalf of which the individual acted, executed the instrument.

____
Notary Public - State of New York

David J. Chiusano
Notary Public, State of New York
No. 01CH5032146
Qualified in Schenectady County
Commission Expires August 22, 2022

SCHEDULE "A" PROPERTY DESCRIPTION

ALL THAT TRACT OR PARCEL OF LAND, situate in the City of Buffalo, County of Erie and State of New York being part of Lot No. 12, Township 11, Range 8 of the Holland Land Company's Survey, bounded and described as follows: BEGINNING at a point in the east line of North Fillmore Avenue (commonly known as Fillmore Avenue) South 00°33'29" West, 559.27 feet southerly measured along the east line of North Fillmore Avenue from the intersection of said east line of North Fillmore Avenue with the southeast line of Kensington Avenue (66 feet wide); thence easterly on a curve to the left having a radius of 13.51 feet an arc length of 11.75 feet to a point in a line drawn North 49°14'57" East, through a point in the east line of North Fillmore Avenue, distant 6.38 feet southerly from the point of beginning, thence North 49°14'57" East, 609.55 feet; thence easterly on a curve to the right having a radius of 393.49 feet and tangent with the last described line, and arc length of 618.09 feet to a point of compound curve; thence southerly on a curve to the right having a radius of 436.49 feet and tangent with the last described curve line. an arc length of 999.16 feet to a point in a line drawn South 89°35'45" East though a point in the east line of North Fillmore Avenue, 356.73 feet southerly from the point of beginning; thence North 89°35'45" West, 695.45 feet to a point; thence westerly on a curve to the left having a radius of 13.51 feet and tangent with the last described course an arc length of 1.97 feet to the east line of North Fillmore Avenue; thence North 00°33'29" East along the east line of North Fillmore Avenue, 356.87 feet to the point of beginning containing 17.11 acres more or less.

ERIE COUNTY CLERK'S OFFICE

County Clerk's Recording Page

Return to:
BOX 108

Party 1:
1827 FILLMORE LLC

Party 2:

Book Type: D Book: 11349 Page: 5013

Page Count:	10
Doc Type:	EASEMENT/RTWY
Rec Date:	09/06/2019
Rec Time:	04:19:09 PM
Control #:	2019192857
UserID:	Kim F
Trans #:	19147552

Document Sequence Number
TT2019002905

Recording Fees:

RECORDING	$70.00
COE CO $1 RET	$1.00
COE STATE $14.25 GEN	$14.25
COE STATE $4.75 RM	$4.75
TP584	$10.00

Consideration Amount: 0.00

BASIC MT	$0.00
SONYMA MT	$0.00
ADDL MT/NFTA	$0.00
SP MT/M-RAIL	$0.00
NY STATE TT	$0.00
ROAD FUND TT	$0.00

Total: $100.00

STATE OF NEW YORK
ERIE COUNTY CLERK'S OFFICE

WARNING – THIS SHEET CONSTITUTES THE CLERK'S ENDORSEMENT REQUIRED BY SECTION 319&316-a (5) OF THE REAL PROPERTY LAW OF THE STATE OF NEW YORK. DO NOT DETACH. THIS IS NOT A BILL.

Michael P. Kearns
Erie County Clerk

PREMISES SUBJECT TO THE FOLLOWING:

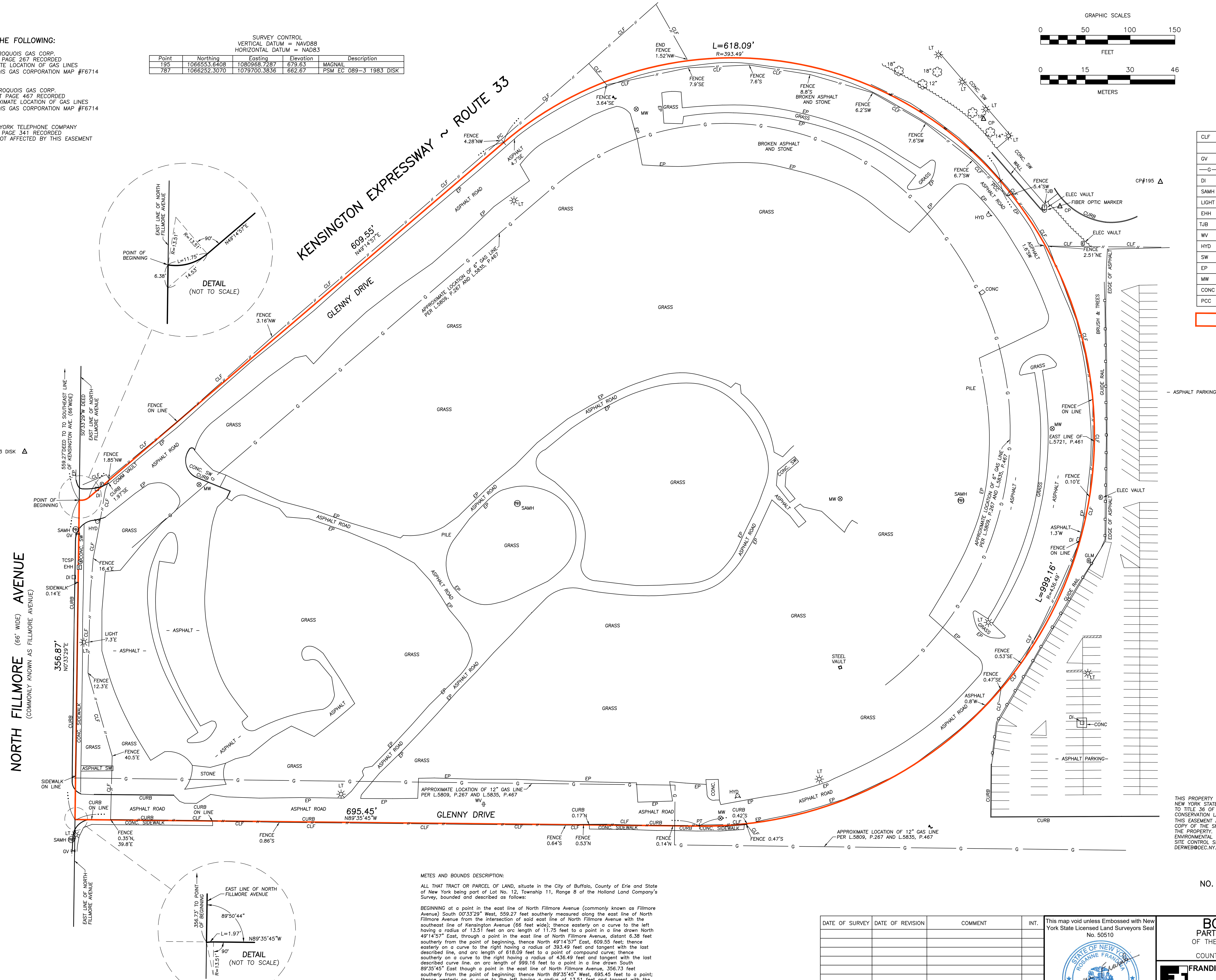
1) RIGHT OF WAY GRANTED TO IROQUOIS GAS CORP. BY LIBER 5809 OF DEEDS AT PAGE 267 RECORDED AUGUST 11, 1955. APPROXIMATE LOCATION OF GAS LINES PLOTTED HEREON PER IROQUOIS GAS CORPORATION MAP #F6714 DATED 5/31/1955.

2) RIGHT OF WAY GRANTED TO IROQUOIS GAS CORP. BY LIBER 5835 OF DEEDS AT PAGE 467 RECORDED SEPTEMBER 19, 1955. APPROXIMATE LOCATION OF GAS LINES PLOTTED HEREON PER IROQUOIS GAS CORPORATION MAP #F6714 DATED 5/31/1955.

3) EASEMENT GRANTED TO NEW YORK TELEPHONE COMPANY BY LIBER 8651 OF DEEDS AT PAGE 341 RECORDED JUNE 2, 1978 – PREMISES NOT AFFECTED BY THIS EASEMENT

SURVEY CONTROL
VERTICAL DATUM = NAVD88
HORIZONTAL DATUM = NAD83

Point	Northing	Easting	Elevation	Description
195	1066553.6408	1080968.7287	679.63	MAGNAIL
787	1066252.3070	1079700.3836	662.67	PSM EC 089–3 1983 DISK



LEGEND

CLF		CHAIN LINK FENCE
		DESCIDUOUS TREE
GV		GAS VALVE
—G—		GAS LINE
DI		DRAINAGE INLET
SAMH		SANITARY MANHOLE
LIGHT		LIGHT STANDARD
EHH		ELECTRIC VAULT/HANDHOLE
TJB		TELEPHONE JUNCTION BOX
WV		WATER VALVE
HYD		HYDRANT
SW		SIDEWALK
EP		EDGE OF PAVEMENT
MW		MONITORING WELL
CONC		CONCRETE
PCC		POINT OF COMPOUND CURVE

BROWNFIELD CLEANUP PROGRAM (BCP) BOUNDARY

THIS PROPERTY IS SUBJECT TO AN ENVIRONMENTAL EASEMENT HELD BY THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION PURSUANT TO TITLE 36 OF ARTICLE 71 OF THE NEW YORK ENVIRONMENTAL CONSERVATION LAW. THE ENGINEERING AND INSTITUTIONAL CONTROLS FOR THIS EASEMENT ARE SET FORTH IN THE SITE MANAGEMENT PLAN (SMP). A COPY OF THE SMP MUST BE OBTAINED BY ANY PARTY WITH AN INTEREST IN THE PROPERTY. THE SMP CAN BE OBTAINED FROM NYS DEPARTMENT OF ENVIRONMENTAL CONSERVATION, DIVISION OF ENVIRONMENTAL REMEDIATION, SITE CONTROL SECTION, 625 BROADWAY, ALBANY, NY 12233 OR AT DERWEB@DEC.NY.GOV.

METES AND BOUNDS DESCRIPTION:

ALL THAT TRACT OR PARCEL OF LAND, situate in the City of Buffalo, County of Erie and State of New York being part of Lot No. 12, Township 11, Range 8 of the Holland Land Company's Survey, bounded and described as follows:

BEGINNING at a point in the east line of North Fillmore Avenue (commonly known as Fillmore Avenue) South 00°33'29" West, 559.27 feet southerly measured along the east line of North Fillmore Avenue from the intersection of said east line of North Fillmore Avenue with the southeast line of Kensington Avenue (66 feet wide); thence easterly on a curve to the left having a radius of 13.51 feet an arc length of 11.75 feet to a point in a line drawn North 49°14'57" East, through a point in the east line of North Fillmore Avenue, distant 6.38 feet southerly from the point of beginning, thence North 49°14'57" East, 609.55 feet; thence easterly on a curve to the right having a radius of 393.49 feet and tangent with the last described line, and arc length of 618.09 feet to a point of compound curve; thence southerly on a curve to the right having a radius of 436.49 feet and tangent with the last described curve line. an arc length of 999.16 feet to a point in a line drawn South 89°35'45" East though a point in the east line of North Fillmore Avenue, 356.73 feet southerly from the point of beginning; thence North 89°35'45" West, 695.45 feet to a point; thence westerly on a curve to the left having a radius of 13.51 feet and tangent with the last described course an arc length of 1.97 feet to the east line of North Fillmore Avenue; thence North 00°33'29" East along the east line of North Fillmore Avenue, 356.87 feet to the point of beginning containing 17.11 acres more or less.

NO. 1827 NORTH FILLMORE AVENUE
BUFFALO, NEW YORK 14215
SBL NO. 90.13–1–11

WARNING: ALTERING THIS DOCUMENT IS IN VIOLATION OF THE LAW EXCEPTING AS PROVIDED IN SECTION 7209, PART 2 OF THE NEW YORK STATE EDUCATION LAW.

ALL UNDERGROUND UTILITY LOCATIONS ARE APPROXIMATE. BEFORE YOU DIG, DRILL, OR BLAST, CALL DIG SAFELY NEW YORK AT 1–800–962–7962

CADD \ 4310 1827 FILLMORE AVE DEC.DWG

DATE OF SURVEY	DATE OF REVISION	COMMENT	INT.

This map void unless Embossed with New York State Licensed Land Surveyors Seal No. 50510

STATE OF NEW YORK · ROSANNE FRANDINA · No. 050510 · LICENSED LAND SURVEYOR

Rosanne Frandina, PE, LS

BOUNDARY SURVEY
PART OF LOT 12, TWP 11, RGE 8
OF THE HOLLAND LAND COMPANY'S SURVEY
CITY OF BUFFALO
COUNTY OF ERIE ~ STATE OF NEW YORK

FRANDINA ENGINEERING and LAND SURVEYING, PC
CIVIL ENGINEERS and LAND SURVEYORS
1701 Hertel Avenue, Buffalo, New York 14216
www.FRANDINA.com
Phone: (716) 883-1299
FAX: (716) 883-1274

DATE : 6/3/2019	SHEET : 1 OF 1	DWN BY : MJC
JOB NO.: 4310	SCALE : 1" = 50'	CHK'D BY : RF

APPENDIX B

TEST PIT, BOREHOLE, & MONITORING WELL CONSTRUCTION LOGS

BENCHMARK
ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

TABLE 11

TEST PIT SUMMARY

1827 Fillmore Avenue Site
Buffalo, New York

Location	Date	Total Depth (fbgs)	Length (feet)	Width (feet)	Depth to Water (fbgs)	Visual/ Olfactory (depth, fbgs)	Top of Rock (fbgs)	Fill Thickness (fbgs)	Sample Depths (fbgs)	Description (ASTM D2488: Visual-Manual Procedure)	PID Readings (ppm)
TP-1	11/28/2017	9.5	15.0	3.0	none	none	9.5	9.5	(4.0 - 6.0)	(0.0 - 9.5) RE-WORKED SANDY LEAN CLAY w/ GRAVEL & FILL: Dark brown to dark grey, moist, mostly medium plasticity fines, some fine sand, asphalt, concrete, orange brick and metal debris, equipment refusal	0.0
TP-2	11/28/2017	9.5	12.0	3.0	none	none	9.5	9.5	(6.0 - 8.0)	(0.0 - 1.5) FILL: Dark brown, mostly non-plastic fines, some fine sand, little fine gravel, roots and concrete, medium dense, loose when disturbed. (1.5 - 3.0) LIMESTONE BACKFILL: Grey/brown, moist, mostly fine to coarse gravel (limestone), some fine sand, medium dense, loose when disturbed. (3.0 - 9.5) RE-WORKED SANDY LEAN CLAY w/FILL: Dark brown to dark grey, moist, mostly medium plasticity fines, some fine sand, asphalt, concrete, orange brick and metal debris.	0.0
TP-3	11/28/2017	14.5	12.0	6.0	14.0	none	14.5	14.5	(10-14.5)	(0.0 - 9.0) FILL: Dark brown to black (9.0 fbgs), mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, 6.0-inch clay tile pipe (6.0 fbgs), medium dense, loose when disturbed. (9.0 - 10.0) RE-WORKED SANDY LEAN CLAY w/FILL: Dark brown to dark grey, moist, mostly medium plasticity fines, some fine sand (black), brick, concrete and metal debris. (10.0 - 14.5) ASH/FILL: White/grey, moist to wet (14.0 fbgs), ash, wood, glass and ceramic (whole bottles), loose.	0.0
TP-4	11/28/2017	12.0	15.0	6.0	none	none	12.0	12.0	(1.0-3.0)	(0.0 - 0.5) FILL: Brown, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, loose when disturbed. (0.5 - 3.0) ASH/FILL: White/grey, ash, wood, glass and ceramic (whole bottles), loose. (3.0 - 5.0) RE-WORKED SANDY LEAN CLAY: Reddish brown, moist, mostly medium plasticity fines, stiff, medium toughness, medium dry strength, massive. (5.0 - 12.0) LIMESTONE TALUS: Grey, mostly fine to coarse gravel (angular limestone), trace fine sand, trace non-plastic fines, loose.	0.0
TP-5	11/28/2017	14.5	17.0	3.0	none	none	14.5	14.5	(6.0-8.0)	(0.0 - 6.0) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, metal debris, loose when disturbed. (6.0 - 7.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), loose. (7.0 - 12.5) FILL: As (0.0 - 6.0 fbgs) above. (12.5 - 13.5) RE-WORKED SANDY LEAN CLAY w/FILL: Reddish brown, moist, mostly medium plasticity fines, concrete, brick, cinders and ash, stiff, medium toughness, medium dry strength, massive. (13.5 - 14.5) LIMESTONE TALUS: Grey, moist, mostly coarse gravel (angular limestone), trace fine sand, trace non-plastic fines, lime stone is iron stained, loose.	0.0
TP-6	11/28/2017	3.0 east end 11.5 west end	25.0	3.0	none	none	3.0 east end 11.5 west end	11.5	(10.0-11.5)	(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, loose. (0.5 - 3.5) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), loose. (3.5 - 11.5) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together.	0.0
TP-7	11/28/2017	15.5	15.0	3.0	none	none	none	15.5	(8.0-10.0)	(0.0 - 2.0) WEATHERED CONCRETE DEBRIS: Grey/White, mostly weathered concrete, with brick and metal debris. (2.0 - 13.0) NON-NATIVE FINE SAND: Black with Brown patches, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together. (13.0 - 15.5) RE-WORKED SANDY LEAN CLAY w/FILL: Reddish brown, moist, mostly medium plasticity fines, some fine sand (black), brick and concrete, stiff, medium toughness, medium dry strength, massive.	0.0
TP-8	11/29/2017	15.0	17.0	3.0	none	Slight Petroleum odor	none	15.0	(6.0-9.0)	(0.0 - 6.0) RE-WORKED SANDY LEAN CLAY w/FILL: Reddish brown/dark brown, moist, mostly medium plasticity fines, some fine sand (brown and black), concrete, brick, cinders, stiff, medium toughness, backfill for 24-inch clay tile sewer line (abandoned), medium dry strength, massive. (3.0 - 11.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), animal bones, petroleum odor (6.0 to 9.0 fbgs), loose. (11.0 - 15.0) LIMESTONE TALUS: Grey, moist, mostly fine to coarse gravel (angular limestone), trace fine sand, trace non-plastic fines, loose.	2.2 (6.0 - 9.0)
TP-9	11/29/2017	15.0	22.0	3.0	none	sweet odor	none	15.0	(10.0-12.0)	(0.0 - 0.5) FILL: Brown, mostly fine sand, some non-plastic fines, little fine to coarse gravel, mixed with sandy lean clay, concrete, orange brick and ash, loose when disturbed. (0.5 - 15.0) ASH/FILL: White/grey, ash, wood, glass and ceramic (whole bottles), sweet odor (10.0 to 12.0 fbgs), loose.	18.4 (0.0-2.0) 276 (10.0-12.0)
TP-10	11/29/2017	4.0	32.0	3.0	none	none	4.0	4.0	(0.0-4.0)	(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 2.5) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), loose. (2.5 - 4.0) IMPORTED SILTY SAND: Reddish brown, moist, mostly fine sand, some non-plastic fines, medium dense.	0.0
TP-11	11/29/2017	15.0	17.0	3.0	none	none	none	15.0	(5.0-8.0)	(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 8.0.0) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together, 1-inch and 6-inch water line in upper 4.0 fbgs (abandoned). (8.0 - 15.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), loose.	0.0
TP-12	11/29/2017	15.0	20.0	3.0	none	none	none	15.0	(10.0-12.0)	(0.0 - 3.5) WEATHERED CONCRETE DEBRIS: Grey/White, mostly weathered concrete, with brick and metal debris. (3.5 - 6.0) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together. (6.0 - 12.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), loose. (12.0 - 15.0) LIMESTONE TALUS: Grey, moist, mostly fine to coarse gravel (angular limestone), trace fine sand, trace non-plastic fines, limestone is iron stained, loose.	0.0
TP-13	12/4/2017	15.0	18.0	3.5	none	none	none	15.0	(10.0 - 15.0)	(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 9.0) RE-WORKED SANDY LEAN CLAY w/FILL: Reddish brown/dark brown, moist, mostly medium plasticity fines, some fine sand (brown and black), orange brick and ash, stiff, medium toughness, medium dry strength, massive. (9.0 - 15.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), wood debris, loose.	0.0
TP-14	11/29/2017	15.0	20.0	3.0	none	none	12.0 on west side no rock on east side	15.0	(10-15)	(0.0 - 1.0) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (1.0 - 8.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), animal bones, loose. (8.0 - 15.0) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, dark brown melted glass chunks, some of the sand tends to be fused together.	0.0
TP-15	11/29/2017	5.0 east end 15.0 west end	20.0	3.0	none	none	5.0 on west side no rock on east side	15.0	(8.0-10.0)	(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 11.0) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together. (11.0 - 15.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), loose.	0.0
TP-16	12/4/2017	15.5	21.0	3.5	none	none	none	15.5	(8.0 - 10.0)	(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 8.0) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together. (8.0 - 15.5) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), loose.	0.0
TP-17	12/4/2017	4.0	30.0	4.0	none	none	none	4.0	(2.5 - 4.0)	(0.0 - 2.5) WEATHERED CONCRETE DEBRIS: Grey/White, mostly weathered concrete, with brick and metal debris. (2.5 - 4.0) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, encountered equipment refusal on large concrete grade beams or pile caps.	0.0
TP-18	12/4/2017	15.0	22.0	3.0	none	none	none	15.0	(5.0 - 9.0)	(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 9.0) RE-WORKED SANDY LEAN CLAY w/FILL: Reddish brown/dark brown, moist, mostly medium plasticity fines, some fine sand (brown and black), orange brick and ash, stiff, medium toughness, medium dry strength, massive. (9.0 - 13.5) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), wood debris, loose. (13.5 - 15.0) LIMESTONE TALUS: Grey, moist, mostly coarse gravel (angular limestone), trace fine sand, trace non-plastic fines, lime stone is iron stained, loose.	0.0
TP-19	12/1/2017	15.0	16.0	7.0	none	none	none	15.0	(3.0-6.0)	(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 12.0) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together. (12.0 - 15.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), loose.	0.0
TP-20	12/1/2017	15.0	17.0	3.0	none	none	none	15.0	(5.0-10.0)	(0.0 - 1.0) WEATHERED CONCRETE DEBRIS: Grey/White, mostly weathered concrete, with brick and metal debris. (1.0 - 16.0) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together, slag fragments.	0.0
TP-21	12/4/2017	16.0	21.0	3.0	none	none	none	16.0	(8.0 - 10.0)	(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 10.0) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together. (10.0 - 16.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), loose.	0.0
TP-22	12/4/2017	15.0	15.0	3.0	none	none	none	15.0	(9.0 - 12.0)	(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 9.0) RE-WORKED SANDY LEAN CLAY w/Fill: Reddish brown/dark brown, moist, mostly medium plasticity fines, some fine sand (brown and black), orange brick and ash, stiff, medium toughness, medium dry strength, massive. (9.0 - 11.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), wood debris, loose. (11.0 - 13.0) RE-WORKED SANDY LEAN CLAY w/FILL: As (0.5 - 9.0 fbgs) above. (13.0 - 15.5) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), wood debris, loose.	0.0
TP-23	12/4/2017	15.5	17.0	8.0	none	none	none	15.5	(13.0 - 15.5)	(0.0 - 8.0) FILL: Dark brown/black, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick, cinders and ash, medium dense, loose when disturbed, 6-inch clay tile drain line on north wall of test pit (5.0 fbgs). (8.0 - 13.0) RE-WORKED SANDY LEAN CLAY w/ FILL: Reddish Brown, moist, mostly medium plasticity fines, some fine sand (Black), brick, cinders, ash, slight petroleum like odor (11.0 to 13.0 fbgs). (13.0 - 15.5) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), loose, petroleum like odor.	10.7 at 12.0 fbgs 47.7 at 14.5 fbgs
TP-24	12/1/2017	16.0	20.0	3.0	none	none	none	16.0	(10.0-15.0)	(0.0 - 1.0) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (1.0 - 16.0) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together.	1.2 at 6.0 fbgs 1.3 at 12.0 fbgs
TP-25	12/1/2017	16.0	20.0	3.0	none	none	none	16.0	(0.0-2.0)	(0.0 - 2.0) WEATHERED CONCRETE DEBRIS: Grey/White, mostly weathered concrete, with brick and metal debris. (2.0 - 16.0) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together.	0.0

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

TABLE 11

TEST PIT SUMMARY

1827 Fillmore Avenue Site
Buffalo, New York

Location	Date	Total Depth (fbgs)	Length (feet)	Width (feet)	Depth to Water (fbgs)	Visual/ Olfactory (depth, fbgs)	Top of Rock (fbgs)	Fill Thickness (fbgs)	Sample Depths (fbgs)	Description (ASTM D2488: Visual-Manual Procedure)	PID Readings (ppm)
TP-26	12/1/2017	16.0	20.0	10.0	14.0	none	none	16.0	(12.0-15.0)	(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 12.0) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together, at 6.0 fbgs two 2-inch steel pipes and 4-inch clay tile pipe running north to south. (12.0 - 16.0) ASH/FILL: White/grey, ash, wet (14.0 fbgs) no free water ash is like paste, wood, glass and ceramic (whole bottles), slag, loose.	0.0
TP-27	12/4/2017	15.0	18.0	3.5	none	none	none	15.0	(7.0 - 9.0)	(0.0 - 1.5) FILL: Brown, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (1.5 - 9.0) RE-WORKED SANDY LEAN CLAY w/ FILL: Reddish Brown, moist, mostly medium plasticity fines, some fine sand (black), brick, concrete, cinders, ash, stiff, medium toughness, medium dry strength, massive. (9.0 - 15.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), leather shoes, loose.	0.0
TP-28	12/1/2017	15.0	20.0	3.0	none	none	none	15.0	(2.0 - 4.0)	(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 15.0) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together.	0.0
TP-29	12/1/2017	15.0	22.0	3.0	none	none	none	15.0	(5.0 - 8.0)	(0.0 - 0.5) FILL: Brown, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 5.0) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together. (5.0 - 8.0) NON-NATIVE FINE SAND: As above, grey. (8.0 - 15.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), loose.	0.0
TP-30	12/1/2017	15.0	17.0	3.0	none	none	none	15.0	(10.0 - 15.0)	(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 7.0) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, slag, some of the sand tends to be fused together, electrical conduit (2.0 fbgs) and clay tile piping (5.0 fbgs). (7.0 - 15.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), loose.	0.0

TABLE 11

TEST PIT SUMMARY

1827 Fillmore Avenue Site
Buffalo, New York

Location	Date	Total Depth (fbgs)	Length (feet)	Width (feet)	Depth to Water (fbgs)	Visual/ Olfactory (depth, fbgs)	Top of Rock (fbgs)	Fill Thickness (fbgs)	Sample Depths (fbgs)	Description (ASTM D2488: Visual-Manual Procedure)	PID Readings (ppm)
Pile Sample Location	**Date**	**Total Depth Into Pile**	**Length (feet)**	**Width (feet)**	**Depth to Water**	**Visual/ Olfactory**	**Top of Rock**	**Fill Thickness**	**Pile Sample Interval**	**Description (ASTM D2488: Visual-Manual Procedure)**	**PID Readings (ppm)**
P-1	12/5/2017	14.0	18.0	3.5	NA	none	NA	14.0	(0.0 - 10.0)	(0.0 - 9.0) TOP SOIL: Brown/grey, moist, mostly non-plastic fines, some fine sand, medium dense, loose when disturbed, roots. (9.0 - 14.0) RE-WORKED SANDY LEAN CLAY: Light Brown/reddish brown, moist, mostly medium plasticity fines, some fine sand, trace fine gravel, stiff, medium toughness, medium dry strength.	0.0
P-2	12/5/2017	12.5	17.0	4.0	NA	none	NA	12.5	(0.0-10.0)	(0.0 - 12.5) TOP SOIL: Brown/grey, moist, mostly non-plastic fines, some fine sand, medium dense, loose when disturbed, roots.	0.0
P-3	12/5/2017	15.0	15.0	3.0	NA	none	NA	15.0	(0.0 - 10.0)	(0.0 - 10.0) TOP SOIL: Brown/grey, moist, mostly non-plastic fines, some fine sand, medium dense, loose when disturbed, roots. (10.0 - 15.0) RE-WORKED SANDY LEAN CLAY: Reddish brown, moist, mostly medium plasticity fines, some fine sand, trace fine gravel, stiff, medium toughness, medium dry strength.	0.0
P-4	12/5/2017	5.0	5.0	3.0	NA	none	NA	5.0	(0-5)	(0-5.0) P-4 - TOP SOIL w/GRAVEL & FILL: Brown, moist, mostly non-plastic fines, some fine sand, little fine gravel, with metal debris, medium dense, loose when disturbed.	0.0
Supplemental Test Pit Location	**Date**	**Total Depth (fbgs)**	**Length (feet)**	**Width (feet)**	**Depth to Water**	**Visual/ Olfactory**	**Top of Rock**	**Fill Thickness**	**Pile Sample Interval**	**Description (ASTM D2488: Visual-Manual Procedure)**	**PID Readings (ppm)**
TP-13R	2/20/2018	17.0	17.0	4.0	none	none	NA	17.0	(8-10) (10-15) (15-17)	(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 9.0) RE-WORKED SANDY LEAN CLAY w/FILL: Reddish brown/dark brown, moist, mostly medium plasticity fines, some fine sand (brown and black), orange brick and ash, stiff, medium toughness, medium dry strength, massive. (9.0-17.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), wood debris, loose.	0.0
TP-13-1	2/20/2018	15.0	17.0	4.0	none	none	NA	15.0	(10-15)	(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 8.5) RE-WORKED SANDY LEAN CLAY w/FILL: Reddish brown/dark brown, moist, mostly medium plasticity fines, some fine sand (brown and black), orange brick and ash, stiff, medium toughness, medium dry strength, massive. (8.5-12.5) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), wood debris, loose. (12.5 - 15.0) LIMESTONE TALUS: Dark Grey/black, mostly cobble sized limestone fragments, mixed with black fines and ash.	0.0
TP-13-2	2/20/2018	16.0	17.0	4.0	none	none	NA	16.0	(10-15)	(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 9.0) RE-WORKED SANDY LEAN CLAY w/FILL: Reddish brown/dark brown, moist, mostly medium plasticity fines, some fine sand (brown and black), orange brick and ash, stiff, medium toughness, medium dry strength, massive. (9.0-12.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), wood debris, loose. (12.0 - 15.0) LIMESTONE TALUS: Dark Grey/black, mostly cobble sized limestone fragments, mixed with black fines and ash.	0.0
TP-13-3	2/20/2018	16.0	17.0	4.0	none	none	NA	16.0	(10-15)	(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 10.0) RE-WORKED SANDY LEAN CLAY w/FILL: Reddish brown/dark brown, moist, mostly medium plasticity fines, some fine sand (brown and black), orange brick and ash, stiff, medium toughness, medium dry strength, massive. (10.0-16.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), wood debris, loose.	0.0
TP-13-4	2/20/2018	15.0	17.0	4.0	none	none	NA	15.0	(11.5-15.0)	(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 10.0) RE-WORKED SANDY LEAN CLAY w/FILL: Reddish brown/dark brown, moist, mostly medium plasticity fines, some fine sand (brown and black), orange brick and ash, stiff, medium toughness, medium dry strength, massive. (10.0-16.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), wood debris, loose.	0.0
TP-13-5	2/20/2018	15.0	17.0	4.0	none	none	NA	15.0	(10-15)	(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 10.0) RE-WORKED SANDY LEAN CLAY w/FILL: Reddish brown/dark brown, moist, mostly medium plasticity fines, some fine sand (brown and black), orange brick and ash, stiff, medium toughness, medium dry strength, massive. (10.0-15.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), wood debris, loose.	0.0
TP-13-6	2/20/2018	16.0	17.0	4.0	none	none	NA	15.0	(10-15)	(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 10.0) RE-WORKED SANDY LEAN CLAY w/FILL: Reddish brown/dark brown, moist, mostly medium plasticity fines, some fine sand (brown and black), orange brick and ash, stiff, medium toughness, medium dry strength, massive. (10.0-13.5) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), wood debris, loose. (13.5 - 16.0) LIMESTONE TALUS: Dark Grey/black, mostly cobble sized limestone fragments, mixed with black fines and ash.	0.0
TP-13-7	2/20/2018	15.0	17.0	4.0	none	none	NA	15.0	(10-15)	(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 10.0) RE-WORKED SANDY LEAN CLAY w/FILL: Reddish brown/dark brown, moist, mostly medium plasticity fines, some fine sand (brown and black), orange brick and ash, stiff, medium toughness, medium dry strength, massive. (10.0-14.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), wood debris, loose. (14.0 - 15.0) LIMESTONE TALUS: Dark Grey/black, mostly cobble sized limestone fragments, mixed with black fines and ash.	0.0
TP-13-8	2/20/2018	16.0	17.0	4.0	none	none	NA	16.0	(10-15)	(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 12.5) RE-WORKED SANDY LEAN CLAY w/FILL: Reddish brown/dark brown, moist, mostly medium plasticity fines, some fine sand (brown and black), orange brick and ash, stiff, medium toughness, medium dry strength, massive. (12.5-16.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), wood debris, loose.	0.0
SB-21R	2/20/2018	18.0	17.0	4.0	none	Slight Petroleum	NA	18.0	(10-12) (12-16) (16-18)	(0.0 - 0.3) ASPHALT (0.3 - 1.0) STONE SUB-BASE: Grey, moist, mostly angular fine gravel, trace non-plastic fines, loose. (1.0 - 10.0) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together. (10.0 - 18.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), wood debris, loose, petroleum like odor	13.3 (10 -16)
SB-21-1	2/20/2018	16.0	17.0	4.0	none	Slight Petroleum	NA	16.0	(10-16)	(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 10.0) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together. (10.0 - 16.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), wood debris, loose, petroleum like odor	10.7 (14.0-16.0)
SB-21-2	2/20/2018	16.0	17.0	4.0	none	Slight Petroleum	NA	16.0	(11-16)	(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 11.0) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together. (11.0 - 16.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), wood debris, loose, petroleum like odor	6.8 (14-16.0)
SB-21-3	2/20/2018	16.0	17.0	4.0	none	Slight Petroleum	NA	16.0	(12-16)	(0.0 - 0.3) ASPHALT (0.3 - 1.0) STONE SUB-BASE: Grey, moist, mostly angular fine gravel, trace non-plastic fines, loose. (1.0 - 10.0) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together. (10.0 - 16.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), wood debris, loose, petroleum like odor	34.7 (10-16)
SB-21-4	2/20/2018	16.0	17.0	4.0	15.5	Slight Petroleum	NA	16.0	(12-16)	(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 11.0) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together. (11.0 - 16.0) ASH/FILL: White/grey, moist to wet (14.5 fbgs), ash, wood, glass and ceramic (whole bottles), wood debris, loose, petroleum like odor	33.8 (14.0 - 16.0)
SB-21-5	2/21/2018	17.0	17.0	4.0	none	Slight Petroleum	NA	17.0		(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 11.0) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together. (11.0 - 17.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), wood debris, loose, petroleum like odor	2.5 (14.0-17.0)
SB-21-6	2/21/2018	16.0	17.0	4.0	none	Slight Petroleum	NA	16.0		(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 11.0) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together. (11.0 - 17.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), wood debris, loose, petroleum like odor	0.0
SB-21-7	2/21/2018	16.0	17.0	4.0	none	Slight Petroleum	NA	16.0		(0.0 - 0.3) ASPHALT (0.3 - 1.0) STONE SUB-BASE: Grey, moist, mostly angular fine gravel, trace non-plastic fines, loose. (1.0 - 12.0) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together. (12.0 - 16.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), wood debris, loose, petroleum like odor	6.6 (14.0-16.0)
SB-21-8	2/21/2018	16.0	17.0	4.0	15	Slight Petroleum	NA	16.0		(0.0 - 0.3) ASPHALT (0.3 - 1.0) STONE SUB-BASE: Grey, moist, mostly angular fine gravel, trace non-plastic fines, loose. (1.0 - 10.0) SAND with CLAY and GRAVEL: Brown, moist, mostly fine sand, some medium plasticity fines, few fine gravel (angular and sub-rounded), medium dense. (10.0 - 16.0) ASH/FILL: White/grey, moist to (wet 15.0 fbgs), ash, wood, glass and ceramic (whole bottles), wood debris, loose, petroleum like odor	4.3 (10.0 - 14.0)
SB-41R	2/21/2018	13.0	17.0	4.0	none	none	NA	13.0	(6.0 - 8.0) (8.0-11.0) (11.0-13.0)	(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 9.0) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the the sand tends to be fused together. (9.0 - 13.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), wood debris, loose.	0.0

Benchmark Environmental Engineering & Science, PLLC

TABLE 11

TEST PIT SUMMARY

1827 Fillmore Avenue Site
Buffalo, New York

Location	Date	Total Depth (fbgs)	Length (feet)	Width (feet)	Depth to Water (fbgs)	Visual/ Olfactory (depth, fbgs)	Top of Rock (fbgs)	Fill Thickness (fbgs)	Sample Depths (fbgs)	Description (ASTM D2488: Visual-Manual Procedure)	PID Readings (ppm)
SB-41-1	2/21/2018	11.0	17.0	4.0	none	none	NA	11.0	(8.0-11.0)	(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 8.0) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together. (8.0 - 11.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), wood debris, loose.	0.0
SB-41-2	2/21/2018	11.0	17.0	4.0	none	none	NA	11.0	(8.0-11.0)	(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 8.0) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together. (8.0 - 11.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), wood debris, loose.	0.0
SB-41-3	2/21/2018	11.0	17.0	4.0	none	none	NA	11.0	(8.0-11.0)	(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 9.5) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together. (9.5 - 11.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), wood debris, loose.	0.0
SB-41-4	2/21/2018	13.0	17.0	4.0	none	none	NA	13.0	(8.0-11.0)	(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 9.0) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together. (9.0 - 11.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), wood debris, loose.	0.0
SB-41-5	2/21/2018	11.0	17.0	4.0	none	Slight Petroleum	NA	11.0	(8.0-11.0)	(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 3.5) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together. (3.5 - 10.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), wood debris, loose. (10.0 - 11.0) SILTY SAND: Dark grey/black, moist, mostly fine sand, some non-plastic fines, wood debris, medium dense, petroleum like odor.	0.2 (10.0-11.0)
SB-41-6	2/21/2018	11.0	17.0	4.0	none	none	NA	11.0	(8.0-11.0)	(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 8.0) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together. (8.0 - 11.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), wood debris, loose.	0.0
SB-41-7	2/21/2018	11.0	17.0	4.0	none	none	NA	11.0	(8.0-11.0)	(0.0 - 5.0) WEATHERED CONCRETE DEBRIS: Grey/White, mostly weathered concrete, with brick and metal debris. (5.0 - 11.0) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together.	0.0
SB-41-8	2/21/2018	11.0	17.0	4.0	none	none	NA	11.0	(8.0-11.0)	(0.0 - 0.5) FILL: Brown, moist, mostly fine sand, some non-plastic fines, little fine to coarse gravel, concrete, orange brick and ash, roots, loose. (0.5 - 10.5) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together. (10.5 - 11.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), wood debris, loose.	0.0
TP-25R	2/22/2018	4.0	9.0	4.0	none	none	NA	4.0	(2.0 - 4.0)	(0.0 - 2.0) WEATHERED CONCRETE DEBRIS: Grey/White, mostly weathered concrete, with brick and metal debris. (2.0 - 4.0) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together.	0.0
TP-25-1	2/22/2018	4.0	9.0	4.0	none	none	NA	4.0	(0.0 - 2.0)	(0.0 - 2.0) WEATHERED CONCRETE DEBRIS: Grey/White, mostly weathered concrete, with brick and metal debris. (2.0 - 4.0) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together.	0.0
TP-25-2	2/22/2018	7.5	9.0	4.0	none	none	NA	7.5	(0.0 - 2.0)	(0.0 - 2.0) WEATHERED CONCRETE DEBRIS: Grey/White, mostly weathered concrete, with brick and metal debris. (2.0 - 7.5) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together.	0.0
TP-25-3	2/22/2018	4.5	9.0	4.0	none	none	NA	4.5	(0.0 - 2.0)	(0.0 - 2.0) WEATHERED CONCRETE DEBRIS: Grey/White, mostly weathered concrete, with brick and metal debris. (2.0 - 4.5) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together.	0.0
TP-25-4	2/22/2018	15.5	9.0	4.0	none	none	NA	15.5	(0.0 - 2.0)	(0.0 - 2.0) WEATHERED CONCRETE DEBRIS: Grey/White, mostly weathered concrete, with brick and metal debris. (2.0 - 15.5) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together.	0.0
SS-13R	2/22/2018	15.5	9.0	4.0	none	none	NA	15.5	(0.2" - 24")	(0.0 - 2.0) WEATHERED CONCRETE DEBRIS with BLACK SAND: Grey/White, mostly weathered concrete, with brick and metal debris. (2.0 - 15.5) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together.	0.0
SS-13-1	2/22/2018	4.0	9.0	4.0	none	none	NA	4.0	(0.0 - 2.0)	(0.0 - 4.0) NON-NATIVE FINE SAND: Black with Brown patches, moist, mostly fine sand, trace non-plastic fines, wood, metal debris, some of the sand tends to be fused together, gas piping in the upper 2.0 feet.	0.0
SS-13-2	2/22/2018	5.0	9.0	4.0	none	none	NA	5.0	(0.0 - 2.0)	(0.0 - 2.0) Fill: Black/dark brown, moist, mostly fine sand, few fine gravel angular, medium dense. (2.0 - 4.0) SAND with CLAY and GRAVEL: Brown, moist, mostly fine sand, some medium plasticity fines, few fine gravel (angular and sub-rounded), medium dense.	0.0
SS-13-3	2/22/2018	12.0	9.0	4.0	none	none	NA	12.0	(0.0 - 2.0)	(0.0 - 2.0) Fill: Dark brown, moist, mostly fine sand, few fine gravel angular, medium dense. (2.0 - 12.0) SAND with CLAY and GRAVEL: Brown, moist, mostly fine sand, some medium plasticity fines, few fine gravel (angular and sub-rounded), ashphalt, medium dense. (12.0) ASH/FILL: White/grey, moist, ash, wood, glass and ceramic (whole bottles), wood debris, loose.	0.0
SS-13-4	2/22/2018	5.0	9.0	4.0	none	none	NA	5.0	(0.0 - 2.0)	(0.0 - 1.0) Fill: Black/dark brown, moist, mostly fine sand, few fine gravel angular, medium dense. (1.0 - 5.0) SAND with CLAY and GRAVEL: Brown, moist, mostly fine sand, some medium plasticity fines, few fine gravel (angular and sub-rounded), medium dense.	0.0

Project No: 0421-017-001-004

Borehole Number: MW-1

Project: 1827 Fillmore Ave, Remedial Investigation

A.K.A.:

Client: Rupp, Baase, Pfalzgraf & Cunningham

Logged By: TAB

Site Location: 1827 Fillmore Ave. Buffalo, NY

Checked By:

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

Benchmark Environmental Engineering & Science, PLLC
2558 Hamburg Turnpike, Suite 300
Buffalo, NY 14218
(716) 856-0599

SUBSURFACE PROFILE			SAMPLE				PID VOCs	Lab Sample	Well Completion Details or Remarks
Depth (fbgs)	Elev. /Depth	Description (ASTM D2488: Visual-Manual Procedure)	Sample No.	SPT N-Value	Recovery (ft)	Symbol	ppm 0 12.5 25		
0.0	0.0	Ground Surface							
	0.0 / -0.2 / 0.2	**Asphalt** Asphalt							
		Stone sub-base Dark grey, moist, mostly fine gravel, few fine sand, trace non-plastic fines, medium dense, loose when disturbed.	S1	28	0.9		0.0		
	-1.5 / 1.5	**Ash/Fill** White, moist, ash.							
	-2.0 / 2.0	No Recovery	S2	8	0.0				
	-4.0 / 4.0	**Re-worked Clay with Fill.** Reddish brown, moist, mostly, medium plasticity fines, some fine sand, orange brick, cinders and ash. Spoon and Auger refusal at 5.4 fbgs.	S3	100 / 4	0.6		0.0	Sample location	
5.0									
	-5.4 / 5.4	End of Borehole							

Drilled By: Earth Dimensions, Inc.
Drill Rig Type: Diedrich D50
Drill Method: Continuous split spoon sampling
Comments:
Drill Date(s): 11/27/17

Hole Size: 8 1/2-inch.
Stick-up: NA
Datum: NA

Project No: 0421-017-001-007

Borehole Number: MW-1

Project: 1827 Fillmore Ave, Remedial Investigation

A.K.A.:

Client: Rupp, Baase, Pfalzgraf & Cunningham

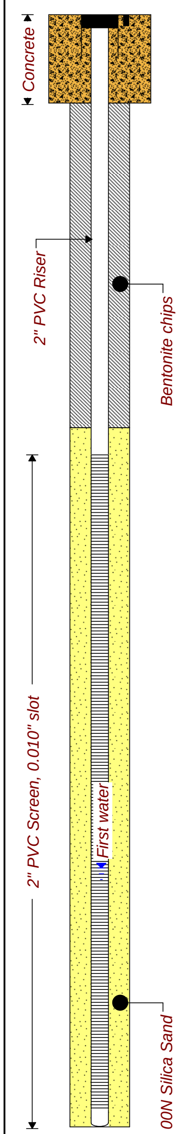
Logged By: TAB

Site Location: 1827 Fillmore Ave. Buffalo, NY

Checked By:

Benchmark Environmental Engineering & Science, PLLC
2558 Hamburg Turnpike, Suite 300
Buffalo, NY 14218
(716) 856-0599

SUBSURFACE PROFILE			SAMPLE				PID VOCs ppm (0 – 12.5 – 25)	Lab Sample	Well Completion Details or Remarks
Depth (fbgs)	Elev. /Depth	Description (ASTM D2488: Visual-Manual Procedure)	Sample No.	SPT N-Value	Recovery (ft)	Symbol			
	0.0	Ground Surface							
0.0	0.0	See borehole log for MW-1.							
5.0	-4.6 4.6	***Limestone*** Grey to dark grey limestone bedrock, moderately hard to hard, massively bedded, moderately fractured horizontally along bedding planes total water lost approximately 150 gallons. Run #1 (4.6 - 12.4)' Length 7.8 ft. Recovery 7.7ft percent recovered 99% rock-quality designation (RQD) 97%							
10.0									
	-12.4 12.4	End of Borehole							



Drilled By: Earth Dimensions, Inc.
Drill Rig Type: Diedrich D50
Drill Method: N/Q-2 size double tubed wireline core barrel.
Comments:
Drill Date(s): 7/6/18

Hole Size: 8 1/2-inch.
Stick-up: NA
Datum: NA

Sheet: 1 of 1

Project No: 0421-017-001-004

Borehole Number: MW-2

Project: 1827 Fillmore Ave, Remedial Investigation

A.K.A.:

Client: Rupp, Baase, Pfalzgraf & Cunningham

Logged By: TAB

Site Location: 1827 Fillmore Ave. Buffalo, NY

Checked By:

Benchmark Environmental Engineering & Science, PLLC
2558 Hamburg Turnpike, Suite 300
Buffalo, NY 14218
(716) 856-0599

SUBSURFACE PROFILE			SAMPLE				PID VOCs (ppm) 0 / 12.5 / 25	Lab Sample	Well Completion Details or Remarks
Depth (fbgs)	Elev. /Depth	Description (ASTM D2488: Visual-Manual Procedure)	Sample No.	SPT N-Value	Recovery (ft)	Symbol			
	0.0 / 0.0	Ground Surface							
0.0	0.0 / 0.0	***Asphalt*** Asphalt							
	-1.0 / 1.0	***Stone sub-base*** Dark grey, moist, mostly fine gravel, few fine sand, trace non-plastic fines, medium dense, loose.	S1	6	0.6		0.0		
	-2.0 / 2.0	***Re-worked Clay with Fill.*** Reddish brown/dark brown, moist, mostly, medium plasticity fines, some fine sand, orange brick, cinders and ash, firm. As above.	S2	7	1.4		0.0	Sample location	
5.0	-4.0 / 4.0	As above.	S3	5	1.3		0.0		
	-6.0 / 6.0	As above, stiff.	S4	11	1.2		0.0		
	-7.0 / 7.0	***Well Graded Fine Sand (Non-native)*** Black moist, mostly fine to medium sand, trace non-plastic fines, trace fine gravel (angular), medium dense, loose when disturbed.							
	-8.0 / 8.0	As above.	S5	19	0.6		0.0		
10.0	-10.0 / 10.0	***Re-worked Clay Fill*** As (1.0 to 2.0 fbgs) above.	S6	8	1.4		0.0		
	-12.0 / 12.0	***Limestone Mining Talus*** Grey, moist, mostly fine grave (lime stone), some coarse sand, loose. Spoon and Auger refusal at 14.0 fbgs.	S7	10	0.1		0.0		
	-14.0 / 14.0	End of Borehole							
15.0									

Drilled By: Earth Dimensions, Inc.
Drill Rig Type: Diedrich D50
Drill Method: Continuous split spoon sampling
Comments:
Drill Date(s): 11/22/17

Hole Size: 8 1/2-inch.
Stick-up: NA
Datum: NA

Sheet: 1 of 1

Project No: 0421-017-001-007

Borehole Number: MW-2

Project: 1827 Fillmore Ave, Remedial Investigation

A.K.A.:

Client: Rupp, Baase, Pfalzgraf & Cunningham

Logged By: TAB

Site Location: 1827 Fillmore Ave. Buffalo, NY

Checked By:

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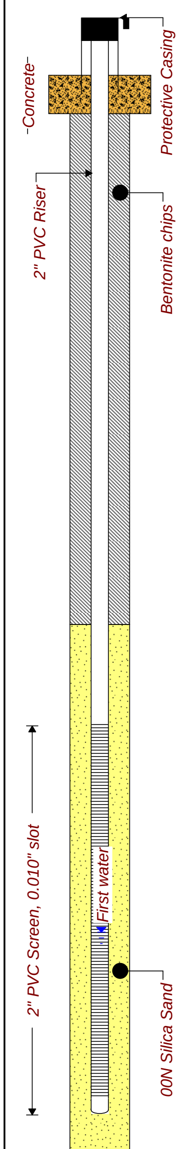
Buffalo, NY 14218
(716) 856-0599

SUBSURFACE PROFILE			SAMPLE				PID VOCs ppm (0 – 12.5 – 25)	Lab Sample	Well Completion Details or Remarks
Depth (fbgs)	Elev. /Depth	Description (ASTM D2488: Visual-Manual Procedure)	Sample No.	SPT N-Value	Recovery (ft)	Symbol			
-1.0	0.0 0.0	Ground Surface See borehole log for MW-2							
4.0									
9.0									
14.0	-14.1 14.1	***Limestone*** Grey to dark grey limestone bedrock, moderately hard to hard, massively bedded, moderately fractured horizontally along bedding planes total water lost approximately 650 gallons. Run #1 (14.1 - 22.5)' Length 8.3 ft. Recovery 8.1 ft Percent recovered 98% RQD 90%							
19.0									
24.0		Run #2 (22.5 - 22.7)' Length 5.3 ft Recovery 4.9 ft Percent Recovered 92% RQD 88%							
	-27.7 27.7	End of Borehole							



Drilled By: Earth Dimensions, Inc.
Drill Rig Type: Diedrich D50
Drill Method: N/Q-2 size double tubed wireline core barrel.
Comments:
Drill Date(s): 7/5/18 and 7/6/18

Hole Size: 8 1/2-inch.
Stick-up: NA
Datum: NA

Sheet: 1 of 1

Project No: 0421-017-001-004

Borehole Number: MW-3

Project: 1827 Fillmore Ave, Remedial Investigation

A.K.A.:

Client: Rupp, Baase, Pfalzgraf & Cunningham

Logged By: TAB

Site Location: 1827 Fillmore Ave. Buffalo, NY

Checked By:

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Buffalo, NY 14218
(716) 856-0599

SUBSURFACE PROFILE			SAMPLE						
Depth (fbgs)	Elev. /Depth	Description (ASTM D2488: Visual-Manual Procedure)	Sample No.	SPT N-Value	Recovery (ft)	Symbol	PID VOCs ppm (0 – 12.5 – 25)	Lab Sample	Well Completion Details or Remarks
	0.0	Ground Surface							
0.0	0.0 / 0.0	***Asphalt*** Asphalt							
		Stone sub-base Dark grey, moist, mostly fine gravel, few fine sand, trace non-plastic fines, medium dense, loose when disturbed.	S1	18	1.1		1.6	Sample location	
	-2.0 / 2.0	***Non-native sand Fill*** Black/brown, moist, mostly fine sand, trace non-plastic fines, glass, medium dense, loose when disturbed. As above, trace slag	S2	16	1.7		0.0		
5.0	-4.0 / 4.0	As above with ash.	S3	17	1.8		0.0		
	-6.0 / 6.0	As above, no slag,	S4	12	1.6		0.0		
	-8.0 / 8.0	As above, sand stone fragments, loose.	S5	7	1.4		0.0		
10.0	-10.0 / 10.0	***Re-worked Clay Fill*** Reddish brown, moist mostly medium plasticity fines, some fine sand, with wood, stiff.	S6	9	1.4		0.0		
	-12.0 / 12.0	As above.	S7	9	0.8		0.0		
15.0	-14.0 / 14.0	As above. Spoon and Auger refusal at 15.6 fbgs.	S8	50 / 5	0.6		0.0		
	-15.6 / 15.6	End of Borehole							

Drilled By: Earth Dimensions, Inc.
Drill Rig Type: Diedrich D50
Drill Method: Continuous split spoon sampling
Comments:
Drill Date(s): 11/22/17

Hole Size: 8 1/2-inch.
Stick-up: NA
Datum: NA

Sheet: 1 of 1

Project No: 0421-017-001-007

Borehole Number: MW-3

Project: 1827 Fillmore Ave, Remedial Investigation

A.K.A.:

Client: Rupp, Baase, Pfalzgraf & Cunningham

Logged By: TAB

Site Location: 1827 Fillmore Ave. Buffalo, NY

Checked By:

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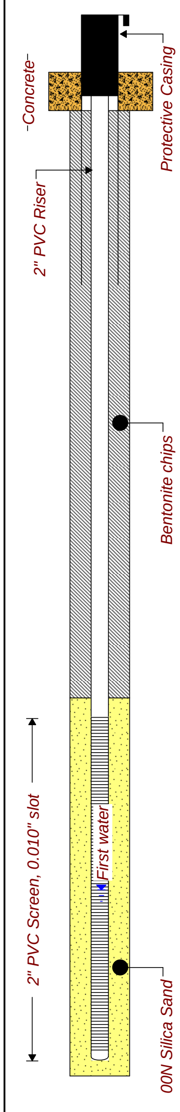
Buffalo, NY 14218
(716) 856-0599

SUBSURFACE PROFILE			SAMPLE				PID VOCs	Lab Sample	Well Completion Details or Remarks
Depth (fbgs)	Elev. /Depth	Description (ASTM D2488: Visual-Manual Procedure)	Sample No.	SPT N-Value	Recovery (ft)	Symbol	ppm 0 12.5 25		
-1.0	0.0 0.0	Ground Surface							
		See borehole log for MW-3							
4.0									
9.0									
14.0									
	-16.1 16.1	***Limestone*** Grey to dark grey limestone bedrock, moderately hard to hard, massively bedded, moderately fractured horizontally along bedding planes. Total water lost approximately 400 gallons. Run #1 (16.9 - 17.8)' Length 0.9 ft. Recovery 0.9 ft Percent recovered 100% RQD 100%							
19.0									
24.0		Run #2 (17.8 - 25.8)' Length 8.0 ft Recovery 7.4 ft Percent Recovered 93% RQD 96%							
	-25.8 25.8	End of Borehole							



Drilled By: Earth Dimensions, Inc.
Drill Rig Type: Diedrich D50
Drill Method: N/Q-2 size double tubed wireline core barrel.
Comments:
Drill Date(s): 7/3/18

Hole Size: 8 1/2-inch.
Stick-up: NA
Datum: NA

Project No: 0421-017-001-004

Borehole Number: MW-4

Project: 1827 Fillmore Ave, Remedial Investigation

A.K.A.:

Client: Rupp, Baase, Pfalzgraf & Cunningham

Logged By: TAB

Site Location: 1827 Fillmore Ave. Buffalo, NY

Checked By:

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

Benchmark Environmental Engineering & Science, PLLC
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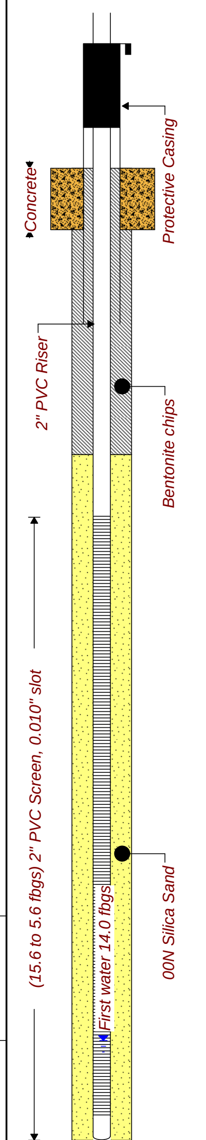
Buffalo, NY 14218
(716) 856-0599

SUBSURFACE PROFILE			SAMPLE						
Depth (fbgs)	Elev. /Depth	Description (ASTM D2488: Visual-Manual Procedure)	Sample No.	SPT N-Value	Recovery (ft)	Symbol	PID VOCs (ppm)	Lab Sample	Well Completion Details or Remarks
-2.0									
	0.0 / 0.0	Ground Surface							
	0.0 / -0.5 / 0.5	***Sandy Lean Clay with Fill*** Dark brown, moist, mostly low plasticity fines, some fine sand, coal fragments, roots, massive, very stiff.	S1	26	1.6		1.6		
	-2.0 / 2.0	***Ash/fill*** Brown/dark brown, moist, mostly fine sand, little non-plastic fines, little fing gravel (slag), coal fragments, medium dense.	S2	9	1.3		0.0		
3.0		***Non-Native Sand and Clay with Fill*** Black, black moist mostly fine to medium sand, trace non-plastic fines, few fine gravels (slag), loose.							
	-4.0 / 4.0	As above with ash, mixed with re-worked clay, yellow brick.	S3	6	1.2		0.0		
	-6.0 / 6.0	As above, orange brick, no slag.	S4	16	1.1		0.0		
8.0	-8.5 / 8.5	As above with concrete fragments	S5	38	1.6		0.0		
	-10.0 / 10.0	***Ash/Fill*** White, moist, mostly ash with cinders, with brown fine sand.	S6	11	1.3		0.0		
13.0	-12.0 / 12.0	As above, as above no fine sand	S7	11	1.1		0.0	Sample location	
	-14.0 / 14.0	As above.	S8	100 / 5	0.8		0.0		
	-15.6 / 15.6	Spoon and Auger refusal at 15.6 fbgs. End of Borehole							

PID VOCs scale: 0, 12.5, 25 ppm



Drilled By: Earth Dimensions, Inc.
Drill Rig Type: Diedrich D50
Drill Method: Continuous split spoon sampling
Comments:
Drill Date(s): 11/22/17

Hole Size: 8 1/2-inch.
Stick-up: NA
Datum: NA

Sheet: 1 of 1

Project No: 0421-017-001-004

Borehole Number: MW-5

Project: 1827 Fillmore Ave, Remedial Investigation

A.K.A.:

Client: Rupp, Baase, Pfalzgraf & Cunningham

Logged By: TAB

Site Location: 1827 Fillmore Ave. Buffalo, NY

Checked By:

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

Benchmark Environmental Engineering & Science, PLLC
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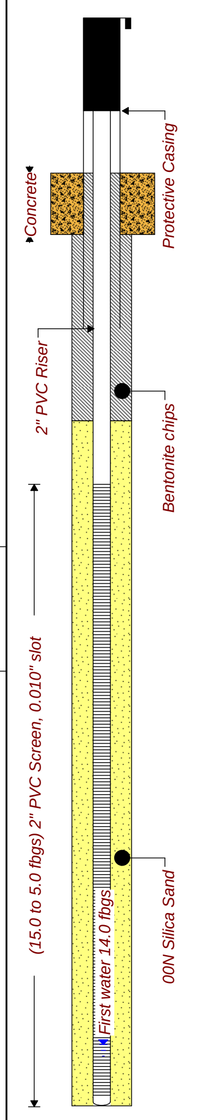
Buffalo, NY 14218
(716) 856-0599

Elev. /Depth	Description (ASTM D2488: Visual-Manual Procedure)	Sample No.	SPT N-Value	Recovery (ft)	PID VOCs (ppm)	Lab Sample
497.8	Ground Surface					
0.0	***Asphalt*** Asphalt	S1	11	1.4	0.0	
496.8 / 1.0	***Poorly Graded Gravel*** Grey, moist, mostly fine to coarse gravel, trace non-plastic fines, medium dense, loose when disturbed.					
495.8 / 2.0	***Ash/fill*** White/brown, moist, mostlly ash with cinders, loose. As above.	S2	4	1.1	0.0	
493.8 / 4.0	As above.	S3	4	0.9	0.0	
491.8 / 6.0	As above.	S4	7	1.8	0.0	Sample location
490.8 / 7.0	***Non-native Fine Sand*** Black, mostly fine sand, trace non-plastic fines, loose.					
489.8 / 8.0	***Ash/fill*** As (6.0 to 7.0 fbgs) above, medium dense.	S5	20	1.6	0.0	
488.3 / 9.5	***Non-native Fine Sand*** As (7.0 to 8.0 above), medium dense..					
487.8 / 10.0	***Ash/Fill*** As above, loose	S6	11	1.3	0.0	
485.8 / 12.0	***Fill*** Black, moist, mostly fine sand, some non-plastic fines, with orange brick and cinders, loose.	S7	8	0.8	0.0	
483.8 / 14.0	As above	S8	100 / 5	0.8	0.0	
482.8 / 15.0	Spoon and Auger refusal at 15.0 fbgs.					
	End of Borehole					

Depth (fbgs): -2.0, 3.0, 8.0, 13.0

PID VOCs ppm scale: 0, 12.5, 25

Well Completion Details or Remarks



Drilled By: Earth Dimensions, Inc.
Drill Rig Type: Diedrich D50
Drill Method: Continuous split spoon sampling
Comments:
Drill Date(s): 11/20/17

Hole Size: 8 1/2-inch.
Stick-up: NA
Datum: NA

Project No: 0421-017-001-004

Borehole Number: MW-7

Project: 1827 Fillmore Ave, Remedial Investigation

A.K.A.:

Client: Rupp, Baase, Pfalzgraf & Cunningham

Logged By: TAB

Site Location: 1827 Fillmore Ave. Buffalo, NY

Checked By:

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

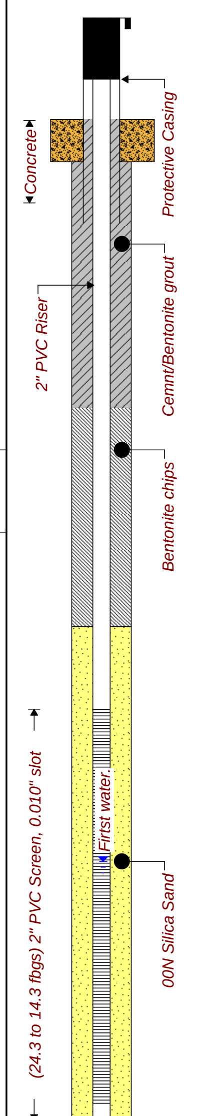
Benchmark Environmental Engineering & Science, PLLC
2558 Hamburg Turnpike, Suite 300
Buffalo, NY 14218
(716) 856-0599

Elev. /Depth	Description (ASTM D2488: Visual-Manual Procedure)	Sample No.	SPT N-Value	Recovery (ft)	PID VOCs (ppm)	Lab Sample
505.5 / 0.0	Ground Surface					
505.5 / 0.0	**Asphalt** Asphalt	S1	12	1.1	0.1	
504.5 / 1.0	**Poorly Graded Gravel** Grey, moist, mostly fine to coarse gravel, trace non-plastic fines, medium dense, loose when disturbed.	S2	27	1.7	0.1	
501.5 / 4.0	**Fill** Black/brown, moist, mostly fine sand, little non-plastic fines, orange brick, cinders, ash, medium dense..	S3	10	1.6	0.0	
	As above.					
499.5 / 6.0	**Re-worked clay with fill** Black/brown, mostly medium plasticty fines, some fine sand (black), with cinders and ash.	S4	5	1.9	0.0	
497.5 / 8.0	As above, loose.					
	As above, stiff.	S5	15	1.8	0.0	Sample location
495.5 / 10.0	**Fill** Dark brown, mostly fine sand, little non-plastic fines, orange brick, ash and cinders, coal fragments, medium dense.	S6	15	1.7	0.0	
493.5 / 12.0	As above.	S7	17	1.6	0.0	
	As above.					
491.5 / 14.0	As above.	S8	11	1.6	0.0	
490.5 / 15.0	**Ash/fill** White, moist, mostly ash with coal fragments and cinders, loose, medium dense.					
489.5 / 16.0	As above, loose.	S9	6	1.1	0.0	
487.5 / 18.0	As above, wet (18.0 fbgs).	S10	7	1.3	0.0	
485.5 / 20.0	As above.	S11	8	0.7	0.0	
483.5 / 22.0	**Ash/fill** Black, wet, mostly cinders with white ash.	S12	9	1.1	0.0	
481.2 / 24.3	Was at spoon refusal from 23.5 to 24.0 fbgs, Augured to 24.3 fbgs where Auger refusal was encountered.		NA			
	End of Borehole					

Depth (fbgs) scale: -2.0, 3.0, 8.0, 13.0, 18.0, 23.0

PID VOCs scale (ppm): 0, 12.5, 25

Well Completion Details or Remarks



Drilled By: Earth Dimensions, Inc.
Drill Rig Type: Diedrich D50
Drill Method: Continuous split spoon sampling
Comments:
Drill Date(s): 11/27/17

Hole Size: 8 1/2-inch.
Stick-up: NA
Datum: NA

Sheet: 1 of 1

Project No: 0421-017-001-004

Borehole Number: SB-21-10

Project: 1827 Fillmore Ave, SB-21 delineation.

A.K.A.:

Client: Rupp, Baase, Pfalzgraf & Cunningham

Logged By: TAB

Site Location: 1827 Fillmore Ave. Buffalo, NY

Checked By:

Benchmark Environmental Engineering & Science, PLLC
2558 Hamburg Turnpike, Suite 300
Buffalo, NY 14218
(716) 856-0599

SUBSURFACE PROFILE			SAMPLE						
Depth (fbgs)	Elev. /Depth	Description (ASTM D2488: Visual-Manual Procedure)	Sample No.	SPT N-Value	Recovery (%)	Symbol	PID VOCs ppm (0 – 12.5 – 25)	Lab Sample	Well Completion Details or Remarks
0.0	504.2 / 0.0	Ground Surface							
		Auger to 12.0 fbgs see MW-8 soil descriptions.							
12.0	492.2 / 12.0	***Ash/Fill*** White, moist to wet (13.0 fbgs), mostly ash, coal fragments, loose.	S1		1.3		0.2	Sample location	First water.
14.0	490.2 / 14.0	As above, dark grey, wet, wood and cinders.	S2		1.0		0.1	Sample location	
16.0	488.2 / 16.0	As above.	S3		0.5		0.0		
18.0	486.2 / 18.0	As above, with limestone fragments. spoon and auger refusal ant 19.5 fbgs.	S4		0.8		0.1		
19.5	484.7 / 19.5	Top of rock.							
		End of Borehole							

Drilled By: Earth Dimensions, Inc.
Drill Rig Type: Diedrich D50
Drill Method: 3 1/4 inch HSA.
Comments:
Drill Date(s): 3/21/19

Hole Size: 7 1/2- inch
Stick-up: NA
Datum: NA

Project No: 0421-017-001-004

Borehole Number: SB-21-11

Project: 1827 Fillmore Ave, SB-21 delineation.

A.K.A.:

Client: Rupp, Baase, Pfalzgraf & Cunningham

Logged By: TAB

Site Location: 1827 Fillmore Ave. Buffalo, NY

Checked By:

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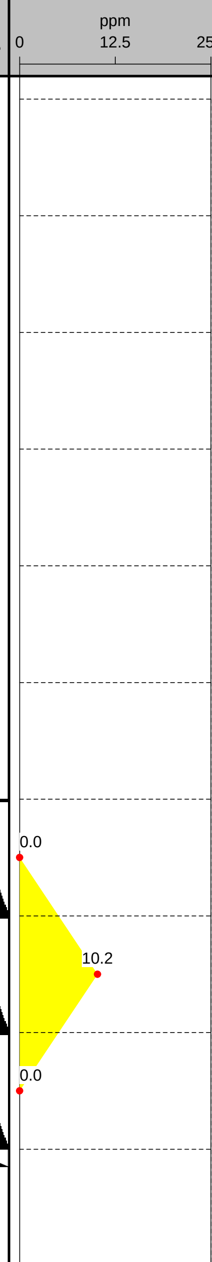
Depth (fbgs)	Elev. /Depth	Description (ASTM D2488: Visual-Manual Procedure)	Sample No.	SPT N-Value	Recovery (%)	Symbol	PID VOCs (ppm)	Lab Sample	Well Completion Details or Remarks
0.0	504.2 / 0.0	Ground Surface							
		Auger to 12.0 fbgs see MW-8 soil descriptions.							
12.0	492.2 / 12.0	***Black Sand*** Black, moist, mostly fine sand, trace non plastic fines.	S1		1.1		0.0	Sample location	
13.0	491.2 / 13.0	***Ash/Fill*** White, moist to wet (13.0 fbgs), mostly ash, coal fragments, loose.							*Firtst water.*
14.0	490.2 / 14.0	As above, dark grey, wet, wood, cinders and brick.	S2		1.3		10.2		
16.0	488.2 / 16.0	As above with limestone fragments	S3		0.2		0.0		
18.0	486.2 / 18.0	Spoon and auger refusal ant 18.3 fbgs. Top of rock.	S4		0.0				
		End of Borehole							
20.0									



Drilled By: Earth Dimensions, Inc.
Drill Rig Type: Diedrich D50
Drill Method: 3 1/4 inch HSA.
Comments:
Drill Date(s): 3/21/19

Hole Size: 7 1/2- inch
Stick-up: NA
Datum: NA

Project No: 0421-017-001-004

Borehole Number: SB-21-12

Project: 1827 Fillmore Ave, SB-21 delineation.

