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Volunteers of America – Back Lot Site

Monroe County
Rochester, NY

SITE MANAGEMENT PLAN
NYSDEC Site Number: C828126

Prepared for:

Volunteers of America Upstate New York
214 Lake Avenue
Rochester, NY

Prepared by:

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Revisions to Final Approved Site Management Plan:

Revision No.	Date Submitted	Summary of Revision	NYSDEC Approval Date

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[December 2017]

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CERTIFICATION STATEMENT

I, James Basile, P.E., certify that I am currently a NYS Professional Engineer as defined in 6 NYCRR Part 375 and that this 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).

12/21/17
DATE

JAMES CHARLES BASILE
080472
12/21/17
SEAL

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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
ECs	Engineering Controls
ECL	Environmental Conservation Law
ELAP	Environmental Laboratory Approval Program
ERP	Environmental Restoration Program
EWP	Excavation Work Plan
GHG	Green House Gas
GWE&T	Groundwater Extraction and Treatment
HASP	Health and Safety Plan
ICs	Institutional Controls
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYCRR	New York Codes, Rules and
Regulations O&M	Operation and Maintenance
OM&M	Operation, Maintenance and Monitoring
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
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
RP	Remedial Party
RSO	Remedial System Optimization
SAC	State Assistance Contract
SCG	Standards, Criteria and Guidelines
SCO	Soil Cleanup Objective
SMP	Site Management Plan
SOP	Standard Operating Procedures
SOW	Statement of Work

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

ES EXECUTIVE SUMMARY

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

Site Identification:	C828126 Volunteers of America – Back Lot. Site, 214 Lake Avenue and 18 Ambrose Street, Rochester, NY
Institutional Controls:	1. The property may be used for restricted residential, commercial and industrial use;
	2. All ECs must be inspected at a frequency and in a manner defined in the SMP.
	3. All ECs must be operated and maintained as specified in this SMP.
	4. The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the Monroe County Department of Public 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 this SMP.
	6. Data and information pertinent to site management must be reported at the frequency and in a manner as defined in this SMP.
	7. All future activities that will disturb remaining contaminated material must be conducted in accordance with this SMP.
	8. Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical component of the remedy shall be performed as defined in this SMP.
	9. 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 Easements.
	10. The potential for vapor intrusion must be evaluated for any buildings developed in the area within the IC boundaries noted on the Site Survey included in Appendix 1, and any potential impacts that are identified must be monitored or mitigated.

Site Identification:	C828126 Volunteers of America – Back Lot Site, 214 Lake Avenue and 18 Ambrose Street, Rochester, NY
	Vegetable gardens and farming on the site are prohibited.
Engineering Controls:	Site-Wide Cover system
Inspections:	Frequency
1. Cover inspection	Annually
Monitoring:	
1. Groundwater Monitoring Wells MW-101, MW-101R, MW-102, MW-102R, MW-103, MW-105, MW-106, and MW-107	Quarterly for five years
Maintenance:	
1. Cover	As needed
Reporting:	
1. Groundwater Monitoring Report	Quarterly for five years
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

1.1 General

This Site Management Plan (SMP) is a required element of the remedial program for the Volunteers of America Back-Lot Site located in Rochester, New York (hereinafter referred to as the "Site"). See Figure 1 – Project Site Map. The Site is currently in the New York State (NYS) Brownfield Cleanup Program (BCP) Site No. C828126 which is administered by New York State Department of Environmental Conservation (NYSDEC).

Volunteers of America of Western New York, Inc. (VOA) as Volunteer entered into a Brownfield Cleanup Agreement (BCA), on June 15, 2005, as amended June 27, 2016, and September 27, 2017 with the NYSDEC to remediate the Site. A figure showing the Site location and boundaries of this Site is provided in Figure 2 – Site Layout. The boundaries of the Site are more fully described in the metes and bounds site description that is part of the two Environmental Easements provided in Appendix 1 – Environmental Easements.

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 Easements granted to the NYSDEC, and recorded with the Monroe County Clerk, requires compliance with this SMP and all ECs and ICs placed on the Site.

This SMP was prepared to manage remaining contamination at the Site until the Environmental Easements 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 Easements 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 Easements. Failure to properly implement the SMP is a violation of the Environmental Easements, 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 #B8-0688-05-04, Site #C828126) for the Site, and thereby subject to applicable penalties.

All reports associated with the Site can be viewed by contacting the NYSDEC or its successor agency managing environmental issues in New York State. A list of contacts for persons involved with the Site is provided in Table A - Notifications and Appendix 3 – Site Contact List of this SMP.

This SMP was prepared by Bergmann Associates, Inc., on behalf of VOA, in accordance with the requirements of the NYSDEC's DER-10 ("Technical Guidance for Site Investigation and Remediation"), dated May 2010, and the guidelines provided by the NYSDEC. This SMP addresses the means for implementing the ICs and/or ECs that are required by the Environmental Easements 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, upgrades to or shut-down of a remedial system, post-remedial removal of contaminated sediment or soil, or other significant change to the Site conditions. In accordance with the Environmental Easements 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.

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 Brownfield Cleanup Agreement (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 A on the following page includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information. A full listing of site-related contact information is provided in Appendix 3.

Table A: Notifications*

Name	**Contact Information**
Charlotte Theobald NYSDEC Project Manager	585-226-5354 charlotte.theobald@dec.ny.gov
Ms. Bernette Schilling, P.E. NYSDEC Regional HW Engineer	585-226-5315 bernette.schilling@dec.ny.gov
Ms. Kelly Lewandowski NYSDEC Site Control	518-402-9553 kelly.lewandowski@dec.ny.us

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

2.0 SUMMARY OF PREVIOUS INVESTIGATIONS AND REMEDIAL ACTIONS

2.1 Site Location and Description

The 214 Lake Avenue Back Lot Site consists of an approximately 3.1-acre property located in the City of Rochester, Monroe County, New York (Figure 1). The Site is located on City Tax Map No. (18 Ambrose Street – 2.4 acres), a portion of 105.60-2-1.002 (0.6 acres part of 214 Lake Avenue, and the area of Haidt Place and it’s right of way. Lot 105.60-2-59.003 is owned by Volunteers of America of Western New York (VOA or the Volunteer”) and the 0.6-acre portion of Lot 105.60-2-1.002 that is part of the Site is owned by the Monroe County Industrial Development Agency. The Site is located east of the centerline of Haidt Place and VOA’s Office Building, Thrift Store and Day Care Center (VOA’s Human Services Complex. The majority of the Site is located at 18 Ambrose Street, west of the former Raeco Oil Superfund Site, and south of a contractor's equipment storage yard and building and a Monroe County right-of-way to the Pure Waters Tunnel Structure 41. The Site is comprised of portions of two tax parcels of land, which are referred to as the eastern portion of Parcel A and all of Parcel B. The majority of the Site is largely undeveloped and the western portion of the Site is improved with parking lot area and roadway. The Site location and surrounding vicinity are shown on Figure 1. The boundaries of the site are more fully described in Appendix 1.

2.2 Physical Setting

2.2.1 Land Use

The Site consists of a vacant partially asphalt paved lot, pavement roadway and undeveloped vegetated areas. The Site is zoned commercial and is currently vacant, undeveloped, and paved parking lot. The properties adjoining the Site and in the neighborhood surrounding the Site primarily include residential and commercial properties. The former RACO site is located east of the Site.

2.2.2 Geology

The Site geology consists of historic fill from the ground surface down to depths ranging from 14 to greater than 45 feet below ground surface. The majority of the historic fill at the ground surface consists of gravel and coal fragments. A former, deep ravine, which extends through roughly the center of the Site from south to north, has been backfilled with the historic fill. The former ravine extends off-site to the north and appears to eventually extend to the Genesee River based on historic maps. A native Glacial till deposit was encountered below the historic fill and overlies the bedrock formation (Upper Silurian Decew Dolostone). The Glacial Till is very dense and was encountered at depths that ranged from 22 to 44 feet below ground surface, see Figure 3 – Geologic Cross-Section Locations Map, Figure 4 – Geologic Cross-Section A-A' and Figure 5 – Geologic Cross-Section B-B'.

Bedrock is encountered at the Site at depths that ranged from 20 to 80 feet bgs. Bedrock at the Site consists of the Upper Silurian Decew Dolostone, which includes the DeCew and Rochester shale formations, and a few others, such as the Irondequoit formation. Bedrock from consist of gray/olive dolostone with numerous horizontal fractures. Site specific boring logs are provided in Appendix 10 – Boring and Monitoring Well Logs.

2.2.3 Hydrogeology

The depth to overburden groundwater ranges from 18.29 ft. to 43.20 ft. Seasonal variations for groundwater elevations were evident at the Site. The depth to groundwater measurements and groundwater elevations are presented in Table 3 - Groundwater Elevations Measurements. The overburden groundwater flow direction is towards the former ravine from the west and east sides of the Site and there appears to be a northern trend of groundwater flow direction along center of the Site. Field permeability tests were performed and the hydraulic conductivities ranged from 3.15 X 10^{-4} to 5.69 X 10^{-4} with an average of 6.97 X 10^{-4} based on if the groundwater monitoring well was screened in the historic fill or in the glacial till deposit. A groundwater contour map is shown in Figure 6 – Groundwater Potentiometric Surface Map. Groundwater elevation data is provided in Table 3 – Groundwater Elevation Measurements. Groundwater monitoring well construction logs are provided in Appendix 10.

2.3 Investigation and Remedial History

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

Summary of Remedial Investigation

The RI activities were conducted in accordance with a NYSDEC approved RI Work Plan (RIWP) last revised August 3, 2012. This report was also completed in accordance with the NYSDEC Division of Environmental Remediation (DER) BCP Guide dated May 2004 and the DER-10 (*Technical Guidance for Site Investigation and Remediation*) dated May 3, 2010.

Prior to being entered into the NYSDEC BCP, the following investigations were performed at the Site:

Previous Investigations

Phase II Environmental Site Assessment, 214 Lake Avenue, Rochester, NY, GZA GeoEnvironmental, Inc., November 1996 – The GZA 1996 Report presented the following conclusions relevant to the Site: Groundwater flow direction at the Site is generally to the northeast and in the direction of the Genesee River.

- Soil and groundwater sample analytical results from boring B-6, located east of the former automobile body shop building that housed the paint shop, and which is the current location of the VOA Administration Building, did not indicate concentrations of VOC compounds above the laboratory detection limits.
- VOC and SVOC compounds were detected in soil samples from boring MW-1 at levels that exceed NYSDEC TAGM 4046 guidelines. Acetone, Pyrene, and Benzo (a) pyrene were detected in the soil samples from MW-1.
- SVOC compounds were detected in the soil sample from soil boring B-3 located directly behind (east) of the former automobile dealership building (currently VOA's Child Care Center). Based on the 1935 Sanborn map, it appears that the Kaplan "Metal and Wood Barrel Storage" building was positioned parallel to the former automobile dealership building and Lake Avenue. The location of soil boring B-3 may be in the former footprint of the Kaplan building. Two additional test borings (B-8 and B-9) were drilled down gradient of B-3. Analytical results of soil samples from B-8 and B-9 indicated that two SVOC compounds were present in the soil sample from B-8, and SVOC compounds were not detected in the sample from the B-9 location. It appears that the SVOC compound contamination may be limited in the vicinity of B-3, B-8, and B-9. The impacted soil samples were collected from sample intervals that were less than 6 feet below ground surface, since the top of rock was encountered at approximately 6 feet below ground surface in this area of the Site.
- SVOCs were not detected in the groundwater samples analyzed.
- Metals were detected in soil samples at concentrations that exceed NYSDEC TAGM 4046 guidelines. Metals were detected in soil samples collected from test borings installed at MW-1, MW-2, and B-3 at depths ranging from approximately 0 to 14 feet. The metals that were detected above the NYSDEC TAGM #4046 Soil Cleanup Objectives (the applicable cleanup standards at this time) included arsenic, chromium, mercury, and selenium.
- Metals were detected in groundwater samples collected from monitoring wells MW-1 and MW-2 at concentrations that exceed Class GA Groundwater Standards. The metals that were detected above the groundwater standards include arsenic, barium, cadmium, chromium, lead, and mercury.
- A heavy weight petroleum hydrocarbon identified by the laboratory as "lube oil" was detected in soil samples from MW-1, MW-2, and B-3. These test borings/monitoring wells are located in the open area behind (east of) the former automobile dealership building. The highest TPH concentration was detected in the soil sample from MW-1 (Sample depth 12 to 14 feet), at a concentration of approximately 7 million parts per billion (ppb).

Supplemental Phase ll Environmental Site Assessment, 214 lake Avenue, Rochester, NY, LGZA GeoEnvironmental, Inc., January 1997 – The GZA 1997 Report included the installation of geoprobe borings P-1 through P-8, and P-10 through P-14. The conclusions relevant to the Site are summarized below:

- Six (6) SVOC compounds were detected in soil samples at concentrations that exceed NYSDEC guidance values. These were identified in shallow subsurface soils (0 to 6 feet) collected from the area immediately northeast and adjacent to the former automobile service area in the main building, and from areas near the eastern property line. It appears that detection of these compounds is limited to the area where geoprobe boreholes P-10, P-11, P-12, and P-14 were installed.

- Metals were identified in subsurface soil samples obtained from geoprobe boreholes P-7, P-10, P-11, P-12, and P-14. The analytical results indicated that the following metals exceed NYSDEC guidelines: arsenic, cadmium, chromium, lead, mercury, selenium, and silver. The spatial distribution of these metals indicates that they are generally present in the east portion of the Site and immediately northeast and adjacent to the former automobile service area in the main building.

- The subsurface soil samples collected and submitted for laboratory analyses generally consisted of fill materials. This fill was comprised of various amounts of fine to coarse sand and gravel, silt and clay, as well as coal, cinders and slag. The components of the fill, specifically the coal, cinder, and slag, may have contributed to the elevated metals concentrations.

BCP Remedial Investigation (RI) and Supplemental Investigation (SI)

The objective of the BCP RI field work was to investigate and characterize the nature and extent of the contamination within the boundary of the Site and to qualitatively evaluate if there is potential off-site migration of contamination pursuant to the requirements in the BCP Law, Environmental Conservation Law Article 27, Title 14, and Section 27-1415. To satisfy the objectives of the RI work plan and subsequent Supplemental Investigation (SI) work plan in the results of the final RI Report, in total, 33 VOCs, 46 SVOCs, 46 Metals, 15 total Cyanide, 20 PCBs, 20 Pesticides, 4 USEPA 8015 Diesel Range Organics (DRO) and 2 USEPA 8015 Gasoline Range Organics (GRO) soil samples were collected and submitted for laboratory analysis from:

- 7 soil borings,
- 6 surface soil samples,
- 9 soil samples from the former bio-cells,
- 6 soil samples from the soil piles at the site,
- 23 soil samples from test pit explorations, and
- 9 groundwater monitoring wells

The RI and SI included additional surface soil, subsurface soil, and groundwater sampling with analysis from surface soil locations, soil borings, monitoring wells and test pit explorations.

VOA's prior consulting firm GeoQuest Environmental, Inc. (GeoQuest) conducted the RI investigations and Bergmann conducted the SI investigations, respectively, in general accordance with the methods and procedures of the approved RI work plan and SI scope of work. In general, the procedures in NYSDEC Investigation Guidance Document DER-10 were followed throughout the investigations. The RI /SI field program included the following activities:

- Preliminary test boring and well location inspection, including site plan review, and utility mark out.
- Soil samples from 11 soil test borings located in the vicinity of potentially impacted areas or near areas were impacts were previously detected. Test borings were advanced to approximately 10 feet below the groundwater table and monitoring wells were installed with 10 foot well screen intervals that extended approximately 2 feet above the groundwater table. Test borings and overburden monitoring wells were completed to depths ranging from 24 to 44.5 feet below ground surface (bgs). One soil sample was generally collected from at depths above the water table from each test boring location.
- Surface soil sampling from 6 locations using hand tools to collect a sample from the ground surface to two inches below any vegetative cover in accordance with NYSDEC approved modifications to the RI Work Plan. The surface soil samples were collected from unconsolidated historical fill soils.
- Installation of 7 overburden monitoring wells and 2 bedrock monitoring wells. Overburden monitoring wells were installed to a depth ranging from 24 to 45 feet at the locations where previous contamination was found, and at up- gradient and down-gradient Site boundary locations to more fully delineate potential off-site contamination. Two rounds of groundwater sampling were conducted during the course of the investigation for the evaluation of potential seasonal groundwater fluctuations with the exception of Monitoring well MW-107 that was sampled once since this well was installed during the October 2010 SI.
- Excavation of 26 test pits during the RI field work and 10 test pits during the SI field work was implemented to evaluate the nature and extent of historical fill and to determine the nature and extent of potential source areas requiring remediation. Sub-surface soil samples were also collected from selected test pit locations to characterize the nature of the material encountered.

To evaluate conditions at the Site, the following soil (total of 182 analyses) and groundwater samples (total of 103 analyses) were submitted for laboratory testing:

Sampled Media	Sample Quantities
Subsurface Soils	18
Surface Soils	6
Former Bio-cells Soils	9
Soil Piles	6
Overburden Groundwater	13
Bedrock Groundwater	4

All samples were submitted for analysis of a combination of the following parameters:

- USEPA TCL VOCs
- USEPA TCL SVOCs
- PCBs
- Pesticides
- TAL Metals and Cyanide
- Diesel Range Organics
- Gasoline Range Organics
- TCLP

Geophysical survey

A geophysical survey was included as a required component of the RI. The geophysical investigation was designed for geophysical characterization of the subsurface, potentially assist with the selection of subsurface exploration locations for the RI, and confirm there were no buried tanks or other structures on the Site. In addition, the information in the geophysical survey was used to assist GeoQuest with the assessment of contaminated areas identified at the Site.

Geomatrix Consultants, Inc. (Geomatrix) performed data acquisition for the geophysical survey on July 24, 2007. Geomatrix used both time and frequency domain geophysical tools (EM61 and EM31) to characterize the geophysical conditions at the Site.

EM31 Results

Seven anomalous areas were identified from the EM31 data and are labeled A through G. Anomalies A, B and E indicate large conductivity and in phase highs. These anomalies were likely related to conductive fill material. Anomaly A remains partially located beneath the paved parking area. Anomalies F and G are likely related to remaining buried railroad lines (F) and utilities (G). Anomaly C remains located largely within a fenced in former boat storage area adjacent to Ambrose Street and may be related to surface debris and/or subsurface material. Anomaly D remains in a zone of buried metals on the east slope of the mounded areas. The character of the response at Anomaly D is suggestive of buried metals. The mounded areas of soil (soil piles) have been placed below the demarcation marker and under the site wide cover system.

EMG61 Results

Most of the anomalies identified with the EM61 correspond with known surface and subsurface features. There were no anomalies identified on the EM61 data set that were interpreted to be significant relative to the objectives of the RI or were required to have been removed during the remediation. Despite the identification of some subsurface structures, the results for the geophysical survey did not indicate the need to modify the locations and or the number of subsurface investigations presented in the RIWP and subsurface investigations were completed in the areas of the geophysical anomalies.

Summary of RI and SI Results

Based on the work completed it was determined that the predominant contaminants of concern include semi-volatile organic compounds (SVOCs) [specifically, Poly Aromatic Hydrocarbons (PAHs)] and metals in soil and groundwater. Based on these findings, it appears the source of the contaminants include the historic fill in surface soil media and subsurface soil, which have impacted overburden groundwater contamination. Contaminant release and transport mechanisms include the chemical composition of the historic fill, which has affected the groundwater as a result of direct contact between the historic fill and the overburden groundwater. SVOCs are present in soil at concentrations exceeding Part 375-6.8(a) Unrestricted Use Soil Cleanup Objectives (SCOs) and Part 375-6.8(b) Restricted Residential SCOs, Commercial SCOs, and Protection of Groundwater SCOs. SVOC concentrations exceed Part 703 Groundwater Standards in the overburden groundwater. Metals are present in soil at concentrations exceeding Part 375-6.8(a) Unrestricted Use Soil Cleanup Objectives (SCOs) and Part 375-6.8(b) Restricted Residential SCOs, Commercial SCOs, and Protection of Groundwater SCOs. Metals concentrations exceed Part 703 Groundwater Standards in the overburden and bedrock groundwater.

Based on the results of the RI and SI the following conclusions were made:

1. The surface soil, subsurface soil and groundwater impacts at the Site have been delineated and the primary contaminants at the Site consist of SVOCs and metals.

2. Subsurface soil sampling at the Site only identified one area of soil that contains elevated SVOCs and metals, black stained color with nesciences odors and elevated PID measurements of total organic vapors (VOCs). This area was named the Black Stained Sandy Source Area located near the north end of the Site and required soil removal and off-site disposal.

3. Subsurface VOC impacts in soil were not identified at concentrations above the NYSDEC Part 375-6.8(b) Restricted Residential SCOs.

4. Groundwater at the Site is slightly impacted by SVOCs and metals at concentrations above Part 703 groundwater standards. The Site groundwater flow direction, evaluated from overburden groundwater elevations, is towards the former ravine historically underlying the Site, which traverses down to approximately 80 feet in the center of the site and the side slopes extend up from this depth on the west and east sides of the Site. There appears to be a northern trend of groundwater flow direction along center of the Site that coincides with the approximate location of the centerline of the former ravine. Because of the overall northerly groundwater flow direction is through the filled ravine it is possible that groundwater contaminants are migrating off-site below commercial properties. The off-site migration of contaminants in the ground water from the southern portion of the Site to the north end of the site is not expected to result in a complete exposure pathway for current, construction/remediation, or future conditions for the following reasons:

    - The Site and surrounding areas obtain their drinking water supply from municipal supply.
    - Groundwater that is impacted would likely discharge to the Genesee River and not to a human receptor.

The COCs are not expected to reach a surface water body that is used as a drinking water source to potentially complete an exposure pathway. Therefore, off-Site sampling was not necessary to confirm the nature and extent of off-site groundwater migration. In addition, the remediation was designed to provide a Site-wide cover system to prevent further infiltration of storm water into the historic fill soils.

Based on the concentrations of COCs in soil that remain beneath the Site in the former Black Sandy Soil area, a completed exposure pathway may still potentially exist for COCs even after the completion of the removal and off-site disposal of Black Sandy Soil source during the remediation competed during June 2016. The requirements for design, installation, and operation and maintenance (O&M) of a future vapor barrier and sub slab depressurization system (SSDS) must be evaluated at the time of future building design / construction to addresses any potential vapor intrusion concerns. All future design, O&M and installation of vapor barrier and SSDS must be coordinated and approved by NYSDEC and the NYS Department of Health.

RI / SI Soil samples containing exceedances of Part 375-6.8 SCOs are presented in the Table section of this SMP. Exceedances of Part 703 Groundwater Standards for VOCs are presented in the Figure section for this SMP. Data collected from the RI/SI is presented in Tables 1 through 10.

Areas of Concern

The cumulative findings of the pre-BCP investigations and the RI/SI performed at the Site identified eight (8) areas of concern (AOCs) [remaining at the Site that warranted further consideration. The data discussed below is included in the RI Report. The nature and extent of impacts for these areas have been defined and are summarized below and the post-remediation status is also provided:

AOC #1: Historic Fill (Site wide)

As a result of the presence of historic fill soil, groundwater quality has been impacted and the levels of metals and PAHs detected based on laboratory analysis in Historic fill soil and groundwater samples exceed 6 NYCRR Part 375-6.8(a) Unrestricted Use SCOs, Part 375-6.8(b) Restricted Residential and Commercial SCOs, protection of groundwater SCOs and Part 703.5 groundwater standards / T.O.G.S. 1.1.1. Guidance values. Historic fill comprised of cinder, ash and coal fragments that are common to the majority of the historic fill at the Site from what appears to be a variety of sources, including but not limited to, areas of buried coal and coke, an area of limited black stained sandy soil within the historic fill, and approximately 55 years of coal pile surface storage have collectively contributed to impacts to Site soil and groundwater quality with respect to SVOCs and metals contamination. Historic fill was landfilled into the former ravine prior to coal pile storage.

An area of black stained sandy soils was encountered during the SI. While these soils are also historic fill, this material is not comprised of cinder, ash and coal fragments that are common to the majority of the historic fill at the Site. This distinct area of black stained sand and silt soils, which exhibited creosote-like odors as observed by Bergmann and NYSDEC representatives who were present at the time, was revealed in test pits TP-131 and TP-132 near the north central portion of the Site. Total organic vapors (VOCs) from direct field measurements of soils excavated ranged from 19.8 parts per million (ppm) to 440 ppm. Analytical soil sample results of these soils indicate detections of polycyclic aromatic hydrocarbons (PAHs), which are a natural component of coal and are found in combustion products. VOCs were also detected in soil samples. The depth of the black stained sand and silt fill soils (black stained sandy soils) was encountered from approximately 6 to 8 ft. below bgs and was greater than 20 feet deep. The black sandy soils were in an area approximately 35 ft. by 35 ft. The soil in this area was excavated and transported off-site for disposal during the completed remediation. Residual impacted soils remain that contain elevated SVOCs, PAHs and VOCs and are below the site-wide cover system. AOC #1 has been remediated by completion of the remediation.

AOC #2: Former Coal Pile Storage (Site wide)

Coal and coke were observed buried in layers within the historic fill (Upper Fill) at several locations across the Site with the exception of test pits TP-109, TP-110, TP-116, TP-117, TP-118 and TP-120. The coal and coke ranged in thickness from 0.5 ft. to greater than 20 ft. based on the field observations from test pits excavated during the RI. Laboratory analysis of coal and coke was not part of the RI/SI. However, the observations confirm the site-wide former use as coal pile storage impacted surface soils, and the subsurface soil, which in turn has impacted groundwater quality. AOC#2 has been remediated by completion of the remediation.

AOC #3: Coal Tar

Based on historic records, it was unclear if coal tar was buried on Site. However, buried coal tar was not encountered during the RI/SI subsurface investigations and did not require remediation.

AOC #4: Impacts from Parked Automobiles (Site Wide)

Petroleum related compounds that are typically used at automobile dealerships or found in gasoline were generally not detected in the six surface soil samples SS-1 through SS-6. Visual and olfactory evidence of petroleum contamination was not noted during the collection of these samples, and there was non-detection of total organic vapors based on field screening with a PID. Therefore, remediation was not required for this AOC and surface soils are below the demarcation marker.

AOC #5: Soils Contained in Former Bio-cells

These soils were place in the bio-cells from the former gasoline spill area located on the western portion of Parcel A during 1998. In addition, some of the soils were petroleum impacted soils removed from catch basins from the former automobile dealership building and from the former automobile body shop building. These bio-cells were subjected to bioremediation in 1998 through 2001 under NYSDEC supervision. Based on laboratory analysis, the soil contained in the former bio-cells was shown not to be impacted with the exception of two SVOCs detected in one bio-cell soil sample that slightly exceed the Part 375-6.8(b) Restricted Residential and Commercial SCOs. The former bio-cells soils were approved for reuse as backfill at the Site into the excavation to remove the black stained sandy soils (AOC #2) by NYSDEC during remediation. AOC #5 has been remediated by completion of the remediation.

AOC# 6: Soil Piles from the Construction of the VOA Facility

Soil piles were placed on the Site during the construction of the VOA Human Services Complex during 1997 through 1998. The soil sample results indicate elevated SVOCs with concentrations that exceed the Commercial SCOs in soil samples based on laboratory analysis. Concentrations of metals exceed the Part 375-6.8(b) Restricted Residential and Commercial SCOs. The former soil piles were approved for reuse as backfill at the Site into the excavation to remove the black stained sandy soils (AOC #2) and under the demarcation marker of the site-wide cover system by NYSDEC during remediation. AOC #6 has been remediated by completion of the remediation.

AOC# 7: Barrel Cleaning and Barrel Reconditioning Operations

The former Kaplan Container barrel cleaning operations were historically present on at least a portion of the southwestern edge for the Site. Correlations of potential impact to the groundwater quality from the former off-site barrel cleaning and barrel reconditioning operations was not evident from the groundwater samples evaluated during the RI/SI. Therefore, remediation was not required for this AOC.

AOC # 8: Former Gasoline Spill (off-site)

VOC and SVOC concentrations in overburden and bedrock groundwater samples indicate that the groundwater is not impacted with gasoline or diesel derived chemical compounds typically associated with petroleum bulk storage or automobile dealerships. It appears that the former automobile dealership uses and former gasoline spill on the western portion of Parcel A has not impacted overburden and bedrock groundwater quality at levels that require remediation of gasoline chemical compounds on this Site. Therefore, correlation of potential impact to the groundwater quality from the former off-site automobile dealership and former gasoline spill was not evident from the groundwater samples evaluated and remediation was not required for this AOC.

Summary of Remedial Actions

A Remedial Action Work Plan (RAWP) was prepared and approved by the NYSDEC and NYSDOH on March 25, 2016. The following remedial actions were performed at the site pursuant to the approved RAWP from May through September 2016 and July through September 2017.

Source Soil Removal Excavation

A source soil excavation at the Back Lot was completed during 2016 for removal and off-Site disposal of the Black Stained Sandy Soil source area. This soil removal was performed to remove this limited area of the historic fill with different physical and chemical characteristics when compared to the rest of the historic fill that is primarily ash / cinders and free of vapor / odors. The characteristics of the Black Stained Sandy Soil included: elevated organic vapors, black stained color, sandy silt soils, creosote odors, and elevated concentrations of mid-range diesel organics (2,200 ppm). Soils in this area had the highest contaminant levels on the Site (source area). The planned excavation was a shored excavation of approximately 35 ft. X 35 ft. with depth of approximately 18 to 20 feet with removal of 1,500 tons impacted soils from approximately 8 feet to 20–foot depths. However, the excavation was completed with dimensions of 35 ft. X 35 ft. with depth ranging from approximately 10 to 20 feet per field monitoring results that revealed less than the estimated quantity and approval to terminate this excavation was granted by NYSDEC. The actual size and location of the excavation is shown on Figure 11 that includes a surveyed as-built of this excavation. Therefore, approximately 420 tons was the actual quantity removed and transported off-site for disposal.

Shoring was used during part of the excavation activities to the approximate depth of 20 feet in order to hold back sidewalls to enable excavation. An engineer's excavation plan was prepared by VOAs remediation contactor to address the requirements for this excavation. Shoring was removed after the contactor demonstrated that the excavation sidewalls remained in place during excavation to complete the source area removal of black stained sandy soils.

In summary, excavation, transportation and off-site disposal of black stained sandy soils (source area soil removal) was completed and included:

- Shoring was installed in order to perform a portion of the excavation work. The approximate limits of Black Sandy Soils area excavation was 35 ft. X 35 ft. with depths ranging from 10 to 20 feet. Approximately 420 tons of grossly contaminated Black Stained Sandy Soils was removed from this area and transported off-site for disposal at the Mill Seat Landfill operated by Waste Management.

- The excavation activities were terminated at approximately 10 ft. to 20 feet depths below the ground surface.

- Post-excavation confirmatory samples were collected from the bottom and sidewalls of the excavation to evaluate the levels that remain. Levels of SVOCs remain that exceed the Part 375-6.8(b) Restricted Residential and Commercial SCOs that are generally comparable to the rest of the historic fill levels evaluated during the RI/SI. The excavation was backfilled with soils from the former bio-cell and soil piles. The remaining impacted soils are covered by the Site - Wide Engineered Cover System.

- Excavation and removal of Historic fill soils from the Haidt Place (ROW) during July 2017. Two soil removal excavation areas located at the east ROW and west ROW along Haidt Place. Each excavation area was approximately 115 ft. X10 ft. X 2 ft. Approximately 242 tons of Historic Fill Soils was removed from the ROW excavations and transported off-site for disposal at the High Acre Landfill operated by Waste Management. The excavated areas were backfilled in accordance with the approved RAWP as part of the Site-Wide Engineered Cover System.

Installation of Site-Wide Engineered Cover System

A Site-Wide Engineered Cover System (Cover System) was installed to address the SVOCs and metals impacts in soil and overburden groundwater in identified AOCs. The Cover System eliminates the potential exposure pathway to the historic fill material at the surface of the Site, a Cover System was installed across the entire Site as shown on Figure 11. The cover type will vary across the Site based on existing improvements and consists of the following:

1. Four inches of Asphalt pavement (Cover Type 1) with 4 to 6 inches of asphalt millings on sloped surfaces with 18 to 27 inches of re-cycled concrete subbase above the demarcation layer (installed during the 2016 Back Lot and Haidt Place east ROW 2017 remediation). Haidt Place east ROW sub-base 2-feet of Crusher Run #2 and four inches of Asphalt pavement.

2. Nine inches of pavement with 12 inches gravel sub base (Cover Type 2) – existing roadway and parking lot areas (constructed in 1998).

3. Grass / landscaped areas (Cover Type 2) – grass lawn area with approximately 2-inces of top soil and 12-inches of gravel (constructed in 1998) and during September 2017 on the west ROW of Haidt Place, approximately 2-feet of Crusher Run #2 with 4 to 6 inches of topsoil with grass seed.

Cover System Details

Cover Type	Cross-Section
Cover Type 1: Asphalt pavement and Asphalt millings constructed over the majority of the Site (Installed 2016) and the western right of way at Haidt Place 2017.	2016 Installation: A subbase-recycled concrete, minimum of 18 inches and maximum of 27 inches compacted above black geo-textile demarcation layer. Binder 4-inches upper surface of cover system (flat surface) installed. Asphalt millings approximately 4 to 6 inches thick compacted on slope perimeter of cover system. 2017 Haidt Place: 2- foot thick Crusher Run #2 with 4 inches of asphalt cover placed along the eastern right of way.
Cover Type 2: Existing Asphalt Pavement roadway, concrete walkway and parking areas (Installed 1998)	Top Course-1.5 inches Binder-3.5 inches Base Course-4 inches Subbase-12 inches Placed for roadways and parking areas along the west side of the Site. Pavement cracks sealed in 2016.
Cover Type 3: Landscaped lawn (Installed1998) and in the west side of the Haidt Place right of way 2017.	1998 Landscaped Lawn: Existing grass covered topsoil 4 to 6-inches, with 12 inches soil cover thickness (min) placed along the southwest side of the Site near VOA children's playground in 1998. 2017 Haidt Place: 2- foot of imported Crusher Run #2 with 4-6 inches of top soil placed in 2017 along the west side of Haidt Place.

* Recycled concrete thickness varies due to underlying impacted re-used Site soils.
* Demarcation layer represented by orange snow fence on Haidt Place 2017

Prior to placement of the cover system in the Back Lot during 2016, rough grading was performed using a bulldozer and on-site stockpiled bio-cell soils and soil piles that were placed and compacted below the black geotextile demarcation marker in accordance with VOA's civil engineer's requirements (compaction 95% of the maximum dry density). The Site historic fill soils and on-site soil fill materials were covered by the demarcation layer (geotextile). A subbase-recycled concrete with a minimum of 18 inches and maximum of 27 inches was compacted above the demarcation layer. Asphalt binder that is approximately 4-inches thick is the upper surface of cover system (flat surface) installed. Asphalt millings approximately 4 to 6 inches thick compacted on slope perimeter of cover system.

Prior to placement of the cover system in the Haidt Place ROW during 2017, impacted historic fill soils were removed to an approximate depth of 2-feet. An orange plastic fence is the demarcation layer that was placed in bottom of the excavations located along the east and west ROW. These excavations were backfilled with imported Crusher Run #2 using a bulldozer and compacted in accordance with VOA's civil engineer's requirements (compaction 95% of the maximum dry density). The top of the cover system along the east ROW is approximately 4-inches of asphalt. The top of the cover along the west ROW is approximately 4 to 6 inches of imported topsoil with grass seed.

The soils used in the cover system sub-base in the Back Lot and the Haidt Place ROW were imported from approved sources and the imported soils conform to NYSDEC DER-10 requirements for backfill soils. The sub-base was placed, spread with a bulldozer, and properly compacted to minimize future settling in accordance with VOA's civil engineer's requirements. A 4-inch thick asphalt layer was placed and compacted after the sub-base was installed and compaction tests were completed for the majority of the Cover System.

Installation of Storm Water Detention System

A storm water detention system was installed below the demarcation marker for permanent storm water management. A storm water Pollution Prevention Plan (SWPPP) was developed by VOA's civil engineer and implemented to help control runoff and pollutants during remedial construction at the Site by VOA's remediation contactor.

Storm Water Management Objectives

The principal objective of this SWPPP is to comply with the NYSDEC SPDES Storm water requirements for remedial construction activities by planning and implementing the following practices:

- Reduction and/or elimination of erosion and sediment loading to water bodies during remedial construction.
- Maintenance of storm water controls during remedial construction.
- Permanent storm water detention system was installed to convey storm water off the surface of the Cover System and into the City of Rochester storm water sewer. The storm water detentions system and storm water sewer laterals installed for the remedy are shown on Figure 11– Cover System and Storm Water Sewer As-Built Figure.

Engineering and Institutional Controls

Recording of an Environmental Easements (EEs) was completed and includes a listing of Engineering Controls (ECs) and a requirement that management of these controls must be in compliance with an approved SMP; and Institutional Controls (ICs), including prohibition of the following: (1) use of groundwater without treatment rendering it safe for the intended use; (2) disturbance of residual contaminated material unless it is conducted in accordance with the SMP; and (3) higher level of land usage without NYSDEC and NYSDOH approval.

ECs are part of the remedial action to address residual contamination remaining at the Site, as detailed in the SMP, since the soil removal efforts and construction of the Cover System are completed (completed remediation). The entire Site is under the ECs as shown on Figure 10 – Engineering Control Location. The Site has an Engineering Control System.

Site-Wide Engineered Cover System

The Cover System, which is part of the completed remediation, is also an EC that has to be annually inspected and maintained over time, See Appendix 7 – Site Management Forms. The location of the Cover System for the entire Site, See Figure 11 – Cover System and Storm Water As-Built Figure. Annual certifications of the Cover System will be made and certified by a NYS Professional Engineer through visual inspections to ensure the Cover System is performing the function of properly capping subsurface soils. The annual certification will be submitted to NYSDEC for review. Any compromise to the Cover System will be repaired in accordance with a NYS Professional Engineer's recommendations.

Institutional Controls

Institutional Controls (IC) that have been implemented at the site are listed below. The location of the ICs is for the entire Site, see Figure 9 – Institutional Control Boundaries. ICs are listed below and long-term implementation of ECs/ICs are established in the

Environmental Easements (EEs) assigned to the property by the title holder, which will run with the land, and are to be implemented under this Site Management Plan (SMP).

- Recorded NYSDEC-approved Environmental Easements (EEs) with the Monroe County Clerk. The EEs includes a description of required ECs and ICs and summarized the requirements of this SMP. The EEs notes the property owner and property owner's successors and assigns must comply with the EEs and the approved SMP.

- Compliance with a SMP, which provides procedures for appropriate operation, maintenance, monitoring, testing, inspection, reporting and certification of ECs.

- Use of groundwater underlying the Site is prohibited without treatment rendering it safe for its intended use without NYSDOH or Monroe County Health Department approval.

- The redevelopment use of the Site is limited to restricted residential, commercial or industrial. Other use must be approved by the NYSDEC and NYSDOH.

2.4 Remedial Action Objectives

The Remedial Action Objectives (RAOs) for the Site as listed in the Decision Document dated March 31, 2016 are as follows:

Groundwater

RAOs for Public Health Protection

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

RAOs for Environmental Protection

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

Soil

RAOs for Public Health Protection

- Prevent ingestion/direct contact with contaminated soil.
- Prevent inhalation of or exposure from contaminants volatilizing from contaminants in soil.

RAOs for Environmental Protection

- Prevent migration of contaminants that would result in groundwater or surface water contamination.

Soil Vapor

- RAOs for Public Health Protection

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

2.5 Remaining Contamination

2.5.1 Soil

Additional soil samples were collected as part of the remedial action as end-point confirmation soil samples from the Black Stained Sandy source area soil removal excavation. The end point samples confirmed that the Black Sandy Soil source area was successfully removed and the residual SVOC, metals, and DRO (EPA 8015) concentrations in this area contains residual concentrations and limited elevated soil concentrations similar to those identified in the RI/SI. Remediation of these remaining impacted soils was completed with the completion of the site-wide cover system.

A summary of the SVOCs and metals were identified in end-point soil samples from the source area soil removal excavation are presented in Table 1 – Remaining Soil Sample Exceedances. These levels are consistent with the levels detected during the RI/SI. The Historic fill soils and or remaining contaminated soils at the Site are below the demarcation marker and Cover System and no longer poses a direct risk to human health and the environment. The remaining soil levels are shown on Figure 7 and 7A – Remaining Soil Sample Levels and Exceedances.

2.5.2 Groundwater

Groundwater contamination was detected in overburden monitoring wells during the RI/SI and post-remediation groundwater monitoring. The potential exists that low-level contamination is migrating off-site with groundwater. Contaminant levels may decrease over time due to the source area soil removal that was completed as part of the remedy implemented at the site.

A summary the groundwater sample results that exceed the SCGs during the RI and after completion of remediation are presented in Table 2 – Groundwater Sample Results and Remaining Exceedances. The locations of the groundwater samples is shown on Figure 12 – Remaining Groundwater Sample levels and Exceedances.

2.5.3 Soil Vapor

Soil vapor (soil gas) samples have not been collected at the Site. However, soil vapor samples are required to be taken as part of pre-design for a future SSDS at the Site to mitigate the potential for vapor intrusion into future Site building(s) and to be taken after such system is installed to demonstrate compliance and confirmation of the active SSDS. All future soil vapor sampling event and the results must be coordinated and submitted to NYSDEC and NYS Department of Health.

3.0 INSTITUTIONAL AND ENGINEERING CONTROL PLAN

3.1 General

Since remaining contamination exists at the Site, ICs and ECs are required to maintain the Site and protect human health and the environment. This IC/EC Plan describes the procedures for the implementation and management of all ICs/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 Easements;
- A description of the controls to be evaluated during each required inspection and periodic review;
- A description of plans and procedures to be followed for implementation of ICs/ECs, such as the implementation of the Excavation Work Plan (EWP), as provided in Appendix 2 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 restricted residential, commercial or industrial uses only. Adherence to these ICs on the Site is required by the Environmental Easements and will be implemented under this SMP. ICs identified in the Environmental Easements may not be discontinued without an amendment to or extinguishment of the Environmental Easements. The IC boundaries are the same as the BCP Site boundaries as shown on Figure 9 and the Environmental easement survey map in Appendix 1. These ICs are:

- The property may be used for restricted residential, commercial or industrial uses;
- All ECs must be operated and maintained as specified in this SMP;
- All ECs must be inspected at a frequency and in a manner defined in the SMP.
- The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the Monroe County Department of Health to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department.
- Groundwater and other environmental or public health monitoring must be performed as defined in this SMP;
- Data and information pertinent to site management must be reported at the frequency and in a manner as defined in this SMP;
- All future activities that will disturb remaining contaminated material must be

conducted in accordance with this SMP;

- Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in this SMP;
- Operation, maintenance, monitoring, inspection, and reporting of any mechanical or 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 Easements.
- The potential for vapor intrusion must be evaluated for any buildings developed in the area within the IC boundaries noted on Figure 8, Area of Soil Vapor Concern, and any potential impacts that are identified must be monitored or mitigated; and
- Vegetable gardens and farming on the site are prohibited.

3.3 Engineering Controls

3.3.1 Site-Wide Engineered Cover System (Cover System)

Exposure to remaining contamination at the Site is prevented by a Cover System placed over the Site. This Cover System in areas of Cover Type 1 is comprised of, asphalt and asphalt millings overly re-cycled concrete layers that were placed and compacted above the demarcation layer during the cover system installation 2016. The thickness of this asphalt with re-cycled concrete cover type ranges from approximately 22 inches to 27 inches. The Cover Type 1 was installed during 2017 along the eastern right of way at Haidt Place. The Cover Type 2 was constructed for roadway areas and parking lots associated with the construction and restoration of the VOA Human Service Complex in 1998. The Cover Type 2 includes asphalt with compacted gravel subbase is approximately 21 inches thick (9-inchs asphalt and 12-inches gravel). The Cover Type 3 is for existing landscaped areas and lawns in a parking lot planter along the west side of the Site and the vicinity area of the Site that adjoins the VOA Children Center playground along Haidt Place. The Cover Type 3 (1998 Landscaped Lawn) includes grass and approximately 2-inches of topsoil with approximately 2 feet of site soil/fill material. Imported topsoil and CR#2 comprise the Cover Type 3 for the Haidt Place right-of-way (ROW) and existing. It should be noted that demarcation layer is not located below the Cover Types 2 and 3 installed in 1998.

The location of the Cover System type and applicable demarcation layers is shown on Figure 11. The Cover System must be maintained in accordance with the EE and Appendix 4 – Maintenance Plan. The Excavation Work Plan (EWP) provided in Appendix 2 outlines the procedures required to be implemented in the event the Cover System is breached, excavated, penetrated or temporarily removed, and any underlying remaining contamination is disturbed. Procedures for the inspection of this Cover System 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 8 – Health and Safety Plan and Appendix 9 – Community Air Monitoring Plan; respectively.

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 Site-Wide Cover System

The Cover System is a permanent EC and the quality and integrity of this system will be maintained and inspected in accordance with maintenance items in Appendix 4 and defined inspection intervals in accordance with this SMP in perpetuity.

4.0 MONITORING AND SAMPLING PLAN

4.1 General

This Monitoring and Sampling Plan describes the measures for evaluating the overall performance and effectiveness of the remedy. This Monitoring and Sampling Plan may only be revised with the approval of the NYSDEC. Details regarding the sampling procedures, data quality usability objectives, analytical methods, etc. for all samples collected as part of site management for the Site are included in Appendix 5 - Quality Assurance/Quality Control Plan and Appendix 6 – Quality Assurance Project Plan.

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

- Sampling and analysis of all appropriate media (e.g., groundwater, indoor air, soil vapor, soils);
- Assessing compliance with applicable NYSDEC standards, criteria and guidance (SCGs), particularly groundwater standards, and if applicable, 6 NYCRR Part 375 SCOs for soil; and
- Evaluating site information periodically to confirm that the remedy continues to be effective in protecting public health and the environment.

In order to adequately address these methods, this Monitoring and Sampling Plan provides information on:

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

Reporting requirements are provided in Section 7.0 of this SMP.

4.2 Site-wide Inspection

Site-wide inspections will be performed annually. 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 Annual Inspection form will be completed as provided in Appendix 7 of this SMP. 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. 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 Easements;
- Achievement of remedial performance criteria; and
- If site records are complete and up to date.

Reporting requirements are outlined in Section 7.0 of this plan.

Inspections will also be performed in the event of an emergency. If an emergency, such as a natural disaster or an unforeseen failure of any of the ECs occurs that reduces or has the potential to reduce the effectiveness of ECs in place at the site, verbal notice to the NYSDEC must be given by noon of the following day. See Table A and Appendix 3. In addition, an inspection of the Site will be conducted within 5 days of the event to verify the effectiveness of the ICs/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 Treatment System Monitoring and Sampling

There are no active treatment systems at the Site; therefore, this section is not applicable. If an active treatment system is installed at the Site, the SMP will be updated accordingly.

4.4 Post-Remediation Media Monitoring and Sampling

Samples shall be collected from the groundwater monitoring wells on a routine basis. Sampling locations, required analytical parameters and schedule are provided in Table C – Groundwater

Monitoring / Sampling Requirements and Schedule below. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

Table B
Monitoring Requirements & Schedule
Site C828126
VOA 214 Lake Avenue Back Lot
Rochester, New York

Report	**Dates (MM/DD/YY)**		**Estimated Initial Event Date**
	Anticipated Date(s) of Initiation	**Anticipated Date of Completion**	
Quarterly Groundwater Monitoring Events	1st Quarter after COC issued	March 2018 through January 2022	1st Quarter after COC issued

Table C
Groundwater Monitoring / Sampling Requirements and Schedule
Site C828126
VOA 214 Lake Avenue Back Lot
Rochester, New York

Sampling Location	**Analytical Parameters**	**Schedule**
	TCL VOCs (EPA Method 8260) TCL SVOCs (EPA Method 8270) TAL Metals ASP Cat. B	
Monitoring Well MW-101	X	Quarterly
Monitoring Well MW-101R	X	Quarterly
Monitoring Well MW-102	X	Quarterly
Monitoring Well MW-102R	X	Quarterly
Monitoring Well MW-103	X	Quarterly
Monitoring Well MW-105	X	Quarterly
Monitoring Well MW-106	X	Quarterly
Monitoring Well MW-107	X	Quarterly

Detailed sample collection and analytical procedures and protocols are provided in Section 4.4.1 below and Appendix 6 – Quality Assurance Project Plan.