A.K.A.:

Client: Rupp, Baase, Pfalzgraf & Cunningham

Logged By: TAB

Site Location: 1827 Fillmore Ave. Buffalo, NY

Checked By:

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

Benchmark Environmental Engineering & Science, PLLC
2558 Hamburg Turnpike, Suite 300
Buffalo, NY 14218
(716) 856-0599

SUBSURFACE PROFILE			SAMPLE						
Depth (fbgs)	Elev. /Depth	Description (ASTM D2488: Visual-Manual Procedure)	Sample No.	SPT N-Value	Recovery (%)	Symbol	PID VOCs ppm (0 – 12.5 – 25)	Lab Sample	Well Completion Details or Remarks
0.0	504.2 / 0.0	Ground Surface							
		Auger to 12.0 fbgs see MW-8 soil descriptions.							
5.0									
10.0									
	492.2 / 12.0	**Re-worked Clay** Reddish Brown, moist, mostly medium plasticity fines, some fine sand, with ash and cinders.	S1		1.7		0.0	Sample location	First water.
	491.7 / 12.5	**Black Sand** Black, moist, mostly fine sand, trace non plastic fines.							
	491.2 / 13.0	**Ash/Fill** White, moist, mostly ash, coal fragments, loose.							
15.0	490.2 / 14.0	As above, dark grey, wet (14.0 fbgs), wood, cinders and brick.	S2		0.7		0.6		
	488.2 / 16.0	As above with limestone fragments	S3		0.3		0.3		
	486.2 / 18.0	Spoon and auger refusal ant 18.5 fbgs.	S4		0.2		0.1		
	485.7 / 18.5	Top of rock.							
		End of Borehole							
20.0									

Drilled By: Earth Dimensions, Inc.
Drill Rig Type: Diedrich D50
Drill Method: 3 1/4 inch HSA.
Comments:
Drill Date(s): 3/21/19

Hole Size: 7 1/2- inch
Stick-up: NA
Datum: NA

Project No: 0421-017-001-004

Borehole Number: SB-21-13

Project: 1827 Fillmore Ave, SB-21 delineation.

A.K.A.:

Client: Rupp, Baase, Pfalzgraf & Cunningham

Logged By: TAB

Site Location: 1827 Fillmore Ave. Buffalo, NY

Checked By:

Benchmark Environmental Engineering & Science, PLLC
2558 Hamburg Turnpike, Suite 300
Buffalo, NY 14218
(716) 856-0599

SUBSURFACE PROFILE			SAMPLE						
Depth (fbgs)	Elev. /Depth	Description (ASTM D2488: Visual-Manual Procedure)	Sample No.	SPT N-Value	Recovery (%)	Symbol	PID VOCs ppm (0 – 12.5 – 25)	Lab Sample	Well Completion Details or Remarks
0.0	0.0 / 0.0	Ground Surface							
0.0	0.0 / 0.0	Auger to 12.0 fbgs see MW-8 soil descriptions.							
12.0	-12.0 / 12.0	**Black Sand** Black, moist, mostly fine sand, trace non plastic fines, mixed with ash and glass	S1		1.4		0.0		
14.0	-14.0 / 14.0	As above.	S2		0.6		0.0	Sample location	Firtst water.
16.0	-16.0 / 16.0	**Ash/Fill** Dark grey/black, wet (16.0 fbgs), mostly ash, glass and wood fragments, with angular lime stone peicies.	S3		0.7		0.0		
18.0	-18.0 / 18.0	Augered to refusal at 19.8 fbgs.							
19.8	-19.8 / 19.8	End of Borehole							

Depth scale: 0.0, 5.0, 10.0, 15.0, 20.0

Drilled By: Earth Dimensions, Inc.
Drill Rig Type: Diedrich D50
Drill Method: 3 1/4 inch HSA.
Comments:
Drill Date(s): 3/21/19

Hole Size: 7 1/2- inch
Stick-up: NA
Datum: NA

Sheet: 1 of 1

Project No: 0421-017-001-004

Borehole Number: SB-21-9

Project: 1827 Fillmore Ave, SB-21 delineation.

A.K.A.:

Client: Rupp, Baase, Pfalzgraf & Cunningham

Logged By: TAB

Site Location: 1827 Fillmore Ave. Buffalo, NY

Checked By:

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SUBSURFACE PROFILE			SAMPLE						
Depth (fbgs)	Elev. /Depth	Description (ASTM D2488: Visual-Manual Procedure)	Sample No.	SPT N-Value	Recovery (%)	Symbol	PID VOCs ppm (0 – 12.5 – 25)	Lab Sample	Well Completion Details or Remarks
0.0	504.2 / 0.0	Ground Surface							
		Auger to 12.0 fbgs see MW-8 soil descriptions.							
12.0	492.2 / 12.0	***Ash/Fill*** White, moist, mostly ash, coal fragments, loose.	S1		1.2		0.1	Sample location	First water.
14.0	490.2 / 14.0	As above, wet (14.0 fbgs), wood and cinders.	S2		1.3		0.0		
16.0	488.2 / 16.0	As above. EOB at 18.0 fbgs.	S3		1.1		0.0		
18.0	486.2 / 18.0	End of Borehole							

Depth scale: 0.0, 5.0, 10.0, 15.0, 20.0, 25.0

Drilled By: Earth Dimensions, Inc.
Drill Rig Type: Diedrich D50
Drill Method: 3 1/4 inch HSA.
Comments:
Drill Date(s): 3/21/19

Hole Size: 7 1/2- inch
Stick-up: NA
Datum: NA

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4K17a HOLE NO. MW-1-18 SURF. ELEVATION _

PROJECT 1827 Fillmore Avenue Site LOCATION _

City of Buffalo, Erie County, NY

CLIENT Benchmark and TurnKey Companies DATE STARTED 07/05/18 COMPLETED 07/06/18

DEPTH IN FT | BLOWS ON SAMPLER

Depth (ft)	SN / REC	0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WELL (1)	WATER TABLE AND REMARKS
0–4.6								Advanced bore hole without split spoon sampling to 4.6 feet.	2-inch FJT PVC riser; (2); (3)	(1) 8-inch diameter roadbox installed in small concrete pad ← 2.0' (2) Concrete (3) Bentonite seal
4.6								4.6		← 4.6'
4.6–12.4	Run #1							Gray to dark gray limestone bedrock, moderately hard to hard, massively bedded, moderately fractured horizontally along bedding planes, core lengths range from (0.1-1.8').	0.010 slot 2-inch PVC screen; #00N size morie sand pack	← 4.9' Water level at 7.1 after Run #1. Water level at 8.1 after 24 hours. Total gallons lost: 150 Total gallons removed: 60
12.4								12.4		← 12.4'
12.4–20								Coring completed at 12.4 feet.		Note: Advanced bore hole with 3 1/4" ID x 7" OD hollow stem auger casing without sampling to refusal at 4.6 feet. Continued below with a NQ-2 size double tubed wireline core barrel with diamond bit to end of coring at 12.4 feet. Installed 2-inch PVC mointoring well in completed bore hole to 12.4 feet.

Run #	Depth (ft)	Length (ft)	Rec (ft)	Rec %	RQD %
1	4.6 to 12.4	7.8	7.7	99	97

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Jason Kryszak, Geologist, (cns)

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4K17a

HOLE NO. MW-1-18

SURF. ELEVATION _

PROJECT 1827 Fillmore Avenue Site
City of Buffalo, Erie County, NY

LOCATION _

CLIENT Benchmark and TurnKey Companies

DATE STARTED 07/05/18 COMPLETED 07/06/18

DEPTH IN FT	SN / REC	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WELL	WATER TABLE AND REMARKS
										EDI Bedrock Hardness Classification --------------------------- Moderately Hard: Can not be peeled or scraped with knife. Can be distinctly scratched with a steel nail. Hard: Intact hand-held specimen requires more than one hammer blow to break it. Can be faintly scratched by a steel nail.
25										
30										
35										
40										

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Jason Kryszak, Geologist. (cns)

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4K17a HOLE NO. MW-2-18 SURF. ELEVATION _

PROJECT 1827 Fillmore Avenue Site
City of Buffalo, Erie County, NY
LOCATION _

CLIENT Benchmark and TurnKey Companies
DATE STARTED 07/05/18 COMPLETED 07/06/18

DEPTH IN FT | BLOWS ON SAMPLER

DEPTH	SN / REC	0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WELL	WATER TABLE AND REMARKS
0–14.1								Advanced bore hole without split spoon sampling to 14.1 feet.	(1); (2); 2-inch FJT PVC riser; Bentonite seal	(1) 4-inch locking steel protective casing installed in small concrete pad ← 2.0' (2) Concrete Lost significant water from 14.1 to 15.7 feet. Driller noted fracture at 22.0 feet. Water level at 18.9 feet after Run #1 Water level at 19.6 feet after Run #2 Water level at 20.1 feet after 24 hours. Water level at 20.1 feet below ground surface on July 05, 2018.
14.1–20		Run	#1				Limestone	14.1 Gray to dark gray limestone bedrock, moderately hard to hard, massively bedded, moderately fractured horizontally along bedding planes, core lengths range from (0.1-1.9').	(3); #00N size morie sand pack	← 14.1' (3) 0.010 slot 2-inch PVC screen ← 16.7'

Run #	Depth (ft)	Length (ft)	Rec (ft)	Rec %	RQD %
1	14.1 to 22.5	8.3	8.1	98	90

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

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4K17a HOLE NO. MW-2-18 SURF. ELEVATION _

PROJECT 1827 Fillmore Avenue Site LOCATION _

City of Buffalo, Erie County, NY

CLIENT Benchmark and TurnKey Companies DATE STARTED 07/05/18 COMPLETED 07/06/18

DEPTH IN FT | BLOWS ON SAMPLER

SN / REC	0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WELL	WATER TABLE AND REMARKS
	Run	#1					Gray to dark gray limestone bedrock, moderately hard to hard, massively bedded, moderately fractured horizontally along bedding planes, core lengths range from (0.1-1.9').	0.010 slot 2-inch PVC screen; #00N size morie sand pack	
25	Run	#2					27.7		← 26.7' ← 27.7'
							Coring completed at 27.7 feet.		

Run #	Depth (ft)	Length (ft)	Rec (ft)	Rec %	RQD %
1	14.1 to 22.5	8.3	8.1	98	90
2	22.5 to 27.7	5.3	4.9	92	88

Note: Advanced bore hole with 3 1/4" ID x 7" OD hollow stem auger casing without sampling to refusal at 14.1 feet. Installed 4" flush joint casing to 14.1 feet. Continued below with a NQ-2 size double tubed wireline core barrel with diamond bit to end of coring at 27.7 feet. Installed 2-inch PVC mointoring well in completed bore hole to 26.7 feet.

EDI Bedrock Hardness Classification

Moderately Hard: Can not be peeled or scraped with knife. Can be distinctly scratched with a steel nail.

Hard: Intact hand-held specimen requires more than one hammer blow to break it. Can be faintly scratched by a steel nail.

Depth scale: 25, 30, 35, 40

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

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4K17a | HOLE NO. MW-3-18 | SURF. ELEVATION _

PROJECT 1827 Fillmore Avenue Site
City of Buffalo, Erie County, NY | LOCATION _

CLIENT Benchmark and TurnKey Companies | DATE STARTED 07/03/18 COMPLETED 07/05/18

DEPTH IN FT	SN / REC	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WELL (1)	WATER TABLE AND REMARKS
0–16.1								Advanced bore hole without split spoon sampling to 16.1 feet.	2-inch FJT PVC riser; (2) / Bentonite seal	(1) 4-inch locking steel protective casing installed in small concrete pad ← 2.0' (2) Concrete Water level at 17.4 feet after Run #2 Water level at 17.4 after continuous pumping for 20 minuets. Water level at 17.5 feet below ground surface on July 05, 2018. Total gallons lost: 400 Total gallons removed: 400
16.1								Apparent limestone bedrock.		← 16.1' ← 16.6'
16.9	Run	#1						Gray to dark gray limestone bedrock, moderately hard to hard, massively bedded, core lengths range from (0.1-1.7').	(3); (4)	(3) 0.010 slot 2-inch PVC screen (4) #00N size morie sand pack
17.8–20	Run	#2								

Run #	Depth (ft)	Length (ft)	Rec (ft)	Rec %	RQD %
1	16.9 to 17.8	0.9	0.9	100	100
2	17.8 to 25.8	8.0	7.4	93	96

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

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4K17a HOLE NO. MW-3-18 SURF. ELEVATION _

PROJECT 1827 Fillmore Avenue Site LOCATION _

City of Buffalo, Erie County, NY

CLIENT Benchmark and TurnKey Companies DATE STARTED 07/03/18 COMPLETED 07/05/18

DEPTH IN FT | BLOWS ON SAMPLER

SN / REC	0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WELL	WATER TABLE AND REMARKS
	Run	#2					Gray to dark gray limestone bedrock, moderately hard to hard, massively bedded, core lengths range from (0.1-1.7'). 25.8	0.010 slot 2-inch PVC screen; #00N size morie sand pack; ← 25.4'; ← 25.8'	
							Coring completed at 25.8 feet.		

Depth markers: 25, 30, 35, 40

Run #	Depth (ft)	Length (ft)	Rec (ft)	Rec %	RQD %
2	17.8 to 25.8	8.0	7.4	93	96

Note: Advanced bore hole with 3 1/4" ID x 7" OD hollow stem auger casing without sampling to refusal at 16.9 feet. Installed 4" flush joint casing to 16.9 feet. Continued below with a NQ-2 size double tubed wireline core barrel with diamond bit to end of coring at 25.8 feet. Installed 2-inch PVC mointoring well in completed bore hole to 25.4 feet.

EDI Bedrock Hardness Classification

Moderately Hard: Can not be peeled or scraped with knife. Can be distinctly scrated with a steel nail.

Hard: Intact hand-held specimen requires more than one hammer blow to break it. Can be faintly scratched by a steel nail.

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Jason Kryszak, Geologist. (cns)

DRILLING LOG OF WELL/BORING NO. SB-1

Project Number: 12MS-104(.5)	Total Depth of Hole: 12 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: Northwest corner of property	Water Encountered: NA
Date Start/Finished: August 7, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Joseph Mecca

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval	PID Reading	Recovery	Comments
			Ground Surface		(Feet)	Parts Per Million (PPM)	(Inches)	
NA	1	NA	0-0.25 ftbg: Asphalt and subbase 0.25-2 ftbg: gray gravelly clayey Fill Material (stiff, no plasticity, dry) 2-4 ftbg: brown gravelly clayey Fill Material (med stiff, low plasticity, moist)	NA	0-4	6.5	20	
	5		4-9 ftbg: dark brown gravelly clayey Fill Material (medium stiff, low plasticity, moist)		4-8	0.7	20	
	10		9-10 ftbg: brown clayey Fill Material (soft, medium plasticity, moist) 10-11 ftbg: gray gravelly Fill Material (angular, medium dense, dry) 11-12 ftbg: dark brown gravelly sandy clayey Fill Material (low plasticity, medium stiff, moist)		8-12	2.7	15	Equipment refusal encountered at approximately 12 ftbg

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DRILLING LOG OF WELL/BORING NO. SB- 2

Project Number: 12MS-104(.5)	Total Depth of Hole: 10 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: North of building A1	Water Encountered: NA
Date Start/Finished: August 7, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Joseph Mecca

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval	PID Reading	Recovery	Comments
			Ground Surface		(Feet)	Parts Per Million (PPM)	(Inches)	
NA	1	NA	0-0.5 ftbg: Asphalt and subbase	NA				
			0.5-4 ftbg: brown gravelly sandy clayey Fill Material (medium stiff, no plasticity, moist)		0-4	0.9	15	
	5		4-5 ftbg: gray Ash (soft, moist) with gravel					
			5-8 ftbg: brown gravelly sandy clayey Fill Material (medium stiff, low plasticity, moist)		4-8	0.4	15	
	10		8-10 ftbg: brown gravelly Clay (stiff, no plasticity, moist)		8-10	0.7	15	Equipment refusal encountered at approximately 10 ftbg

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Project Number: 12MS-104(.5)	Total Depth of Hole: 5 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: Northwest of Building B2	Water Encountered: NA
Date Start/Finished: August 7, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Joseph Mecca

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval	PID Reading	Recovery	Comments
			Ground Surface		(Feet)	Parts Per Million (PPM)	(Inches)	
NA	1	NA	0-0.5 ftbg: Asphalt and subbase	NA	0-2	1.2	10	
			0.5-4 ftbg: brown gravelly clayey Fill Material (stiff, no plastic, moist)		2-4	1.2	10	
	5		4-5 ftbg: gray sandy gravelly Fill Material (angular, medium dense, moist)		4-5	1.2	6	Equipment refusal encountered at approximately 5 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-4

Project Number: 12MS-104(.5)	Total Depth of Hole: 6 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: Northwest of Building A3	Water Encountered: NA
Date Start/Finished: August 7, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Joseph Mecca

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval	PID Reading	Recovery	Comments
			Ground Surface		(Feet)	Parts Per Million (PPM)	(Inches)	
NA	1	NA	0-0.5 ftbg: Asphalt and subbase 0.5-3.5 ftbg: brown gravelly clayey Fill Material (stiff, no plasticity, moist)	NA	0-4	9.9	15	
	5		3.5-4.5 ftbg: gray gravelly Sand (coarse and medium grain, medium dense, dry) 4.5-6 ftbg: brown gravelly Clay (stiff, low plasticity, moist)		4-6	0.8	15	Equipment refusal encountered at approximately 6 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-5

Project Number: 12MS-104(.5)	Total Depth of Hole: 12.5 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: Northwest of Building A3	Water Encountered: NA
Date Start/Finished: August 7, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Joseph Mecca

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval	PID Reading	Recovery	Comments
			Ground Surface		(Feet)	Parts Per Million (PPM)	(Inches)	
NA	1	NA	0-0.5 ftbg: Asphalt and subbase	NA	0-4	1.6	15	
	5		0.5-8 ftbg: brown gravelly sandy clayey Fill Material (medium stiff, no plasticity, moist)		4-8	0.9	15	
	10		8-12 ftbg: gray sandy clayey gravelly Fill Material (angular, medium dense, moist)		8-12	1.0	15	
			12-12.5 ftbg: brown gravelly Clay (stiff, low plasticity, moist)		12-12.5	0.7	6	Equipment refusal encountered at approximately 12.5 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-6

Project Number: 12MS-104(.5)	Total Depth of Hole: 12 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: Southeast of Building B4	Water Encountered: NA
Date Start/Finished: August 7, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Joseph Mecca

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval (Feet)	PID Reading Parts Per Million (PPM)	Recovery (Inches)	Comments
			Ground Surface					
NA	1	NA	0-0.5 ftbg: Asphalt and subbase	NA	0-4	1.1	15	
	5		0.5-8 ftbg: brown gravelly Clay (medium stiff, low plasticity, moist)		4-8	0.8	15	
	10		8-12 ftbg: brown clayey Gravel (angular, medium dense, moist)		8-12	1.2	6	Equipment refusal encountered at approximately 12 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-7

Project Number: 12MS-104(.5)	Total Depth of Hole: 10 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: Southeast of Building B6	Water Encountered: NA
Date Start/Finished: August 7, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Joseph Mecca

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval	PID Reading	Recovery	Comments
			Ground Surface		(Feet)	Parts Per Million (PPM)	(Inches)	
NA	1	NA	0-0.5 ftbg: Asphalt and subbase	NA	0-4	1.3	15	
	5		0.5-10 ftbg: brown gravelly sandy clayey Fill Material (medium stiff, no plasticity, moist)		4-8	1.4	15	
	10				8-10	0.5	15	Equipment refusal encountered at approximately 10 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-8

Project Number: 12MS-104(.5)	Total Depth of Hole: 7 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: South of Building B6	Water Encountered: NA
Date Start/Finished: August 7, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Joseph Mecca

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval	PID Reading	Recovery	Comments
			Ground Surface		(Feet)	Parts Per Million (PPM)	(Inches)	
NA	1	NA	0-0.5 ftbg: Asphalt and subbase 0.5-4 ftbg: brown sandy gravelly Clay (medium stiff, low plasticity, moist)	NA	0-4	0.3	15	
	5		4-7 ftbg: brown clayey gravel Fill Material (angular, medium dense, moist)		4-7	0.4	20	Equipment refusal encountered at approximately 7 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-9

Project Number: 12MS-104(.5)	Total Depth of Hole: 7 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: West of Building A1	Water Encountered: NA
Date Start/Finished: August 7, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Joseph Mecca

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval	PID Reading	Recovery	Comments
			Ground Surface		(Feet)	Parts Per Million (PPM)	(Inches)	
NA	1	NA	0-0.5 ftbg: Asphalt and subbase 0.25-4 ftbg: brown/black sandy gravelly clayey Fill Material (stiff, no plasticity, moist)	NA	0-2	2.7	15	
					2-4	1.3	15	
	5		4-6 ftbg: black/tan gravelly clayey Sand (coarse and medium grain, dense, moist) 6-7 ftbg: brown gravelly Clay (stiff, no plasticity, moist)		4-7	17.6	15	Equipment refusal encountered at approximately 7 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-10

Project Number: 12MS-104(.5)	Total Depth of Hole: 15 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: South East of Building B2	Water Encountered: NA
Date Start/Finished: August 7, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Joseph Mecca

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval (Feet)	PID Reading Parts Per Million (PPM)	Recovery (Inches)	Comments
			Ground Surface					
NA	1	NA	0-0.25 ftbg: Asphalt and subbase	NA				
			0.25-4 ftbg: dark brown gravelly Sand (coarse, medium and fine grain, dense, moist)		0-4	7.3	15	
	5				4-8	0.8	10	
			4-11.5 ftbg: dark brown gravelly Sand (coarse, medium and fine grain, dense, moist) with white ash					
	10				8-12	2.4	15	
	15		11.5-15 ftbg: white/beige Ash (soft, moist)		12-15	1.3	15	Equipment refusal encountered at approximately 15 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-11

Project Number: 12MS-104(.5)	Total Depth of Hole: 20 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: East of Building A1	Water Encountered: NA
Date Start/Finished: August 7, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Joseph Mecca

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval (Feet)	PID Reading Parts Per Million (PPM)	Recovery (Inches)	Comments
			Ground Surface					
NA	1	NA	0-0.25 ftbg: Asphalt and subbase	NA				
			0.25-4 ftbg: tan/black Sand (coarse, medium and fine grain, dense, moist)		0-4	2.2	15	
	5		4-8 ftbg: black gravelly clayey Sand (coarse, medium and fine grain, medium dense, moist)		4-8	5.4	15	
	10		8-10 ftbg: black/tan gravelly Sand (coarse grain, medium grain, fine grain, medium dense, moist)		8-10	1.7	10	
			10-20 ftbg: gray gravelly Clay (stiff, medium plasticity, moist) with ash		10-12	1.2	10	
	15				12-16	1.1	15	
					16-20	1.1	6	

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DRILLING LOG OF WELL/BORING NO. SB-12

Project Number: 12MS-104(.5)	Total Depth of Hole: 10 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: West of Building B2	Water Encountered: NA
Date Start/Finished: August 8, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Ryan Welch

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval	PID Reading	Recovery	Comments
			Ground Surface		(Feet)	Parts Per Million (PPM)	(Inches)	
NA	1	NA	0-0.5 ftbg: Asphalt and subbase	NA	0-4	0.2	24	
	5		0.5-7.5 ftbg: gray/dark brown gravelly sandy clayey Fill Material (stiff, medium to low Plasticity, moist) with some ash		4-8	0.3	20	
	10		7.5-8 ftbg: gray Ash (moist) 8-10 ftbg: gray/dark brown gravelly sand Fill Material (coarse and medium grain, medium dense, moist) with ash and rock fragments		8-10	0.6	15	Equipment refusal encountered at approximately 10 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-13

Project Number: 12MS-104(.5)	Total Depth of Hole: 5 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: North of Building B2	Water Encountered: NA
Date Start/Finished: August 8, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Ryan Welch

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval	PID Reading	Recovery	Comments
			Ground Surface		(Feet)	Parts Per Million (PPM)	(Inches)	
NA	1	NA	0-0.5 ftbg: Asphalt and subbase 0.5-4 ftbg: gray/dark brown gravelly sandy clayey Fill Material (medium stiff, medium plasticity, moist) with some ash	NA	0-4	1.0	12	
	5		4-5 ftbg: brown/black gravelly sandy clayey Fill Material (medium stiff, low plasticity, moist) with some ash and fractured rock		4-5	0.3	12	Equipment refusal encountered at approximately 5 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-14

Project Number: 12MS-104(.5)	Total Depth of Hole: 13 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: North West of Building A2	Water Encountered: NA
Date Start/Finished: August 8, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Ryan Welch

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval (Feet)	PID Reading Parts Per Million (PPM)	Recovery (Inches)	Comments
			Ground Surface					
NA	1	NA	0-0.5 ftbg: Asphalt and subbase	NA				
			0.5-4 ftbg: brown gravelly sandy clayey Fill Material (medium stiff, low to medium plasticity, moist) with some ash		0-4	1.2	20	
	5		4-6 ftbg: brown/black sandy clayey Fill Material (medium stiff, low to medium plasticity, moist) with some ash and brick debris		4-6	1.2	15	
			6-8 ftbg: brown Clay (medium stiff, medium plasticity, moist)		6-8	0.9	15	
	10		8-12 ftbg: brown/black clayey Fill Material (medium stiff, medium plasticity, moist) with gray ash		8-12	1.3	20	
			12-13 ftbg: brown sandy Clay (medium stiff, low plasticity, moist)		12-13	1.4	12	Equipment refusal encountered at approximately 13 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-15

Project Number: 12MS-104(.5)	Total Depth of Hole: 19 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: North of Building A3	Water Encountered: 18 ftbg
Date Start/Finished: August 8, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Ryan Welch

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval	PID Reading	Recovery	Comments
			Ground Surface		(Feet)	Parts Per Million (PPM)	(Inches)	
NA	1	NA	0-0.5 ftbg: Asphalt and subbase 0.5-1 ftbg: brown sandy Clay Fill Material (medium stiff, low plasticity, moist)	NA	0-4	2.9	20	
	5		1-8 ftbg: dark brown sandy Fill Material (coarse, medium fine grain, medium dense, moist) with some gravel		4-8	2.8	22	
	10		8-10 ftbg: brown sandy clayey Fill Material (medium stiff, low plasticity, moist) 10-12 ftbg: brown Clay (medium stiff, medium plasticity, moist)		8-12	1.7	15	
	15		12-18 ftbg: brown gravelly sandy clayey Fill material (medium stiff, low plasticity, moist) with gray ash		12-16	2.1	15	
			18-19 ftbg: brown gravelly sandy Clay Fill (medium stiff, low plasticity, wet) with gray ash, metal debris and fractured rock		16-19	1.1	12	Equipment refusal encountered at approximately 19 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-16

Project Number: 12MS-104(.5)	Total Depth of Hole: 7 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: NE of Building A3	Water Encountered: NA
Date Start/Finished: August 8, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Ryan Welch

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval	PID Reading	Recovery	Comments
			Ground Surface		(Feet)	Parts Per Million (PPM)	(Inches)	
NA	1	NA	0-0.5 ftbg: Asphalt and subbase	NA	0-4	1.3	20	
			0.5-6 ftbg: brown gravely sandy clayey Fill Material (medium stiff, low plasticity, moist)					
	5		6-7 ftbg: brown gravely sandy clayey Fill Material (medium stiff, low plasticity, moist) with fractured rock		4-7	1.2	20	Equipment refusal encountered at approximately 7 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-17

Project Number: 12MS-104(.5)	Total Depth of Hole: 11 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: North West of Building B4	Water Encountered: NA
Date Start/Finished: August 8, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Ryan Welch

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval	PID Reading	Recovery	Comments
			Ground Surface		(Feet)	Parts Per Million (PPM)	(Inches)	
NA	1	NA	0-0.5 ftbg: Asphalt and subbase 0.5-2 ftbg: brown sandy Clay (stiff, low plasticity, moist)	NA	0-2	1.4	15	
			2-4 ftbg: brown Clay (medium stiff, medium plasticity, moist)		2-4	1.4	15	
	5				4-6	1.9	15	
			4-8 ftbg: brown Clay (medium stiff, medium plasticity, moist) with black sand		6-8	2.3	15	
	10		8-10.5 ftbg: brown/ black mottled Clay (medium stiff, medium plasticity, moist) 10.5-11 ftbg: brown Sand (coarse, medium and fine grain, medium dense, moist)		8-11	0.9	22	Equipment refusal encountered at approximately 11 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-18

Project Number: 12MS-104(.5)	Total Depth of Hole: 11 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: North of Building B4	Water Encountered: NA
Date Start/Finished: August 8, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Ryan Welch

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval	PID Reading	Recovery	Comments
			Ground Surface		(Feet)	Parts Per Million (PPM)	(Inches)	
NA	1	NA	0-0.5 ftbg: Asphalt and subbase 0.5-4 ftbg: gray/brown gravelly sandy clayey Fill Material (stiff, no plasticity, moist)	NA	0-4	2.9	15	
	5		4-7 ftbg: tan/brown Sand Fill (coarse, medium and fine grain, medium dense, moist)		4-8	17	20	
	10		7-11 ftbg: brown sandy Clay Fill (medium stiff, low plasticity, moist)with some ash		8-11	4.9	18	Equipment refusal encountered at approximately 11 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-19

Project Number: 12MS-104(.5)	Total Depth of Hole: 18 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: North East of Building B4	Water Encountered: NA
Date Start/Finished: August 8, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Ryan Welch

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval	PID Reading	Recovery	Comments
			Ground Surface		(Feet)	Parts Per Million (PPM)	(Inches)	
NA	1	NA	0-0.5 ftbg: Asphalt and subbase 0.5-2 ftbg: brown gravelly sandy clayey Fill Material (stiff, low plasticity, moist) with ash 2-5 ftbg: brown/black gravelly sandy Fill Material (medium and fine grain, medium dense, moist) with ash	NA	0-4	2.4	18	
	5				4-6	3.5	12	
			5-10 ftbg: black gravelly sandy Fill Material (medium and fine grain, medium dense, moist)with ash		6-8	2.0	12	
	10				8-10	2.5	12	
					10-12	1.7	12	
			10-15 ftbg: gray Ash (moist)		12-16	2.7	15	
	15		15-16 ftbg: black Clay (low plasticity, medium stiff, moist) with ash					
			16-18 ftbg: black sandy Clay (soft, low plasticity, moist) with wood debris		16-18	1.7	6	Equipment refusal encountered at approximately 18 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-20

Project Number: 12MS-104(.5)	Total Depth of Hole: 8 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: East of Building B4	Water Encountered: NA
Date Start/Finished: August 8, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Ryan Welch

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval	PID Reading	Recovery	Comments
			Ground Surface		(Feet)	Parts Per Million (PPM)	(Inches)	
NA	1	NA	0-0.5 ftbg: Asphalt and subbase	NA	0-4	1.2	18	
	5		0.5-8 ftbg: brown gravely sandy clayey Fill Material (stiff, low plasticity, moist)		4-8	1.8	18	Equipment refusal encountered at approximately 8 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-21

Project Number: 12MS-104(.5)	Total Depth of Hole: 19 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: East of Building B4	Water Encountered: NA
Date Start/Finished: August 9, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Ryan Welch

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval (Feet)	PID Reading Parts Per Million (PPM)	Recovery (Inches)	Comments
			Ground Surface					
NA	1	NA	0-0.5 ftbg: Asphalt and subbase 0.5-3 ftbg: brown gravelly sandy Fill Material (coarse, medium and fine grain, medium dense, moist)	NA	0-4	1.8	15	
	5		3-9 ftbg: dark brown/black gravelly sandy Fill Material (coarse, medium and fine grain, medium dense, moist) with brick debris		4-8	2.5	18	
	10		9-11 ftbg: gray/brown gravelly sandy Fill Material (coarse and medium grain, medium dense, moist) 11-12 ftbg: dark brown sandy Clay Fill (medium stiff, low plasticity, moist) with ash		8-12	1.5	12	
	15		12-16 ftbg: black sandy Clay Fill (medium stiff, low plasticity, moist) with ash		12-16	3.9	15	
			16-19 ftbg: black sandy Clay Fill (medium stiff, low plasticity, moist) with ash and wood debris		16-19	3.5	12	Equipment refusal encountered at approximately 19 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-22

Project Number: 12MS-104(.5)	Total Depth of Hole: 19 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: North East of Building A5	Water Encountered: NA
Date Start/Finished: August 9, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Ryan Welch

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval	PID Reading	Recovery	Comments
			Ground Surface		(Feet)	Parts Per Million (PPM)	(Inches)	
NA	1	NA	0-0.5 ftbg: Asphalt and subbase	NA				
			0.5-4 ftbg: brown/dark brown sandy Fill Material (medium and fine grain, medium dense, moist)		0-4	1.1	12	
	5		4-8 ftbg: dark brown gravelly sandy Fill Material (coarse, medium and fine grain, medium dense, moist) with trace ash		4-8	2.1	18	
	10		8-12 ftbg: brown/dark brown sandy Fill Material (coarse, medium and fine grain, medium dense, moist)		8-12	2.1	12	
	15		12-16 ftbg: brown/dark brown gravelly Sand Fill (coarse, medium and fine grain, medium dense, moist) with trace ash		10-12	3.0	12	
			16-19 ftbg: dark brown sandy Fill Material (coarse, medium and fine grain, medium dense, moist) with brick debris		14-16	1.3	10	Equipment refusal encountered at approximately 19 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-23

Project Number: 12MS-104(.5)	Total Depth of Hole: 9 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: South East of Building B4	Water Encountered: NA
Date Start/Finished: August 9, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Ryan Welch

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval	PID Reading	Recovery	Comments
			Ground Surface		(Feet)	Parts Per Million (PPM)	(Inches)	
NA	1	NA	0-0.5 ftbg: Asphalt and subbase	NA				
			0.5-4 ftbg: brown gravelly sandy clayey Fill Material (stiff, no plasticity, moist)		0-4	2.3	15	
	5		4-8 ftbg: dark brown gravelly sandy Fill Material (coarse, medium and fine grain, medium dense, moist) with brick debris and wire debris		4-8	1.8	20	
			8-9 ftbg: dark brown gravelly sandy Fill Material (coarse, medium and fine grain, medium dense, moist) with brick debris with fractured rock		8-9	1.6	10	Equipment refusal encountered at approximately 9 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-24

Project Number: 12MS-104(.5)	Total Depth of Hole: 3 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: East of Building A5	Water Encountered: NA
Date Start/Finished: August 9, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Ryan Welch

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval	PID Reading	Recovery	Comments
			Ground Surface		(Feet)	Parts Per Million (PPM)	(Inches)	
NA	1	NA	0-0.5 ftbg: Asphalt and subbase 0.5-3 ftbg: brown gravelly sandy clayey Fill Material (medium stiff, low plasticity, moist)	NA	0-3	0.8	10	Equipment refusal encountered at approximately 3 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-25

Project Number: 12MS-104(.5)	Total Depth of Hole: 19 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: South East of Building A5	Water Encountered: NA
Date Start/Finished: August 9, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Ryan Welch

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval (Feet)	PID Reading Parts Per Million (PPM)	Recovery (Inches)	Comments
			Ground Surface					
NA	1	NA	0-0.5 ftbg: Asphalt and subbase 0.5-4 ftbg: brown gravelly sandy clayey Fill Material (medium stiff, low plasticity, moist) with brick debris	NA	0-4	1.7	15	
	5		4-7 ftbg: brown gravelly sandy clayey Fill Material (medium stiff, low plasticity, moist) 7-8 ftbg: brown Clay (medium stiff, medium plasticity, moist)		4-8	1.7	15	
	10		8-12 ftbg: brown/dark brown gravelly sandy clayey Fill Material (stiff, low plasticity, moist)		8-12	2.1	12	
			12-16 ftbg: brown/dark brown gravelly sandy clayey Fill Material (medium stiff, low plasticity, moist)		12-16	2.2	15	
	15		16-17.5 ftbg: brown/ black mottled Clay (medium stiff, medium plasticity, moist) 17.5-19 ftbg: brown/black sandy Fill Material (medium and fine grain, medium dense, moist)		16-19	2.2	15	Equipment refusal encountered at approximately 19 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-26

Project Number: 12MS-104(.5)	Total Depth of Hole: 14 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: South of building A5	Water Encountered: NA
Date Start/Finished: August 9, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Ryan Welch

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval	PID Reading	Recovery	Comments
			Ground Surface		(Feet)	Parts Per Million (PPM)	(Inches)	
NA	1	NA	0-0.5 ftbg: Asphalt and subbase 0.5-3 ftbg: brown gravelly sandy clayey Fill Material (stiff, low plasticity, moist) 3-5 ftbg: tan/brown gravelly sandy Fill Material (coarse and medium grain, medium dense, moist)	NA	0-4	1.1	18	
	5				4-8	0.7	18	
	10		5-14 ftbg: brown gravelly sandy clayey Fill Material (medium stiff, low plasticity, moist)		8-12	1.4	15	
					12-14	2.3	6	Equipment refusal encountered at approximately 14 ftbg

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Project Number: 12MS-104(.5)	Total Depth of Hole: 14 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: South East of Building B6	Water Encountered: NA
Date Start/Finished: August 9, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Ryan Welch

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval	PID Reading	Recovery	Comments
			Ground Surface		(Feet)	Parts Per Million (PPM)	(Inches)	
NA	1	NA	0-0.5 ftbg: Asphalt and subbase 0.5-1.5 ftbg: gray gravely sandy clayey Fill Material (stiff, no plasticity, moist) 1.5-4 ftbg: black gravelly sandy clayey Fill Material (medium stiff, low plasticity, moist) with ash	NA	0-4	1.8	15	
	5		4-5 ftbg: dark brown gravelly sandy Fill Material (coarse, medium and fine grain, medium dense, moist) with ash 5-9 ftbg: dark brown gravelly sandy Fill Material (coarse, medium and fine grain, medium dense, moist)		4-8	1.7	15	
	10		9-11 ftbg: brown sandy clayey Fill Material (medium stiff, low plasticity, moist) with some ash		8-12	1.9	18	
			11-13 ftbg: black sandy Fill Material (coarse, medium and fine grain, medium dense, moist) with brick debris and wood debris 13-14 ftbg: brown gravelly Clay Fill (medium stiff, low plasticity, moist)		12-14	1.3	15	Equipment refusal encountered at approximately 14 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-28

Project Number: 12MS-104(.5)	Total Depth of Hole: 8 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: South West of Building B6	Water Encountered: NA
Date Start/Finished: August 9, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Ryan Welch

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval	PID Reading	Recovery	Comments
			Ground Surface		(Feet)	Parts Per Million (PPM)	(Inches)	
NA	1	NA	0-0.5 ftbg: Asphalt and subbase 0.5-5 ftbg: brown/dark brown gravelly sandy clayey Fill Material (medium stiff, low plasticity, moist) with some ash	NA	0-4	1.6	12	
	5		5-8 ftbg: dark brown/black gravelly Sand Fill (coarse, medium and fine grain, medium dense, moist)		4-8	1.8	12	Equipment refusal encountered at approximately 8 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-29

Project Number: 12MS-104(.5)	Total Depth of Hole: 1.5 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: South West of Building B6	Water Encountered: NA
Date Start/Finished: August 9, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Ryan Welch

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval	PID Reading	Recovery	Comments
			Ground Surface		(Feet)	Parts Per Million (PPM)	(Inches)	
NA	1	NA	0-0.5 ftbg: Asphalt and subbase 0.5-1.5 ftbg: gray/brown sandy Clay Fill (medium stiff, low plasticity, moist) with some ash	NA	0-1.5	1.2	12	Equipment refusal encountered at approximately 1.5 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-30

Project Number: 12MS-104(.5)	Total Depth of Hole: 2 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: South West of Building B6	Water Encountered: NA
Date Start/Finished: August 9, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Ryan Welch

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval	PID Reading	Recovery	Comments
			Ground Surface		(Feet)	Parts Per Million (PPM)	(Inches)	
NA	1	NA	0-0.5 ftbg: Asphalt and subbase 0.5-2 ftbg: dark brown gravelly sandy clayey Fill Material (stiff, low plasticity, moist) with some ash	NA	0-2	0.7	15	Equipment refusal encountered at approximately 2 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-31

Project Number: 12MS-104(.5)	Total Depth of Hole: 2 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: South West of Building B6	Water Encountered: NA
Date Start/Finished: August 9, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Ryan Welch

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval	PID Reading	Recovery	Comments
			Ground Surface		(Feet)	Parts Per Million (PPM)	(Inches)	
NA	1	NA	No Recovery	NA	0-2	-	-	Equipment refusal encountered at approximately 2 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-32

Project Number: 12MS-104(.5)	Total Depth of Hole: 5 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: South East of Building A1	Water Encountered: NA
Date Start/Finished: August 10, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Ryan Welch

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval	PID Reading	Recovery	Comments
			Ground Surface		(Feet)	Parts Per Million (PPM)	(Inches)	
NA	1	NA	0-0.5 ftbg: Asphalt and subbase 0.5-3 ftbg: brown sandy clayey Fill Material (medium stiff, no plasticity, moist)	NA	0-4	1.4	15	
	5		3-5 ftbg: brown gravelly sandy clayey Fill Material (medium stiff, no plasticity, moist)		4-5	0.8	9	Equipment refusal encountered at approximately 5 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-33

Project Number: 12MS-104(.5)	Total Depth of Hole: 6 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: South West of Building A1	Water Encountered: NA
Date Start/Finished: August 10, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Ryan Welch

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval	PID Reading	Recovery	Comments
			Ground Surface		(Feet)	Parts Per Million (PPM)	(Inches)	
NA	1 5	NA	0-0.5 ftbg: Asphalt and subbase 0.5-2 ftbg: dark brown sandy clayey Fill Material (medium stiff, low plasticity, moist) 2-5 ftbg: brown gravelly clayey Fill Material (medium stiff, medium plasticity, moist)	NA	0-4	1.4	20	
			5-6 ftbg: brown gravelly clayey Fill Material (stiff, low plasticity, moist)		4-6	1.0	15	Equipment refusal encountered at approximately 6 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-34	
Project Number: 12MS-104(.5)	Total Depth of Hole: 5 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: South West of Building A1	Water Encountered: NA
Date Start/Finished: August 10, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Ryan Welch

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval	PID Reading	Recovery	Comments
			Ground Surface		(Feet)	Parts Per Million (PPM)	(Inches)	
NA	1	NA	0-0.5 ftbg: Asphalt and subbase	NA				
			0.5-4 ftbg: gray gravelly sandy clayey Fill Material (medium stiff, low plasticity, moist)		0-4	2.6	10	
	5		4-5 ftbg: brown/dark brown gravelly sandy clayey Fill Material (medium stiff, low plasticity, moist)		4-5	2.2	12	Equipment refusal encountered at approximately 5 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-35

Project Number: 12MS-104(.5)	Total Depth of Hole: 12 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: South West of Building A1	Water Encountered: NA
Date Start/Finished: August 10, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Ryan Welch

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval (Feet)	PID Reading Parts Per Million (PPM)	Recovery (Inches)	Comments
			Ground Surface					
NA	1	NA	0-0.5 ftbg: Asphalt and subbase	NA				
			0.5-2 ftbg: dark brown gravelly sandy clayey Fill Material (stiff, no plasticity, moist)		0-2	1.8	12	
	5		2-4 ftbg: brown sandy clayey Fill Material (medium stiff, low plasticity, moist)		2-4	2.4	12	
			4-8 ftbg: brown gravelly sandy clayey Fill Material (medium stiff, low plasticity, moist)		4-8	2.7	12	
	10		8-12 ftbg: brown gravelly sandy clayey Fill Material (stiff, no plasticity, moist)		8-12	3.2	10	Equipment refusal encountered at approximately 12 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-36

Project Number: 12MS-104(.5)	Total Depth of Hole: 9 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: North West of Building A1	Water Encountered: NA
Date Start/Finished: August 10, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Ryan Welch

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval (Feet)	PID Reading Parts Per Million (PPM)	Recovery (Inches)	Comments
			Ground Surface					
NA	1	NA	0-0.5 ftbg: Asphalt and subbase 0.5-3 ftbg: dark brown/black gravelly sandy clayey Fill Material (stiff, no plasticity, moist) with brick debris	NA	0-2	1.7	12	
			3-4 ftbg: brown gravelly sandy clayey Fill Material (stiff, no plasticity, moist)		2-4	1.8	12	
	5		4-7 ftbg: brown sandy clayey Fill Material (medium stiff, low to medium plasticity, moist) 7-8 ftbg: brown gravelly sandy clayey Fill Material (medium stiff, no plasticity, moist)		4-8	2.1	15	
			8-9 ftbg: brown sandy gravelly Fill Material (angular, medium dense, moist)		8-9	4.5	6	Equipment refusal encountered at approximately 9 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-37

Project Number: 12MS-104(.5)	Total Depth of Hole: 20 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: North of Building A1	Water Encountered: 16 ftbg
Date Start/Finished: August 10, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Ryan Welch

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval (Feet)	PID Reading Parts Per Million (PPM)	Recovery (Inches)	Comments
			Ground Surface					
NA	1	NA	0-0.5 ftbg: Asphalt and subbase 0.5-2 ftbg: gray gravelly sandy clayey Fill Material (stiff, no plasticity, moist) 2-4 ftbg: dark brown gravelly sandy clayey Fill Material (medium stiff, low plasticity, moist)	NA	0-4	1.7	20	
	5		4-6 ftbg: dark brown gravelly sandy clayey Fill Material (medium stiff, low plasticity, moist) with some ash		4-6	1.7	12	
			6-9 ftbg: dark brown gravelly sandy clayey Fill Material (medium stiff, low plasticity, moist) with ash and brick debris		6-8	1.4	12	
	10		9-10 ftbg: gray Ash (moist)		8-10	2.2	12	
			10-12 ftbg: brown sandy Clay (soft, medium plasticity, moist)		10-12	2.1	12	
			12-16 ftbg: brown gravelly sandy clayey Fill Material (medium stiff, low plasticity, moist)		12-16	2.2	15	
	15		16-20 ftbg: gray Gravel (angular and subrounded, medium dense, wet)		16-20	1.2	2	Equipment refusal encountered at approximately 20 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-38

Project Number: 12MS-104(.5)	Total Depth of Hole: 4 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: North East of Building A1	Water Encountered: NA
Date Start/Finished: August 10, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Ryan Welch

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval (Feet)	PID Reading Parts Per Million (PPM)	Recovery (Inches)	Comments
			Ground Surface					
NA	1	NA	0-0.5 ftbg: Asphalt and subbase 0.5-2 ftbg: gray/brown gravelly sandy Fill Material (coarse, medium and fine grain, medium dense, moist)	NA	0-2	1.3	12	
			2-3 ftbg: brown gravelly Sand Fill (coarse, medium and, fine grain, medium dense, moist) with brick debris 3-3.5 ftbg: brown gravelly sandy Fill Material (coarse grain, medium dense, moist) with brick debris 3.5-4 ftbg: brown sandy clayey Fill Material (stiff, no plasticity, moist)		2-4	1.9	12	Equipment refusal encountered at approximately 4 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-39

Project Number: 12MS-104(.5)	Total Depth of Hole: 10 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: East of Building A1	Water Encountered: NA
Date Start/Finished: August 10, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Ryan Welch

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval	PID Reading	Recovery	Comments
			Ground Surface		(Feet)	Parts Per Million (PPM)	(Inches)	
NA	1	NA	0-0.5 ftbg: Asphalt and subbase	NA				
			0.5-4 ftbg: dark brown sandy Fill Material (coarse, medium and fine grain, medium dense, moist)		0-4	5.1	18	
	5		4-6 ftbg: dark brown/black sandy Fill Material (coarse, medium and fine grain, medium dense, moist)		4-6	1.5	12	
			6-8 ftbg: dark brown/black gravelly sandy Fill Material (coarse, medium and fine grain, medium dense, moist)		6-8	16.2	12	
	10		8-10 ftbg: dark brown/black gravelly sandy Fill Material (coarse, medium and fine grain, medium dense, moist) with rock fragments		8-10	2.9	6	Equipment refusal encountered at approximately 10 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-40

Project Number: 12MS-104(.5)	Total Depth of Hole: 3 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: South East of Building A1	Water Encountered: NA
Date Start/Finished: August 10, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Ryan Welch

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval	PID Reading	Recovery	Comments
			Ground Surface		(Feet)	Parts Per Million (PPM)	(Inches)	
NA	1	NA	0-0.5 ftbg: Asphalt and subbase 0.5-3 ftbg: gray/black gravelly sandy Clay (stiff, no plasticity, moist)	NA	0-3	3.6	15	Equipment refusal encountered at approximately 3 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-41

Project Number: 12MS-104(.5)	Total Depth of Hole: 11 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: North of Building B6	Water Encountered: NA
Date Start/Finished: August 10, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Ryan Welch

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval	PID Reading	Recovery	Comments
			Ground Surface		(Feet)	Parts Per Million (PPM)	(Inches)	
NA	1	NA	0-0.5 ftbg: Asphalt and subbase	NA	0-2	1.5	15	
			0.5-6 ftbg: black sandy Fill Material (coarse, medium and fine grain, medium dense, moist) with some brick debris		2-4	2.0	15	
	5				4-6	1.7	12	
			6-8 ftbg: black sandy Fill Material (coarse, medium and fine grain, medium dense, moist) with brick debris		6-8	2.9	12	
	10		8-9.5 ftbg: black sandy Fill Material (coarse, medium and fine grain, medium dense, moist) 9.5-11 ftbg: black sandy clayey Fill Material (medium stiff, no plasticity, moist) with ash		8-11	1.8	18	Slight organic odor observed between approximately 9.5-11 ftbg Equipment refusal encountered at approximately 11 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-42

Project Number: 12MS-104(.5)	Total Depth of Hole: 16 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: North East of Building B6	Water Encountered: NA
Date Start/Finished: August 10, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Ryan Welch

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval (Feet)	PID Reading Parts Per Million (PPM)	Recovery (Inches)	Comments
			Ground Surface					
NA	1	NA	0-0.5 ftbg: Asphalt and subbase 0.5-2.5 ftbg: dark brown/black sandy Fill Material (coarse, medium and fine grain, medium dense, moist)	NA	0-2	5.8	12	
			2.5-3 ftbg: brown clayey Fill Material (medium stiff, low plasticity, moist)		2-4	6.1	12	
	5		3-6 ftbg: dark brown/black sandy Fill Material (coarse, medium and fine grain, medium dense, moist)		4-6	2.1	12	
			6-6.5 ftbg: brown Clay (stiff, no plasticity, moist) 6.5-8 ftbg: dark brown/black sandy Fill Material (coarse, medium and fine grain, medium dense, moist) with brick debris		6-8	6.1	12	
					8-10	3.9	12	
	10		8-13 ftbg: tan sandy Fill Material (coarse, medium and fine grain, medium dense, moist) with brick debris		10-12	3.2	12	
			13-14 ftbg: brown gravelly sandy Fill Material (coarse, medium and fine grain, medium dense, moist) with some ash and brick debris		12-14	4.2	12	
	15		14-15.5 ftbg: gray/brown Ash (moist) 15.5-16 ftbg: brown Clay (stiff, no plasticity, moist)		14-16	2.5	12	Equipment refusal encountered at approximately 16 ftbg

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Project Number: 12MS-104(.5)	Total Depth of Hole: 22 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: East of Building A1	Water Encountered: 16 ftbg
Date Start/Finished: August 13, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Joseph Mecca

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval (Feet)	PID Reading Parts Per Million (PPM)	Recovery (Inches)	Comments
			Ground Surface					
NA	1	NA	0-0.5 ftbg: Asphalt and subbase	NA	0-2	2.4	15	
					2-4	6.8	15	
	5		0.5-10 ftbg: black/tan Sand (coarse, medium and fine grain, medium dense, moist) with some gravel		4-6	2.4	20	
					6-8	37.6	20	
					8-10	2.6	15	
	10		10-12 ftbg: gray/black sandy clayey gravelly Fill Material (angular and subrounded, medium dense, moist)		10-12	1.5	15	
			12-16 ftbg: gray clayey Ash (medium stiff, moist)		12-14	1.5	15	
	15				14-16	1.7	15	
			16-20 ftbg: gray clayey Ash (medium stiff, wet)		16-20	1.6	10	
	20		20-21.5 ftbg: gray clayey silty Ash (medium stiff, wet) 21.5-22 ftbg: brown Clay (medium stiff, medium plasticity, moist)		20-22	2.1	10	Equipment refusal encountered at approximately 22 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-44

Project Number: 12MS-104(.5)	Total Depth of Hole: 23 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: North of Building A1	Water Encountered: 16 ftbg
Date Start/Finished: August 13,2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Joseph Mecca

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval (Feet)	PID Reading Parts Per Million (PPM)	Recovery (Inches)	Comments
			Ground Surface					
NA	1	NA	0-0.5 ftbg: Asphalt and subbase	NA	0-4	1.3	15	
	5		0.5-7 ftbg: black/brown sandy gravelly clayey Fill Material (stiff, low plasticity, moist)		4-8	2.0	15	
			7-8 ftbg: black/brown sandy gravelly clayey Fill Material (stiff, low plasticity, moist) with ash					
	10		8-12 ftbg: brown sandy gravelly Clay (medium stiff, low plasticity, moist) with some ash		8-12	1.0	15	
			12-16 ftbg: brown gravelly Clay (medium stiff, low plasticity, moist)		12-16	1.0	6	
			16-20 ftbg: brown silty sandy Gravel (angular and subrounded, medium dense, wet)		16-20	0.7	6	
	20		20-23 ftbg: gray silty Gravel (angular and subrounded, loose, wet)		20-23	0.7	6	Equipment refusal encountered at approximately 23 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-45

Project Number: 12MS-104(.5)	Total Depth of Hole: 20 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: South East of Building B2	Water Encountered: NA
Date Start/Finished: August 13, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Joseph Mecca

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval	PID Reading	Recovery	Comments
			Ground Surface		(Feet)	Parts Per Million (PPM)	(Inches)	
NA	1	NA	0-0.5 ftbg: Asphalt and subbase	NA				
			0.5-4 ftbg: black/brown/tan clayey Sand (coarse, medium and fine grain, medium dense, moist)		0-4	1.3	15	
	5		4-6 ftbg: black/tan Sand (coarse, medium and fine grain, medium dense, moist)		4-8	4.6	15	
			6-10 ftbg: brown gravelly clayey Sand (coarse and medium grain, dense, moist)		8-10	1.6	15	
	10		10-12 ftbg: gray/black Ash (soft, moist)		10-12	1.2	15	
	15		12-20 ftbg: no recovery, boring terminated		12-20	-	-	Boring terminated due to obstruction in boring at approximately 20 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-46

Project Number: 12MS-104(.5)	Total Depth of Hole: 21 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: South East of Building B2	Water Encountered: NA
Date Start/Finished: August 13, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Joseph Mecca

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval (Feet)	PID Reading Parts Per Million (PPM)	Recovery (Inches)	Comments
			Ground Surface					
NA	1	NA	0-0.5 ftbg: Asphalt and subbase	NA	0-4	1.6	15	
			0.5-6 ftbg: black/tan Sand (course, medium and fine grain, medium dense, moist)					
	5				4-6	1.1	15	
			6-9 ftbg: black sandy clayey Gravel (angular, medium dense, moist)		6-8	2.4	15	
					8-10	1.8	15	
	10				10-12	1.0	15	
			9-20 ftbg: gray clayey Ash (soft, moist) with gravel		12-16	1.4	20	
	15				16-20	1.6	15	
	20		20-21 ftbg: black clayey Gravel (angular, medium dense, moist) with wood debris		20-21	1.5	12	Equipment refusal encountered at approximately 21 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-47

Project Number: 12MS-104(.5)	Total Depth of Hole: 10 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: South of Building A3	Water Encountered: NA
Date Start/Finished: August 12, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Joseph Mecca

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval (Feet)	PID Reading Parts Per Million (PPM)	Recovery (Inches)	Comments
			Ground Surface					
NA	1	NA	0-0.5 ftbg: Asphalt and subbase	NA	0-2	1.6	15	
					2-4	2.1	15	
	5		0.5-9.5 ftbg: black/tan Sand (coarse, medium and fine grain, medium dense, moist)		4-6	2.0	15	
					6-8	2.8	15	
	10		9.5-10 ftbg: gray Ash (stiff, moist)		8-10	2.3	20	Equipment refusal encountered at approximately 10 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-48

Project Number: 12MS-104(.5)	Total Depth of Hole: 7 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: South West of Building B4	Water Encountered: NA
Date Start/Finished: August 13, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Joseph Mecca

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval	PID Reading	Recovery	Comments
			Ground Surface		(Feet)	Parts Per Million (PPM)	(Inches)	
NA	1	NA	0-0.5 ftbg: Asphalt and subbase 0.5-4 ftbg: black/tan gravelly Sand (coarse, medium and fine grain, medium dense, moist)	NA	0-4	8.8	15	
	5		4-7 ftbg: black/tan gravelly Sand (coarse, medium and fine grain, medium dense, moist) with brick in end of macrocore		4-7	4.1	15	Equipment refusal encountered at approximately 7 ftbg

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DRILLING LOG OF WELL/BORING NO. SB-49

Project Number: 12MS-104(.5)	Total Depth of Hole: 3.5 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: South West of Building B4	Water Encountered: NA
Date Start/Finished: August 13, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Joseph Mecca

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval	PID Reading	Recovery	Comments
			Ground Surface		(Feet)	Parts Per Million (PPM)	(Inches)	
NA	1	NA	0-0.5 ftbg: Asphalt and subbase 0.5-3.5 ftbg: brown/tan gravelly Sand (coarse, medium and fine grain, medium dense, moist)	NA	0-3.5	4.2	20	Equipment refusal encountered at approximately 3.5 ftbg

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Project Number: 12MS-104(.5)	Total Depth of Hole: 13 feet below grade (ftbg)
Project Location: Kensington Heights 1827 Fillmore Avenue, Buffalo, New York	Ground Elevation: NA
Boring Location: North West of Building A5	Water Encountered: NA
Date Start/Finished: August 13, 2012	Water At End of Drilling: NA
Drilling Contractor: Russo Development, Inc.	Equipment: PowerProbe
Drilling Method: Hydraulically driven system (PowerProbe)	Technician: Joseph Mecca

Elevation	Depth	Well Completion Diagram	Soil/Rock Description	Blow Counts	Interval (Feet)	PID Reading Parts Per Million (PPM)	Recovery (Inches)	Comments
			Ground Surface					
NA	1	NA	0-0.5 ftbg: Asphalt and subbase	NA				
			0.5-4.5 ftbg: brown/black gravelly Sand (coarse, medium and fine grain, medium dense, moist)		0-4	1.2	15	
	5				4-8	5.9	15	
	10		4.5-12 ftbg: black/brown Sand (coarse, medium and fine grain, medium dense, moist)		8-12	1.7	15	
			12-13 ftbg: black/brown gravelly Sand (coarse, medium and fine grain, medium dense, moist) with pieces of glass		12-13	1.5	12	Equipment refusal encountered at approximately 13 ftbg

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APPENDIX C

EXCAVATION WORK PLAN

BROWNFIELD CLEANUP PROGRAM
SITE MANAGEMENT PLAN

APPENDIX C
EXCAVATION WORK PLAN

1827 FILLMORE AVENUE SITE
NYSDEC SITE NUMBER: C915279
BUFFALO, NEW YORK

November 2019 | 0421-017-001

Prepared for:

1827 FILLMORE LLC

Prepared By:

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SITE MANAGEMENT PLAN
APPENDIX C: EXCAVATION PLAN
1827 FILLMORE AVENUE SITE

Table of Contents

C-1: NOTIFICATION

At least 15 days prior to the start of any activity that is anticipated to encounter remaining contamination, the site owner or their representative will notify the NYSDEC. Table 1 includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information.

Table 1: Notifications*

NYSDEC Project Manager Mr. David Locey	716-851-7220 David.locey@dec.ny.gov
NYSDEC Regional HW Engineer Mr. Chad Staniszewski, P.E.	716-851-7220 Chad.staniszewski@dec.ny.gov
NYSDEC Site Control Ms. Kelly Lewandowski, P.E.	518-402-9543 Kelly.lewandowski@dec.ny.gov

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

This notification will include:

- A detailed description of the work to be performed, including the location and areal extent of excavation, plans/drawings for site re-grading, intrusive elements or utilities to be installed below the soil cover, estimated volumes of contaminated soil to be excavated and any work that may impact an engineering control;
- A summary of environmental conditions anticipated to be encountered in the work areas, including the nature and concentration levels of contaminants of concern, potential presence of grossly contaminated media, and plans for any pre-construction sampling;
- A schedule for the work, detailing the start and completion of all intrusive work;
- A summary of the applicable components of this EWP;
- A statement that the work will be performed in compliance with this EWP and 29 CFR 1910.120;
- A copy of the contractor's health and safety plan (HASP), in electronic format, if it differs from the HASP provided in Appendix E of this SMP;
- Identification of disposal facilities for potential waste streams; and

- Identification of sources of any anticipated backfill, along with all required chemical testing results.

C-2: SOIL SCREENING METHODS

Visual, olfactory and instrument-based (e.g. photoionization detector) soil screening will be performed by a qualified environmental professional during all excavations into known or potentially contaminated material (remaining contamination). Soil screening will be performed when invasive work is done and will include all excavation and invasive work performed during development, such as excavations for foundations and utility work, after issuance of the COC.

Soils will be segregated based on previous environmental data and screening results into material that requires off-site disposal and material that requires testing to determine if the material can be reused on-site as soil beneath a cover or if the material can be used as cover soil. Further discussion of off-site disposal of materials and on-site reuse is provided below.

C-3: SOIL STAGING METHODS

Soil stockpiles will be continuously encircled with a berm and/or silt fence. Hay bales will be used as needed near catch basins, surface waters and other discharge points.

Stockpiles will be kept covered at all times with appropriately anchored tarps. Stockpiles will be routinely inspected and damaged tarp covers will be promptly replaced.

Stockpiles will be inspected at a minimum once each week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the site and available for inspection by the NYSDEC.

C-4: MATERIALS EXCAVATION AND LOAD-OUT

A qualified environmental professional or person under their supervision will oversee all invasive work and the excavation and load-out of all excavated material.

The owner of the property and remedial party (if applicable) and its contractors are responsible for safe execution of all invasive and other work performed under this Plan.

The presence of utilities and easements on the site will be investigated by the qualified environmental professional. It will be determined whether a risk or impediment to the planned work under this SMP is posed by utilities or easements on the site.

Loaded vehicles leaving the site will be appropriately lined, tarped, securely covered, manifested, and placarded in accordance with appropriate Federal, State, local, and NYSDOT requirements (and all other applicable transportation requirements).

A truck wash will be operated on-site, as appropriate. The qualified environmental professional will be responsible for ensuring that all outbound trucks will be washed at the truck wash before leaving the site until the activities performed under this section are complete Truck wash waters will be collected and disposed of off-site in an appropriate manner.

Locations where vehicles enter or exit the site shall be inspected daily for evidence of off-site soil tracking.

The qualified environmental professional will be responsible for ensuring that all egress points for truck and equipment transport from the site are clean of dirt and other materials derived from the site during intrusive excavation activities. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to site-derived materials.

C-5: MATERIALS TRANSPORT OFF-SITE

All transport of materials will be performed by licensed haulers in accordance with appropriate local, State, and Federal regulations, including 6 NYCRR Part 364. Haulers will be appropriately licensed and trucks properly placarded.

Material transported by trucks exiting the site will be secured with tight-fitting covers. Loose-fitting canvas-type truck covers will be prohibited. If loads contain wet material capable of producing free liquid, truck liners will be used.

Truck transport routes shall be selected to involve the shortest commute through residential neighborhoods as feasible. All trucks loaded with site materials will exit the vicinity of the site using only these approved truck routes. This is the most appropriate route and takes into account: (a) limiting transport through residential areas and past sensitive sites; (b) use of city mapped truck routes; (c) prohibiting off-site queuing of trucks entering the facility; (d) limiting total distance to major highways; (e) promoting safety in access to highways; and (f) overall safety in transport.

Trucks will be prohibited from stopping and idling in the neighborhood outside the project site.

Egress points for truck and equipment transport from the site will be kept clean of dirt and other materials during site remediation and development.

Queuing of trucks will be performed on-site in order to minimize off-site disturbance. Off-site queuing will be prohibited.

C-6: MATERIALS DISPOSAL OFF-SITE

All material excavated and removed from the site will be treated as contaminated and regulated material and will be transported and disposed in accordance with all local, State (including 6NYCRR Part 360) and Federal regulations. If disposal of material from this site is proposed for unregulated off-site disposal (i.e., clean soil removed for development purposes), a formal request with an associated plan will be made to the NYSDEC. Unregulated off-site management of materials from this site will not occur without formal NYSDEC approval.

Off-site disposal locations for excavated soils will be identified in the pre-excavation notification. This will include estimated quantities and a breakdown by class of disposal facility if appropriate, i.e. hazardous waste disposal facility, solid waste landfill, petroleum treatment facility, C/D recycling facility, etc. Actual disposal quantities and associated documentation will be reported to the NYSDEC in the Periodic Review Report. This documentation will include: waste profiles, test results, facility acceptance letters, manifests, bills of lading and facility receipts.

Non-hazardous historic fill and contaminated soils taken off-site will be handled, at minimum, as a Municipal Solid Waste per 6NYCRR Part 360-1.2. Material that does not meet Unrestricted SCOs is prohibited from being taken to a New York State recycling facility (6NYCRR Part 360-16 Registration Facility).

C-7: MATERIALS REUSE ON-SITE

'Reuse on-site' means reuse on-site of material that originates at the site and which does not leave the Site during the excavation. The criteria under which soil/fill originating on-Site may be used on-Site are presented below.

- **Excavated, Non-Impacted On-Site Soil/Fill:** Non-impacted soil/fill (i.e., soil/fill that does not exhibit visible evidence of contamination, and is not grossly contaminated (as described in Part 375), and does not exhibit sustained PID readings above 10 parts per million (ppm) that is excavated from the Site, may be used on-Site as subgrade backfill beneath the cover system without special handling. The qualified environmental professional will ensure that procedures defined for materials reuse in this SMP are followed and that unacceptable material does not remain on-Site.

- **Excavated, Potentially Impacted on-Site Soil/Fill:** Potentially impacted soil/fill (i.e., soils that exhibit field visual and/or olfactory evidence of contamination, or with sustained elevated PID readings (above 10 ppm) may not be used on-Site unless tested and determined to meet the chemical criteria for Restricted Commercial Use SCOs per 6NYCRR Part 375. Potentially impacted material will be segregated, as described above, and sampled to determine acceptance for reuse. The material reuse analyses will be discussed with the Department and may include those constituents identified in 6NYCRR Part 375 for VOCs, SVOCs, metals, PCBs, pesticides and herbicides, in accordance with applicable USEPA SW846 analytical methodology.

The qualified environmental professional will ensure that procedures defined for materials reuse in this SMP are followed and that unacceptable material does not remain on-site. Contaminated on-site material, including historic fill and contaminated soil, that is acceptable for reuse on-site will be placed below the demarcation layer or impervious surface, and will not be reused within a cover soil layer, within landscaping berms, or as backfill for subsurface utility lines.

Any demolition material proposed for reuse on-site will be sampled for asbestos and the results will be reported to the NYSDEC for acceptance. Concrete crushing or processing on-site will not be performed without prior NYSDEC approval. Organic matter (wood, roots, stumps, etc.) or other solid waste derived from clearing and grubbing of the site will not be reused on-site.

C-8: FLUIDS MANAGEMENT

All liquids to be removed from the site, including but not limited to, excavation dewatering and decontamination waters, will be handled, transported and disposed in accordance with applicable local, state, and federal regulations. Dewatering fluids will not be recharged back to the land surface or subsurface of the site, and will be managed off-site, unless prior approval is obtained from NYSDEC.

Discharge of water generated during large-scale construction activities to surface waters (i.e. a local pond, stream, or river) will be performed under a SPDES permit.

C-9: COVER SYSTEM RESTORATION

The existing cover system is comprised of a minimum of 12 inches of clean soil with a vegetative layer or asphalt pavement. After the completion of soil removal and any other invasive activities the cover system will be restored in a manner that complies with the decision document. The existing cover system must be replaced with a minimum of 12 inches of clean soil, with the upper six inches of sufficient quality to maintain a vegetative layer, and/or asphalt pavement. The demarcation layer, consisting of orange snow fencing material, white geotextile or equivalent material will be replaced to provide a visual reference to the top of the remaining contamination zone, the zone that requires adherence to special conditions for disturbance of remaining contaminated soils defined in this SMP. If the type of cover system changes from that which exists prior to the excavation (i.e., a soil cover is replaced by asphalt) this will constitute a modification of the cover element of the remedy and the upper surface of the remaining contamination. A figure showing the modified surface will be included in the subsequent Periodic Review Report and in an updated SMP.

C-10: BACKFILL FROM OFF-SITE SOURCES

All materials proposed for import onto the site will be approved by the qualified environmental professional and will be in compliance with provisions in this SMP prior to receipt at the site. A Request to Import/Reuse Fill or Soil form, which can be found at **http://www.dec.ny.gov/regulations/67386.html**, will be prepared and submitted to the NYSDEC project manager allowing a minimum of 5 business days for review.

Material from industrial sites, spill sites, or other environmental remediation sites or potentially contaminated sites will not be imported to the site.

All imported soils will meet the backfill and cover soil quality standards established in 6NYCRR 375-6.7(d).

The criteria under which off-site material may be used as backfill are presented below.

- **Off-Site Soil/Fill:** Off-Site soil/fill may be used as backfill provided that it originates from known sources having no evidence of disposal or releases of hazardous substances; hazardous, toxic or radioactive wastes; or petroleum, and is tested and meet all of the criteria in accordance with Appendix 5 of DER-10 for a Commercial Use Site. In addition, no off-Site materials meeting the definition of a solid waste as defined in 6 NYCRR, Part 360-1.2 (a) shall be used as backfill.

- **Other Off-Site Material:** Material other than soil may be imported as backfill, without chemical testing, provided it contains less than 10% (by weight) material that would pass through a size 80 sieve: 1) Rock or stone, consisting of virgin material from a permitted mine or quarry; 2) Recycled concrete, brick, or asphalt from a NYSDEC-registered or permitted C&D debris processing facility (as specified in Section 360-16.1 of 6 NYCRR Part 360) that conforms to Section 304 of the New York State Department of Transportation Standard Specifications Construction and Materials Volume 1 (2002). As stated in Section 360-16.4(b)(2), the facility may only accept recognizable, uncontaminated, non-pulverized C&D debris or C&D debris from other authorized C&D processing facilities. According to Section 360-16.2(c), "uncontaminated" means C&D debris that is not mixed or commingled with other solid waste at the point of generation, processing, or disposal, and that is not contaminated with spills of a petroleum product, hazardous waste, or industrial waste.

Off-Site borrow soils shall be tested to assure conformance with the criteria identified above. If an off-Site soil/fill borrow source is of unknown origin or originates from a commercial or urban site, then a tiered approach based on the volume of impacted soil/fill being excavated will be used to determine the frequency of characterization sampling in accordance with DER-10, Section 5.4 and Table 5.4(3)10.

Soils that meet 'exempt' fill requirements under 6 NYCRR Part 360, but do not meet backfill or cover soil objectives for this site, will not be imported onto the site without prior approval by NYSDEC. Solid waste will not be imported onto the site.