4.4.1 Groundwater Sampling

Groundwater monitoring will be performed quarterly frequency for a five-years to assess the performance of the remedy. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

The network of monitoring wells has been installed to monitor upgradient, on-site and down gradient groundwater conditions at the site. Both Table D and Table 4-Monitoring Well Construction Details, provides a listing of the groundwater monitoring wells to be sampled as part of the long-term groundwater monitoring at the Site. See Appendix 7 for groundwater monitoring forms.

Low-flow sampling methods will be utilized for groundwater sample collection in accordance with ASTM D6771-02. Groundwater samples will be collected using low-flow sampling techniques in accordance with Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells, see Appendix 5. Low flow purging and sampling procedures will be as follows:

1. Low flow purging of the monitoring wells will include collection of water quality indicator parameters. Water quality indicator parameters will be recorded at five (5)-minute intervals during the purging of the well. These water quality indicator parameters will include:
   - Water Level Drawdown
   - Temperature
   - pH
   - Dissolved Oxygen
   - Specific Conductance
   - Oxidation Reduction Potential
   - Turbidity

2. Groundwater sampling will commence once the groundwater quality indicator parameters have stabilized for at least three (3) consecutive readings for the following parameters:
   - Water Level Drawdown <0.3 ft.
   - Temperature - +/- 3%
   - pH - +/- 0.1 unit
   - Dissolved Oxygen - +/-10%
   - Specific Conductance - +/-3%
   - Oxidation Reduction Potential - +/-10 millivolts
   - Turbidity - +/-10% for values greater than 1 NTU

Each groundwater sample collected for laboratory analysis will be labeled and preserved in accordance with the QAPP, see Appendix 6. Laboratory QA/QC, see Appendix 5, will include analysis of sample blanks as follows: one trip blank. The blanks will be provided at a rate of one per 20 samples collected for each parameter group, or one per shipment, whichever is greater. Additionally, one (1) Matrix Spike/Matrix Spike Duplicate (MS/MSD) and one (1) duplicate sample will be collected and analyzed for each twenty samples collected for each parameter group, or one per shipment, whichever is greater. Duplicate samples will be submitted to the laboratory as blind duplicates.

The samples will be delivered under Chain of Custody procedures to a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP)-certified laboratory. The laboratory will provide a NYSDEC ASP Category B Deliverables data package for groundwater samples. A DUSR will be completed for all ASP-B and ASP-B format laboratory data packages per DER-10. The DUSRs will include the laboratory data summary pages showing corrections made by the data validator and each page will be initialed by the data validator. The laboratory data summary pages will be included even if no changes were made.

Table D summarizes the wells identification number, as well as the purpose, location, depths, diameter, and screened intervals of the wells. As part of the groundwater monitoring, on-Site wells are sample to evaluate the effectiveness of the remedial system.

Table D – Monitoring Well Construction Details

Monitoring Well ID	Well Location	Coordinates (longitude/ latitude)	Well Diameter (inches)	Well Ref. Elev.	Ground Surface Elev.	Well Screen Interval Below BGS	Type of Well
MW-101	Down gradient	43.1804° N 77.6197° W	2	481.89	482.3	20.0 – 30.0 ft.	Overburden
MWR-101	Down gradient	43.1805° N 77.6196° W	2	481.84	482.2	44.5 – 54.5 ft.	Bedrock
MW-102	Up gradient	43.1806° N 77.6198° W	2	490.61	490.6	21.0 – 31.0 ft.	Overburden
MWR-102	Up gradient	43.1806° N 77.6199° W	2	490.16	490.5	44.0 – 54.0 ft.	Bedrock
MW-103	Down gradient	43.1805° N 77.6199° W	2	486.34	486.0	34.0 – 44.0 ft.	Overburden
MW-105	Cross gradient	43.1809° N 77.6198° W	2	483.85	484.0	18.0 – 28.0 ft.	Overburden
MW-106	Cross gradient	43.1809° N 77.6197° W	2	483.53	484.0	22.0 – 32.0 ft.	Overburden
MW-107	Down gradient	43.1809° N 77.6195° W	2	485.17	486.0	34.0 – 44.0 ft.	Overburden

Monitoring well construction logs are included in Appendix 10 of this document.

If bio-fouling 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.

4.4.2 Monitoring and Sampling Protocol

All sampling activities will be recorded in a field book and associated sampling log(s). Other observations (e.g., groundwater monitoring well integrity) will be noted on the sampling log. The sampling log will serve as the inspection form for the monitoring network.

5.0 OPERATION AND MAINTENANCE PLAN

5.1 General

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

6.0 PERIODIC ASSESSMENTS/EVALUATIONS

6.1 Climate Change Vulnerability Assessment

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

This section provides a summary of vulnerability assessments that will be conducted for the site during periodic assessments, and briefly summarizes the vulnerability of the site and/or engineering controls to severe storms/weather events and associated flooding. Given the urban nature of the Site and surrounding area, the distance from and elevation above nearby water bodies (e.g., the Genesee River), and the presence of new municipal storm water collection infrastructure, which was installed as part of the remediation, vulnerability assessments do not appear to be warranted at this Site. In addition, this Site is not in a flood plain.

6.2 Green Remediation Evaluation

NYSDEC's DER-31 Green Remediation requires that green remediation concepts and techniques be considered during all stages of the remedial program including site management, with the goal of improving the sustainability of the cleanup and summarizing the net environmental benefit of any implemented green technology. This section 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 Periodic Review Report (PRR).

The Green Remediation Evaluation will include the following items:

- Energy usage: Minimal energy usage will be used at the site during sampling events based on the groundwater sampling technique being implemented.
- Waste generation: Minimal due to the groundwater sampling technique being used. Purge and decontamination water along with personal protection equipment will be generated during sampling events.
- Water usage: Potable water used on the Site (i.e., decontamination water) will be procured from the Monroe County Pure Waters (MCPW) or City of Rochester drinking water systems.
- Emissions: Fuel usage for transportation to and from the site will be minimized by coordinating sampling and inspection events.

6.2.1 Timing of Green Remediation Evaluations

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

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

6.2.2 Remedial Systems

Remedial systems will be maintained properly considering the current Site conditions to conserve materials and resources to the greatest extent possible. Consideration will be given to reducing visits to the Site and reduced consumables. Spent materials will be sent for recycling, as appropriate.

6.2.3 Building Operations

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

6.2.4 Frequency of System Checks, Sampling and Other Periodic Activities

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

Consideration shall be given to:

- Reduced sampling frequencies;
- Reduced site visits and system checks;
- Installation of remote sensing/operations and telemetry, when appropriate;
- Coordination/consolidation of activities to maximize foreman/labor time; and
- Use of mass transit for site visits, where available.

6.2.5 Metrics and Reporting

As discussed in Section 7.0 and as shown in Appendix 7, information on energy usage, solid waste generation, transportation and shipping, water usage and land use and ecosystems will be recorded to facilitate and document consistent implementation of green remediation during site management and to identify corresponding benefits; a set of metrics has been developed.

6.3 Remedial System Optimization

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

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

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

7.0. REPORTING REQUIREMENTS

7.1 Site Management Reports

All Site management inspection, maintenance and monitoring events will be recorded on the appropriate Site management forms provided in Appendix 7. These forms are subject to NYSDEC revision.

All applicable inspection forms and other records, including media sampling data and system maintenance reports, generated for the Site during the reporting period will be provided in electronic format to the NYSDEC in accordance with the requirements of Table E – Schedule of Monitoring/Inspection Reports and summarized in the Periodic Review Report. Table 6-Reporting Summary and Schedule includes a listing of scheduled reporting events.

Table E: Schedule of Monitoring / Inspection Reports

Task/Report	Reporting Frequency*
Cover System Inspection	Annually
Groundwater Monitoring Report	Quarterly for five years
Periodic Review Report	1st PRR due 18 months after COC issued. Annually thereafter, or as otherwise determined by the Department

* 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);
- Type of samples collected (e.g., sub-slab vapor, indoor air, outdoor air);
- Copies of all field forms completed (e.g., well sampling logs, chain-of-custody documentation);
- Sampling results in comparison to appropriate standards/criteria;

- A figure illustrating sample type and sampling locations;
- Copies of all laboratory data sheets and the required laboratory data deliverables required for all points sampled (to be submitted electronically in the NYSDEC-identified format);
- Any observations, conclusions, or recommendations; and
- A determination as to whether contaminant conditions have changed since the last reporting event.

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

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

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

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

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

7.2 Periodic Review Report

A Periodic Review Report (PRR) will be submitted to the Department beginning eighteen

(18) months after the Certificate of Completion is issued. After submittal of the initial Periodic Review Report, the next PRR shall be submitted annually to the 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 1. The report will be prepared in accordance with NYSDEC's DER-10 and submitted within 30 days of the end of each certification period. Media sampling results will also be incorporated into the Periodic Review Report. The report will include:

- Identification, assessment and certification of all ECs/ICs required by the remedy for the site.

- Results of the required annual site inspections 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 summary of any discharge monitoring data and/or information generated during the reporting period, with comments and conclusions.

- Data summary tables and graphical representations of contaminants of concern by media (groundwater, soil vapor, etc.), which include a listing of all compounds analyzed, along with the applicable standards, with all exceedances highlighted. These will include a presentation of past data as part of an evaluation of contaminant concentration trends.

- Results of all analyses, copies of all laboratory data sheets, and the required laboratory data deliverables for all samples collected during the reporting period will be submitted in digital format as determined by the NYSDEC. Currently, data is supplied electronically and submitted to the NYSDEC EQuIS^{TM} database in accordance with the requirements found at this link: http://www.dec.ny.gov/chemical/62440.html.

- A Site evaluation, which includes the following:

    - The compliance of the remedy with the requirements of the site-specific Decision Document;

    - The operation and the effectiveness of all treatment units, etc., including identification of any needed repairs or modifications;

    - Any new conclusions or observations regarding site contamination based on inspections or data generated by the Monitoring and Sampling Plan for the media being monitored;

    - Recommendations regarding any necessary changes to the remedy and/or Monitoring and Sampling Plan; and

    - Trends in contaminant levels in the affected media will be evaluated to determine if the remedy continues to be effective in achieving remedial goals as specified by the Decision Document.

- 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 Professional Engineer licensed to practice in New York State will prepare, and include in the Periodic Review Report, the following certification as per the requirements of NYSDEC DER-10:

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

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

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

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

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

The Periodic Review Report will be submitted, in electronic format, to the NYSDEC Central Office, Regional Office in which the site is located and the NYSDOH Bureau of Environmental Exposure Investigation. The Periodic Review Report 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 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.

7.4 Remedial Site Optimization Report

In the event that an RSO is to be performed (see Section 6.3, upon completion of an RSO), an RSO report must be submitted to the Department for approval. A general outline for the RSO report is provided in Appendix 12 – Remedial System Optimization Table of Contents. The RSO report will document the research/ investigation and data gathering that was conducted, evaluate the results and facts obtained, present a revised conceptual site model and present recommendations. RSO recommendations are to be implemented upon approval from the NYSDEC. Additional work plans, design documents, HASPs etc., may still be required to implement the recommendations, based upon the actions that need to be taken. A final engineering report and update to the SMP may also be required.

The RSO report will be submitted, in electronic format, to the NYSDEC Central Office, Regional Office in which the site is located, Site Control and the NYSDOH Bureau of Environmental Exposure Investigation.

8.0 REFERENCES

Bergmann Associates, Remedial Investigation Report, Volunteers of America, Back Lot Site, August 2012

Bergmann Associates, Remedial Alternatives Analysis/Remedial Action Work Plan, Volunteers of America, Back Lot Site, March 2016

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

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

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

Bergmann Associates, Final Engineering Report, Volunteers of America, Back Lot Site, December 2017

Decision Document, NYSDEC, March 2016

TABLES

TABLE 1

REMAINING SOIL SAMPLE EXCEEDANCES

Table 1.1 Soil Sample Analytical Summary SVOC (subsurface)
Semi-Volatile Organic Compounds – Method OLM 4.2

Volunteers of America of Western New York
214 Lake Avenue Rochester, New York

Semi-volatile Organic Compounds Page 1 of 10	**TP - 103 (16.0-16.5 ft.) 10/31/07**	**TP - 104 (17.0-17.5 ft.) 10/31/07**	**TP - 106 (14.0-14.5 ft.) 11/1/07**	**TP - 118 (8.0-8.5 ft.) 11/2/07**	**Unrestricted Use Soil Cleanup Objectives**	**Restricted Use Soil Cleanup Objectives Commercial**	**Protection of Groundwater**
Acenaphthene	**0.440 J**	**0.160J**	**1.000 J**	**0.720 J**	20	500	98
Acenaphthylene	**0.630 J**	**3.000 J**	4.1ND	2.0ND	100	500	107
Acetophenone	4.6ND	6.8ND	4.1ND	2.0ND	--	--	--
Anthracene	**2.400 J**	**0.960 J**	**2.500 J**	**1.100 J**	100	500	1,000
Atrazine	4.6ND	6.8ND	4.1ND	2.0ND	--	--	--
Benzaldehyde	4.6ND	6.8ND	4.1ND	2.0ND	--	--	--
Benzo (a) Anthracene	**12.000***	**1.800 J***	**3.800 J***	**2.400 ***	1	5.6	1
Benzo (a) Pyrene	**12.000**	**7.000**	**3.400 J**	**1.900 J**	1	1	22
Benzo (b) Fluoranthene	**8.600***	**4.200 J***	**2.400 J***	**1.700 J**	1	5.6	1.7
Benzo (g,h,i) Perylene	**9.300**	**6.700 J**	**2.500 J**	**1.500 J**	100	500	1,000
Benzo (k) Fluoranthene	**9.600***	**1.500 J**	**2.500 J***	**1.600 J**	0.8	56	1.7
Biphenyl	4.6ND	6.8ND	4.1ND	**0.270 J**	--	--	--
Butyl Benzyl Phthalate	4.6ND	6.8ND	4.1ND	2.0ND	--	--	--
Di-N-Butylphthalate	4.6ND	6.8ND	4.1ND	2.0ND	--	--	--
Caprolactam	12ND	17ND	10ND	5.0ND	--	--	--
Carbazole	**0.550 J**	**0.400 J**	**0.700 J**	**0.180 J**	--	--	--
Indeno (1,2,3-cd) Pyrene	**8.300 ***	**5.900 J**	**2.200 J**	**1.300 J**	0.5	5.6	8.2
4-Chloroaniline	4.6ND	6.8ND	4.1ND	2.0ND	--	--	--
Bis (-2-Chloroethoxy) Methane	4.6ND	6.8ND	4.1ND	2.0ND	--	--	--
Bis (-2-Chloroethyl) Ether	4.6ND	6.8ND	4.1ND	2.0ND	--	--	--
2-Chloronaphthalene	4.6ND	6.8ND	4.1ND	2.0ND	--	--	--
2-Chlorophenol	4.6ND	6.8ND	4.1ND	2.0ND	--	--	--
2,2'- Oxybis (1-Chloropropane)	4.6ND	6.8ND	4.1ND	2.0ND	--	--	--
Chrysene	**11.000 ***	**3.500 J ***	**3.500 J***	**2.700 ***	--	56	1
Dibenz (a,h) Anthracene	**2.500 J**	**1.600 J**	**0.670 J**	**0.480 J**	0.5	0.56	1,000
Dibenzofuran	**0.300 J**	6.8ND	**0.620 J**	**0.600 J**	--	--	--
3,3'- Dichlorobenzidine	4.6ND	6.8ND	4.1ND	2.0ND	--	--	--
2,4- Dichlorophenol	4.6ND	6.8ND	4.1ND	2.0ND	--	--	--
Diethylphthalate	4.6ND	6.8ND	4.1ND	2.0ND	--	--	--
Dimethyl Phthalate	4.6ND	6.8ND	4.1ND	2.0ND	--	--	--
2,4- Dimethylphenol	4.6ND	6.8ND	4.1ND	2.0ND	--	--	--
2,4- Dinitrophenol	4.6ND	6.8ND	4.1ND	2.0ND	--	--	--
2,4- Dinitrotoluene	12ND	17ND	10ND	5.0ND	--	--	--
2,6- Dinitrotoluene	4.6ND	6.8ND	4.1ND	2.0ND	--	--	--
Bis (2-Ethylhexyl) Phthalate	4.6ND	6.8ND	4.1ND	2.0ND	--	--	--

Table 1.1 Soil Sample Analytical Summary SVOC (subsurface)
Semi-Volatile Organic Compounds – Method OLM 4.2

Volunteers of America of Western New York
214 Lake Avenue Rochester, New York

Semi – volatile Organic Compounds Page 2 of 10	**TP - 103 (16.0-16.5 ft.) 10/31/07**	**TP - 104 (17.0-17.5 ft.) 10/31/07**	**TP - 106 (14.0-14.5 ft.) 11/1/07**	**TP - 118 (8.0-8.5 ft.) 11/2/07**	**Unrestricted Use Soil Cleanup Objectives**	**Restricted Use Soil Cleanup Objectives Commercial**	**Protection of Groundwater**
Fluoranthene	**19.000**	**2.000 J**	**9.100**	**5.200**	100	500	1,000
Fluorene	**0.630 J**	6.8ND	**1.100 J**	**0.920 J**	30	500	386
Hexachlorobenzene	4.6ND	6.8ND	4.1ND	2.0ND	--	--	--
Hexachlorobutadiene	4.6ND	6.8ND	4.1ND	2.0ND	--	--	--
Hexachlorocyclopentadiene	4.6ND	6.8ND	4.1ND	2.0ND	--	--	--
Hexachloroethane	4.6ND	6.8ND	4.1ND	2.0ND	--	--	--
Isophorone	4.6ND	6.8ND	4.1ND	2.0ND	--	--	--
2- Methylnaphthalene	4.6ND	6.8ND	**0.180 J**	**1.500 J**	--	--	--
4,6- Dinitro-2- Methylphenol	12ND	17ND	10ND	5.0ND	--	--	--
4- Chloro-3- Methylphenol	4.6ND	6.8ND	4.1ND	2.0ND	--	--	--
2- Methylphenol	4.6ND	6.8ND	4.1ND	2.0ND	0.33	--	--
4- Methylphenol	12ND	17ND	10ND	5.0ND	0.33	--	--
Naphthalene	**0.450 J**	6.8ND	**0.280 J**	**0.890 J**	12	500	12
2- Nitroaniline	12ND	17ND	10ND	5.0ND	--	--	--
3- Nitroaniline	12ND	17ND	10ND	5.0ND	--	--	--
4- Nitroaniline	12ND	17ND	10ND	5.0ND	--	--	--
Nitrobenzene	4.6ND	6.8ND	4.1ND	2.0ND	--	--	--
2- Nitrophenol	4.6ND	6.8ND	4.1ND	2.0ND	--	--	--
4- Nitrophenol	4.6ND	6.8ND	4.1ND	2.0ND	--	--	--
N- Nitrosodiphenylamine	4.6ND	6.8ND	4.1ND	2.0ND	--	--	--
Di-n-octyl Phthalate	4.6ND	6.8ND	4.1ND	2.0ND	--	--	--
Pentachlorophenol	12ND	17ND	10ND	5.0ND	0.8	--	--
Phenanthrene	**6.600**	**1.200 J**	**7.000**	**5.000**	100	500	1,000
Phenol	4.6ND	6.8ND	4.1ND	2.0ND	0.33	500	0.33
4- Bromophenyl- Phenylether	4.6ND	6.8ND	4.1ND	2.0ND	--	--	--
4- Chlorophenyl- Phenylether	12ND	6.8ND	4.1ND	2.0ND	--	--	--
N- nitroso-di-n- Propylamine	4.6ND	6.8ND	4.1ND	2.0ND	--	--	--
Pyrene	**17.000**	**3.600 J**	**6.300**	**4.300**	100	500	1,000
2,4,6- Trichlorophenol	4.6ND	6.8ND	4.1ND	2.0ND	--	--	--
2,4,5- Trichlorophenol	12ND	17ND	10ND	5.0ND	--	--	--
Total TICs Concentration and Number of TICs Detected	**121 / 79,900** (30TICs) **(JN,J)**	**43.12 / 192,100** (25TIC) **(J,JN)**	**10.48 / 36,780** (18TICs) **(J,JN)**	**34.26 / 50,400** (29TICs) **(J,JN)**	--	--	--

Notes: Test pit soil pile samples collected from October 31, 2007 through November 2, 2007 by GeoQuest Environmental, Inc. and delivered to Columbia Analytical Services. All concentrations expressed in parts per million (ppm). Bold font indicates concentration above the laboratory detection limit and shaded concentrations exceed Part 375 – 6.8 (b) Restricted Use Soil Cleanup Objectives for Commercial Use, blue shaded exceed Unrestricted Residential Use, and underlined exceeds protection of groundwater.

TICS = Tentatively Identified Compounds. The number of TICS and designations with **J** and **JN** indicate estimated values.

*Concentration exceeds Protection of Groundwater Part 375 6.5 values.

Table 1.1 Soil Sample Analytical Summary SVOC (subsurface)
Semi-Volatile Organic Compounds – Method OLM 4.2

Volunteers of America of Western New York
214 Lake Avenue Rochester, New York

Semi-volatile Organic Compounds Page 3 of 10	**MW - 103 (20.0-22.0 ft.) 7/1/08**	**Unrestricted Use Soil Cleanup Objectives**	**Restricted Use Soil Cleanup Objectives Commercial**	**Protection of Groundwater**
Acenaphthene	**7.100 J**	20	500	98
Acenaphthylene	20.0ND	100	500	107
Acetophenone	20.0ND	--	--	--
Anthracene	**35.000**	100	500	1,000
Atrazine	20.0ND	--	--	--
Benzaldehyde	20.0ND	--	--	--
Benzo (a) Anthracene	**56.000***	1	5.6	1
Benzo (a) Pyrene	**54.000***	1	1	22
Benzo (b) Fluoranthene	**35.000***	1	5.6	1.7
Benzo (g,h,i) Perylene	**34.000**	100	500	1,000
Benzo (k) Fluoranthene	**32.000***	0.8	56	1.7
Biphenyl	20.0ND	--	--	--
Butyl Benzyl Phthalate	20.0ND	--	--	--
Di-N-Butylphthalate	20.0ND	--	--	--
Caprolactam	50.0ND	--	--	--
Carbazole	**14.000J**	--	--	--
Indeno (1,2,3-cd) Pyrene	**32.000***	0.5	5.6	8.2
4-Chloroaniline	20.0ND	--	--	--
Bis (-2-Chloroethoxy) Methane	20.0ND	--	--	--
Bis (-2-Chloroethyl) Ether	20.0ND	--	--	--
2-Chloronaphthalene	20.0ND	--	--	--
2-Chlorophenol	20.0ND	--	--	--
2,2'- Oxybis (1-Chloropropane)	20.0ND	--	--	--
Chrysene	**51.000***	1	56	1
Dibenz (a,h) Anthracene	**12.000J**	0.33	0.56	1,000
Dibenzofuran	**6.200J**	--	--	--
3,3'- Dichlorobenzidine	20.0ND	--	--	--
2,4- Dichlorophenol	20.0ND	--	--	--
Diethylphthalate	20.0ND	--	--	--
Dimethyl Phthalate	20.0ND	--	--	--
2,4- Dimethylphenol	20.0ND	--	--	--
2,4- Dinitrophenol	20.0ND	--	--	--
2,4- Dinitrotoluene	50.0ND	--	--	--
2,6- Dinitrotoluene	20.0ND	--	--	--
Bis (2-Ethylhexyl) Phthalate	20.0ND	--	--	--

Table 1.1 Soil Sample Analytical Summary SVOC (subsurface)
Semi-Volatile Organic Compounds – Method OLM 4.2

Volunteers of America of Western New York
214 Lake Avenue Rochester, New York

Semi – volatile Organic Compounds Page 4 of 10	**MW - 103 (20.0-22.0 ft.) 7/1/08**	**Unrestricted Use Soil Cleanup Objectives**	**Restricted Use Soil Cleanup Objectives Commercial**	**Protection of Groundwater**
Fluoranthene	**130.000**	100	500	1,000
Fluorene	**13.000J**	30	500	386
Hexachlorobenzene	20.0ND	--	--	--
Hexachlorobutadiene	20.0ND	--	--	--
Hexachlorocyclopentadiene	20.0ND	--	--	--
Hexachloroethane	20.0ND	--	--	--
Isophorone	20.0ND	--	--	--
2- Methylnaphthalene	20.0ND	--	--	--
4,6- Dinitro-2- Methylphenol	50.0ND	--	--	--
4- Chloro-3- Methylphenol	20.0ND	--	--	--
2- Methylphenol	20.0ND	0.33	--	--
4- Methylphenol	50.0ND	0.33	--	--
Naphthalene	20.0ND	12	500	12
2- Nitroaniline	50.0ND	--	--	--
3- Nitroaniline	50.0ND	--	--	--
4- Nitroaniline	50.0ND	--	--	--
Nitrobenzene	20.0ND	--	--	--
2- Nitrophenol	20.0ND	--	--	--
4- Nitrophenol	20.0ND	--	--	--
N- Nitrosodiphenylamine	20.0ND	--	--	--
Di-n-octyl Phthalate	20.0ND	--	--	--
Pentachlorophenol	50.0ND	0.8	--	--
Phenanthrene	**91.000**	100	500	1,000
Phenol	20.0ND	0.33	500	0.33
4- Bromophenyl- Phenylether	20.0ND	--	--	--
4- Chlorophenyl- Phenylether	50.0ND	--	--	--
N- nitroso-di-n- Propylamine	20.0ND	--	--	--
Pyrene	**95.000**	100	500	1,000
2,4,6- Trichlorophenol	20.0ND	--	--	--
2,4,5- Trichlorophenol	50.0ND	--	--	--
Total TICs Concentration and Number of TICs Detected	**683.31/582.600** (30TICs) **(J,JN)**	--	--	--

Notes: Monitoring well / test boring soil samples collected from June 27, 2008. July 2, 2008 and July 3, 2008 by GeoQuest Environmental, Inc. and delivered to Columbia Analytical Services. All concentrations expressed in parts per million (ppm). Bold font indicates concentration above the laboratory detection limit and shaded concentrations exceed Part 375 – 6.8 (b) Restricted Use Soil Cleanup Objectives for Commercial Use, blue shaded exceed Unrestricted Residential Use, underlined exceeds Protection of Groundwater.

TICS = Tentatively Identified Compounds.

*Concentration exceeds Protection of Groundwater Part 375-6.5 values. The number of TICS and designations with **J, JN, JB** indicate estimated values

Table 1.1 Soil Sample Analytical Summary SVOC (subsurface)
Semi-Volatile Organic Compounds – Method OLM 4.2

Volunteers of America of Western New York
214 Lake Avenue Rochester, New York

Semi-Volatile Organic Compounds Page 5 of 10	**TP-127 (8.0-10.0 ft.) ppm**	**TP-130 (8.0-10.0 ft.) ppm**	**Unrestricted Use Soil Cleanup Objectives**	**Restricted Use Soil Cleanup Objectives Commercial**	**Protection of Groundwater**
Acenaphthene	**1.600J**	**0.690J**	100	500	98
Acenaphthylene	ND<5.000	0.610J	100	500	107
Acetophenone	ND<5.000	ND<1.300	-	-	--
Anthracene	9.800	2.300	100	500	1,000
Atrazine	ND<5.000	ND<1.300		-	--
Benzaldehyde	ND<5.000	ND<1.300		-	--
Benzo (a) Anthracene	**26.000**	**6.400**	1	5.6	1
Benzo (a) Pyrene	**19.000**	**6.100**	1	1	22
Benzo (b) Fluoranthene	**15.000**	**4.400**	1	5.6	1.7
Benzo (g,h,i) Perylene	11.000	4.600	100	500	1,000
Benzo (k) Fluoranthene	**14.000**	**4.100**	1	56	1.7
Biphenyl	ND<5.000	ND<1.300	-	-	--
Butyl Benzyl Phthalate	ND<5.000	ND<1.300	-	-	--
Di-N-Butylphthalate	ND<5.000	ND<1.300	-	-	--
Caprolactam	ND<5.000	ND<1.300	-	-	--
Carbazole	1.700J	1.200J	-	-	--
Indeno (1,2,3-cd) Pyrene	**9.800**	**3.900**	0.5	5.6	8.2
4-Chloroaniline	ND<5.000	ND<1.300	-	-	--
Bis (-2-Chloroethoxy) Methane	ND<5.000	ND<1.300	-	-	--
Bis (-2-Chloroethyl) Ether	ND<5.000	ND<1.300	-	-	--
2-Chloronaphthalene	ND<5.000	ND<1.300	-	-	--
2-Chlorophenol	ND<5.000	ND<1.300	-	-	--
2,2'- Oxybis (1-Chloropropane)	ND<5.000	ND<1.300	-	-	--
Chrysene	**24.000**	**6.900**	1	56	1
Dibenz (a,h) Anthracene	**3.600J**	**1.200J**	0.33	0.56	1,000
Dibenzofuran	1.400J	0.510J	-	-	--
3,3'- Dichlorobenzidine	ND<5.000	ND<1.300	-	-	--
2,4- Dichlorophenol	ND<5.000	ND<1.300	-	-	--
Diethylphthalate	ND<5.000	ND<1.300	-	-	--
Dimethyl Phthalate	ND<5.000	ND<1.300	-	-	--
2,4- Dimethylphenol	ND<5.000	ND<1.300	-	-	--
2,4- Dinitrophenol	ND<26.000	ND<6.800	-	-	--
2,4- Dinitrotoluene	ND<5.000	ND<1.300	-	-	--
2,6- Dinitrotoluene	ND<5.000	ND<1.300	-	-	--
Bis (2-Ethylhexyl) Phthalate	ND<5.000	ND<1.300	-	-	--
Fluoranthene	55.000	12.000	100	500	1,000

Table 1.1 Soil Sample Analytical Summary SVOC (subsurface)
Semi-Volatile Organic Compounds – Method OLM 4.2

Volunteers of America of Western New York
214 Lake Avenue Rochester, New York

Semi-Volatile Organic Compounds Page 6 of 10	**TP-127 (8.0 -10.0 ft.) ppm**	**TP-130 (8.0 -10.0 ft.) ppm**	**Unrestricted Use Soil Cleanup Objectives**	**Restricted Use Soil Cleanup Objectives Commercial**	**Protection of Groundwater**
Fluorene	2.000J	0.960J	100	500	386
Hexachlorobenzene	ND<5.000	ND<1.300	-	-	--
Hexachlorobutadiene	ND<5.000	ND<1.300	-	-	--
Hexachlorocyclopentadiene	ND<5.000	ND<1.300	-	-	--
Hexachloroethane	ND<5.000	ND<1.300	-	-	--
Isophorone	ND<5.000	ND<1.300	-	-	--
2- Methylnaphthalene	ND<5.000	**0.230J**	0.41	-	--
4,6- Dinitro-2- Methylphenol	ND<26.000	ND<6.800	-	-	--
4- Chloro-3- Methylphenol	ND<5.000	ND<1.300	-	-	--
2- Methylphenol	ND<5.000	ND<1.300	100	500	--
3and4 Methylphenol Coelution	ND<5.000	ND<1.300	-	-	--
Naphthalene	ND<5.000	**0.360J**	100	500	12
2- Nitroaniline	ND<26.000	ND<6.800	-	-	--
3- Nitroaniline	ND<26.000	ND<6.800	-	-	--
4- Nitroaniline	ND<26.000	ND<6.800	-	-	--
Nitrobenzene	ND<5.000	ND<1.300	3.7	69	--
2- Nitrophenol	ND<5.000	ND<1.300			--
4- Nitrophenol	ND<26.000	ND<6.800			--
N- Nitrosodiphenylamine	ND<5.000	ND<1.300		-	--
Di-n-octyl Phthalate	ND<5.000	ND<1.300			--
Pentachlorophenol	ND<26.000	ND<6.800	2.4	6.7	--
Phenanthrene	**34.000**	**11.000**	100	500	1,000
Phenol	ND<5.000	ND<1.300	100	500	0.33
4- Bromophenyl- Phenylether	ND<5.000	ND<1.300	-		--
4- Chlorophenyl- Phenylether	ND<5.000	ND<1.300	-		--
N- nitroso-di-n- Propylamine	ND<5.000	ND<1.300	-		--
Pyrene	**40.000**	**11.000**	100	500	1,000
2,4,6- Trichlorophenol	ND<5.000	ND<1.300	-		--
2,4,5- Trichlorophenol	ND<5.000	ND<1.300	100	-	--
Total Semi-Volatile Organic Compounds / TICS	**267.9 / 75.1 (TICS)**	**78.46 / 30.27 (TICS)**	NA	NA	NA

Notes:

NA = Not Applicable, ND = Less than laboratory detection limits, J = estimated value, concentrations shown in bolt type indicate detection above laboratory limits, and concentrations shown in bold type and shaded indicate values above New York State Department of Environmental Conservation (NYSDEC) Part 375-6.8 (b) Restricted Use Commercial Soil Cleanup Objectives. Blue shaded concentrations exceed NYSDEC Part 375-6 Unrestricted Use residential Soil Cleanup Objectives, and underlined exceeds protection of groundwater. TICS= Tentatively Identified Compounds.

- = No standard available. Concentrations are expressed in parts per million (ppm) equivalent to mg/kg or mg/L.

Samples collected by Bergmann Associates, Inc. on October 25 and 26, 2010 and analyzed by Columbia Analytical Services, Rochester, New York (Lab ID # 10145).

***Restricted Use Soil Cleanup Objective values for commercial use from NYSDEC Table 375 – 6.8(b).**

Table 1.1 Soil Sample Analytical Summary SVOC (subsurface)
Semi-Volatile Organic Compounds – Method OLM 4.2

Volunteers of America of Western New York
214 Lake Avenue Rochester, New York

Semi-Volatile Organic Compounds Page 7 of 10	**TP-133 (8.0 -10.0 ft.) ppm**	**MW-107 (12.0-14.0 ft.) ppm**	**Unrestricted Use Soil Cleanup Objectives**	**Restricted Use Soil Cleanup Objectives Commercial**	**Protection of Groundwater**
Acenaphthene	**1.200J**	**0.820J**	100	500	98
Acenaphthylene	**0.490J**	ND<1.200	100	500	107
Acetophenone	ND<2.400	ND<1.200	-	-	--
Anthracene	**3.500**	**1.500**	100	500	1,000
Atrazine	ND<2.400	ND<1.200		-	--
Benzaldehyde	ND<2.400	ND<1.200		-	--
Benzo (a) Anthracene	**9.700**	**5.3**	1	5.6	1
Benzo (a) Pyrene	**8.300**	**4.700**	1	1	22
Benzo (b) Fluoranthene	**5.800**	**3.000**	1	5.6	1.7
Benzo (g,h,i) Perylene	**4.900**	**3.200**	100	500	1,000
Benzo (k) Fluoranthene	**5.300**	**3.100**	1	56	1.7
Biphenyl	ND<2.400	ND<1.200	-	-	--
Butyl Benzyl Phthalate	ND<2.400	ND<1.200	-		--
Di-N-Butylphthalate	ND<2.400	ND<1.200	-		--
Caprolactam	ND<2.400	ND<1.200	-	-	--
Carbazole	**0.830J**	**0.620J**	-	-	--
Indeno (1,2,3-cd) Pyrene	**4.100**	**2.700**	0.5	5.6	8.2
4-Chloroaniline	ND<2.400	ND<1.200	-		--
Bis(-2-Chloroethoxy)Methane	ND<2.400	ND<1.200	-	-	--
Bis (-2-Chloroethyl) Ether	ND<2.400	ND<1.200	-	-	--
2-Chloronaphthalene	ND<2.400	ND<1.200	-	-	--
2-Chlorophenol	ND<2.400	ND<1.200	-		--
2,2'-Oxybis(1-Chloropropane)	ND<2.400	ND<1.200	-	-	--
Chrysene	**9.600**	**5.300**	1	56	1
Dibenz (a,h) Anthracene	**1.300J**	**0.920J**	0.33	0.56	1,000
Dibenzofuran	**1.100J**	**0.400J**	-		--
3,3'- Dichlorobenzidine	ND<2.400	ND<1.200	-		--
2,4- Dichlorophenol	ND<2.400	ND<1.200	-		--
Diethylphthalate	ND<2.400	ND<1.200	-		--
Dimethyl Phthalate	ND<2.400	ND<1.200	-		--
2,4- Dimethylphenol	ND<2.400	ND<1.200	-	-	--
2,4- Dinitrophenol	ND<12.00	ND<6.200	-		--
2,4- Dinitrotoluene	ND<2.400	ND<1.200	-		--
2,6- Dinitrotoluene	ND<2.400	ND<1.200	-		--
Bis (2-Ethylhexyl) Phthalate	ND<2.400	ND<1.200	-		--
Fluoranthene	**24.000**	**9.500**	100	500	1,000

Table 1.1 Soil Sample Analytical Summary SVOC (subsurface)
Semi-Volatile Organic Compounds – Method OLM 4.2

Volunteers of America of Western New York
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Semi-Volatile Organic Compounds Page 8 of 10	**TP-133 (8.0-10.0 ft.) ppm**	**MW-107 (12.0-14.0 ft.) ppm**	**Unrestricted Use Soil Cleanup Objectives**	**Restricted Use Soil Cleanup Objectives Commercial**	**Protection of Groundwater**
Fluorene	**1.700J**	**0.800J**	100	500	386
Hexachlorobenzene	ND<2.400	ND<1.200	-		--
Hexachlorobutadiene	ND<2.400	ND<1.200	-		--
Hexachlorocyclopentadiene	ND<2.400	ND<1.200	-		--
Hexachloroethane	ND<2.400	ND<1.200	-		--
Isophorone	ND<2.400	ND<1.200	-		--
2- Methylnaphthalene	**0.270J**	ND<1.200	0.41		--
4,6- Dinitro-2- Methylphenol	ND<12.00	ND<6.200	-		--
4- Chloro-3- Methylphenol	ND<2.400	ND<1.200	-		--
2- Methylphenol	ND<2.400	ND<1.200	100		--
3and4 Methylphenol Coelution	ND<2.400	**0.320J**	-		--
Naphthalene	**0.760J**	**0.230J**	100	500	12
2- Nitroaniline	ND<12.00	ND<6.200	-		--
3- Nitroaniline	ND<12.00	ND<6.200	-		--
4- Nitroaniline	ND<12.00	ND<6.200	-		--
Nitrobenzene	ND<2.400	ND<1.200	3.7		--
2- Nitrophenol	ND<2.400	ND<1.200			--
4- Nitrophenol	ND<12.00	ND<6.200			--
N- Nitrosodiphenylamine	ND<2.400	ND<1.200		-	--
Di-n-octyl Phthalate	ND<2.400	ND<1.200			--
Pentachlorophenol	ND<12.00	ND<6.200	2.4	6.7	--
Phenanthrene	**13.000**	**4.400**	100	500	1,000
Phenol	ND<2.400	ND<1.200	100	500	0.33
4- Bromophenyl Phenyl ether	ND<2.400	ND<1.200	-		--
4- Chlorophenyl Phenyl ether	ND<2.400	ND<1.200	-		--
N- nitroso-di-n- Propylamine	ND<2.400	ND<1.200	-		--
Pyrene	**20.000**	**7.800**	100	500	1,000
2,4,6- Trichlorophenol	ND<2.400	ND<1.200	-		--
2,4,5- Trichlorophenol	ND<2.400	ND<1.200	100		--
Total Semi-Volatile Organic Compounds / TICS	**115.85 / 43.18 (TICS)**	**54.61 / 0.00 (TICS)**	NA	NA	NA

Notes:

NA = Not Applicable, ND = Less than laboratory detection limits, J = estimated value, concentrations shown in bolt type indicate detection above laboratory limits, and shaded concentrations exceed New York State Department of Environmental Conservation (NYSDEC) Part 375-6.8 (b) Restricted Use Commercial Soil Cleanup Objectives. Blue shaded concentrations exceed NYSDEC Part 375-6 Unrestricted Use residential Soil Cleanup Objectives and Underlined Concentration exceeds Protection of Groundwater Part 375 - 6.5 values.

= No standard available. Concentrations are expressed in parts per million (ppm) equivalent to mg/kg or mg/L.

Samples collected by Bergmann Associates, Inc. on October 25 and 26, 2010 and analyzed by Columbia Analytical Services, Rochester, New York (Lab ID # 10145).

TICS = Tentatively Identified Compounds.

Table 1.1 Soil Sample Analytical Summary SVOC (subsurface)
Semi-Volatile Organic Compounds – Method OLM 4.2

Volunteers of America of Western New York
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Semi-volatile Organic Compounds Page 9 of 10	**VOA SS-1**	**VOA SS-2**	**VOA SS-3**	**VOA SS-5**	**Unrestricted Use Soil Cleanup Objectives**	**Restricted Use Soil Cleanup Objectives Commercial**	**Protection of Groundwater**
Acenaphthene	**0.230J**	12.0ND	**3.700**	**0.160J**	20	500	98
Acenaphthylene	0.800ND	12.0ND	11.0ND	**0.095J**	100	500	107
Acetophenone	0.800ND	12.0ND	11.0ND	0.840ND	--	--	--
Anthracene	**0.940**	**0.330J**	**4.900J**	**0.310J**	100	500	1,000
Atrazine	0.800ND	12.0ND	11.0ND	0.840ND	--	--	--
Benzaldehyde	0.800ND	12.0ND	11.0ND	0.840ND	--	--	--
Benzo (a) Anthracene	**2.800**	**1.300**	**27.000**	**1.100**	1	5.6	1
Benzo (a) Pyrene	**3.200**	**1.300**	**24.000**	**1.300**	1	1	22
Benzo (b) Fluoranthene	**2.300**	**1.100J**	**25.000**	**0.990**	1	5.6	1.7
Benzo (g,h,i) Perylene	**2.500**	**0.870J**	**17.000**	**0.990**	100	500	1,000
Benzo (k) Fluoranthene	**2.300**	**1.100J**	**23.000**	**1.100**	0.8	56	1.7
Biphenyl	0.800ND	12.0ND	11.0ND	0.840ND	--	--	--
Butyl Benzyl Phthalate	0.800ND	12.0ND	11.0ND	**0.180J**	--	--	--
Di-N-Butylphthalate	0.800ND	12.0ND	11.0ND	0.840ND	--	--	--
Caprolactam	2.000ND	28.0ND	28.0ND	2.100ND	--	--	--
Carbazole	**0.150J**	**0.190J**	**5.600J**	**0.220J**	--	--	--
Indeno (1,2,3-cd) Pyrene	**2.300**	**0.820J**	**16.000**	**0.880**	0.5	5.6	8.2
4-Chloroaniline	0.800ND	12.0ND	11.0ND	0.840ND	--	--	--
Bis (-2-Chloroethoxy) Methane	0.800ND	12.0ND	11.0ND	0.840ND	--	--	--
Bis (-2-Chloroethyl) Ether	0.800ND	12.0ND	11.0ND	0.840ND	--	--	--
2-Chloronaphthalene	0.800ND	12.0ND	11.0ND	0.840ND	--	--	--
2-Chlorophenol	0.800ND	12.0ND	11.0ND	0.840ND	--	--	--
2,2'- Oxybis (1-Chloropropane)	0.800ND	12.0ND	11.0ND	0.840ND	--	--	--
Chrysene	**2.900**	**1.400**	**30.000**	**1.400**	1	56	1
Dibenz (a,h) Anthracene	**0.580J**	**0.270J**	**5.1J**	**0.250J**	0.33	0.56	1,000
Dibenzofuran	**0.087J**	12.0ND	**1.500**	**0.190J**	--	--	--
3,3'- Dichlorobenzidine	0.800ND	12.0ND	11.0ND	0.840ND	--	--	--
2,4- Dichlorophenol	0.800ND	12.0ND	11.0ND	0.840ND	--	--	--
Diethylphthalate	0.800ND	12.0ND	11.0ND	0.840ND	--	--	--
Dimethyl Phthalate	0.800ND	12.0ND	11.0ND	0.840ND	--	--	--
2,4- Dimethylphenol	0.800ND	12.0ND	11.0ND	0.840ND	--	--	--
2,4- Dinitrophenol	2.000ND	28.0ND	28.0ND	2.100ND	--	--	--
2,4- Dinitrotoluene	0.800ND	12.0ND	11.0ND	0.840ND	--	--	--
2,6- Dinitrotoluene	0.800ND	12.0ND	11.0ND	0.840ND	--	--	--
Bis (2-Ethylhexyl) Phthalate	**0.089J**	12.0ND	11.0ND	**0.140J**	--	--	--

Table 1.1 Soil Sample Analytical Summary SVOC (subsurface)
Semi-Volatile Organic Compounds – Method OLM 4.2

Volunteers of America of Western New York
214 Lake Avenue Rochester, New York

Semi-volatile Organic Compounds Page 10 of 10	**VOA SS-1**	**VOA SS-2**	**VOA SS-3**	**VOA SS-5**	**Unrestricted Use Soil Cleanup Objectives**	**Restricted Use Soil Cleanup Objectives Commercial**	**Protection of Groundwater**
Fluoranthene	**6.000**	**2.700**	**60.000**	**2.800**	100	500	1,000
Fluorene	**0.260J**	12.0ND	**2.600**	**0.250J**	30	500	386
Hexachlorobenzene	0.800ND	12.0ND	11.0ND	0.840ND	--	--	--
Hexachlorobutadiene	0.800ND	12.0ND	11.0ND	0.840ND	--	--	--
Hexachlorocyclopentadiene	0.800ND	12.0ND	11.0ND	0.840ND	--	--	--
Hexachloroethane	0.800ND	12.0ND	11.0ND	0.840ND	--	--	--
Isophorone	0.800ND	12.0ND	11.0ND	0.840ND	--	--	--
2- Methylnaphthalene	0.800ND	**0.140J**	11.0ND	**0.089J**	--	--	--
4,6- Dinitro-2- Methylphenol	2.000ND	28.0ND	28.0ND	2.100ND	--	--	--
4- Chloro-3- Methylphenol	0.800ND	12.0ND	11.0ND	0.840ND	--	--	--
2- Methylphenol	0.800ND	12.0ND	11.0ND	0.840ND	0.33	--	--
4- Methylphenol	0.800ND	12.0ND	11.0ND	0.840ND	0.33	--	--
Naphthalene	0.800ND	12.0ND	11.0ND	**0.210J**	12	500	12
2- Nitroaniline	2.000ND	28.0ND	28.0ND	2.100ND	--	--	--
3- Nitroaniline	2.000ND	28.0ND	28.0ND	2.100ND	--	--	--
4- Nitroaniline	2.000ND	28.0ND	28.0ND	2.100ND	--	--	--
Nitrobenzene	0.800ND	12.0ND	11.0ND	0.840ND	--	--	--
2- Nitrophenol	0.800ND	12.0ND	11.0ND	0.840ND	--	--	--
4- Nitrophenol	0.800ND	12.0ND	11.0ND	0.840ND	--	--	--
N- Nitrosodiphenylamine	0.800ND	12.0ND	11.0ND	0.840ND	--	--	--
Di-n-octyl Phthalate	0.800ND	12.0ND	11.0ND	0.840ND	--	--	--
Pentachlorophenol	2.000ND	28.0ND	28.0ND	2.100ND	0.8	--	--
Phenanthrene	**2.600**	**1.400**	**34.000**	**1.900**	100	500	1,000
Phenol	0.800ND	12.0ND	11.0ND	0.840ND	0.33	500	0.33
4- Bromophenyl- Phenylether	0.800ND	12.0ND	11.0ND	0.840ND	--	--	--
4- Chlorophenyl- Phenylether	2.000ND	12.0ND	28.0ND	0.840ND	--	--	--
N- nitroso-di-n- Propylamine	0.800ND	12.0ND	11.0ND	0.840ND	--	--	--
Pyrene	**4.400**	**1.700**	**46.000**	**1.900**	100	500	1,000
2,4,6- Trichlorophenol	0.800ND	12.0ND	11.0ND	0.840ND	--	--	--
2,4,5- Trichlorophenol	2.000ND	28.0ND	28.0ND	2.100ND	--	--	--
Total Semi-Volatile Organic Compounds / Total TICS	**33.636 / 13.380** (29 TIC) **(J,JN,JNB)**	**14.62 / 9.290** **(15TIC) (J,JN,)**	**325.4 / 163.800** (30TICs) **(J,JN)**	**16.454 / 14.090** (28TICs) **(J,JN)**	**--**	**--**	--

Notes: Surface soil samples collected on February 17, 2009 by GeoQuest Environmental, Inc. and delivered to Columbia Analytical Services. All concentrations expressed in parts per million (ppm). Bold font indicates concentration above the laboratory detection limit and shaded concentrations exceed NYSDEC Part 375 – 6.8

(b) Restricted Use Soil Cleanup Objectives for Commercial Use, blue shaded exceed Unrestricted Use Soil Cleanup Objectives for Residential Use, and underlined exceeds protection of groundwater.