Trucks entering the site with imported soils will be securely covered with tight fitting covers. Imported soils will be stockpiled separately from excavated materials and covered to prevent dust releases.

C-11: STORMWATER POLLUTION PREVENTION

If future site activities include large excavation, details of storm water pollution prevention will be included in the applicable notification provided to the Department. If required by the Department as part of the planned future excavation activities, barriers and hay bale checks will be installed and inspected once a week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the site and available for inspection by the NYSDEC. All necessary repairs shall be made immediately.

Accumulated sediments will be removed as required to keep the barrier and hay bale check functional.

All undercutting or erosion of the silt fence toe anchor shall be repaired immediately with appropriate backfill materials.

Manufacturer's recommendations will be followed for replacing silt fencing damaged due to weathering.

Erosion and sediment control measures identified in the SMP shall be observed to ensure that they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters.

Silt fencing or hay bales will be installed around the entire perimeter of the construction area.

C-12: EXCAVATION CONTINGENCY PLAN

If underground tanks or other previously unidentified contaminant sources are found during post-remedial subsurface excavations or development related construction, excavation activities will be suspended until sufficient equipment is mobilized to address the condition.

Sampling will be performed on product, sediment and surrounding soils, etc. as necessary to determine the nature of the material and proper disposal method. Chemical analysis will be performed in accordance with 6NYCRR Part 375 and consultation with the Department.

Identification of unknown or unexpected contaminated media identified by screening during invasive site work will be promptly communicated by phone to NYSDEC's Project Manager. Reportable quantities of petroleum product will also be reported to the NYSDEC spills hotline. These findings will be also included in the Periodic Review Report.

C-13: COMMUNITY AIR MONITORING PLAN

The Community Air Monitoring Plan (CAMP) will follow the guidance provided in the New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan found in Appendix 1A of NYSDEC's DER-10 *Technical Guidance for Site Investigation and Remediation*. The CAMP for this Site is included as Appendix E of this SMP. The CAMP will be implemented for all intrusive activities beneath the cover system performed at the site. The upwind and downwind monitoring locations required in the generic CAMP will be determined based on the prevailing wind direction at the start of work. Air sampling locations will be adjusted on a daily or more frequent basis based on actual wind directions and work locations. VOC monitoring will be performed using a PID or other equipment that is capable of calculating 15-minute running average concentrations. All air monitoring equipment will be calibrated at least daily. The 15-minute average concentration will be compared to the levels specified below.

Alternatively, the upwind monitoring location may be removed, as long as the background contribution is considered to be 0.0 ppm.

C-14: ODOR CONTROL PLAN

This odor control plan is capable of controlling emissions of nuisance odors off-site. Specific odor control methods to be used on a routine basis will include: limiting exposed face of the excavation area, reduction in work hours and/or specific work activities (e.g. load out of material), proof rolling excavation, and application of odor control agents (e.g. spray-foam).

If nuisance odors are identified at the site boundary, or if odor complaints are received, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. NYSDEC and NYSDOH will be notified of all odor events and of any other complaints about the project. Implementation of all odor controls, including the halt of work, is the responsibility of the remedial party's Remediation Engineer, and any measures that are implemented will be discussed in the Periodic Review Report.

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

If nuisance odors develop during intrusive work that cannot be corrected, or where the control of nuisance odors cannot otherwise be achieved due to on-site conditions or close proximity to sensitive receptors, odor control will be achieved by sheltering the excavation and handling areas in a temporary containment structure equipped with appropriate air venting/filtering systems.

C-15: DUST CONTROL PLAN

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

- Dust suppression will be achieved through the use of a dedicated on-site water truck for road wetting. The truck will be equipped with a water cannon capable of spraying water directly onto off-road areas including excavations and stockpiles.
- Clearing and grubbing of larger sites will be done in stages to limit the area of exposed, unvegetated soils vulnerable to dust production.
- Gravel will be used on roadways to provide a clean and dust-free road surface.
- On-site roads will be limited in total area to minimize the area required for water truck sprinkling.
- Covering or proof-rolling excavated areas and materials after excavation activity ceases.
- Reducing the excavation size and/or number of excavations

C-16: OTHER NUISANCES

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

A plan will be developed and utilized by the contractor for all remedial work to ensure compliance with local noise control ordinance.

APPENDIX D

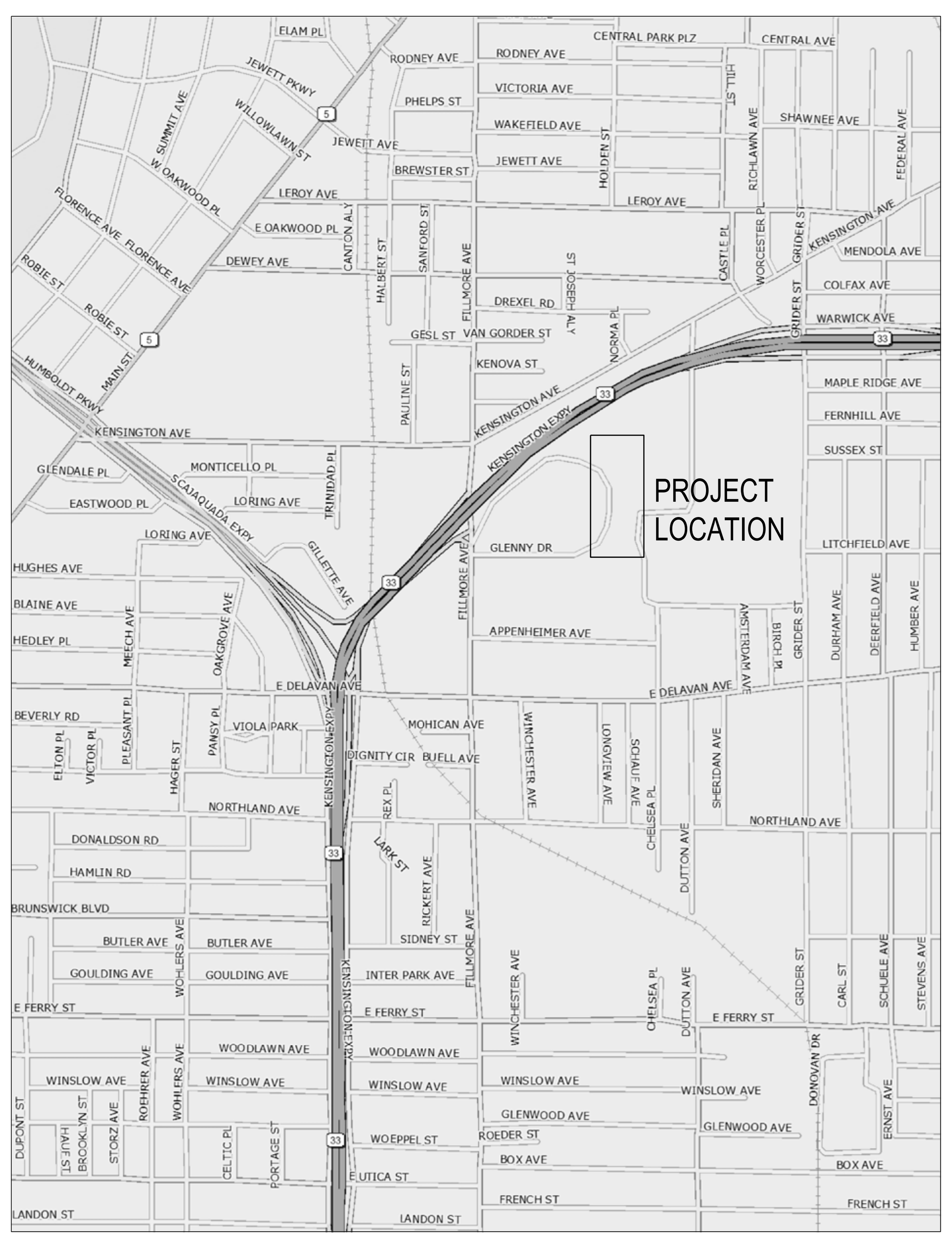
CONSTRUCTION DETAILS

C&S COMPANIES®

CONTRACT DRAWINGS
FOR THE CONSTRUCTION OF

PROPOSED
ERIE COUNTY MEDICAL CENTER
PARKING EXPANSION
1827 FILLMORE AVENUE, LLC

OWNER:
1827 FILLMORE AVENUE, LLC
462 GRIDER STREET
BUFFALO, NEW YORK 14215



LOCATION MAP

NORTH

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OVERALL CAMPUS PLAN	C-100
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C&S PROJECT: V14.002.001

JUNE 2019

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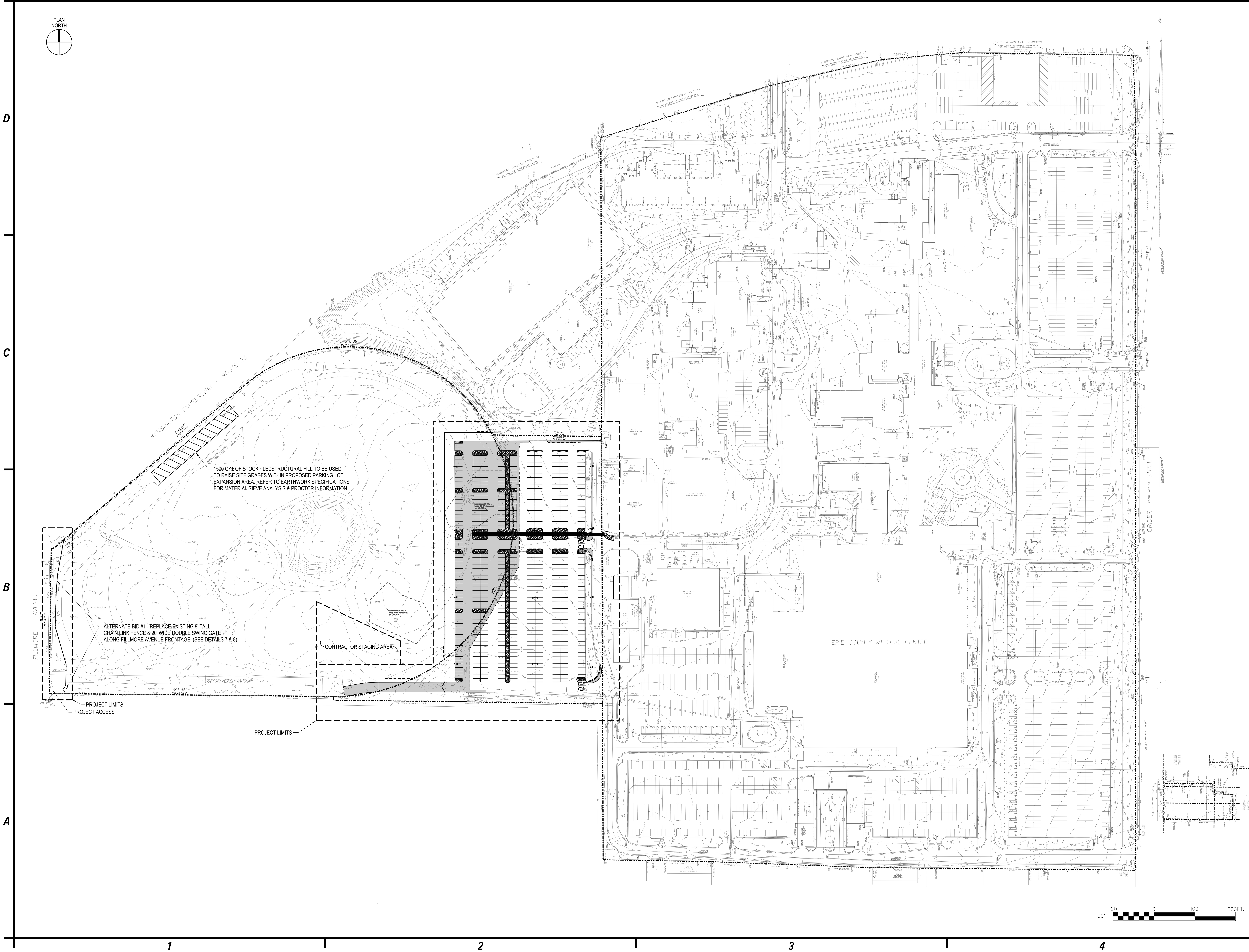

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PROPOSED ERIE COUNTY MEDICAL CENTER PARKING EXPANSION
1827 FILLMORE, LLC
1827 FILLMORE AVENUE
BUFFALO, NEW YORK

MARK	DATE	DESCRIPTION

REVISIONS

PROJECT NO:	V14.002.001
DATE:	6-6-2019
SCALE:	AS SHOWN
DRAWN BY:	JMH
DESIGNED BY:	VO
CHECKED BY:	VO

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OVERALL CAMPUS PLAN

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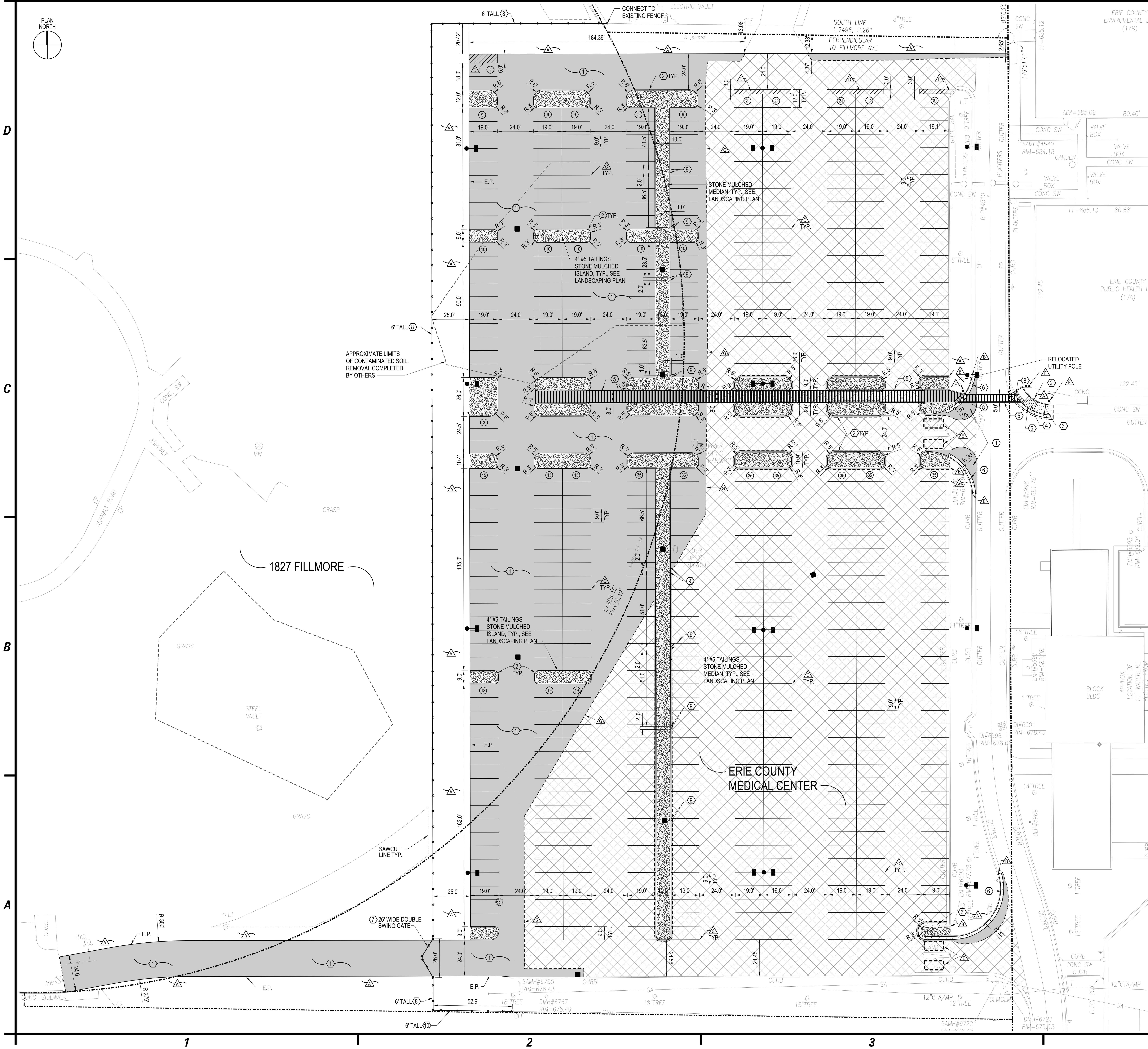

GENERAL NOTES

1. SURVEY INFORMATION WAS PROVIDED BY OTHERS. C&S ENGINEERS, INC. ASSUMES NO RESPONSIBILITY FOR ITS ACCURACY.

2. THIS SITE CONTAINS PRIVATE UNDERGROUND UTILITIES, WHICH MAY NOT BE INCLUDED IN UFPO. CONTRACTOR SHALL LOCATE ALL PUBLIC AND PRIVATE UTILITIES INCLUDING THOSE NOT MARKED BY UFPO USING GROUND PENETRATING RADAR OR OTHER MEANS AS REQUIRED, PRIOR TO THE START OF CONSTRUCTION. ALL COSTS FOR SUCH WORK SHALL BE INCLUDED IN THE CONTRACTOR'S BID.

3. CONTRACTOR SHALL VERIFY ALL FIELD CONDITIONS AND CONTACT THE ENGINEER WITH ANY DISCREPANCIES FOUND IN THE FIELD.

4. ALL DIMENSIONS FROM PROPERTY LINES ARE 90° FROM PROPERTY LINE UNLESS OTHERWISE NOTED.

5. ALL DIMENSIONS ARE FROM FACE OF CURB UNLESS OTHERWISE NOTED.

6. FIBER OPTIC COMMUNICATION LINE IS PRESENT ON SITE. CROWN CASTLE FIBER SHALL MAKE ALL ADJUSTMENTS AND MODIFICATIONS TO EXISTING FIBER LINE. CONTACT CROWN CASTLE FIBER @ 585-743-1775 FOR COORDINATION.

7. WORK SHALL BE PHASED SUCH THAT A MINIMUM OF 300 USEABLE PARKING SPACES ARE PROVIDED MONDAY AT 6:00 AM THRU FRIDAY UNTIL 4:00 PM FOR THE PROJECT DURATION. A SEPARATE CONSTRUCTION VEHICLE ENTRACE SHALL BE MAINTAINED. CONTRACTOR SHALL SUBMIT A PHASING PLAN MEETING THIS CRITERIA PRIOR TO BEGINNING WORK.

SOIL MANAGEMENT NOTES

1. ALL EXCAVATED SOIL FROM 1827 FILLMORE PROPERTY SHALL REMAIN ON 1827 FILLMORE PROPERTY UNLESS DISPOSED OF IN ACCORDANCE WITH THE APPROVED REMEDIAL ACTION WORK PLAN AND/OR SOIL MANAGEMENT PLAN.

2. EXCAVATED SOIL FROM THE ERIE COUNTY MEDICAL CENTER (ECMC) PROPERTY SHALL NOT BE PLACED ON 1827 FILLMORE PROPERTY. EXCAVTED MATERIAL FROM THE ECMC PROPERTY NOT REUSED ON SITE SHALL BE DISPOSED OF IN AN APPROVED LANDFILL.

3. ANY FILL MATERIALS BROUGHT ONTO THE 1827 FILLMORE PROPERTY SHALL MEET NYSDEC DER-10 REQUIREMENTS. REFER TO SPECIFICATIONS.

PROPOSED LEGEND

- PROPERTY LINE
- PROPOSED SIGN
- PROPOSED CONCRETE PAVEMENT/SIDEWALK
- PROPOSED CURB
- 5 NUMBER OF PARKING SPACES
- E.P. EDGE OF PAVEMENT
- LIGHTING FIXTURES
- SAW CUT LINE
- DETECTABLE WARNING SURFACE
- #5 TAILINGS RIVER ROCK MULCH
- NEW ASPHALT PAVEMENT
- MILL 1 1/2" EXISTING ASPHALT, RESURFACE WITH 1 1/2" NEW TOP COURSE & RE-STRIPE PAVEMENT

NOTE LEGEND

- A 4" TOPSOIL & SEED IF NO PLANTINGS-SEE LANDSCAPING PLAN.
- B MATCH EXISTING CURB OR RUN OUT IN 2'-0".
- C 4" WIDE PAINTED YELLOW PAVEMENT STRIPES.
- D 4" WIDE PAINTED YELLOW PAVEMENT STRIPES @ 45° AND 2'-0" O.C.
- E INDUCTANCE LOOPS FOR PARKING COUNTERS (BY OTHERS) - COORD. INSTALLATION BEFORE MILLING AND RESURFACING.
- F RELOCATED SIGN (SEE DEMOLITION PLAN)
- G EXACT LOCATION OF SAW CUT & PAVEMENT REMOVAL TO BE DETERMINED IN FIELD BY CONTRACTOR PRIOR TO BID DUE TO ONGOING SOIL REMEDIATION PROJECT.

DETAIL LEGEND

1. STANDARD DUTY ASPHALT
2. CONCRETE CURB
3. CONCRETE SIDEWALK
4. ACCESSIBLE CURB RAMP
5. PEDESTRIAN CROSSWALK
6. CONCRETE CURB & GUTTER
7. DOUBLE GATE DETAIL
8. CHAIN LINK FENCE
9. DROP CURB DETAIL
10. BOARD FENCE

PARKING

356 EXISTING
550 NEW LAYOUT
194 ADDITIONAL SPACES

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SITE PLAN

C-101

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DEMOLITION NOTES:

1. CONTRACTOR TO REMOVE & DISPOSE OF ALL ITEMS INDICATED & ANY ITEMS INCIDENTAL TO THE CONSTRUCTION AS REQUIRED.

2. CONTRACTOR SHALL PROTECT/PRESERVE ALL EXISTING ITEMS TO REMAIN, INCLUDING, BUT NOT LIMITED TO BUILDINGS, PAVEMENT, OVERHEAD & BURIED UTILITIES, TREES LANDSCAPING, ETC. DAMAGE TO ITEMS SCHEDULED TO REMAIN SHALL BE REPAIRED OR REPLANTED AT NO ADDITIONAL COST TO THE OWNER.

3. UTILITIES SHOWN ARE APPROXIMATE. CONTRACTOR SHALL HAVE ALL UNDER -GROUND FACILITIES LOCATED AND MARKED PRIOR TO EXCAVATION/DEMOLITION/ CONSTRUCTION. THIS INCLUDES PRIVATE AND PUBLIC UTILITIES. ALL RELATED COSTS SHALL BE INCLUDED IN THE CONTRACTOR'S BID.

4. ALL UTILITY TERMINATIONS SHALL BE IN ACCORDANCE W/ THE APPLICABLE UTILITY COMPANY REQUIREMENTS.

5. CONTRACTOR SHALL LEGALLY DISPOSE OF ALL MATERIALS/DEBRIS REMOVED FROM THE SITE.

6. THIS PLAN IS PREPARED FROM A SURVEY SHOWING KNOWN SURFACE FEATURES. IT IS INTENDED AS A GUIDE TO THE CONTRACTOR, NOT AS A COMPLETE AND UNIVERSAL DEMOLITION PLAN. SEE THE SITE PLAN. MORE FEATURES (NOT INDICATED) MAY REQUIRE DEMOLITION TO CONSTRUCT THE SITE PLAN. CONTRACTOR MUST VISIT THE SITE TO CONFIRM DEMOLITION EFFORT PRIOR TO BIDDING.

7. REMOVE CONCRETE SIDEWALK, CURBS AND/OR PAVEMENT TO THE LIMITS INDICATED. SAW CUT CONCRETE TO THE NEAREST EXISTING CONTROL/EXPANSION JOINT.

8. MAINTAIN STORM SEWER CONTINUITY & POSITIVE DRAINAGE DURING DEMOLITION, REMOVAL & CONSTRUCTION OF STORM SEWERS & INLETS.

LEGEND:

	CONCRETE/ASPHALT PAVEMENT TO BE REMOVED
	SAWCUT LINE
SA	EXISTING SANITARY SEWER
ST	EXISTING STORM SEWER LINE
W	EXISTING WATER LINE
G	EXISTING GAS LINE
FO	EXISTING FIBER OPTIC LINE (UNDERGROUND)
OFO	EXISTING FIBER OPTIC LINE (OVERHEAD)
CTV	EXISTING CABLE TV LINE (UNDERGROUND)

NOTE LEGEND

- A REMOVE & DISPOSE OF ASPHALT PAVEMENT.
- B REMOVE GUARDRAIL.
- C REMOVE CHAINLINK FENCE.
- D REMOVE DRAINAGE STRUCTURE & ASSOCIATED PIPING WITHIN PROPOSED WORK LIMITS.
- E REMOVE & DISPOSE OF CONCRETE CURB/GUTTER.
- F UTILITY POLE TO BE RELOCATED - SEE SITE PLAN.
- G SIGN TO BE RELOCATED.
- H LIGHT POLE TO BE REMOVED.
- I REMOVE CONCRETE SIDEWALK.
- J REMOVE STORM STRUCTURE & ASSOCIATED PIPING WITHIN PROPOSED WORK LIMITS & PLUG REMAINING PIPE.
- K EXISTIONG CABLE TV LINE. PROTECT DURING DEMOLITION/ CONSTRUCTION. COORDINATE WITH UTILITY COMPANY.
- L EXISTING FIBER OPTIC LINE. PROTECT DURING DEMOLITION - CONSTRUCTION. CONTACT CROWN CASTLE FIBER 585-743-1775 FOR COORDINATION.
- M REMOVE & REPLACE EXISTING CATCH BASIN WITH NEW.
- N EXISTING GAS LINE TO BE ABANDONED - REMOVE AS REQUIRED FOR CONSTRUCTION AFTER VERIFICATION WITH UTILITY CO.
- O REMOVE EXISTING BOLLARD.
- P REMOVE EXISTING WATERMAIN AS REQUIRED TO CONSTRUCT IMPROVEMENTS.
- Q CAP WATERMAIN ADJACENT TO HYDRANT.
- R PRESERVE EXISTING CONCRETE MEDIAN, PARKING GATES & BOLLARDS.

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DEMOLITION PLAN

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USER **DATE** **TIME** **\$TIME**

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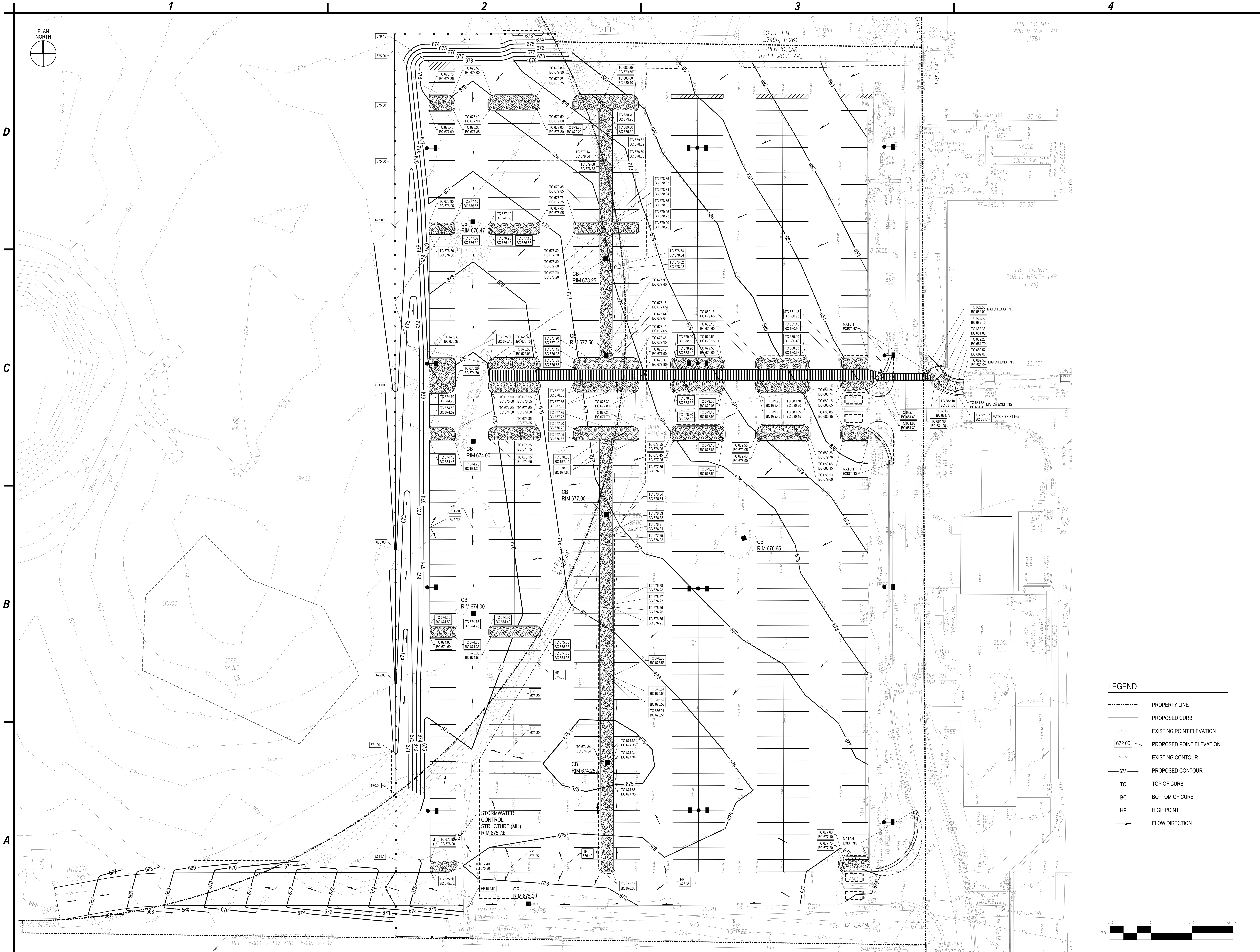

LEGEND

	PROPERTY LINE
	PROPOSED CURB
678.67	EXISTING POINT ELEVATION
672.00	PROPOSED POINT ELEVATION
678	EXISTING CONTOUR
675	PROPOSED CONTOUR
TC	TOP OF CURB
BC	BOTTOM OF CURB
HP	HIGH POINT
	FLOW DIRECTION

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GRADING PLAN

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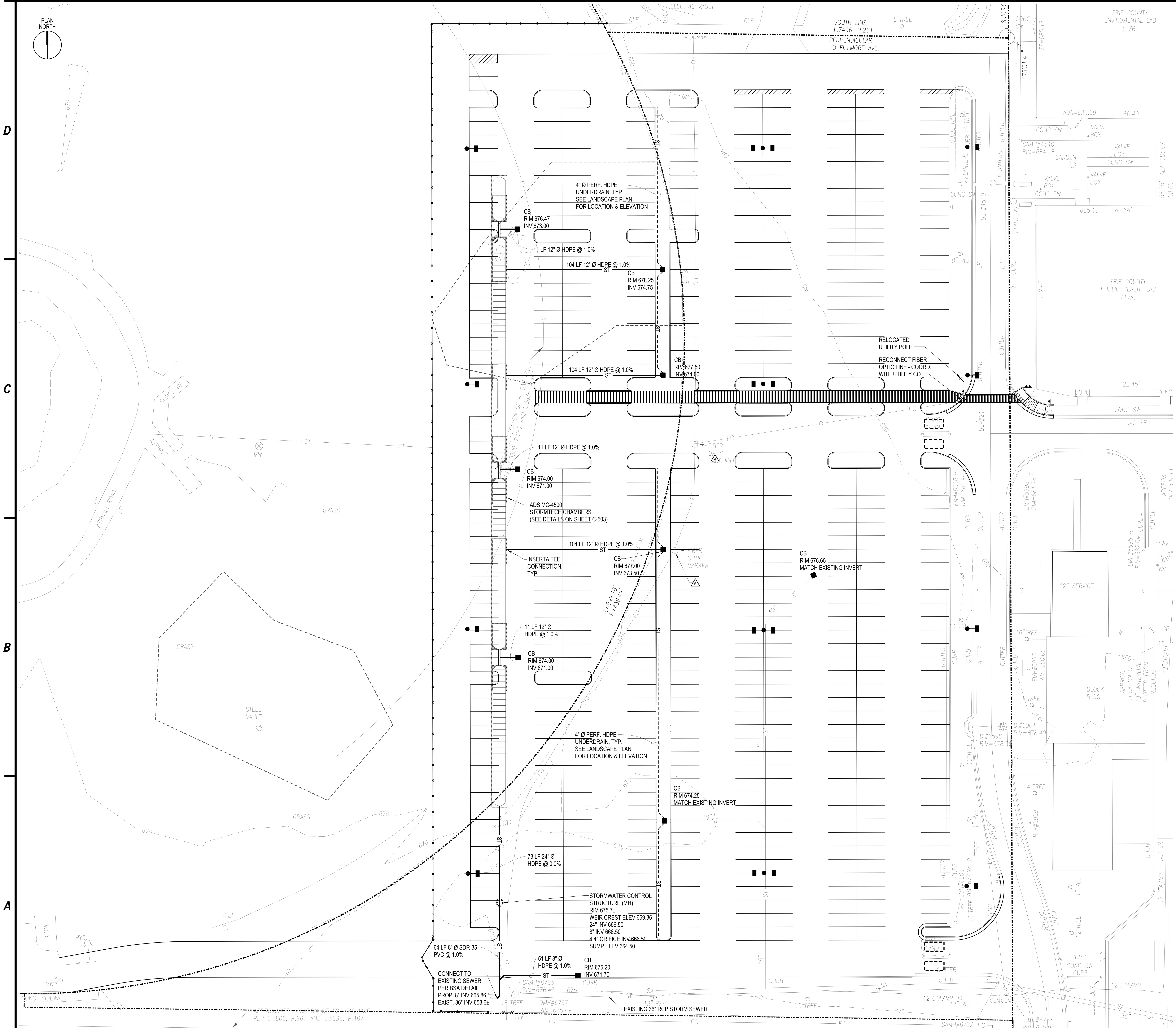

NOTE LEGEND

A — FIBER MARKER TO BE RELOCATED BY CROWN CASTLE FIBER

B — HANDHOLE TO BE REPLACED WITH TRAFFIC RATED STRUCTURE BY CROWN CASTLE FIBER

GENERAL NOTES

1. FIBER OPTIC COMMUNICATION LINE IS PRESENT ON SITE. CROWN CASTLE FIBER SHALL MAKE ALL ADJUSTMENTS AND MODIFICATIONS TO EXISTING FIBER LINE. CONTACT CROWN CASTLE FIBER @ 585-743-1775 FOR COORDINATION.

2. ALL MODIFICATIONS TO EXISTING FIBER OPTIC CABLE SHALL BE COMPLETED BY CROWN CASTLE FIBER - CONTRACTOR SHALL COORDINATE AS REQUIRED.

3. WHERE FIBER OPTIC LINE ELEVATION OR LOCATION REQUIRES MODIFICATION, CONTRACTOR WILL BE RESPONSIBLE FOR TRENCHING AND BACKFILL IN NEW LOCATION AND INCLUDE SAID COSTS IN HIS BID. LABOR AND MATERIALS (EXCAVATION) WILL BE PROVIDED BY CROWN CASTLE FIBER.

LEGEND

EXISTING SANITARY SEWER	SA
EXISTING STORM SEWER	ST
EXISTING GAS	G
PROPOSED STORM SEWER	ST
PROPOSED MANHOLE	●
PROPOSED CATCH BASIN	■
PROPOSED LIGHT STANDARD	

30 0 30 60 Ft.

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UTILITY PLAN

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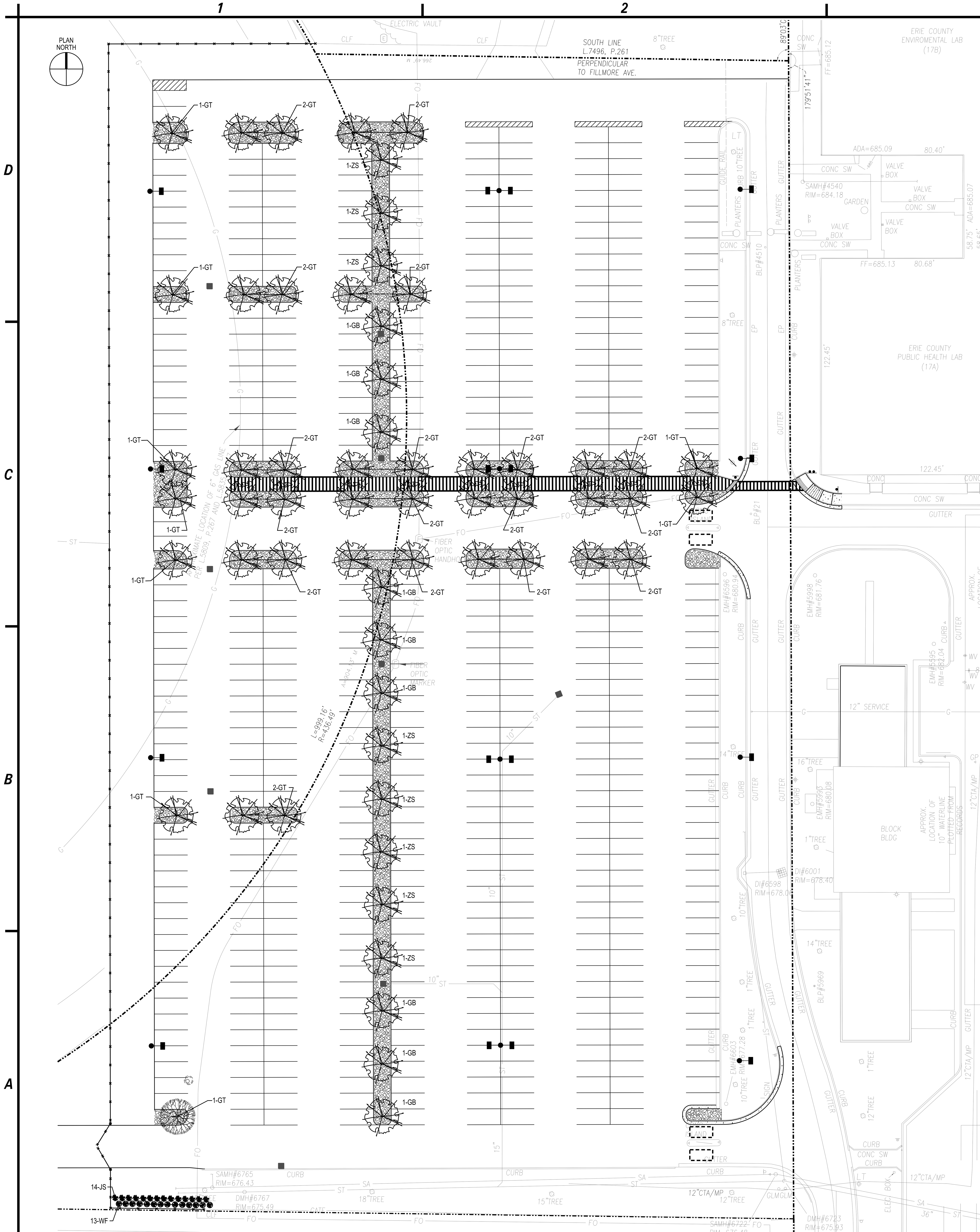
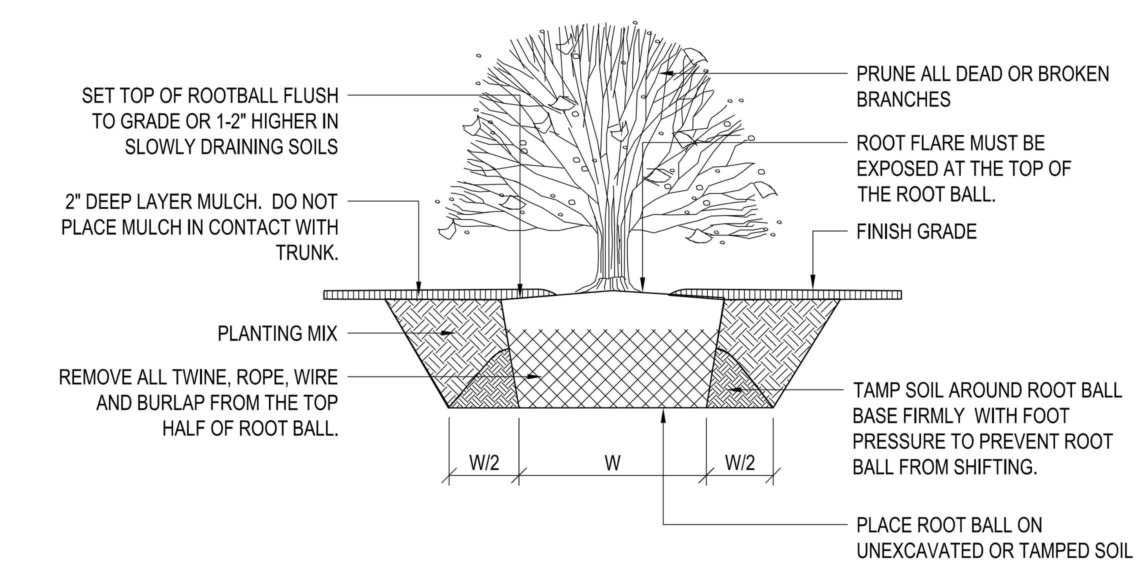


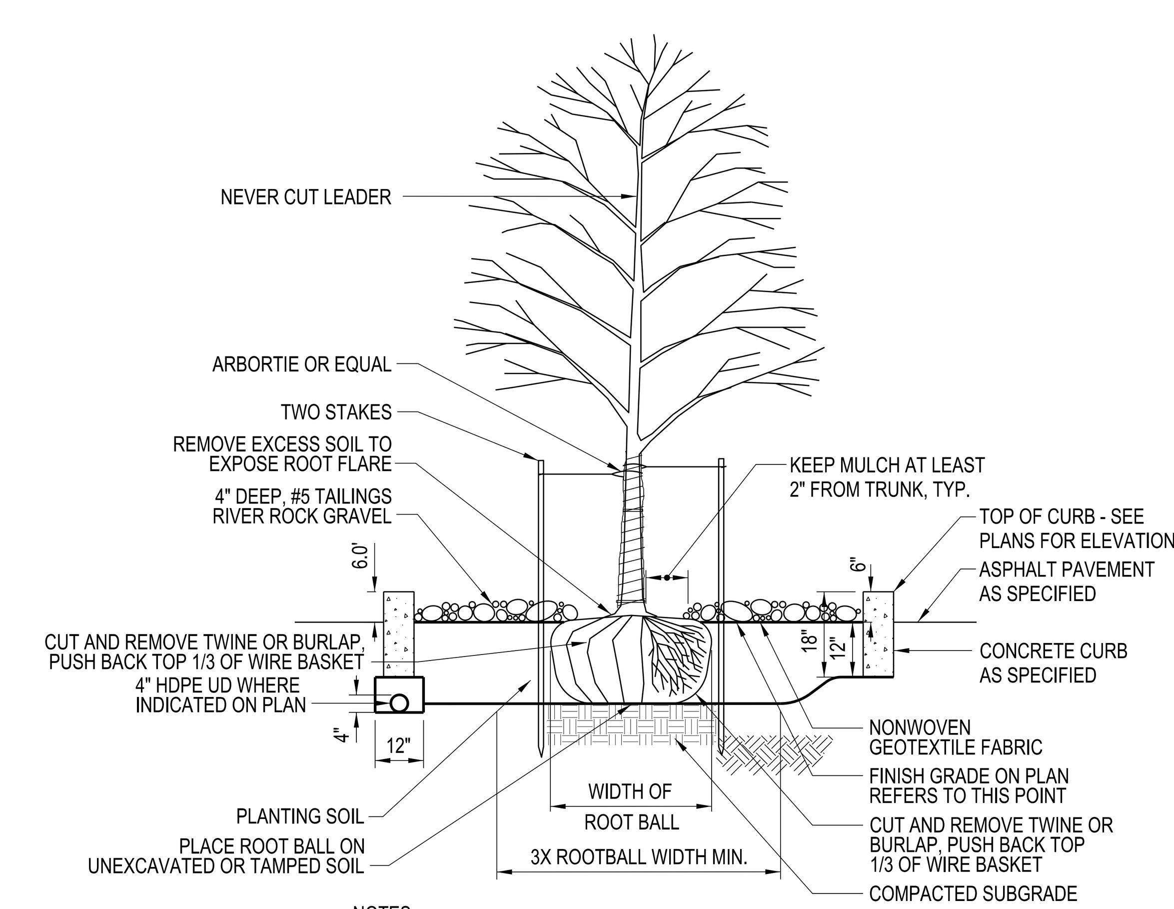
PLANTING SPECIFICATION

1. SCOPE OF WORK
   A. THIS WORK SHALL CONSIST OF PERFORMING, CLEARING, AND GRUBBING, SOIL PREPARATION, FINISH GRADING, PLANTING AND DRAINAGE INCLUDING ALL LABOR MATERIALS, TOOLS, EQUIPMENT, AND ANY OTHER APPURTENANCES NECESSARY FOR FOR THE COMPLETION OF THIS PROJECT.
2. MATERIALS
   A. PLANTS - ALL PLANTS SHALL BE HEALTHY, OF NORMAL GROWTH, WELL ROOTED FREE FROM DISEASE AND INSECTS. QUALITY AND PLANT MATERIAL SHALL CONFORM CONFORM TO THE AMERICAN ASSOCIATION OF NURSERYMAN STANDARDS FOR NURSERY STOCK AND BE OF NUMBER ONE GRADE.
   B. VARIETIES AND SIZES OF PLANTS SHALL BE AS SHOWN ON DRAWINGS.
3. FERTILIZER
   A. FERTILIZER SHALL BE MILORGANITE (6-2-0)
4. GENERAL WORK PROCEDURES
   A. LANDSCAPE WORK SHALL BE ACCORDING TO THE WORKMANLIKE STANDARDS ESTABLISHED FOR LANDSCAPE CONSTRUCTION AND PLANTING.
5. WEEDING
   A. BEFORE AND DURING PRELIMINARY GRADING AND FINISH GRADING, ALL WEEDS AND GRASSES SHALL BE DUG OUT BY THE ROOTS AND DISPOSED OF AT THE CONTRACTOR'S EXPENSE.
6. SOIL CONDITIONING
   A. CULTIVATE ALL AREAS TO BE PLANTED TO A DEPTH OF 6". ALL DEBRIS EXPOSED FROM EXCAVATION AND CULTIVATION SHALL BE DISPOSED OF AT THE CONTRACTOR'S EXPENSE.
7. PLANTING
   POSITION TREES AND SHRUBS AT THEIR INTENDED LOCATIONS AS PER THE PLANS AND SECURE THE APPROVAL OF THE LANDSCAPE ARCHITECT BEFORE EXCAVATING PITS, MAKING NECESSARY ADJUSTMENTS AS DIRECTED.
   A. PLANTING PITS SHALL BE DUG WITH LEVEL BOTTOMS, AS SHOWN ON THE PLANTING DETAILS.
   - 3 PARTS TOPSOIL
   - 1 PART PEAT MOSS OR COMPOST
   - 1/3 PART MILORGANITE FERTILIZER

   B. PREPARED SOIL SHALL BE TAMPED FIRMLY AT BOTTOM OF PIT. FILL PREPARED SOIL AROUND BALL OF PLAN ½ WAY, AND WATER. COMPLETE BACK-FILLING AND WATER THOROUGHLY.
   C. ALL PLANTS SHALL BE SET SO THAT, WHEN SETTLED, THEY BEAR THE SAME RELATION TO THE REQUIRED GRADE AS THEY BORE TO THE NATURAL GRADE BEFORE BEING TRANSPLANTED.
   D. IMMEDIATELY AFTER PLANTING, STAKE ALL TREES WITH 3 CEDAR STAKES PER TREE.
   E. PREPARE RAISED EARTH SAUCER AS WIDE AS PLANTING HOLE OF EACH PLANT.
   F. WATER IMMEDIATELY AFTER PLANTING. WATER SHALL BE APPLIED TO EACH TREE AND SHRUB IN SUCH MANNER AS NOT TO DISTURB BACKFILL AND TO THE EXTENT THAT ALL MATERIALS IN THE PLANTING HOLE ARE THOROUGHLY SATURATED.
   G. AFTER SHRUB BEDS AND TREE SAUCERS ARE BACKFILLED AND FINE GRADED MULCH WITH 3" DEPTH OF DARK, SHREDDED HARDWOOD BARK MULCH.
8. FINISH GRADING
   A. PLUS/MINUS .1 FOOT OF FINISH GRADE.
   B. ALL LAWN AND PLANTING AREAS SHALL BE GRADED TO A SMOOTH, EVEN UNIFORM PLANE WITH NO ABRUPT CHANGE OF SURFACE. SOIL AREAS ADJACENT TO THE BUILDING SHALL SLOPE AWAY FROM THE BUILDING.
   C. ALL PLANTING AREAS SHALL BE GRADED AND MAINTAINED TO ALLOW FREE FLOW OF SURFACE WATER.
9. GUARANTEE
   A. CONTRACTOR SHALL GUARANTEE ALL PLANTS FOR A PERIOD OF ONE (1) YEAR.
10. CLEAN-UP
    A. UPON THE COMPLETION OF ALL PLANTING WORK AND BEFORE FINAL ACCEPTANCE, THE CONTRACTOR SHALL REMOVE ALL MATERIAL, EQUIPMENT, AND DEBRIS RESULTING FROM HIS WORK. ALL ACCEPTABLE CONDITIONS AS APPROVED BY THE OWNERS AUTHORIZED REPRESENTATIVE.
11. MAINTENANCE
    MAINTENANCE PERIOD TO COMMENCE AFTER FINAL INSPECTION.
    A. MAINTENANCE PERIOD FOR THIS CONTRACT SHALL BE 90 CALENDAR DAYS COMMENCING AFTER FINAL INSPECTION OF CONSTRUCTION. MAINTAIN TREES, SHRUBS AND OTHER PLANTS BY PRUNING, CULTIVATING AND WEEDING AS REQUIRED FOR HEALTHY GROWTH. RESTORE PLANTING SAUCERS. TIGHTEN AND REPAIR STAKE AND GUY SUPPORTS AND RESET TREES AND SHRUBS TO PROPER GRADES OR VERTICAL POSITION AS REQUIRED. SPRAY AS REQUIRED TO KEEP TREES AND SHRUBS FREE OF INSECTS AND DISEASE. MAINTAIN LAWNS BY WATERING, FERTILIZING, WEEDING, MOWING, TRIMMING, AND OTHER OPERATIONS SUCH AS ROLLING, REGRADING AND REPLANTING AS REQUIRED TO ESTABLISH A SMOOTH, ACCEPTABLE LAWN, FREE OF ERODED OR BARE AREAS.



SHRUB PLANTING DETAIL
NTS



NOTES:
- ROOT FLARE OF TREE SHALL BE SET AT 2" ABOVE FINISHED GRADE.
- ALL TREES TO BE STAKED
- WHERE TREES OCCUR IN EXISTING GRAVEL AREAS, EXCAVATE TREE PIT THROUGH GRAVEL. BACKFILL AND COMPACT PLANTING SOIL

DECIDUOUS TREE PLANTING DETAIL WITH STAKES
NTS

NEW PARKING LOT AREA = 70,620 SF
INTERIOR GREENSPACE REQUIRED = 10% = 7,062 SF
INTERIOR GREENSPACE PROVIDED = 7,392 SF (10.5%)

PLANT LIST

KEY	QTY.	BOTANICAL NAME	COMMON NAME	MINIMUM SIZE	NOTES
GT	43	Gleditsia Triacanthos Inermis "Skyline"	Skyline Honeylocust	2" Caliper Min.	
GB	9	Ginkgo biloba "Autumn Gold"	Autumn Gold Ginkgo	2" Caliper Min.	Male Only
ZS	8	Zelkova serrata "Village Green"	Village Green Zelkova	2" Caliper Min.	
JS	14	Juniperus Chinensis "Sea Green"	Sea Green Juniper	24-30"	
WF	13	Weigela Florida "Alexandra"	Wine & Roses Weigela	18-24"	

30 0 30 60 Ft.
30'

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LANDSCAPE PLAN

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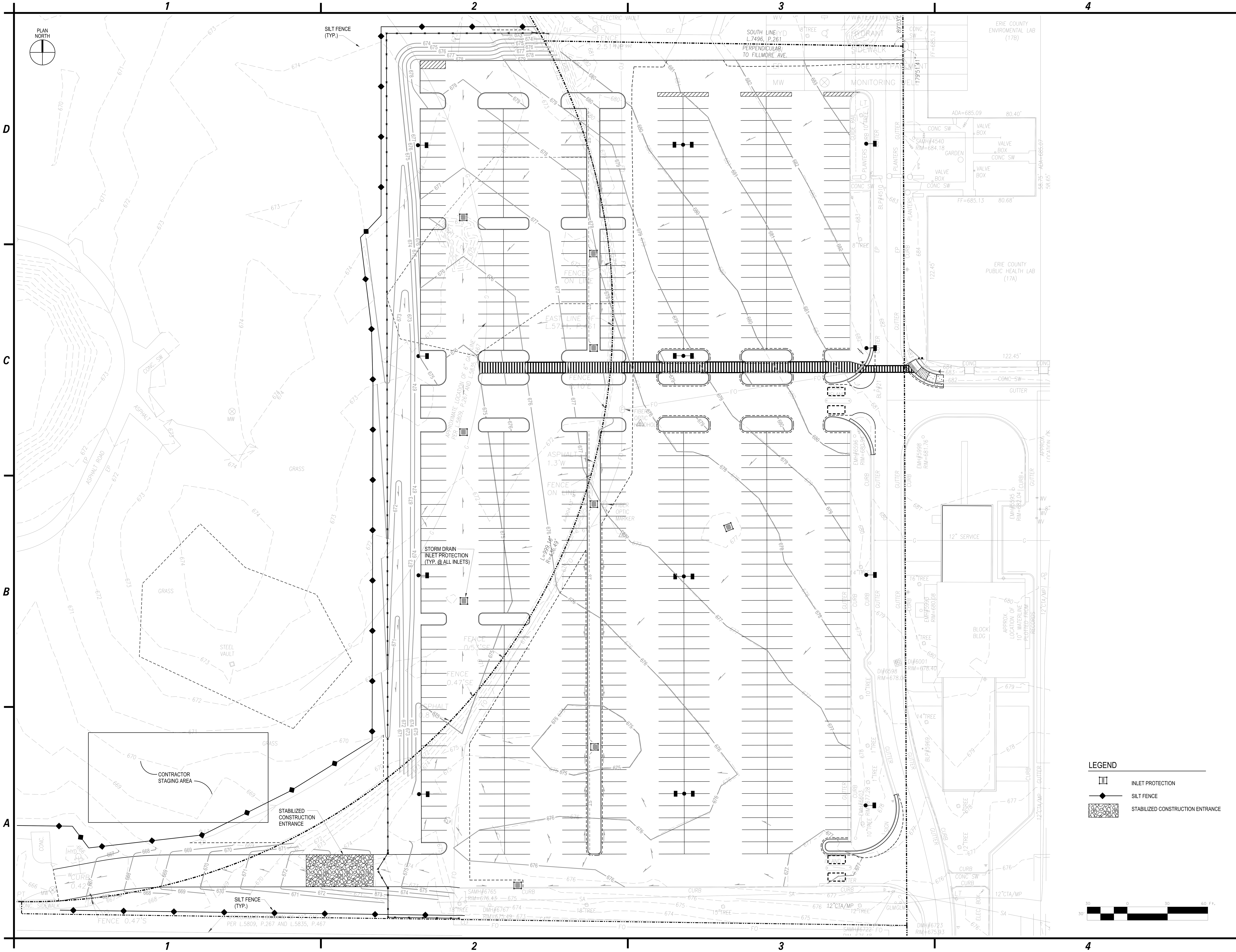

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EROSION & SEDIMENT CONTROL PLAN

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REMOVAL WORK NOTES (D3)

1. ALL AREAS DISTURBED BY WORK SHALL BE RESTORED TO A CONDITION EQUAL TO OR BETTER THAN ORIGINAL AS DETERMINED BY THE ENGINEER.
2. ALL ELECTRICAL CONDUCTORS DISCONNECTED AND NOT TO BE REUSED SHALL BE REMOVED. ASSOCIATED INTERIOR AND EXTERIOR CONDUIT SYSTEM SHALL BE REMOVED WHERE EXPOSED.
3. CONTRACTOR SHALL FIELD VERIFY ALL EXISTING CONDITIONS BEFORE STARTING WORK. IF ONLY A PORTION OF AN EXISTING CIRCUIT IS BEING REMOVED FOR DEMOLITION, CONTINUITY SHALL BE MAINTAINED TO THE REST OF THE REMAINING CIRCUIT. PROVIDE ADDITIONAL CONDUIT AND CONDUCTORS AS NEEDED TO MAINTAIN CIRCUIT CONTINUITY.
4. UNLESS NOTED OTHERWISE, REMOVE DESIGNATED LIGHT POLE BASE, POLE, FIXTURE, AND ASSOCIATED CONTROLS, CONDUIT, AND CONDUCTORS BACK TO SOURCE. LEGALLY DISPOSE MATERIALS OFFSITE, REFER TO SPECIFICATION 260502 ELECTRICAL DEMOLITION FOR ADDITIONAL INFORMATION.

D3 REMOVAL WORK NOTES

SCALE: NOT TO SCALE

— E —	UNDER GROUND ELECTRICAL CONDUIT
— C —	UNDER GROUND COMM CONDUIT
	TO BE REMOVED BY CONTRACTOR
	EXISTING TO REMAIN
	NEW WORK PROVIDED BY CONTRACTOR
	POLE MOUNTED LUMINAIRE LOCATION
C	COMMUNICATIONS HANDHOLE
E	ELECTRICAL HANDHOLE
J	JUNCTION BOX
	DISCONNECT SWITCH
	SURFACE MOUNTED PANEL
BL	EMERGENCY PHONE WITH CAMERA LOCATION
	CAMERA

B3 SYMBOL LIST

SCALE: NOT TO SCALE

AC	ASPHALT CONCRETE
AIC	AMPERE INTERRUPTING CAPACITY
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AU	AT UNIT
CLL	CONTRACT LIMIT LINE
EM	EMERGENCY
EMT	ELECTRIC METALLIC TUBING
(E)	EXISTING TO REMAIN ITEM OR EQUIPMENT
GND	GROUND
JB	JUNCTION BOX
K	KILO
KV	KILO VOLT
KVA	KILO VOLT AMP
NC	NORMALLY CLOSED
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
NO	NORMALLY OPEN
PB	PULL BOX
PCC	PORTLAND CONCRETE CEMENT
(R)	ITEM OR EQUIPMENT TO BE REMOVED BY CONTRACTOR
RGS	RIGID GALVANIZED STEEL CONDUIT
TYP	TYPICAL
WP	WATER PROOF OR WEATHERPROOF

A3 GENERAL NOTES

SCALE: NOT TO SCALE

1. ELECTRICAL WORK SHALL CONFORM TO ALL STATE, LOCAL, AND NATIONAL ELECTRICAL CODES.
2. ELECTRICAL CHARACTERISTICS SHALL BE VERIFIED WITH EQUIPMENT MANUFACTURER PRIOR TO COMMENCEMENT OF WORK.
3. ITEMS OF SPECIFIC MANUFACTURERS SHALL BE INSTALLED IN STRICT ACCORDANCE WITH MANUFACTURER'S PRINTED INSTRUCTIONS AND/OR MANUFACTURER'S REPRESENTATIVE'S DIRECTIONS.
4. THE CONTRACTOR SHALL FIELD VERIFY ALL LOCATIONS AND DIMENSIONS SHOWN ON DRAWINGS.
5. THE CONTRACTOR SHALL COORDINATE THE INSTALLATION OF ALL EQUIPMENT WITH EXISTING CONDITIONS.
6. ALL BRANCH CIRCUITS SHALL CONSIST OF 2 CONDUCTORS PLUS GROUND, UNLESS OTHERWISE SHOWN. NO SHARED NEUTRALS.
7. PROVIDE HAND HOLES WHERE INDICATED ON DRAWINGS AND WHERE REQUIRED TO FACILITATE INSTALLATION. NOT ALL HAND HOLES ARE INDICATED.
8. WHERE CONDUCTOR SIZE IS LARGER THAN THE TERMINATION POINT LUGS, PROVIDE A JUNCTION BOX WITHIN TWO FEET OF THE TERMINATION POINT AND JUNCTION CONDUCTORS TO THE LARGEST SIZE CONDUCTOR THE LUGS WILL ACCEPT.
9. PROVIDE A LIGHTING CONTROL SCHEME SERVING NEW SITE LIGHTING CIRCUITS CONSISTING OF AN EXTERIOR PHOTOCELL AT EACH FIXTURE FOR DUSK TO DAWN OPERATION. PROVIDE ALL CONDUIT, CONDUCTORS, RELAYS, ETC. FOR A COMPLETE FUNCTIONAL SYSTEM.
10. PROVIDE EACH LIGHT POLE AND BLUE LIGHT PHONE WITH A UNIQUE IDENTIFIED LABEL. REFER TO DRAWING DETAILS FOR ADDITIONAL REQUIREMENTS.
11. UNDERGROUND UTILITY LAYOUT INFORMATION WAS COMPILED FROM EXISTING PLANS OF RECORD AND A SITE SURVEY AND INVESTIGATION, AND IS OFFERED IN GOOD FAITH SOLELY TO PROVIDE THE CONTRACTOR WITH DATA AVAILABLE TO THE ENGINEER. THE FINAL LOCATION OF EXISTING UTILITIES SHOWN SHALL BE FIELD VERIFIED BY THE CONTRACTOR PRIOR TO CONSTRUCTION.SURVEY AND BASE MAPPING FOR THIS PROJECT WAS PREPARED BY AUBERTINE & CURRIER PLLC (A&C) N AUGUST OF 2018. THE NORTH AMERICAN DATUM SYSTEM (NAD83 & NGVD'88) WAS USED AS A BASIS FOR THE SITE SURVEY. THE LOCATION, SIZES AND ELEVATIONS OF EXISTING UTILITIES ARE BASED ON INFORMATION COMPLIED FROM RECORD DRAWINGS AND FIELD LOCATIONS BY A&C IN MARCH 2018.
12. CONTRACTOR SHALL NOTIFY DIG SAFELY NEW YORK AT LEAST THREE (3) DAYS PRIOR TO START OF WORK. CONTRACTOR SHALL COORDINATE ALL WORK WITH UTILITY COMPANIES AND THE CAMPUS. CONTRACTOR SHALL PROVIDE INDEPENDENT UTILITY LOCATING SERVICES FOR THE CAMPUS OWNED UNDERGROUND UTILITIES IN THE PROJECT AREA. REFER TO SPECIFICATION 310100. LOCATIONS AND ELEVATIONS OF EXISTING UTILITIES SHALL BE MARKED ON AS-BUILT DRAWINGS.
13. IN THE EVENT OF DAMAGE TO EXISTING UTILITIES, THE ENGINEER SHALL BE NOTIFIED IMMEDIATELY. THE CONTRACTOR SHALL REPAIR ALL DAMAGED UTILITIES TO THEIR ORIGINAL CONDITION, OR AS DIRECTED, IMMEDIATELY AND AT NO ADDITIONAL COST TO THE OWNER.
14. WHERE CONSTRUCTION DETAILS ARE SHOWN OR NOTED FOR ANY PART OF THE WORK, DETAILS SHALL BE THE SAME AS FOR OTHER SIMILAR WORK.
15. UNLESS DETAILED, SPECIFIED OR INDICATED OTHERWISE, CONSTRUCTION SHALL BE AS INDICATED IN THE APPLICABLE TYPICAL DETAILS AND GENERAL NOTES. TYPICAL DETAILS ARE MEANT TO APPLY EVEN THOUGH NOT REFERENCED AT SPECIFIC LOCATIONS OR IN SPECIFIC DRAWINGS.
16. CONTRACTOR TO COORDINATE WITH THE OWNERS REPRESENTATIVE FOR OTHER CONCURRENT CONSTRUCTION PROJECTS ON CAMPUS.
17. PROVIDE COMPLETE FUNCTIONING SYSTEMS, AND EACH ELEMENT THEREOF, AS SPECIFIED, INDICATED, OR REASONABLY INFERRED, ON THE DRAWINGS AND SPECIFICATIONS, INCLUDING EVERY DEVICE, OR ACCESSORY (WHETHER OR NOT SPECIFICALLY CALLED FOR BY ITEM) NECESSARY TO FACILITATE EACH SYSTEMS FUNCTIONING AS INDICATED BY THE DESIGN AND THE EQUIPMENT SPECIFIED. ELEMENTS OF WORK INCLUDE, BUT ARE NOT LIMITED TO, MATERIALS, LABOR, SUPERVISION,SUPPLIES, TOOLS, EQUIPMENT, TRANSPORTATION, AND UTILITIES.
18. EXISTING BUILDING MOUNTED LIGHT FIXTURES AND CONTROLS SHALL REMAIN.
19. THE TERM "DUCTBANK" SHALL MEAN A SINGLE CONDUIT OR GROUP OF CONDUITS IN A COMMON TRENCH.

A4 GENERAL NOTES

SCALE: NOT TO SCALE

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PROPOSED PARKING EXPANSION
1827 FILLMORE, LLC
1827 FILLMORE AVENUE
BUFFALO, NEW YORK

MARK	DATE	DESCRIPTION

REVISIONS

PROJECT NO: V14.002.001
DATE: JUNE 6, 2019
DRAWN BY: D.W.B
DESIGNED BY: W.R.B.
CHECKED BY: S.H.S

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GENERAL NOTES, SYMBOLS AND ABBREVIATIONS

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LABEL	CALCTYPE	UNITS	AVERAGE	MAXIMUM	MINIMUM	AVG/MIN	MAX/MIN
ENTIRE LOT	ILLUMINANCE	Fc	1.76	5.6	0.3	5.87	18.67

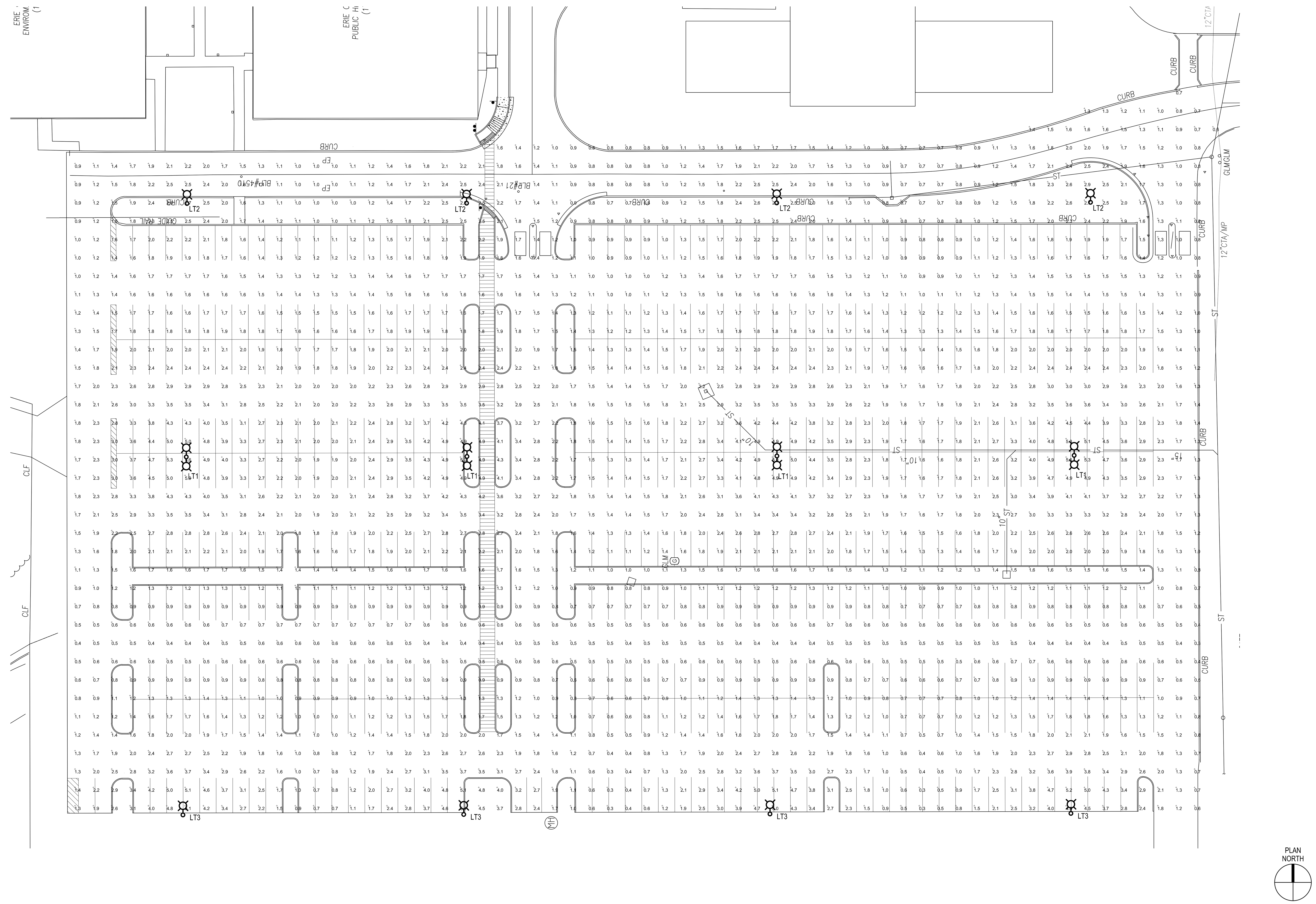
D1 CALCULATION SUMMARY
SCALE: NOT TO SCALE

SYMBOL	QTY.	LABEL	ARRANGEMENT	LLF	DESCRIPTION	LUM. WATTS	PHOTOCELL	COLOR	NOTES
	04	LT1	BACK-BACK	0.950	NV-2-T5-80L-1-50K-TWIN @ 30' MTG. HT	263	YES	BLACK	2
	04	LT2	SINGLE	0.950	NV-2-T5-80L-1-50K-SINGLE @ 30' MTG. HT	263	YES	BLACK	1
	04	LT3	SINGLE	0.950	NV-2-T4-80L-1-50K-SINGLE @ 30' MTG. HT	263	YES	BLACK	1

NOTES:

1. USE SQUARE NON-TAPERED STEEL POLE, 5IN. 11GA THICKNESS, 28FT TALL, BLACK, DRILLED FOR TWO LUMINAIRES, PRODUCT NO: SS50001130-FIN-DM28-BC.
2. USE SQUARE NON-TAPERED STEEL POLE, 5IN. 11GA THICKNESS, 28FT TALL, BLACK, DRILLED FOR ONE LUMINAIRE, PRODUCT NO: SS50001130-FIN-DM10-BC.