TICS = Tentatively Identified Compounds. The number of TICS and designations with **J, JN, and JNB** indicate estimated values.

Table 1.2 Soil Sample Analytical Summary Metals (Test Pits)
Metals and Total Cyanide

Volunteers of America of Western New York
214 Lake Avenue Rochester, New York

Metals and Cyanide Page 1 of 5	**TP-102 (10.0-10.5 ft.)**	**TP-103 (16.0-16.5 ft.)**	**TP-104 (17.0-17.5 ft.)**	**TP-105 (15.0-15.5 ft.)**	**TP-106 (14.0-14.5 ft.)**	**TP-107 (8.0-8.5 ft.)**	**TP-118 (8.0-8.5 ft.)**	**Unrestricted Use Soil Cleanup Objectives**	**Restricted Use Soil Cleanup Objectives Commercial**	**Protection of Groundwater**
Aluminum	5,670	5,370	6,850	1,580	11,200	2,470	3,090	-	-	-
Antimony	0.70B	4.6B	0.51	1.1B	0.26ND	0.69B	0.26ND	-	-	-
Arsenic	**37.3**	**14.3**	12.7	10	**18.3**	**72.6**	12.8	13	16	16[f]
Barium	104	105	164	42.2	90	106	42.9	350	400	820[c]
Beryllium	0.53B	0.56B	0.87	0.44B	0.73	0.26B	0.41B	7.2	590	47
Cadmium	0.61	0.35B	0.19	0.16B	0.30B	0.33B	0.10B	2.5	9.3	7.5
Calcium	30,900	14,100	9,190	14,200	17,000	947	17,000	-	-	-
Chromium	**12.6**	**10.1**	**8.6**	**4.7**	**10.9**	**6.6**	**5.1**	1	400	19[b]
Cobalt	14.2	8.3	7.9	2.4B	7.9	0.07ND	5.5B	-	-	-
Copper	**79.1**	**212**	49.1	**63.8**	**63.4**	48.9	17.3	50	270	1720
Iron	45,300	22,900	11,700	11,600	15,900	68,100	13,300	-	-	-
Lead	**381**	**1,110**	**439**	**220**	**105**	**178**	60.6	63	1,000	450
Magnesium	4,940	2,710	956	3,900	4,170	319	7,930	-	-	-
Manganese	947	345	192	143	211	13.7	183	1,000	10,000	2000
Mercury	**1.0**	**1.3**	0.11B	**0.66**	**0.48**	**0.44**	**0.23**	0.18	2.8	0.75
Nickel	27.2	18.5	16.6	7.3	16.6	1.3B	11.2	30	310	130
Potassium	751	818	934	445B	800	2,190	791	-	-	-
Selenium	3.8B	3.3	2.4B	1.9B	1.7	**4.3**	1.3B	3.9	1,500	4
Silver	0.10ND	0.11ND	0.11ND	0.09ND	0.09ND	0.09ND	0.09ND	2	1,500	8.3
Sodium	128B	313B	275B	99.5B	593	5,430	221B	-	-	-
Thallium	0.69B	0.21ND	0.20ND	0.16ND	0.18ND	0.84B	0.18ND	-	-	-
Vanadium	16.1	23	33.2	10.9	17.3	9.4	11.9	-	-	-
Zinc	**137**	**507**	**386**	**121**	96.8	16.3	71.8	109	10,000	2480
Total Cyanide	NA	NA	NA	1.10ND	NA	1.19ND	NA	27	27	40

Notes:

1. NA = Not analyzed, ND = Less than laboratory detection limits, B = metal detected in blank, - = No standard. **Concentration in shaded background and bold font indicates detection above New York State Department of Environmental Conservation Restricted Use Soil Cleanup Objective for Commercial Use. Concentration in blue highlight indicates detection above NYSDEC Unrestricted Use Soil Cleanup Objective for Residential Use.**

2. Concentrations are expressed in parts per million (ppm) equivalent to MG/KG.

3. Samples collected by GeoQuest Environmental, Inc. on October 31 through November 2, 2007 and analyzed by Columbia Analytical Services, Rochester, New York (Lab ID # 10145).

Restricted Use Soil Cleanup Objective values for commercial use from NYSDEC Table 375 – 6.8 (b).

Table 1.2 Soil Sample Analytical Summary Metals (Test Pits)
Metals and Total Cyanide

Volunteers of America of Western New York
214 Lake Avenue Rochester, New York

Metals and Cyanide Page 2 of 5	**MW-101 (22.0-23.0 ft.)**	**MW-102 (22.0-22.5 ft.)**	**MW-103 (20.0-22.0 ft.)**	**MW-104 (30.0-32.0 ft.)**	**MW-105 (26.0-26.3 ft.)**	**MW-106 (26.0-28.0 ft.)**	**Unrestricted Use Soil Cleanup Objectives**	**Restricted Use Soil Cleanup Objectives Commercial**	**Protection of Groundwater**
Aluminum	3,410	8,330	5,780	2,130	4,110	4,630	-	-	-
Antimony	1.2B	0.24B	0.26B	0.72B	0.15ND	2.1B	-	-	-
Arsenic	5.0	7.1	10.2	6.3	5.1	6.1	13	16	16[f]
Barium	76.2	101	111	124	11.3B	150	350	400	820[c]
Beryllium	0.27B	0.53B	0.47B	0.26B	0.40B	0.26B	7.2	590	47
Cadmium	0.14B	0.19B	0.16B	0.03B	0.03B	0.36B	2.5	9.3	7.5
Calcium	50,300	17,800	6,510	4,790	155,000	53,800	-	-	-
Chromium	**7.1**	**11.8**	**23.5**	**4.9**	**6.2**	**13.1**	1	400	19[b]
Cobalt	3.3B	8.5	5.7B	3.0B	4.4B	3.0B	-	-	-
Copper	**83.0**	**74.7**	41.5	**116**	13.5	**467**	50	270	1720
Iron	15,700	18,400	10,700	13,600	12,500	9,340	-	-	-
Lead	**235**	**92.5**	**264**	**109**	24.6	**425**	63	1,000	450
Magnesium	11,400	5,550	939	793	38,200	12,900	-	-	-
Manganese	305	1,090	110	121	282	341	1,600	10,000	2000
Mercury	**16.0**	**149**	**0.31**	**1.5**	0.05B	**1.5**	0.18	2.8	0.75
Nickel	7.3	16.0	12.3	10.0	9.8	7.4	30	310	130
Potassium	758B	1,310	677	281B	2,940	769	-	-	-
Selenium	1.8B	1.6B	1.9B	1.3B	0.53B	1.7B	3.9	1,500	4
Silver	0.40B	0.69B	0.05ND	0.23B	0.04ND	0.51B	2	1,500	8.3
Sodium	428B	277B	238B	263B	183B	391B	-	-	-
Thallium	0.11ND	0.09ND	0.11B	0.10ND	1.9B	0.31B	-	-	-
Vanadium	9.6	17.5	20.3	11.5	7.1	12.1	-	-	-
Zinc	105	**120**	**147**	**132**	13.1	**651**	109	10,000	2480
Total Cyanide	1.59ND	1.39ND	1.21ND	1.47ND	1.05ND	1.34ND	27	27	40

Notes:

1. NA = Not analyzed, ND = Less than laboratory detection limits, B = metal detected in blank, - = No standard. **Concentration in shaded background and bold font indicates detection above New York State Department of Environmental Conservation Restricted Use Soil Cleanup Objective for Commercial Use.**
2. **Bold type indicates detection above New York State Department of Environmental Conservation unrestricted Use Soil Cleanup Objective.**
3. Concentrations are expressed in parts per million (ppm) equivalent to MG/KG.
4. Samples collected by GeoQuest Environmental, Inc. on June 27, 2008, July 2, 2008 and July 3, 2008, analyzed by Columbia Analytical Services, Rochester, New York (Lab ID # 10145).

Restricted Use Soil Cleanup Objective values for commercial use from NYSDEC Table 375 – 6.8 (b).

Table 1.2 Soil Sample Analytical Summary (Test Pits)
Metals

Volunteers of America of Western New York
214 Lake Avenue Rochester, New York

Metals Page 3 of 5	**TP-127 (8.0-10.0 ft.)**	**TP-128 (8.0-10.0 ft.)**	**TP-130 (8.0-10.0 ft.)**	**TP-131 (8.0-10.0 ft.)**	**Unrestricted Use Soil Cleanup Objectives**	**Restricted Commercial Use Soil Cleanup Objectives**	**Protection of Groundwater**
Aluminum	7,500	6,730	2,150	3,400	-	-	-
Antimony	ND<7.5	ND<8.0	ND<8.0	ND<7.6	-	-	-
Arsenic	**13.4**	9.2	**119**	**53.5**	13	16	16[f]
Barium	116	113	84.6	55.1	350	400	820[c]
Beryllium	0.748	ND<0.664	ND<0.664	ND<0.631	7.2	590	47
Cadmium	ND<0.627	ND<0.664	ND<0.664	ND<0.631	2.5	9.3	7.5
Calcium	6,800	13,400	3,470	2,050	-	-	-
Chromium	**12.3**	**11.2**	**5.7**	**6.3**	1	400	19[b]
Cobalt	12.4	ND<6.6	ND<6.6	ND<6.3	-	-	-
Copper	**167**	**266**	33.1	17.3	50	270	1720
Iron	32,400	17,000	73,000	35,400	-	-	-
Lead	**301**	**319**	**89.0**	50.3	63	1,000	450
Magnesium	3,750	2,840	508	965	-	-	-
Manganese	504	278	51.2	38.8	1,600	10,000	2000
Mercury	**0.752**	**0.380**	0.164	**0.213**	0.18	2.8	0.75
Nickel	23.2	**60.9**	ND<5.3	ND<5.1	30	310	130
Potassium	782	826	1,340	978	-	-	-
Selenium	1.8	1.8	**4.6**	2.7	3.9	1,500	4
Silver	ND<1.3	ND<1.3	ND<1.3	ND<1.3	2	1,500	8.3
Sodium	ND<125	ND<133	858	348	-	-	-
Thallium	ND<1.3	ND<1.3	ND<1.3	ND<1.3	-	-	-
Vanadium	16.8	23.4	15.6	12.4	-	-	-
Zinc	**220**	**151**	28.8	20.5	109	10,000	2480

Notes:

1. NA = Not analyzed, ND = Less than laboratory detection limits, B = metal detected in blank, - = No standard. **Concentration in shaded background and bold type indicates detection above New York State Department of Environmental Conservation Restricted Use Soil Cleanup Objective for Commercial Use.**
2. **Bold type indicates detection above New York State Department of Environmental Conservation unrestricted Use Soil Cleanup Objective for Residential Use.**
3. Concentrations are expressed in parts per million (ppm) equivalent to MG/KG.
4. Samples collected by Bergmann Associates, Inc. on October 25 and 26, 2010 and analyzed by Columbia Analytical Services, Rochester, New York (Lab ID # 10145).
5. Restricted Use Soil Cleanup Objective values for commercial use from NYSDEC Table 375 – 6.8 (b) and unrestricted SCO for residential use from 375-6.8 (a).

The soil sample results listed in the table are from the Supplemental Investigation (SI)

Table 1.2 Soil Sample Analytical Summary (Test Pits)
Metals

Volunteers of America of Western New York
214 Lake Avenue Rochester, New York

Metals Page 4 of 5	**TP-132 (8.0-10.0 ft.)**	**TP-133 (8.0-10.0 ft.)**	**TP-134 (8.0-10.0 ft.)**	**MW-107 (12.0 – 14.0 ft.)**	**Unrestricted Use Soil Cleanup Objectives**	**Restricted Commercial Use Soil Cleanup Objectives**	**Protection of Groundwater**
Aluminum	8,470	2,840	2,630	3,670	-	-	-
Antimony	ND<7.1	ND<8.3	ND<7.6	ND<7.3	-	-	-
Arsenic	4.5	**140***	**132***	**28.1***	13	16	16^{f}
Barium	53.6	133	71.1	51.6	350	400	820^{c}
Beryllium	ND<0.595	ND<0.690	ND<0.630	ND<0.604	7.2	590	47
Cadmium	ND<0.595	0.751	ND<0.630	ND<0.604	2.5	9.3	7.5
Calcium	11,700	5,170	1,320	34,500	-	-	-
Chromium	**9.9**	**7.7**	**6.2**	**10.6**	1	400	19^{b}
Cobalt	6.2	ND<6.9	ND<6.3	ND<6.0	-	-	-
Copper	18.9	**72.6**	11.5	**176**	50	270	1720
Iron	14,700	108,000	53,700	51,300	-	-	-
Lead	**64.7**	**169**	**128**	**269**	63	1,000	450
Magnesium	3,720	552	702	6,320	-	-	-
Manganese	196	165	50.4	850	1,600	10,000	2000
Mercury	**0.199**	0.107	0.111	**0.505**	0.18	2.8	0.75
Nickel	11.2	9.3	ND<5.0	12.5	30	310	130
Potassium	913	1,200	1,240	602	-	-	-
Selenium	ND<1.2	**6.9***	**8.3***	**6.5***	3.9	1,500	4
Silver	ND<1.2	ND<1.4	ND<1.3	ND<1.2	2	1,500	8.3
Sodium	ND<119	338	1,630	ND<121	-	-	-
Thallium	ND<1.2	ND<1.4	ND<1.3	ND<1.2	-	-	-
Vanadium	17.7	34.1	13.8	14.3	-	-	-
Zinc	49.1	55.6	21.5	**110**	109	10,000	2480

Notes:

1. NA = Not analyzed, ND = Less than laboratory detection limits, B = metal detected in blank, - = No standard. **Concentration in shaded background and bold type indicates detection above New York State Department of Environmental Conservation Restricted Use Soil Cleanup Objective for Commercial Use.**
2. **Blue highlight indicated detection above New York State Department of Environmental Conservation unrestricted Use Soil Cleanup Objective for Residential Use**
3. Concentrations are expressed in parts per million (ppm) equivalent to MG/KG.
4. **Concentrations exceeds Protections of Groundwater Part 375-6.5 values.**
5. Samples collected by Bergmann Associates, Inc. on October 25 and 26, 2010 and analyzed by Columbia Analytical Services, Rochester, New York (Lab ID # 10145).
6. Restricted Use Soil Cleanup Objective values for commercial use from NYSDEC Table 375 – 6.8 (b)

Table 1.2 Soil Sample Analytical Summary (Surface)
Metals and Total Cyanide

Volunteers of America of Western New York
214 Lake Avenue Rochester, New York

Metals and Cyanide Page 5 of 5	**VOA SS-1**	**VOA SS-2**	**VOA SS-3**	**VOA SS-4**	**VOA SS-5**	**VOA SS-6**	**Unrestricted Use Soil Cleanup Objectives**	**Restricted Use Soil Cleanup Objectives Commercial**	**Protection of Groundwater**
Aluminum	NA	NA	NA	NA	NA	NA	-	-	-
Antimony	0.96B	0.30ND	0.29ND	1.4B	0.32ND	0.28ND	-	-	-
Arsenic	11.3	8.1	4.1	5.8	5.5	4.0	13	16	16^{f}
Barium	NA	NA	NA	NA	NA	NA	350	400	820^{c}
Beryllium	0.27B	0.39B	0.20B	0.29B	1.6	0.30B	7.2	590	47
Cadmium	0.18B	0.40B	0.73	0.11B	1.9	0.23B	2.5	9.3	7.5
Calcium	NA	NA	NA	NA	NA	NA	-	-	-
Chromium	**138**	**10.5**	**5.2**	**6.9**	**11.0**	**4.6**	1	400	19^{b}
Cobalt	NA	NA	NA	NA	NA	NA	-	-	-
Copper	139	36.9	14.2	45.5	80.1	21.6	50	270	1720
Iron	NA	NA	NA	NA	NA	NA	-	-	-
Lead	**1,050**	**343**	**74.8**	**457**	**418**	26.7	63	1,000	450
Magnesium	NA	NA	NA	NA	NA	NA	-	-	-
Manganese	NA	NA	NA	NA	NA	NA	1,600	10,000	2000
Mercury	**10.1**	**0.46**	0.07B	**0.72**	**0.68**	0.03B	0.18	2.8	0.75
Nickel	9.9	11.0	5.3	9.2	**144**	5.8	30	310	130
Potassium	NA	NA	NA	NA	NA	NA	-	-	-
Selenium	2.6B	0.73B	0.38B	1.3B	2.5B	0.27ND	3.9	1,500	4
Silver	0.56B	0.65B	1.1B	0.61B	0.66B	0.21B	2	1,500	8.3
Sodium	NA	NA	NA	NA	NA	NA	-	-	-
Thallium	0.39B	1.0B	2.4B	0.14ND	1.2B	2.8	-	-	-
Vanadium	NA	NA	NA	NA	NA	NA	-	-	-
Zinc	**192**	**123**	90.9	79.6	**748**	31.4	109	10,000	2480
Total Cyanide	1.3ND	1.2ND	1.2ND	1.47ND	1.1ND	0.98ND	27	27	40

Notes:

1. NA = Not analyzed, ND = Less than laboratory detection limits, B = metal detected in blank, - = No standard. **Concentration in shaded background and bold type indicates detection above New York State Department of Environmental Conservation Restricted Use Soil Cleanup Objective for Commercial Use.**

2. **Bold type indicates concentration detection above New York State Department of Environmental Conservation Unrestricted Use Soil Cleanup Objective for Residential Use.**

3. Concentrations are expressed in parts per million (ppm) equivalent to MG/KG.

4. Samples collected by GeoQuest Environmental, Inc. on February 17, 2009 and analyzed by Columbia Analytical Services, Rochester, New York (Lab ID # 10145).

5. Restricted Use Soil Cleanup Objective values for commercial use from NYSDEC Table 375 – 6.8 (b) and unrestricted SCO for residential use from 375-6.8 (a).

TABLE 2

GROUNDWATER SAMPLE RESULTS AND REMAINING EXCEEDANCES

TABLE 2.1 Groundwater Sample Analysis Summary
Metals and Total Cyanide

Volunteers of America of Western New York
214 Lake Avenue Rochester, New York

Metals and Cyanide Page 1 of 5	**VOAMW-101 (10/30/08)**	**VOAMWR-101 (10/30/08)**	**VOAMW-102 (10/31/08)**	**VOAMWR-102 (10/31/08)**	**VOAMW-103 (10/31/08)**	**VOAMW-104 (10/30/08)**	**NYSDEC Groundwater Standards**
Aluminum	4,270	366	19,400	31.0B	31,700	6,310	-
Antimony	0.81B	**5.0B**	0.57ND	0.57ND	**142**	0.57ND	3
Arsenic	3.6B	2.7B	13.5	1.9ND	**99.2**	4.1B	25
Barium	249	20.0B	457	77.0B	**1,660**	179B	1,000
Beryllium	0.31B	0.05ND	0.84B	0.05ND	3.8B	0.35B	-
Cadmium	0.31B	0.25B	0.50B	0.06ND	4.7B	0.23B	5
Calcium	161,000	39,500	269,000	168,000	368,000	342,000	-
Chromium	11.7	0.90B	25.1	0.27B	**121**	12.6	50
Cobalt	2.8B	0.25ND	5.0B	0.48B	35.7B	2.9B	-
Copper	78.7	12.3B	55.6	4.0B	**8,840**	67.2	200
Iron	**21,000**	**460**	**50,900**	**529**	**80,500**	**31,300**	300
Lead	**489**	6.3B	**109**	0.99ND	**6,600**	**106**	25
Magnesium	87,900	12,300	107,000	104,000	84,300	70,500	-
Manganese	**677**	45.4	**1,120**	114	**1,060**	**728**	300
Mercury	**5.9**	0.04B	**0.93**	0.01B	**193**	0.59	0.7
Nickel	7.5B	3.6B	13.8B	4.0B	**155**	8.9B	100
Potassium	14,000	13,700	33,700	14,100	18,000	16,200	-
Selenium	3.5B	2.4B	1.5ND	1.5ND	**11.4B**	2.5B	10
Silver	1.7B	0.65ND	2.4B	0.74B	12.9	2.0B	50
Sodium	**131,000**	**86,200**	**499,000**	**350,000**	**188,000**	**225,000**	20,000
Thallium	1.3ND	1.3ND	1.3ND	1.3ND	1.3ND	1.3ND	-
Vanadium	11.8B	0.86B	23.3B	0.13ND	125	12.8B	-
Zinc	130	37.2	98.8	2.9ND	4,070	104	-
Total Cyanide	12.4	10.0ND	10.0ND	10.0ND	10.0ND	10.0ND	200

Notes:

1. NA = Not analyzed, ND = Less than laboratory detection limits, B = metal detected in blank, - = No standard. **Concentration in bold type indicates detection above New York State Department of Environmental Conservation groundwater standards.**
2. Concentrations of metals are expressed in parts per billion (ppb) equivalent to ug/l.
3. Samples collected by GeoQuest Environmental, Inc. on October 30, 2008 and October 31, 2008, analyzed by Columbia Analytical Services, Rochester, New York (Lab ID # 10145).
4. NYSDEC groundwater standards 703.5 and June 1998 Division of Technical and Operational guidance series T.O.G.S. 1.1.1 and as amended April 2000.

GeoQuest
Environmental, Inc.

TABLE 2.1 Groundwater Sample Analysis Summary
Metals and Total Cyanide

Volunteers of America of Western New York
214 Lake Avenue Rochester, New York

Metals and Cyanide Page 2 of 5	**VOAMW-105 (10/31/08)**	**VOAMW-105 (10/31/08) dup.**	**VOAMW-106 (10/30/08)**	**NYSDEC Groundwater Standards**
Aluminum	83,100	115,000	3,090	-
Antimony	0.57ND	0.57ND	0.58B	3
Arsenic	**35.2**	**40.6**	2.6B	25
Barium	157B	205	282	1,000
Beryllium	4.1B	5.4	0.09B	-
Cadmium	1.1B	1.1B	0.25B	5
Calcium	821,000	916,000	116,000	-
Chromium	**86.2**	**116**	8.7B	50
Cobalt	28.5B	36.6B	1.2B	-
Copper	74.5	87.9	47.4	200
Iron	**79,500**	**101,000**	**10,200**	300
Lead	**115**	**145**	**92.7**	25
Magnesium	330,000	366,000	61,400	-
Manganese	**1,630**	**1,860**	**376**	300
Mercury	0.29	0.41	**0.75**	0.7
Nickel	66.5	87.7	3.6B	100
Potassium	52,000	67,600	18,600	-
Selenium	1.5ND	1.5ND	1.5ND	10
Silver	2.2B	2.0B	0.93B	50
Sodium	**61,600**	**62,500**	**282,000**	20,000
Thallium	8.7B	11.9B	1.3ND	-
Vanadium	94.6	127	6.1B	-
Zinc	71.0	85.0	97.8	-
Total Cyanide	10.0ND	10.0ND	10.0ND	200

Notes:

1. NA = Not analyzed, ND = Less than laboratory detection limits, B = metal detected in blank, - = No standard. **Concentration in bold font indicates detection above New York State Department of Environmental Conservation groundwater standards.**
2. Concentrations of metals are expressed in parts per billion (ppb) equivalent to ug/l.
3. Samples collected by GeoQuest Environmental, Inc. on October 30, 2008 and October 31, 2008, analyzed by Columbia Analytical Services, Rochester, New York (Lab ID # 10145).
4. NYSDEC groundwater standards 703.5 and June 1998 Division of Technical and Operational guidance series T.O.G.S. 1.1.1 and as amended April 2000.

GeoQuest
Environmental, Inc.

TABLE 2.1 Groundwater Sample Analysis Summary

Metals and Total Cyanide

Volunteers of America of Western New York
214 Lake Avenue Rochester, New York

Metals and Cyanide Page 3 of 5	**VOAMW-101 (7/27/09)**	**VOAMW-101Duplicate (7/27/09)**	**VOAMWR-101 (7/27/09)**	**VOAMW-102 (7/27/09)**	**VOAMWR-102 (7/27/09)**	**VOAMW-103 (7/27/09)**	**NYSDEC Groundwater Standards**
Aluminum	74,700	93,900	120B	7,400	770	47,000	-
Antimony	**10B**	**6B**	60ND	60ND	60ND	**165**	3
Arsenic	**144**	**167**	10ND	10ND	10ND	**145**	25
Barium	**1,840**	**2,110**	20B	420	60B	**2,310**	1,000
Beryllium	6.0	7.2	5.0ND	0.2B	5.0ND	5.4	-
Cadmium	**5.6**	**6.8**	5.0ND	0.3B	5.0ND	**7.7**	5
Calcium	381,000	443,000	222,000	265,000	24,100	340,000	-
Chromium	**229**	**271**	10ND	12	4B	**163**	50
Cobalt	60	72	50ND	50ND	50ND	47B	-
Copper	**2,050**	**2,440**	5B	32	8B	**11,700**	200
Iron	**140,000**	**165,000**	220	**44,700**	**1,300**	**127,000**	300
Lead	**14,100**	**16,500**	5B	**64**	8B	**11,700**	25
Magnesium	152,000	182,000	88,800	100,000	3,600B	78,100	-
Manganese	**3,840**	**4,380**	78	**1,270**	14B	**1,410**	300
Mercury	**1.87**	**8.93**	0.20B	0.21	0.02B	**15.1**	0.7
Nickel	**132**	**161**	40ND	7B	40ND	**209**	100
Potassium	23,000	27,600	12,400	27,500	4,200B	18,600	-
Selenium	**11B**	**16B**	6B	5B	35ND	**17B**	10
Silver	16	19	10ND	10ND	10ND	18	50
Sodium	**125,000**	**134,000**	**336,000**	**628,000**	**102,000**	**192,000**	20,000
Thallium	25ND	25ND	25ND	25ND	25ND	25ND	-
Vanadium	252	296	50B	12B	50B	170	-
Zinc	3,080	3,660	143	286	915	7,030	-
Total Cyanide	0.010ND	0.010ND	0.010ND	0.010ND	0.010ND	NA	200

Notes:

1. NA = Not analyzed, ND = Less than laboratory detection limits, B = metal detected in blank, - = No standard. **Concentration in bold type indicates detection above New York State Department of Environmental Conservation groundwater standards.**
2. Concentrations of metals are expressed in parts per billion (ppb) equivalent to ug/l.
3. Samples collected by GeoQuest Environmental, Inc. on July 27,2009, analyzed by Columbia Analytical Services, Rochester, New York (Lab ID # 10145).
4. NYSDEC groundwater standards 703.5 and June 1998 Division of Technical and Operational guidance series T.O.G.S. 1.1.1 and as amended April 2000.

GeoQuest Environmental, Inc.

TABLE 2.1 Groundwater Sample Analysis Summary
Metals and Total Cyanide

Volunteers of America of Western New York
214 Lake Avenue Rochester, New York

Metals and Cyanide Page 4 of 5	VOAMW-104 (7/27/09)	VOAMW-105 (7/27/09)	VOAMW-106 (7/27/09)	NYSDEC Groundwater Standards
Aluminum	18,800	170,000	36,900	-
Antimony	60ND	60ND	9B	3
Arsenic	**29**	**102**	**44**	25
Barium	450	320	790	1,000
Beryllium	0.9B	8.9	1.6B	-
Cadmium	1.2B	3.7B	4.5B	5
Calcium	350,000	1,820,000	229,000	-
Chromium	37	**177**	**118**	50
Cobalt	9B	74	19B	-
Copper	**204**	**204**	**1,040**	200
Iron	**104,000**	**210,000**	**60,000**	300
Lead	**364**	**327**	**2,010**	25
Magnesium	81,900	761,000	76,000	-
Manganese	**1,260**	**3,810**	**1,690**	300
Mercury	0.53	0.20ND	**1.24**	0.7
Nickel	26B	**171**	57	100
Potassium	16,600	83,500	23,200	-
Selenium	4B	35ND	12B	10
Silver	10ND	10ND	10ND	50
Sodium	**200,000**	**58,700**	**351,000**	20,000
Thallium	25ND	25ND	25ND	-
Vanadium	41B	180	81	-
Zinc	313	163	1,500	-
Total Cyanide	NA	NA	NA	200

Notes:

1. NA = Not analyzed, ND = Less than laboratory detection limits, B = metal detected in blank, - = No standard. **Concentration in bold type indicates detection above New York State Department of Environmental Conservation groundwater standards.**
2. Concentrations of metals are expressed in parts per billion (ppb) equivalent to ug/l.
3. Samples collected by GeoQuest Environmental, Inc. on July 27, 2009, analyzed by Columbia Analytical Services, Rochester, New York (Lab ID # 10145).
4. NYSDEC groundwater standards 703.5 and June 1998 Division of Technical and Operational guidance series T.O.G.S. 1.1.1 and as amended April 2000.

GeoQuest
Environmental, Inc.

TABLE 2.1 Groundwater Sample Analysis Summary

Metals

Volunteers of America of Western New York – Supplemental Investigation
214 Lake Avenue Rochester, New York

Metals Page 5 of 5	**MW-107 ppb**	**NYSDEC Groundwater Standards (ppb)**
Aluminum	52,100	--
Antimony	**154**	3
Arsenic	**160**	25
Barium	**1,370**	1,000
Beryllium	ND<5.0	--
Cadmium	**6.2**	5
Calcium	393,000	--
Chromium	**319**	50
Cobalt	ND<50.0	--
Copper	**1,360**	200
Iron	**127,000**	300
Lead	**4,230**	25
Magnesium	101,000	--
Manganese	**1,920**	300
Mercury	**29.2**	0.7
Nickel	**209**	100
Potassium	20,200	--
Selenium	**21.8**	10
Silver	ND<10.0	50
Sodium	**178,000**	20,000
Thallium	ND<10.0	--
Vanadium	161	--
Zinc	3,420	--

Notes:

1. NA = Not analyzed, ND = Less than laboratory detection limits, B = metal detected in blank, -- = No standard. **Concentration in shaded background and bold type indicates detection above New York State Department of Environmental Conservation Part 703.5 GA Groundwater Quality Standards and June 1998 Division of Technical and Operational Guidance Series T.O.G.S. 1.1.1 and as amended April 2000.**
2. Concentrations are expressed in parts per billion (ppb) equivalent to ug/L.
3. Sample collected by Bergmann Associates, Inc. on November 4, 2010 and analyzed by Columbia Analytical Services, Rochester, New York (Lab ID # 10145).

TABLE 2.2 Groundwater Sample Analysis Summary
Semi-Volatile Organic Compounds – Method OLM 4.2

Volunteers of America of Western New York
214 Lake Avenue Rochester, New York

Semi-volatile Organic Compounds Page 1 of 4	**VOAMW - 101** **10/30/08**	**VOAMWR - 101** **10/30/08**	**VOAMW - 102** **10/31/08**	**VOAMWR - 102** **10/31/08**	**VOAMW – 103** **10/31/08**	**VOAMW – 104** **10/30/08**	**NYSDEC** **Groundwater Standards**
Acenaphthene	9ND	9ND	9ND	9ND	**2.0J**	9ND	20
Acenaphthylene	9ND	9ND	9ND	9ND	9ND	9ND	-
Acetophenone	9ND	9ND	9ND	9ND	9ND	9ND	-
Anthracene	**1.0J**	9ND	9ND	9ND	9ND	9ND	50
Atrazine	9ND	9ND	9ND	9ND	9ND	9ND	7.5
Benzaldehyde	9ND	9ND	9ND	9ND	9ND	9ND	-
Benzo (a) Anthracene	**2.0J**	9ND	9ND	9ND	**1.0J**	**1.0J**	0.002
Benzo (a) Pyrene	**2.0J**	9ND	9ND	9ND	**2.0J**	**1.0J**	ND
Benzo (b) Fluoranthene	**1.0J**	9ND	9ND	9ND	**1.0J**	**1.0J**	0.002
Benzo (g,h,i) Perylene	**1.0J**	9ND	9ND	9ND	**2.0J**	9ND	-
Benzo (k) Fluoranthene	**1.0J**	9ND	9ND	9ND	9ND	9ND	0.002
Biphenyl	9ND	9ND	9ND	9ND	9ND	9ND	-
Butyl Benzyl Phthalate	9ND	9ND	9ND	9ND	9ND	9ND	50
Di-N-Butylphthalate	**3.0JB**	**3.0JB**	**3.0JB**	**3.0JB**	**3.0JB**	**3.0JB**	50
Caprolactam	24ND	**3.0J**	9ND	9ND	**8.0J**	9ND	-
Carbazole	9ND	9ND	9ND	9ND	9ND	9ND	-
Indeno (1,2,3-cd) Pyrene	**1.0J**	9ND	9ND	9ND	**1.0J**	9ND	0.002
4-Chloroaniline	9ND	9ND	9ND	9ND	9ND	9ND	5.0
Bis (-2-Chloroethoxy) Methane	9ND	9ND	9ND	9ND	9ND	9ND	5.0
Bis (-2-Chloroethyl) Ether	9ND	9ND	9ND	9ND	9ND	9ND	1.0
2-Chloronaphthalene	9ND	9ND	9ND	9ND	9ND	9ND	10
2-Chlorophenol	9ND	9ND	9ND	9ND	9ND	9ND	1.0
2,2'- Oxybis (1-Chloropropane)	9ND	9ND	9ND	9ND	9ND	9ND	5.0
Chrysene	**2.0J**	9ND	9ND	9ND	**1.0J**	**1.0J**	0.002
Dibenz (a,h) Anthracene	9ND	9ND	9ND	9ND	9ND	9ND	-
Dibenzofuran	9ND	9ND	9ND	9ND	**2.0J**	9ND	-
3,3'- Dichlorobenzidine	9ND	9ND	9ND	9ND	9ND	9ND	5.0
2,4- Dichlorophenol	9ND	9ND	9ND	9ND	9ND	9ND	1.0
Diethylphthalate	9ND	9ND	9ND	9ND	9ND	9ND	50
Dimethyl Phthalate	9ND	9ND	9ND	9ND	9ND	9ND	50
2,4- Dimethylphenol	24ND	24ND	24ND	24ND	**1.0J**	9ND	1.0
2,4- Dinitrophenol	9ND	9ND	9ND	9ND	9ND	9ND	1.0
2,4- Dinitrotoluene	9ND	9ND	9ND	9ND	9ND	9ND	5.0
2,6- Dinitrotoluene	9ND	9ND	9ND	9ND	9ND	9ND	5.0
Bis (2-Ethylhexyl) Phthalate	**2.0JB**	**4.0JB**	**3.0JB**	**9.0JB**	**4.0JB**	**3.0JB**	5.0

TABLE 2.2 Groundwater Sample Analysis Summary
Semi-Volatile Organic Compounds – Method OLM 4.2

Volunteers of America of Western New York
214 Lake Avenue Rochester, New York

Semi – volatile Organic Compounds Page 2 of 4	**VOAMW - 101** **10/30/08**	**VOAMWR - 101** **10/30/08**	**VOAMW - 102** **10/31/08**	**VOAMWR - 102** **10/31/08**	**VOAMW – 103** **10/31/08**	**VOAMW – 104** **10/30/08**	**NYSDEC** **Groundwater Standards**
Fluoranthene	**4.0J**	9ND	9ND	9ND	9ND	**2.0J**	50
Fluorene	9ND	9ND	9ND	9ND	9ND	9ND	50
Hexachlorobenzene	9ND	9ND	9ND	9ND	9ND	9ND	0.04
Hexachlorobutadiene	9ND	9ND	9ND	9ND	9ND	9ND	0.5
Hexachlorocyclopentadiene	9ND	9ND	9ND	9ND	9ND	9ND	5.0
Hexachloroethane	9ND	9ND	9ND	9ND	9ND	9ND	5.0
Isophorone	9ND	9ND	9ND	9ND	9ND	9ND	5.0
2- Methylnaphthalene	9ND	9ND	9ND	9ND	**2.0J**	9ND	-
4,6- Dinitro-2- Methylphenol	24ND	24ND	24ND	24ND	24ND	9ND	1.0
4- Chloro-3- Methylphenol	9ND	9ND	9ND	9ND	9ND	9ND	1.0
2- Methylphenol	9ND	9ND	9ND	9ND	9ND	9ND	1.0
4- Methylphenol	**36.0**	9ND	9ND	9ND	**3.0J**	**1.0J**	1.0
Naphthalene	**2.0J**	9ND	9ND	9ND	**6.0J**	9ND	10
2- Nitroaniline	24ND	24ND	24ND	24ND	24ND	24ND	5.0
3- Nitroaniline	24ND	24ND	24ND	24ND	24ND	24ND	5.0
4- Nitroaniline	24ND	24ND	24ND	24ND	24ND	24ND	5.0
Nitrobenzene	9ND	9ND	9ND	9ND	9ND	9ND	0.4
2- Nitrophenol	9ND	9ND	9ND	9ND	9ND	9ND	1.0
4- Nitrophenol	24ND	24ND	24ND	24ND	24ND	24ND	1.0
N- Nitrosodiphenylamine	9ND	9ND	9ND	9ND	9ND	9ND	50
Di-n-octyl Phthalate	9ND	9ND	9ND	9ND	9ND	9ND	50
Pentachlorophenol	24ND	24ND	24ND	24ND	24ND	24ND	5.0
Phenanthrene	**4.0J**	9ND	9ND	9ND	**3.0J**	**1.0J**	5.0
Phenol	**6.0J**	9ND	9ND	9ND	**2.0J**	9ND	1.0
4- Bromophenyl- Phenylether	9ND	9ND	9ND	9ND	9ND	9ND	-
4- Chlorophenyl- Phenylether	9ND	9ND	9ND	9ND	9ND	9ND	-
N- nitroso-di-n- Propylamine	9ND	9ND	9ND	9ND	9ND	9ND	-
Pyrene	**3.0J**	9ND	9ND	9ND	**2.0J**	**2.0J**	5.0
2,4,6- Trichlorophenol	9ND	9ND	9ND	9ND	9ND	9ND	1.0
2,4,5- Trichlorophenol	24ND	24ND	24ND	24ND	24ND	24ND	1.0
Total TICs Concentration and Number of TICs Detected	**53.0J,JB (16)**	**8.0 J,JB (3)**	**12.0 J,JB,JN (5)**	**2.0JB (1)**	**18.0 J,JB,JN (7)**	**40.0 J,JB,JN (8)**	NA

Notes: Groundwater samples collected on October 300, 2008 and October 31, 2008 by GeoQuest Environmental, Inc. concentrations expressed in parts per billion (ppb). Bold type indicates concentration above the laboratory detection limit and shaded concentrations exceed NYSDEC Groundwater standard. See laboratory case narrative page 3 for **J**, **JN, JB** estimated values. - = No standard, ND = non detection above limits. NYSDEC groundwater standards 703.5 and June 1998 Division of Technical and Operational guidance series T.O.G.S. 1.1.1 and as amended April 2000.

TABLE 2.2 Groundwater Sample Analysis Summary

Semi-Volatile Organic Compounds – Method OLM 4.2

Volunteers of America of Western New York
214 Lake Avenue Rochester, New York

Semi-volatile Organic Compounds Page 3 of 4	VOAMW - 105 10/31/08	VOAMW - 105 10/30/08 dup.	VOAMW - 106 10/30/08	NYSDEC Groundwater Standards
Acenaphthene	9ND	9ND	**3.0J**	20
Acenaphthylene	9ND	9ND	9ND	-
Acetophenone	9ND	9ND	9ND	-
Anthracene	9ND	9ND	**4.0J**	50
Atrazine	9ND	9ND	9ND	7.5
Benzaldehyde	9ND	9ND	9ND	-
Benzo (a) Anthracene	9ND	9ND	**10.0J**	0.002
Benzo (a) Pyrene	9ND	9ND	**10.0J**	ND
Benzo (b) Fluoranthene	9ND	9ND	**7.0J**	0.002
Benzo (g,h,i) Perylene	9ND	9ND	**6.0J**	-
Benzo (k) Fluoranthene	9ND	9ND	**8.0J**	0.002
Biphenyl	9ND	9ND	9ND	-
Butyl Benzyl Phthalate	9ND	9ND	9ND	50
Di-N-Butylphthalate	**2.0JB**	**3.0JB**	**3.0JB**	50
Caprolactam	24ND	24ND	24ND	-
Carbazole	9ND	9ND	9ND	-
Indeno (1,2,3-cd) Pyrene	9ND	9ND	**5.0J**	0.002
4-Chloroaniline	9ND	9ND	9ND	5.0
Bis (-2-Chloroethoxy) Methane	9ND	9ND	9ND	5.0
Bis (-2-Chloroethyl) Ether	9ND	9ND	9ND	1.0
2-Chloronaphthalene	9ND	9ND	9ND	10
2-Chlorophenol	9ND	9ND	9ND	1.0
2,2'- Oxybis (1-Chloropropane)	9ND	9ND	9ND	5.0
Chrysene	9ND	9ND	**9.0J**	0.002
Dibenz (a,h) Anthracene	9ND	9ND	9ND	-
Dibenzofuran	9ND	9ND	9ND	-
3,3'- Dichlorobenzidine	9ND	9ND	9ND	5.0
2,4- Dichlorophenol	9ND	9ND	9ND	1.0
Diethylphthalate	9ND	9ND	9ND	50
Dimethyl Phthalate	9ND	9ND	9ND	50
2,4- Dimethylphenol	24ND	24ND	24ND	1.0
2,4- Dinitrophenol	9ND	9ND	9ND	1.0
2,4- Dinitrotoluene	9ND	9ND	9ND	5.0
2,6- Dinitrotoluene	9ND	9ND	9ND	5.0
Bis (2-Ethylhexyl) Phthalate	**2.0JB**	**2.0JB**	**5.0JB**	5.0

TABLE 2.2 Groundwater Sample Analysis Summary
Semi-Volatile Organic Compounds – Method OLM 4.2

Volunteers of America of Western New York
214 Lake Avenue Rochester, New York

Semi – volatile Organic Compounds Page 4 of 4	**VOAMW - 105** **10/31/08**	**VOAMW - 105** **10/31/08 dup.**	**VOAMW - 106** **10/30/08**	**NYSDEC** **Groundwater Standards**
Fluoranthene	9ND	9ND	**22.0**	50
Fluorene	9ND	9ND	**3.0J**	50
Hexachlorobenzene	9ND	9ND	9ND	0.04
Hexachlorobutadiene	9ND	9ND	9ND	0.5
Hexachlorocyclopentadiene	9ND	9ND	9ND	5.0
Hexachloroethane	9ND	9ND	9ND	5.0
Isophorone	9ND	9ND	9ND	5.0
2- Methylnaphthalene	9ND	9ND	9ND	-
4,6- Dinitro-2- Methylphenol	24ND	24ND	24ND	1.0
4- Chloro-3- Methylphenol	9ND	9ND	9ND	1.0
2- Methylphenol	9ND	9ND	9ND	1.0
4- Methylphenol	9ND	9ND	9ND	1.0
Naphthalene	9ND	9ND	**4.0J**	10
2- Nitroaniline	24ND	24ND	24ND	5.0
3- Nitroaniline	24ND	24ND	24ND	5.0
4- Nitroaniline	24ND	24ND	24ND	5.0
Nitrobenzene	9ND	9ND	9ND	0.4
2- Nitrophenol	9ND	9ND	9ND	1.0
4- Nitrophenol	24ND	24ND	24ND	1.0
N- Nitrosodiphenylamine	9ND	9ND	9ND	50
Di-n-octyl Phthalate	9ND	9ND	9ND	50
Pentachlorophenol	24ND	24ND	24ND	5.0
Phenanthrene	9ND	**2.0J**	**11.0J**	5.0
Phenol	9ND	9ND	9ND	1.0
4- Bromophenyl- Phenylether	9ND	9ND	9ND	-
4- Chlorophenyl- Phenylether	9ND	9ND	9ND	-
N- nitroso-di-n- Propylamine	9ND	9ND	9ND	-
Pyrene	9ND	9ND	**18.0J**	5.0
2,4,6- Trichlorophenol	9ND	9ND	9ND	1.0
2,4,5- Trichlorophenol	24ND	24ND	24ND	1.0
Total TICs Concentration and Number of TICs Detected	**2.0 JB (1)**	**9.0 J,JB,JN (4)**	**60.0 J,JB,JN, (9)**	NA

Notes: Groundwater samples collected on October 30, 2008 and October 31, 2008 by GeoQuest Environmental, Inc.
All concentrations expressed in parts per billion (ppb). Bold type indicates concentration above the laboratory detection limit and shaded concentrations exceed NYSDEC groundwater standard. See laboratory case narrative page 3 for **J**, **JN, JB** estimated values. - = No standard, ND = non-detection above detection limits.
NYSDEC groundwater standards 703.5 and June 1998 Division of Technical and Operational guidance series T.O.G.S. 1.1.1 and as amended April 2000.

TABLE 2.3 Groundwater Analysis Summary

Volatile Organic Compounds – Method OLM

Volunteers of America of Western New York
214 Lake Avenue Rochester, New York

VOC – 8260 Compounds Page 1 of 8	**VOAMW-101 (10/30/08)**	**VOAMWR-101 (10/30/08)**	**VOAMW-102 (10/31/08)**	**VOAMWR-102 (10/31/08)**	**VOAMW-103 (10/31/08)**	**VOAMW-104 (10/30/08)**	**NYDEC Groundwater Standard**
Acetone	**2.0JB**	10ND	10ND	**1.0JB**	**2.0JB**	**1.0JB**	50
Benzene	10ND	10ND	10ND	10ND	10ND	10ND	0.7
Bromodichloromethane	10ND	**3.0J**	10ND	10ND	10ND	10ND	50
Bromoform	10ND	10ND	10ND	10ND	10ND	10ND	50
Bromomethane	10ND	10ND	10ND	10ND	10ND	10ND	5
2- Butanone (MEK)	10ND	10ND	10ND	10ND	10ND	10ND	50
Methyl Tert- Butyl Ether	10ND	10ND	10ND	**31.0**	10ND	10ND	10
Carbon Disulfide	10ND	10ND	10ND	**0.9J**	10ND	10ND	5
Carbon Tetrachloride	10ND	10ND	10ND	10ND	10ND	10ND	5
Chlorobenzene	10ND	10ND	10ND	10ND	10ND	10ND	5
Chloroethane	10ND	10ND	10ND	10ND	10ND	10ND	5
Chloroform	10ND	**6.0J**	10ND	10ND	10ND	10ND	7
Chloromethane	10ND	10ND	10ND	10ND	10ND	10ND	5
1,2- Dibromo-3- Chloropropane	10ND	10ND	10ND	10ND	10ND	10ND	-
Cyclohexane	10ND	10ND	10ND	10ND	10ND	10ND	-
Dibromochloromethane	10ND	**1.0J**	10ND	10ND	10ND	10ND	50
1,2- Dibromoethane	10ND	10ND	10ND	10ND	10ND	10ND	0.6
1,2- Dichlorobenzene	10ND	10ND	10ND	10ND	10ND	10ND	3
1,4- Dichlorobenzene	10ND	10ND	10ND	10ND	10ND	10ND	3
1,3- Dichlorobenzene	10ND	10ND	10ND	10ND	10ND	10ND	3
Dichlorodifluoromethane	10ND	10ND	10ND	10ND	10ND	10ND	-
1,1- Dichloroethane	10ND	10ND	10ND	10ND	10ND	**0.7J**	5
1,2- Dichloroethane	10ND	10ND	10ND	10ND	10ND	10ND	5
1,1- Dichloroethene	10ND	10ND	10ND	10ND	10ND	10ND	5
Trans-1,2- Dichloroethene	10ND	10ND	10ND	10ND	10ND	10ND	5
Cis-1,2-Dichloroethene	10ND	10ND	10ND	**1.0J**	10ND	10ND	5
1,2- Dichloropropane	10ND	10ND	10ND	10ND	10ND	10ND	5
Trans-1,3- Dichloropropene	10ND	10ND	10ND	10ND	10ND	10ND	5
Cis-1,3- Dichloropropene	10ND	10ND	10ND	10ND	10ND	10ND	5
Ethylbenzene	10ND	10ND	10ND	10ND	10ND	10ND	5
2- Hexanone	10ND	10ND	10ND	10ND	10ND	10ND	50
Isopropylbenzene	10ND	10ND	10ND	10ND	10ND	10ND	-
Methyl Acetate	10ND	10ND	10ND	10ND	10ND	10ND	-
Methylcyclohexane	10ND	**0.4J**	**3.0J**	10ND	10ND	10ND	-
Methylene Chloride	10ND	10ND	10ND	10ND	10ND	10ND	5
4- Methyl-2- Pentanone	10ND	10ND	10ND	10ND	10ND	10ND	5

TABLE 2.2 Groundwater Sample Analysis Summary

Volatile Organic Compounds – Method OLM

Volunteers of America of Western New York
214 Lake Avenue Rochester, New York

VOC – 8260 Compounds Page 2 of 8	**VOAMW-101 (10/30/08)**	**VOAMWR-101 (10/30/08)**	**VOAMW-102 (10/31/08)**	**VOAMWR-102 (10/31/08)**	**VOAMW-103 (10/31/08)**	**VOAMW-104 (10/30/08)**	**NYSDEC Groundwater Standard**
Styrene	10ND	10ND	10ND	10ND	10ND	10ND	5
1,1,2,2- Tetrachloroethane	10ND	10ND	10ND	10ND	10ND	10ND	5
Tetrachloroethene	10ND	10ND	10ND	10ND	10ND	10ND	5
Toluene	10ND	10ND	10ND	10ND	10ND	10ND	5
1,2,4- Trichlorobenzene	10ND	10ND	10ND	10ND	10ND	10ND	-
1,1,1- Trichloroethane	10ND	10ND	10ND	10ND	10ND	10ND	5
1,1,2- Trichloroethane	10ND	10ND	10ND	10ND	10ND	10ND	5
Trichloroethene	10ND	10ND	10ND	10ND	10ND	10ND	5
Trichlorofluoromethane	10ND	10ND	10ND	10ND	10ND	10ND	-
1,1,2-Trichloro-1,2,2- Trifluoroeth	10ND	10ND	10ND	10ND	10ND	10ND	-
Vinyl Chloride	10ND	10ND	10ND	10ND	10ND	10ND	2
M+P- Xylene	10ND	10ND	**0.3J**	10ND	10ND	10ND	5
O- Xylene	10ND	10ND	10ND	10ND	10ND	10ND	5
Tentatively Indentified Compounds Total and number detected	ND	ND	**39J,JN (5)**	**8J (1)**	ND	ND	NA

Notes:

1. NA = Not Applicable, ND = Less than laboratory detection limits, J = estimated value, JB = estimated value and compound detected in blank, concentrations shown in bold type indicate detection above laboratory limits. Concentrations in bold type and shaded exceed the NYSDEC groundwater standards.
2. - = No standards available and ND = non detection above the laboratory limits.
3. Concentrations are expressed in parts per billion (ppb) equivalent to ug/l.
4. Samples collected by GeoQuest Environmental, Inc. on October 30, 2008 and October 31, 2008 and analyzed by Columbia Analytical Services, Rochester, New York (Lab ID # 10145).
5. NYSDEC groundwater standards 703.5 and June 1998 Division of Technical and Operational guidance series T.O.G.S. 1.1.1 and as amended April 2000.