D3 LUMINAIRE SCHEDULE
SCALE: NOT TO SCALE



A2 PARKING LOT PLAN
SCALE: 1/32" = 1'-0"

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Fa□: 716-847-1454
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PARKING LOT PHOTOMETRICS

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D1 TRANSFORMER SCHEDULE

SCALE: NOT TO SCALE

ELECTRICAL CHARACTERISTICS							
XFMR. NUMBER	KVA	MTG	PRIMARY VOLTAGE	SECONDARY VOLTAGE	PHASE	NEMA TYPE	GROUND
T1	0.5	WALL	277	120	1	3R	YES

D3 GENERAL NOTES

SCALE: NOT TO SCALE

1. THE ECMC VERINT NETWORK MANAGEMENT SYSTEM IS PRESENTLY SERVICED AND MAINTAINED BY SECURITY INTEGRATIONS. ALL PROGRAMMING OF THE ECMC VERIENT VIDEO MANAGEMENT SYSTEM CAMERAS SHALL BE PERFORMED BY SECURITY INTEGRATIONS. CONTACT: MIKE GUZIK , EMAIL: MIKEG@SECURITYINTEGRATIONS.COM, PHONE: (716) 860-2936. FOR COST INFORMATION. ALL COSTS FOR THIS WORK SHALL BE INCLUDED IN THE BID.

D4 CAMERA SCHEDULE

SCALE: NOT TO SCALE

CAMERA TYPES:

TYPE A: COMBINATION MULTI IMAGER CAMERA AND PTZ CAMERA; AXIS Q6000-E MK11 AND AXIS Q6155-E PTZ

TYPE B: FIXED DOME CAMERA AXIS Q3518-LVE

CAMERA	TYPE	MOUNTING	NOTE
C1	A	POLE	MOUNT 14'AFF
C2	A	POLE	MOUNT 14'AFF
C3	A	POLE	MOUNT 14'AFF
C4	A	POLE	MOUNT 14'AFF
C5	B	EM PHONE	MOUNT ON POLE MOUNTED PHONE ENCLOSURE
C6	B	EM PHONE	MOUNT ON POLE MOUNTED PHONE ENCLOSURE

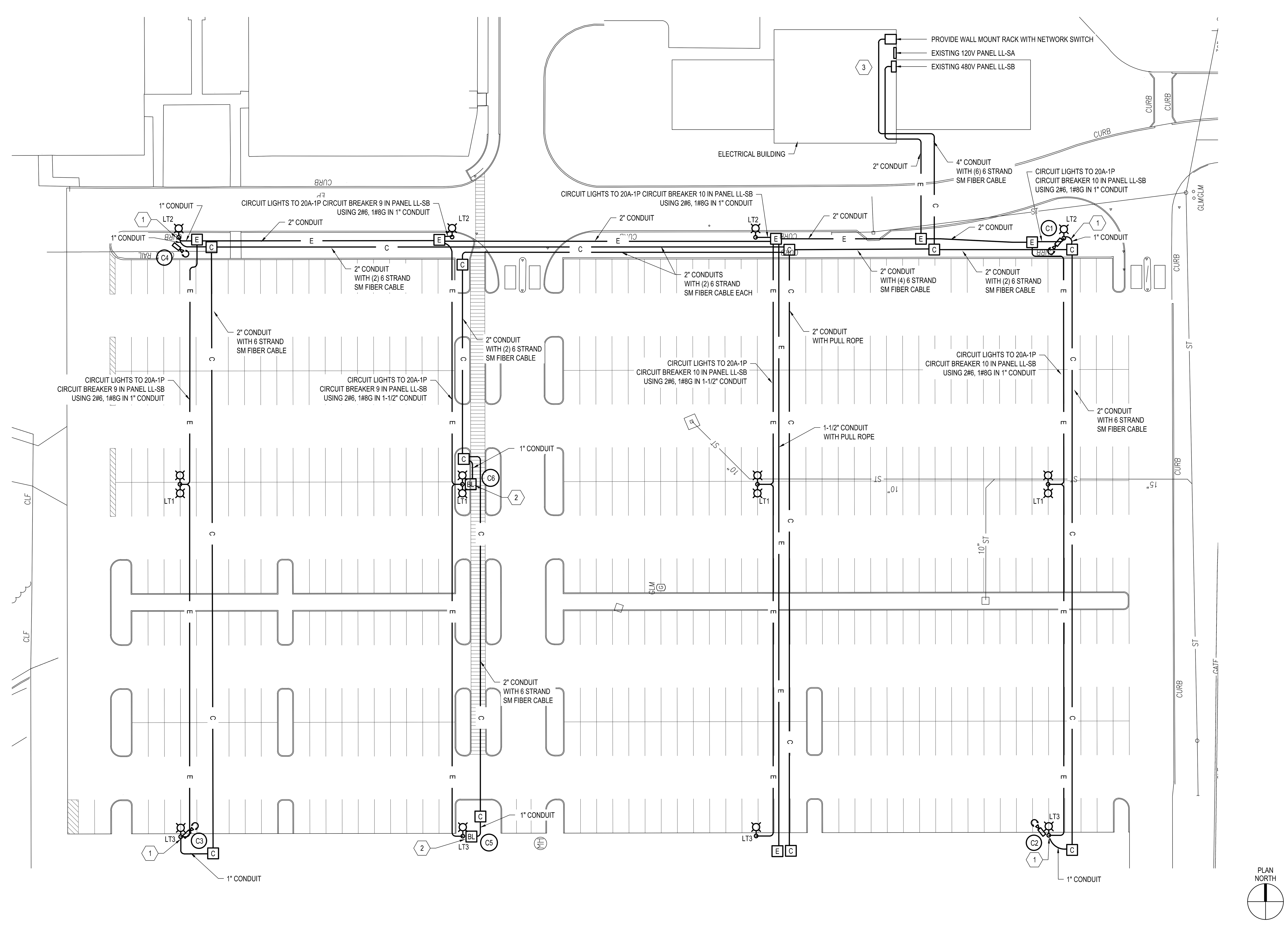
A1 KEYED NOTES

SCALE: NOT TO SCALE

1. MOUNT CAMERA TO POLE AT APPROXIMATELY 14' AFF, UTILIZE MANUFACTURER RECOMMENDED BRACKETS AND HARDWARE.
2. MOUNT EMERGENCY PHONE TO LIGHT POLE, MOUNT CAMERA TO EMERGENCY LIGHT, UTILIZE MANUFACTURER RECOMMENDED BRACKETS AND HARDWARE.
3. COORDINATE ALL SHUTDOWNS AND CONNECTIONS WITH ECMC PLANT OPERATIONS.

A2 PARKING LOT PLAN

SCALE: 1/32" = 1'-0"



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PROPOSED PARKING EXPANSION
1827 FILLMORE, LLC
1827 FILLMORE AVENUE
BUFFALO, NEW YORK

MARK	DATE	DESCRIPTION
		REVISIONS

PROJECT NO:	V14.002.001
DATE:	JUNE 6, 2019
DRAWN BY:	D.W.B
DESIGNED BY:	W.R.B.
CHECKED BY:	S.H.S

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PARKING LOT CONDUIT PLAN

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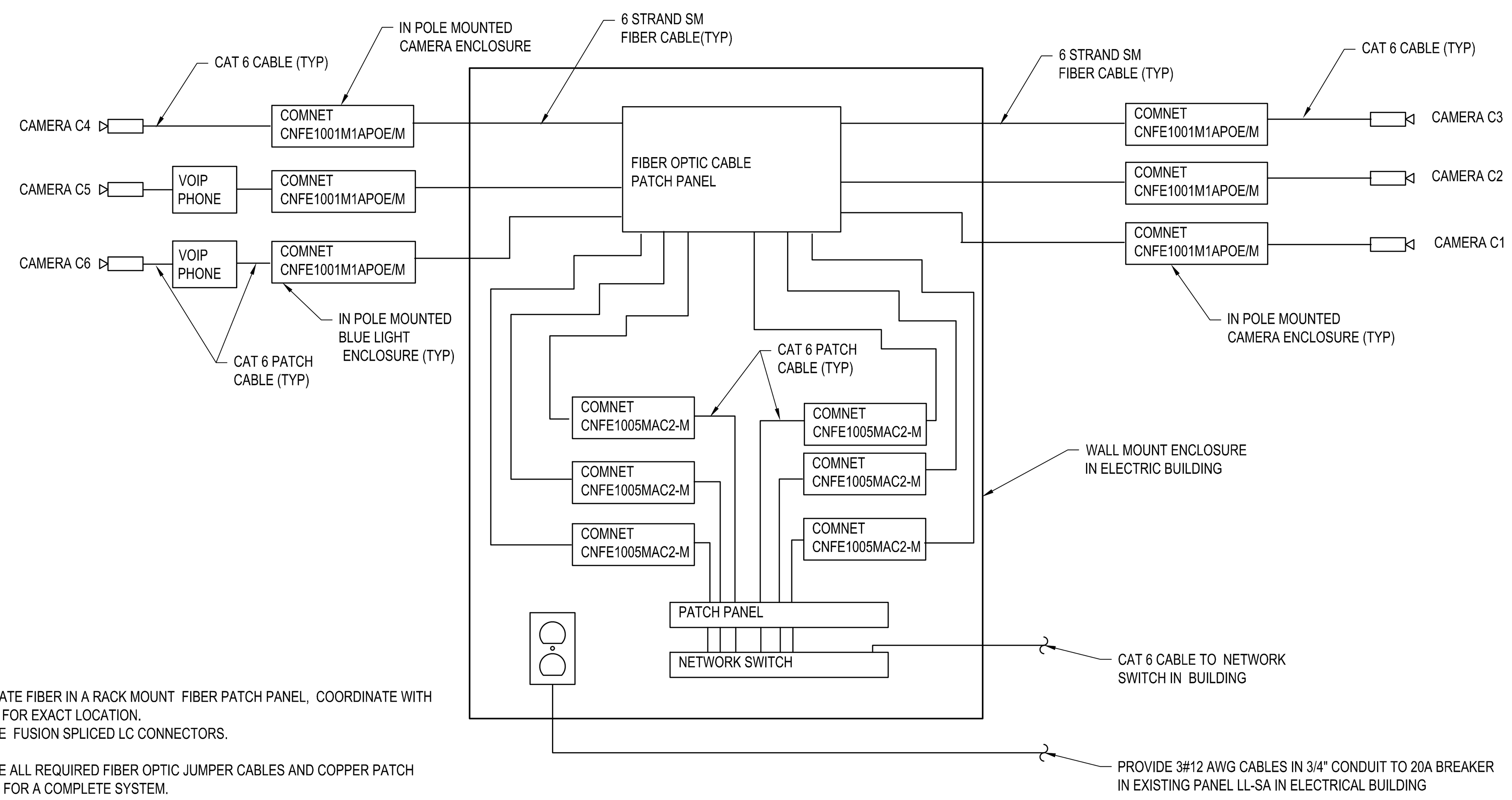
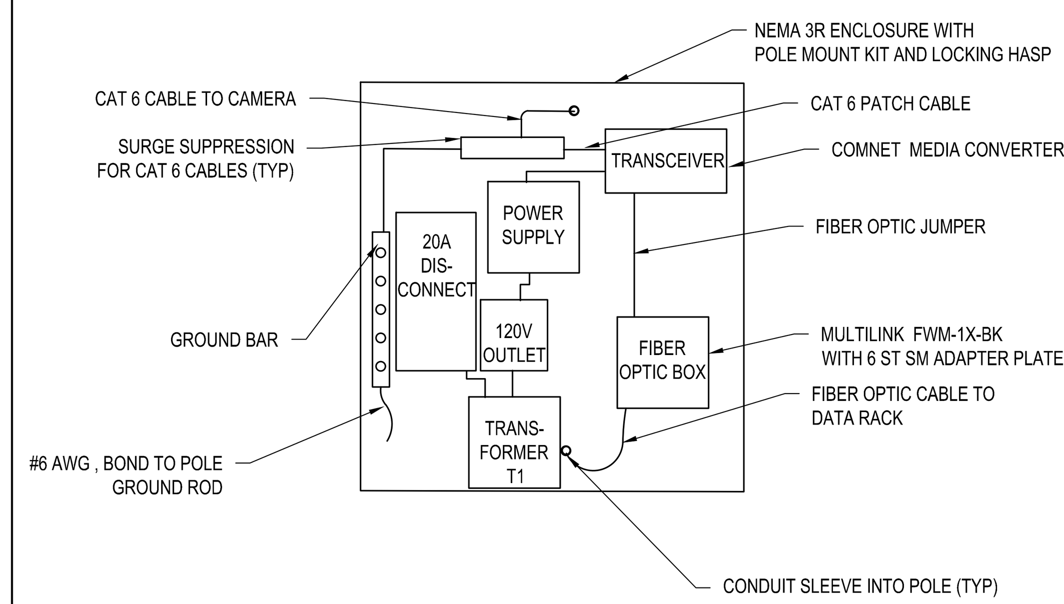


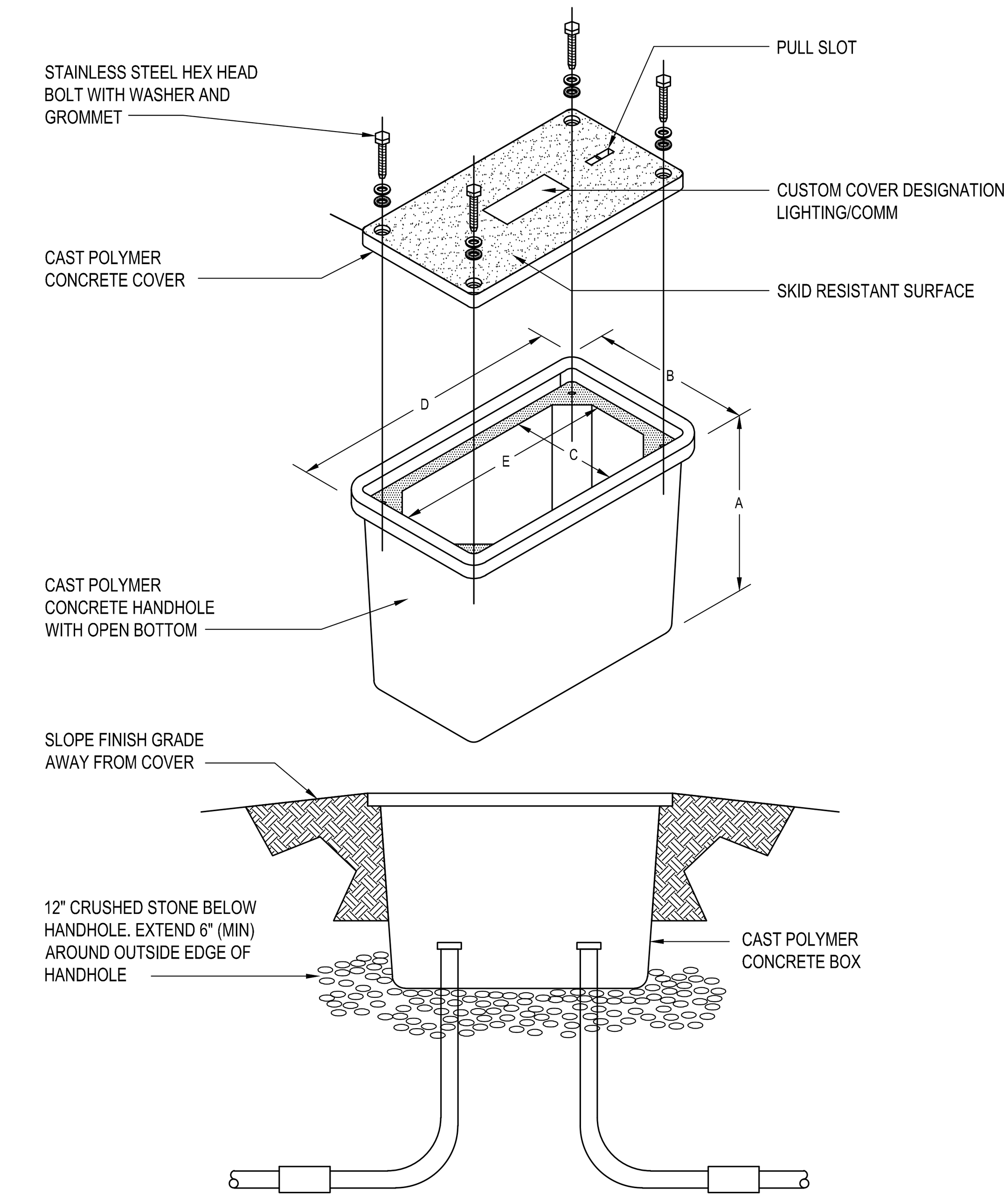
NOTES:

1. TERMINATE FIBER IN A RACK MOUNT FIBER PATCH PANEL. COORDINATE WITH OWNER FOR EXACT LOCATION. PROVIDE FUSION SPLICED LC CONNECTORS.
2. PROVIDE ALL REQUIRED FIBER OPTIC JUMPER CABLES AND COPPER PATCH CABLES FOR A COMPLETE SYSTEM.
3. ROUTE ALL CABLING IN MINIMUM 1" CONDUIT.
4. PROVIDE 120V 20A OUTLET IN WALL MOUNT ENCLOSURE.

C1 COMMUNICATIONS CABLING ONE LINE
SCALE: NOT TO SCALE



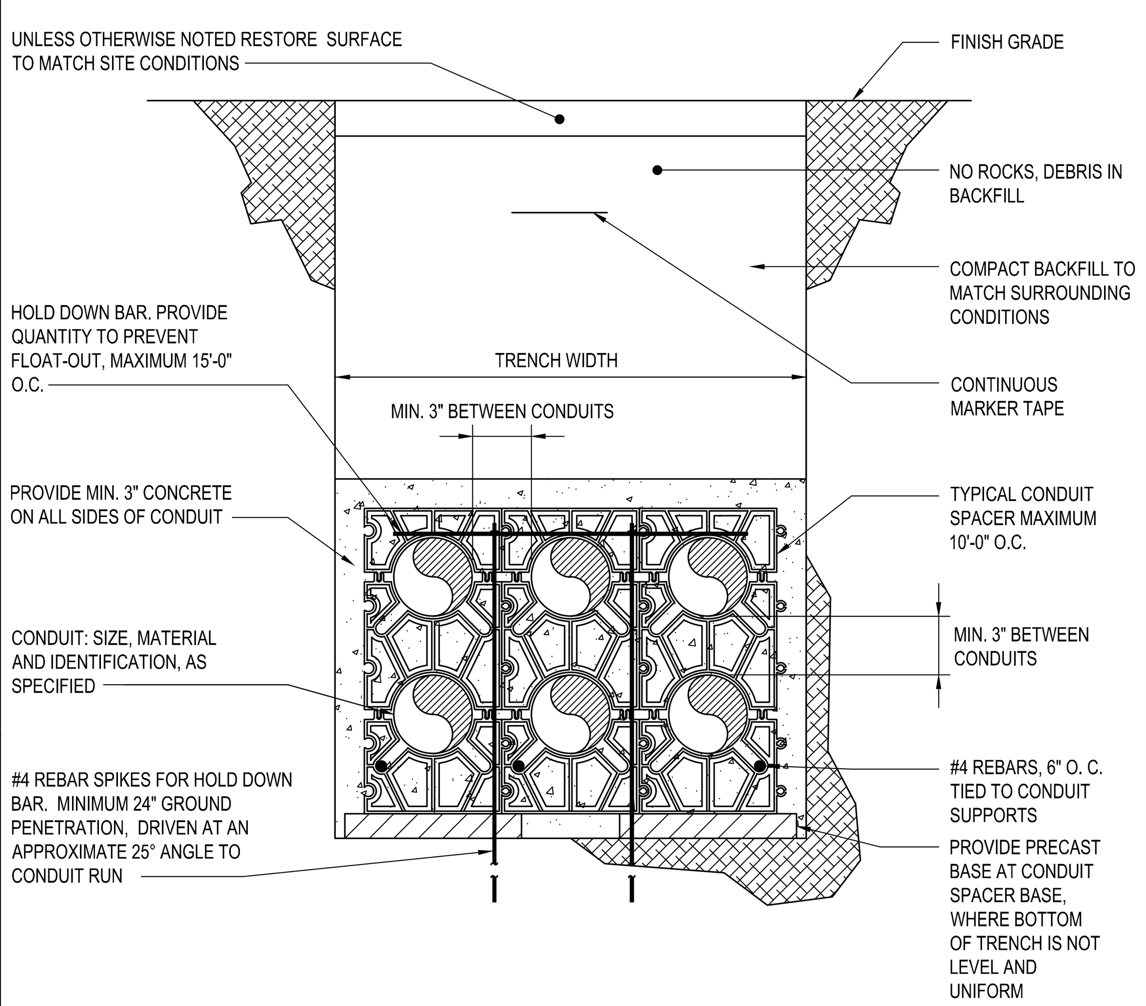
C3 TYPICAL CAMERA ENCLOSURE
SCALE: NOT TO SCALE



DIMENSION SCHEDULE					
HANDHOLE TYPE	DIMENSIONS				
	A	B	C	D	E
HH	12"	12"	10"	20"	18"

GENERAL NOTES:
1. DO NOT LOCATE IN VEHICULAR TRAFFIC OR SIDE WALK AREAS.
2. REFER TO PLANS FOR QUANTITY OF CONDUITS SERVING EACH HAND HOLE.

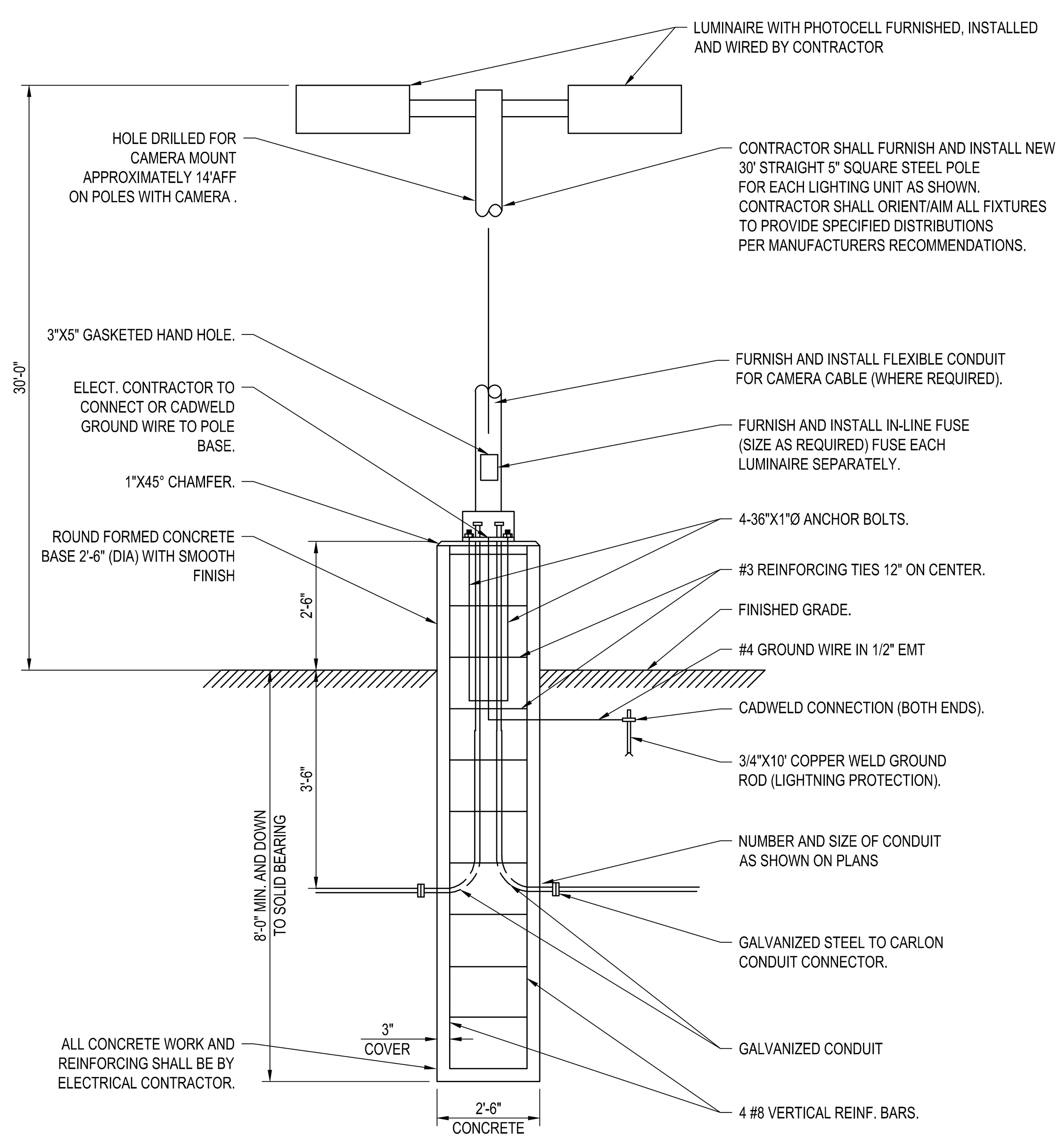
C4 HANDHOLE DETAIL
SCALE: NOT TO SCALE



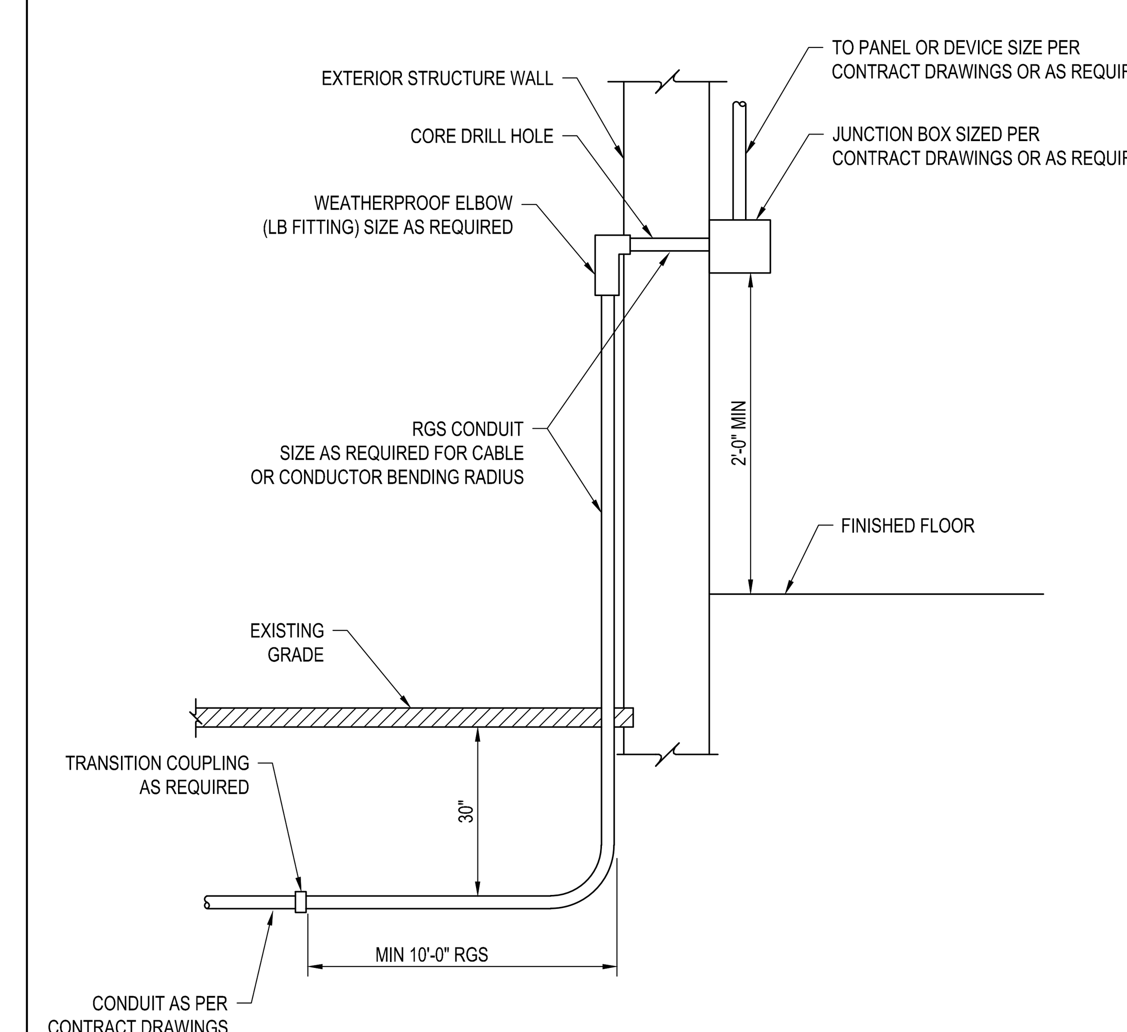
GENERAL NOTES:

A. PROVIDE REINFORCED CONCRETE DUCTBANK CONSTRUCTION FOR ALL DUCTBANKS CROSSING ROADS, DRIVEWAYS, AND PARKING LOTS.
B. REFER TO DRAWINGS FOR ACTUAL QUANTITY AND SIZE OF CONDUITS REQUIRED.
C. LEAVE PULL ROPE IN ALL SPARES.
D. EXCAVATED MATERIAL MEETING SPECIFICATIONS MAY BE USED FOR BACKFILL IN TRENCHES. IN THE EVENT EXCAVATED MATERIAL DOES NOT MEET SPECIFICATIONS, PROVIDE GRANULAR BACKFILL AS SPECIFIED FOR BACKFILL. REMOVE UNSUITABLE MATERIAL FROM SITE.
E. UNLESS OTHERWISE NOTED, TOP OF CONDUIT SHALL BE 30" BELOW FINISHED GRADE.
F. PROVIDE 3" SEPARATION BETWEEN LINE VOLTAGE CONDUITS. PROVIDE 6" SEPARATION BETWEEN LINE VOLTAGE AND COMMUNICATION CONDUITS.

D3 TYPICAL REINFORCED CONCRETE ENCASED DUCTBANK DETAIL
SCALE: NOT TO SCALE



D3 TYPICAL LIGHTPOLE DETAIL
SCALE: NOT TO SCALE



D3 ABOVE GRADE CONDUIT ENTRANCE DETAIL
SCALE: NOT TO SCALE

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PROPOSED PARKING EXPANSION
1827 FILLMORE, LLC
1827 FILLMORE AVENUE
BUFFALO, NEW YORK

MARK	DATE	DESCRIPTION
		REVISIONS

PROJECT NO: V14.002.001
DATE: JUNE 6, 2019
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DESIGNED BY: W.R.B.
CHECKED BY: S.H.S

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PARKING LOT LIGHTING DETAILS

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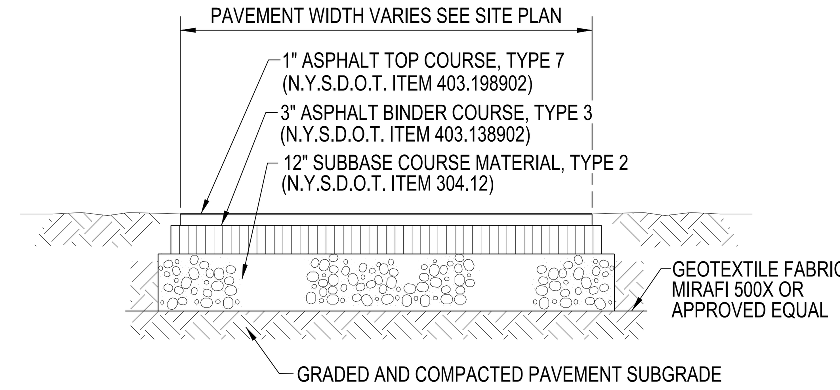
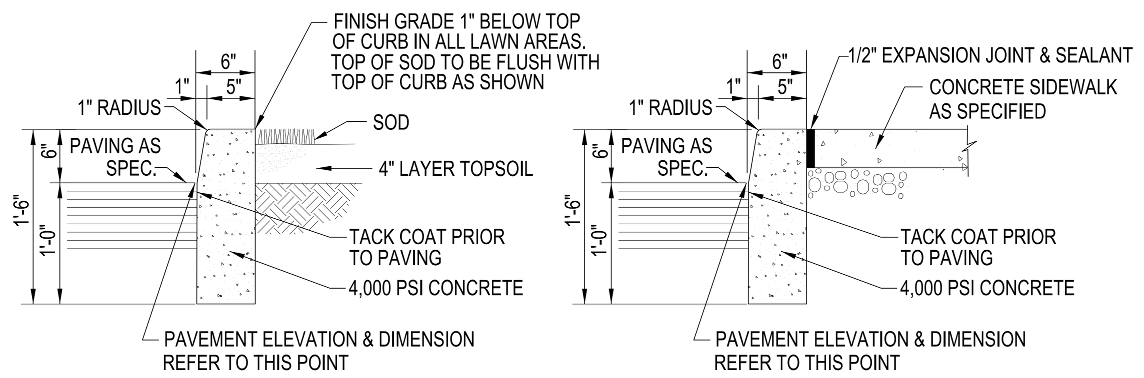


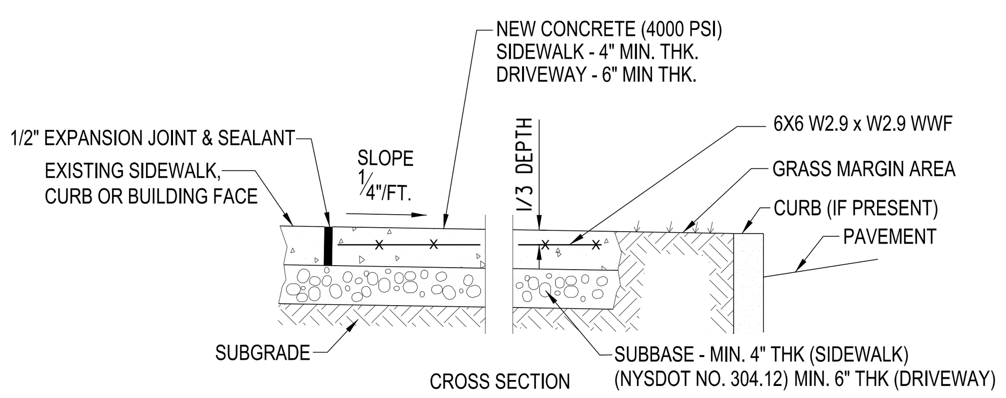
NOTE: CONSTRUCTION METHODS FOR ASPHALT PAVEMENT SHALL CONFORM TO NYSDOT STANDARD SPECIFICATION 401-3, WITH SUBBASE CONSTRUCTION METHODS CONFORMING TO NYSDOT STANDARD SPECIFICATION 304-3.

STANDARD DUTY ASPHALT SECTION (1)
N.T.S.



NOTE: CONTROL JOINTS TO BE 2" DEEP AT 15'-0" SEE SPECIFICATIONS FOR FURTHER JOINT REQUIREMENTS NYSDOT 702-0700

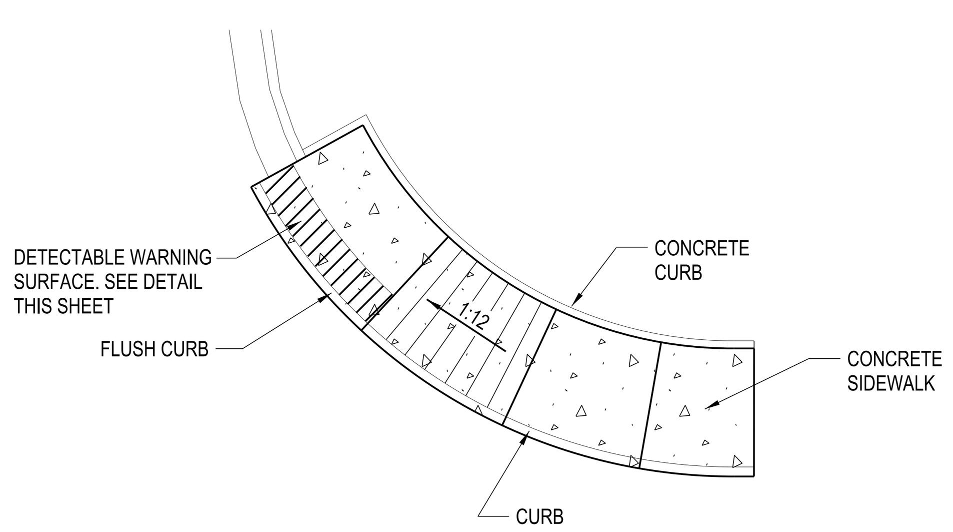
CONCRETE CURB (2)
N.T.S.



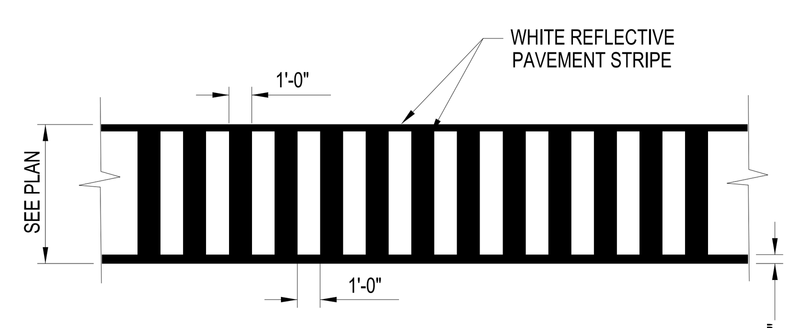
NOTES:

1. CONTROL JOINTS TO BE AT 5'-0" O.C. BOTH WAYS OR AS SHOWN ON DRAWINGS SEAL JOINTS PER SPECIFICATIONS
2. CONCRETE SIDEWALK AND DRIVEWAY MATERIAL SHALL CONFORM TO NYSDOT STANDARD SPECIFICATION 501 AND CONSTRUCTION METHODS SHALL CONFORM TO NYSDOT STANDARD SPECIFICATION 608-3.

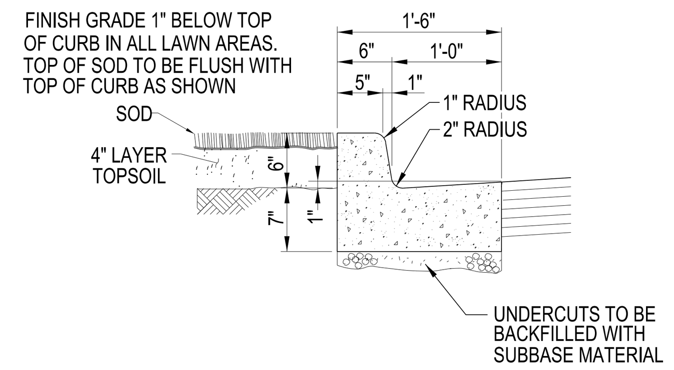
CONCRETE SIDEWALK (3)
N.T.S.



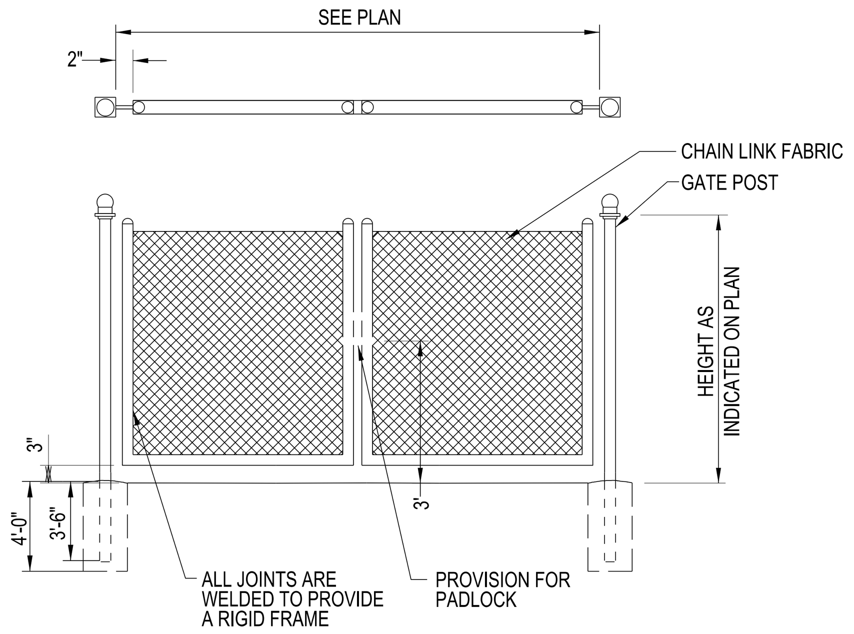
ACCESSIBLE CURB RAMP (4)
N.T.S.



PEDESTRIAN CROSSWALK DETAIL (5)
N.T.S.

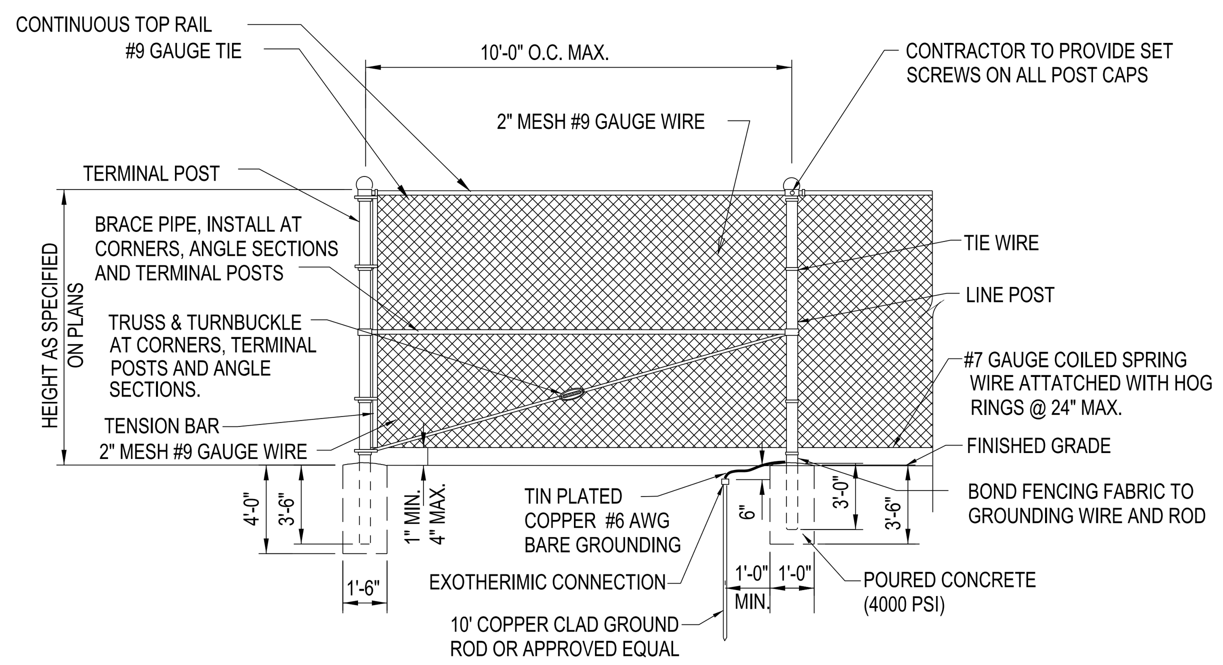


CONCRETE CURB & GUTTER (6)
N.T.S.



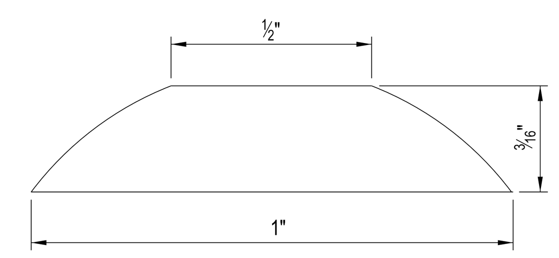
NOTE: PROVIDE BRACING IN GATE WHERE REQ'D

DOUBLE GATE DETAIL (7)
N.T.S.

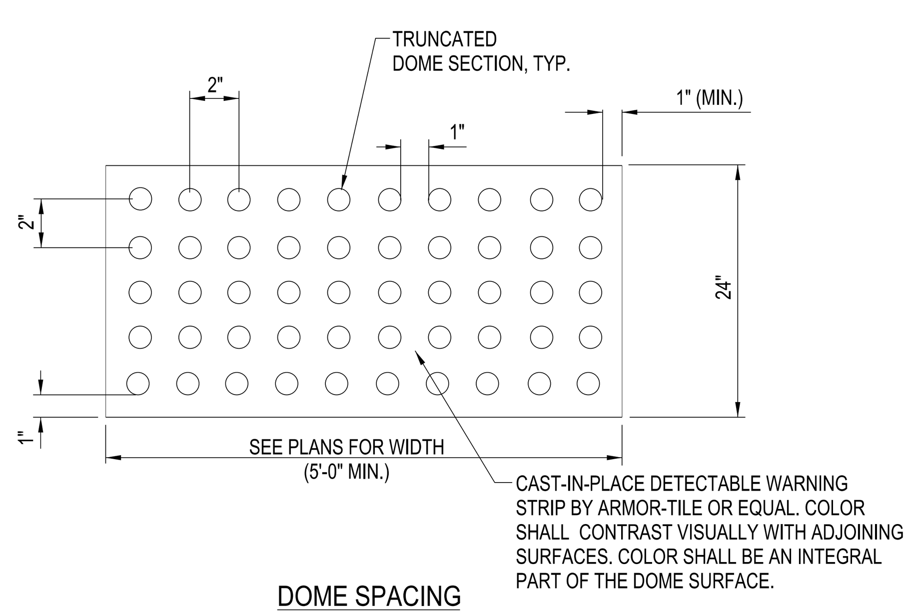


NOTE: CHAIN LINK FENCE TO BE BLACK VINYL COATED

CHAIN LINK FENCE DETAIL (8)
N.T.S.



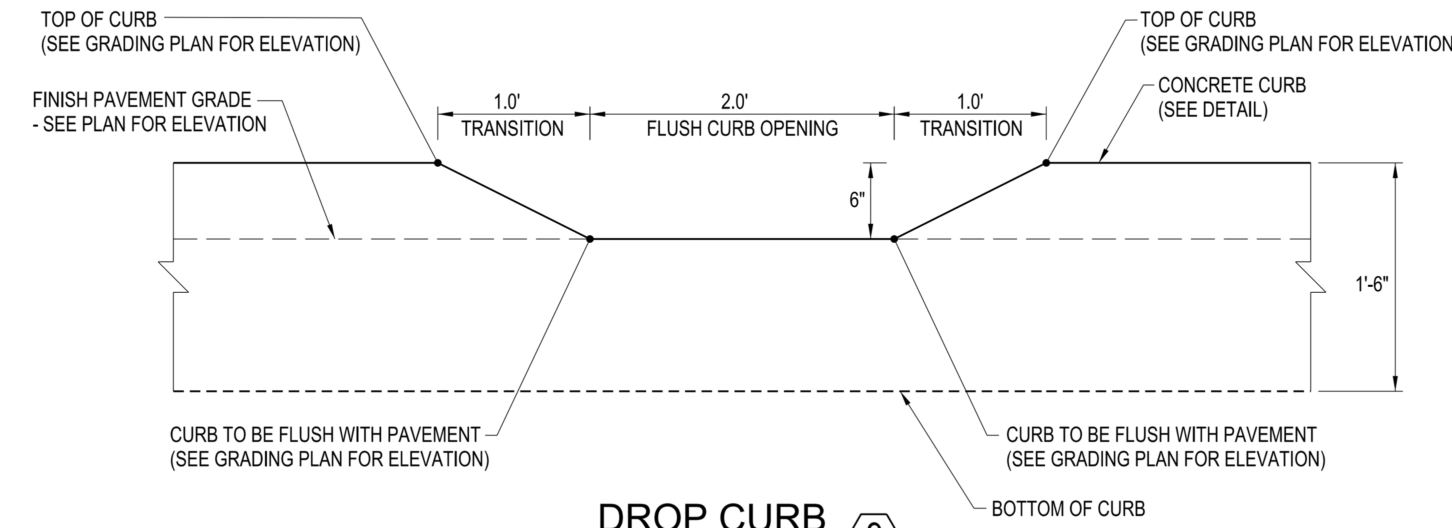
TRUNCATED DOME SECTION



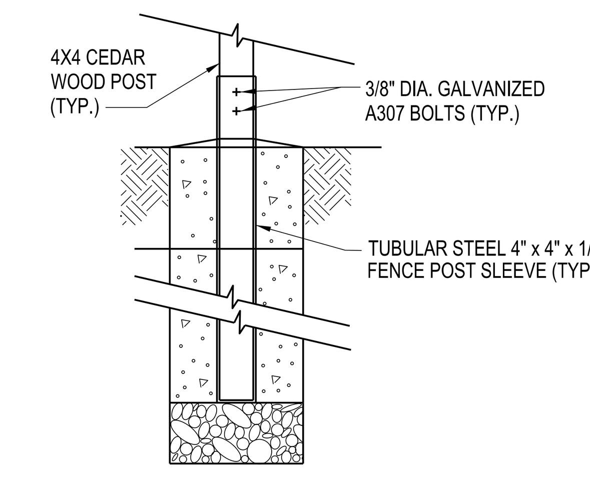
DOME SPACING

NOTE:
DETECTABLE WARNING DEVICES SHALL BE PER 2010 ADA STANDARDS SECTION 705 OR THE MOST CURRENT UPDATE

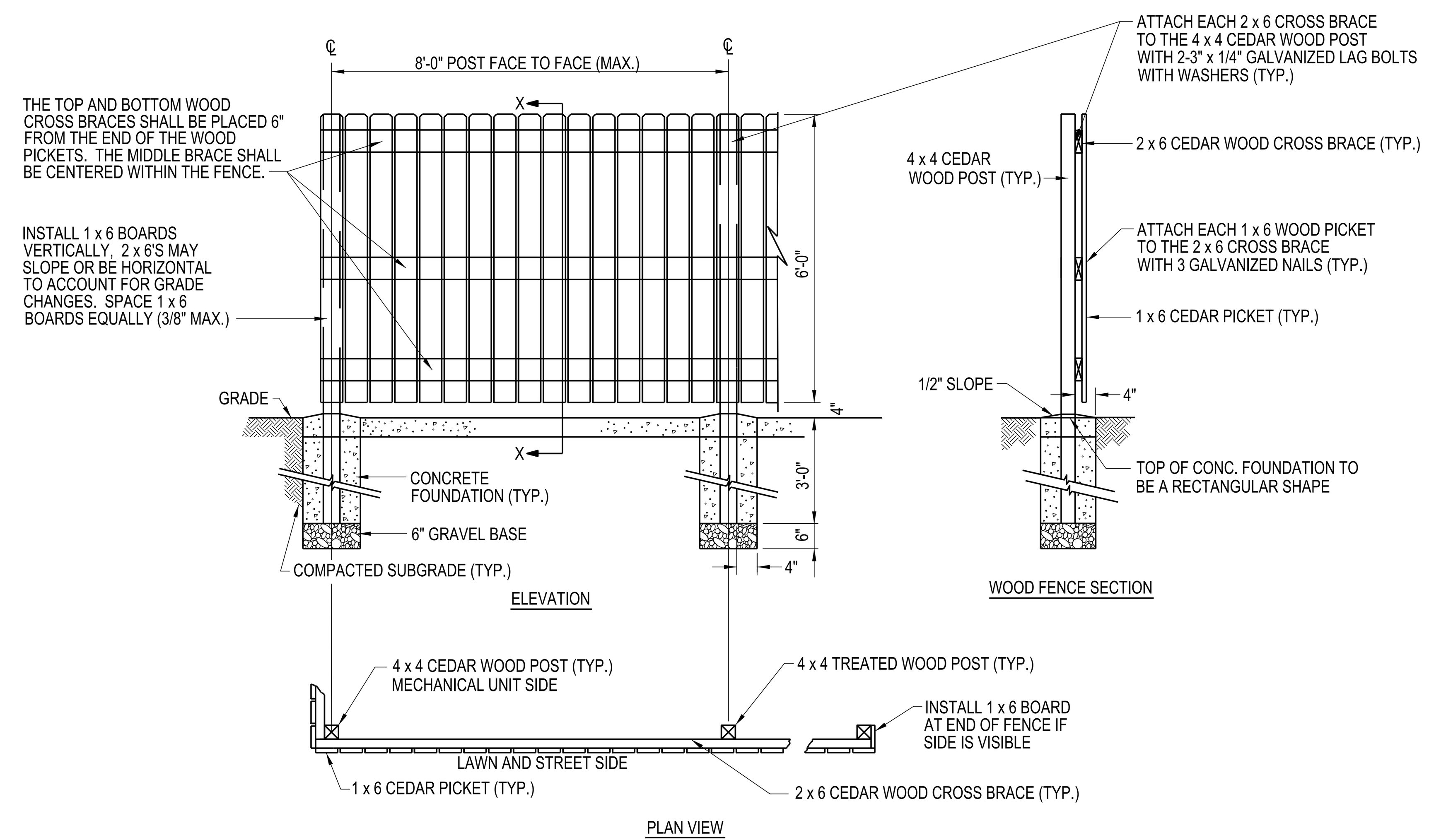
DETECTABLE WARNING SURFACE
N.T.S.



DROP CURB (9)
N.T.S.



WOOD POST DETAILS



BOARD FENCE DETAIL (10)
N.T.S.

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PROPOSED ERIE COUNTY MEDICAL CENTER
PARKING EXPANSION
1827 FILLMORE, LLC
1827 FILLMORE AVENUE
BUFFALO, NEW YORK

MARK	DATE	DESCRIPTION
REVISIONS		

PROJECT NO:	V14.002.001
DATE:	6-6-2019
SCALE:	AS SHOWN
DRAWN BY:	JMH
DESIGNED BY:	VO
CHECKED BY:	VO

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SITE DETAILS

C-501

USER **DATE** **SYTIME** **TIME**

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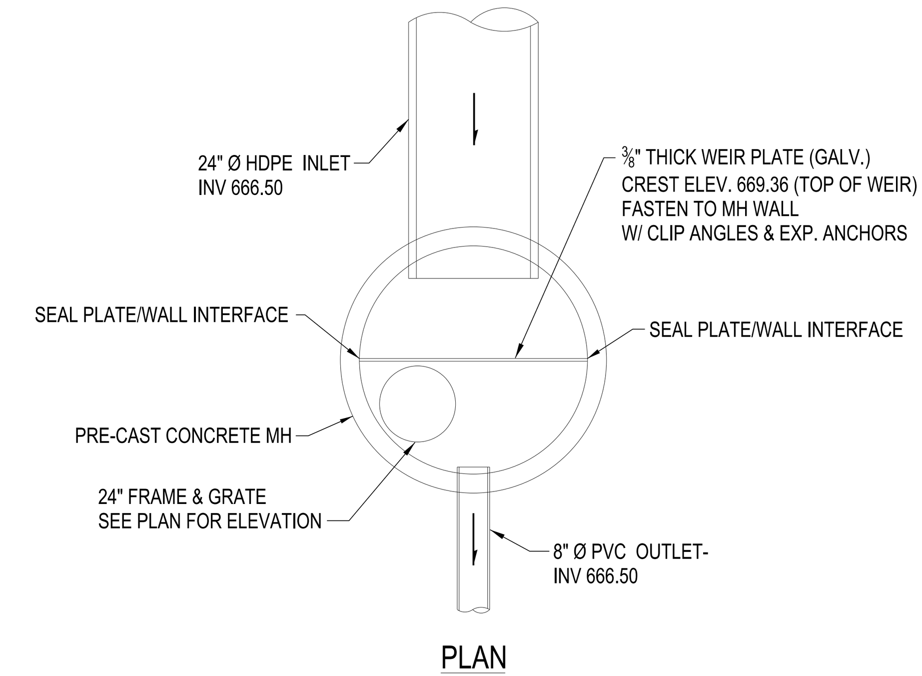
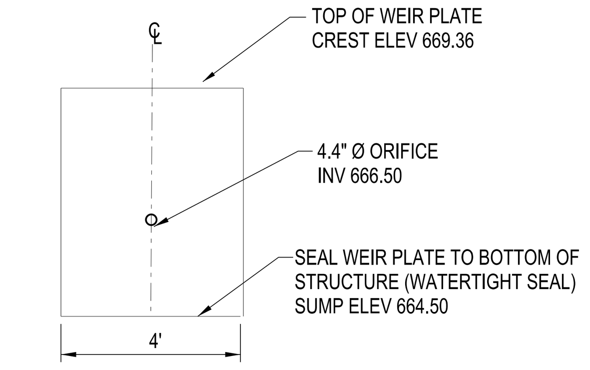


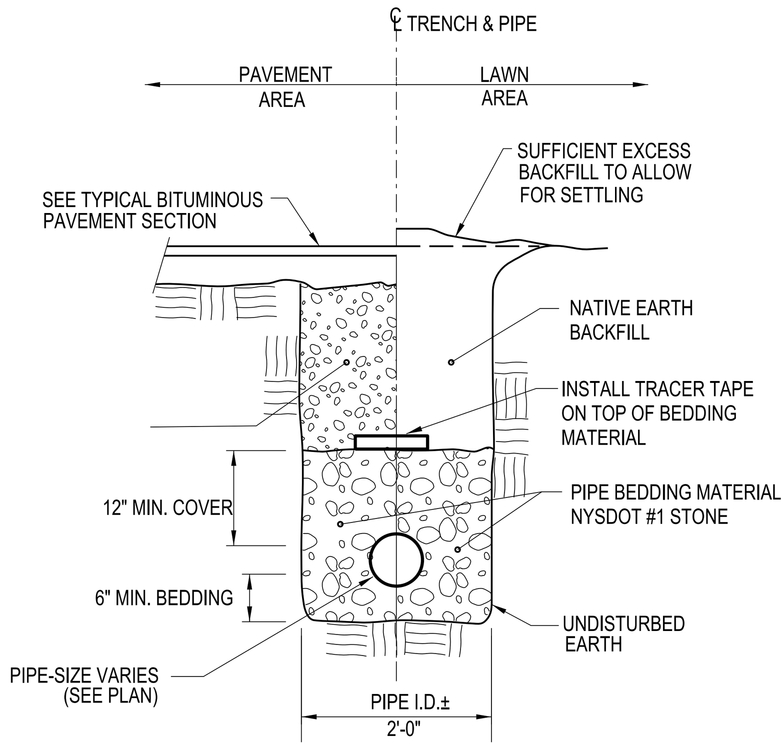
PLAN

STORMWATER CONTROL STRUCTURE DETAIL
N.T.S.

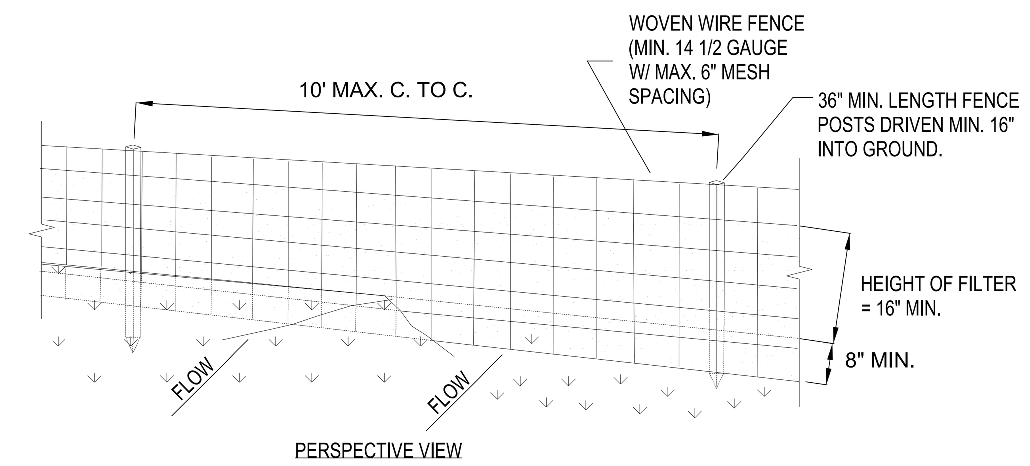


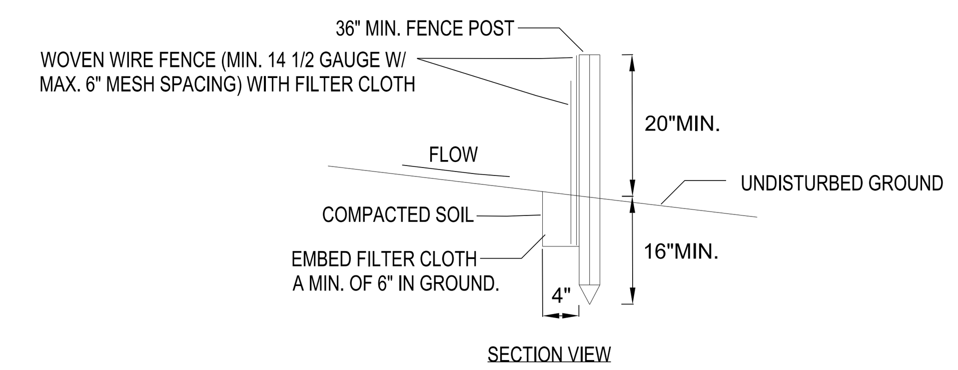
WEIR PLATE - ELEVATION VIEW
N.T.S.

COMPACTED NYSDOT
TYPE II CRUSHER
RUN STONE



UTILITY TRENCH SECTION
N.T.S.





CONSTRUCTION SPECIFICATIONS

1. WOVEN WIRE FENCE TO BE FASTENED SECURELY TO FENCE POSTS WITH WIRE TIES OR STAPLES. POSTS SHALL BE STEEL EITHER "T" OR "U" TYPE OR HARDWOOD.

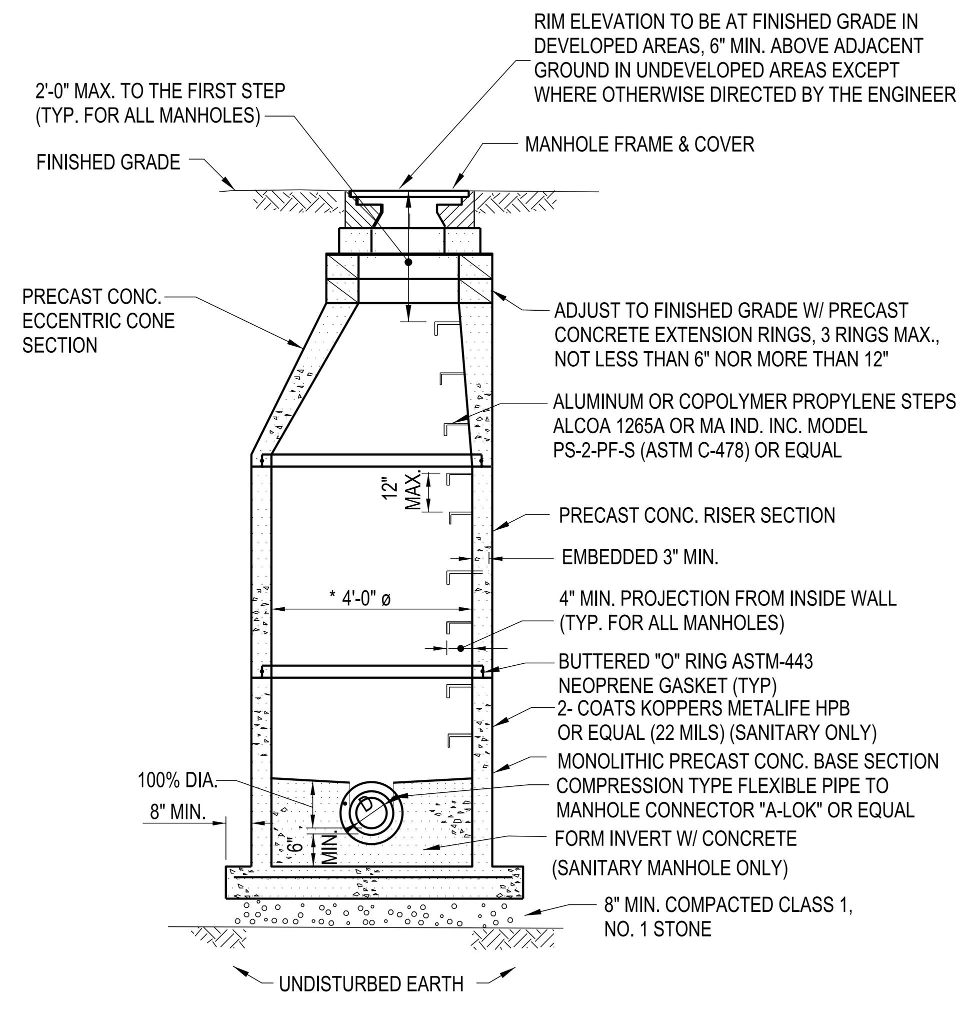
2. FILTER CLOTH TO BE TO BE FASTENED SECURELY TO WOVEN WIRE FENCE WITH TIES SPACED EVERY 24" AT TOP AND MID SECTION. FENCE SHALL BE WOVEN WIRE, 12 1/2 GAUGE, 6" MAXIMUM MESH OPENING.

3. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN EACH OTHER THEY SHALL BE OVER-LAPPED BY SIX INCHES AND FOLDED. FILTER CLOTH SHALL BE EITHER FILTER X, MIRAFI 100X, STABILINKA T140N, OR APPROVED EQUIVALENT.

4. PREFABRICATED UNITS SHALL BE GEOFAB, ENVIROFENCE, OR APPROVED EQUIVALENT.

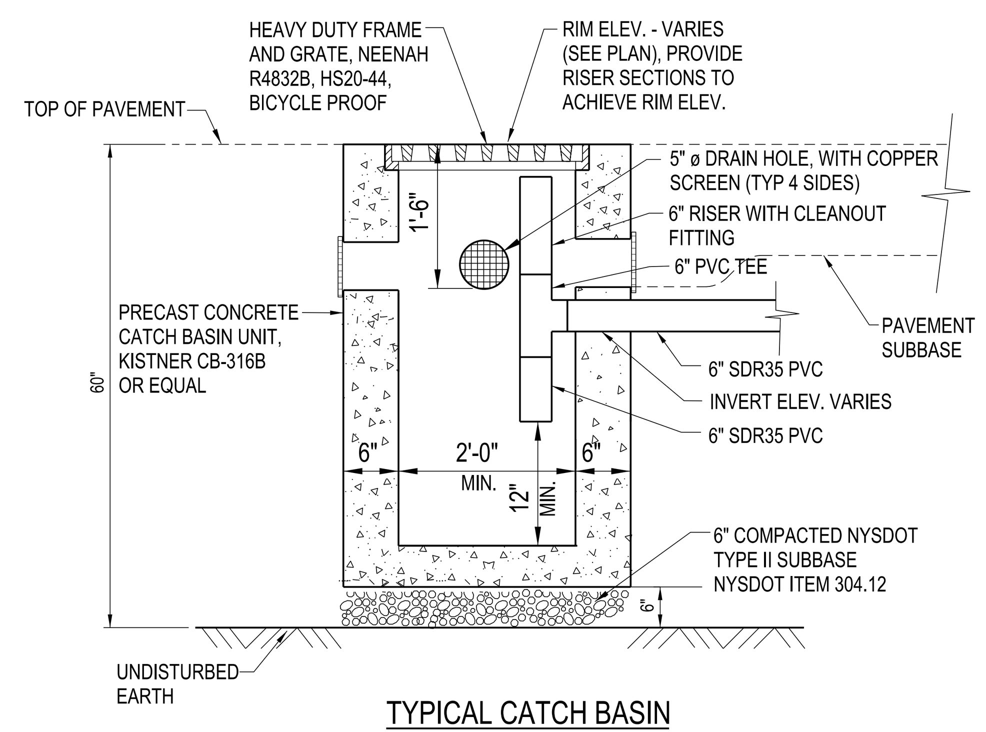
5. MAINTENANCE SHALL BE PERFORMED AS NEEDED AND MATERIAL REMOVED WHEN "BULGES" DEVELOP IN THE SILT FENCE.

SILT FENCE
N.T.S.

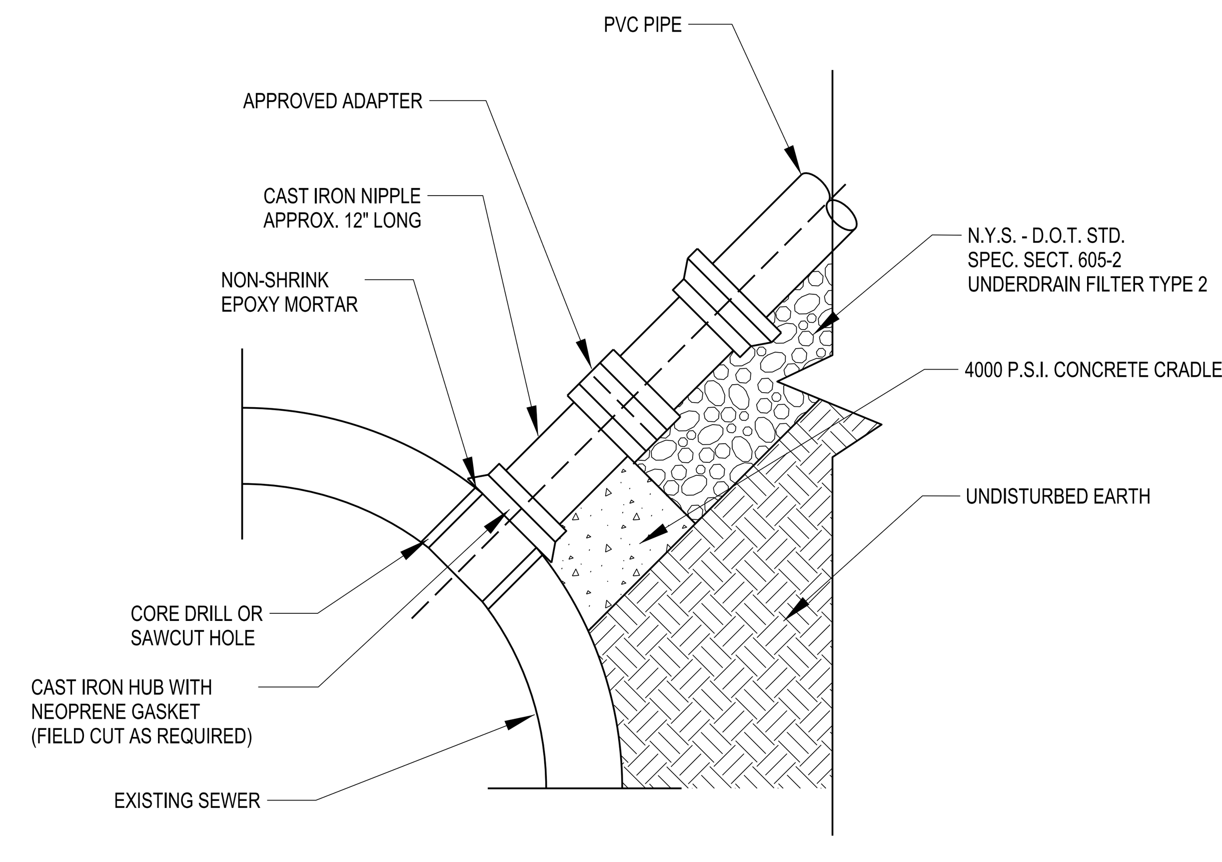


NOTE: PROVIDE HEAVY DUTY NEENAH
R-1792-FG OPEN GRATE AND
FRAME FOR ALL STORM MANHOLES

PRECAST CONCRETE MANHOLE DETAIL
N.T.S.

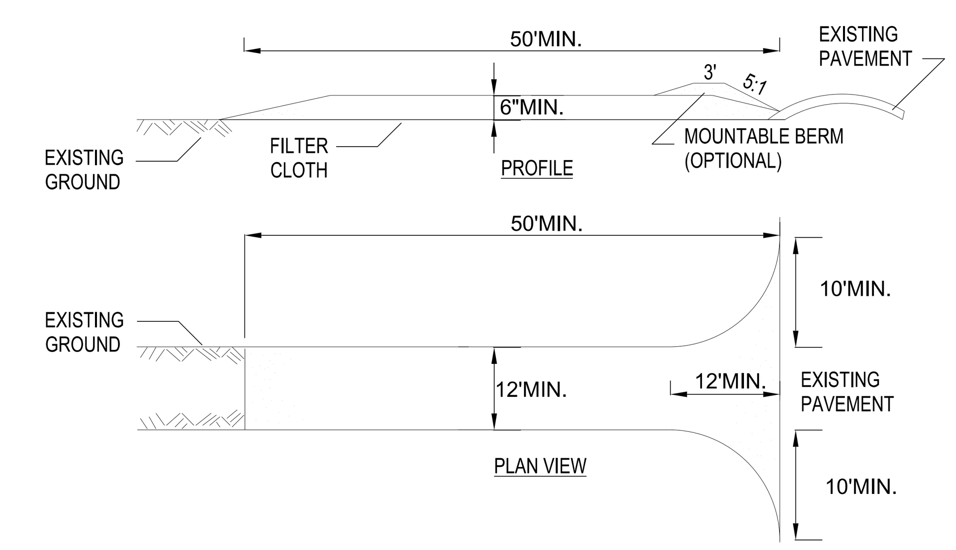


TYPICAL CATCH BASIN
(CITY OF BUFFALO) N.T.S.
NOTE: SEE CITY OF BUFFALO DETAIL
FOR ADDITIONAL INFORMATION



* ALL WORK PERFORMED UNDER THE SUPERVISION OF A LICENSED MASTER PLUMBER

TYPICAL CONNECTION TO EXISTING SEWER
N.T.S.



CONSTRUCTION SPECIFICATIONS

1. STONE SIZE - USE 2" STONE, OR RECLAIMED OR RECYCLED CONCRETE EQUIVALENT.

2. LENGTH - NOT LESS THAN 50 FEET (EXCEPT ON A SINGLE RESIDENCE LOT WHERE A 30 FOOT MINIMUM LENGTH WOULD APPLY).

3. THICKNESS - NOT LESS THAN SIX (6) INCHES.

4. WIDTH - TWELVE (12) FOOT MINIMUM, BUT NOT LESS THAN THE FULL WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCURS. TWENTY-FOUR (24) FOOT IF SINGLE ENTRANCE TO SITE.

5. FILTER CLOTH - WILL BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING OF STONE.

6. SURFACE WATER - ALL SURFACE WATER FLOWING OR DIVERTED TOWARD CON-STRUCTION ENTRANCES SHALL BE PIPED ACROSS THE ENTRANCE. IF PIPING IS IMPRACTICAL, A MOUNTABLE BERM WITH 5:1 SLOPES WILL BE PERMITTED.

7. MAINTENANCE - THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS-OF-WAY, ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACTED ONTO PUBLIC RIGHTS-OF-WAY MUST BE REMOVED IMMEDIATELY.

8. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON A AREA STABILIZED WITH STONE AND WHICH DRAINS INTO AN APPROVED SEDIMENT TRAPPING DEVICE.

9. PERIODIC INSPECTION AND NEEDED MAINTENANCE SHALL BE PROVIDED AFTER EACH RAIN.

STABILIZED CONSTRUCTION ENTRANCE
N.T.S.

EROSION CONTROL NOTES:

THE FOLLOWING EROSION CONTROL PROCEDURE SHALL BE ADHERED TO BY THE CONTRACTOR:

1. INSTALL TEMPORARY SILT FENCE BARRIERS AS SHOWN ON THE PLAN AND AT ALL EXISTING STORMWATER CATCH BASINS WITHIN THE WORK AREA TO PREVENT SEDIMENT MIGRATION. ALL SILT FENCE BARRIERS SHALL BE INSTALLED IN ACCORDANCE WITH THE DETAILS SHOWN ON THE PLANS.

2. THE TOPSOIL SHALL BE STRIPPED AND STOCKPILED ON SITE FOR RE-USE AS DIRECTED BY THE OWNER. ALL LOCAL ORDINANCES REGARDING THE SALE AND/OR REMOVAL OF TOPSOIL FROM SITE MUST BE FOLLOWED.

3. ALL SILT FENCE BARRIERS SHALL BE REPLACED WHEREVER THEY BECOME CLOGGED OR INOPERABLE.

4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTENANCE AND REMOVAL OF TEMPORARY SEDIMENTATION CONTROLS.

5. THE CONTRACTOR MUST CONTROL DUST DURING CONSTRUCTION. DURING EARTHWORK OPERATIONS, WATER-SPREADING EQUIPMENT SHALL BE PROVIDED BY THE CONTRACTOR, AND WATER SPREAD AS NECESSARY AND AS DIRECTED BY THE OWNER IN ORDER TO CONTROL DUST.

6. DIRT OR DEBRIS LEFT ON LOCAL PUBLIC ROADS AS A RESULT OF THIS CONSTRUCTION PROJECT SHALL BE REMOVED AND ROAD SURFACES CLEANED BY THE CONTRACTOR ON A DAILY BASIS.

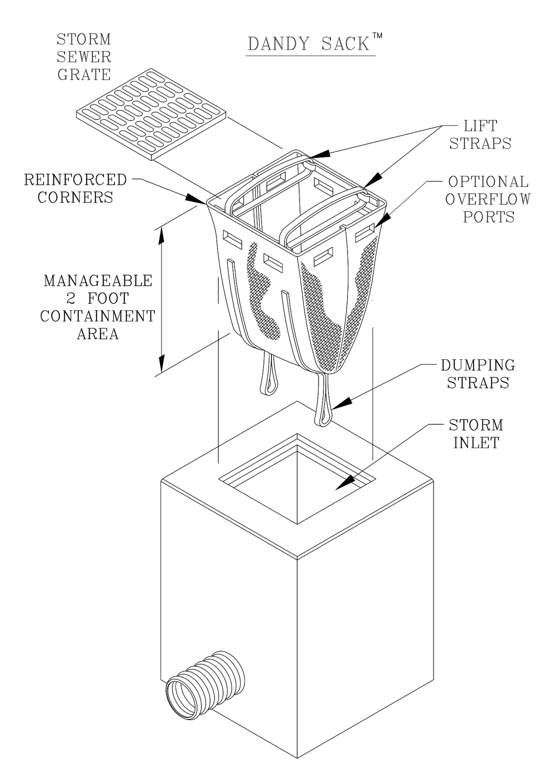
7. ALL DISTURBED AREAS (EXCEPT AREAS TO BE PAVED OR BUILT UPON) SHALL BE TOPSOILED TO A MINIMUM 4" DEPTH AND SEEDED IMMEDIATELY AFTER FINE GRADING TAKES PLACE AND AS SOON AS PHYSICALLY POSSIBLE.

8. THE CONTRACTOR IS RESPONSIBLE FOR THE MAINTENANCE OF DOWNSTREAM STORM SEWERS, DITCHES, AND CULVERTS. SILT BUILDUP FOUND TO BE A RESULT OF THIS SITE CONSTRUCTION WORK SHALL BE REMOVED FROM DOWNSTREAM CULVERTS BY THE CONTRACTOR AT NO ADDITIONAL EXPENSE TO THE OWNER OR THE TOWN.

9. IN ADDITION TO STORM WATER DISCHARGES, THE FOLLOWING NON-STORM WATER DISCHARGES MAY CONTRIBUTE TO THE RUNOFF FROM THE SITE:

* WATER FROM WATER SERVICE FLUSHINGS
* WATER USED TO WASH DOWN CONSTRUCTION VEHICLES (NO DETERGENTS)
* WATER USED FOR DUST CONTROL
* UNCONTAMINATED GROUNDWATER

THE ABOVE NON-STORM WATER FLOWS SHALL BE TREATED IN THE SAME MANNER AS STORM WATER FLOWS INDICATED HEREIN.



DANDY SACK™ SPECIFICATIONS

NOTE: THE DANDY SACK™ WILL BE MANUFACTURED IN THE U.S.A. FROM A WOVEN MONOFILAMENT FABRIC THAT MEETS OR EXCEEDS THE FOLLOWING SPECIFICATIONS:

REGULAR FLOW DANDY SACK™ (BLACK)

Mechanical Properties	Test Method	Units	MARV
Grab Tensile Strength	ASTM D 4632	kN (lbs)	1.78 (400) x 1.40 (315)
Grab Tensile Elongation	ASTM D 4632	%	15 x 15
Puncture Strength	ASTM D 4833	kN (lbs)	0.67 (150)
Mullen Burst Strength	ASTM D 3786	kPa (psi)	5506 (800)
Trapezoid Tear Strength	ASTM D 4533	kN (lbs)	0.67 (150) x 0.73 (165)
UV Resistence	ASTM D 4355	%	90
Apparent Opening Size	ASTM D 4751	Mm (US Std Sieve)	0.425 (40)
Flow Rate	ASTM D 4491	$1/min/m^2$ ($gal/min/ft^2$)	2852 (70)
Permittivity	ASTM D 4491	Sec^{-1}	0.90

HI-FLOW DANDY SACK™ (SAFETY ORANGE)

Mechanical Properties	Test Method	Units	MARV
Grab Tensile Strength	ASTM D 4632	kN (lbs)	1.62 (365) X 0.89 (200)
Grab Tensile Elongation	ASTM D 4632	%	24 X 10
Puncture Strength	ASTM D 4833	kN (lbs)	0.40 (90)
Mullen Burst Strength	ASTM D 3786	kPa (psi)	3097 (450)
Trapezoid Tear Strength	ASTM D 4533	kN (lbs)	0.51 (115) X 0.33 (75)
UV Resistence	ASTM D 4355	%	90
Apparent Opening Size	ASTM D 4751	Mm (US Std Sieve)	0.425 (40)
Flow Rate	ASTM D 4491	$1/min/m^2$ ($gal/min/ft^2$)	5907 (145)
Permittivity	ASTM D 4491	Sec^{-1}	2.1

*Note: All Dandy Sacks™ can be ordered with our optional oil absorbent pillows

FILTER SACK INLET PROTECTION
N.T.S.

C&S COMPANIES®
C&S Engineers, Inc.
141 Elm St. Suite 100
Buffalo, New York 14203
Phone: 716-847-1630
Fax: 716-847-1454
www.cscos.com

PROPOSED ERIE COUNTY MEDICAL CENTER
PARKING EXPANSION
1827 FILLMORE, LLC
1827 FILLMORE AVENUE
BUFFALO, NEW YORK

MARK	DATE	DESCRIPTION
		REVISIONS

PROJECT NO:	V14.002.001
DATE:	6-6-2019
SCALE:	AS SHOWN
DRAWN BY:	JMH
DESIGNED BY:	VO
CHECKED BY:	VO

NO ALTERATION PERMITTED HEREON EXCEPT AS PROVIDED UNDER SECTION 7209 SUBDIVISION 2 OF THE NEW YORK EDUCATION LAW

UTILITY &
EROSION & SEDIMENT
CONTROL DETAILS

C-502

USER **DATE** **TIME** **SYTIME**

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PROJECT INFORMATION

ENGINEERED PRODUCT MANAGER:	IAN KUCHMAN 585-472-1312 IAN.KUCHMAN@ADS-PIPE.COM
ADS SALES REP:	DAVE ESNER 716-860-4608 DAVE.ESNER@ADS-PIPE.COM
PROJECT NO:	S129408

ADVANCED DRAINAGE SYSTEMS, INC.

SiteASSIST™ FOR STORMTECH INSTRUCTIONS, DOWNLOAD THE INSTALLATION APP

ECMC PARKING EXPANSION - 1827 FILLMORE AVE

BUFFALO - NY

MC-4500 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH MC-4500.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 60x101.
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS [illegible]
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 500 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION [illegible] REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF MC-4500 CHAMBER SYSTEM

1. STORMTECH MC-4500 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH MC-4500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM 9" (230 mm) SPACING BETWEEN THE CHAMBER ROWS.
7. INLET AND OUTLET MANIFOLDS MUST BE INSERTED A MINIMUM OF 12" (300 mm) INTO CHAMBER END CAPS.
8. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE MEETING THE AASHTO M43 DESIGNATION OF #3 OR #4.
9. STONE SHALL BE BROUGHT UP EVENLY AROUND CHAMBERS SO AS NOT TO DISTORT THE CHAMBER SHAPE. STONE DEPTHS SHOULD NEVER DIFFER BY MORE THAN 12" (300 mm) BETWEEN ADJACENT CHAMBER ROWS.
10. STONE MUST BE PLACED ON THE TOP CENTER OF THE CHAMBER TO ANCHOR THE CHAMBERS IN PLACE AND PRESERVE ROW SPACING.
11. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIAL BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
12. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH MC-4500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
2. THE USE OF EQUIPMENT OVER MC-4500 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADER, DUMP TRUCK, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. FULL 36" (900 mm) OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY USING THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

PROPOSED LAYOUT

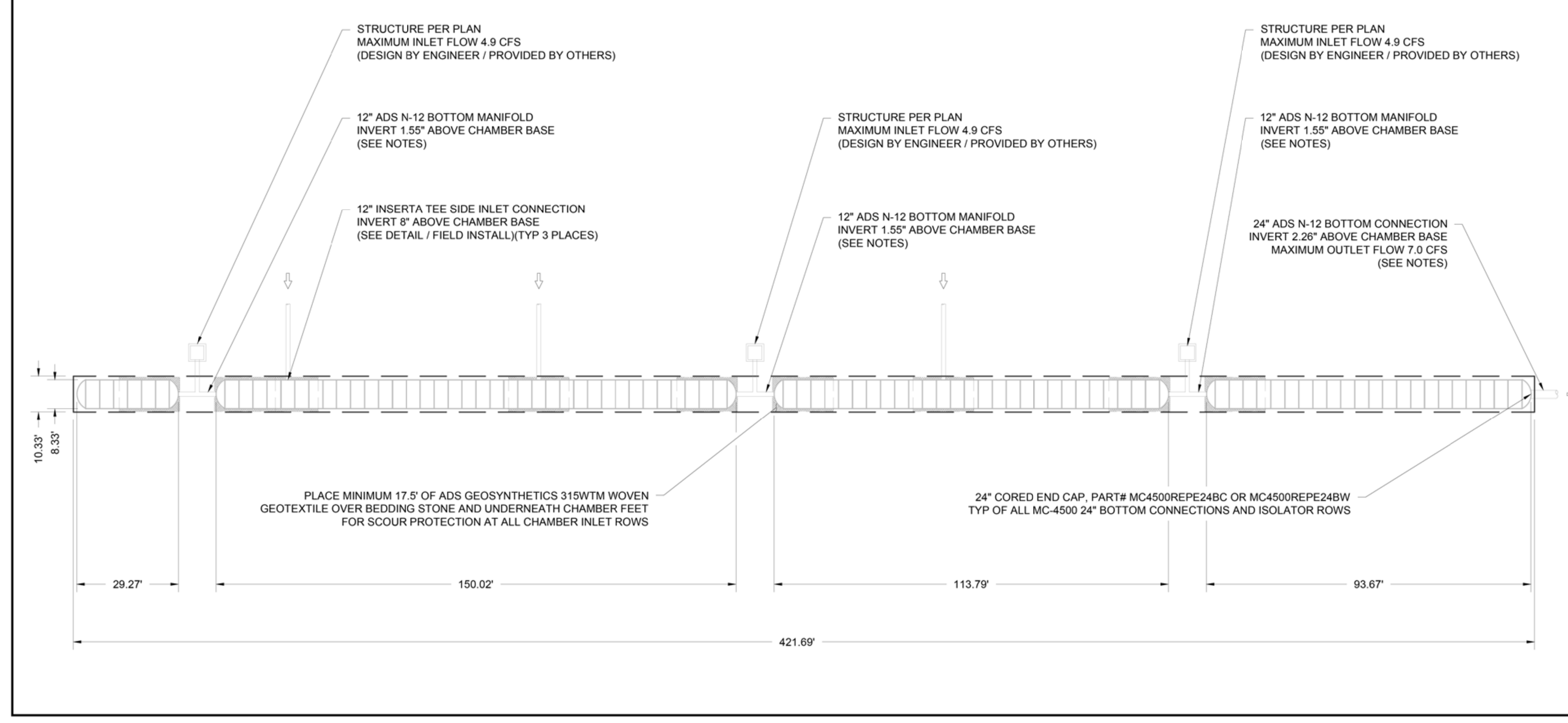
91	STORMTECH MC-4500 CHAMBERS
8	STORMTECH MC-4500 END CAPS
12	STONE ABOVE (in)
9	STONE BELOW (in)
40	% STONE VOID
17751	**INSTALLED SYSTEM VOLUME (CF) (PERIMETER STONE INCLUDED)**
16443	**INSTALLED SYSTEM VOLUME (CF) (PERIMETER STONE INCLUDED) ABOVE ELEVATION 666.50**
4357	[illegible]
864	SYSTEM PERIMETER (ft)

PROPOSED ELEVATIONS

678.50	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED)
674.00	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC)
673.50	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC)
673.50	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT)
673.50	MINIMUM ALLOWABLE GRADE (TOP OF RIGID PAVEMENT)
672.50	TOP OF STONE
671.50	TOP OF MC-4500 CHAMBER
667.17	INSERTA TEE SIDE INLET CONNECTION INVERT
666.69	24" BOTTOM CONNECTION INVERT
666.63	12" BOTTOM MANIFOLD INVERT
666.50	BOTTOM OF MC-4500 CHAMBER
665.75	BOTTOM OF STONE

NOTES

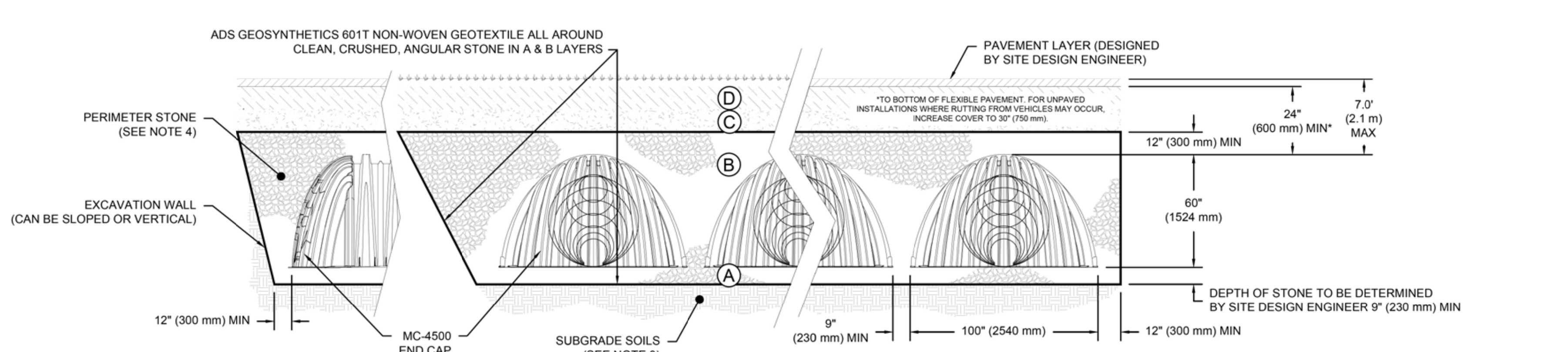
- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH SHEET #7 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- THE STORMTECH SYSTEM DEPICTED DOES NOT INCLUDE WATER QUALITY MEASURES AND/OR DOES NOT PROVIDE THE ABILITY TO BE INSPECTED, CLEANED, AND MAINTAINED. NOT MAINTAINING THE SYSTEM MAY LEAD TO A DECREASE IN STORAGE VOLUME OVER TIME. ADS RECOMMENDS THE USE OF THE ISOLATOR ROW ON ALL STORMTECH SYSTEMS.



ACCEPTABLE FILL MATERIALS: STORMTECH MC-4500 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 24" (600 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145•• A-1, A-2-4, A-3 OR AASHTO M43•• 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS.
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43•• 3, 4	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43•• 3, 4	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.

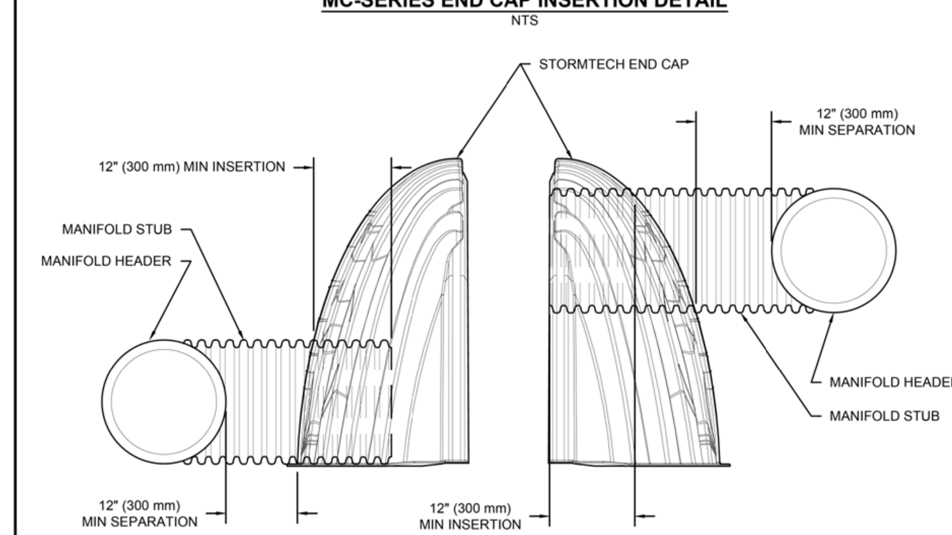


NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 60x101
2. MC-4500 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - [illegible]
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 500 LBS/IN/IN. [illegible]

MC-SERIES END CAP INSERTION DETAIL

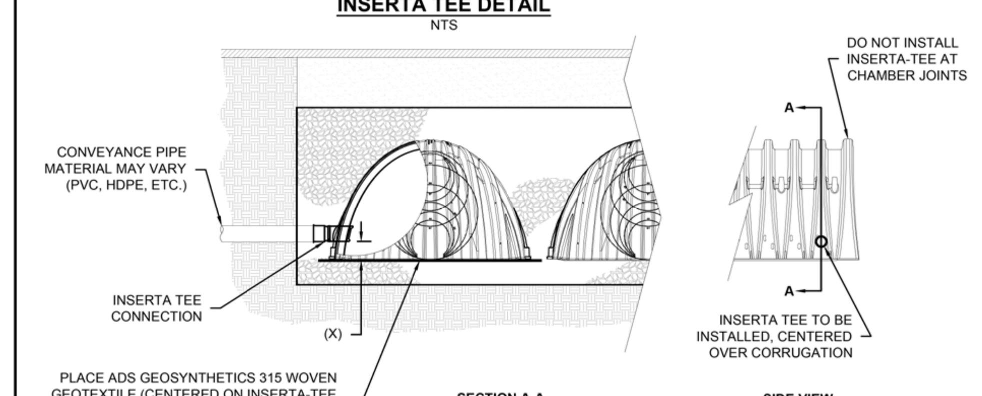
NTS



NOTE: MANIFOLD STUB MUST BE LAID HORIZONTAL FOR A PROPER FIT IN END CAP OPENING.

INSERTA TEE DETAIL

NTS

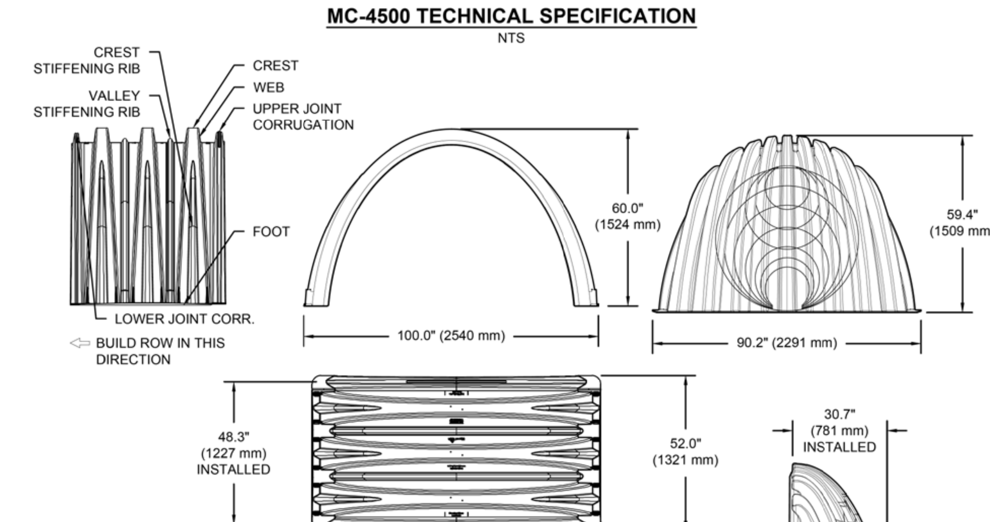


CHAMBER	MAX DIAMETER OF INSERTA TEE	HEIGHT FROM BASE OF CHAMBER (X)
SC-310	6" (150 mm)	4" (100 mm)
SC-740	10" (250 mm)	4" (100 mm)
DC-780	10" (250 mm)	4" (100 mm)
MC-3500	12" (300 mm)	6" (150 mm)
MC-4500	12" (300 mm)	8" (200 mm)
INSERTA TEE FITTINGS AVAILABLE FOR SDR 26, SDR 35, SCH 40 IPS GASKETED & SOLVENT WELD, N-12, HP STORM, C-900 OR DUCTILE IRON		

NOTE:
PART NUMBERS WILL VARY BASED ON INLET PIPE MATERIALS. CONTACT STORMTECH FOR MORE INFORMATION.

MC-4500 TECHNICAL SPECIFICATION

NTS



NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	100.0" X 60.0" X 48.3"	(2540 mm X 1524 mm X 1227 mm)
CHAMBER STORAGE	106.5 CUBIC FEET	[illegible]
MINIMUM INSTALLED STORAGE*	162.6 CUBIC FEET	[illegible]
WEIGHT	130.0 lbs.	(59.0 kg)

NOMINAL END CAP SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	90.2" X 59.4" X 30.7"	(2291 mm X 1509 mm X 781 mm)
END CAP STORAGE	35.7 CUBIC FEET	[illegible]
MINIMUM INSTALLED STORAGE*	108.7 CUBIC FEET	[illegible]
WEIGHT	135.0 lbs.	(61.2 kg)

*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION AND BETWEEN CHAMBERS, 12" (305 mm) STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY.

STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
END CAPS WITH A WELDED CROWN PLATE END WITH "C"
END CAPS WITH A PREFABRICATED WELDED STUB END WITH "W"

PART #	STUB	B	C
MC4500REPE06T	6" (150 mm)	42.54" (1.081 m)	---
MC4500REPE06B		---	0.86" (22 mm)
MC4500REPE08T	8" (200 mm)	40.50" (1.029 m)	---
MC4500REPE08B		---	1.01" (26 mm)
MC4500REPE10T	10" (250 mm)	38.37" (975 mm)	---
MC4500REPE10B		---	1.33" (34 mm)
MC4500REPE12T	12" (300 mm)	35.69" (907 mm)	---
MC4500REPE12B		---	1.55" (39 mm)
MC4500REPE15T	15" (375 mm)	32.72" (831 mm)	---
MC4500REPE15B		---	1.70" (43 mm)
MC4500REPE18TC	18" (450 mm)	29.36" (746 mm)	---
MC4500REPE18TW			
MC4500REPE18BC		---	1.97" (50 mm)
MC4500REPE18BW			
MC4500REPE24TC	24" (600 mm)	23.05" (585 mm)	---
MC4500REPE24TW			
MC4500REPE24BC		---	2.26" (57 mm)
MC4500REPE24BW			
MC4500REPE30BC	30" (750 mm)	---	2.95" (75 mm)
MC4500REPE36BC	36" (900 mm)	---	3.25" (83 mm)
MC4500REPE42BC	42" (1050 mm)	---	3.55" (90 mm)

NOTE: ALL DIMENSIONS ARE NOMINAL

CUSTOM PRECORED INVERTS ARE AVAILABLE UPON REQUEST. INVENTORIED MANIFOLDS INCLUDE 12-24" (300-600 mm) SIZE ON SIZE AND 15-48" (375-1200 mm) ECCENTRIC MANIFOLDS. CUSTOM INVERT LOCATIONS ON THE MC-4500 END CAP CUT IN THE FIELD ARE NOT RECOMMENDED FOR PIPE SIZES GREATER THAN 10" (250 mm). THE INVERT LOCATION IN COLUMN 'B' ARE THE HIGHEST POSSIBLE FOR THE PIPE SIZE.

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BUFFALO - NY
DATE: 04-16-19 DRAWN: DRW
PROJECT #: S129408 CHECKED: CTS

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SHEET 3 OF 4

SHEET 4 OF 4

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PROPOSED ERIE COUNTY MEDICAL CENTER
PARKING EXPANSION
1827 FILLMORE, LLC
1827 FILLMORE AVENUE
BUFFALO, NEW YORK

MARK	DATE	DESCRIPTION
REVISIONS		

PROJECT NO:	V14.002.001
DATE:	6-6-2019
SCALE:	AS SHOWN
DRAWN BY:	JMH
DESIGNED BY:	VO
CHECKED BY:	VO

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APPENDIX E

HASP & CAMP

SITE HEALTH AND SAFETY PLAN
for
BROWNFIELD CLEANUP PROGRAM
SITE MANAGEMENT PLAN

1827 FILLMORE AVENUE SITE

BUFFALO, NEW YORK

October 2019 B0421-017-001

Prepared for:

1827 Fillmore LLC

Prepared By:

Benchmark Environmental Engineering & Science, PLLC
2558 Hamburg Turnpike, Suite 300
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(716) 856-0599

In Association With:

TurnKey Environmental Restoration, LLC
2558 Hamburg Turnpike, Suite 300
Buffalo, NY 14218
(716) 856-0635

1827 FILLMORE AVENUE SITE
HEALTH AND SAFETY PLAN FOR POST-REMEDIAL ACTIVITIES

ACKNOWLEDGEMENT

Plan Reviewed by (initial):

Corporate Health and Safety Director:	Thomas H. Forbes, P.E.
Project Manager:	Michael A. Lesakowski
Designated Site Safety and Health Officer:	Bryan W. Mayback

Acknowledgement:
I acknowledge that I have reviewed the information contained in this site-specific Health and Safety Plan, and understand the hazards associated with performance of the field activities described herein. I agree to comply with the requirements of this plan.

NAME (PRINT)	SIGNATURE	DATE

1827 FILLMORE AVENUE SITE
HEALTH AND SAFETY PLAN FOR POST-REMEDIAL ACTIVITIES

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1.0 INTRODUCTION

1.1 General

In accordance with OSHA requirements contained in 29 CFR 1910.120, this Health and Safety Plan (HASP) describes the specific health and safety practices and procedures to be employed by Benchmark Environmental Engineering & Science, PLLC and TurnKey Environmental Restoration, LLC employees (referred to jointly hereafter as "Benchmark-TurnKey") during post-remedial activities at the 1827 Fillmore Avenue Site (Site) located in Buffalo, Erie County, New York. This HASP presents procedures for Benchmark-TurnKey employees who will be involved with post-remedial field activities; it does not cover the activities of other contractors, subcontractors, or other individuals on the Site. These firms will be required to develop and enforce their own HASPs as discussed in Section 2.0. Benchmark-TurnKey accepts no responsibility for the health and safety of contractor, subcontractor or other personnel.

This HASP presents information on known Site health and safety hazards using available historical information, and identifies the equipment, materials and procedures that will be used to eliminate or control these hazards. Environmental monitoring will be performed during the course of field activities to provide real-time data for on-going assessment of potential hazards.

1.2 Background

The Site consists of one parcel, identified as 1827 Fillmore Avenue, totaling approximately +/- 17.15 acres, located in the City of Buffalo, Erie County, New York. The Site is currently vacant with green areas, asphalt paved areas, former roadways and former building areas. According to the Erie County Real Property & GIS Web page (**http://www2.erie.gov/ecrpts/index.php?q=real-property-parcel-search**) 1827 Fillmore is the only address associated with this property.

From at least 1917 the Site was utilized as a stone quarry. Sometime between the 1940s and 1950s, prior to development of the Kensington Heights Towers in 1958, the stone quarry was backfilled with unknown fill materials. The Kensington Heights apartments were built as low-income housing, formally as a federal/state development. The Site was improved with six (6), seven-story brick apartment buildings with approximately 67 units per building, open space, and on-Site parking. The Site has been vacant since the 1980s. From 2009 to 2014 asbestos abatement and demolition of five (5) of the six (6) buildings were demolished. The sixth building was recently demolished in October 2018.

1.3 Known and Suspected Environmental Conditions

Previous investigations have confirmed that historic operation as a stone quarry, which was backfilled with unknown materials prior to the 1958 construction of low-income housing impacted that Site, which will require remediation prior to redevelopment. Previous investigation findings include:

- On-Site soil/fill materials are impacted with polycyclic aromatic hydrocarbons (PAHs) and metals exceeding Part 375 Soil Cleanup Objectives (SCOs). Elevated PAHs and metals were detected in numerous soil/fill samples collected from across the Site at concentrations exceeding Part 375 Unrestricted SCOs (USCOs), Residential SCOs (RSCOs), Restricted Residential SCOs (RRSCOs), Commercial SCOs (CSCOs) and/or Industrial SCOs (ISCOs). Lead is the primary metal of concern.

The RI was performed in support of the BCP to determine the nature and extent of impacts from these known and suspect environmental conditions on this parcel. Findings of the RI include:

<u>Soil</u>
The 17.15 acre Site is a portion of a greater former quarry that was backfilled with impacted fill materials from unknown sources. While fill materials with elevated PAHs and metals above CSCOs were identified across the Site, the more significant impacted fill is present in four distinct "hot spots," identified as the TP-13 Lead Area, the SB-21 Lead Area, MW-6 Lead Area and the TP-25/SS-13 PAH area.

<u>Groundwater</u>
No significant overburden or bedrock groundwater impacts were identified.

1.4 Parameters of Interest

Based on the previous investigations, previous Site uses, and RI activities, constituents of potential concern (COPCs) in soil and groundwater at the Site include:

- **Semi-Volatile Organic Compounds (SVOCs)** – SVOCs present at elevated concentrations may include benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene, identified as polycyclic aromatic hydrocarbons (PAHs), which are byproducts of incomplete combustion and impurities in petroleum products.

- **Inorganic Compounds** – The inorganic COPC present at elevated concentrations include arsenic, barium, cadmium, copper, lead, manganese, mercury.

1.5 Overview of Post-Remedial Activities

Benchmark-TurnKey personnel will be on-site to observe and perform remedial activities. The field activities to be completed as part of the remedial are described below.

1. Redevelopment soil/fill excavation.
2. Waste characterization sampling.

2.0 ORGANIZATIONAL STRUCTURE

This section of the HASP describes the lines of authority, responsibility and communication as they pertain to health and safety functions at the Site. The purpose of this chapter is to identify the personnel who impact the development and implementation of the HASP and to describe their roles and responsibilities. This chapter also identifies other contractors and subcontractors involved in work operations and establish the lines of communications among them for health and safety matters. The organizational structure described in this chapter is consistent with the requirements of 29 CFR 1910.120(b)(2). This section will be reviewed by the Project Manager and updated as necessary to reflect the current organizational structure at this Site.

2.1 Roles and Responsibilities

Benchmark-TurnKey personnel on the Site must comply with the minimum requirements of this HASP. The specific responsibilities and authority of management, safety and health, and other personnel on this Site are detailed in the following paragraphs.

2.1.1 Corporate Health and Safety Director

The Benchmark-TurnKey Corporate Health and Safety Director is ***Mr. Thomas H. Forbes, P.E.*** The Corporate Health and Safety Director responsible for developing and implementing the Health and Safety program and policies for Benchmark Environmental Engineering & Science, PLLC and TurnKey Environmental Restoration, LLC, and consulting with corporate management to ensure adequate resources are available to properly implement these programs and policies. The Corporate Health and Safety Director coordinates Benchmark-TurnKey's Health and Safety training and medical monitoring programs and assists project management and field staff in developing site-specific health and safety plans.

2.1.2 Project Manager

The Project Manager for this Site is ***Mr. Michael A. Lesakowski.*** The Project Manager has the responsibility and authority to direct all Benchmark-TurnKey work operations at the Site. The Project Manager coordinates safety and health functions with the Site Safety and Health Officer, and bears ultimate responsibility for proper implementation of this HASP. He may delegate authority to expedite and facilitate any application of the program, including modifications to the overall project approach as necessary to circumvent unsafe work conditions. Specific duties of the Project Manager include:

- Preparing and coordinating the Site work plan.
- Providing Benchmark-TurnKey workers with work assignments and overseeing their performance.
- Coordinating health and safety efforts with the Site Safety and Health Officer (SSHO).
- Reviewing the emergency response coordination plan to assure its effectiveness.
- Serving as the primary liaison with Site contractors and the property owner.

2.1.3 Site Safety and Health Officer

The Site Safety and Health Officer (SSHO) for this Site is ***Mr. Bryan Mayback***. The SSHO reports to the Project Manager. The SSHO is on-site or readily accessible to the Site during work operations and has the authority to halt Site work if unsafe conditions are detected. The specific responsibilities of the SSHO are:

- Managing the safety and health functions for Benchmark-TurnKey personnel on the Site.
- Serving as the point of contact for safety and health matters.
- Ensuring that Benchmark-TurnKey field personnel working on the Site have received proper training (per 29 CFR Part 1910.120(e)), that they have obtained medical clearance to wear respiratory protection (per 29 CFR Part 1910.134), and that they are properly trained in the selection, use and maintenance of personal protective equipment, including qualitative respirator fit testing.
- Performing or overseeing Site monitoring as required by the HASP.
- Assisting in the preparation and review of the HASP.
- Maintaining site-specific safety and health records as described in this HASP.
- Coordinating with the Project Manager, Site Workers, and Contractor's SSHO as necessary for safety and health efforts.

2.1.4 Site Workers

Site workers are responsible for: complying with this HASP or a more stringent HASP, if appropriate (i.e., Contractor and Subcontractor's HASP); using proper PPE;

reporting unsafe acts and conditions to the SSHO; and following the safety and health instructions of the Project Manager and SSHO.

2.1.5 Other Site Personnel

Other Site personnel who will have health and safety responsibilities will include the Test Pit Contractor and Drilling Contractor, who will be responsible for developing, implementing and enforcing a Health and Safety Plan equally stringent or more stringent than Benchmark-TurnKey's HASP. Benchmark-TurnKey assumes no responsibility for the health and safety of anyone outside its direct employ. Each Contractor's HASP shall cover all non- Benchmark/TurnKey Site personnel. Each Contractor shall assign a SSHO who will coordinate with Benchmark-TurnKey's SSHO as necessary to ensure effective lines of communication and consistency between contingency plans.

In addition to Benchmark-TurnKey and Contractor personnel, other individuals who may have responsibilities in the work zone include subcontractors and governmental agencies performing Site inspection work (i.e., the New York State Department of Environmental Conservation (NYSDEC)). The Contractor shall be responsible for ensuring that these individuals have received OSHA-required training (29 CFR 1910.120(e)), including initial, refresher and site-specific training, and shall be responsible for the safety and health of these individuals while they are on-site.

3.0 HAZARD EVALUATION

Due to the presence of certain contaminants at the Site, the possibility exists that workers will be exposed to hazardous substances during field activities. The principal points of exposure would be through direct contact with and incidental ingestion of soil, and through the inhalation of contaminated particles or vapors. Other points of exposure may include direct contact with groundwater. In addition, the use of drilling and/or medium to large-sized construction equipment (e.g., excavator) will also present conditions for potential physical injury to workers. Further, since work will be performed outdoors, the potential exists for heat/cold stress to impact workers, especially those wearing protective equipment and clothing. Adherence to the medical evaluations, worker training relative to chemical hazards, safe work practices, proper personal protection, environmental monitoring, establishment work zones and Site control, appropriate decontamination procedures and contingency planning outlined herein will reduce the potential for chemical exposures and physical injuries.

3.1 Chemical Hazards

As discussed in Section 1.3, historic activities have potentially resulted in impacts to Site soils and groundwater. Table 1 lists exposure limits for airborne concentrations of the COPCs identified in Section 1.4 of this HASP. Brief descriptions of the toxicology of the prevalent COPCs and related health and safety guidance and criteria are provided below.

1. **Polycyclic Aromatic Hydrocarbons (PAHs)** are formed as a result of the pyrolysis and incomplete combustion of organic matter such as fossil fuel. PAH aerosols formed during the combustion process disperse throughout the atmosphere, resulting in the deposition of PAH condensate in soil, water and on vegetation. In addition, several products formed from petroleum processing operations (e.g., roofing materials and asphalt) also contain elevated levels of PAHs. Hence, these compounds are widely dispersed in the environment. PAHs are characterized by a molecular structure containing three or more fused, unsaturated carbon rings. Seven of the PAHs are classified by USEPA as probable human carcinogens (USEPA Class B2). These are benzo(a)pyrene; benzo(a)anthracene; benzo(b)fluoranthene; benzo(k) fluoranthene; chrysene; dibenz(a,h)anthracene; and indeno(1,2,3-cd)pyrene. The primary route of exposure to PAHs is through incidental ingestion and inhalation of contaminated particulates. PAHs are characterized by an organic odor, and exist as oily liquids in pure form. Acute exposure symptoms may include acne-type blemishes in areas of the skin exposed to sunlight.

2. **Arsenic (CAS #7440-38-2)** is a naturally occurring element and is usually found combined with one or more elements, such as oxygen or sulfur. Inhalation is a more important exposure route than ingestion. First phase exposure symptoms include nausea, vomiting, diarrhea and pain in the stomach. Prolonged contact is corrosive to the skin and mucus membranes. Arsenic is considered a Group A human carcinogen by the USEPA. Exposure via inhalation is associated with an increased risk of lung cancer. Exposure via the oral route is associated with an increased risk of skin cancer.

3. **Barium (CAS #7440-39-3)** is found in waste streams from a large number of industrial uses. Acute exposures to barium may cause gastrointestinal disturbances and muscular weakness. Long term exposures may cause hypertension.

4. **Cadmium (CAS #7440-43-9)** is a natural element and is usually combined with one or more elements, such as oxygen, chloride or sulfur. Breathing high levels of cadmium severely damages the lungs and can cause death. Ingestion of high levels of cadmium severely irritates the stomach, leading to vomiting and diarrhea. Long term exposure to lower levels of cadmium leads to a buildup of this substance in the kidneys and possible kidney disease. Other potential long term effects are lung damage and fragile bones. Cadmium is suspected to be a human carcinogen.

5. **Copper (CAS #7440-50-8)** is a naturally occurring metal in the environment in rocks, soil, water and air. The most common use of copper is to make wire, pipes, and sheet metal. High levels of copper exposure may cause irritation of the nose, mouth, and eyes, vomiting, diarrhea, stomach cramps, and death.

6. **Lead (CAS #7439-92-1)** can affect almost every organ and system in our bodies. The most sensitive is the central nervous system, particularly in children. Lead also damages kidneys and the immune system. The effects are the same whether it is breathed or swallowed. Lead may decrease reaction time, cause weakness in fingers, wrists or ankles and possibly affect memory. Lead may cause anemia.

7. **Manganese (CAS #7439-96-5)** is a naturally occurring metal found in rocks and soil. Manganese is commonly used in steel production to improve hardness and strength. It may also be found as an additive in gasoline. The primary route of exposure of manganese is through ingestion. The most common health problems associated with manganese involve the nervous system.

8. **Mercury (CAS #7439-97-6)** is used in industrial applications for the production of caustic and chlorine, and in electrical control equipment and apparatus. Over-exposure to mercury may cause coughing, chest pains, bronchitis, pneumonia, indecision, headaches, fatigue and salivation. Mercury is a skin and eye irritant.

With respect to the anticipated post-remedial activities discussed in Section 1.5, possible routes of exposure to the above-mentioned contaminants are presented in Table 2. The use of proper respiratory equipment, as outlined in Section 7.0 of this HASP, will minimize the potential for exposure to airborne contamination. Exposure to contaminants through dermal and other routes will also be minimized through the use of protective clothing (Section 7.0), safe work practices (Section 6.0), and proper decontamination procedures (Section 12.0).

3.2 Physical Hazards

Post-remedial field activities at the 1827 Fillmore Avenue Site may present the following physical hazards:

- Physical injury during heavy construction equipment use, such as backhoes, excavators and drilling equipment.
- Heat/cold stress to employees during the summer/winter months (see Section 10).
- Slip and fall injuries due to rough, uneven terrain and/or open excavations.

These hazards represent only some of the possible means of injury that may be present during post-remedial operations and sampling activities at the Site. Since it is impossible to list all potential sources of injury, it shall be the responsibility of each individual to exercise proper care and caution during all phases of the work.

4.0 TRAINING

4.1 Site Workers

Personnel performing post-remedial activities at the Site (such as, but not limited to, equipment operators and general laborers) and who may be exposed to hazardous substances, health hazards, or safety hazards and their supervisors/managers responsible for the Site shall receive training in accordance with 29 CFR 1910.120(e) before they are permitted to engage in operations in the exclusion zone or contaminant reduction zone. This training includes an initial 40-hour Hazardous Waste Site Worker Protection Course, an 8-hour Annual Refresher Course subsequent to the initial 40-hour training, and 3 days of actual field experience under the direct supervision of a trained, experienced supervisor. Additional site-specific training shall also be provided by the SSHO prior to the start of field activities. A description of topics to be covered by this training is provided below.

4.1.1 Initial and Refresher Training

Initial and refresher training is conducted by a qualified instructor as specified under OSHA 29 CFR 1910.120(e)(5), and is specifically designed to meet the requirements of OSHA 29 CFR 1910.120(e)(3) and 1910.120(e)(8). The training covers, as a minimum, the following topics:

- OSHA HAZWOPER regulations.
- Site safety and hazard recognition, including chemical and physical hazards.
- Medical monitoring requirements.
- Air monitoring, permissible exposure limits, and respiratory protection level classifications.
- Appropriate use of personal protective equipment (PPE), including chemical compatibility and respiratory equipment selection and use.
- Work practices to minimize risk.
- Work zones and Site control.
- Safe use of engineering controls and equipment.
- Decontamination procedures.
- Emergency response and escape.

- Confined space entry procedures.
- Heat and cold stress monitoring.
- Elements of a Health and Safety Plan.
- Spill containment.

Initial training also incorporates workshops for PPE and respiratory equipment use (Levels A, B and C), and respirator fit testing. Records and certification received from the course instructor documenting each employee's successful completion of the training identified above are maintained on file at Benchmark-TurnKey's Buffalo, NY office. Contractors and Subcontractors are required to provide similar documentation of training for all their personnel who will be involved in on-site work activities.

Any employee who has not been certified as having received health and safety training in conformance with 29 CFR 1910.120(e) is prohibited from working in the exclusion and contamination reduction zones, or to engage in any on-site work activities that may involve exposure to hazardous substances or wastes.

4.1.2 Site Training

Site workers are given a copy of the HASP and provided a site-specific briefing prior to the commencement of work to ensure that employees are familiar with the HASP and the information and requirements it contains. The Site briefing shall be provided by the SSHO prior to initiating field activities and shall include:

- Names of personnel and alternates responsible for Site safety and health.
- Safety, health and other hazards present on the Site.
- The site lay-out including work zones and places of refuge.
- The emergency communications system and emergency evacuation procedures.
- Use of PPE.
- Work practices by which the employee can minimize risks from hazards.
- Safe use of engineering controls and equipment on the site.
- Medical surveillance, including recognition of symptoms and signs of over-exposure as described in Chapter 5 of this HASP.
- Decontamination procedures as detailed in Chapter 12 of this HASP.

- The emergency response plan as detailed in Chapter 15 of this HASP.
- Confined space entry procedures, if required, as detailed in Chapter 13 of this HASP.
- The spill containment program as detailed in Chapter 9 of this HASP.
- Site control as detailed in Chapter 11 of this HASP.

Supplemental health and safety briefings will also be conducted by the SSHO on an as-needed basis during the course of the work. Supplemental briefings are provided as necessary to notify employees of any changes to this HASP as a result of information gathered during ongoing Site characterization and analysis. Conditions for which the SSHO may schedule additional briefings include, but are not limited to: a change in Site conditions (e.g., based on monitoring results); changes in the work schedule/plan; newly discovered hazards; and safety incidents occurring during Site work.

4.2 Supervisor Training

On-site safety and health personnel who are directly responsible for or who supervise the safety and health of workers engaged in hazardous waste operations (i.e., SSHO) shall receive, in addition to the appropriate level of worker training described in Section 4.1, above, 8 additional hours of specialized supervisory training, in compliance with 29 CFR 1910.120(e)(4).

4.3 Emergency Response Training

Emergency response training is addressed in Appendix A of this HASP, Emergency Response Plan.

4.4 Site Visitors

Each Contractor's SSHO will provide a site-specific briefing to Site visitors and other non- Benchmark-TurnKey personnel who enter the Site beyond the Site entry point. The site-specific briefing will provide information about Site hazards, the Site layout including work zones and places of refuge, the emergency communications system and emergency evacuation procedures, and other pertinent safety and health requirements as appropriate.

Site visitors will not be permitted to enter the exclusion zone or contaminant reduction zones unless they have received the level of training required for Site workers as described in Section 4.1.

5.0 MEDICAL MONITORING

Medical monitoring examinations are provided to Benchmark-TurnKey employees as stipulated under 29 CFR Part 1910.120(f). These exams include initial employment, annual and employment termination physicals for Benchmark-TurnKey employees involved in hazardous waste site field operations. Post-exposure examinations are also provided for employees who may have been injured, received a health impairment, or developed signs or symptoms of over-exposure to hazardous substances or were accidentally exposed to substances at concentrations above the permissible exposure limits without necessary personal protective equipment. Such exams are performed as soon as possible following development of symptoms or the known exposure event.

Medical evaluations are performed by Health Works, an occupational health care provider under contract with Benchmark-TurnKey. Health Works is located in Seneca Square Plaza, 1900 Ridge Road, West Seneca, New York 14224. The facility can be reached at (716) 823-5050 to schedule routine appointments or post-exposure examinations.

Medical evaluations are conducted according to the Benchmark-TurnKey Medical Monitoring Program and include an evaluation of the workers' ability to use respiratory protective equipment. The examinations include:

- Occupational/medical history review.
- Physical exam, including vital sign measurement.
- Spirometry testing.
- Eyesight testing.
- Audio testing (minimum baseline and exit, annual for employees routinely exposed to greater than 85db).
- EKG (for employees >40 years age or as medical conditions dictate).
- Chest X-ray (baseline and exit, and every 5 years).
- Blood biochemistry (including blood count, white cell differential count, serum multiplastic screening).
- Medical certification of physical requirements (i.e., sight, musculoskeletal, cardiovascular) for safe job performance and to wear respiratory protection equipment.

The purpose of the medical evaluation is to determine an employee's fitness for duty on hazardous waste sites; and to establish baseline medical data.

In conformance with OSHA regulations, Benchmark-TurnKey will maintain and preserve medical records for a period of 30 years following termination of employment. Employees are provided a copy of the physician's post-exam report, and have access to their medical records and analyses.

6.0 SAFE WORK PRACTICES

Benchmark-TurnKey employees shall conform to the following safe work practices during on-site work activities conducted within the exclusion and contamination reduction zones:

- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth contact is strictly prohibited.
- The hands and face must be thoroughly washed upon leaving the work area and prior to engaging in any activity indicated above.
- Respiratory protective equipment and clothing must be worn by all personnel entering the Site as required by the HASP or as modified by the Site safety officer. Excessive facial hair (i.e., beards, long mustaches or sideburns) that interferes with the satisfactory respirator-to-face seal is prohibited.
- Contact with surfaces/materials either suspected or known to be contaminated will be avoided to minimize the potential for transfer to personnel, cross contamination and need for decontamination.
- Medicine and alcohol can synergize the effects of exposure to toxic chemicals. Due to possible contraindications, use of prescribed drugs should be reviewed with the Benchmark-TurnKey occupational physician. Alcoholic beverage and illegal drug intake are strictly forbidden during the workday.
- Personnel shall be familiar with standard operating safety procedures and additional instructions contained in this Health and Safety Plan.
- On-site personnel shall use the "buddy" system. No one may work alone (i.e., out of earshot or visual contact with other workers) in the exclusion zone.
- Personnel and equipment in the contaminated area shall be minimized, consistent with effective Site operations.
- Employees have the obligation to immediately report and if possible, correct unsafe work conditions.
- Use of contact lenses on-site will not be permitted. Spectacle kits for insertion into full-face respirators will be provided for Benchmark-TurnKey employees, as requested and required.

The recommended specific safety practices for working around the contractor's equipment (e.g., backhoes, bulldozers, excavators, drill rigs etc.) are as follows:

- Although the Contractor and subcontractors are responsible for their equipment and safe operation of the Site, Benchmark-TurnKey personnel are also responsible for their own safety.
- Subsurface work will not be initiated without first clearing underground utility services.
- Heavy equipment should not be operated within 20 feet of overhead wires. This distance may be increased if windy conditions are anticipated or if lines carry high voltage. The Site should also be sufficiently clear to ensure the project staff can move around the heavy machinery safely.
- Care should be taken to avoid overhead wires when moving heavy-equipment from location to location.
- Hard hats, safety boots and safety glasses should be worn in the vicinity of heavy equipment. Hearing protection is also recommended.
- The work Site should be kept neat. This will prevent personnel from tripping and will allow for fast emergency exit from the Site.
- Proper lighting must be provided when working at night.
- Construction activities should be discontinued during an electrical storm or severe weather conditions.
- The presence of combustible gases should be checked before igniting any open flame.
- Personnel shall stand upwind of any construction operation when not immediately involved in sampling/logging/observing activities.
- Personnel will not approach the edge of an unsecured trench/excavation closer than two feet.

7.0 PERSONAL PROTECTIVE EQUIPMENT

7.1 Equipment Selection

Personal protective equipment (PPE) will be donned when work activities may result in exposure to physical or chemical hazards beyond acceptable limits, and when such exposure can be mitigated through appropriate PPE. The selection of PPE will be based on an evaluation of the performance characteristics of the PPE relative to the requirements and limitations of the Site, the task-specific conditions and duration, and the hazards and potential hazards identified at the Site.

Equipment designed to protect the body against contact with known or suspect chemical hazards are grouped into four categories according to the degree of protection afforded. These categories designated A through D consistent with United States Environmental Protection Agency (USEPA) Level of Protection designation, are:

- **Level A:** Should be selected when the highest level of respiratory, skin and eye protection is needed.
- **Level B:** Should be selected when the highest level of respiratory protection is needed, but a lesser level of skin protection is required. Level B protection is the minimum level recommended on initial Site entries until the hazards have been further defined by on-site studies. Level B (or Level A) is also necessary for oxygen-deficient atmospheres.
- **Level C:** Should be selected when the types of airborne substances are known, the concentrations have been measured and the criteria for using air-purifying respirators are met. In atmospheres where no airborne contaminants are present, Level C provides dermal protection only.
- **Level D:** Should not be worn on any Site with elevated respiratory or skin hazards. This is generally a work uniform providing minimal protection.

OSHA requires the use of certain PPE under conditions where an immediate danger to life and health (IDLH) may be present. Specifically, OSHA 29 CFR 1910.120(g)(3)(iii) requires use of a positive pressure self-contained breathing apparatus, or positive pressure air-line respirator equipped with an escape air supply when chemical exposure levels present a substantial possibility of immediate serious injury, illness or death, or impair the ability to escape. Similarly, OSHA 29 CFR 1910.120(g)(3)(iv) requires donning totally-encapsulating chemical protective suits (with a protection level equivalent to Level A protection) in conditions where skin absorption of a hazardous substance may result in a substantial possibility of immediate serious illness, injury or death, or impair the ability to escape.

In situations where the types of chemicals, concentrations, and possibilities of contact are unknown, the appropriate level of protection must be selected based on professional experience and judgment until the hazards can be further characterized. The individual components of clothing and equipment must be assembled into a full protective ensemble to protect the worker from site-specific hazards, while at the same time minimizing hazards and drawbacks of the personal protective gear itself. Ensemble components are detailed below for levels A/B, C, and D protection.

7.2 Protection Ensembles

7.2.1 Level A/B Protection Ensemble

Level A/B ensembles include similar respiratory protection, however Level A provides a higher degree of dermal protection than Level B. Use of Level A over Level B is determined by: comparing the concentrations of identified substances in the air with skin toxicity data, and assessing the effect of the substance (by its measured air concentrations or splash potential) on the small area of the head and neck unprotected by Level B clothing. The recommended PPE for level A/B is:

- Pressure-demand, full-face piece self-contained breathing apparatus (MSHA/NIOSH approved) or pressure-demand supplied-air respirator with escape self-contained breathing apparatus (SCBA).
- Chemical-resistant clothing. For Level A, clothing consists of totally-encapsulating chemical resistant suit. Level B incorporates hooded one-or two-piece chemical splash suit.
- Inner and outer chemical resistant gloves.
- Chemical-resistant safety boots/shoes.
- Hardhat.

7.2.2 Level C Protection Ensemble

Level C protection is distinguished from Level B by the equipment used to protect the respiratory system, assuming the same type of chemical-resistant clothing is used. The main selection criterion for Level C is that conditions permit wearing an air-purifying device.

The device (when required) must be an air-purifying respirator (MSHA/NIOSH approved) equipped with filter cartridges. Cartridges must be able to remove the substances encountered. Respiratory protection will be used only with proper fitting, training and the approval of a qualified individual. In addition, an air-purifying respirator can be used only if: oxygen content of the atmosphere is at least 19.5% in volume; substances are identified and concentrations measured; substances have adequate warning properties; the individual passes a qualitative fit-test for the mask; and an appropriate cartridge/canister is used, and its service limit concentration is not exceeded. Recommended PPE for Level C conditions includes:

- Full-face piece, air-purifying respirator equipped with MSHA and NIOSH approved organic vapor/acid gas/dust/mist combination cartridges or as designated by the SSHO.
- Chemical-resistant clothing (hooded, one or two-piece chemical splash suit or disposable chemical-resistant one-piece suit).
- Inner and outer chemical-resistant gloves.
- Chemical-resistant safety boots/shoes.
- Hardhat.

An air-monitoring program is part of all response operations when atmospheric contamination is known or suspected. It is particularly important that the air be monitored thoroughly when personnel are wearing air-purifying respirators. Continual surveillance using direct-reading instruments is needed to detect any changes in air quality necessitating a higher level of respiratory protection.

7.2.3 Level D Protection Ensemble

As indicated above, Level D protection is primarily a work uniform. It can be worn in areas where only boots can be contaminated, where there are no inhalable toxic substances and where the atmospheric contains at least 19.5% oxygen. Recommended PPE for Level D includes:

- Coveralls.
- Safety boots/shoes.
- Safety glasses or chemical splash goggles.

- Hardhat.
- Optional gloves; escape mask; face shield.

7.2.4 Recommended Level of Protection for Site Tasks

Based on current information regarding both the contaminants suspected to be present at the Site and the various tasks that are included in the post-remedial activities, the minimum required levels of protection for these tasks shall be as identified in Table 3.

8.0 EXPOSURE MONITORING

8.1 General

Based on the results of historic sample analysis and the nature of the proposed work activities at the Site, the possibility exist that organic vapors and/or particulates may be released to the air during intrusive construction activities. Ambient breathing zone concentrations may at times, exceed the permissible exposure limits (PELs) established by OSHA for the individual compounds (see Table 1), in which case respiratory protection will be required. Respiratory and dermal protection may be modified (upgraded or downgraded) by the SSHO based upon real-time field monitoring data.

8.1.1 On-Site Work Zone Monitoring

Benchmark-TurnKey personnel will conduct routine, real-time air monitoring during intrusive construction phases such as excavation, backfilling, drilling, etc. The work area will be monitored at regular intervals using a photoionization detector (PID) and a particulate meter. Observed values will be recorded and maintained as part of the permanent field record.

Additional air monitoring measurements may be made by Benchmark-TurnKey personnel to verify field conditions during subcontractor oversight activities. Monitoring instruments will be protected from surface contamination during use. Additional monitoring instruments may be added if the situations or conditions change. Monitoring instruments will be calibrated in accordance with manufacturer's instructions before use.

8.1.2 Off-Site Community Air Monitoring

In addition to on-Site monitoring within the work zone(s), monitoring at the down-wind portion of the Site perimeter will be conducted. This will provide a real-time method for determination of vapor and/or particulate releases to the surrounding community as a result of ground intrusive investigation work.

Ground intrusive activities are defined in the Generic Community Air Monitoring Plan and attached as Appendix C. Ground intrusive activities include soil/piping excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells. Non-intrusive activities include the collection of soil and sediment samples or the collection of groundwater samples from existing wells. Continuous monitoring is required for ground intrusive activities and periodic monitoring is required for non-intrusive activities. Periodic monitoring consists of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring while bailing a well, and taking a reading prior to leaving a sampling location. This may be upgraded to continuous if the sampling location is in close proximity to individuals not involved in the Site activity (i.e., on a curb of a busy street). The action levels below will be used during periodic monitoring.

8.2 Monitoring Action Levels

8.2.1 On-Site Work Zone Action Levels

The PID, or other appropriate instrument(s), will be used by Benchmark-TurnKey personnel to monitor organic vapor concentrations as specified in this HASP. In addition, fugitive dust/particulate concentrations will be monitored during major soil intrusion (i.e., well/boring installation) using a real-time particulate monitor as specified in this plan. In the absence of such monitoring, appropriate respiratory protection for particulates shall be donned. Sustained readings obtained in the breathing zone may be interpreted (with regard to other Site conditions) as follows for Benchmark-TurnKey personnel:

- Total atmospheric concentrations of unidentified vapors or gases ranging from 0 to 1 ppm above background on the PID) - Continue operations under Level D (see Appendix A).
- Total atmospheric concentrations of unidentified vapors or gases yielding sustained readings from >1 ppm to 5 ppm above background on the PID (vapors not suspected of containing high levels of chemicals toxic to the skin) - Continue operations under Level C (see Appendix A).
- Total atmospheric concentrations of unidentified vapors or gases yielding sustained readings of >5 ppm to 50 ppm above background on the PID - Continue operations under Level B (see Attachment 1), re-evaluate and alter (if possible) construction methods to achieve lower vapor concentrations.
- Total atmospheric concentrations of unidentified vapors or gases above 50 ppm on the PID - Discontinue operations and exit the work zone immediately.

The particulate monitor will be used to monitor respirable dust concentrations during intrusive activities and during handling of Site soil/fill. Action levels based on the instrument readings shall be as follows:

- Less than 50 mg/m3 - Continue field operations.
- 50-150 mg/m3 - Don dust/particulate mask or equivalent
- Greater than 150 mg/m3 - Don dust/particulate mask or equivalent. Initiate engineering controls to reduce respirable dust concentration (viz., wetting of excavated soils or tools at discretion of Site Health and Safety Officer).

Readings from the field equipment will be recorded and documented on the appropriate Project Field Forms. Instruments will be calibrated before use on a daily basis and the procedure will be documented on the appropriate Project Field Forms.

8.2.2 Community Air Monitoring Action Levels

In addition to the action levels prescribed in Section 8.2.1 for Benchmark-TurnKey personnel on-site, the following criteria shall also be adhered to for the protection of downwind receptors consistent with NYSDOH requirements (Appendix C):

o **<u>ORGANIC VAPOR PERIMETER MONITORING</u>:**

- If the <u>sustained</u> ambient air concentration of organic vapors at the downwind perimeter of the exclusion zone <u>exceeds 5 ppm</u> above background for the 15-minute average, work activities will be temporarily halted and monitoring continued. If the <u>sustained</u> organic vapor decreases below 5 ppm over background, work activities can resume with continued monitoring.
- If the <u>sustained</u> ambient air concentration of organic vapors at the downwind perimeter of the exclusion zone are <u>greater than 5 ppm</u> over background <u>but less than 25 ppm</u> for the 15-minute average, activities can resume provided that: the organic vapor level 200 feet downwind of the working site or half the distance to the nearest off-site residential or commercial structure, whichever is less, but in no case less than 20 feet, is below 5 ppm over background; and more frequent intervals of monitoring, as directed by the Site Health and Safety Officer, are conducted.
- If the sustained organic vapor level is <u>above 25 ppm</u> at the perimeter of the exclusion zone for the 15-minute average, the Site Health and Safety Officer must be notified and work activities shut down. The Site Health and Safety Officer will determine when re-entry of the exclusion zone is possible and will implement downwind air

monitoring to ensure vapor emissions do not impact the nearest off-site residential or commercial structure at levels exceeding those specified in the ***Organic Vapor Contingency Monitoring Plan*** below. All readings will be recorded and will be available for NYSDEC and New York State Department of Health (NYSDOH) personnel to review.

- **ORGANIC VAPOR CONTINGENCY MONITORING PLAN:**
  - If the sustained organic vapor level is greater than 5 ppm over background 200 feet downwind from the work area or half the distance to the nearest off-site residential or commercial property, whichever is less, all work activities must be halted.
  - If, following the cessation of the work activities or as the result of an emergency, sustained organic levels persist above 5 ppm above background 200 feet downwind or half the distance to the nearest off-site residential or commercial property from the work area, then the air quality must be monitored within 20 feet of the perimeter of the nearest off-site residential or commercial structure (20-foot zone).
  - If efforts to abate the emission source are unsuccessful and if sustained organic vapor levels approach or exceed 5 ppm above background within the 20-foot zone for more than 30 minutes, or are sustained at levels greater than 10 ppm above background for longer than one minute, then the ***Major Vapor Emission Response Plan*** (see below) will automatically be placed into effect.

- **MAJOR VAPOR EMISSION RESPONSE PLAN:**

  Upon activation, the following activities will be undertaken:

  1. All Emergency Response Contacts as listed in this Health and Safety Plan and the Emergency Response Plan (Appendix A) will be advised.
  2. The local police authorities will immediately be contacted by the Site Health and Safety Officer and advised of the situation.
  3. Frequent air monitoring will be conducted at 30-minute intervals within the 20-foot zone. If two sustained successive readings below action levels are measured, air monitoring may be halted or modified by the Site Health and Safety Officer.

The following personnel are to be notified in the listed sequence in the event that a Major Vapor Emission Plan is activated:

Responsible Person	Contact	Phone Number
SSHO	Police	911
SSHO	State Emergency Response Hotline	(800) 457-7362

Additional emergency numbers are listed in the Emergency Response Plan included as Appendix A.

- **<u>EXPLOSIVE VAPORS:</u>**
  - <u>Sustained</u> atmospheric concentrations of greater than 10% LEL in the work area - Initiate combustible gas monitoring at the downwind portion of the Site perimeter.
  - <u>Sustained</u> atmospheric concentrations of greater than 10% LEL at the downwind Site perimeter – Halt work and contact local Fire Department.

- **<u>AIRBORNE PARTICULATE COMMUNITY AIR MONITORING</u>**
  - Respirable (PM-10) particulate monitoring will be performed on a continuous basis at the upwind and downwind perimeter of the exclusion zone. The monitoring will be performed using real-time monitoring equipment capable of measuring PM-10 and integrating over a period of 15-minutes for comparison to the airborne particulate action levels. The equipment will be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration will be visually assessed during all work activities. All readings will be recorded and will be available for NYSDEC and NYSDOH review. Readings will be interpreted as follows:
  - If the downwind PM-10 particulate level is 100 micrograms per cubic meter (ug/m^3) greater than the background (upwind perimeter) reading for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression provided that the downwind PM-10 particulate levels do not exceed 150 ug/m^3 above the upwind level and that visible dust is not migrating from the work area.
  - If, after implementation of dust suppression techniques downwind PM-10 levels are greater than 150 ug/m^3 above the upwind level, work activities must be stopped and dust suppression controls re-evaluated. Work can resume provided that supplemental dust suppression measures and/or other controls are successful in

reducing the downwind PM-10 particulate concentration to within 150 ug/m^3 of the upwind level and in preventing visible dust migration.

Pertinent emergency response information including the telephone number of the Fire Department is included in the Emergency Response Plan (Appendix A).

9.0 SPILL RELEASE/RESPONSE

This chapter of the HASP describes the potential for and procedures related to spills or releases of known or suspected petroleum and/or hazardous substances on the Site. The purpose of this Section of the HASP is to plan appropriate response, control, counter-measures and reporting, consistent with OSHA requirements in 29 CFR 1910.120(b)(4)(ii)(J) and (j)(1)(viii). The spill containment program addresses the following elements:

- Potential hazardous material spills and available controls.
- Initial notification and evaluation.
- Spill response.
- Post-spill evaluation.

9.1 Potential Spills and Available Controls

An evaluation was conducted to determine the potential for hazardous material and oil/petroleum spills at this Site. For the purpose of this evaluation, hazardous materials posing a significant spill potential are considered to be:

- CERCLA Hazardous Substances as identified in 40 CFR Part 302, where such materials pose the potential for release in excess of their corresponding Reportable Quantity (RQ).
- Extremely Hazardous Substances as identified in 40 CFR Part 355, Appendix A, where such materials pose the potential for release in excess of their corresponding Reportable Quantity (RQ).
- Hazardous Chemicals as defined under Section 311(e) of the Emergency Planning and Community Right-To-Know Act of 1986, where such chemicals are present or will be stored in excess of 10,000 lbs.
- Toxic Chemicals as defined in 40 CFR Part 372, where such chemicals are present or will be stored in excess of 10,000 lbs.
- Chemicals regulated under 6NYCRR Part 597, where such materials pose the potential for release in excess of their corresponding Reportable Quantity (RQ).

Oil/petroleum products are considered to pose a significant spill potential whenever the following situations occur:

- The potential for a "harmful quantity" of oil (including petroleum and non-petroleum-based fuels and lubricants) to reach navigable waters of the U.S. exists (40

CFR Part 112.4). Harmful quantities are considered by USEPA to be volumes that could form a visible sheen on the water or violate applicable water quality standards.