TABLE 2.2 Groundwater Analysis Summary
Volatile Organic Compounds – Method OLM

Volunteers of America of Western New York
214 Lake Avenue Rochester, New York

VOC – 8260 Compounds Page 3 of 8	**VOAMW-105 (10/31/08)**	**VOAMW-105 (10/31/08)dup.**	**VOAMW-106 (10/30/08)**	**TRIP BLANK (10/30/08)**	**NYDEC Groundwater Standard**
Acetone	10ND	10ND	**2.0JB**	**0.7JB**	50
Benzene	10ND	10ND	10ND	10ND	0.7
Bromodichloromethane	10ND	10ND	10ND	10ND	50
Bromoform	10ND	10ND	10ND	10ND	50
Bromomethane	10ND	10ND	10ND	10ND	5
2- Butanone (MEK)	10ND	10ND	10ND	10ND	50
Methyl Tert- Butyl Ether	10ND	10ND	10ND	10ND	10
Carbon Disulfide	10ND	10ND	10ND	10ND	5
Carbon Tetrachloride	10ND	10ND	10ND	10ND	5
Chlorobenzene	10ND	10ND	**2.0J**	10ND	5
Chloroethane	10ND	10ND	10ND	10ND	5
Chloroform	10ND	10ND	10ND	10ND	7
Chloromethane	10ND	10ND	10ND	10ND	5
1,2- Dibromo-3- Chloropropane	10ND	10ND	10ND	10ND	-
Cyclohexane	10ND	10ND	10ND	10ND	-
Dibromochloromethane	10ND	10ND	10ND	10ND	50
1,2- Dibromoethane	10ND	10ND	10ND	10ND	0.6
1,2- Dichlorobenzene	10ND	10ND	**0.4J**	10ND	3
1,4- Dichlorobenzene	10ND	10ND	10ND	10ND	3
1,3- Dichlorobenzene	10ND	10ND	10ND	10ND	3
Dichlorodifluoromethane	10ND	10ND	10ND	10ND	-
1,1- Dichloroethane	10ND	10ND	10ND	10ND	5
1,2- Dichloroethane	10ND	10ND	10ND	10ND	5
1,1- Dichloroethene	10ND	10ND	10ND	10ND	5
Trans-1,2- Dichloroethene	10ND	10ND	10ND	10ND	5
Cis-1,2-Dichloroethene	10ND	10ND	10ND	10ND	5
1,2- Dichloropropane	10ND	10ND	10ND	10ND	5
Trans-1,3- Dichloropropene	10ND	10ND	10ND	10ND	5
Cis-1,3- Dichloropropene	10ND	10ND	10ND	10ND	5
Ethylbenzene	10ND	10ND	10ND	10ND	5
2- Hexanone	10ND	10ND	10ND	10ND	50
Isopropylbenzene	10ND	10ND	10ND	10ND	-
Methyl Acetate	10ND	10ND	10ND	10ND	-
Methylcyclohexane	**0.3J**	**0.4J**	10ND	10ND	-
Methylene Chloride	10ND	10ND	10ND	10ND	5
4- Methyl-2- Pentanone	10ND	10ND	10ND	10ND	5

TABLE 2.2 Groundwater Analysis Summary
Volatile Organic Compounds – Method OLM

Volunteers of America of Western New York
214 Lake Avenue Rochester, New York

VOC – 8260 Compounds Page 4 of 8	**VOAMW-105 (10/31/08)**	**VOAMW-105 (10/31/08)dup.**	**VOAMW-106 (10/30/08)**	**TRIP BLANK (10/30/08)**	**NYSDEC Groundwater Standard**
Styrene	10ND	10ND	10ND	10ND	5
1,1,2,2- Tetrachloroethane	10ND	10ND	10ND	10ND	5
Tetrachloroethene	10ND	10ND	10ND	10ND	5
Toluene	**0.3J**	**0.4J**	10ND	10ND	5
1,2,4- Trichlorobenzene	10ND	10ND	10ND	10ND	-
1,1,1- Trichloroethane	10ND	10ND	10ND	10ND	5
1,1,2- Trichloroethane	10ND	10ND	10ND	10ND	5
Trichloroethene	10ND	10ND	10ND	10ND	5
Trichlorofluoromethane	10ND	10ND	10ND	10ND	-
1,1,2-Trichloro-1,2,2- Trifluoroeth	10ND	10ND	10ND	10ND	-
Vinyl Chloride	10ND	10ND	10ND	10ND	2
M+P- Xylene	10ND	10ND	10ND	10ND	5
O- Xylene	10ND	10ND	10ND	10ND	5
Tentatively Indentified Compounds Total and number detected	ND	ND	ND	ND	NA

Notes:

1. NA = Not Applicable, ND = Less than laboratory detection limits, J = estimated value, JB = estimated value and compound detected in blank, concentrations shown in bold type indicate detection above laboratory detection limits. Concentrations in bold type and shaded exceed the NYSDEC groundwater standard.
2. - = No standards available and ND = non detection above the laboratory detection limits.
3. Concentrations are expressed in parts per billion (ppb) equivalent to ug/l.
4. Samples collected by GeoQuest Environmental, Inc. on October 30, 2008 and October 31, 2008 and analyzed by Columbia Analytical Services, Rochester, New York (Lab ID # 10145).
5. NYSDEC groundwater standards 703.5 and June 1998 Division of Technical and Operational guidance series T.O.G.S. 1.1.1 and as amended April 2000.

TABLE 2.2 Groundwater Analysis Summary
Volatile Organic Compounds – Method OLM

Volunteers of America of Western New York
214 Lake Avenue Rochester, New York

VOC – 8260 Compounds Page 5 of 8	**VOAMW-101 (7/27/09)**	**VOAMW-101Duplicate (7/27/09)**	**VOAMWR-101 (7/27/09)**	**VOAMW-102 (7/27/09)**	**VOAMWR-102 (7/27/09)**	**VOAMW-103 (7/27/09)**	**VOAMW-104 (7/27/09)**	**NYDEC Groundwater Standard**
Acetone	**1.4J**	**3.6J**	**2.1J**	**4.2J**	**2.0J**	**1.3J**	**1.3J**	50
Benzene	10ND	10ND	10ND	10ND	10ND	10ND	10ND	0.7
Bromodichloromethane	10ND	10ND	10ND	10ND	10ND	10ND	10ND	50
Bromoform	10ND	10ND	10ND	10ND	10ND	10ND	10ND	50
Bromomethane	10ND	10ND	10ND	10ND	10ND	10ND	10ND	5
2- Butanone (MEK)	10ND	10ND	10ND	10ND	10ND	10ND	10ND	50
Methyl Tert- Butyl Ether	10ND	10ND	**1.7J**	10ND	10ND	10ND	10ND	10
Carbon Disulfide	10ND	10ND	10ND	10ND	**0.38J**	10ND	10ND	5
Carbon Tetrachloride	10ND	10ND	10ND	10ND	10ND	10ND	10ND	5
Chlorobenzene	10ND	10ND	10ND	10ND	10ND	10ND	10ND	5
Chloroethane	10ND	10ND	10ND	10ND	10ND	10ND	10ND	5
Chloroform	10ND	10ND	10ND	10ND	10ND	10ND	10ND	7
Chloromethane	10ND	10ND	10ND	10ND	10ND	10ND	10ND	5
1,2- Dibromo-3- Chloropropane	10ND	10ND	10ND	10ND	10ND	10ND	10ND	-
Cyclohexane	10ND	10ND	10ND	10ND	10ND	10ND	10ND	-
Dibromochloromethane	10ND	10ND	10ND	10ND	10ND	10ND	10ND	50
1,2- Dibromoethane	10ND	10ND	10ND	10ND	10ND	10ND	10ND	0.6
1,2- Dichlorobenzene	10ND	10ND	10ND	10ND	10ND	10ND	10ND	3
1,4- Dichlorobenzene	10ND	10ND	10ND	10ND	10ND	10ND	10ND	3
1,3- Dichlorobenzene	10ND	10ND	10ND	10ND	10ND	10ND	10ND	3
Dichlorodifluoromethane	10ND	10ND	10ND	10ND	10ND	10ND	10ND	-
1,1- Dichloroethane	10ND	10ND	**0.91J**	10ND	10ND	10ND	**0.68J**	5
1,2- Dichloroethane	10ND	10ND	10ND	10ND	10ND	10ND	10ND	5
1,1- Dichloroethene	10ND	10ND	10ND	10ND	10ND	10ND	10ND	5
Trans-1,2- Dichloroethene	10ND	10ND	**0.35J**	10ND	10ND	10ND	10ND	5
Cis-1,2-Dichloroethene	10ND	10ND	**8.2J**	10ND	10ND	10ND	10ND	5
1,2- Dichloropropane	10ND	10ND	10ND	10ND	10ND	10ND	10ND	5
Trans-1,3- Dichloropropene	10ND	10ND	10ND	10ND	10ND	10ND	10ND	5
Cis-1,3- Dichloropropene	10ND	10ND	10ND	10ND	10ND	10ND	10ND	5
Ethylbenzene	10ND	10ND	10ND	10ND	10ND	10ND	10ND	5
2- Hexanone	10ND	10ND	10ND	10ND	10ND	10ND	10ND	50
Isopropylbenzene	10ND	10ND	10ND	10ND	10ND	10ND	10ND	-
Methyl Acetate	10ND	10ND	10ND	10ND	10ND	10ND	10ND	-
Methylcyclohexane	10ND	10ND	10ND	10ND	10ND	10ND	10ND	-
Methylene Chloride	10ND	10ND	10ND	10ND	10ND	10ND	10ND	5
4- Methyl-2- Pentanone	10ND	10ND	10ND	10ND	10ND	10ND	10ND	5

TABLE 2.2 Groundwater Analysis Summary
Volatile Organic Compounds – Method OLM

Volunteers of America of Western New York
214 Lake Avenue Rochester, New York

VOC – 8260 Compounds Page 6 of 8	**VOAMW-101 (7/27/09)**	**VOAMW-101 Duplicate (7/27/09)**	**VOAMWR-101 (7/27/09)**	**VOAMW-102 (7/27/09)**	**VOAMWR-102 (7/27/09)**	**VOAMW-103 (7/27/09)**	**VOAMW-104 (7/27/09)**	**NYSDEC Groundwater Standard**
Styrene	10ND	10ND	10ND	10ND	10ND	10ND	10ND	5
1,1,2,2- Tetrachloroethane	10ND	10ND	10ND	10ND	10ND	10ND	10ND	5
Tetrachloroethene	10ND	10ND	10ND	10ND	10ND	10ND	10ND	5
Toluene	10ND	10ND	10ND	10ND	10ND	10ND	10ND	5
1,2,4- Trichlorobenzene	10ND	10ND	10ND	10ND	10ND	10ND	10ND	-
1,1,1- Trichloroethane	10ND	10ND	10ND	10ND	10ND	10ND	10ND	5
1,1,2- Trichloroethane	10ND	10ND	10ND	10ND	10ND	10ND	10ND	5
Trichloroethene	10ND	10ND	10ND	10ND	10ND	10ND	10ND	5
Trichlorofluoromethane	10ND	10ND	10ND	10ND	10ND	10ND	10ND	-
1,1,2-Trichloro-1,2,2- Trifluoroeth	10ND	10ND	10ND	10ND	10ND	10ND	10ND	-
Vinyl Chloride	10ND	10ND	10ND	10ND	10ND	10ND	10ND	2
M+P- Xylene	10ND	10ND	10ND	10ND	10ND	10ND	10ND	5
O- Xylene	10ND	10ND	10ND	10ND	10ND	10ND	10ND	5
Tentatively Indentified Compounds Total and number detected	ND	ND	ND	**6.1JN (1)**	**9.4JN (1)**	ND	ND	NA

Notes:

1. NA = Not Applicable, ND = Less than laboratory detection limits, J = estimated value, JB = estimated value and compound detected in blank, concentrations shown in bold type indicate detection above laboratory limits. Concentrations in bold type and shaded exceed the NYSDEC groundwater standards.
2. - = No standards available and ND = non detection above the laboratory limits.
3. Concentrations are expressed in parts per billion (ppb) equivalent to ug/l.
4. Samples collected by GeoQuest Environmental, Inc. on July 27, 2009 and analyzed by Columbia Analytical Services, Rochester, New York (Lab ID # 10145).
5. NYSDEC groundwater standards 703.5 and June 1998 Division of Technical and Operational guidance series T.O.G.S. 1.1.1 and as amended April 2000.

TABLE 2.2 Groundwater Analysis Summary
Volatile Organic Compounds – Method OLM

Volunteers of America of Western New York
214 Lake Avenue Rochester, New York

VOC – 8260 Compounds Page 7 of 8	**VOAMW-105 (7/27/09)**	**VOAMW-106 (7/27/09)**	**NYDEC Groundwater Standard**
Acetone	**2.6J**	**1.5J**	50
Benzene	10ND	10ND	0.7
Bromodichloromethane	10ND	10ND	50
Bromoform	10ND	10ND	50
Bromomethane	10ND	10ND	5
2- Butanone (MEK)	10ND	10ND	50
Methyl Tert- Butyl Ether	10ND	**0.41J**	10
Carbon Disulfide	10ND	10ND	5
Carbon Tetrachloride	10ND	10ND	5
Chlorobenzene	10ND	**22**	5
Chloroethane	10ND	10ND	5
Chloroform	10ND	10ND	7
Chloromethane	10ND	10ND	5
1,2- Dibromo-3- Chloropropane	10ND	10ND	-
Cyclohexane	10ND	10ND	-
Dibromochloromethane	10ND	10ND	50
1,2- Dibromoethane	10ND	10ND	0.6
1,2- Dichlorobenzene	10ND	**1.7J**	3
1,4- Dichlorobenzene	10ND	**1.2J**	3
1,3- Dichlorobenzene	10ND	10ND	3
Dichlorodifluoromethane	10ND	10ND	-
1,1- Dichloroethane	10ND	**0.37J**	5
1,2- Dichloroethane	10ND	10ND	5
1,1- Dichloroethene	10ND	10ND	5
Trans-1,2- Dichloroethene	10ND	10ND	5
Cis-1,2-Dichloroethene	10ND	10ND	5
1,2- Dichloropropane	10ND	10ND	5
Trans-1,3- Dichloropropene	10ND	10ND	5
Cis-1,3- Dichloropropene	10ND	10ND	5
Ethylbenzene	10ND	10ND	5
2- Hexanone	10ND	10ND	50
Isopropylbenzene	10ND	10ND	-
Methyl Acetate	10ND	10ND	-
Methylcyclohexane	10ND	10ND	-
Methylene Chloride	10ND	10ND	5
4- Methyl-2- Pentanone	10ND	10ND	5

TABLE 2.2 Groundwater Analysis Summary
Volatile Organic Compounds – Method OLM

Volunteers of America of Western New York
214 Lake Avenue Rochester, New York

VOC – 8260 Compounds Page 8 of 8	**VOAMW-105 (7/27/09)**	**VOAMW-106 (7/27/09)**	**NYSDEC Groundwater Standard**
Styrene	10ND	10ND	5
1,1,2,2- Tetrachloroethane	10ND	10ND	5
Tetrachloroethene	10ND	10ND	5
Toluene	10ND	10ND	5
1,2,4- Trichlorobenzene	10ND	10ND	-
1,1,1- Trichloroethane	10ND	10ND	5
1,1,2- Trichloroethane	10ND	10ND	5
Trichloroethene	10ND	10ND	5
Trichlorofluoromethane	10ND	10ND	-
1,1,2-Trichloro-1,2,2- Trifluoroeth	10ND	10ND	-
Vinyl Chloride	10ND	10ND	2
M+P- Xylene	10ND	10ND	5
O- Xylene	10ND	10ND	5
Tentatively Indentified Compounds Total and number detected	ND	ND	NA

Notes:

1. NA = Not Applicable, ND = Less than laboratory detection limits, J = estimated value, JB = estimated value and compound detected in blank, concentrations shown in bold type indicate detection above laboratory limits. Concentrations in bold type and shaded exceed the NYSDEC groundwater standard.
2. - = No standards available and ND = non detection above the laboratory detection limits.
3. Concentrations are expressed in parts per billion (ppb) equivalent to ug/l.
4. Samples collected by GeoQuest Environmental, Inc. on July 27, 2009 and analyzed by Columbia Analytical Services, Rochester, New York (Lab ID # 10145).
5. NYSDEC groundwater standards 703.5 and June 1998 Division of Technical and Operational guidance series T.O.G.S. 1.1.1 and as amended April 2000.

TABLE 2.3 Metals Field Screen Results

Volunteers of America of Western New York - Supplemental Investigation
214 Lake Avenue Rochester, New York

Metals	**TP-128 (12 -14 ft.)**	**TP-129 (1.5 - 2 ft.)**	**TP-130 (18 -20 ft.)**	**TP-131 (8 -10 ft.)**	**TP-132 (4 -6 ft.)**	**TP-133 (6 -8 ft.)**	**TP-134 (18 -20 ft.)**
Arsenic	< LOD	34.86	< LOD	< LOD	< LOD	136.89	136.2
Chromium	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD	449.46
Copper	404.55	171.1	56.32	248.07	< LOD	< LOD	< LOD
Iron	22,981,7	54,621.32	31,522.28	18,236.69	14,422.69	73,483.41	60,796.38
Lead	358.36	192.04	71.09	281.46	87.77	< LOD	30.87
Manganese	1,395.45	562.11	< LOD	487.85	< LOD	< LOD	< LOD
Mercury	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD
Molybdenum	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD
Nickel	55.54	66.83	< LOD	189.88	< LOD	< LOD	98.37
Rubidium	34.38	26.35	42.51	38.28	33.11	30.49	37.8
Selenium	< LOD	8.83	< LOD	< LOD	< LOD	< LOD	< LOD
Strontium	96.53	87.95	61.73	102.58	125.28	145.82	146.17
Zinc	502.02	142.52	< LOD	95.75	< LOD	< LOD	< LOD
Zirconium	317.46	256.29	297.98	261.02	187.5	404.81	348.78

Notes:

1. Measurements were taken with an Olympus Innov-x DP-4000 hand held XRF Analyzer from random test pit soil screen depths intervals on October 25 and 26, 2010 for the purpose of field screening excavated soils.
2. There are no NYSDEC criteria for comparing these field screen results.
3. <LOD = non detection.

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TABLE 3

GROUNDWATER ELEVATION MEASUREMENTS

TABLE 3
Groundwater Elevation Measurements
Volunteers of America of Western New York
R1 Final Report
214 Lake Avenue
Rochester, NY

Well Name	Total Depth (ff)	Depth to Water 10/30-31/08	Depth to Water 3/22/2011	Depth to Water 07/27/2009	Saturated Thickness	GW Elev. 10/2008	GW Elev. 07/2009	GW Elev. 03/2011	Ref. Elev.
MW-101	30.0	24.38	24.37	24.48	5.63	457.51	457.41	457.52	481.89
MWR-101	54.5	24.69	24.68	24.80	29.82	457.15	457.04	457.16	481.84
MW-102	31.0	23.40	23.39	23.50	7.61	466.69	466.59	466.70	490.61
MWR-102	54.0	31.58	31.57	31.69	22.43	458.58	458.47	458.59	490.16
MW-103	44.0	43.03	43.02	43.14	0.98	443.45	443.34	443.46	486.48
MW-104	34.0	30.70	30.69	30.80	3.31	453.98	453.88	453.99	484.68
MW-105	28.0	18.30	18.29	18.41	9.71	465.83	465.72	465.84	484.13
MW-106	32.0	25.47	25.46	25.58	6.54	457.70	457.59	457.71	483.17
MW-107	44.0	43.20	43.19	--	0.81	--	--	443.30	486.49

TABLE 4

MONITORING WELL CONSTRUCTION DETAILS

TABLE 4
Monitoring Well Construction Details
VOA 214 lake Avenue- Back Lot Site
Site No. B828126
Rochester, NY

Well Name	Date of Well Installation	Total Depth (ft.)	Well Material	Top of Well Casing Reference Elevation, (ft.)	Approximate Depth to Groundwater	Well Screen Interval Below BGS	Ground Surface Elevation	Depth to Top of Bedrock	Type of Well
MW-101	7/2/2008	30.0	2" PVC	481.89	24.38	20.0 – 30.0 ft.	482.3	NA	Overburden
MWR-101	7/10/2008	54.5	2" PVC	481.84	24.69	44.5 – 54.5 ft.	482.2	44.5	Bedrock
MW-102	7/7/2008	31.0	2" PVC	490.61	23.40	21.0 – 31.0 ft.	490.6	NA	Overburden
MWR-102	7/8/2008	54.0	2" PVC	490.16	31.58	44.0 – 54.0 ft.	490.5	44.0	Bedrock
MW-103	7/2/2008	44.0	2" PVC	486.34	43.03	34.0 – 44.0 ft.	486.0	NA	Overburden
MW-105	6/27/2008	28.0	2" PVC	483.85	18.30	18.0 – 28.0 ft.	484.0	NA	Overburden
MW-106	6/27/2008	32.0	2" PVC	483.53	25.47	22.0 – 32.0 ft.	484.0	NA	Overburden
MW-107	10/27/2010	44.0	2" PVC	485.17	30.60	34.0 – 44.0 ft.	486.0	NA	Overburden

NOTES:

1) All measurements are in feet unless noted, see Appendix 10 in the Site Management Plan for monitoring well logs.
2) Below Ground Surface = BGS
3) NA = Not Encountered, monitoring well completed in overburden soils.