- The potential for any amount of petroleum to reach any waters of NY State, including groundwater, exists. Petroleum, as defined by NY State in 6NYCRR Part 612, is a petroleum-based heat source, energy source, or engine lubricant/maintenance fluid.
- The potential for any release, to soil or water, of petroleum from a bulk storage facility regulated under 6NYCRR Part 612. A regulated petroleum storage facility is defined by NY State as a site having stationary tank(s) and intra-facility piping, fixtures and related equipment with an aggregate storage volume of 1,100 gallons or greater.

9.2 Initial Spill Notification and Evaluation

Any worker who discovers a hazardous substance or oil/petroleum spill will immediately notify the Project Manager and SSHO. The worker will, to the best of his/her ability, report the material involved, the location of the spill, the estimated quantity of material spilled, the direction/flow of the spill material, related fire/explosion incidents, if any, and any associated injuries. The Emergency Response Plan presented in Attachment H2 of this HASP will immediately be implemented if an emergency release has occurred.

Following initial report of a spill, the Project Manager will make an evaluation as to whether the release exceeds RQ levels. If an RQ level is exceeded, the Project Manager will notify the Site owner and NYSDEC at 1-800-457-7362 within 2 hours of spill discovery. The Project Manager will also determine what additional agencies (e.g., USEPA) are to be contacted regarding the release, and will follow-up with written reports as required by the applicable regulations.

9.3 Spill Response

For spill situations, the following general response guidelines will apply:

- Only those personnel involved in overseeing or performing containment operations will be allowed within the spill area. If necessary, the area will be roped, ribboned, or otherwise blocked off to prevent unauthorized access.
- Appropriate PPE, as specified by the SSHO, will be donned before entering the spill area.
- Ignition points will be extinguished/removed if fire or explosion hazards exist.

- Surrounding reactive materials will be removed.
- Drains or drainage in the spill area will be blocked to prevent inflow of spilled materials or applied materials.

For minor spills, the Contractor will maintain a Spill Control and Containment Kit in the Field Office or other readily accessible storage location. The kit will consist of, at a minimum, a 50 lb. bag of "speedy dry" granular absorbent material, absorbent pads, shovels, empty 5-gallon pails and an empty open-top 55-gallon drum. Spilled materials will be absorbed, and shoveled into a 55-gallon drum for proper disposal (NYSDEC approval will be secured for on-site treatment of the impacted soils/absorbent materials, if applicable). Impacted soils will be hand-excavated to the point that no visible signs of contamination remains, and will be drummed with the absorbent.

In the event of a major release or a release that threatens surface water, a spill response contractor will be called to the Site. The response contractor may use heavy equipment (e.g., excavator, backhoe, etc.) to berm the soils surrounding the spill Site or create diversion trenching to mitigate overland migration or release to navigable waters. Where feasible, pumps will be used to transfer free liquid to storage containers. Spill control/cleanup contractors in the Western New York area that may be contacted for assistance include:

- The Environmental Service Group of NY, Inc.: (716) 695-6720
- Environmental Products and Services, Inc.: (716) 447-4700
- Op-Tech: (716) 873-7680

9.4 Post-Spill Evaluation

If a reportable quantity of hazardous material or oil/petroleum is spilled as determined by the Project Manager, a written report will be prepared as indicated in Section 9.2. The report will identify the root cause of the spill, type and amount of material released, date/time of release, response actions, agencies notified and/or involved in cleanup, and procedures to be implemented to avoid repeat incidents. In addition, all re-useable spill cleanup and containment materials will be decontaminated, and spill kit supplies/disposable items will be replenished.

10.0 HEAT/COLD STRESS MONITORING

Since some of the work activities at the Site will be scheduled for both the summer and winter months, measures will be taken to minimize heat/cold stress to Benchmark-TurnKey employees. The Site Safety and Health Officer and/or his or her designee will be responsible for monitoring Benchmark-TurnKey field personnel for symptoms of heat/cold stress.

10.1 Heat Stress Monitoring

Personal protective equipment may place an employee at risk of developing heat stress, a common and potentially serious illnesses often encountered at construction, landfill, waste disposal, industrial or other unsheltered sites. The potential for heat stress is dependent on a number of factors, including environmental conditions, clothing, workload, physical conditioning and age. Personal protective equipment may severely reduce the body's normal ability to maintain temperature equilibrium (via evaporation and convection), and require increased energy expenditure due to its bulk and weight.

Proper training and preventive measures will mitigate the potential for serious illness. Heat stress prevention is particularly important because once a person suffers from heat stroke or heat exhaustion, that person may be predisposed to additional heat related illness. To avoid heat stress, the following steps should be taken:

- Adjust work schedules.
- Modify work/rest schedules according to monitoring requirements.
- Mandate work slowdowns as needed.
- Perform work during cooler hours of the day if possible or at night if adequate lighting can be provided.
- Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods.
- Maintain worker's body fluids at normal levels. This is necessary to ensure that the cardiovascular system functions adequately. Daily fluid intake must approximately equal the amount of water lost in sweat (i.e., eight fluid ounces must be ingested for approximately every 1 lb of weight lost). The normal thirst mechanism is not sensitive enough to ensure that enough water will be consumed to replace lost perspiration. When heavy sweating occurs, workers should be encouraged to drink more.
- Train workers to recognize the symptoms of heat related illness.

Heat-Related Illness - Symptoms:

- Heat rash may result from continuous exposure to heat or humid air.
- Heat cramps are caused by heavy sweating with inadequate electrolyte replacement. Signs and symptoms include: muscle spasms; pain in the hands, feet and abdomen.
- Heat exhaustion occurs from increased stress on various body organs including inadequate blood circulation due to cardiovascular insufficiency or dehydration. Signs and symptoms include: pale, cool, moist skin; heavy sweating; dizziness; nausea; fainting.
- Heat stroke is the most serious form of heat stress. Temperature regulation fails and the body temperature rises to critical levels. Immediate action must be taken to cool the body before serious injury and death occur. Competent medical help must be obtained. Signs and symptoms are: red, hot, usually dry skin; lack of or reduced perspiration; nausea; dizziness and confusion; strong, rapid pulse; coma.

The monitoring of personnel wearing protective clothing should commence when the ambient temperature is 70 degrees Fahrenheit or above. For monitoring the body's recuperative ability to excess heat, one or more of the following techniques should be used as a screening mechanism.

- Heart rate may be measured by the radial pulse for 30 seconds as early as possible in the resting period. The rate at the beginning of the rest period should not exceed 100 beats per minute. If the rate is higher, the next work period should be shortened by 10 minutes (or 33%), while the length of the rest periods stay the same, If the pulse rate is 100 beats per minute at the beginning of the nest rest period, the following work cycle should be further shortened by 33%.
- Body temperature may be measured orally with a clinical thermometer as early as possible in the resting period. Oral temperature at the beginning of the rest period should not exceed 99.6 degrees Fahrenheit. If it does, the next work period should be shortened by 10 minutes (or 33%), while the length of the rest period remains the same. However, if the oral temperature exceeds 99.6 degrees Fahrenheit at the beginning of the next period, the work cycle may be further shortened by 33%. Oral temperature should be measured at the end of the rest period to make sure that it has dropped below 99.6 degrees Fahrenheit. No Benchmark-TurnKey employee will be permitted to continue wearing semi-permeable or impermeable garments when his/her oral temperature exceeds 100.6 degrees Fahrenheit.

10.2 Cold Stress Monitoring

Exposure to cold conditions may result in frostbite or hypothermia, each of which progresses in stages as shown below.

- **Frostbite** occurs when body tissue (usually on the extremities) begins to freeze. The three states of frostbite are:

    1. **Frost nip** - This is the first stage of the freezing process. It is characterized by a whitened area of skin, along with a slight burning or painful sensation. Treatment consists of removing the victim from the cold conditions, removal of boots and gloves, soaking the injured part in warm water (102 to 108 degrees Fahrenheit) and drinking a warm beverage. Do not rub skin to generate friction/ heat.
    2. **Superficial Frostbite** - This is the second stage of the freezing process. It is characterized by a whitish gray area of tissue, which will be firm to the touch but will yield little pain. The treatment is identical for Frost nip.
    3. **Deep Frostbite** - In this final stage of the freezing process the affected tissue will be cold, numb and hard and will yield little to no pain. Treatment is identical to that for Frost nip.

- **Hypothermia** is a serious cold stress condition occurring when the body loses heat at a rate faster than it is produced. If untreated, hypothermia may be fatal. The stages of hypothermia may not be clearly defined or visible at first, but generally include:

    1. Shivering
    2. Apathy (i.e., a change to an indifferent or uncaring mood)
    3. Unconsciousness
    4. Bodily freezing

Employees exhibiting signs of hypothermia should be treated by medical professionals. Steps that can be taken while awaiting help include:

1. Remove the victim from the cold environment and remove wet or frozen clothing. (Do this carefully as frostbite may have started.)
2. Perform active re-warming with hot liquids for drinking (Note: do not give the victim any liquid containing alcohol or caffeine) and a warm water bath (102 to 108 degrees Fahrenheit).
3. Perform passive re-warming with a blanket or jacket wrapped around the victim.

In any potential cold stress situation, it is the responsibility of the Site Health and Safety Officer to encourage the following:

- Education of workers to recognize the symptoms of frostbite and hypothermia.
- Workers should dress warmly, with more layers of thin clothing as opposed to one thick layer.
- Personnel should remain active and keep moving.
- Personnel should be allowed to take shelter in a heated areas, as necessary.
- Personnel should drink warm liquids (no caffeine or alcohol if hypothermia has set in).
- For monitoring the body's recuperation from excess cold, oral temperature recordings should occur:
    - At the Site Safety Technicians discretion when suspicion is based on changes in a worker's performance or mental status.
    - At a workers request.
    - As a screening measure, two times per shift, under unusually hazardous conditions (e.g., wind chill less than 20 degrees Fahrenheit or wind chill less than 30 degrees Fahrenheit with precipitation).
    - As a screening measure, whenever anyone worker on-site develops hypothermia.

Any person developing moderate hypothermia (a core body temperature of 92 degrees Fahrenheit) will not be allowed to return to work for 48 hours without the recommendation of a qualified medical doctor.

11.0 WORK ZONES AND SITE CONTROL

Work zones around the areas designated for construction activities will be established on a daily basis and communicated to employees and other Site users by the SSHO. It shall be each Contractor's Site Safety and Health Officer's responsibility to ensure that Site workers are aware of the work zone boundaries and to enforce proper procedures in each area. The zones will include:

- Exclusion Zone ("Hot Zone"): The area where contaminated materials may be exposed, excavated or handled and all areas where contaminated equipment or personnel may travel. Flagging tape will delineate the zone. Personnel entering the Exclusion Zone must wear the prescribed level of personal protective equipment identified in Section 7.
- Contamination Reduction Zone: The zone where decontamination of personnel and equipment takes place. Any potentially contaminated clothing, equipment and samples must remain in the Contamination Reduction Zone until decontaminated.
- Support Zone: The part of the site that is considered non-contaminated or "clean." Support equipment will be located in this zone, and personnel may wear normal work clothes within this zone.

In the absence of other task-specific work zone boundaries established by the SSHO, the following boundaries will apply to investigation and construction activities involving disruption or handling of Site soils or groundwater:

- Exclusion Zone: 50 foot radius from the outer limit of the sampling/construction activity.
- Contaminant Reduction Zone: 100 foot radius from the outer limit of the sampling/construction activity.
- Support Zone: Areas outside the Contaminant Reduction Zone.

Access of non-essential personnel to the Exclusion and Contamination Reduction Zones will be strictly controlled by the SSHO. Only personnel who are essential to the completion of the task will be allowed access to these areas and only if they are wearing the prescribed level of protection. Entrance of personnel must be approved by the SSHO.

The SSHO will maintain a Health and Safety Logbook containing the names of Benchmark-TurnKey workers and their level of protection. The zone boundaries may be changed by the SSHO as environmental conditions warrant, and to respond to the necessary changes in work locations on-site.

12.0 DECONTAMINATION

12.1 Decontamination for Benchmark-TurnKey Employees

The degree of decontamination required is a function of a particular task and the environment within which it occurs. The following decontamination procedure will remain flexible, thereby allowing the decontamination crew to respond appropriately to the changing environmental conditions that may arise at the Site. Benchmark-TurnKey personnel on-site shall follow the procedure below, or the Contractor's procedure (if applicable), whichever is more stringent.

Station 1 - Equipment Drop: Deposit visibly contaminated (if any) re-useable equipment used in the contamination reduction and exclusion zones (tools, containers, monitoring instruments, radios, clipboards, etc.) on plastic sheeting.

Station 2 - Boots and Gloves Wash and Rinse: Scrub outer boots and outer gloves. Deposit tape and gloves in waste disposal container.

Station 3 - Tape, Outer Boot and Glove Removal: Remove tape, outer boots and gloves. Deposit tape and gloves in waste disposal container.

Station 4 - Canister or Mask Change: If worker leaves exclusive zone to change canister (or mask), this is the last step in the decontamination procedure. Worker's canister is exchanged, new outer gloves and boot cover donned, and worker returns to duty.

Station 5 - Outer Garment/Face Piece Removal: Protective suit removed and deposited in separate container provided by Contractor. Face piece or goggles are removed if used. Avoid touching face with fingers. Face piece and/or goggles deposited on plastic sheet. Hard hat removed and placed on plastic sheet.

Station 6 - Inner Glove Removal: Inner gloves are the last personal protective equipment to be removed. Avoid touching the outside of the gloves with bare fingers. Dispose of these gloves in waste disposal container.

Following PPE removal, personnel shall wash hands, face and forearms with absorbent wipes. If field activities proceed for duration of 6 consecutive months or longer, shower facilities will be provided for worker use in accordance with OSHA 29 CFR 1910.120(n).

12.2 Decontamination for Medical Emergencies

In the event of a minor, non-life-threatening injury, personnel should follow the decontamination procedures as defined, and then administer first-aid.

In the event of a major injury or other serious medical concern (e.g., heat stroke), immediate first-aid is to be administered and the victim transported to the hospital in lieu of further decontamination efforts unless exposure to a Site contaminant would be considered "Immediately Dangerous to Life or Health."

12.3 Decontamination of Field Equipment

The Contractor in accordance with his approved Health and Safety Plan in the Contamination Reduction Zone will conduct decontamination of heavy equipment. As a minimum, this will include manually removing heavy soil contamination, followed by steam cleaning on an impermeable pad.

Benchmark-TurnKey personnel will conduct decontamination of tools used for sample collection purposes. It is expected that tools will be constructed of nonporous, nonabsorbent materials (i.e., metal), which will aid in the decontamination effort. Any tool or part of a tool made of porous, absorbent material (i.e., wood) will be placed into suitable containers and prepared for disposal.

Decontamination of bailers, split-spoons, spatula knives, and other tools used for environmental sampling and examination shall be as follows:

- Disassemble the equipment
- Water wash to remove visible foreign matter.
- Wash with detergent.
- Rinse parts with distilled-deionized water.
- Allow to air dry.
- Wrap parts in aluminum foil or polyethylene.

13.0 CONFINED SPACE ENTRY

OSHA 29 CFR 1910.146 identifies a confined space as a space that is large enough and so configured that an employee can physically enter and do assigned work, has limited or restricted means for entry and exit, and is not intended for continuous employee occupancy. Confined spaces include, but are not limited to, trenches, storage tanks, process vessels, pits, sewers, tunnels, underground utility vaults, pipelines, sumps, wells, and excavations.

Confined space entry by Benchmark-TurnKey employees is not anticipated to be necessary to complete the post-remedial activities identified in Section 2.0. In the event that the scope of work changes or confined space entry appears necessary, the Project Manager will be consulted to determine if feasible engineering alternatives to confined space entry can be implemented. If confined space entry by Benchmark-TurnKey employees cannot be avoided through reasonable engineering measures, task-specific confined space entry procedures will be developed and a confined-space entry permit will be issued through Benchmark-TurnKey's corporate Health and Safety Director. Benchmark-TurnKey employees shall not enter a confined space without these procedures and permits in place.

14.0 FIRE PREVENTION AND PROTECTION

14.1 General Approach

Recommended practices and standards of the National Fire Protection Association (NFPA) and other applicable regulations will be followed in the development and application of Project Fire Protection Programs. When required by regulatory authorities, the project management will prepare and submit a Fire Protection Plan for the approval of the contracting officers, authorized representative or other designated official. Essential considerations for the Fire Protection Plan will include:

- Proper Site preparation and safe storage of combustible and flammable materials.
- Availability of coordination with private and public fire authorities.
- Adequate job-site fire protection and inspections for fire prevention.
- Adequate indoctrination and training of employees.

14.2 Equipment and Requirements

Fire extinguishers will be provided by each Contractor and are required on heavy equipment and in each field trailer. Fire extinguishers will be inspected, serviced, and maintained in accordance with the manufacturer's instructions. As a minimum, extinguishers shall be checked monthly and weighed semi-annually, and recharged if necessary. Recharge or replacement shall be mandatory immediately after each use.

14.3 Flammable and Combustible Substances

Storage, handling or use of flammable and combustible substances will be under the supervision of qualified persons. Tanks, containers and pumping equipment, whether portable or stationary, used for the storage and handling of flammable and combustible liquids, will meet the recommendations of the National Fire Protection Association.

14.4 Hot Work

If the scope of work necessitates welding or blowtorch operation, the hot work permit presented in Appendix B will be completed by the SSHO and reviewed/issued by the Project Manager.

15.0 EMERGENCY INFORMATION

In accordance with OSHA 29 CFR Part 1910, an Emergency Response Plan is attached to this HASP as Appendix A. The hospital route map is presented within Appendix A as Figure 1.

16.0 REFERENCES

1. New York State Department of Environmental Conservation. *DER-10; Technical Guidance for Site Investigation and Remediation.* May 2010.

TABLES

TABLE 1
TOXICITY DATA FOR CONSTITUENTS OF POTENTIAL CONCERN

1827 FILLMORE AVENUE SITE
BUFFALO, NEW YORK

Parameter	Synonyms	CAS No.	Code	Concentration Limits [1]		
				PEL	TLV	IDLH
Semi-volatile Organic Compounds (SVOCs) [2] *: ppm*						
Benzo(a)anthracene	*none*	56-55-3	*none*	--	--	--
Benzo(a)pyrene	*none*	50-32-8	*none*	--	--	--
Benzo(b)fluoranthene	*none*	205-99-2	*none*	--	--	--
Dibenz(a,h)anthracene	*none*	53-70-3	*none*	--	--	--
Indeno(1,2,3-cd)pyrene	*none*	193-39-5	*none*	--	--	--
Inorganic Compounds [2] *: mg/m^3*						
Arsenic	*none*	7440-38-2	Ca	0.01	0.01	5
Barium	*none*	7440-39-3	*none*	--	0.5	--
Cadmium	*none*	7440-43-9	Ca	0.005	0.01	9
Copper	*none*	7440-50-8	*none*	1	1	100
Lead	*none*	7439-92-1	*none*	0.05	0.15	100
Manganese	*none*	7439-96-5	*none*	0.2	0.2	500
Mercury	*none*	7439-97-6	C-0.1	0.1	0.05	10

Notes:

1. Concentration limits as reported by NIOSH Pocket Guide to Chemical Hazards, February 2004 (NIOSH Publication No. 97-140, fourth printing with changes and updates).
2. " -- " = concentration limit not available; exposure should be minimized to the extent feasible through appropriate engineering controls & PPE.

Explanation:

Ca = NIOSH considers constituent to be a potential occupational carcinogen.
C-## = Ceiling Level equals the maximum exposure concentration allowable during the work day.
IDLH = Immediately Dangerous to Life or Health.
ND indicates that an IDLH has not been determined.
TLV = Threshold Limit Value, established by American Conference of Industrial Hygienists (ACGIH), equals the maximum exposure concentration allowable for 8 hours/day @ 40 hours/week.

TLVs are the amounts of chemicals in the air that almost all healthy adult workers are predicted to be able to tolerate without adverse effects. There are three types.

TLV-TWA (TLV-Time-Weighted Average) which is averaged over the normal eight-hour day/forty-hour work week. (Most TLVs.)

TLV-STEL or Short Term Exposure Limits are 15 minute exposures that should not be exceeded for even an instant. It is not a stand alone value but is accompanied by the TLV-TWA.

TLV-C or Ceiling limits are the concentration that should not be exceeded during any part of the working exposure.

Unless the initials "STEL" or "C" appear in the Code column, the TLV value should be considered to be the eight-hour TLV-TWA.

PEL = Permissible Exposure Limit, established by OSHA, equals the maximium exposure conconcentration allowable for 8 hours per day @ 40 hours per week

TABLE 2
POTENTIAL ROUTES OF EXPOSURE TO THE CONSTITUENTS OF POTENTIAL CONCERN

1827 FILLMORE AVENUE SITE
BUFFALO, NEW YORK

Activity [1]	Direct Contact with Soil/Fill	Inhalation of Vapors or Dust	Direct Contact with Water
Post-Remedial Tasks			
1. Redevelopment Soil/Fill Excavation	x	x	x
2. Waste Characterization Sampling	x	x	

Notes:
1. Activity as described in Section 1.5 of the Health and Safety Plan.

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TURNKEY ENVIRONMENTAL RESTORATION, LLC

TABLE 3
REQUIRED LEVELS OF PROTECTION FOR POST-REMEDIAL TASKS

1827 FILLMORE AVENUE SITE
BUFFALO, NEW YORK

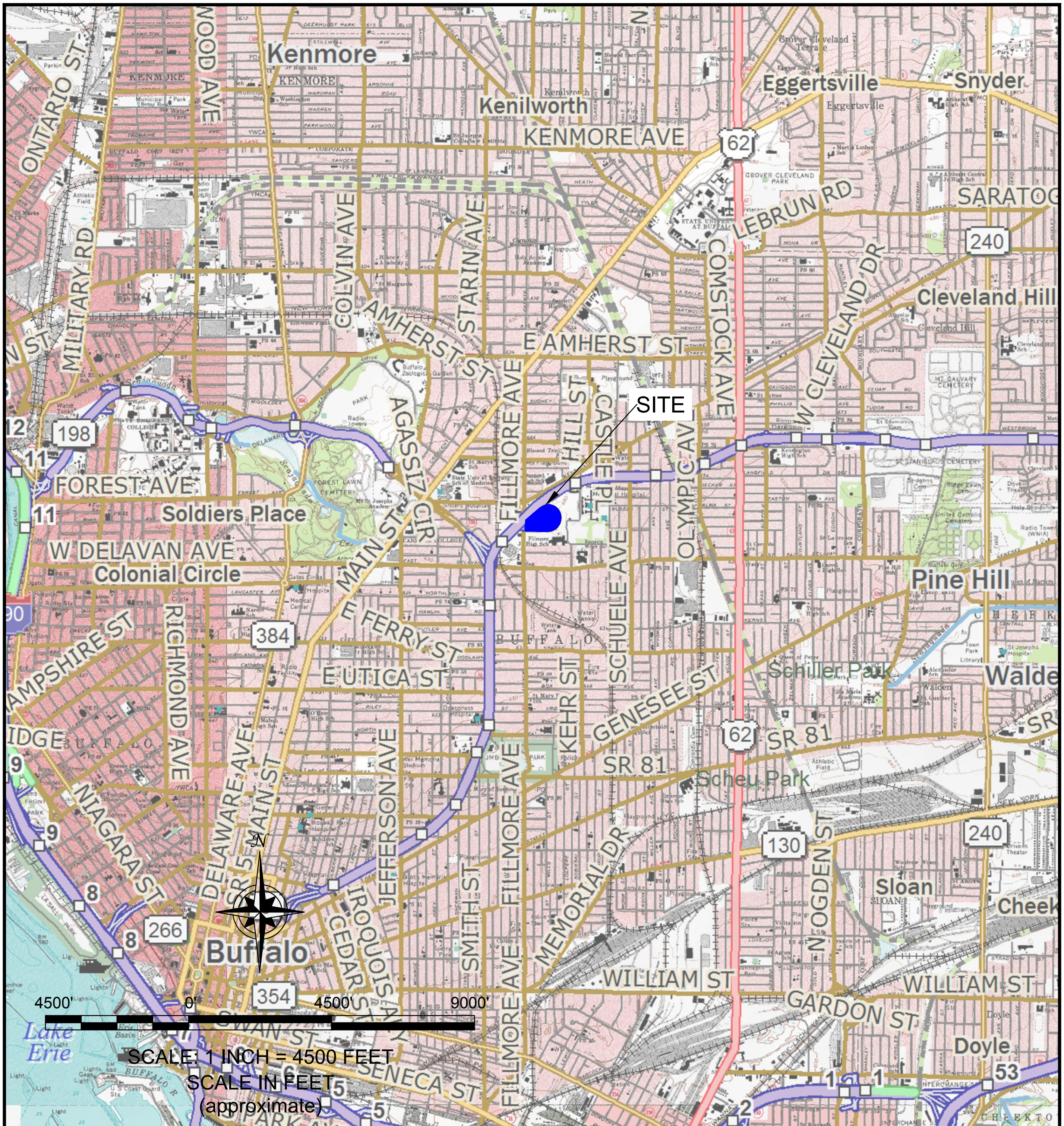
Activity	Respiratory Protection [1]	Clothing	Gloves [2]	Boots [2, 3]	Other Required PPE/ Modifications [2, 4]
Post-Remedial Tasks					
1. Redevelopment Soil/Fill Exacavtion	Level D (upgrade to Level C if necessary)	Work Uniform or Tyvek	L/N	outer: L inner: STSS	HH SGSS
2. Waste Characterization Sampling	Level D (upgrade to Level C if necessary)	Work Uniform or Tyvek	L/N	outer: L inner: STSS	SGSS

Notes:
1. Respiratory equipment shall conform to guidelines presented in Section 7.0 of this HASP. The Level C requirement is an air-purifying respirator equiped with organic compound/acid gas/dust cartridge.
2. HH = hardhat; L= Latex; L/N = latex inner glove, nitrile outer glove; N = Nitrile; S = Saranex; SG = safety glasses; SGSS = safety glasses with sideshields; STSS = steel toe safety shoes.
3. Latex outer boot (or approved overboot) required whenever contact with contaminated materials may occur. SSHO may downgrade to STSS (steel-toed safety shoes) if contact will be limited to cover/replacement soils.
4. Dust masks shall be donned as directed by the SSHO (site safety and health officer) or site safety technician whenever potentially contaminated airborne particulates (i.e., dust) are present

FIGURES

F:\CAD\Benchmark\Rupp, Base, Pfalzgraf & Cunningham LLC\1827 Fillmore Avenue\03 - RI Work Plan\HASP\Figure 1; Site Location & Vicinity Map.dwg

FIGURE 1



BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

TURNKEY ENVIRONMENTAL RESTORATION, LLC

2558 HAMBURG TURNPIKE, SUITE 300, BUFFALO, NY 14218, (716) 856-0599

PROJECT NO.: 0421-017-001

DATE: JUNE 2017

DRAFTED BY: CCB

SITE LOCATION & VICINITY MAP

HEALTH AND SAFETY PLAN

1827 FILLMORE AVENUE SITE
BUFFALO, NEW YORK

PREPARED FOR

1827 FILLMORE LLC

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ATTACHMENT A

EMERGENCY RESPONSE PLAN

EMERGENCY RESPONSE PLAN
for
BROWNFIELD CLEANUP PROGRAM
SITE MANAGEMENT PLAN

1827 FILLMORE AVENUE SITE
BUFFALO, NEW YORK

August 2019 | 0421-017-001

Prepared for:
1827 Fillmore LLC

Prepared By:

Benchmark Environmental Engineering & Science, PLLC
2558 Hamburg Turnpike, Suite 300
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(716) 856-0599

In Association With:

TurnKey Environmental Restoration, LLC
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1827 FILLMORE AVENUE SITE
HEALTH AND SAFETY PLAN FOR POST-REMEDIAL ACTIVITIES
ATTACHMENT A: EMERGENCY RESPONSE PLAN

TABLE OF CONTENTS

LIST OF FIGURES

1.0 GENERAL

This report presents the site-specific Emergency Response Plan (ERP) referenced in the Site Health and Safety Plan (HASP) prepared for post-remedial activities at the 1827 Fillmore Avenue Site in Buffalo, New York. This attachment of the HASP describes potential emergencies that may occur at the Site; procedures for responding to those emergencies; roles and responsibilities during emergency response; and training all workers must receive in order to follow emergency procedures. This ERP also describes the provisions this Site has made to coordinate its emergency response planning with other contractors on-site and with off-site emergency response organizations.

This ERP is consistent with the requirements of 29 CFR 1910.120(l) and provides the following site-specific information:

- Pre-emergency planning.
- Personnel roles, lines of authority, and communication.
- Emergency recognition and prevention.
- Safe distances and places of refuge.
- Evacuation routes and procedures.
- Decontamination procedures.
- Emergency medical treatment and first aid.
- Emergency alerting and response procedures.
- Critique of response and follow-up.
- Emergency personal protective equipment (PPE) and equipment.

2.0 PRE-EMERGENCY PLANNING

This Site has been evaluated for potential emergency occurrences, based on site hazards, the required work tasks, the site topography, and prevailing weather conditions. The results of that evaluation indicate the potential for the following site emergencies to occur at the locations indicated.

Type of Emergency:
1. Medical, due to physical injury

Source of Emergency:
1. Slip/trip/fall

Location of Source:
1. Non-specific

3.0 ON-SITE EMERGENCY RESPONSE EQUIPMENT

Emergency procedures may require specialized equipment to facilitate worker rescue, contamination control and reduction, or post-emergency clean up. Emergency response equipment available on the Site is listed below. The equipment inventory and storage locations are based on the potential emergencies described above. This equipment inventory is designed to meet on-site emergency response needs and any specialized equipment needs that off-site responders might require because of the hazards at this Site but not ordinarily stocked.

Any additional personal protective equipment (PPE) required and stocked for emergency response is also listed in below. During an emergency, the Emergency Response Coordinator (ERC) is responsible for specifying the level of PPE required for emergency response. At a minimum, PPE used by emergency responders will comply with Section 7.0, Personal Protective Equipment, of this HASP. Emergency response equipment is inspected at regular intervals and maintained in good working order. The equipment inventory is replenished as necessary to maintain response capabilities.

Emergency Equipment	Quantity	Location
First Aid Kit	1	Site Vehicle
Chemical Fire Extinguisher	2 (minimum)	Heavy equipment and Site Vehicle

Emergency PPE	Quantity	Location
Full-face respirator	1 for each worker	Site Vehicle
Chemical-resistant suits	4 (minimum)	Site Vehicle

4.0 EMERGENCY PLANNING MAPS

An area-specific map of the Site will be developed on a daily basis during performance of field activities. The map will be marked to identify critical on-site emergency planning information, including: emergency evacuation routes, a place of refuge, an assembly point, and the locations of key site emergency equipment. Site zone boundaries will be shown to alert responders to known areas of contamination. There are no major topographical features, however the direction of prevailing winds/weather conditions that could affect emergency response planning are also marked on the map. The map will be posted at site-designated place of refuge and inside the Benchmark-TurnKey personnel field vehicle.

5.0 EMERGENCY CONTACTS

The following identifies the emergency contacts for this ERP.

Emergency Telephone Numbers:

Project Manager: ***Michael Lesakowski***
Work: (716) 856-0599
Mobile: (716) 818-3954

Corporate Health and Safety Director: ***Thomas H. Forbes***
Work: (716) 856-0599
Mobile: (716) 864-1730

Site Safety and Health Officer (SSHO): ***Bryan W. Mayback***
Work: (716) 856-0599
Mobile: (716) 844-1699

Alternate SSHO: ***Nathan Munley***
Work: (716) 856-0635
Mobile: (716) 289-1072

ERIE COUNTY MEDICAL CENTER (ER):	(800) 729-5433
FIRE:	911
AMBULANCE:	911
BUFFALO POLICE:	911
STATE EMERGENCY RESPONSE HOTLINE:	(800) 457-7362
NATIONAL RESPONSE HOTLINE:	(800) 424-8802
NYSDOH:	(716) 847-4385
NYSDEC:	(716) 851-7220
NYSDEC 24-HOUR SPILL HOTLINE:	(800) 457-7252

The Site location is:

1827 Fillmore Avenue
Buffalo, New York 14214
Site Phone Number: (Insert Cell Phone or Field Trailer): ____________________

6.0 EMERGENCY ALERTING & EVACUATION

Internal emergency communication systems are used to alert workers to danger, convey safety information, and maintain site control. Any effective system can be employed. Two-way radio headsets or field telephones are often used when work teams are far from the command post. Hand signals and air-horn blasts are also commonly used. Every system must have a backup. It shall be the responsibility of each contractor's SSHO to ensure personnel entering the site understand an adequate method of internal communication. Unless personnel are otherwise informed, the following signals shall be used.

1. Emergency signals by portable air horn, siren, or whistle: two short blasts, personal injury; continuous blast, emergency requiring site excavation.
2. Visual signals: hand gripping throat, out of air/cannot breathe; hands on top of head, need assistance; thumbs up, affirmative/ everything is OK; thumbs down, no/ negative; grip partner's wrist or waist, leave area immediately.

If evacuation notice is given, site workers leave the worksite with their respective buddies, if possible, by way of the nearest exit. Emergency decontamination procedures detailed in Section 12.0 of the HASP are followed to the extent practical without compromising the safety and health of site personnel. The evacuation routes and assembly area will be determined by conditions at the time of the evacuation based on wind direction, the location of the hazard source, and other factors as determined by rehearsals and inputs from emergency response organizations. Wind direction indicators are located so that workers can determine a safe up wind or cross wind evacuation route and assembly area if not informed by the emergency response coordinator at the time the evacuation alarm sounds. Since work conditions and work zones within the site may be changing on daily basis, it shall be the responsibility of the construction SSHO to review evacuation routes and procedures as necessary and to inform all Benchmark-TurnKey workers of any changes.

Personnel exiting the site will gather at a designated assembly point. To determine that everyone has successfully exited the site, personnel will be accounted for at the assembly site. If any worker cannot be accounted for, notification is given to the SSHO (***Bryan Mayback*** or ***Nathan Munley***) so that appropriate action can be initiated. Contractors and subcontractors on this site have coordinated their emergency response plans to ensure that these plans are compatible and that source(s) of potential emergencies are recognized, alarm systems are clearly understood, and evacuation routes are accessible to all personnel relying upon them.

7.0 EXTREME WEATHER CONDITIONS

In the event of adverse weather conditions, the SSHO in conjunction with the Contractor's SSHO will determine if engineering operations can continue without sacrificing the health and safety of site personnel. Items to be considered prior to determining if work should continue include but are not limited to:

- Potential for heat/cold stress.
- Weather-related construction hazards (e.g., flooding or wet conditions producing undermining of structures or sheeting, high wind threats, etc.).
- Limited visibility.
- Potential for electrical storms.
- Limited site access/egress (e.g., due to heavy snow)

8.0 EMERGENCY MEDICAL TREATMENT & FIRST AID

Personnel Exposure:

The following general guidelines will be employed in instances where health impacts threaten to occur acute exposure is realized:

- Skin Contact: Use copious amounts of soap and water. Wash/rinse affected area for at least 15 minutes. Decontaminate and provide medical attention. Eyewash stations will be provided on site. If necessary, transport to Hospital.
- Inhalation: Move to fresh air and, if necessary, transport to Hospital.
- Ingestion: Decontaminate and transport to Hospital.

Personal Injury:

Minor first-aid will be applied on-site as deemed necessary. In the event of a life threatening injury, the individual should be transported to Hospital via ambulance. The SSHO will supply available chemical specific information to appropriate medical personnel as requested.

First aid kits will conform to Red Cross and other applicable good health standards, and shall consist of a weatherproof container with individually sealed packages for each type of item. First aid kits will be fully equipped before being sent out on each job and will be checked weekly by the SSHO to ensure that the expended items are replaced.

Directions to Erie County Medical Center (see Figure 1):

The following directions describe the best route from the Site to Erie County Medical Center located 1.2 miles away:

- Head **north** on **Fillmore Avenue** toward **Kensington Avenue**
- Turn **right** at the first cross street onto **Kensington Avenue**
- Turn **right** onto **Grider Street**
- Turn **right**
- Erie County Medical Center is located at **462 Grider Street, Buffalo, New York**

9.0 Emergency Response Critique & Record Keeping

Following an emergency, the SSHO and Project Manager shall review the effectiveness of this Emergency Response Plan (ERP) in addressing notification, control and evacuation requirements. Updates and modifications to this ERP shall be made accordingly. It shall be the responsibility of each contractor to establish and assure adequate records of the following:

- Occupational injuries and illnesses.
- Accident investigations.
- Reports to insurance carrier or State compensation agencies.
- Reports required by the client.
- Records and reports required by local, state, federal and/or international agencies.
- Property or equipment damage.
- Third party injury or damage claims.
- Environmental testing logs.
- Explosive and hazardous substances inventories and records.
- Records of inspections and citations.
- Safety training.

10.0 EMERGENCY RESPONSE TRAINING

Persons who enter the worksite, including visitors, shall receive a site-specific briefing about anticipated emergency situations and the emergency procedures by the SSHO. Where this site relies on off-site organizations for emergency response, the training of personnel in those off-site organizations has been evaluated and is deemed adequate for response to this site.

FIGURES

F:\CAD\Benchmark\Rupp, Baase, Pfalzgraf & Cunningham LLC\1827 Fillmore Avenue\03 - RI Work Plan\HASP\Figure 1; Hospital Route Map.dwg

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PROJECT NO.: 0421-017-001

DATE: JUNE 2017

DRAFTED BY: CCB

HOSPITAL ROUTE MAP

EMERGENCY RESPONSE PLAN

1827 FILLMORE AVENUE SITE
BUFFALO, NEW YORK

PREPARED FOR

1827 FILLMORE LLC

FIGURE 1

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ATTACHMENT B

HOT WORK PERMIT FORM

Benchmark Environmental Engineering & Science, PLLC

HOT WORK PERMIT

PART 1 - INFORMATION

Issue Date:

Date Work to be Performed: Start: Finish (permit terminated):

Performed By:

Work Area:

Object to be Worked On:

PART 2 - APPROVAL

(for 1, 2 or 3: mark Yes, No or NA)*

Will working be on or in: Finish (permit terminated):

1. Metal partition, wall, ceiling covered by combustible material?	yes	no
2. Pipes, in contact with combustible material?	yes	no
3. Explosive area?	yes	no

* = If any of these conditions exist (marked "yes"), a permit will not be issued without being reviewed and approved by Thomas H. Forbes (Corporate Health and Safety Director). Required Signature below.

PART 3 - REQUIRED CONDITIONS**

(Check all conditions that must be met)

	PROTECTIVE ACTION		PROTECTIVE EQUIPMENT
	Specific Risk Assessment Required		Goggles/visor/welding screen
	Fire or spark barrier		Apron/fireproof clothing
	Cover hot surfaces		Welding gloves/gauntlets/other:
	Move movable fire hazards, specifically		Wellintons/Knee pads
	Erect screen on barrier		Ear protection: Ear muffs/Ear plugs
	Restrict Access		B.A.: SCBA/Long Breather
	Wet the ground		Respirator: Type:
	Ensure adequate ventilation		Cartridge:
	Provide adequate supports		Local Exhaust Ventilation
	Cover exposed drain/floor or wall cracks		Extinguisher/Fire blanket
	Fire watch (must remain on duty during duration of permit)		Personal flammable gas monitor
	Issue additional permit(s):		

Other precautions:

** Permit will not be issued until these conditions are met.

SIGNATURES

Orginating Employee: Date:

Project Manager: Date:

Part 2 Approval: Date:

ATTACHMENT C

NYSDOH GENERIC COMMUNITY AIR MONITORING PLAN

Appendix C1
New York State Department of Health
Generic Community Air Monitoring Plan

Overview

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical- specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for VOCs and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate DEC/NYSDOH staff.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. “Periodic” monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions, particularly if wind direction changes. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

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

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

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

4. All 15-minute readings must be recorded and be available for State (DEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

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

1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

2. If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.

3. All readings must be recorded and be available for State (DEC and NYSDOH) and County Health personnel to review.

December 2009

Appendix C2
Fugitive Dust and Particulate Monitoring

A program for suppressing fugitive dust and particulate matter monitoring at hazardous waste sites is a responsibility on the remedial party performing the work. These procedures must be incorporated into appropriate intrusive work plans. The following fugitive dust suppression and particulate monitoring program should be employed at sites during construction and other intrusive activities which warrant its use:

1. Reasonable fugitive dust suppression techniques must be employed during all site activities which may generate fugitive dust.

2. Particulate monitoring must be employed during the handling of waste or contaminated soil or when activities on site may generate fugitive dust from exposed waste or contaminated soil. Remedial activities may also include the excavation, grading, or placement of clean fill. These control measures should not be considered necessary for these activities.

3. Particulate monitoring must be performed using real-time particulate monitors and shall monitor particulate matter less than ten microns (PM10) with the following minimum performance standards:

(a) Objects to be measured: Dust, mists or aerosols;
(b) Measurement Ranges: 0.001 to 400 mg/m3 (1 to 400,000 :ug/m3);
(c) Precision (2-sigma) at constant temperature: +/- 10 :g/m3 for one second averaging; and +/- 1.5 g/m3 for sixty second averaging;
(d) Accuracy: +/- 5% of reading +/- precision (Referred to gravimetric calibration with SAE fine test dust (mmd= 2 to 3 :m, g= 2.5, as aerosolized);
(e) Resolution: 0.1% of reading or 1g/m3, whichever is larger;
(f) Particle Size Range of Maximum Response: 0.1-10;
(g) Total Number of Data Points in Memory: 10,000;
(h) Logged Data: Each data point with average concentration, time/date and data point number
(i) Run Summary: overall average, maximum concentrations, time/date of maximum, total number of logged points, start time/date, total elapsed time (run duration), STEL concentration and time/date occurrence, averaging (logging) period, calibration factor, and tag number;
(j) Alarm Averaging Time (user selectable): real-time (1-60 seconds) or STEL (15 minutes), alarms required;
(k) Operating Time: 48 hours (fully charged NiCd battery); continuously with charger;
(l) Operating Temperature: -10 to 50^{o} C (14 to 122^{o} F);
(m) Particulate levels will be monitored upwind and immediately downwind at the working site and integrated over a period not to exceed 15 minutes.

4. In order to ensure the validity of the fugitive dust measurements performed, there must be appropriate Quality Assurance/Quality Control (QA/QC). It is the responsibility of the remedial party to adequately supplement QA/QC Plans to include the following critical features: periodic instrument calibration, operator training, daily instrument performance (span) checks, and a record keeping plan.

5. The action level will be established at 150 ug/m3 (15 minutes average). While conservative,

this short-term interval will provide a real-time assessment of on-site air quality to assure both health and safety. If particulate levels are detected in excess of 150 ug/m3, the upwind background level must be confirmed immediately. If the working site particulate measurement is greater than 100 ug/m3 above the background level, additional dust suppression techniques must be implemented to reduce the generation of fugitive dust and corrective action taken to protect site personnel and reduce the potential for contaminant migration. Corrective measures may include increasing the level of personal protection for on-site personnel and implementing additional dust suppression techniques (see paragraph 7). Should the action level of 150 ug/m3 continue to be exceeded work must stop and DER must be notified as provided in the site design or remedial work plan. The notification shall include a description of the control measures implemented to prevent further exceedances.

6. It must be recognized that the generation of dust from waste or contaminated soil that migrates off-site, has the potential for transporting contaminants off-site. There may be situations when dust is being generated and leaving the site and the monitoring equipment does not measure PM10 at or above the action level. Since this situation has the potential to allow for the migration of contaminants off-site, it is unacceptable. While it is not practical to quantify total suspended particulates on a real-time basis, it is appropriate to rely on visual observation. If dust is observed leaving the working site, additional dust suppression techniques must be employed. Activities that have a high dusting potential--such as solidification and treatment involving materials like kiln dust and lime--will require the need for special measures to be considered.

7. The following techniques have been shown to be effective for the controlling of the generation and migration of dust during construction activities:

(a) Applying water on haul roads;
(b) Wetting equipment and excavation faces;
(c) Spraying water on buckets during excavation and dumping;
(d) Hauling materials in properly tarped or watertight containers;
(e) Restricting vehicle speeds to 10 mph;
(f) Covering excavated areas and material after excavation activity ceases; and
(g) Reducing the excavation size and/or number of excavations.

Experience has shown that the chance of exceeding the 150ug/m3 action level is remote when the above-mentioned techniques are used. When techniques involving water application are used, care must be taken not to use excess water, which can result in unacceptably wet conditions. Using atomizing sprays will prevent overly wet conditions, conserve water, and provide an effective means of suppressing the fugitive dust.

8. The evaluation of weather conditions is necessary for proper fugitive dust control. When extreme wind conditions make dust control ineffective, as a last resort remedial actions may need to be suspended. There may be situations that require fugitive dust suppression and particulate monitoring requirements with action levels more stringent than those provided above. Under some circumstances, the contaminant concentration and/or toxicity may require additional monitoring to protect site personnel and the public. Additional integrated sampling and chemical analysis of the dust may also be in order. This must be evaluated when a health and safety plan is developed and when appropriate suppression and monitoring requirements are established for protection of health and the environment.

APPENDIX F

SITE MANAGEMENT FORMS

BENCHMARK
ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

Field Inspection Report
Post-Remedial Operation & Maintenance Plan

Property Name: Project No.:

Client:

Property Address:

Property ID: (Tax Assessment Map) Section: Block: Lot(s):

Preparer's Date/Time:

CERTIFICATION

The results of this inspection were discussed with the Site Manager. Any corrective actions required have been identified and noted in this report, and a supplemental Corrective Action Form has been completed. Proper implementation of these corrective actions have been discussed with the Site Manager, agreed upon, and scheduled.

Preparer / Inspector: **Date:**

Signature:

Next Scheduled Inspection Date:

Property Access

1. Is the access road in need of repair? ☐ yes ☐ no ☐ N/A
2. Sufficient signage posted (No Trespassing)? ☐ yes ☐ no ☐ N/A
3. Has there been any noted or reported trespassing? ☐ yes ☐ no ☐ N/A

Please note any irregularities/ changes in site access and security:

Final Surface Cover / Vegetation

The integrity of the vegetative soil cover or other surface coverage (e.g., asphalt, concrete) over the entire Site must be maintained. The following documents the condition of the above.

1. Final Cover is in Place and in good condition? ☐ yes ☐ no ☐ N/A

   Cover consists of (mainly):

2. Evidence of erosion? ☐ yes ☐ no ☐ N/A
3. Cracks visible in pavement? ☐ yes ☐ no ☐ N/A
4. Evidence of distressed vegetation/turf? ☐ yes ☐ no ☐ N/A
5. Evidence of unintended traffic and/or rutting? ☐ yes ☐ no ☐ N/A
6. Evidence of uneven settlement and/or ponding? ☐ yes ☐ no ☐ N/A

Field Inspection Report
Post-Remedial Operation & Maintenance Plan

Final Surface Cover / Vegetation (continued)

7. Damage to any surface coverage? ☐ yes ☐ no ☐ N/A

If yes to any question above, please provide more information below.

Groundwater Monitoring

☐ ☐ ☐

Is there a plan in place and currently being followed? ☐ yes ☑ no ☐ N/A

Are the wells currently intact and operational? ☐ yes ☐ no ☑ N/A

When was the most recent sampling event report and submittal? Date:

When is the next projected sampling event? Date:

Property Use Changes / Site Development

Has the property usage changed, or site been redeveloped since the last inspection?

☐ yes ☐ no ☐ N/A

If yes, please list with date:

Field Inspection Report
Post-Remedial Operation & Maintenance Plan

New Information

Has any new information been brought to the owner/engineer's attention regarding any and/or all engineering and institutional controls and their operation and effectiveness?

☐ yes ☐ no ☐ N/A

Comments: ______________________________

This space for Notes and Comments

Please include the following Attachments:

1. Site Sketch
2. Photographs

Summary of Green Remediation Metrics for Site Management

Site Name: ______________________________ Site Code: ____________________
Address: ________________________________ City: _______________________
State: ____________ Zip Code: __________ County: ________________

Initial Report Period (Start Date of period covered by the Initial Report submittal)
Start Date: ____________________

Current Reporting Period
Reporting Period From: __________________ To: ________________________

Contact Information
Preparer's Name: ____________________ Phone No.: __________________
Preparer's Affiliation: ______________________________

I. Energy Usage: Quantify the amount of energy used directly on-site and the portion of that derived from renewable energy sources.

	Current Reporting Period	**Total to Date**
Fuel Type 1 (e.g. natural gas (cf))		
Fuel Type 2 (e.g. fuel oil, propane (gals))		
Electricity (kWh)		
Of that Electric usage, provide quantity:		
Derived from renewable sources (e.g. solar, wind)		
Other energy sources (e.g. geothermal, solar thermal (Btu))		

Provide a description of all energy usage reduction programs for the site in the space provided on Page 3.

II. Solid Waste Generation: Quantify the management of solid waste generated on-site.

	Current Reporting Period (tons)	**Total to Date (tons)**
Total waste generated on-site		
OM&M generated waste		
Of that total amount, provide quantity:		
Transported off-site to landfills		
Transported off-site to other disposal facilities		
Transported off-site for recycling/reuse		
Reused on-site		

Provide a description of any implemented waste reduction programs for the site in the space provided on Page 3.

BENCHMARK TURNKEY

III. Transportation/Shipping: Quantify the distances travelled for delivery of supplies, shipping of laboratory samples, and the removal of waste.

	Current Reporting Period (miles)	**Total to Date (miles)**
Standby Engineer/Contractor		
Laboratory Courier/Delivery Service		
Waste Removal/Hauling		

Provide a description of all mileage reduction programs for the site in the space provided on Page 3. Include specifically any local vendor/services utilized that are within 50 miles of the site.

IV. Water Usage: Quantify the volume of water used on-site from various sources.

	Current Reporting Period (gallons)	**Total to Date (gallons)**
Total quantity of water used on-site		
Of that total amount, provide quantity:		
Public potable water supply usage		
Surface water usage		
On-site groundwater usage		
Collected or diverted storm water usage		

Provide a description of any implemented water consumption reduction programs for the site in the space provided on Page 3.

V. Land Use and Ecosystems: Quantify the amount of land and/or ecosystems disturbed and the area of land and/or ecosystems restored to a pre-development condition (i.e. Green Infrastructure).

	Current Reporting Period (acres)	**Total to Date (acres)**
Land disturbed		
Land restored		

Provide a description of any implemented land restoration/green infrastructure programs for the site in the space provided on Page 3.

Description of green remediation programs reported above (Attach additional sheets if needed)
Energy Usage:
Waste Generation:
Transportation/Shipping:
Water usage:
Land Use and Ecosystems:
Other:

CERTIFICATION BY CONTRACTOR
I, ________________________ (**Name**) do hereby certify that I am ____________________ (**Title**) of the Company/Corporation herein referenced and contractor for the work described in the foregoing application for payment. According to my knowledge and belief, all items and amounts shown on the face of this application for payment are correct, all work has been performed and/or materials supplied, the foregoing is a true and correct statement of the contract account up to and including that last day of the period covered by this application. ____ **Date** **Contractor**

APPENDIX G

FIELD OPERATING PROCEDURES (FOPS)

BENCHMARK
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FIELD OPERATING PROCEDURES

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

FOP Number	Description
001.1	Abandonment of Borehole Procedures
002.0	Abandonment of Monitoring Wells Procedure
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
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
017.0	Drill Site Selection Procedure
018.0	Drilling and Excavation Equipment Decontamination Procedures
022.0	Groundwater Level Measurement
023.1	Groundwater Purging Procedures Prior to Sample Collection
024.1	Groundwater Sample Collection Procedures
026.1	Hollow Stem Auger (HSA) Drilling Procedures
031.2	Low Flow (Minimal Drawdown) Groundwater Purging & Sampling Procedure
032.1	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
046.0	Sample Labeling, Storage and Shipment Procedures
054.2	Soil Description Procedures Using The Visual-Manual Method
070.0	Well/Piezometer Construction Materials and Design
073.2	Real-Time Air Monitoring During Intrusive Activities

Notes:

1. FOPs are identified by the sequential FOP number and revision number.

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FIELD OPERATING PROCEDURES

Abandonment of Borehole Procedures

PURPOSE

Soil borings that are not completed as monitoring wells will be plugged by filling the holes with a cement/bentonite grout. Field staff will calculate the borehole volume and compare it to the final installed volume of grout to evaluate whether bridging or loss to the formation has occurred. These calculations and the actual volume placed will be noted on the Boring Log.

PROCEDURE

1. Determine most suitable seal materials. 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

2. Calculate the volume of the borehole base on the bit or auger head 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 Well Abandonment/Decommissioning 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.

6. Identify the volumes to be pumped at each stage or in total if only one stage is to be used.

7. Prepare the borehole abandonment plan and discuss the plan and activities with the drilling contractor prior to beginning any mixing activities.

8. Begin mixing the grout to be emplaced.

9. Record the type and amount of materials used during the mixing operation. Ensure the ratios are within specifications tolerance.

10. Begin pumping the grout through the return line bypass system to confirm all pump and surface fittings are secure.

11. Initiate downhole pumping from the bottom of the borehole. Record the times and volumes emplaced on the Well Abandonment/Decommissioning Log (sample attached).

12. 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.

13. Identify what procedures will be used for grouting in the upper 3 feet. When casing exists in the borehole, decisions are required as to the timing for removal and final disposition of the casing. Generally, it will not be removed prior to grouting because of the potential for difficult access and loss of circulation in the upper soil or rock layers. Accordingly, when cement return is achieved at surface, the casing is commonly removed and the borehole is topped off with grout or soils. If casing removal is not possible or not desired, the casing left in place should be cut off at a depth of 5 feet or greater below ground surface. If casing is not present during grouting, the grout level in the borehole is topped off after the rods or tremie pipe is removed.

14. Clear and clean the surface near the borehole.

15. The uppermost five feet of the borehole at the land surface should be filled with material physically similar to the natural soils. The surface of the borehole should be restored to the condition of the area surrounding the borehole. For example, concrete or asphalt will be patched with concrete or asphalt of the same type and thickness, grassed areas will be seeded, and topsoil will be used in other areas. All solid waste materials generated during the decommissioning process must be disposed of properly.

16. A follow-up check at each site should be made within one week to 10 days of completion. It should be noted that on occasion, the grout and/or surface material may settle over several days. If settling occurs, additional material physically similar to surrounding materials (i.e., asphalt, concrete, or soil) must be used to match the existing grade.

17. Document borehole and/or well/piezometer decommissioning activities on a Well Abandonment/Decommissioning Log (sample attached).

ATTACHMENTS

Well Abandonment/Decommissioning Log (sample)

REFERENCES

ASTM D 5299: *Guide for Decommissioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities.*

NYSDEC, July 1988, *Drilling and Monitoring Well Installation Guidance Manual.*

NYSDEC, November 2009, *CP-43: Groundwater Monitoring Well Decommissioning Policy.*

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

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

WELL ABANDONMENT/ DECOMMISSIONING LOG

PROJECT INFORMATION	WELL INFORMATION
Project Name:	WELL I.D.:
Client:	Stick-up (fags):
Project Job Number:	Total Depth (fbgs):
Date:	Screen Interval (fbgs):
Weather:	Well Material:
	Diameter (inches):
BM/TK Personnel:	
Drilling Company:	Drilling Company Personnel:
Drill Rig Type:	

DECOMMISSIONING PROCEDURES

Time	Description of Field Activities

PREPARED BY: DATE:

SAMPLE

Benchmark
Environmental
Engineering &
Science, PLLC

Field Operating Procedures

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.

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.

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 accordance with Benchmark'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.

Benchmark 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.

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

WELL ABANDONMENT/ DECOMMISSIONING LOG

PROJECT INFORMATION	WELL INFORMATION
Project Name:	WELL I.D.:
Client:	Stick-up (fags):
Project Job Number:	Total Depth (fbgs):
Date:	Screen Interval (fbgs):
Weather:	Well Material:
	Diameter (inches):
BM/TK Personnel:	
Drilling Company:	Drilling Company Personnel:
Drill Rig Type:	

DECOMMISSIONING PROCEDURES

Time	Description of Field Activities

SAMPLE

Benchmark Environmental Engineering & Science, PLLC

Field Operating Procedures

Calibration and Maintenance of Portable Dissolved Oxygen Meter

FOP 007.0

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 ± 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.

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)

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

EQUIPMENT CALIBRATION

PROJECT INFORMATION:

Project Name: Date:

Project No.:

Client: Instrument Source: ☐ BM ☐ Rental

METER TYPE	UNITS	TIME	MAKE/MODEL	SERIAL NUMBER	CAL. BY	STANDARD	READING	SETTI
☐ pH meter	units		Myron L Company Ultra Meter 6P	606987		4.00		
						7.00		
						10.01		
☐ Turbidity meter	NTU		Hach 2100P Turbidimeter	970600014560		< 0.4		
						20		
						100		
						800		
☐ Sp. conductance meter	uS/mS		Myron L Company Ultra Meter 6P	606987		µS @ 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		
☐								

SAMPLE

ADDITIONAL REMARKS:

PREPARED BY: **DATE:**

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FIELD OPERATING PROCEDURES

Calibration and Maintenance of Portable Field pH/Eh Meter

FOP 008.0

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.

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)

- 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 meeting system 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)

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

EQUIPMENT CALIBRATION

PROJECT INFORMATION:

Project Name: ______________________ Date: ______________

Project No.: ______________________

Client: ______________________ Instrument Source: ☐ BM ☐ Rental

METER TYPE	UNITS	TIME	MAKE/MODEL	SERIAL NUMBER	CAL. BY	STANDARD	READING	SETTI
☐ pH meter	units		Myron L Company Ultra Meter 6P	606987		4.00		
						7.00		
						10.01		
☐ Turbidity meter	NTU		Hach 2100P Turbidimeter	970600014560		< 0.4		
						20		
						100		
						800		
☐ Sp. conductance meter	uS/mS		Myron L Company Ultra Meter 6P	60698		µS @ 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:** ______________

SAMPLE

BENCHMARK
ENVIRONMENTAL
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FIELD OPERATING PROCEDURES

Calibration and Maintenance of Portable Field Turbidity Meter

FOP 009.0

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 ± 2% of reading below 499 NTU or ± 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.

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.

<u>Preparing StablCal Stabilized Standards in Sealed Vials</u>

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*)

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 (→) 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

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

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 11of 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 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)

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

EQUIPMENT CALIBRATION

PROJECT INFORMATION:

Project Name: ______________________ Date: ______________

Project No.: ______________________

Client: ______________________ Instrument Source: ☐ BM ☐ Rental

☐	METER TYPE	UNITS	TIME	MAKE/MODEL	SERIAL NUMBER	CAL. BY	STANDARD	READING	SETTI
☐	pH meter	units		Myron L Company Ultra Meter 6P	606987		4.00		
							7.00		
							10.01		
☐	Turbidity meter	NTU		Hach 2100P Turbidimeter	970600014560		< 0.4		
							20		
							100		
							800		
☐	Sp. conductance meter	uS/mS		Myron L Company Ultra Meter 6P	606987		[illegible] µS @ 25 °C		
☐	PID	ppm		Photovac 2020 PID	[illegible]		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:** ______________

SAMPLE

BENCHMARK
ENVIRONMENTAL
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SCIENCE, PLLC

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.

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 <u>total</u> 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 ± 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.

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

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

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.

ATTACHMENTS

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

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	

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		

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	

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-Dibromoethene	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

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 (methylal)	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	

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	
Ethylenelmine	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-trifluororethane)	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	

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	

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 napthalene	7.96	
1-Methyl napthalene	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

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	

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	

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

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	

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

EQUIPMENT CALIBRATION LOG

PROJECT INFORMATION:

Project Name: ____________ Date: ____________

Project No.: ____________

Client: ____________ Instrument Source: ☐ BM ☐ 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	9706000145[illegible]		< 0.4 [illegible] [illegible]00 800		
☐ Sp. Cond. meter	uS mS		Myron L Company Ultra Meter 6P	[illegible]		_______ mS @ 25 °C		
☐ PID	ppm		MinRAE 20[illegible]			open air zero _____ ppm Iso. Gas		MIBK response factor = 1.0
☐ Dissolved Oxygen	ppm		YSI Model 5[illegible]	[illegible]				
☐ 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		
☐								

SAMPLE

ADDITIONAL REMARKS:

PREPARED BY: ____________ **DATE:** ____________

Correction Factors, Ionization Energies*, And Calibration Characteristics

Correction Factors and Ionization Energies

RAE Systems PIDs can be used for the detection of a wide variety of gases that exhibit different responses. In general, any compound with ionization energy (IE) lower than that of the lamp photons can be measured.* 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. In our PIDs, correction factors can be used in one of three ways:

1) Calibrate the monitor with isobutylene in the usual fashion to read in isobutylene equivalents. Manually multiply the reading by the correction factor (CF) to obtain the concentration of the gas being measured.

2) Calibrate the unit with isobutylene in the usual fashion to read in isobutylene equivalents. Call up the correction factor from the instrument memory or download it from a personal computer and then call it up. The monitor will then read directly in units of the gas of interest.

3) Calibrate the unit with isobutylene, but input an equivalent, "corrected" span gas concentration when prompted for this value. The unit will then read directly in units of the gas of interest.

* *The term "ionization energy" is more scientifically correct and replaces the old term "ionization potential." High-boiling ("heavy") compounds may not vaporize enough to give a response even when their ionization energies are below the lamp photon energy. Some inorganic compounds like H_2O_2 and NO_2 give weak response even when their ionization energies are well below the lamp photon energy.*

Example 1:

With the unit calibrated to read isobutylene equivalents, the reading is 10 ppm with a 10.6 eV lamp. The gas being measured is butyl acetate, which has a correction factor of 2.6. Multiplying 10 by 2.6 gives an adjusted butyl acetate value of 26 ppm. Similarly, if the gas being measured were trichloroethylene (CF = 0.54), the adjusted value with a 10 ppm reading would be 5.4 ppm.

Example 2:

With the unit calibrated to read isobutylene equivalents, the reading is 100 ppm with a 10.6 eV lamp. The gas measured is m-xylene (CF = 0.43). After downloading this factor, the unit should read about 43 ppm when exposed to the same gas, and thus read directly in m-xylene values.

Example 3:

The desired gas to measure is ethylene dichloride (EDC). The CF is 0.6 with an 11.7 eV lamp. During calibration with 100 ppm isobutylene, insert 0.6 times 100, or 60 at the prompt for the calibration gas concentration. The unit then reads directly in EDC values.

Conversion to mg/m^3

To convert from ppm to mg/m^3, use the following formula:

$$\text{Conc. (mg/m}^3) = \frac{[\text{Conc.(ppmv) x mol. wt. (g/mole)}]}{\text{molar gas volume (L)}}$$

For air at 25 °C (77 °F), the molar gas volume is 24.4 L/mole and the formula reduces to:

$$\text{Conc.(mg/m}^3) = \text{Conc.(ppmv) x mol. wt. (g/mole) x 0.041}$$

For example, if the instrument is calibrated with a gas standard in ppmv, such as 100 ppm isobutylene, and the user wants the display to read in mg/m^3 of hexane, whose m.w. is 86 and CF is 4.3, the overall correction factor would be 4.3 x 86 x 0.041 equals 15.2.

Correction Factors for Mixtures

The correction factor for a mixture is calculated from the sum of the mole fractions Xi of each component divided by their respective correction factors CFi:

$$CF_{mix} = 1 / (X_1/CF_1 + X_2/CF_2 + X_3/CF_3 + ... X_i/CF_i)$$

Thus, for example, a vapor phase mixture of 5% benzene and 95% n-hexane would have a CFmix of CFmix = 1 / (0.05/0.53 + 0.95/4.3) = 3.2. A reading of 100 would then correspond to 320 ppm of the total mixture, comprised of 16 ppm benzene and 304 ppm hexane.

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For a spreadsheet to compute the correction factor and TLV of a mixture see the appendix at the end of the CF table.

TLVs and Alarm Limits for Mixtures

The correction factor for mixtures can be used to set alarm limits for mixtures. To do this one first needs to calculate the exposure limit for the mixture. The Threshold Limit Value (TLV) often defines exposure limits. The TLV for the mixture is calculated in a manner similar to the CF calculation:

$$TLV\ mix = 1 / (X_1/TLV_1 + X_2/TLV_2 + X_3/TLV_3 + ... Xi/TLVi)$$

In the above example, the 8-h TLV for benzene is 0.5 ppm and for n-hexane 50 ppm. Therefore the TLV of the mixture is TLVmix = 1 / (0.05/0.5 + 0.95/50) = 8.4 ppm, corresponding to 8.0 ppm hexane and 0.4 ppm benzene. For an instrument calibrated on isobutylene, the reading corrsponding to the TLV is:

$$\text{Alarm Reading} = TLVmix / CFmix = 8.4 / 3.2 = 2.6 \text{ ppm}$$

A common practice is to set the lower alarm limit to half the TLV, and the higher limit to the TLV. Thus, one would set the alarms to 1.3 and 2.6 ppm, respectively.

Calibration Characteristics

a) Flow Configuration. PID response is essentially independent of gas flow rate as long as it is sufficient to satisfy the pump demand. Four main flow configurations are used for calibrating a PID:

1) **Pressurized gas cylinder (Fixed-flow regulator):** The flow rate of the regulator should match the flow demand of the instrument pump or be slightly higher.
2) **Pressurized gas cylinder (Demand-flow regulator):** A demand-flow regulator better matches pump speed differences, but results in a slight vacuum during calibration and thus slightly high readings.
3) **Collapsible gas bag:** The instrument will draw the calibration gas from the bag at its normal flow rate, as long as the bag valve is large enough. The bag should be filled with enough gas to allow at least one minute of flow (~ 0.6 L for a MiniRAE, ~0.3 L for MultiRAE).
4) **T (or open tube) method:** The T method uses a T-junction with gas flow higher than the pump draw. The gas supply is connected to one end of the T, the instrument inlet is connected to a second end of the T, and excess gas flow escapes through the third, open end of the T. To prevent ambient air mixing, a long tube should be connected to the open end, or a high excess rate should be used. Alternatively, the instrument probe can be inserted into an open tube slightly wider than the probe. Excess gas flows out around the probe.

The first two cylinder methods are the most efficient in terms of gas usage, while the bag and T methods give slightly more accurate results because they match the pump flow better.

b) Pressure. Pressures deviating from atmospheric pressure affect the readings by altering gas concentration and pump characteristics. It is best to calibrate with the instrument and calibration gas at the same pressure as each other and the sample gas. (Note that the cylinder pressure is not relevant because the regulator reduces the pressure to ambient.) If the instrument is calibrated at atmospheric pressure in one of the flow configurations described above, then 1) pressures slightly above ambient are acceptable but high pressures can damage the pump and 2) samples under vacuum may give low readings if air leaks into the sample train.

c) Temperature. Because temperature effects gas density and concentration, the temperature of the calibration gas and instrument should be as close as possible to the ambient temperature where the unit will be used. We recommend that the temperature of the calibration gas be within the instrument's temperature specification (typically 14° to 113° F or -10° to 45° C). Also, during actual measurements, the instrument should be kept at the same or higher temperature than the sample temperature to avoid condensation in the unit.

d) Matrix. The matrix gas of the calibration compound and VOC sample is significant. Some common matrix components, such as methane and water vapor can affect the VOC signal. PIDs are

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most commonly used for monitoring VOCs in air, in which case the preferred calibration gas matrix is air. For a MiniRAE, methane, methanol, and water vapor reduce the response by about 20% when their concentration is 15,000 ppm and by about 40% at 30,000 ppm. Despite earlier reports of oxygen effects, RAE PID responses with 10.6 eV lamps are independent of oxygen concentration, and calibration gases in a pure nitrogen matrix can be used. H_2 and CO_2 up to 5 volume % also have no effect.

e) Concentration. Although RAE Systems PIDs have electronically linearized output, it is best to calibrate in a concentration range close to the actual measurement range. For example, 100 ppm standard gas for anticipated vapors of 0 to 250 ppm, and 500 ppm standard for expected concentrations of 250 to 1000 ppm. The correction factors in this table were typically measured at 50 to 100 ppm and apply from the ppb range up to about 1000 ppm. Above 1000 ppm the CF may vary and it is best to calibrate with the gas of interest near the concentration of interest.

f) Filters. Filters affect flow and pressure conditions and therefore all filters to be used during sampling should also be in place during calibration. Using a water trap (hydrophobic filter) greatly reduces the chances of drawing water aerosols or dirt particles into the instrument. Regular filter replacements are recommended because dirty filters can adsorb VOCs and cause slower response time and shifts in calibration.

g) Instrument Design. High-boiling ("heavy") or very reactive compounds can be lost by reaction or adsorption onto materials in the gas sample train, such as filters, pumps and other sensors. Multi-gas meters, including EntryRAE, MultiRAE and AreaRAE have the pump and other sensors upstream of the PID and are prone to these losses. Compounds possibly affected by such losses are shown in green in the table, and may give slow response, or in extreme cases, no response at all. In many cases the multi-gas meters can still give a rough indication of the relative concentration, without giving an accurate, quantitative reading. The ppbRAE and MiniRAE series instruments have inert sample trains and therefore do not exhibit significant loss; nevertheless, response may be slow for the very heavy compounds and additional sampling time up to a minute or more should be allowed to get a stable reading.

Table Abbreviations:

CF = Correction Factor (multiply by reading to get corrected value for the compound when calibrated to isobutylene)

NR= No Response

IE = Ionization Energy (values in parentheses are not well established)

C = Confirmed Value indicated by "+" in this column; all others are preliminary or estimated values and are subject to change

ne = Not Established ACGIH 8-hr. TWA

C## = Ceiling value, given where 8-hr.TWA is not available

Disclaimer:

Actual readings may vary with age and cleanliness of lamp, relative humidity, and other factors. For accurate work, the instrument should be calibrated regularly under the operating conditions used. The factors in this table were measured in dry air at room temperature, typically at 50-100 ppm. CF values may vary above about 1000 ppm.

Updates:

The values in this table are subject to change as more or better data become available. Watch for updates of this table on the Internet at **http://www.raesystems.com**

IE data are taken from the CRC Handbook of Chemistry and Physics, 73rd Edition, D.R. Lide (Ed.), CRC Press (1993) and NIST Standard Ref. Database 19A, NIST Positive Ion Energetics, Vers. 2.0, Lias, et.al., U.S. Dept. Commerce (1993). Exposure limits (8-h TWA and Ceiling Values) are from the 2005 ACGIH Guide to Occupational Exposure Values, ACGIH, Cincinnati, OH 2005. Equations for exposure limits for mixtures of chemicals were taken from the 1997 TLVs and BEIs handbook published by the ACGIH (1997).

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Compound Name	Synonym/Abbreviation	CAS No.	Formula	9.8	C	10.6	C	11.7	C	IE (eV)	TWA
Acetaldehyde		75-07-0	C_2H_4O	NR	+	6	+	3.3	+	10.23	C25
Acetic acid	Ethanoic Acid	64-19-7	$C_2H_4O_2$	NR	+	22	+	2.6	+	10.66	10
Acetic anhydride	Ethanoic Acid Anhydride	108-24-7	$C_4H_6O_3$	NR	+	6.1	+	2.0	+	10.14	5
Acetone	2-Propanone	67-64-1	C_3H_6O	1.2	+	1.1	+	1.4	+	9.71	500
Acetone cyanohydrin	2-Hydroxyisobutyronitrile	75-86-5	C_4H_7NO					4	+	11.1	C5
Acetonitrile	Methyl cyanide, Cyanomethane	75-05-8	C_2H_3N					100		12.19	40
Acetylene	Ethyne	74-86-2	C_2H_2					2.1	+	11.40	ne
Acrolein	Propenal	107-02-8	C_3H_4O	42	+	3.9	+	1.4	+	10.10	0.1
Acrylic acid	Propenoic Acid	79-10-7	$C_3H_4O_2$			12	+	2.0	+	10.60	2
Acrylonitrile	Propenenitrile	107-13-1	C_3H_3N			NR	+	1.2	+	10.91	2
Allyl alcohol		107-18-6	C_3H_6O	4.5	+	2.4	+	1.6	+	9.67	2
Allyl chloride	3-Chloropropene	107-05-1	C_3H_5Cl			4.3		0.7		9.9	1
Ammonia		7664-41-7	H_3N	NR	+	9.7	+	5.7	+	10.16	25
Amyl acetate	mix of n-Pentyl acetate & 2-Methylbutyl acetate	628-63-7	$C_7H_{14}O_2$	11	+	2.3	+	0.95	+	<9.9	100
Amyl alcohol	1-Pentanol	75-85-4	$C_5H_{12}O$			5		1.6		10.00	ne
Aniline	Aminobenzene	62-53-3	C_7H_7N	0.50	+	0.48	+	0.47	+	7.72	2
Anisole	Methoxybenzene	100-66-3	C_7H_8O	0.89	+	0.58	+	0.56	+	8.21	ne
Arsine	Arsenic trihydride	7784-42-1	AsH_3			1.9	+			9.89	0.05
Benzaldehyde		100-52-7	C_7H_6O					1		9.49	ne
Benzenamine, N-methyl-	N-Methylphenylamine	100-61-8	C_7H_9N			0.7				7.53	
Benzene		71-43-2	C_6H_6	0.55	+	0.53	+	0.6	+	9.25	0.5
Benzonitrile	Cyanobenzene	100-47-0	C_7H_5N			1.6				9.62	ne
Benzyl alcohol	α-Hydroxytoluene, Hydroxymethylbenzene, Benzenemethanol	100-51-6	C_7H_8O	1.4	+	1.1	+	0.9	+	8.26	ne
Benzyl chloride	α-Chlorotoluene, Chloromethylbenzene	100-44-7	C_7H_7Cl	0.7	+	0.6	+	0.5	+	9.14	1
Benzyl formate	Formic acid benzyl ester	104-57-4	$C_8H_8O_2$	0.9	+	0.73	+	0.66	+		ne
Boron trifluoride		7637-07-2	BF_3	NR		NR		NR		15.5	C1
Bromine		7726-95-6	Br_2	NR	+	1.30	+	0.74	+	10.51	0.1
Bromobenzene		108-86-1	C_6H_5Br			0.6		0.5		8.98	ne
2-Bromoethyl methyl ether		6482-24-2	C_3H_7OBr			0.84	+			~10	ne
Bromoform	Tribromomethane	75-25-2	$CHBr_3$	NR	+	2.5	+	0.5	+	10.48	0.5
Bromopropane,1-	n-Propyl bromide	106-94-5	C_3H_7Br	150	+	1.5	+	0.6	+	10.18	ne
Butadiene	1,3-Butadiene, Vinyl ethylene	106-99-0	C_4H_6	0.8		0.85	+	1.1		9.07	2
Butadiene diepoxide, 1,3-	1,2,3,4-Diepoxybutane	298-18-0	$C_4H_6O_2$	25	+	3.5	+	1.2		~10	ne
Butanal	1-Butanal	123-72-8	C_4H_8O			1.8				9.84	
Butane		106-97-8	C_4H_{10}			67	+	1.2		10.53	800
Butanol, 1-	Butyl alcohol, n-Butanol	71-36-3	$C_4H_{10}O$	70	+	4.7	+	1.4	+	9.99	20
Butanol, t-	tert-Butanol, t-Butyl alcohol	75-65-0	$C_4H_{10}O$	6.9	+	2.9	+			9.90	100
Butene, 1-	1-Butylene	106-98-9	C_4H_8			0.9				9.58	ne
Butoxyethanol, 2-	Butyl Cellosolve, Ethylene glycol monobutyl ether	111-76-2	$C_6H_{14}O_2$	1.8	+	1.2	+	0.6	+	<10	25
Butoxyethanol acetate	Ethanol, 2-(2-butoxyethoxy)-, acetate	124-17-4	$C_{10}H_{20}O_4$			5.6				≤10.6	
Butoxyethoxyethanol	2-(2-Butoxyethoxy)ethanol	112-34-5	$C_8H_{18}O_3$			4.6				≤10.6	
Butyl acetate, n-		123-86-4	$C_6H_{12}O_2$			2.6	+			10	150
Butyl acrylate, n-	Butyl 2-propenoate, Acrylic acid butyl ester	141-32-2	$C_7H_{12}O_2$			1.6	+	0.6	+		10
Butylamine, n-		109-73-9	$C_4H_{11}N$	1.1	+	1.1	+	0.7	+	8.71	C5
Butyl cellosolve	see 2-Butoxyethanol	111-76-2									
Butyl hydroperoxide, t-		75-91-2	$C_4H_{10}O_2$	2.0	+	1.6	+			<10	1
Butyl mercaptan	1-Butanethiol	109-79-5	$C_4H_{10}S$	0.55	+	0.52	+			9.14	0.5
Carbon disulfide		75-15-0	CS_2	4	+	1.2	+	0.44		10.07	10
Carbon tetrachloride	Tetrachloromethane	56-23-5	CCl_4	NR	+	NR	+	1.7	+	11.47	5
Carbonyl sulfide	Carbon oxysulfide	463-58-1	COS							11.18	
Cellosolve see 2-Ethoxyethanol											
CFC-14 see Tetrafluoromethane											
CFC-113 see 1,1,2-Trichloro-1,2,2-trifluoroethane											

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Chlorine		7782-50-5	Cl_2					1.0	+	11.48	0.5
Chlorine dioxide		10049-04-4	ClO_2	NR	+	NR	+	NR	+	10.57	0.1
Chlorobenzene	Monochlorobenzene	108-90-7	C_6H_5Cl	0.44	+	0.40	+	0.39	+	9.06	10
Chlorobenzotrifluoride, 4-	PCBTF, OXSOL 100 p-Chlorobenzotrifluoride	98-56-6	$C_7H_4ClF_3$	0.74	+	0.63	+	0.55	+	<9.6	25
Chloro-1,3-butadiene, 2-	Chloroprene	126-99-8	C_4H_5Cl			3					10
Chloro-1,1-difluoroethane, 1-	HCFC-142B, R-142B	75-68-3	$C_2H_3ClF_2$	NR		NR		NR		12.0	ne
Chlorodifluoromethane	HCFC-22, R-22	75-45-6	$CHClF_2$	NR		NR		NR		12.2	1000
Chloroethane	Ethyl chloride	75-00-3	C_2H_5Cl	NR	+	NR	+	1.1	+	10.97	100
Chloroethanol	Ethylene chlrohydrin	107-07-3	C_2H_5ClO					2.9		10.52	C1
Chloroethyl ether, 2-	bis(2-chloroethyl) ether	111-44-4	$C_4H_8Cl_2O$	8.6	+	3.0	+				5
Chloroethyl methyl ether, 2-	Methyl 2-chloroethyl ether	627-42-9	C_3H_7ClO			3					ne
Chloroform	Trichloromethane	67-66-3	$CHCl_3$	NR	+	NR	+	3.5	+	11.37	10
Chloro-2-methylpropene, 3-	Methallyl chloride, Isobutenyl chloride	563-47-3	C_4H_7Cl	1.4	+	1.2	+	0.63	+	9.76	ne
Chloropicrin		76-06-2	CCl_3NO_2	NR	+	~400	+	7	+	?	0.1
Chlorotoluene, o-	o-Chloromethylbenzene	95-49-8	C_7H_7Cl			0.5		0.6		8.83	50
Chlorotoluene, p-	p-Chloromethylbenzene	106-43-4	C_7H_7Cl					0.6		8.69	ne
Chlorotrifluoroethene	CTFE, Chlorotrifluoroethylene Genetron 1113	79-38-9	C_2ClF_3	6.7	+	3.9	+	1.2	+	9.76	5
Chlorotrimethylsilane		75-77-4	C_3H_9ClSi	NR		NR		0.82	+	10.83	ne
Cresol, m-	m-Hydroxytoluene	108-39-4	C_7H_8O	0.57	+	0.50	+	0.57	+	8.29	5
Cresol, o-	o-Hydroxytoluene	95-48-7	C_7H_8O			1.0				8.50	
Cresol, p-	p-Hydroxytoluene	106-44-5	C_7H_8O			1.4				8.35	
Crotonaldehyde	*trans*-2-Butenal	123-73-9 4170-30-3	C_4H_6O	1.5	+	1.1	+	1.0	+	9.73	2
Cumene	Isopropylbenzene	98-82-8	C_9H_{12}	0.58	+	0.54	+	0.4	+	8.73	50
Cyanogen bromide		506-68-3	CNBr	NR		NR		NR		11.84	ne
Cyanogen chloride		506-77-4	CNCl	NR		NR		NR		12.34	C0.3
Cyclohexane		110-82-7	C_6H_{12}	3.3	+	1.4	+	0.64	+	9.86	300
Cyclohexanol	Cyclohexyl alcohol	108-93-0	$C_6H_{12}O$	1.5	+	0.9	+	1.1	+	9.75	50
Cyclohexanone		108-94-1	$C_6H_{10}O$	1.0	+	0.9	+	0.7	+	9.14	25
Cyclohexene		110-83-8	C_6H_{10}			0.8	+			8.95	300
Cyclohexylamine		108-91-8	$C_6H_{13}N$			1.2				8.62	10
Cyclopentane 85% 2,2-dimethylbutane 15%		287-92-3	C_5H_{10}	NR	+	15	+	1.1		10.33	600
Cyclopropylamine	Aminocyclpropane	765-30-0	C_3H_7N	1.1	+	0.9	+	0.9	+		ne
Decamethylcyclopentasiloxane		541-02-6	$C_{10}H_{30}O_5Si_5$	0.16	+	0.13	+	0.12	+		ne
Decamethyltetrasiloxane		141-62-8	$C_{10}H_{30}O_3Si_4$	0.17	+	0.13	+	0.12	+	<10.2	ne
Decane		124-18-5	$C_{10}H_{22}$	4.0	+	1.4	+	0.35	+	9.65	ne
Diacetone alcohol	4-Methyl-4-hydroxy-2-pentanone	123-42-2	$C_6H_{12}O_2$			0.7					50
Dibromochloromethane	Chlorodibromomethane	124-48-1	$CHBr_2Cl$	NR	+	5.3	+	0.7	+	10.59	ne
Dibromo-3-chloropropane, 1,2-	DBCP	96-12-8	$C_3H_5Br_2Cl$	NR	+	1.7	+	0.43	+		0.001
Dibromoethane, 1,2-	EDB, Ethylene dibromide, Ethylene bromide	106-93-4	$C_2H_4Br_2$	NR	+	1.7	+	0.6	+	10.37	ne
Dichlorobenzene, o-	1,2-Dichlorobenzene	95-50-1	$C_6H_4Cl_2$	0.54	+	0.47	+	0.38	+	9.08	25
Dichlorodifluoromethane	CFC-12	75-71-8	CCl_2F_2			NR	+	NR	+	11.75	1000
Dichlorodimethylsilane		75-78-5	$C_2H_6Cl_2Si$	NR		NR		1.1	+	>10.7	ne
Dichloroethane, 1,2-	EDC, 1,2-DCA, Ethylene dichloride	107-06-2	$C_2H_4Cl_2$			NR	+	0.6	+	11.04	10
Dichloroethene, 1,1-	1,1-DCE, Vinylidene chloride	75-35-4	$C_2H_2Cl_2$			0.82	+	0.8	+	9.79	5
Dichloroethene, c-1,2-	*c*-1,2-DCE, *cis*-Dichloroethylene	156-59-2	$C_2H_2Cl_2$			0.8				9.66	200
Dichloroethene, t-1,2-	*t*-1,2-DCE, *trans*-Dichloroethylene	156-60-5	$C_2H_2Cl_2$			0.45	+	0.34	+	9.65	200
Dichloro-1-fluoroethane, 1,1-	R-141B	1717-00-6	$C_2H_3Cl_2F$	NR	+	NR	+	2.0	+		ne
Dichloromethane	see Methylene chloride										

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Dichloropentafluoropropane	AK-225, mix of ~45% 3,3-dichloro-1,1,1,2,2-pentafluoro-propane (HCFC-225ca) & ~55% 1,3-Dichloro-1,1,2,2,3-pentafluoropropane (HCFC-225cb)	442-56-0 507-55-1	$C_3HCl_2F_5$	NR	+	NR	+	25	+		ne
Dichloropropane, 1,2-		78-87-5	$C_3H_6Cl_2$					0.7		10.87	75
Dichloro-1-propene, 1,3-		542-75-6	$C_3H_4C_{12}$	1.3	+	0.96	+			<10	1
Dichloro-1-propene, 2,3-		78-88-6	$C_3H_4Cl_2$	1.9	+	1.3	+	0.7	+	<10	ne
Dichloro-1,1,1-trifluoroethane, 2,2-	R-123	306-83-2	$C_2HCl_2F_3$	NR	+	NR	+	10.1	+	11.5	ne
Dichloro-2,4,6-trifluoropyridine, 3,5-	DCTFP	1737-93-5	$C_5Cl_2F_3N$	1.1	+	0.9	+	0.8	+		ne
Dichlorvos *	Vapona; O,O-dimethyl O-dichlorovinyl phosphate	62-73-7	$C_4H_7Cl_2O_4P$			0.9	+			<9.4	0.1
Dicyclopentadiene	DCPD, Cyclopentadiene dimer	77-73-6	$C_{10}H_{12}$	0.57	+	0.48	+	0.43	+	8.8	5
Diesel Fuel		68334-30-5	m.w. 226			0.9	+				11
Diesel Fuel #2 (Automotive)		68334-30-5	m.w. 216	1.3		0.7	+	0.4	+		11
Diethylamine		109-89-7	$C_4H_{11}N$			1	+			8.01	5
Diethylaminopropylamine, 3-		104-78-9	$C_7H_{18}N_2$			1.3					ne
Diethylbenzene	See Dowtherm J										
Diethylmaleate		141-05-9	$C_8H_{12}O_4$			4					ne
Diethyl sulfide	see Ethyl sulfide										
Diglyme	See Methoxyethyl ether	111-96-6	$C_6H_{14}O_3$								
Diisobutyl ketone	DIBK, 2,2-dimethyl-4-heptanone	108-83-8	$C_9H_{18}O$	0.71	+	0.61	+	0.35	+	9.04	25
Diisopropylamine		108-18-9	$C_6H_{15}N$	0.84	+	0.74	+	0.5	+	7.73	5
Diketene	Ketene dimer	674-82-8	$C_4H_4O_2$	2.6	+	2.0	+	1.4	+	9.6	0.5
Dimethylacetamide, N,N-	DMA	127-19-5	C_4H_9NO	0.87	+	0.8	+	0.8	+	8.81	10
Dimethylamine		124-40-3	C_2H_7N			1.5				8.23	5
Dimethyl carbonate	Carbonic acid dimethyl ester	616-38-6	$C_3H_6O_3$	NR	+	~70	+	1.7	+	~10.5	ne
Dimethyl disulfide	DMDS	624-92-0	$C_2H_6S_2$	0.2	+	0.20	+	0.21	+	7.4	ne
Dimethyl ether	see Methyl ether										
Dimethylethylamine	DMEA	598-56-1	$C_4H_{11}N$	1.1	+	1.0	+	0.9	+	7.74	~3
Dimethylformamide, N,N-	DMF	68-12-2	C_3H_7NO	0.7	+	0.7	+	0.8	+	9.13	10
Dimethylhydrazine, 1,1-	UDMH	57-14-7	$C_2H_8N_2$			0.8	+	0.8	+	7.28	0.01
Dimethyl methylphosphonate	DMMP, methyl phosphonic acid dimethyl ester	756-79-6	$C_3H_9O_3P$	NR	+	4.3	+	0.74	+	10.0	ne
Dimethyl sulfate		77-78-1	$C_2H_6O_4S$	~23		~20	+	2.3	+		0.1
Dimethyl sulfide	see Methyl sulfide										
Dimethyl sulfoxide	DMSO, Methyl sulfoxide	67-68-5	C_2H_6OS			1.4	+			9.10	ne
Dioxane, 1,4-		123-91-1	$C_4H_8O_2$			1.3				9.19	25
Dioxolane, 1,3-	Ethylene glycol formal	646-06-0	$C_3H_6O_2$	4.0	+	2.3	+	1.6	+	9.9	20
Dowtherm A see Therminol® *											
Dowtherm J (97% Diethylbenzene) *		25340-17-4	$C_{10}H_{14}$			0.5					
DS-108F Wipe Solvent	Ethyl lactate/Isopar H/ Propoxypropanol ~7:2:1	97-64-3 64742-48-9 1569-01-3	m.w. 118	3.3	+	1.6	+	0.7	+		ne
Epichlorohydrin	ECH Chloromethyloxirane, 1-chloro2,3-epoxypropane	106-89-8	C_2H_5ClO	~200	+	8.5	+	1.4	+	10.2	0.5
Ethane		74-84-0	C_2H_6			NR	+	15	+	11.52	ne
Ethanol	Ethyl alcohol	64-17-5	C_2H_6O			10	+	3.1	+	10.47	1000
Ethanolamine *	MEA, Monoethanolamine	141-43-5	C_2H_7NO	5.6	+	1.6	+			8.96	3
Ethene	Ethylene	74-85-1	C_2H_4			9	+	4.5	+	10.51	ne
Ethoxyethanol, 2-	Ethyl cellosolve	110-80-5	$C_4H_{10}O_2$			1.3				9.6	5
Ethyl acetate		141-78-6	$C_4H_8O_2$			4.6	+	3.5		10.01	400
Ethyl acetoacetate		141-97-9	$C_6H_{10}O_3$	1.4	+	1.2	+	1.0	+	<10	ne
Ethyl acrylate		140-88-5	$C_5H_8O_2$			2.4	+	1.0	+	<10.3	5
Ethylamine		75-04-7	C_2H_7N			0.8				8.86	5

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Ethylbenzene		100-41-4	C_8H_{10}	0.52	+	0.52	+	0.51	+	8.77	100
Ethyl caprylate	Ethyl octanoate	106-32-1	$C_{10}H_{20}O_2$		+	0.52	+	0.51	+		
Ethylenediamine	1,2-Ethanediamine; 1,2-Diaminoethane	107-15-3	$C_2H_8N_2$	0.9	+	0.8	+	1.0	+	8.6	10
Ethylene glycol *	1,2-Ethanediol	107-21-1	$C_2H_6O_2$			16	+	6	+	10.16	C100
Ethylene glycol, Acrylate	2-hydroxyethyl Acrylate	818-61-1	$C_5H_8O_3$			8.2				≤10.6	
Ethylene glycol dimethyl ether	1,2-Dimethoxyethane, Monoglyme	110-71-4	$C_4H_{10}O_2$	1.1		0.86		0.7		9.2	ne
Ethylene glycol monobutyl ether acetate	2-Butoxyethyl acetate	112-07-2	$C_8H_{16}O_3$			1.3				≤10.6	
Ethylene glycol, monothio	mercapto-2-ethanol	60-24-2	C_2H_6OS			1.5				9.65	
Ethylene oxide	Oxirane, Epoxyethane	75-21-8	C_2H_4O			13	+	3.5	+	10.57	1
Ethyl ether	Diethyl ether	60-29-7	$C_4H_{10}O$			1.1	+	1.7		9.51	400
Ethyl 3-ethoxypropionate	EEP	763-69-9	$C_7H_{14}O_3$	1.2	+	0.75	+				ne
Ethyl formate		109-94-4	$C_3H_6O_2$					1.9		10.61	100
Ethylhexyl acrylate, 2-	Acrylic acid 2-ethylhexyl ester	103-11-7	$C_{11}H_{20}O_2$			1.1	+	0.5	+		ne
Ethylhexanol	2-Ethyl-1-hexanol	104-76-7	C8H18O			1.9				≤10.6	
Ethylidenenorbornene	5-Ethylidene bicyclo(2,2,1)hept-2-ene	16219-75-3	C_9H_{12}	0.4	+	0.39	+	0.34	+	≤8.8	ne
Ethyl (S)-(-)-lactate see also DS-108F	Ethyl lactate, Ethyl (S)-(-)-hydroxypropionate	687-47-8 97-64-3	$C_5H_{10}O_3$	13	+	3.2	+	1.6	+	~10	ne
Ethyl mercaptan	Ethanethiol	75-08-1	C_2H_6S	0.60	+	0.56	+			9.29	0.5
Ethyl sulfide	Diethyl sulfide	352-93-2	$C_4H_{10}S$			0.5	+			8.43	ne
Formaldehyde	Formalin	50-00-0	CH_2O	NR	+	NR	+	1.6	+	10.87	C0.3
Formamide		75-12-7	CH_3NO			6.9	+	4		10.16	10
Formic acid		64-18-6	CH_2O_2	NR	+	NR	+	9	+	11.33	5
Furfural	2-Furaldehyde	98-01-1	$C_5H_4O_2$			0.92	+	0.8	+	9.21	2
Furfuryl alcohol		98-00-0	$C_5H_6O_2$			0.80	+			<9.5	10
Gasoline #1		8006-61-9	m.w. 72			0.9	+				300
Gasoline #2, 92 octane		8006-61-9	m.w. 93	1.3	+	1.0	+	0.5	+		300
Glutaraldehyde	1,5-Pentanedial, Glutaric dialdehyde	111-30-8	$C_5H_8O_2$	1.1	+	0.8	+	0.6	+		C0.05
Glycidyl methacrylate	2,3-Epoxypropyl methacrylate	106-91-2	$C_7H_{10}O_3$	2.6	+	1.2	+	0.9	+		0.5
Halothane	2-Bromo-2-chloro-1,1,1-trifluoroethane	151-67-7	$C_2HBrClF_3$					0.6		11.0	50
HCFC-22 see Chlorodifluoromethane											
HCFC-123 see 2,2-Dichloro-1,1,1-trifluoroethane											
HCFC-141B see 1,1-Dichloro-1-fluoroethane											
HCFC-142B see 1-Chloro-1,1-difluoroethane											
HCFC-134A see 1,1,1,2-Tetrafluoroethane											
HCFC-225 see Dichloropentafluoropropane											
Heptane, n-		142-82-5	C_7H_{16}	45	+	2.8	+	0.60	+	9.92	400
Heptanol, 4-	Dipropylcarbinol	589-55-9	$C_7H_{16}O$	1.8	+	1.3	+	0.5	+	9.61	ne
Hexamethyldisilazane, 1,1,1,3,3,3- *	HMDS	999-97-3	$C_6H_{19}NSi_2$			0.2	+	0.2	+	~8.6	ne
Hexamethyldisiloxane	HMDSx	107-46-0	$C_6H_{18}OSi_2$	0.33	+	0.27	+	0.25	+	9.64	ne
Hexane, n-		110-54-3	C_6H_{14}	350	+	4.3	+	0.54	+	10.13	50
Hexanol, 1-	Hexyl alcohol	111-27-3	$C_6H_{14}O$	9	+	2.5	+	0.55	+	9.89	ne
Hexene, 1-		592-41-6	C_6H_{12}			0.8				9.44	30
HFE-7100 see Methyl nonafluorobutyl ether											
Histoclear (Histo-Clear)	Limonene/corn oil reagent		m.w. ~136	0.5	+	0.4	+	0.3	+		ne
Hydrazine *		302-01-2	H_4N_2	>8	+	2.6	+	2.1	+	8.1	0.01
Hydrazoic acid	Hydrogen azide		HN_3							10.7	
Hydrogen	Synthesis gas	1333-74-0	H_2	NR	+	NR	+	NR	+	15.43	ne
Hydrogen cyanide	Hydrocyanic acid	74-90-8	HCN	NR	+	NR	+	NR	+	13.6	C4.7
Hydrogen iodide *	Hydriodic acid	10034-85-2	HI			~0.6*				10.39	
Hydrogen peroxide		7722-84-1	H_2O_2	NR	+	NR	+	NR	+	10.54	1
Hydrogen sulfide		7783-06-4	H_2S	NR	+	3.3	+	1.5	+	10.45	10
Hydroxypropyl methacrylate		27813-02-1 923-26-2	$C_7H_{12}O_3$	9.9	+	2.3	+	1.1	+		ne
Iodine *		7553-56-2	I_2	0.1	+	0.1	+	0.1	+	9.40	C0.1

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Iodomethane	Methyl iodide	74-88-4	CH_3I	0.21	+	0.22	+	0.26	+	9.54	2
Isoamyl acetate	Isopentyl acetate	123-92-2	$C_7H_{14}O_2$	10.1		2.1		1.0		<10	100
Isobutane	2-Methylpropane	75-28-5	C_4H_{10}			100	+	1.2	+	10.57	ne
Isobutanol	2-Methyl-1-propanol	78-83-1	$C_4H_{10}O$	19	+	3.8	+	1.5		10.02	50
Isobutene	Isobutylene, Methyl butene	115-11-7	C_4H_8	1.00	+	1.00	+	1.00	+	9.24	Ne
Isobutyl acrylate	Isobutyl 2-propenoate	106-63-8	$C_7H_{12}O_2$			1.5	+	0.60	+		Ne
Isoflurane	1-Chloro-2,2,2-trifluoroethyl difluoromethyl ether, forane	26675-46-7	$C_3H_2ClF_5O$	NR	+	NR	+	48	+	~11.7	Ne
Isooctane	2,2,4-Trimethylpentane	540-84-1	C8H18			1.2				9.86	ne
Isopar E Solvent	Isoparaffinic hydrocarbons	64741-66-8	m.w. 121	1.7	+	0.8	+				Ne
Isopar G Solvent	Photocopier diluent	64742-48-9	m.w. 148			0.8	+				Ne
Isopar K Solvent	Isoparaffinic hydrocarbons	64742-48-9	m.w. 156	0.9	+	0.5	+	0.27	+		Ne
Isopar L Solvent	Isoparaffinic hydrocarbons	64742-48-9	m.w. 163	0.9	+	0.5	+	0.28	+		Ne
Isopar M Solvent	Isoparaffinic hydrocarbons	64742-47-8	m.w. 191			0.7	+	0.4	+		Ne
Isopentane	2-Methylbutane	78-78-4	C_5H_{12}			8.2					Ne
Isophorone		78-59-1	$C_9H_{14}O$					3		9.07	C5
Isoprene	2-Methyl-1,3-butadiene	78-79-5	C_5H_8	0.69	+	0.63	+	0.60	+	8.85	Ne
Isopropanol	Isopropyl alcohol, 2-propanol, IPA	67-63-0	C_3H_8O	500	+	6.0	+	2.7		10.12	200
Isopropyl acetate		108-21-4	$C_5H_{10}O_2$			2.6				9.99	100
Isopropyl ether	Diisopropyl ether	108-20-3	$C_6H_{14}O$			0.8				9.20	250
Jet fuel JP-4	Jet B, Turbo B, F-40 Wide cut type aviation fuel	8008-20-6 + 64741-42-0	m.w. 115			1.0	+	0.4	+		Ne
Jet fuel JP-5	Jet 5, F-44, Kerosene type aviation fuel	8008-20-6 + 64747-77-1	m.w. 167			0.6	+	0.5	+		29
Jet fuel JP-8	Jet A-1, F-34, Kerosene type aviation fuel	8008-20-6 + 64741-77-1	m.w. 165			0.6	+	0.3	+		30
Jet fuel A-1 (JP-8)	F-34, Kerosene type aviation fuel	8008-20-6 + 64741-77-1	m.w. 145			0.67					34
Jet Fuel TS	Thermally Stable Jet Fuel, Hydrotreated kerosene fuel	8008-20-6 + 64742-47-8	m.w. 165	0.9	+	0.6	+	0.3	+		30
Limonene, D-	(R)-(+)-Limonene	5989-27-5	$C_{10}H_{16}$			0.33	+			~8.2	Ne
Kerosene C10-C16 petro.distillate – see Jet Fuels		8008-20-6									
MDI – see 4,4'-Methylenebis(phenylisocyanate)											
Maleic anhydride	2,5-Furandione	108-31-6	$C_4H_2O_3$							~10.8	0.1
Mesitylene	1,3,5-Trimethylbenzene	108-67-8	C_9H_{12}	0.36	+	0.35	+	0.3	+	8.41	25
Methallyl chloride – see 3-Chloro-2-methylpropene											
Methane	Natural gas	74-82-8	CH_4	NR	+	NR	+	NR	+	12.61	Ne
Methanol	Methyl alcohol, carbinol	67-56-1	CH_4O	NR	+	NR	+	2.5	+	10.85	200
Methoxyethanol, 2-	Methyl cellosolve, Ethylene glycol monomethyl ether	109-86-4	$C_3H_8O_2$	4.8	+	2.4	+	1.4	+	10.1	5
Methoxyethoxyethanol, 2-	2-(2-Methoxyethoxy)ethanol Diethylene glycol monomethyl ether	111-77-3	$C_7H_{16}O$	2.3	+	1.2	+	0.9	+	<10	Ne
Methoxyethyl ether, 2-	bis(2-Methoxyethyl) ether, Diethylene glycol dimethyl ether, Diglyme	111-96-6	$C_6H_{14}O_3$	0.64	+	0.54	+	0.44	+	<9.8	Ne
Methyl acetate		79-20-9	$C_3H_6O_2$	NR	+	6.6	+	1.4	+	10.27	200
Methyl acrylate	Methyl 2-propenoate, Acrylic acid methyl ester	96-33-3	$C_4H_6O_2$			3.7	+	1.2	+	(9.9)	2
Methylamine	Aminomethane	74-89-5	CH_5N			1.2				8.97	5
Methyl amyl ketone	MAK, 2-Heptanone, Methyl pentyl ketone	110-43-0	$C_7H_{14}O$	0.9	+	0.85	+	0.5	+	9.30	50
Methyl bromide	Bromomethane	74-83-9	CH_3Br	110	+	1.7	+	1.3	+	10.54	1
Methyl t-butyl ether	MTBE, *tert*-Butyl methyl ether	1634-04-4	$C_5H_{12}O$			0.9	+			9.24	40
Methyl cellosolve	see 2-Methoxyethanol										
Methyl chloride	Chloromethane	74-87-3	CH_3Cl	NR	+	NR	+	0.74	+	11.22	50
Methylcyclohexane		107-87-2	C_7H_{14}	1.6	+	0.97	+	0.53	+	9.64	400
Methylene bis(phenyl-isocyanate), 4,4'- *	MDI, Mondur M		$C_{15}H_{10}N_2O_2$	Very slow ppb level response							0.005

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Compound Name	Synonym/Abbreviation	CAS No.	Formula	9.8	C	10.6	C	11.7	C	IE (eV)	TWA
Methylene chloride	Dichloromethane	75-09-2	CH_2Cl_2	NR	+	NR	+	0.89	+	11.32	25
Methyl ether	Dimethyl ether	115-10-6	C_2H_6O	4.8	+	3.1	+	2.5	+	10.03	Ne
Methyl ethyl ketone	MEK, 2-Butanone	78-93-3	C_4H_8O	0.86	+	0.9	+	1.1	+	9.51	200
Methylhydrazine	Monomethylhydrazine, Hydrazomethane	60-34-4	$C_2H_6N_2$	1.4	+	1.2	+	1.3	+	7.7	0.01
Methyl isoamyl ketone	MIAK, 5-Methyl-2-hexanone	110-12-3	$C_7H_{14}O$	0.8	+	0.76	+	0.5	+	9.28	50
Methyl isobutyl ketone	MIBK, 4-Methyl-2-pentanone	108-10-1	$C_6H_{12}O$	0.9	+	0.8	+	0.6	+	9.30	50
Methyl isocyanate	CH3NCO	624-83-9	C_2H_3NO	NR	+	4.6	+	1.5		10.67	0.02
Methyl isothiocyanate	CH3NCS	551-61-6	C_2H_3NS	0.5	+	0.45	+	0.4	+	9.25	ne
Methyl mercaptan	Methanethiol	74-93-1	CH_4S	0.65		0.54		0.66		9.44	0.5
Methyl methacrylate		80-62-6	$C_5H_8O_2$	2.7	+	1.5	+	1.2	+	9.7	100
Methyl nonafluorobutyl ether	HFE-7100DL	163702-08-7, 163702-07-6	$C_5H_3F_9O$			NR	+	~35	+		ne
Methyl-1,5-pentanediamine, 2- (coats lamp) *	Dytek-A amine, 2-Methyl pentamethylenediamine	15520-10-2	C6H16N2			~0.6	+			<9.0	ne
Methyl propyl ketone	MPK, 2-Pentanone	107-87-9	$C_5H_{12}O$			0.93	+	0.79	+	9.38	200
Methyl-2-pyrrolidinone, N-	NMP, N-Methylpyrrolidone, 1-Methyl-2-pyrrolidinone, 1-Methyl-2-pyrrolidone	872-50-4	C_5H_9NO	1.0	+	0.8	+	0.9	+	*9.17*	ne
Methyl salicylate	Methyl 2-hydroxybenzoate	119-36-8	C_8H_8O3	1.3	+	0.9	+	0.9	+	~9	ne
Methylstyrene, α-	2-Propenylbenzene	98-83-9	C_9H_{10}			0.5				8.18	50
Methyl sulfide	DMS, Dimethyl sulfide	75-18-3	C_2H_6S	0.49	+	0.44	+	0.46	+	8.69	ne
Mineral spirits	Stoddard Solvent, Varsol 1, White Spirits	8020-83-5, 8052-41-3, 68551-17-7	m.w. 144	1.0		0.69	+	0.38	+		100
Mineral Spirits - Viscor 120B Calibration Fluid, b.p. 156-207°C		8052-41-3	m.w. 142	1.0	+	0.7	+	0.3	+		100
Monoethanolamine - see Ethanolamine											
Mustard *	HD, Bis(2-chloroethyl) sulfide	505-60-2, 39472-40-7, 68157-62-0	$C_4H_8Cl_2S$			0.6					0.0005
Naphtha - see VM & P Naptha											
Naphthalene	Mothballs	91-20-3	$C_{10}H_8$	0.45	+	0.42	+	0.40	+	8.13	10
Nickel carbonyl (in CO)	Nickel tetracarbonyl	13463-39-3	C_4NiO_4			0.18				<8.8	0.001
Nicotine		54-11-5	$C_{10}H_{14}N_2$			2.0				≤10.6	
Nitric oxide		10102-43-9	NO	~6		5.2	+	2.8	+	9.26	25
Nitrobenzene		98-95-3	$C_6H_5NO_2$	2.6	+	1.9	+	1.6	+	9.81	1
Nitroethane		79-24-3	$C_2H_5NO_2$					3		10.88	100
Nitrogen dioxide		10102-44-0	NO_2	23	+	16	+	6	+	9.75	3
Nitrogen trifluoride		7783-54-2	NF_3	NR		NR		NR		13.0	10
Nitromethane		75-52-5	CH_3NO_2					4		11.02	20
Nitropropane, 2-		79-46-9	$C_3H_7NO_2$					2.6		10.71	10
Nonane		111-84-2	C_9H_{20}			1.4				9.72	200
Norpar 12	n-Paraffins, mostly C_{10}-C_{13}	64771-72-8	m.w. 161	3.2	+	1.1	+	0.28	+		ne
Norpar 13	n-Paraffins, mostly C_{13}-C_{14}	64771-72-8	m.w. 189	2.7	+	1.0	+	0.3	+		ne
Octamethylcyclotetrasiloxane		556-67-2	$C_8H_{24}O_4Si_4$	0.21	+	0.17	+	0.14	+		ne
Octamethyltrisiloxane		107-51-7	$C_8H_{24}O_2Si_3$	0.23	+	0.18	+	0.17	+	<10.0	ne
Octane, n-		111-65-9	C_8H_{18}	13	+	1.8	+			9.82	300
Octene, 1-		111-66-0	C_8H_{16}	0.9	+	0.75	+	0.4	+	9.43	75
Pentane		109-66-0	C_5H_{12}	80	+	8.4	+	0.7	+	10.35	600
Peracetic acid *	Peroxyacetic acid, Acetyl hydroperoxide	79-21-0	$C_2H_4O_3$	NR	+	NR	+	2.3	+		ne
Peracetic/Acetic acid mix *	Peroxyacetic acid, Acetyl hydroperoxide	79-21-0	$C_2H_4O_3$			50	+	2.5	+		ne
Perchloroethene	PCE, Perchloroethylene, Tetrachloroethylene	127-18-4	C_2Cl_4	0.69	+	0.57	+	0.31	+	9.32	25
PGME	Propylene glycol methyl ether, 1-Methoxy-2-propanol	107-98-2	$C_6H_{12}O_3$	2.4	+	1.5	+	1.1	+		100

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PGMEA	Propylene glycol methyl ether acetate, 1-Methoxy-2-acetoxypropane, 1-Methoxy-2-propanol acetate	108-65-6	$C_6H_{12}O_3$	1.65	+	1.0	+	0.8	+		ne
Phenol	Hydroxybenzene	108-95-2	C_6H_6O	1.0	+	1.0	+	0.9	+	8.51	5
Phosgene	Dichlorocarbonyl	75-44-5	CCl_2O	NR	+	NR	+	8.5	+	11.2	0.1
Phosgene in Nitrogen	Dichlorocarbonyl	75-44-5	CCl_2O	NR	+	NR	+	6.8	+	11.2	0.1
Phosphine (coats lamp)		7803-51-2	PH_3	28		3.9	+	1.1	+	9.87	0.3
Photocopier Toner	Isoparaffin mix					0.5	+	0.3	+		ne
Picoline, 3-	3-Methylpyridine	108-99-6	C_6H_7N			0.9				9.04	ne
Pinene, α-		2437-95-8	$C_{10}H_{16}$			0.31	+	0.47		8.07	ne
Pinene, β-		18172-67-3	$C_{10}H_{16}$	0.38	+	0.37	+	0.37	+	~8	100
Piperylene, isomer mix	1,3-Pentadiene	504-60-9	C_5H_8	0.76	+	0.69	+	0.64	+	8.6	100
Propane		74-98-6	C_3H_8			NR	+	1.8	+	10.95	2500
Propanol, n-	Propyl alcohol	71-23-8	C_3H_8O			5		1.7		10.22	200
Propene	Propylene	115-07-1	C_3H_6	1.5	+	1.4	+	1.6	+	9.73	ne
Propionaldehyde	Propanal	123-38-6	C_3H_6O			1.9				9.95	ne
Propyl acetate, n-		109-60-4	$C_5H_{10}O_2$			3.5		2.3		10.04	200
Propylamine, n-	1-Propylamine, 1-Aminopropane	107-10-8	C_3H_9N	1.1	+	1.1	+	0.9	+	8.78	ne
Propylene carbonate *		108-32-7	$C_4H_6O_3$			62	+	1	+	10.5	ne
Propylene glycol	1,2-Propanediol	57-55-6	$C_3H_8O_2$	18		5.5	+	1.6	+	<10.2	ne
Propylene glycol propyl ether	1-Propoxy-2-propanol	1569-01-3	$C_6H_{14}O_2$	1.3	+	1.0	+	1.6	+		ne
Propylene oxide	Methyloxirane	75-56-9 16088-62-3 15448-47-2	C_3H_6O	~240		6.6	+	2.9	+	10.22	20
Propyleneimine	2-Methylaziridine	75-55-8	C_3H_7N	1.5	+	1.3	+	1.0	+	9.0	2
Propyl mercaptan, 2-	2-Propanethiol, Isopropyl mercaptan	75-33-2	C_3H_8S	0.64	+	0.66	+			9.15	ne
Pyridine		110-86-1	C_5H_5N	0.78	+	0.7	+	0.7	+	9.25	5
Pyrrolidine (coats lamp)	Azacyclohexane	123-75-1	C_4H_9N	2.1	+	1.3	+	1.6	+	~8.0	ne
RR7300 (PGME/PGMEA)	70:30 PGME:PGMEA (1-Methoxy-2-propanol:1-Methoxy-2-acetoxypropane)	107-98-2	$C_4H_{10}O_2$ / $C_6H_{12}O_3$			1.4	+	1.0	+		ne
Sarin	GB, Isopropyl methylphosphonofluoridate	107-44-8 50642-23-4	$C_4H_{10}FO_2P$			~3					
Stoddard Solvent - see Mineral Spirits		8020-83-5									
Styrene		100-42-5	C_8H_8	0.45	+	0.40	+	0.4	+	8.43	20
Sulfur dioxide		7446-09-5	SO_2	NR		NR	+	NR	+	12.32	2
Sulfur hexafluoride		2551-62-4	SF_6	NR		NR		NR		15.3	1000
Sulfuryl fluoride	Vikane	2699-79-8	SO_2F_2	NR		NR		NR		13.0	5
Tabun *	Ethyl N, N-dimethylphosphoramidocyanidate	77-81-6	$C_5H_{11}N_2O_2P$			0.8					15ppt
Tetrachloroethane, 1,1,1,2-		630-20-6	$C_2H_2Cl_4$					1.3		~11.1	ne
Tetrachloroethane, 1,1,2,2-		79-34-5	$C_2H_2Cl_4$	NR	+	NR	+	0.60	+	~11.1	1
Tetrachlorosilane		10023-04-7	$SiCl_4$	NR		NR		15	+	11.79	ne
Tetraethyl lead	TEL	78-00-2	$C_8H_{20}Pb$	0.4		0.3		0.2		~11.1	0.008
Tetraethyl orthosilicate	Ethyl silicate, TEOS	78-10-4	$C_8H_{20}O_4Si$			0.7	+	0.2	+	~9.8	10
Tetrafluoroethane, 1,1,1,2-	HFC-134A	811-97-2	$C_2H_2F_4$			NR		NR			ne
Tetrafluoroethene	TFE, Tetrafluoroethylene, Perfluoroethylene	116-14-3	C_2F_4			~15				10.12	ne
Tetrafluoromethane	CFC-14, Carbon tetrafluoride	75-73-0	CF_4			NR	+	NR	+	>15.3	ne
Tetrahydrofuran	THF	109-99-9	C_4H_8O	1.9	+	1.7	+	1.0	+	9.41	200
Tetramethyl orthosilicate	Methyl silicate, TMOS	681-84-5	$C_4H_{12}O_4Si$	10	+	1.9	+			~10	1
Therminol® D-12 *	Hydrotreated heavy naphtha	64742-48-9	m.w. 160	0.8	+	0.51	+	0.33	+		ne
Therminol® VP-1 *	Dowtherm A, 3:1 Diphenyl oxide: Biphenyl	101-84-8 92-52-4	$C_{12}H_{10}O$ $C_{12}H_{10}$			0.4	+				1
Toluene	Methylbenzene	108-88-3	C_7H_8	0.54	+	0.50	+	0.51	+	8.82	50

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Tolylene-2,4-diisocyanate	TDI, 4-Methyl-1,3-phenylene-2,4-diisocyanate	584-84-9	$C_9H_6N_2O_2$	1.4	+	1.4	+	2.0	+		0.002
Trichlorobenzene, 1,2,4-	1,2,4-TCB	120-82-1	$C_6H_3Cl_3$	0.7	+	0.46	+			9.04	C5
Trichloroethane, 1,1,1-	1,1,1-TCA, Methyl chloroform	71-55-6	$C_2H_3Cl_3$			NR	+	1	+	11	350
Trichloroethane, 1,1,2-	1,1,2-TCA	79-00-5	$C_2H_3Cl_3$	NR	+	NR	+	0.9	+	11.0	10
Trichloroethene	TCE, Trichoroethylene	79-01-6	C_2HCl_3	0.62	+	0.54	+	0.43	+	9.47	50
Trichloromethylsilane	Methyltrichlorosilane	75-79-6	CH_3Cl_3Si	NR		NR		1.8	+	11.36	ne
Trichlorotrifluoroethane, 1,1,2-	CFC-113	76-13-1	$C_2Cl_3F_3$			NR		NR		11.99	1000
Triethylamine	TEA	121-44-8	$C_6H_{15}N$	0.95	+	0.9	+	0.65	+	7.3	1
Triethyl borate	TEB; Boric acid triethyl ester	150-46-9	$C_6H_{15}O_3B$			2.2	+	1.1	+	~10	ne
Triethyl phosphate	Ethyl phosphate	78-40-0	$C_6H_{15}O_4P$	~50	+	3.1	+	0.60	+	9.79	ne
Trifluoroethane, 1,1,2-		430-66-0	$C_2H_3F_3$					34		*12.9*	ne
Trimethylamine		75-50-3	C_3H_9N			0.9				7.82	5
Trimethylbenzene, 1,3,5- - see Mesitylene		108-67-8									25
Trimethyl borate	TMB; Boric acid trimethyl ester, Boron methoxide	121-43-7	$C_3H_9O_3B$			5.1	+	1.2	+	10.1	ne
Trimethyl phosphate	Methyl phosphate	512-56-1	$C_3H_9O_4P$			8.0	+	1.3	+	9.99	ne
Trimethyl phosphite	Methyl phosphite	121-45-9	$C_3H_9O_3P$			1.1	+		+	*8.5*	2
Turpentine	Pinenes (85%) + other diisoprenes	8006-64-2	$C_{10}H_{16}$	0.37	+	0.30	+	0.29	+	~8	20
Undecane		1120-21-4	$C_{11}H_{24}$			2				9.56	ne
Varsol – see Mineral Spirits											
Vinyl actetate		108-05-4	$C_4H_6O_2$	1.5	+	1.2	+	1.0	+	9.19	10
Vinyl bromide	Bromoethylene	593-60-2	C_2H_3Br			0.4				9.80	5
Vinyl chloride	Chloroethylene, VCM	75-01-4	C_2H_3Cl			2.0	+	0.6	+	9.99	5
Vinyl-1-cyclohexene, 4-	Butadiene dimer, 4-Ethenylcyclohexene	100-40-3	C_8H_{12}	0.6	+	0.56	+			9.83	0.1
Vinylidene chloride - see 1,1-Dichloroethene											
Vinyl-2-pyrrolidinone, 1-	NVP, N-vinylpyrrolidone, 1-ethenyl-2-pyrrolidinone	88-12-0	C_6H_9NO	1.0	+	0.8	+	0.9	+		ne
Viscor 120B - see Mineral Spirits - Viscor 120B Calibration Fluid											
V. M. & P. Naphtha	Ligroin; Solvent naphtha; Varnish maker's & painter's naptha	64742-89-8	m.w. 111 (C_8-C_9)	1.7	+	0.97	+				300
Xylene, m-	1,3-Dimethylbenzene	108-38-3	C_8H_{10}	0.50	+	0.44	+	0.40	+	8.56	100
Xylene, o-	1,2-Dimethylbenzene	95-47-6	C_8H_{10}	0.56	+	0.46	+	0.43		8.56	100
Xylene, p-	1,4-Dimethylbenzene	106-42-3	C_8H_{10}	0.48	+	0.39	+	0.38	+	8.44	100
None				1		1		1			
Undetectable				1E+6		1E+6		1E+6			

* Compounds indicated in green can be detected using a MiniRAE 2000 or ppbRAE/+ with slow response, but may be lost by adsorption on a MultiRAE or EntryRAE. Response on multi-gas meters can give an indication of relative concentrations, but may not be quantitative and for some chemicals no response is observed.

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Appendix I:
Example of Automatic Calculation of Correction Factors, TLVs and Alarm Limits for Mixtures
(Calculations performed using Excel version of this database, available on request)

Compound	CF 9.8 eV	CF 10.6 eV	CF 11.7eV	Mol. Frac	Conc ppm	TLV ppm	STEL Ppm
Benzene	0.55	0.53	0.6	0.01	1	0.5	2.5
Toluene	0.54	0.5	0.51	0.06	10	50	150
Hexane, n-	300	4.3	0.54	0.06	10	50	150
Heptane, n-	45	2.8	0.6	0.28	50	400	500
Styrene	0.45	0.4	0.42	0.06	10	20	40
Acetone	1.2	1.1	1.4	0.28	50	750	1000
Isopropanol	500	6	2.7	0.28	50	400	500
None	1	1	1	0.00	0	1	
Mixture Value:	2.1	1.5	0.89	1.00	181 ppm	56 ppm	172 ppm
TLV Alarm Setpoint when Calibrated to Isobutylene:	26 ppm	37 ppm	62 ppm				
STEL Alarm Setpoint, same Calibration	86 ppm	115 ppm	193 ppm				

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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.

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

- 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.

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)

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EQUIPMENT CALIBRATION

PROJECT INFORMATION:

Project Name: Date:

Project No.:

Client: Instrument Source: ☐ BM ☐ Rental

	METER TYPE	UNITS	TIME	MAKE/MODEL	SERIAL NUMBER	CAL. BY	STANDARD	READING	SETTI
☐	pH meter	units		Myron L Company Ultra Meter 6P	606987		4.00		
							7.00		
							10.01		
☐	Turbidity meter	NTU		Hach 2100P Turbidimeter	970600014560		< 0.4		
							20		
							100		
							800		
☐	Sp. conductance meter	uS/mS		Myron L Company Ultra Meter 6P	606987		µS @ 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:**

SAMPLE

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Field Operating Procedures

Documentation Requirements for Drilling and Well Installation

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. Benchmark 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 Benchmark 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.

- 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 Benchmark field person overseeing the drilling. At a minimum, these forms will include:

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

- 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 Benchmark 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.

- 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 Benchmark field supervisor and the driller's representative, and provided to the Benchmark Field Team Leader.

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)

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

DAILY LOG			
DATE			
NO.			
SHEET	OF		

FIELD ACTIVITY DAILY LOG

PROJECT NAME:	PROJECT NO.
PROJECT LOCATION:	CLIENT:
FIELD ACTIVITY SUBJECT:	
DESCRIPTION OF DAILY ACTIVITIES AND EVENTS:	
TIME	DESCRIPTION
VISITORS ON SITE:	CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS:
WEATHER CONDITIONS: A.M.: P.M.:	IMPORTANT TELEPHONE CALLS:
BM/TK PERSONNEL ON SITE:	
SIGNATURE	DATE:

SAMPLE

(CONTINUED)

Benchmark Environmental Engineering & Science, PLLC

FIELD BOREHOLE LOG

PROJECT:		**Log of Boring No.:**		
BORING LOCATION:		ELEVATION AND DATUM:		
DRILLING CONTRACTOR:		DATE STARTED:		DATE FINISHED:
DRILLING METHOD:		TOTAL DEPTH:		SCREEN INTERVAL:
DRILLING EQUIPMENT:		DEPTH TO WATER: FIRST:	COMPL.:	CASING:
SAMPLING METHOD:		LOGGED BY:		
HAMMER WEIGHT:	DROP:	RESPONSIBLE PROFESSIONAL:		REG. NO.

Depth (fbgs)	SAMPLES: Sample No.	Sample	Blows (per 6")	SPT N-Value	Recovery	PID Scan (ppm)	SAMPLE DESCRIPTION USCS Classification: Color, Moisture Condition, % of Soil Type, Texture, Plasticity, Fabric, Bedding, Weathering/Fracturing, Odor, Other SURFACE ELEVATION (FMSL):	REMARKS

SAMPLE

ABANDONMENT:

Volume of cement/bentonite grout required:	$V = \pi r^2 \times 7.48 =$	gallons	borehole depth =	ft.
Volume of cement/bentonite grout installed:		gallons	borehole diameter =	ft.
Has bridging of grout occurred?	☐ yes ☐ no		borehole radius =	ft.
If yes, explain resolution:				
Method of installation:				

Project No:	**Benchmark Environmental Engineering & Science, PLLC**	Figure

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

FIELD BOREHOLE/MONITORING WELL INSTALLATION LOG

PROJECT:		Log of Well No.:		
BORING LOCATION:		ELEVATION AND DATUM:		
DRILLING CONTRACTOR:		DATE STARTED:		DATE FINISHED:
DRILLING METHOD:		TOTAL DEPTH:		SCREEN INTERVAL:
DRILLING EQUIPMENT:		DEPTH TO WATER: FIRST:	COMPL.:	CASING:
SAMPLING METHOD:		LOGGED BY:		
HAMMER WEIGHT:	DROP:	RESPONSIBLE PROFESSIONAL:		REG. NO.

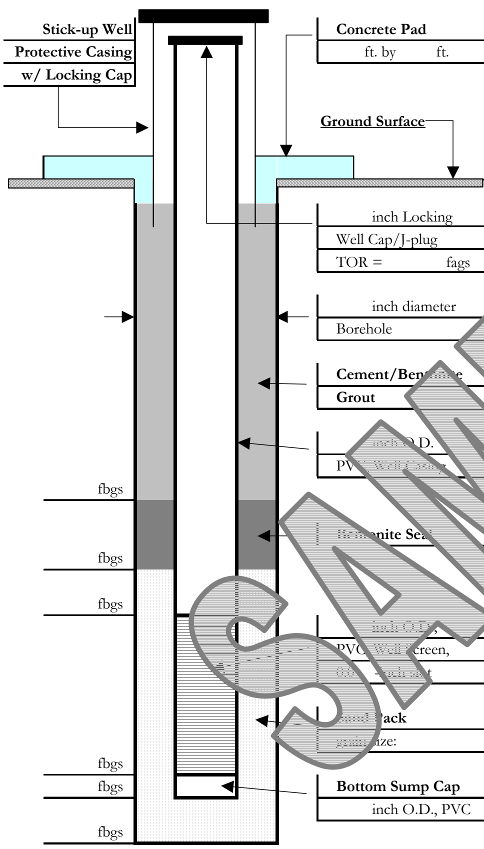
Depth (fbgs)	SAMPLES: Sample No.	Sample	Blows (per 6")	SPT N-Value	Recovery	PID Scan (ppm)	SAMPLE DESCRIPTION USCS Classification: Color, Moisture Condition, % of Soil Type, Texture, Plasticity, Fabric, Bedding, Weathering/Fracturing, Odor, Other SURFACE ELEVATION (FMSL):	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS

Project No:	Benchmark Environmental Engineering & Science, PLLC	Figure

SAMPLE

STICK-UP 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:	
Techneque(s):	
Date Completed:	
BM/TK Personnel:	
Total Volume Purge:	gallons
Static Water Level:	fbTOR
Pump Depth:	
Purge Duration:	minutes
Yeild:	gpm
Specific Capacity:	gpm/ft

SAMPLE

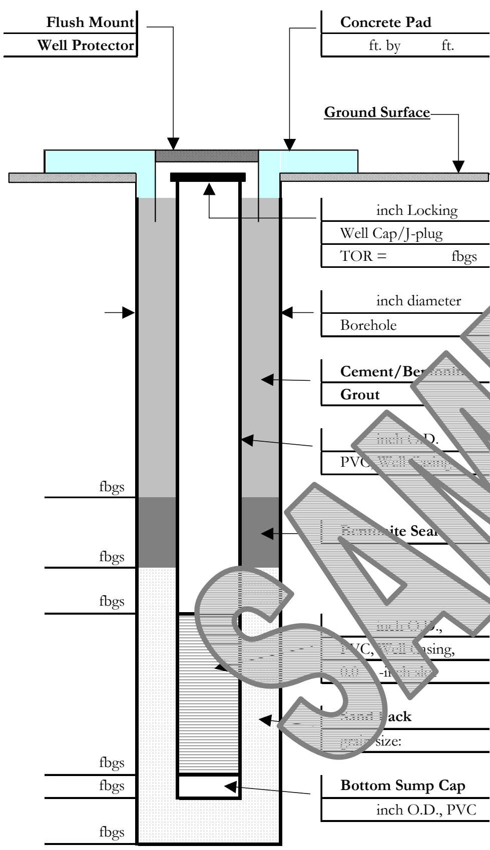
Comments:

PREPARED BY: DATE:

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

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:	
Techneque(s):	
Date Completed:	
BM/TK Personnel:	
Total Volume Purge:	gallons
Static Water Level:	fbTOR
Pump Depth:	
Purge Duration:	minutes
Yeild:	gpm
Specific Capacity:	gpm/ft

SAMPLE

Comments:

PREAPRED BY: DATE:

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

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	QUANTITIES	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/beontonite grout							
☐ Protective casing ☐ Flushmount road box							
Lockable J-plug							
Lock							

PERSONNEL TIME LOG:

POSITION	NAME	HOURS
Observer		
Drillers		

DRILLER (optional):	BM REP.

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FIELD OPERATING PROCEDURES

Drill Site Selection Procedure

FOP 017.0

DRILL SITE SELECTION PROCEDURE

PURPOSE

This procedure presents a method for selecting a site location for drilling. Drill site selection should be based on the project objectives, ease of site access, freedom from obstructions and buried metallic objects (drums) and site safety (appropriate set backs from overhead and buried services).

PROCEDURE

The following procedure outlines procedures prior to drilling activities:

1. Review project objectives and tentatively select drilling locations that provide necessary information for achieving objectives (i.e., Work Plan).

2. Clear locations with property owner/operator to ensure that drilling activities will not interfere with site operations and select appropriate access routes.

3. Stake locations in the field, measure distance from locations to recognizable landmarks, such as building or fence lines and plot locations on site plan. Ensure location is relatively flat, free of overhead wires and readily accessible. Survey location if property ownership is in doubt.

4. Obtain clearances from appropriate utilities and if buried waste/metallic objects are suspected, screen location with appropriate geophysical method.

5. Establish a secure central staging area for storage of drilling supplies and for equipment decontamination. Locate a secure storage area for drilling samples, as necessary.

ATTACHMENTS

none

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FIELD OPERATING PROCEDURES

Drilling and Excavation Equipment Decontamination Procedures

FOP 018.0

DRILLING AND EXCAVATION EQUIPMENT DECONTAMINATION PROCEDURES

PURPOSE

This procedure is to be used for the decontamination of drilling and excavation equipment (i.e., drill rigs, backhoes, augers, drill bits, drill rods, buckets, and associated equipment) used during a subsurface investigation. The purpose of this procedure is to remove chemical constituents associated with a particular drilling or excavation location from this equipment. This prevents these constituents from being transferred between drilling or excavation locations, or being transported out of controlled areas.

PROCEDURE

The following procedure will be utilized prior to the use of drilling or excavation equipment at each location, and prior to the demobilization of such equipment from the site:

1. Remove all loose soil and other particulate materials from the equipment at the survey site.

2. Wrap augers, tools, plywood, and other reusable items with a plastic cover prior to transport from the site of use to the decontamination facility.

3. Transport equipment to the decontamination facility. All equipment must be decontaminated at an established decontamination facility. This facility will be placed within a controlled area, and will be equipped with necessary features to contain and collect wash water and entrained materials.

4. Wash equipment thoroughly with pressurized low-volume water or steam, supplied by a pressure washer or steam cleaner.

5. If necessary, use a brush or scraper to remove visible soils adhering to the equipment, and a non-phosphate detergent to remove any oils, grease, and/or hydraulic fluids adhering to the equipment. Continue pressure washing until all visible contaminants are removed.

6. Allow equipment to air dry.

7. Store equipment in a clean area or wrap the equipment in new plastic sheeting as necessary to ensure cleanliness until ready for use.

8. Manage all wash waters and entrained solids as described in the Benchmark Field Operating Procedure for Management of Investigation-Derived Waste.

ATTACHMENTS

none

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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 Benchmark 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.

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

<u>Benchmark FOPs:</u>
040 Non-Disposable and Non-Dedicated Sampling Equipment Decontamination

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

WATER LEVEL MONITORING RECORD

Project Name:	Client:
Project No.:	Location:
Field Personnel:	Date:
Weather:	

Well No.	Time	Top of Riser Elevation (fmsl)	Static Depth to Water (fbTOR)	Groundwater Elevation (fmsl)	Total Depth (fbTOR)	Last Total Depth Measurement (fbTOR)

Comments/Remarks:

SAMPLE

PREAPRED BY: DATE:

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Field Operating Procedures

Groundwater Purging Procedures Prior to Sample Collection

FOP 023.1

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 Benchmark 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 Benchmark 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

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 Benchmark 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 Benchmark 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,

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:

    - <u>Bailer</u> – 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.

    - <u>Well Wizard Purge Pump (or similar)</u> – This pneumatic bladder pump uses compressed air to push water to the surface. Groundwater is not in contact 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 Benchmark 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:

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 Benchmark 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.

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

Benchmark 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

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

GROUNDWATER FIELD FORM

Project Name: Date:

Location: Project No.: Field Team:

Well No.			Diameter (inches):			Sample Time:			
Product Depth (fbTOR):			Water Column (ft):			DTW when sampled:			
DTW (static) (fbTOR):			Casing Volume:			Purpose:	☐ Development	☐ Sample	
Total Depth (fbTOR):			Purge Volume (gal):			Purge Method:			
Time	Water Level (fbTOR)	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 (fbTOR):			Water Column (ft):			DTW when sampled:			
DTW (static) (fbTOR):			Casing Volume:			Purpose:	☐ Development	☐ Sample	
Total Depth (fbTOR):			Purge Volume (gal):			Purge Method:			
Time	Water Level (fbTOR)	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								

SAMPLE

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:

BENCHMARK
ENVIRONMENTAL
ENGINEERING &
SCIENCE, PLLC

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:

SAMPLE

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FIELD OPERATING PROCEDURES

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 Benchmark 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

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 Benchmark 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 Benchmark 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 Benchmark 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 Benchmark 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 Benchmark 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).

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 Benchmark 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:

Parameter	Units
Dissolved Oxygen	parts per million (ppm)
Specific Conductance	μmhos/cm or μS or mS
pH	pH units
Temperature	°C or °F
Turbidity	NTU
Eh (*optional*)	mV
PID VOCs (*optional*)	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 Benchmark 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

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 Benchmark 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

- 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.

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 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 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

<u>Benchmark FOPs:</u>

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

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

GROUNDWATER FIELD FORM

Project Name: Date:

Location: Project No.: Field Team:

Well No.		Diameter (inches):			Sample Time:			
Product Depth (fbTOR):		Water Column (ft):			DTW when sampled:			
DTW (static) (fbTOR):		Casing Volume:			Purpose: ☐ Development ☐ Sample			
Total Depth (fbTOR):		Purge Volume (gal):			Purge Method:			
Time	Water Level (fbTOR)	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 (fbTOR):		Water Column (ft):			DTW when sampled:			
DTW (static) (fbTOR):		Casing Volume:			Purpose: ☐ Development ☐ Sample			
Total Depth (fbTOR):		Purge Volume (gal):			Purge Method:			
Time	Water Level (fbTOR)	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								

SAMPLE

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:

Benchmark Environmental Engineering & Science, PLLC

Field Operating Procedures

Hollow Stem Auger Drilling Procedures

HOLLOW STEM AUGER (HSA) DRILLING PROCEDURES

PURPOSE

This guideline presents a method for drilling a borehole through unconsolidated materials, including soils or overburden, and consolidated materials, including bedrock.

PROCEDURE

The following procedure will be used to drill a borehole for sampling and/or well installation, using hollow-stem auger methods and equipment.

1. Follow Benchmark's Field Operating Procedure for Drill Site Selection Procedure prior to implementing any drilling activity.

2. Perform drill rig safety checks with the driller by completing the Drilling Safety Checklist form (sample attached).

3. Conduct tailgate health and safety meeting with project team and drillers by completing the Tailgate Safety Meeting Form.

4. Calibrate air-monitoring equipment in accordance with the appropriate Benchmark's Field Operating Procedures (i.e., PID, FID, combustible gas meter) or manufacturer's recommendations for calibration of field meters (i.e., DataRAM 4 Particulate Meter).

5. Ensure all drilling equipment (i.e., augers, rods, split-spoons) appear clean and free of soil prior to initiating any subsurface intrusion. Decontamination of drilling equipment should be in accordance with Benchmark's FOP: Drilling and Excavation Equipment Decontamination Procedures.

6. Mobilize the auger rig to the site and position over the borehole.

7. Level and stabilize the rig using the rig jacks, and recheck the rig location against the planned drilling location. If necessary, raise the jacks and adjust the rig position.

8. Place a metal or plywood auger pan over the borehole location to collect the auger cuttings. This auger pan will be equipped with a 12-inch nominal diameter hole for auger passage. As an alternative, a piece of polyethylene tarp may be used as a substitute.

9. Advance augers into the subsurface. For sampling or pilot-hole drilling, nominal 8-inch outside diameter (OD) augers should be used. The boring diameter will be approved by the Benchmark field supervisor.

10. Collect soil samples via split spoon sampler in accordance with Benchmark's Field Operating Procedure for Split Spoon Sampling.

11. Check augers periodically during drilling to ensure the boring is plumb. Adjust rig position as necessary to maintain plumb.

12. Continue drilling until reaching the assigned total depth, or until auger refusal occurs. Auger refusal is when the drilling penetration drops below 0.1 feet per 10 minutes, with the full weight of the rig on the auger bit, and a center <u>bit</u> (not center plug) in place.

13. Plug and abandon boreholes not used for well installation in accordance with Benchmark's Field Operating Procedure for Abandonment of Borehole.

OTHER PROCEDURAL ISSUES

- Slip rings may be used for lifting a sampling or bit string. The string will not be permitted to extend more than 15 feet above the mast crown.

- Borings will not be over drilled (rat holed) without the express permission of the Benchmark field supervisor. All depth measurements should be accurate to the nearest 0.1 foot, to the extent practicable.

- Potable water may be placed in the auger stem if critically necessary for borehole control or to accomplish sampling objectives and must be approved by the Benchmark Project Manager and/or NYSDEC Project Manager. Upon approval, the potable water source and quantity used will be documented in the Project Field Book and subsequent report submittal.

ATTACHMENTS

Drilling Safety Checklist (sample)
Tailgate Safety Meeting Form (sample)

REFERENCES

Benchmark FOPs:

001 *Abandonment of Borehole Procedures*
010 *Calibration and Maintenance of Portable Flame Ionization Detector*
011 *Calibration and Maintenance of Portable Photoionization Detector*
017 *Drill Site Selection Procedure*
018 *Drilling and Excavation Equipment Decontamination Procedures*
058 *Split Spoon Sampling Procedures*

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

DRILLING SAFETY CHECKLIST

Project: **Supplemental Phase II RFI/ICMs**	Date:
Project No.: **0041-009-500**	Drilling Company:
Client: **RealCo., Inc.**	Drill Rig Type:

ITEMS TO CHECK	OK	ACTION NEEDED
"Kill switches" installed by the manufacturer are in operable condition and all workers at the drill site are familiar with their location and how to activate them?		
"Kill switches" are accessible to workers on both sides of the rotating stem? NOTE: Optional based on location and number of switches provided by the manufacturer.		
Cables on drill rig are free of kinks, frayed wires, "bird cages" and worn or missing sections?		
Cables are terminated at the working end with a proper eye splice, either swaged Coupling or using cable clamps?		
Cable clamps are installed with the saddle on the live or load side? Clamps should not be alternated and should be of the correct size and number for the cable size to which it is installed. Clamps are complete with no missing parts?		
Hooks installed on hoist cables are the safety type with a functional latch to prevent accidental separation?		
Safety latches are functional and completely span the entire throat of the hook and have positive action to close the throat except when manually displaced for connecting or disconnecting a load?		
Drive shafts, belts, chain drives and universal joints shall be guarded to prevent accidental insertion of hands and fingers or tools.		
Outriggers shall be extended prior to and whenever the boom is raised off its cradle. Hydraulic outriggers must maintain pressure to continuously support and stabilize the drill rig even while unattended.		
Outriggers shall be properly supported on the ground surface to prevent settling into the soil.		
Controls are properly labeled and have freedom of movement. Controls should not be blocked or locked in an action position.		
Safeties on any device shall not be bypassed or neutralized.		
Controls shall be operated smoothly and cables and lifting devices shall not be jerked or operated erratically to overcome resistance.		
Slings, chokers and lifting devices are inspected before using and are in proper working order? Damaged units are removed from service and are properly tagged?		
Shackles and clevises are in proper working order and pins and screws are fully inserted before placing under a load?		
High-pressure hoses have a safety (chain, cable or strap) at each end of the hose section to prevent whipping in the event of a failure?		
Rotating parts of the drill string shall be free of sharp projections or hooks, which could entrap clothing or foreign objects?		
Wire ropes should not be allowed to bend around sharp edges without cushion material.		
The exclusion zone is centered over the borehole and the radius is equal or greater than the boom height?		

SAMPLE

ITEMS TO CHECK	OK	ACTION NEEDED

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DRILLING SAFETY CHECKLIST

Project: **Supplemental Phase II RFI/ICMs**	Date:
Project No.: **0041-009-500**	Drilling Company:
Client: **RealCo., Inc.**	Drill Rig Type:

ITEMS TO CHECK	OK	ACTION NEEDED
The work area around the borehole shall be kept clear of trip hazards and walking surfaces should be free of slippery material.		
Workers shall not proceed higher than the drilling deck without a fall restraining device and must attach the device in a manner to restrict fall to less than 6 feet.		
A fire extinguisher of appropriate size shall be immediately available to the drill crew. The drill crew shall have received annual training on proper use of the fire extinguisher.		
29 CFR 1910.333 © (3) Except where electrical distribution and transmission lines have been de-energized and visibly grounded, drill rigs will be operated proximate to, under, by, or near power lines only in accordance with the following: .333 © (3) (ii) 50 kV or less -minimum clearance is 10 ft. For 50 kV or over - 10ft. Plus ½ in. For each additional kV **Benchmark Policy: Maintain 20 feet clearance**		
29 CFR 1910.333 © (3) (iii) While the rig is in transit with the boom in the down position, clearance from energized power lines will be maintained as follows: Less than 50 kV - 4 feet 50 to 365 kV - 10 feet 365 to 720 kV - 16 feet		

Name: ______________________________ (printed)

Signed: ______________________________ Date: ____________________

SAMPLE

TAILGATE SAFETY MEETING FORM

Project Name: Date: Time:
Project Number: Client:
Work Activities:

HOSPITAL INFORMATION:

Name:
Address: *City:* *State:* *Zip:*
Phone No.: *Ambulance Phone No.*

SAFETY TOPICS PRESENTED:

Chemical Hazards:

Physical Hazards: Slips, Trips, Falls

PERSONAL PROTECTIVE EQUIPMENT:

Activity:	*PPE Level:*	A	B	C	D
Activity:	*PPE Level:*	A	B	C	D
Activity:	*PPE Level:*	A	B	C	D
Activity:	*PPE Level:*	A	B	C	D
Activity:	*PPE Level:*	A	B	C	D

New Equipment:

Other Safety Topic (s): Environmental Hazards (aggressive fauna)
Eating, drinking, use of tobacco products is prohibited in the Exclusion Zone (EZ)

ATTENDEES

Name Printed	Signatures

Meeting conducted by:

SAMPLE

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FIELD OPERATING PROCEDURES

Low-Flow (Minimal Drawdown) Groundwater Purging & Sampling Procedure

FOP 031.2

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 Benchmark'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.

2. Prepare the electronic water level indicator (e-line) in accordance with the procedures referenced in the Benchmark's Groundwater Level Measurement FOP and decontaminate the e-line probe and a lower portion of cable following the procedures referenced in the Benchmark'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 Benchmark'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 Benchmark'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 Benchmark's Non-disposable and Non-dedicated Sampling Equipment Decontamination FOP.

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 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. Three successive readings should be within ± 0.1 units for pH, ± 3% for specific conductance, ± 10 mV for Eh, and ± 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 Benchmark'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 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.*

Benchmark 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

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GROUNDWATER FIELD FORM

Project Name: Date:
Location: Project No.: Field Team:

Well No.			Diameter (inches):			Sample Time:		
Product Depth (fbTOR):			Water Column (ft):			DTW when sampled:		
DTW (static) (fbTOR):			Casing Volume:			Purpose: ☐ Development ☐ Sample		
Total Depth (fbTOR):			Purge Volume (gal):			Purge Method:		
Time	Water Level (fbTOR)	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 (fbTOR):			Water Column (ft):			DTW when sampled:		
DTW (static) (fbTOR):			Casing Volume:			Purpose: ☐ Development ☐ Sample		
Total Depth (fbTOR):			Purge Volume (gal):			Purge Method:		
Time	Water Level (fbTOR)	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								

SAMPLE

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:

Benchmark
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Field Operating Procedures

Management of Investigative-Derived Waste (IDW)

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.

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 Benchmark 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 Benchmark'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 Property Owner, Project Manager, and/or NYSDEC Project Manager approval, dispose of investigation-derived wastes as follows:

- 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

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INVESTIGATION DERIVED WASTE CO

Project Name: Location:

Project Number: Personnel:

Container		Contents	Date		Staging Location	Date Sampled	Co
Number	Description		Started	Ended			

SAMPLE

Prepared By:

Signed:

IDW Container Label (sample):

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Project Name:

Project Number:

Container I.D.:

Contents/Matrix:

Estimated Quantity:

Date of Generation:

Date of Sample Collection:

Contact Name:

Contact Phone Number:

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FIELD OPERATING PROCEDURES

Monitoring Well Construction for Hollow Stem Auger Boreholes

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 Benchmark'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 Benchmark'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.)

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.

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 Benchmark Field Operating Procedure for Monitoring Well Development.

18. Manage all waste materials generated during well installation and development as described in the Benchmark Field Operating Procedure for Management of Investigation Derived Waste.

ATTACHMENTS

Field Borehole/Monitoring Well Installation Log (sample)
Typical Monitoring Well Detail (Figure 1)

REFERENCES

Benchmark 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

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FIELD BOREHOLE/MONITORING WELL INSTALLATION LOG

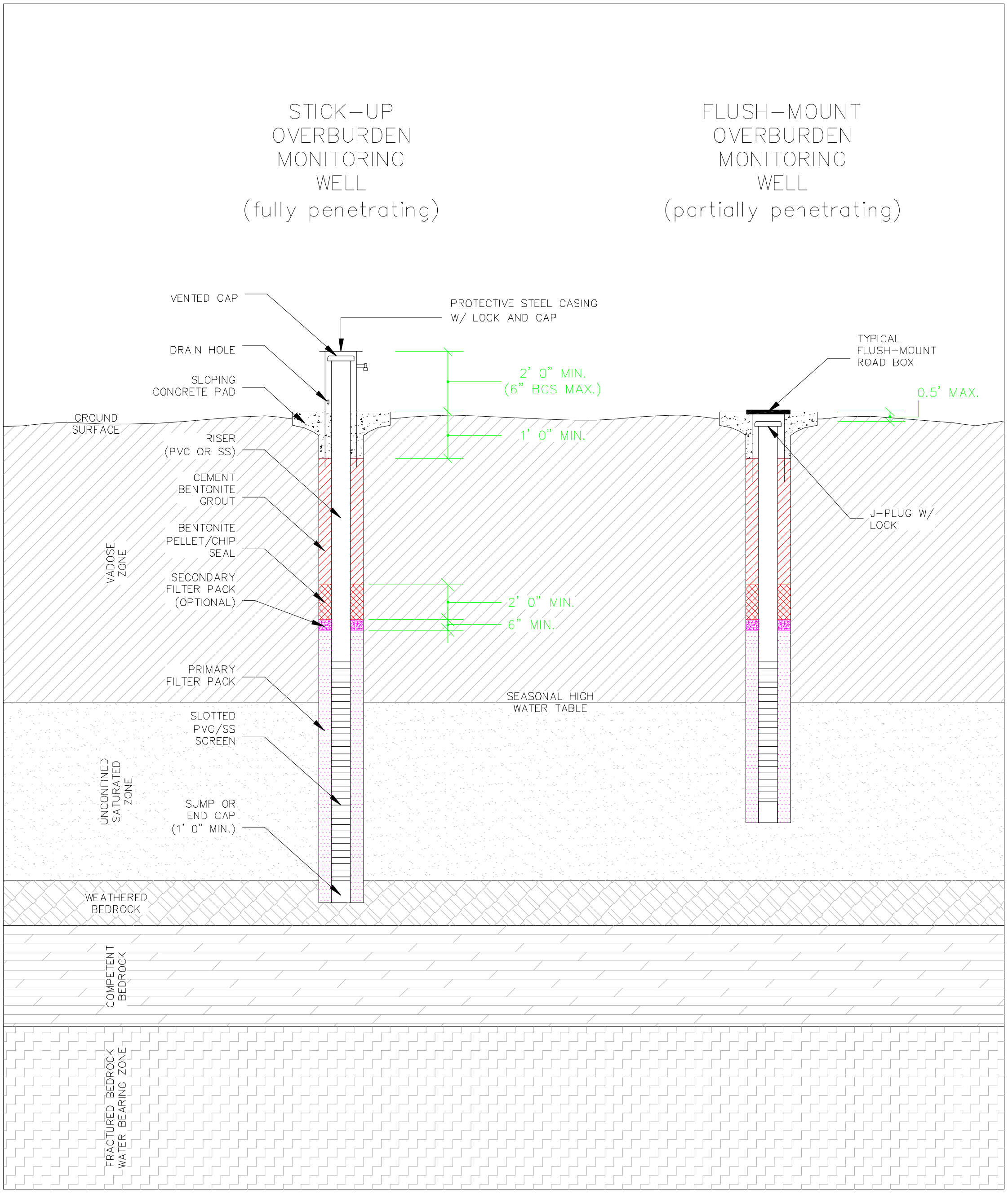
PROJECT:		**Log of Well No.:**			
BORING LOCATION:		ELEVATION AND DATUM:			
DRILLING CONTRACTOR:		DATE STARTED:		DATE FINISHED:	
DRILLING METHOD:		TOTAL DEPTH:		SCREEN INTERVAL:	
DRILLING EQUIPMENT:		DEPTH TO WATER:	FIRST:	COMPL.:	CASING:
SAMPLING METHOD:		LOGGED BY:			
HAMMER WEIGHT:	DROP:	RESPONSIBLE PROFESSIONAL:			REG. NO.

Depth (fbgs)	SAMPLES: Sample No.	Sample	Blows (per 6")	SPT N-Value	Recovery	PID Scan (ppm)	SAMPLE DESCRIPTION USCS Classification: Color, Moisture Condition, % of Soil Type, Texture, Plasticity, Fabric, Bedding, Weathering/Fracturing, Odor, Other SURFACE ELEVATION (FMSL):	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS

Project No:	**Benchmark Environmental Engineering & Science, PLLC**	Figure

SAMPLE

FIGURE 1


STICK-UP
OVERBURDEN
MONITORING
WELL
(fully penetrating)
FLUSH-MOUNT
OVERBURDEN
MONITORING
WELL
(partially penetrating)
VENTED CAP
PROTECTIVE STEEL CASING
W/ LOCK AND CAP
DRAIN HOLE
SLOPING
CONCRETE PAD
GROUND
SURFACE
RISER
(PVC OR SS)
CEMENT
BENTONITE
GROUT
BENTONITE
PELLET/CHIP
SEAL
SECONDARY
FILTER PACK
(OPTIONAL)
PRIMARY
FILTER PACK
SLOTTED
PVC/SS
SCREEN
SUMP OR
END CAP
(1' 0" MIN.)
2' 0" MIN.
(6" BGS MAX.)
1' 0" MIN.
2' 0" MIN.
6" MIN.
TYPICAL
FLUSH-MOUNT
ROAD BOX
0.5' MAX.
J-PLUG W/
LOCK
SEASONAL HIGH
WATER TABLE
VADOSE
ZONE
UNCONFINED
SATURATED
ZONE
WEATHERED
BEDROCK
COMPETENT
BEDROCK
FRACTURED BEDROCK
WATER BEARING ZONE

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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 Benchmark 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 Benchmark 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

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:
     - Dissolved Oxygen: ± 0.3 mg/L
     - Turbidity: ± 10%
     - Specific Conductance: ± 3%
     - ORP: ± 10 mV
     - 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 Benchmark Groundwater Well Development Log (sample attached).

ATTACHMENTS

Groundwater Well Development Log (sample)

REFERENCES

<u>Benchmark FOPs:</u>
040 Non-Disposable and Non-Dedicated Sampling Equipment Decontamination

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GROUNDWATER WELL DEVELOPMENT LOG

Project Name:	WELL NUMBER:
Project Number:	Sample Matrix:
Client:	Weather:

WELL DATA: DATE: TIME:

Casing Diameter (inches):	Casing Material:
Screened interval (fbTOR):	Screen Material:
Static Water Level (fbTOR):	Bottom Depth (fbTOR):
Elevation Top of Well Riser (fmsl):	Datum Ground Surface: Mean Sea Level
Elevation Top of Screen (fmsl):	Stick-up (feet):

PURGING DATA: DATE: START TIME: END TIME:

VOLUME CALCULATION:

(A) Total Depth of Well (fbTOR):	
(B) Casing Diameter (inches):	
(C) Static Water Level (fbTOR):	
One Well Volume (V, gallons): $V = 0.0408 [(B)^2 \times \{ (A) - (C) \}]$	

*Use the table to the right to calculate one well volume.

Field Personnel:

Volume Calculation

Well Diameter	Volume gal/ft
1"	0.041
2"	0.163
3"	0.367
4"	0.653
5"	1.020
6"	1.469
8"	2.611

Stabilization Criteria

Parameter	Criteria
DO	+/- 0.3 mg/L
Turbidity	+/- 10%
SC	+/- 3%
ORP	+/- 10 mV
pH	+/- 0.1 unit

EVACUATION STABILIZATION TEST DATA:

Time	Water Level (fbTOR)	Accumulated Volume (gallons)	pH (units)	Temperature (degrees C)	Specific Conductance (uS/cm)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	Appearance & Odor

REMARKS:

PREPARED BY:

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FIELD OPERATING PROCEDURES

Non-Disposable and Non-Dedicated Sampling Equipment Decontamination

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:

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.

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 Benchmark 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.

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 (HNO_3).

9. Rinse the impeller assembly with isopropanol.

10. Rinse the impeller assembly with distilled/deionized water.

<u>Between Wells Decontamination Procedure:</u>

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

<u>Benchmark FOPs:</u>

032 Management of Investigation-Derived Waste

BENCHMARK
ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

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 47^{th} sample retained for analysis during the field investigation, collected on May 14, 2002.

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 Benchmark Field Team Leader until time of shipment. Periodically drain melt-water off coolers and replenish ice as necessary.

4. Ship samples on a daily basis, unless otherwise directed by the Benchmark 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.

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

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

AIR SAMPLE COLLECTION SUMMARY LOG

Field ID	Location	QC Type	Analytical Parameters	Containers	Date	Time	Sampler Initials	Comments (e.g. problems encountered, ref. to variance, location changes, important observations or descriptions, etc.)

Notes:

1. See QAPP for sampling frequency and actual number of QC samples.
2. SC - Summa Canister.
3. TB - Tedlar Bag (quantity).
4. No Matrix Spike, Matrix Spike Duplicate, Matrix Spike Blanks, Field Duplicates, Field Blanks or Rinsates collected for air samples.

SAMPLE

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

CHAIN OF CUSTODY RECORD

Project No.	Project Name
Samplers (Signature)	

No.	Date	Time	comp	grab	Sample Identification	Number of Containers	VOCs	SVOCs	Metals						REMARKS

Possible Hazard Identification:
☐ Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal:
Return to Client ☐ Disposal by Lab ☐ Archive ____________(mos.)

Turnaround Time Required:
Normal ☐ Rush ☐

QC Level:
I. ☐ II. ☐ III. ☐ Project Specific (specify):__________________

Relinquished by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	REMARKS:
Relinquished by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	

SAMPLE

Benchmark Environmental Engineering & Science, PLLC

WIPE SAMPLE COLLECTION SUMMARY LOG

Field ID	Location	QC Type	Analytical Parameters	Containers	Date	Time	Sampler Initials	Comments (e.g. problems encountered, ref. to variance, location changes, important observations or descriptions, etc.)

Notes:
1. See QAPP for sampling frequency and actual number of QC samples.
2. CWM - clear, wide-mouth glass jar with Teflon-lined cap.
3. FD - Field Duplicate.
4. FB - Field Blank.
5. RS - Rinsate.
6. No Matrix Spike, Matrix Spike Duplicate or Matrix Spike Blanks for wipe samples.
7. Rinsates should be taken at a rate of 1 per day during wipe sampling. Only take when reusable equipment is used.
8. Wipe sample FB collected by wiping unused glove (and any other sampling equipment coming into contact with sampled surface) with prepared gauze pad and place in sample jar. Take at a rate of 1 FB per 20 samples.
9. Wipe sample FDs taken adjacent to original sample at a rate of 1 FD per 20 samples.
10. **EH :** Extract and Hold

SAMPLE

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

AIR SAMPLE COLLECTION SUMMARY LOG

Field ID	Location	QC Type	Analytical Parameters	Containers	Date	Time	Sampler Initials	Comments (e.g. problems encountered, ref. to variance, location changes, important observations or descriptions, etc.)

Notes:
1. See QAPP for sampling frequency and actual number of QC samples.
2. SC - Summa Canister.
3. TB - Tedlar Bag (quantity).
4. No Matrix Spike, Matrix Spike Duplicate, Matrix Spike Blanks, Field Duplicates, Field Blanks or Rinsates collected for air samples.

SAMPLE

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

CHAIN OF CUSTODY RECORD

Project No.	Project Name					Number of Containers	VOCs	SVOCs	Metals						REMARKS
Samplers (Signature)															
No.	Date	Time	comp	grab	Sample Identification										

Possible Hazard Identification:
☐ Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal:
Return to Client ☐ Disposal by Lab ☐ Archive ____________(mos.)

Turnaround Time Required:
Normal ☐ Rush ☐

QC Level:
I. ☐ II. ☐ III. ☐ Project Specific (specify):________________

Relinquished by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	REMARKS:
Relinquished by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	

SAMPLE

Benchmark Environmental Engineering & Science, PLLC

Field Operating Procedures

Soil Description Procedures Using The Visual-Manual Method

FOP 054.2

SOIL DESCRIPTION PROCEDURES USING THE VISUAL-MANUAL METHOD

PURPOSE

This guideline presents a means for insuring consistent and proper field identification and description of collected soils during a project (via, split-spoon (barrel) sampler, hand auger, test pit etc.). The lithology and moisture content of each soil sample will be physically characterized by visual-manual observation in accordance with ASTM Method D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). When precise classification of soils for engineering purposes is required, the procedures prescribed in ASTM Method D2487 (Standard Practice for Classification of Soils for Engineering Purposes [Unified Soil Classification System, USCS]) will be used. The method of soil characterization presented herein describes soil types based on grain size, liquid and plastic limits, and moisture content based on visual examination and manual tests. When using this FOP to classify soil, the detail of description provided for a particular material should be dictated by the complexity and objectives of the project. However, more often than not, "after the fact" field information is required later in the project, therefore, every attempt to describe the soil as completely as possibly should be made.

Intensely weathered or decomposed rock that is friable and can be reduced to gravel size or smaller by normal hand pressure should be classified as a soil. The soil classification would be followed by the parent rock name in parenthesis. Projects requiring depth to bedrock determinations should always classify weathered or decomposed bedrock as bedrock (i.e., landfill siting). The project manager should always be consulted prior to making this determination.

PROCEDURE

Assemble necessary equipment and discuss program requirements with drilling contractor.

1. Calibrate air-monitoring equipment in accordance with the appropriate Benchmark's Field Operating Procedures or manufacturers recommendations for calibration of field meters.

2. Collect desired soil sample in accordance with appropriate Benchmark FOP (i.e., split-spoon sampling, hand augering, test pitting etc.).

3. Shave a thin layer off the entire length of the sample to expose fresh sample.

4. Photograph and scan the sample with a photoionization detector (PID) at this time, if applicable, in accordance with Benchmark's Screening of Soil Samples for Organic Vapors During Drilling Activities FOP.

5. Describe the sample using terminology presented in the Descriptive Terms section below.

6. Record all pertinent information in the Project Field Book and Field Borehole Log (sample attached) or Field Borehole/Monitoring Well Installation Log (sample attached).

7. After the sample has been described, place a representative portion of the sample in new, precleaned jars or self-sealing plastic bags for archival purposes (if required). Label the jar or bag with the sample identification number, sample interval, date, project number and store in a secure location.

8. If the soil is to be submitted to a laboratory for analysis, collect the soil sample with a dedicated stainless steel sampling tool, place the sample into the appropriate laboratory-supplied containers, and store in an ice-chilled cooler staged in a secure location in accordance with Benchmark's Sample Labeling, Storage and Shipment Procedures FOP.

9. All remaining soil from soil sample collection activities shall be containerized in accordance with Benchmark's Management of Investigative-Derived Waste (IDW) FOP and/or the Project Work Plan.

DESCRIPTIVE TERMS

All field soil samples will be described using the Unified Soil Classification System (USCS) presented in Figures 1 and 2 (attached). In addition to ASTM Method D2488, Method D1586, Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils (a.k.a., Standard Penetration Test, STP), when implemented, can also be used to classify the resistance of soils. In certain instances, it is desirable to supplement the USCS classification with a geologic interpretation of the soil sample that is supported by the soil descriptive terms presented in this section. The project manager should be consulted when making any geologic interpretation. Field test methods are provided to assist field personnel in classifying soil and are identified by a bold blue **FTM** and shaded. Classification of sampled soils will use the following ASTM descriptive terms and criteria:

- **Group Name** (USCS, see Figure 2)
- **Group Symbol** (USCS, see Figure 2) – only use if physical laboratory testing has been performed to substantiate. The USCS can be applied to most unconsolidated materials, and is represented by a two-letter symbol, except Peat (Pt).
  - The first letter includes: G (gravel), S (sand), M (silt), C (clay), and O (organic).
  - The second letter includes: P (poorly graded or uniform particle sizes), W (well graded or diversified particle sizes), H (high plasticity), and L (low plasticity).
  - Examples:
    - GW = well graded gravels and gravel-sand mixtures, little or no fines
    - GP = poorly graded gravels and gravel-sand mixtures, little or no fines
    - GM = silty gravels, gravel-sand-silt mixtures

    - GC = clayey gravels, gravel-sand-clay mixtures
    - SW = well graded sands and gravelly sands, little or no fines
    - SP = poorly graded sands and gravelly sands, little or no fines
    - SM = silty sand, sand-silt mixtures
    - SC = clayey sand sand-clay mixtures
    - ML = inorganic silts, very fine sands, rock flour, silty or clayey fine sands
    - CL = inorganic clays of low to medium plasticity, gravelly/sandy/silty/lean clays
    - OL = organic silts and organic silty clays of low plasticity
    - MH = inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts (very rare)
    - CH = inorganic clays of high plasticity, fat clays
    - OH = organic clays of medium to high plasticity
    - Pt = peat, muck, and other highly organic soils

- **Angularity** (ASTM D2488; Table 1)
  - Angular – particles have sharp edges and relatively planar sides with unpolished surfaces
  - Subangular – particles are similar to angular description but have rounded edges
  - Subrounded – particles have nearly planar sides but have well-rounded corners and edges
  - Rounded – particles have smoothly curved sides and no edges
- **Particle Shape** (ASTM D2488; Table 2)
  - Flat – particles with width/thickness > 3
  - Elongated – particles with length/width > 3
  - Flat and Elongated – particles meet criteria for both flat and elongated
- **Moisture Condition** (ASTM D2488; Table 3)
  - Dry – absence of moisture, dusty, dry to the touch
  - Moist – damp, but no visible water
  - Wet – visible free water, usually soil is below water table
- **Reaction with Hydrochloric Acid (HCL)** (ASTM D2488; Table 4)
  - None – no visible reaction

  - Weak – some reaction, with bubbles forming slowly
  - Strong – violent reaction, with bubbles forming immediately

- **Consistency of Cohesive Soils** (ASTM D2488; Table 5)
  - Very soft – squeezes between fingers when fist is closed; easily penetrated several inches by fist (SPT = 2 or less)
  - Soft – easily molded by fingers; easily penetrated several inches by thumb (SPT = 2 to 4)
  - Firm – molded by strong pressure of fingers; can be penetrated several inches by thumb with moderate effort (SPT = 4 to 8)
  - Stiff – dented by strong pressure of fingers; readily indented by thumb but can be penetrated only with great effort (SPT = 8 to 15)
  - Very stiff – readily indented by thumbnail (SPT = 15 to 30)
  - Hard – indented with difficultly by thumbnail (SPT >30)

- **Cementation** (ASTM D2488; Table 6)
  - Weak – crumbles or breaks with handling or slight finger pressure
  - Moderate – crumbles or breaks with considerable finger pressure
  - Strong – will not crumble or break with finger pressure

- **Structure (Fabric)** (ASTM D2488; Table 7)
  - Varved – alternating 1 mm to 12 mm (0.04 – 0.5 inch) layers of sand, silt and clay
  - Stratified – alternating layers of varying material or color with the layers less than 6 mm (0.23 inches) thick; note thickness
  - Laminated – alternating layers of varying material or color with the layers less than 6 mm (0.23 inches) thick; note thickness
  - Fissured – contains shears or separations along planes of weakness
  - Slickensided – shear planes appear polished or glossy, sometimes striated

- Blocky – cohesive soil that can be broken down into small angular lumps which resist further breakdown
- Lensed – inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay; note thickness
- Homogeneous or Massive – same color and appearance throughout

- **Inorganic Fine-Grained Soil Characteristics** (ASTM D2488; Table 12)

  Several field tests can be performed to determine the characteristics of fine-grained soils (material passing the No. 40 sieve), such as dry strength, dilatency, and toughness. These field testing methods are described below.

  - **Dry Strength** (ASTM D2488; Table 8)

    FTM (Dry Strength): Select enough material and moisten with water until it can be molded or shaped without sticking to your fingers (slightly below the sticky limit) into a ball about 1 inch in diameter. From this ball, form three balls about ½ inch in diameter and allow to dry in air, or sun, or by artificial means (temperature not to exceed 60° C (140° F). Soil containing natural dry lumps about ½ inch in diameter may be used in place of molded balls, however the dry strengths are usually lower. Test the strength by crushing the dry balls or lumps between your fingers using the descriptions below.

    - None – the dry specimen crumbles with the slightest pressure of handling
    - Low – the dry specimen crumbles with some finger pressure
    - Medium – the dry specimen breaks into pieces or crumbles with considerable finger pressure
    - High – the dry specimen cannot be broken with finger pressure. The specimen will break into pieces between the thumb and a hard surface.
    - Very High – the dry specimen cannot be broken between the thumb and a hard surface

  - **Dilatency** (ASTM D2488; Table 9)

    FTM (Dilatency): Place enough material in your hand to form a ball approximately ½ inch in diameter and moisten with water until it can be molded or shaped without sticking to your fingers (slightly below the sticky limit). Smooth the ball in the palm of one hand with the blade of a knife or small spatula. Shake horizontally, striking the side of the hand vigorously against the other several times. Note the reaction of water appearing on the surface of the soil. The soil is said to have given a reaction to this test if, when it is shaken, water comes to the surface of the sample producing a smooth, shiny appearance. Squeeze the sample between the thumb and forefinger and note the reaction as follows:

- None – no visible change in the specimen
- Slow – water slowly appears on the surface of the specimen during shaking and does not disappear or disappears slowly upon squeezing
- Rapid – water quickly appears on the surface of the specimen during shaking and disappears upon squeezing

- **Toughness** (ASTM D2488; Table 10)

  FTM (Toughness): Following the dilatency test above, shape the test specimen into an elongated pat and roll by hand on a smooth surface or between palms into a thread about 1/8 inch in diameter. Fold the sample threads and re-roll repeatedly until the thread crumbles at a diameter of about 1/8 inch (e.g., near the plastic limit). Note the pressure required to roll the thread near the plastic limit as well as the strength of the thread. After the thread crumbles, lump the pieces together and knead the lump until it crumbles. Describe the toughness as follows:

  - Low – only slight pressure is required to roll the thread near the plastic limit. The thread and the lump are weak and very soft.
  - Medium – medium pressure is required to roll the thread to near the plastic limit. The thread and the lump are soft.
  - High – considerable pressure is required to roll the thread to near the plastic limit. The thread and the lump are firm.

Using the results of the dry strength, dilatency, and toughness test described above, classify the soil according to the following:

Soil Symbol	Dry Strength	Dilatency	Toughness
Silt (ML)	None to low	Slow to rapid	Low or thread cannot be formed
Lean clay (CL)	Medium to high	None to slow	Medium
Elastic Silt (MH)	Low to medium	None to slow	Low to medium
Fat Clay (CH)	High to very high	None	Low to medium high

- **Plasticity** (ASTM D2488; Table 11)

  Two field test methods can be used to determine plasticity of fine-grained soils (material passing the No. 40 sieve): the roll or thread test and the ribbon test. Each test is described below.

  FTM (Roll or Thread Test): As with the toughness test above, mix a representative portion of the soil sample with water until it can be molded or shaped without sticking to your fingers (slightly below the sticky limit). Place an elongated cylindrical sample on a nonabsorbent rolling surface (e.g., glass or was paper on a flat surface) and attempt to roll it into a thread approximately 1/8 inch in diameter. The results of this test are defined below (non-plastic to high plasticity).

  FTM (Ribbon Test): Form a roll from a handful of moist soil (slightly below the sticky limit) about ½ to ¾ inches in diameter and about 3 to 5 inches long. Place the material in the palm of your hand and, starting at one end, flatten the roll between your thumb and forefinger to form the longest and thinnest ribbon possible that can be supported by the cohesive properties of the material before breaking. If the soil sample holds together for a length of 6 to 10 inches without breaking, the material is considered to be both highly plastic and highly compressive (Fat Clay, CH). If the soil cannot be ribboned, it is non-plastic (Silt, ML or MH). If it can be ribboned only with difficulty into short lengths, it has low plasticity (Lean Clay, CL). Use the following terms to describe the plasticity of soil:

- Nonplastic (ML or MH) – a 3 mm (0.12 inches) thread cannot be rolled at any water content
- Low Plasticity (CL, ML, or MH) – the thread can barely be rolled, and crumbles easily
- Medium Plasticity (CL) – the thread is easy to roll and not much time is required to reach the plastic limit before crumbling
- High Plasticity (CH) – it takes considerable time rolling and kneading to reach the plastic limit; the thread can be rolled several times before crumbling

Note: A soil with as little as 20% clay will behave as a clayey soil. A soil needs 45% to over 60% medium to coarse sand to behave as a sandy soil. In a soil with 20% clay and 80% sand, the soil will behave as a clayey soil.

- **Relative Density of Cohesionless (Granular) Soils**
  - Very loose – easily penetrated 30 cm (1.2 inches) with 13 mm (0.5 inch) rebar pushed by hand (SPT = 0 to 4)
  - Loose – easily penetrated several cm with 13 mm (0.5 inch) rebar pushed by hand (SPT = 4 to 10)
  - Medium dense – easily to moderately penetrated with 13 mm (0.5 inch) rebar driven by 2.3 kg (6 pound) hammer (SPT = 10 to 30)
  - Dense – penetrated 0.3 m (1 foot) with difficulty using 13 mm (0.5 inch) rebar driven by 2.3 kg (6 pound) hammer (SPT = 30 to 50)
  - Very dense – penetrated only a few cm with 13 mm (0.5 inch) rebar driven by 2.3 kg (6 pound) hammer (SPT = >50)
- **Color** (use Munsel® Color System, as necessary)
- **Particle Size** (see Figure 3)
  - Boulder – larger than a basketball
  - Cobble – grapefruit, orange, volleyball
  - Coarse Gravel – tennis ball, grape

- Fine Gravel – pea
- Coarse Sand – rock salt
- Medium Sand – opening in window screen
- Fine Sand – sugar, table salt
- Fines (silt and clay) – cannot visually determine size (unaided)

- **Gradation**
  - Well Graded (GW, SW) – full range and even distribution of grain sizes present
  - Poorly-graded (GP, SP) – narrow range of grain sizes present
  - Uniformly-graded (GP, SP) – consists predominantly of one grain size
  - Gap-graded (GP-SP) – within the range of grain sizes present, one or more sizes are missing
- **Organic Material** – Organic soils usually have a dark brown to black color and may have an organic odor. Often, organic soils will change color, for example, black to brown, when exposed to the air. Some organic soils will lighten in color significantly when air-dried. Organic soils normally will not have a high toughness or plasticity. The thread of the toughness test will be spongy.
  - PEAT – 50 to 100 percent organics by volume, primary constituent
  - Organic (soil name) – 15 to 50 percent organics by volume, secondary organic constituent
  - (Soil name) with some organics – 5 to 15 percent organics by volume, additional organic constituents
- **Fill Materials** – All soils should be examined to see if they contain materials indicative of man-made fills. Man-made fill items should be listed in each of the soil descriptions. Common fill indicators include glass, brick, dimensioned lumber, concrete, pavement sections, asphalt, metal, plastics, plaster etc. Other items that could suggest fill include buried vegetation mats, tree limbs, stumps etc. The soil description for a fill material should be followed by the term "FILL", i.e., for a sandy silt with some brick fragments the description would be "SANDY

SILT (ML), with brick fragments (Fill)". The size and distribution of fill indicators should be noted. The limits (depth range) of fill material should be determined and identified at each exploration location.

- **Other Constituents/Characteristics**
  - Additional constituents and/or pertinent soil characteristics not included in the previous categories should be described depending on the scope and objectives of the project. Observations that may be discussed include:
    - Oxide staining
    - Odor
    - Origin
    - Presence of root cast
    - Presence of mica
    - Presence of gypsum
    - Presence of calcium carbonate
    - Percent by volume of cobbles & boulders with size description and appropriate rock classification
  - Other pertinent information from the exploratory program should be recorded, if it would be useful from a biddability/constructability perspective. The conditions that should be listed include caving or sloughing, difficulty in drilling and groundwater infiltration.

SOIL DESCRIPTIONS

Generally, soil descriptions collected during most investigations are not intended for civil engineering (construction) purposes, but rather for hydrogeologic and contaminant transport purposes. As such, the ASTM visual-manual assessments are somewhat limited in that they are only performed in order to indicate important information about potential hydraulic properties of a soil. Soil descriptions should be concise, stressing major constituents and characteristics, and should be given in a consistent order and format. The following order is recommended:

- Soil name. The basic name of the predominant grain size and a single-word modifier indicating the major subordinate grain size (i.e., mostly clay with some silt). The feel test can be used to determine the texture of the soil by rubbing some moist soil between your fingers; sand feels gritty, silt feels smooth, and clays feel sticky. The terms representing percentages of grain size to be used include:
    - Trace – particles are present, but estimated to be less than 5%
    - Few – 5 to 10%
    - Little – 15 to 25%
    - Some – 30 to 45%
    - Mostly – 50 to 100%
- Color (using Munsell® charts, as necessary). Color is an important property in identifying organic soils, and within a given locality it may also be useful in identifying materials of similar geologic origin. It the sample contains layers or patches of varying colors (e.g., mottled), this shall be noted and all representative colors shall be described. The color shall be described for moist samples, however if the color represents a dry condition, it must be stated as such in the log. Generally, colors become darker as the moisture content increases and lighter as the soil dries. Examples include:
    - Some fine-grained soils (OL, OH) with dark drab shades of brown or gray, including almost black, contain organic colloidal matter.
    - In contrast, clean, bright looking shades of gray, olive green, brown, red, yellow, and white are associated with inorganic soils.
    - Gray-blue or gray- and yellow-mottled colors frequently result from poor drainage.
    - Red, yellow, and yellowish brown result from the presence of iron oxides.

   - White to pink may indicate considerable silica, calcium carbonate, or aluminum compounds.

- Field moisture condition as dry, moist, or wet;
- Gradation or Plasticity. Granular soils (i.e., sands or gravels) should be described as well-graded, poorly graded, uniform, or gap-graded, depending on the gradation of the minus 3-inch fraction. Cohesive soils (i.e., silts and clays) should be described as non-plastic, low, medium, or high, depending on the results of the manual evaluation for dry strength, dilatency, toughness, and plasticity discussed previously.
- Consistency/Density. An estimate of consistency of a cohesive soil or density of a granular soil, usually based on the SPT results (see Descriptive Terms section of this FOP);
- Soil Structure or Mineralogy. Description of discontinuities, inclusions, and structures, including joints, fissures, and slickensides.
- Odor. Describe the odor if organic or unusual. Soils containing a significant amount of organic material usually have a distinctive odor of decaying vegetation. This is especially apparent in fresh samples, but if the samples are dried, the odor may often be revived by heating a moistened sample. If the odor is unusual (petroleum, chemical, etc.), it should be noted in the log.
- Other important geologic information such as consolidation, gravel size and shape, visible internal structure, root holes, mica, odors, etc.

The first step when describing soil is to determine if the sample is predominantly fine-grained or coarse-grained (see Figures 3 and 4). Coarse-grained soils are relatively easy to identify, however descriptions of fine-grained soils can be more difficult, requiring additional field tests to assist the field geologist arrive at the proper soils classification (see **FTMs** under Descriptive Terms above). These tests are explained in detail in the ASTM Standard D2488 and briefly herein. Generally, the differentiation between silt and clay is based on plasticity and "texture". However, tests for dry strength and dilatency, along with plasticity, can be very helpful and are recommended in the ASTM Standard. If additional tests are performed, in addition to plasticity, to classify the fines, record them with the soil description on the logs. Doing this will assist the reader (i.e., Project Manager) to follow the logic used to describe a soil (e.g., medium plasticity, low dry strength = elastic silt [MH]; not a lean clay [CL]).

Fines described in the classification should be modified by their plasticity (e.g., non-plastic fines, low plasticity fines, etc.) reserving the words "silt" and "clay" for the soil name.

In summary, adhering to the ASTM Standard and the guidelines outlined in this FOP will provide uniformity in soil descriptions provided by all field personnel. Prior to mobilization to the field, field staff should make sure to have laminated copies of the ASTM Standard flow charts and tables as well as this FOP (as necessary). Some examples of complete soil descriptions are as follows:

Coarse-grained Soil

POORLY GRADED FINE SAND w/ SILT: Dark grey, wet, mostly fine sand with some non-plastic fines, some iron-stained mottling, laminated, medium dense

Fine-grained Soil

LEAN CLAY: Dark reddish/brown, moist, mostly fines, medium plasticity, firm, no dilatency, medium dry strength, root holes.

Soil/Fill (option 1) – visual evidence of fill

FILL: Black, moist, mostly fines with some fine sand, slag, cinders, metal, brick, non-plastic, loose when disturbed, strong odor

Soil/Fill (option 2) – no visual evidence of fill, suspected reworked material

FILL (reworked): Black, moist, mostly fines with some fine sand and few coarse angular gravel, non-plastic, hard, loose when disturbed, mild odor

BORING AND MONITORING WELL INSTALLATION LOGS

Currently, Benchmark utilizes WinLoG software to construct subsurface logs and a template of the log is included in this FOP as an example. One of the most important functions of a boring/monitoring well installation log, besides transmitting the soil description, is to indicate where the "data" (soil samples) were collected, giving the reader an idea of how reliable or representative the description is. On each sample log, depths of attempted and recovered or non-recovered interval are shown. Odor, if noted, should be considered subjective and not necessarily indicative of specific compounds or concentrations.

Remember: all field logs should be NEAT, ACCURATE, and LEGIBLE. Don't forget that the well completion diagram completed for each well requires details of the surface completion (i.e., flush-mount, stick-up etc.). It is the responsibility of the field staff to double-check each log (i.e., soil names, classifications, well construction details etc.) prior to implementing into a final report. A registered professional (i.e., professional engineer, PE or professional geologist, PG) must review each log and will be ultimately responsible for its content and accuracy.

REQUIRED EQUIPMENT

- Knife
- Engineer's rule/measuring tape

- Permanent marker
- Pre-cleaned wide-mouth sample jars (typically provided by the driller)
- Pre-cleaned wide-mouth laboratory sample jars (provided by the laboratory)
- Stainless steel sampling equipment (i.e., spoons, spatulas, bowls etc.)
- 10x hand lens
- Hydrochloric acid
- ASTM D2488 flow charts (preferably laminated)
- ASTM D2488 test procedures (Tables 1 through 12) (preferably laminated)
- Camera (disposable, 35 mm or digital)
- Munsell soil color chart (as necessary)
- Project Field Book/field forms

ATTACHMENTS

Figure 1; Field Guide for Soil and Stratigraphic Analysis
Figure 2; USCS Soil Classification Flow Chart (modified from ASTM D2488)
Figure 3; Illustration of Particle Sizes
Figure 4; Grain-Size Scale (Modified Wentworth Scale)

Field Borehole Log (sample)

REFERENCES

American Society for Testing and Materials, 2008a. *ASTM D1586: Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils.*

American Society for Testing and Materials, 2010. *ASTM D2487: Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).*

American Society for Testing and Materials, 2009a. *ASTM D2488: Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).*

State of California, Department of Transportation, Engineering Service Center, Office of Structural Foundations, August 1996. *Soil & Rock Logging Classification Manual (Field Guide), by Joseph C. de Larios.*

Benchmark FOPs:

010 Calibration and Maintenance of Portable Flame Ionization Detector
011 Calibration and Maintenance of Portable Photoionization Detector
015 Documentation Requirements for Drilling and Well Installation
025 Hand Augering Procedures
032 Management of Investigation-Derived Waste
046 Sample Labeling, Storage and Shipment Procedures
047 Screening of Soil Samples for Organic Vapors During Drilling Activities
058 Split-Spoon Sampling Procedures
065 Test Pit Excavation and Logging Procedures

FIGURE 1

FIELD GUIDE FOR SOIL AND STRATIGRAPHIC ANALYSIS

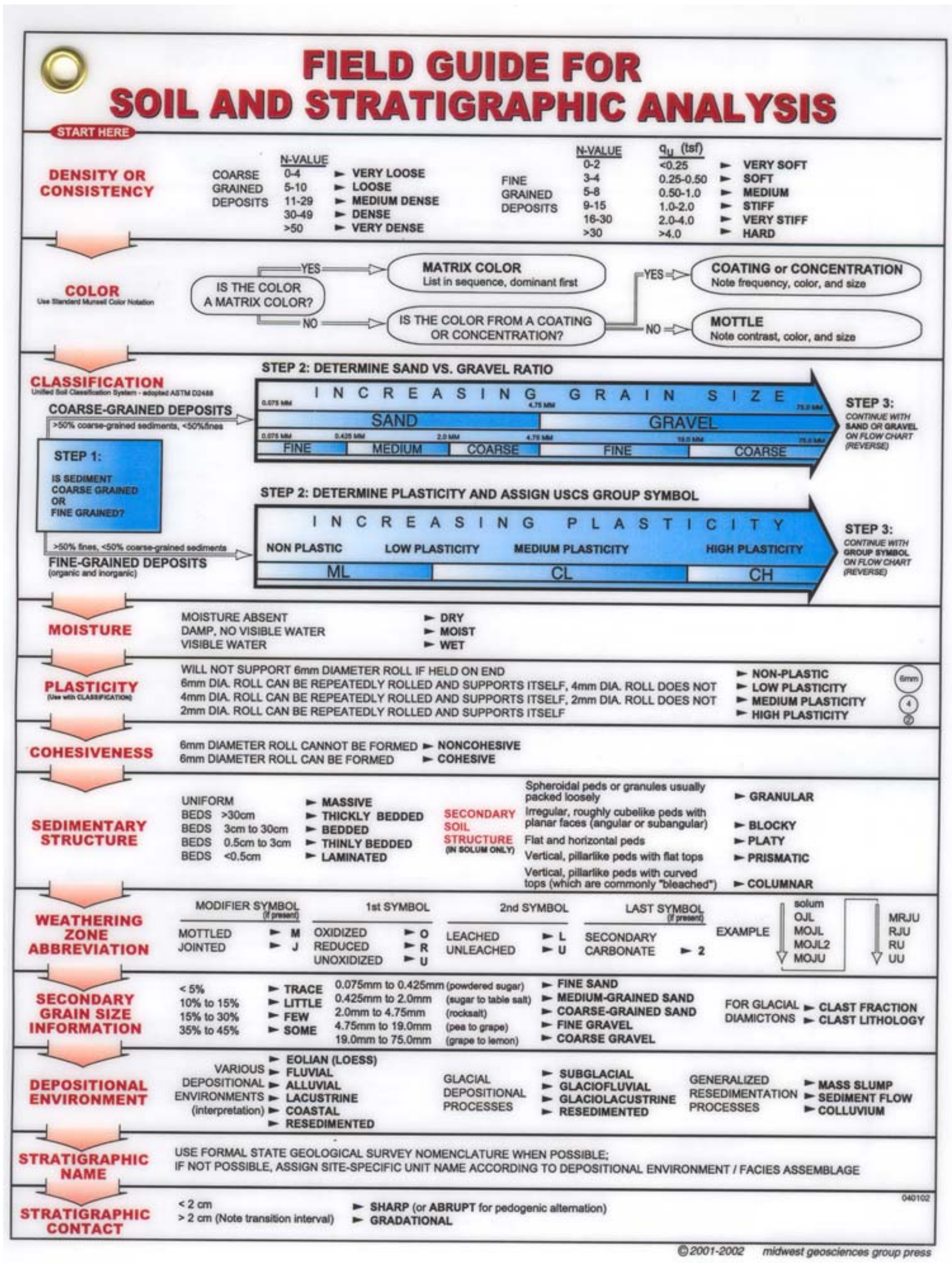

FIGURE 2

USCS SOIL CLASSIFICATION FLOW CHART
(MODIFIED FROM ASTM D2488)

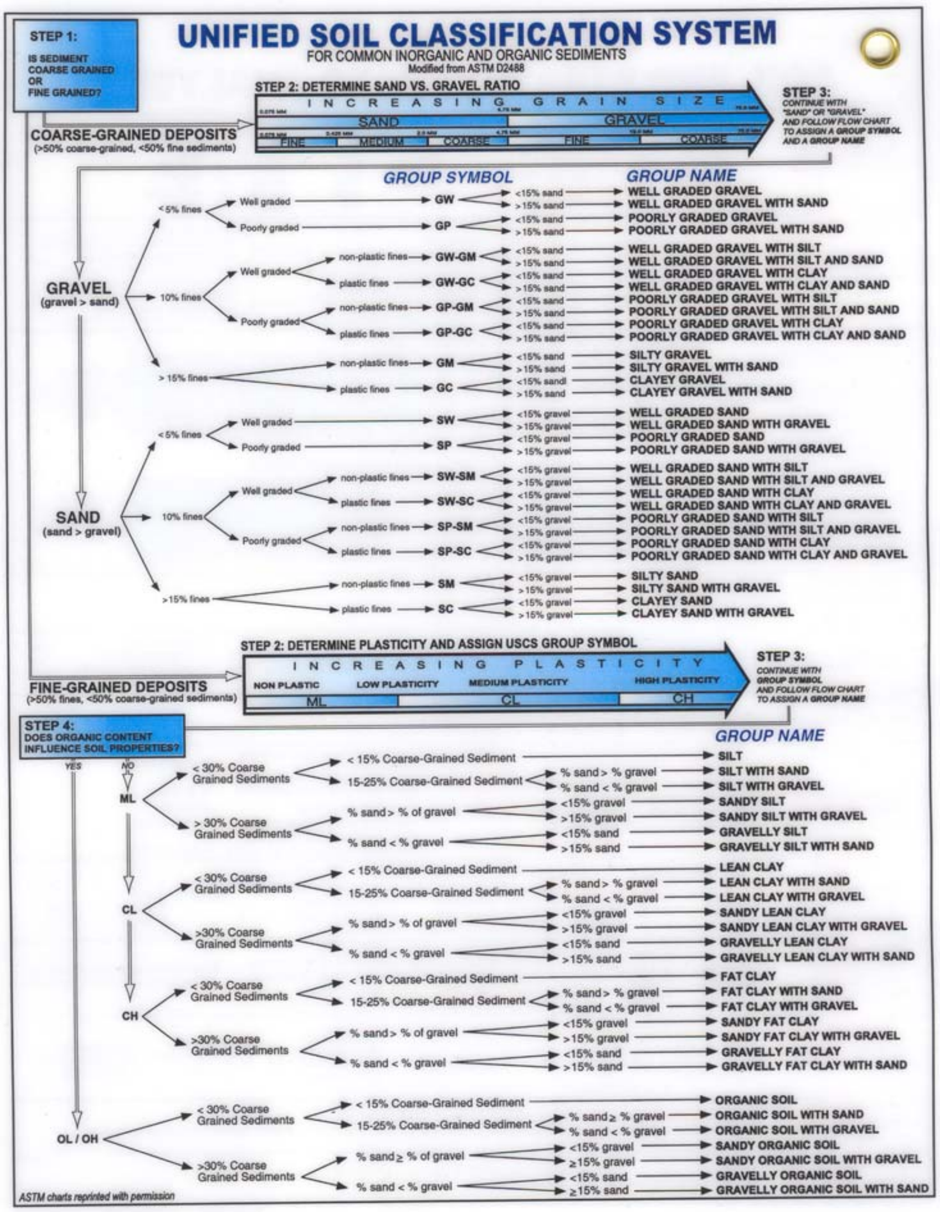

FIGURE 3

Illustration of Particle Sizes

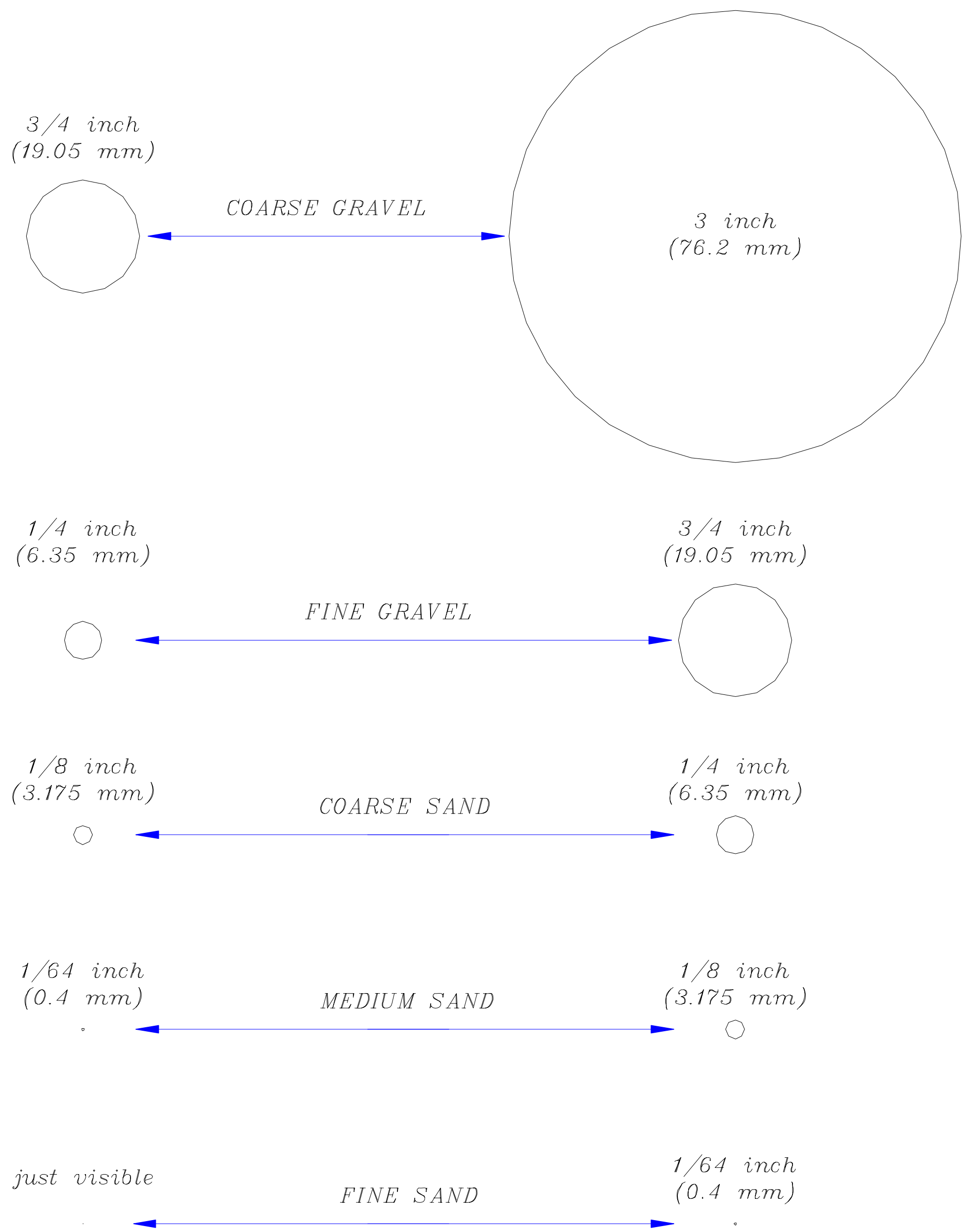

FIGURE 4

GRAIN-SIZE SCALE (MODIFIED WENTWORTH SCALE)

Grain size refers to the physical dimensions of particles of rock or other solid. This is different from the crystallite size, which is the size of a single crystal inside the solid (a grain can be made of several single crystals). Grain sizes can range from very small colloidal particles, through clay, silt, sand, and gravel, to boulders. Size ranges define limits of classes that are given names in the Wentworth scale used in the United States. The Krumbein *phi* (φ) scale, a modification of the Wentworth scale created by W. C. Krumbein, is a logarithmic scale computed by the equation: $\varphi = -\log_2(\text{grain size in mm})$.

φ scale	Size range (metric)	Size range (approx. inches)	Aggregate name (Wentworth Class)
< −8	> 256 mm	> 10.1 in	Boulder
−6 to −8	64–256 mm	2.5–10.1 in	Cobble
−5 to −6	32–64 mm	1.26–2.5 in	Very coarse gravel
−4 to −5	16–32 mm	0.63–1.26 in	Coarse gravel
−3 to −4	8–16 mm	0.31–0.63 in	Medium gravel
−2 to −3	4–8 mm	0.157–0.31 in	Fine gravel
−1 to −2	2–4 mm	0.079–0.157 in	Very fine gravel
0 to −1	1–2 mm	0.039–0.079 in	Very coarse sand
1 to 0	½–1 mm	0.020–0.039 in	Coarse sand
2 to 1	¼–½ mm	0.010–0.020 in	Medium sand
3 to 2	125–250 μm	0.0049–0.010 in	Fine sand
4 to 3	62.5–125 μm	0.0025–0.0049 in	Very fine sand
8 to 4	3.90625–62.5 μm	0.00015–0.0025 in	Silt
> 8	< 3.90625 μm	< 0.00015 in	Clay
<10	< 1 μm	< 0.000039 in	Colloid

In some schemes "gravel" is anything larger than sand (>2.0 mm), and includes "granule", "pebble", "cobble", and "boulder" in the above table. In this scheme, "pebble" covers the size range 4 to 64 mm (−2 to −6 φ).

Project No:	**Borehole Number:**	
Project:		
Client:	Logged By:	
Site Location:	Checked By:	

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SUBSURFACE PROFILE			SAMPLE				PID VOCs	Lab Sample	Well Completion Details or Remarks
Elev. /Depth	Symbol	Description (ASTM D2488: Visual-Manual Procedure)	Sample No.	SPT N-Value	Recovery (ft)	Symbol	ppm 0 25 50		
0.0		Ground Surface							
0.0									

SAMPLE

Drilled By:	Hole Size:
Drill Rig Type:	Stick-up:
Drill Method:	Datum:
Drill Date(s):	Sheet: 1 of 1

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FIELD OPERATING PROCEDURES

Well/Piezometer Construction Materials and Design

FOP 070.0

WELL/PIEZOMETER CONSTRUCTION MATERIALS AND DESIGN

PURPOSE

This guideline presents construction materials and design requirements for monitoring well/piezometer installations in accordance with NYSDEC recommended specifications (6NYCRR Part 360).

CONSTRUCTION MATERIALS

1. Well Screen and Riser – Only new flush threaded screen and riser materials will be used. Screen and riser materials, well dimensions, screen slot opening size and length to be determined based on formation characteristics and suspect water quality or as specified by the project geologist/hydrogeologist. A vented cap or J-plug should be placed over the riser. A V-slot cut in the riser or permanent marking, both placed on the north side of the riser, will act as a monitoring reference point.

2. Bentonite Well Seal – The bentonite should be from a commercial source free of chemical additives (granular or powdered for grout and pelletized for seal).

3. Concrete – Low heat of hydration concrete should be used for grout and cementing protective casing if well construction materials are composed of PVC (ASTM Type II or Type IV Portland Cement).

4. Water – Water should be from a potable source of known chemistry and free of chemical constituents which may compromise integrity of installation.

5. Grout – Mixture of bentonite, cement and water in accordance with the following specifications. Premix bentonite and water prior to adding cement.

   Grout Slurry Composition (% Weight)

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

6. Filter Pack – The filter pack should consist of clean, inert, siliceous, rounded to subrounded particles. Filter pack particle size is dependent on the formation and the slot size of the screen.

   A secondary filter about 6-inches thick may be placed between filter pack and the bentonite seal and potentially between the bentonite seal and the grout backfill, to minimize grout penetration of the seal. A uniformly graded fine sand (100% passing No. 30 sieve) should be used as a secondary filter.

7. Protective Casing, Locking Cap and Lock – Protective casing with a lockable cap should be cemented in place around the riser. The inside diameter of the protective casing should be a minimum of 2-inches larger than the outside diameter of the well riser. The annular space between the casing and the riser should be filled with pea gravel or coarse sand. A weep hole should be drilled near the base of the casing to facilitate drainage of standing water. If more than one well is installed, all locks should be keyed alike.

8. A sample of all cement, bentonite and sand used in well construction should be saved in a labeled, Teflon-sealed, precleaned glass jar.

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.

Sara, M. N., *Proposed Recommended Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers: ASTM Subcommittee D18.21.*

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FIELD OPERATING PROCEDURES

Real-Time Air Monitoring During Intrusive Activities

FOP 073.2

REAL-TIME AIR MONITORING DURING INTRUSIVE ACTIVITIES PROCEDURE

PURPOSE

This guideline presents requirements for real-time community air monitoring and required responses during all project required intrusive activities, such as drilling, test pitting, earthwork construction etc. This procedure is consistent with the requirements for community air monitoring for all intrusive projects, including projects conducted at remediation sites, as established by the New York State Department of Health (NYSDOH) and the New York State Department of Environmental Conservation (NYSDEC). Accordingly, it follows procedures and practices outlined under NYSDEC's DER-10 (May 2010) Appendix 1A (NYSDOH's Generic Community Air Monitoring Plan) and Appendix 1B (Fugitive Dust and Particulate Monitoring).

This FOP requires real-time monitoring for constituents of concern (COC) (i.e., volatile organic compounds (VOCs), lower explosive limit (% LEL), particulates (i.e., dust) etc.) at the upwind and downwind perimeter as well as the exclusion zone of a project site during all intrusive activities. This FOP is not intended for use in establishing action levels for worker respiratory protection (see Project Health and Safety Plan (HASP) for worker protection action levels). Rather, its intent is to provide a measure of protection for the surrounding community from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The community, as referenced in this document, includes any off-site residences, public buildings/grounds and commercial or industrial establishments adjacent to the project site. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, this FOP helps to confirm that work activities did not spread contamination off-site through via air transport mechanisms. Community air monitoring shall be integrated with the construction worker personal exposure-monitoring program contained in the project and site-specific HASP.

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for volatile organic compounds (VOCs) and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate NYSDEC/NYSDOH staff.

MONITORING & MITIGATION PROCEDURE

Real-time air monitoring perimeter locations for monitoring stations will be established based on the location of the exclusion zone (i.e., immediate work area) and wind direction. Where wind direction is shifting or winds are calm, the downwind monitoring location will default to the perimeter location nearest the most sensitive receptor (i.e., residential property). All downwind receptors being equal, the downwind monitoring location will default to the perimeter location downwind of the prevailing winds at the site. Although additional site specific COCs may be monitored during real-time air monitoring activities, the most common COCs are discussed in this FOP, including organic vapors (i.e., VOCs), airborne particulates (i.e., fugitive dust) and combustible gases (i.e., methane) and oxygen.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. "Periodic" monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence

ORGANIC VAPORS

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

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

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

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

- All 15-minute readings must be recorded and be available for State (DEC and DOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

o **<u>Special Requirements for Work Within 20 Feet of Potentially Exposed Individuals or Structures</u>**

  - When work areas are within 20 feet of potentially exposed populations or occupied structures, the continuous monitoring locations for VOCs and particulates must reflect the nearest potentially exposed individuals and the location of ventilation system intakes for nearby structures. The use of engineering controls such as vapor/dust barriers, temporary negative-pressure enclosures, or special ventilation devices should be considered to prevent exposures related to the work activities and to control dust and odors. Consideration should be given to implementing the planned activities when potentially exposed populations are at a minimum, such as during weekends or evening hours in non-residential settings.

- If total VOC concentrations opposite the walls of occupied structures or next to intake vents exceed 1 ppm, monitoring should occur within the occupied structure (s). Background readings in the occupied spaces must be taken prior to commencement of the planned work. Any unusual background readings should be discussed with NYSDOH prior to commencement of the work.

- If total particulate concentrations opposite the walls of occupied structures or next to intake vents exceed 150 mcg/m3, work activities should be suspended until controls are implemented and are successful in reducing the total particulate concentration to 150 mcg/m3 or less at the monitoring point.

- Depending upon the nature of contamination and remedial activities, other parameters (e.g., explosivity, oxygen, hydrogen SUlfide, carbon monoxide) may also need to be monitored Response levels and actions should be pre-determined, as necessary, for each site.

Additionally, if following the cessation of work and efforts to abate the emission source are unsuccessful, and if sustained organic vapor levels exceed 25 ppm above background within the 20-foot zone for more than 30 minutes, then the **Major Vapor Emission Response Plan** (see below) will automatically be placed into effect.

Major Vapor Emission Response Plan

Upon activation of Major Vapor Emission Response Plan, the following activities will be undertaken:

1. All Emergency Response Contacts as listed below and in the Site-Specific Health and Safety Plan will be contacted.

2. The local police authorities will immediately be contacted by the Site Safety and Health Officer and advised of the situation.

3. The Site Safety and Health Officer will determine if site workers can safely undertake source abatement measures. Abatement measures may include covering the source area with clean fill or plastic sheeting, or consolidating contaminated materials to minimize surface area. The Site Safety and Health Officer will adjust worker personal protective equipment as necessary to protect workers from over-exposure to organic vapors.

The following personnel are to be notified by the Site Safety and Health Officer in the listed sequence if the Major Vapor Emission Response Plan is activated:

Contact	**Phone**
Police/Fire Department	911
New York State DOH	(518) 402-7860
New York State DEC Region 8	(585) 226-2466, switchboard

New York State DEC Region 9	(716) 851-7220
State Emergency Response Hotline	(800) 457-7362

In addition, the Site Safety and Health Officer will provide these authorities with a description of the apparent source of the contamination and abatement measures being taken by the contractor, if any.

AIRBORNE PARTICULATES

Fugitive dust suppression and airborne particulate monitoring shall be performed during any intrusive activities involving disturbance or handling of site soil/fill materials. Fugitive dust suppression techniques will include the following minimum measures:

- Spraying potable water on all excessively dry work areas and roads.
- All fill materials leaving the site will be hauled in properly covered containers or haul trailers.
- Additional dust suppression efforts may be required as discussed below.

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

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter ($\mu g/m^3$) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 $\mu g/m^3$ above the upwind level and provided that no visible dust is migrating from the work area.

- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 $\mu g/m^3$ above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 $\mu g/m^3$ of the upwind level and in preventing visible dust migration.

- All readings must be recorded and be available for State (DEC and DOH) personnel to review.

Visual Assessment

In conjunction with the real-time monitoring program, TurnKey personnel and any subcontractors thereof will be responsible for visually assessing fugitive dust migration from the site. If airborne dust is observed leaving the site, the work will be stopped until supplemental dust suppression techniques are employed in those areas.

Supplemental Dust Suppression

Supplemental dust suppression techniques may include but are not necessarily limited to the following measures:

- Reducing the excavation size, number of excavations or volume of material handled.
- Restricting vehicle speeds.
- Applying water on buckets during excavation and dumping.
- Wetting equipment and excavation faces.
- Wetting haul roads.
- Restricting work during extreme wind conditions.
- Use of a street sweeper on paved haul roads, where feasible.

Work can resume using supplemental dust suppression techniques provided that the measures are successful in reducing the sustained downwind particulate concentration to below 150 ug/m^3 of the upwind level, and in preventing visible dust migration off-site.

COMBUSTIBLE GASES & OXYGEN

Ambient combustible gas and oxygen concentrations should be measured prior to commencing intrusive activities each workday and a minimum of every 30-minutes thereafter. Air monitoring activities should be performed using equipment appropriate to measure combustible gases in percent lower explosive limit (LEL) and percent oxygen and calibrated daily. All combustible gas and oxygen readings must be recorded in the Project Field Book and/or Real-Time Air Monitoring Logs (sample attached) and, if applicable, be made available for State (DEC and DOH) personnel to review.

Mitigation upon the detection of various action levels of organic vapors are presented below:

Combustible Gas:

- If the sustained ambient air concentration of combustible gas at the downwind perimeter of the site exceeds a reading of 10 to 25% LEL, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 10% LEL, work activities can resume with continued monitoring.

- If sustained combustible gas levels at the downwind perimeter of the site persist at levels in excess of 25% LEL, work activities must be halted, the source of explosion hazards identified, corrective actions taken to abate emissions and monitoring continued. Following combustible gas mitigation, work activities can resume provided that the sustained total organic vapor level 200 feet downwind of the exclusions zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less, (but in no case less than 20 feet) is below a sustained value of 10% LEL.

Oxygen:

- If the sustained ambient oxygen concentration at the downwind perimeter of the site measures a reading between 19.5% - 21% oxygen, work activities can continue with extreme caution, however attempts to determine the potential source of oxygen displacement must be conducted.

- If the sustained oxygen level readily decreases below 19.5% LEL, work activities should be discontinued and all personnel must leave the area immediately.

- If the sustained oxygen level at the downwind perimeter of the site persists at levels between 21-25%, work activities can resume with caution.

- If the sustained oxygen level at the downwind perimeter of the site persists at levels exceeding 25% (fire hazard potential), work activities should be discontinued and all personnel must leave the area immediately.

ATTACHMENTS

Real-Time Air Monitoring Log (sample)

REFERENCES

TurnKey FOPs:

006 Calibration and Maintenance of Combustible Gas/Oxygen Meter
010 Calibration and Maintenance of Flame Ionization Detector
011 Calibration and Maintenance of Portable Photoionization Detector
084 Calibration and Maintenance of Portable Particulate Meter

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REAL TIME AIR MONITORING LOG

Date:
Project Name:
Project Number:
Project Location:
Client:
Purpose of Air Monitoring:

WEATHER CONDITIONS:

	A.M.	P.M.
Time of Day:		
Ambient Air Temp.:		
Wind Direction:		
Wind Speed:		
Precipitation:		

Date	Personnel	Time	Air Monitoring Meter Measurement (Units)							Location/Activity/Comments
			PID (ppm)	LEL (%)	H_2S (ppm)	O_2 (%)	CO (ppm)	Particulates (mg/m^3)	Other	

SAMPLE

NOTE: SEE EQUIPMENT CALIBRATION LOG FOR DESCRIPTION OF EQUIPMENT TYPE.

Prepared By: Date:

APPENDIX H

QUALITY ASSURANCE PROJECT PLAN (QAPP)

QUALITY ASSURANCE PROJECT PLAN

1827 FILLMORE AVENUE SITE
BUFFALO, NEW YORK
BCP SITE NO. C915279

October 2019 B0421-017-001

Prepared for:

1827 FILLMORE LLC

Prepared By:

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QUALITY ASSURANCE PROJECT PLAN (QAPP)

1827 Fillmore Avenue Site

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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 1827 Fillmore Avenue Site (hereinafter referred to as the "Site") under the New York State (NYS) Brownfield Cleanup Program (BCP), administered by New York State Department of Environmental Conservation (NYSDEC). The Site was remediated in accordance with Brownfield Cleanup Agreements (BCA) Index # C915279-10-17, Site C915279, which was executed on November 8, 2017.

1.1 Site Location and Description

The site is located in the City of Buffalo, Erie County, New York and is identified as S.B.L. 90.13-1-11 on the Erie County Tax Map. The site is an approximately 17.15-acre area and is bounded by the Kensington Expressway (Route 33) to the north with commercial and residential properties beyond; Buffalo Public School #89, Dr. Lydia T. Wright School of Excellence and athletic fields to the south with Appenheimer Avenue beyond; Erie County Medical Center (ECMC) and Buffalo Public School #84 to the east; and Fillmore Avenue to the west with commercial properties and the Kensington Expressway beyond.

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 post-remedial Site redevelopment and data interpretation. 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 USEPA's Requirements for Quality Assurance Project Plans for Environmental Data Operations; the EPA Region II CERCLA Quality Assurance Manual, and NYSDEC's DER-10 Technical Guidance for Site Investigation and Remediation (May 2010).This document may be modified for subsequent phases of investigative work, as necessary.

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 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; and,
- Detailed descriptions of the data documentation materials and procedures, project files, and tabular and graphical reports.

The QAPP is primarily concerned with the quality assurance and quality control 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 the investigation activities, once completed, will yield data whose integrity can be defended.

QA refers to the conduct of all planned and systematic actions necessary to perform satisfactorily all 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). QA is an overview monitoring of the performance of QC activities through audits rather than first time inspections.

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 New York State Department of Environmental Conservation (NYSDEC), in conjunction with the New York State Department of Health, to review the 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 all 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 activities either directly or through their designated environmental consultant and/or legal counsel. 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 (PM) 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:

- Define project objectives and develop a detailed work plan schedule.
- Establish project policy and procedures to address the specific needs of the project as a whole, as well as the objectives of each task.

- Acquire and apply technical and corporate resources as needed to assure performance within budget and schedule constraints.
- Develop and meet ongoing project and/or task staffing requirements, including mechanisms to review and evaluate each task product.
- Review the work performed on each task to assure its quality, responsiveness, and timeliness.
- Review and analyze overall task performance with respect to planned requirements and authorizations.
- Review and approve all deliverables before their submission to NYSDEC.
- Develop and meet ongoing project and/or task staffing requirements, including mechanisms to review and evaluate each task product.
- Ultimately be responsible for the preparation and quality of interim and final reports.
- 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:

- Define daily develop work activities.
- Orient field staff concerning the project's special considerations.
- Monitor and direct subcontractor personnel.
- Review the work performed on each task to ensure its quality, responsiveness, and timeliness.
- 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:

- Performing QA audits on various phases of the field operations.
- Reviewing and approving QA plans and procedures.
- Providing QA technical assistance to project staff.
- Reporting on the adequacy, status, and effectiveness of the QA program on a regular basis to the Project Manager for technical operations.
- 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, NY State Department of Health (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 TestAmerica Laboratory Director include:

  - Provide technical, operational, and administrative leadership.
  - Allocation and management of personnel and equipment resources.
  - Quality performance of the facility.
  - Certification and accreditation activities.
  - 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:

  - Oversee laboratory QA.
  - Oversee QA/QC documentation.
  - Conduct detailed data review.
  - Determine whether to implement laboratory corrective actions, if required.
  - Define appropriate laboratory QA procedures.
  - 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 soil, and 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

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 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. Walk-in coolers or refrigerators are maintained at 4°C, ± 2°C, or as required by the applicable regulatory program. The temperatures of all refrigerated storage areas are monitored and recorded a minimum of once per day. Deviations of temperature from the applicable range require corrective action, including moving samples to another storage location if necessary. 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 include pH, turbidity, specific conductance, temperature, dissolved oxygen and depth to groundwater. Quantitative water level measurements will be obtained with an electronic sounder or steel tape, which require no calibration. Quantitative field data to be obtained during soil sampling include screening for the presence of volatile organic constituents using a photoionization detector (PID).

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:

- Photoionization detector (PID)
- Water quality meters (includes pH, turbidity, temperature, Eh, and specific conductance)
- Electric water level indicator

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 log books 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 will supplement 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

SITE MANAGEMENT PLAN

1827 Fillmore Avenue
Buffalo, New York

Matrix	Parameter [1]	Method	Container Type	Minimum Volume	Preservation (Cool to 2-4 ^oC for all samples)	Holding Time from Sample Date
Soil/Fill	Part 375 VOCs/TICs/GRO	8260B/8015B	WMG	4 oz.	Cool to 2-4 ^oC, Zero Headspace	14 days
	Part SVOCs/TICs/DRO	8270C/8015B	WMG	8 oz.	Cool to 2-4 ^oC	14 days extrac./40 days
	Part 375 Metals	6010B/7470A	WMG	8 oz.	Cool to 2-4 ^oC	6 months/Hg 28 days
	PCBs	8082	WMG	4 oz.	Cool to 2-4 ^oC	14 days extrac./40 days
Groundwater	VOCS/TICs/GRO	8260B	glass vial	2- 40 mL	Cool to 2-4 ^oC, HCl to pH<2,Zero Headspace	14 days
	SVOCs/TICs/DRO	8270C/8015B	glass amber	1 liter	Cool to 2-4 ^oC	14 days extrac./40 days

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

Acronyms:
- VOCs = Volatile Organic Compounds
- SVOCs = Semi-Volatile Organic Compounds
- TICs = Tentatively Identified Compounds
- PCBS = Polychlorinated Biphenyls
- WMG = Wide Mouth Glass

APPENDIX I

ELECTRONIC COPY