TABLE 5

REMEDIAL SYSTEM SAMPLING REQUIREMENTS

Table 5
Remedial System Sampling Requirements
Site C828126
VOA 214 Lake Avenue Back Lot Site
Rochester, New York

Site Groundwater Monitoring	System Equipment	Organization	Dates (MM/DD/YY)		Type of Test Required	Estimated Initial Event Date
			Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Quarterly groundwater monitoring 2018	None Sample site monitoring wells	Bergmann	3/15/18 6/15/18 9/15/18 12/15/18	4/15/18 7/15/18 10/15/18 1/15/19	• Groundwater testing in the QAAP • Submit Quarterly monitoring report to NYSDEC	3/15/18
Quarterly groundwater monitoring 2019	None Sample site monitoring wells	Bergmann	3/15/19 6/15/19 9/15/19 12/15/19	4/15/19 7/15/19 10/15/19 1/15/20	• Groundwater testing in the QAAP • Submit Quarterly monitoring report to NYSDEC	3/15/19
Quarterly groundwater monitoring 2020	None Sample site monitoring wells	Bergmann	3/15/20 6/15/20 9/15/20 12/15/20	4/15/20 7/15/20 10/15/20 1/15/21	• Groundwater testing in the QAAP • Submit Quarterly monitoring report to NYSDEC	3/15/20
Quarterly groundwater monitoring 2021	None Sample site monitoring wells	Bergmann	3/15/21 6/15/21 9/15/21 12/15/21	4/15/21 7/15/21 10/15/21 1/15/22	• Groundwater testing in the QAAP • Submit Quarterly monitoring report to NYSDEC	3/15/21
Quarterly groundwater monitoring 2022	None Sample site monitoring wells	Bergmann	3/15/22 6/15/22 9/15/22 12/15/22	4/15/22 7/15/22 10/15/22 1/15/23	• Groundwater testing in the QAAP • Submit Quarterly monitoring report to NYSDEC	3/15/22

Site Cover System Inspections	System Equipment	Organization	Dates (MM/DD/YY)		Type of Test Required	Estimated Initial Event Date
			Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Annual Inspection of Cover System 2018	None	Bergmann	3/15/2018	4/15/2018	• Visual Assessment • Recommendation for Repair • Submit Annual report to NYSDEC	3/15/18
Annual Inspection of Cover System 2019	None	Bergmann	3/15/2019	4/15/2019	• Visual Assessment • Recommendation for Repair • Submit Annual report to NYSDEC	3/15/19
Annual Inspection of Cover System 2020	None	Bergmann	3/15/2020	4/15/2020	• Visual Assessment • Recommendation for Repair • Submit Annual report to NYSDEC	3/15/20
Annual Inspection of Cover System 2021	None	Bergmann	3/15/2021	4/15/2021	• Visual Assessment • Recommendation for Repair • Submit Annual report to NYSDEC	3/15/21
Annual Inspection of Cover System 2022	None	Bergmann	3/15/2022	4/15/2022	• Visual Assessment • Recommendation for Repair • Submit Annual report to NYSDEC	3/15/22

TABLE 6

REPORTING SUMMARY AND SCHEDULE

Table 6
Reporting Summary and Schedule
Site C828126
VOA 214 Lake Avenue Back Lot
Rochester, New York

Report	Scheduled Events	Anticipated Date(s) of Initiation	Report Summary	Estimated Initial Event Date
Periodic Progress Report (Annual reporting)	Site inspection of Engineering controls cover system, security fencing	18 Months After COC Issued	• Summary for the quarterly monitoring results for the year. • Site inspection report of engineering controls	18 Months After COC Issued
Cover System Inspection	Annual	6 Months After COC issued	• Field inspection of cover system, storm water management system & site fencing (engineering controls) • Prepare Annual Maintenance Inspection Form • Describe maintenance, repairs and or modifications • Prepare Inspection report certified by a professional Engineer	6 Months After COC issued
Quarterly Groundwater Monitoring Events	20 Quarterly events are scheduled from 2018 through 2022	1st Quarter After COC Issued	• Summary of groundwater sampling event of 7 on-site monitoring wells. • pH (field) • Dissolved Oxygen (field) • Oxygen Reduction Potential (field) • presence of LNAPL • static water level • groundwater potentiometric contour map	1st Quarter After COC Issued

Note: Certificate of Completion = COC

FIGURES

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Figure 1
Project Site Map
Site Management Plan
Volunteers of America- NYDEC site NO. C828126

🟥 Site Boundary

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SITE MANAGEMENT PLAN
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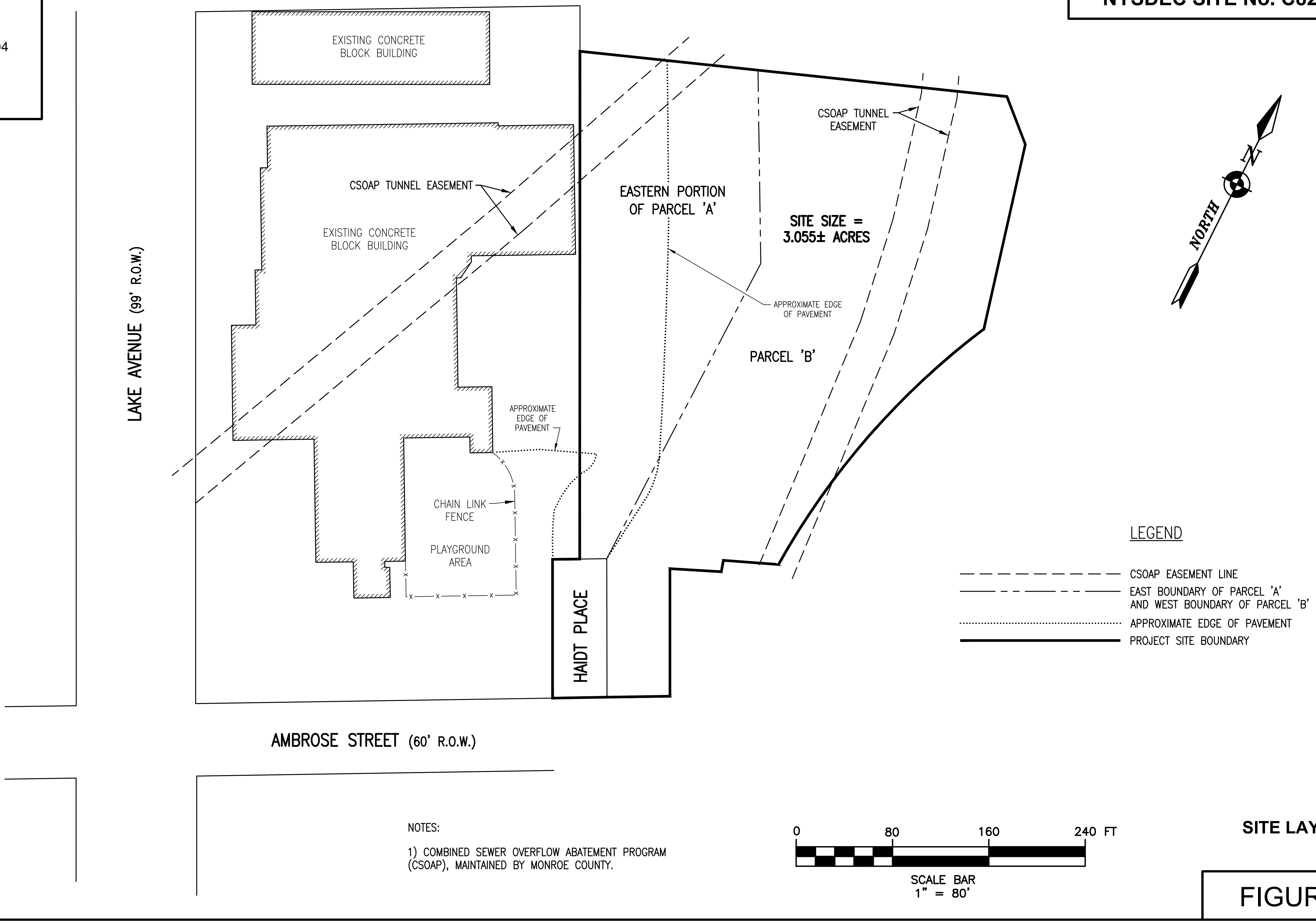
BACK LOT SITE
NYSDEC SITE No. C828126



NOTES:

1) COMBINED SEWER OVERFLOW ABATEMENT PROGRAM (CSOAP), MAINTAINED BY MONROE COUNTY.

SITE LAYOUT

FIGURE 2

I:\VOA\008726.05 VOA-214 LAKE AVE NYS TITLE 14 BROWNFIELD\3.0 Design\3.8 Reports\Site Management Plan\Final SMP\Figures\Figure 2.dwg

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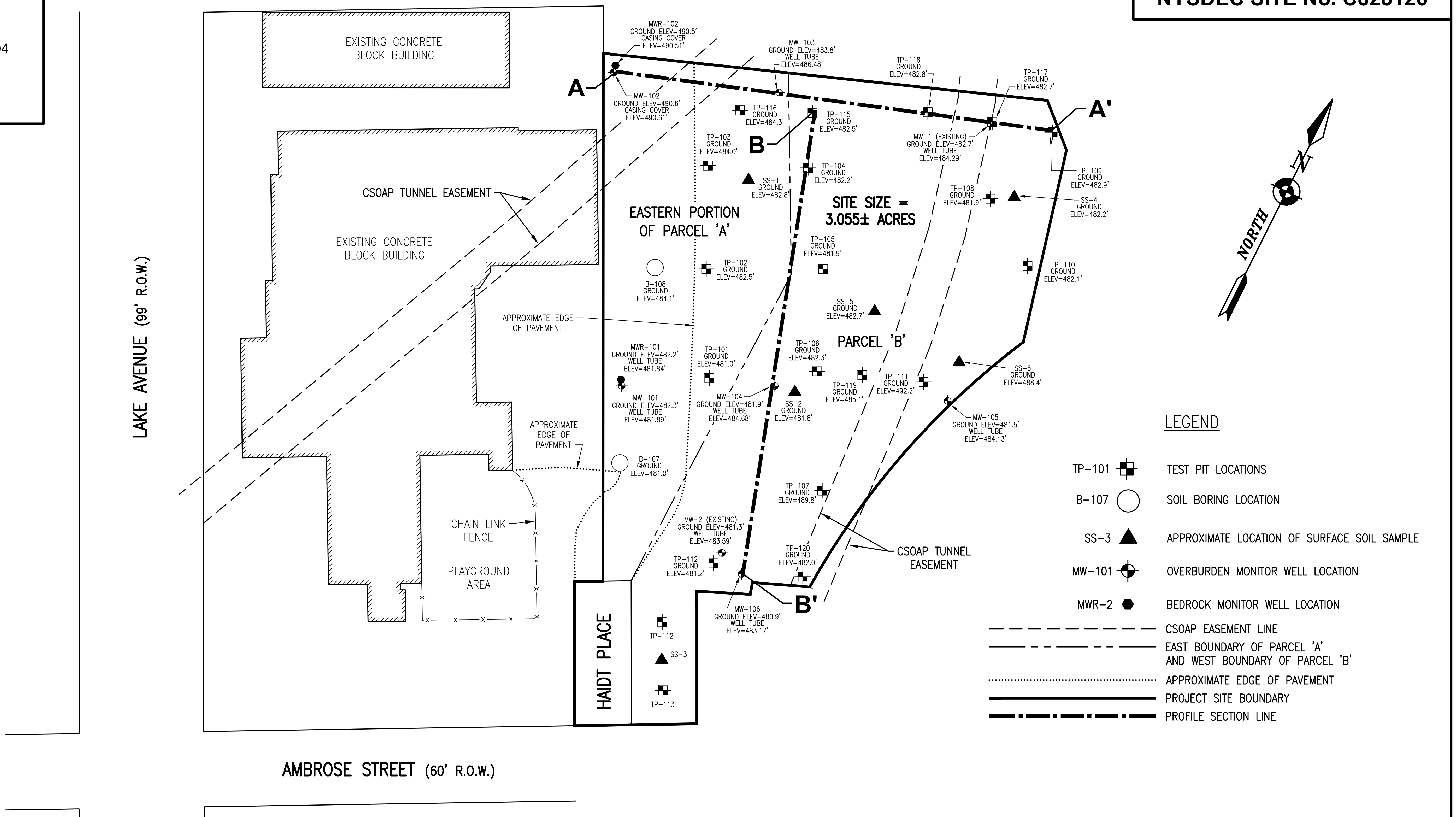

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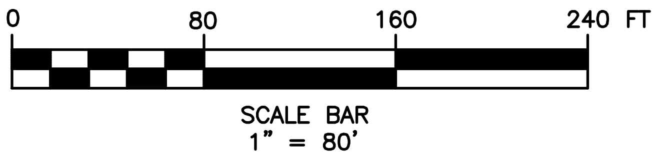
NOTES:

1) LOCATIONS OF SUBSURFACE LOCATIONS ARE APPROXIMATE.

2) LOCATIONS SURVEYED ON OCT. 12, 2009 BY PARRONE ENGINEERING.

3) COMBINED SEWER OVERFLOW ABATEMENT PROGRAM (CSOAP), MAINTAINED BY MONROE COUNTY.



GEOLOGIC CROSS-SECTION LOCATION MAP

FIGURE 3

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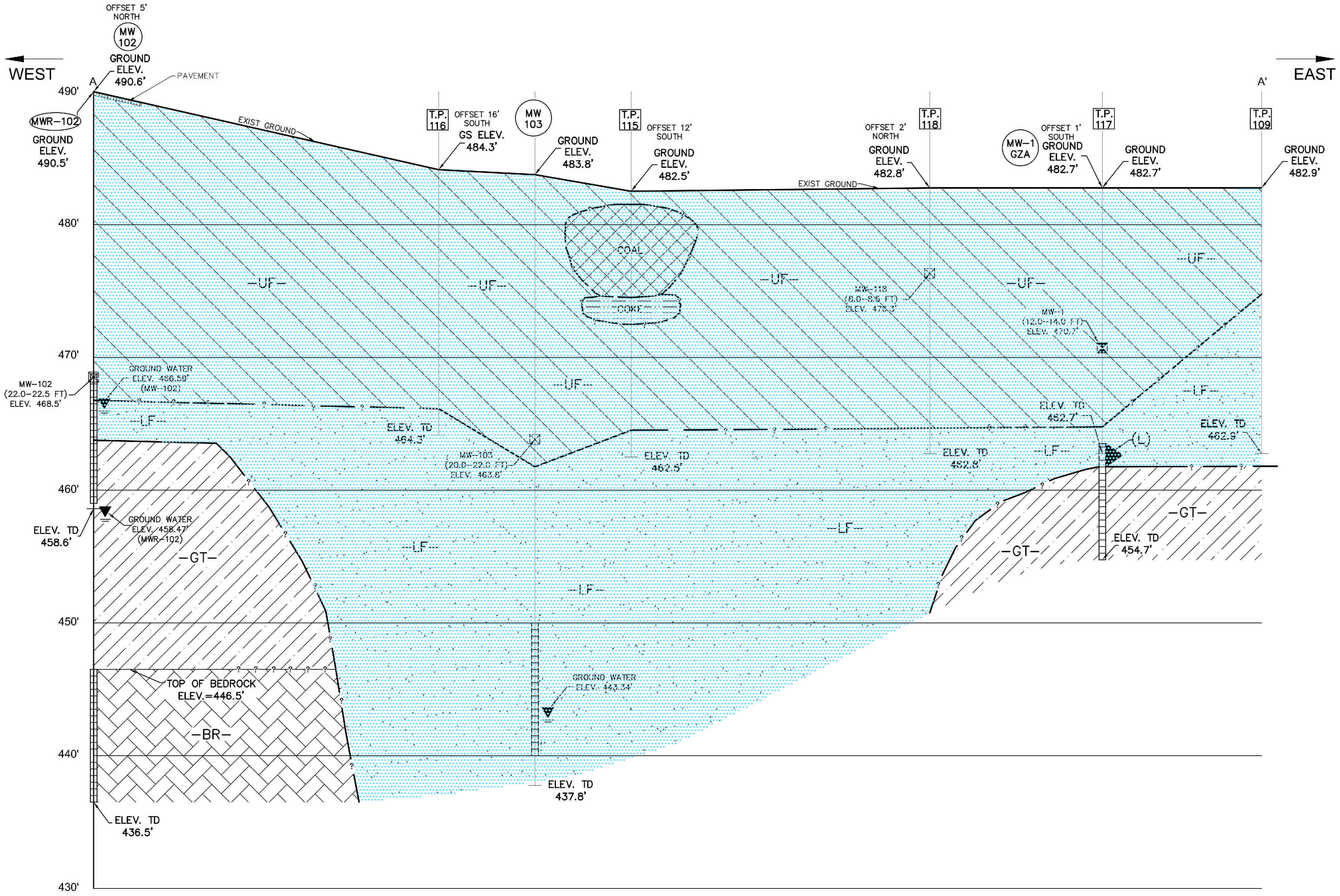
SITE MANAGEMENT PLAN
VOLUNTEERS OF AMERICA
BACK LOT SITE
NYSDEC SITE No. C828126



GEOLOGIC CROSS SECTION
A - A'

LEGEND:

▧ = UPPER FILL (UF)

▨ = GLACIAL TILL (GT)

░ = LOWER FILL (LF)

▩ = BEDROCK (BR)

■ = LACUSTRINE (L) (GZA 1996)

☰ = COKE

▩ = COAL

▥ = WELL SCREEN INTAKE

(MW–1 GZA) = TEST BORING/MONITOR WELL, GZA 1996

T.P. 117 = TEST PIT EXPLORATION

——— = DEPOSIT INTERVAL

— — — — = DEPOSIT INTERVAL (LESS CONFIDENT-APPROXIMATE)

—— ? —— = DEPOSIT INTERVAL (LEAST CONFIDENT-VERY APPROXIMATE)

TD = TOTAL DEPTH

GS = GROUND SURFACE

☒ = GEOQUEST SOIL SAMPLE LOCATION / ELEVATION

▼ = GEOQUEST GROUNDWATER ELEVATION JULY 2009.

⧗ = GZA-1996 SOIL SAMPLE

▥ = PAVEMENT

🟦 = REMAINING CONTAMINATION THAT EXCEEDS UNRESTRICTED SCOs

SCALE:

HORIZONTAL SCALE = 1" = 20'

VERTICAL SCALE = 1" = 5'
(VERTICAL EXAGGERATION IS 4x)

NOTES:

1) LOCATIONS OF SUBSURFACE LOCATIONS ARE APPROXIMATE.

2) SEE TEST BORING LOGS AND ENVIRONMENTAL TEST PIT LOGS FOR SUBSURFACE DESCRIPTIONS.

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REMAINING SOIL CONTAMINATION VERTICAL VIEW CROSS-SECTION A - A'

FIGURE 4

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SITE MANAGEMENT PLAN
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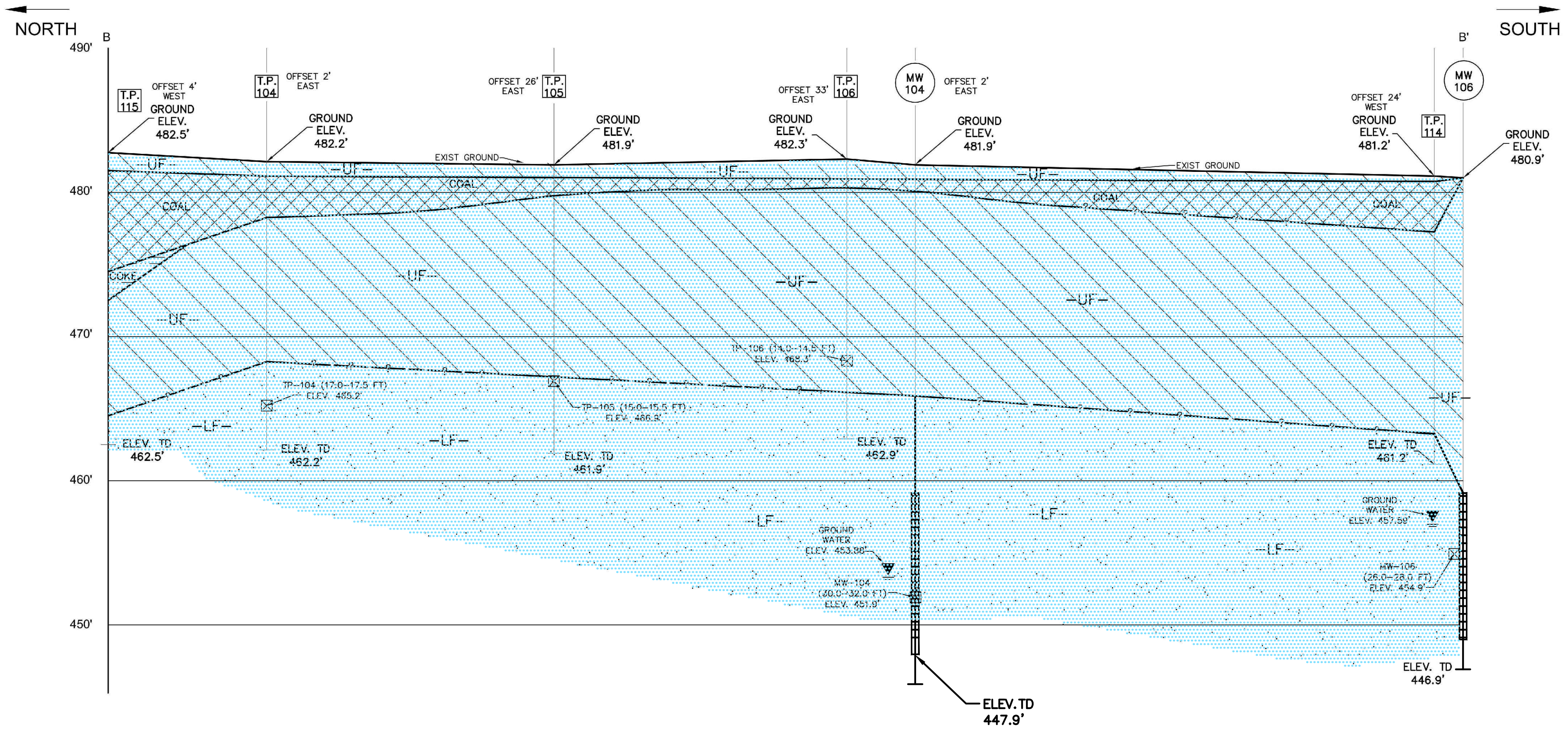
NYSDEC SITE No. C828126



GEOLOGIC CROSS SECTION
B - B'

▨ = GLACIAL TILL (GT)

▨ = LOWER FILL (LF)

▨ = BEDROCK (BR)

▤ = COKE

▨ = COAL

▥ = WELL SCREEN INTAKE

T.P. 117 = TEST PIT EXPLORATION

—— = DEPOSIT INTERVAL

— — — = DEPOSIT INTERVAL (LESS CONFIDENT-APPROXIMATE)

—— ? —— = DEPOSIT INTERVAL (LEAST CONFIDENT-VERY APPROXIMATE)

TD = TOTAL DEPTH

GS = GROUND SURFACE

☒ = GEOQUEST SOIL SAMPLE LOCATION / ELEVATION

▼ = GEOQUEST GROUNDWATER ELEVATION JULY 2009.

🟦 = REMAINING CONTAMINATION THAT EXCEEDS UNRESTRICTED SCOs

SCALE:

HORIZONTAL SCALE = 1" = 20'

VERTICAL SCALE = 1" = 5'
(VERTICAL EXAGGERATION IS 4x)

NOTES:

1) LOCATIONS OF SUBSURFACE LOCATIONS ARE APPROXIMATE.
2) SEE TEST BORING LOGS AND ENVIRONMENTAL TEST PIT LOGS FOR SUBSURFACE DESCRIPTIONS.
3) HISTORIC FILL EXTENDS APPROXIMATELY 80 FEET BELOW GROUND SURFACE THAT EXCEEDS UNRESTRICTED SOIL CLEANUP OBJECTIVE LEVELS.

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REMAINING SOIL CONTAMINATION VERTICAL VIEW CROSS SECTION B - B'

FIGURE 5

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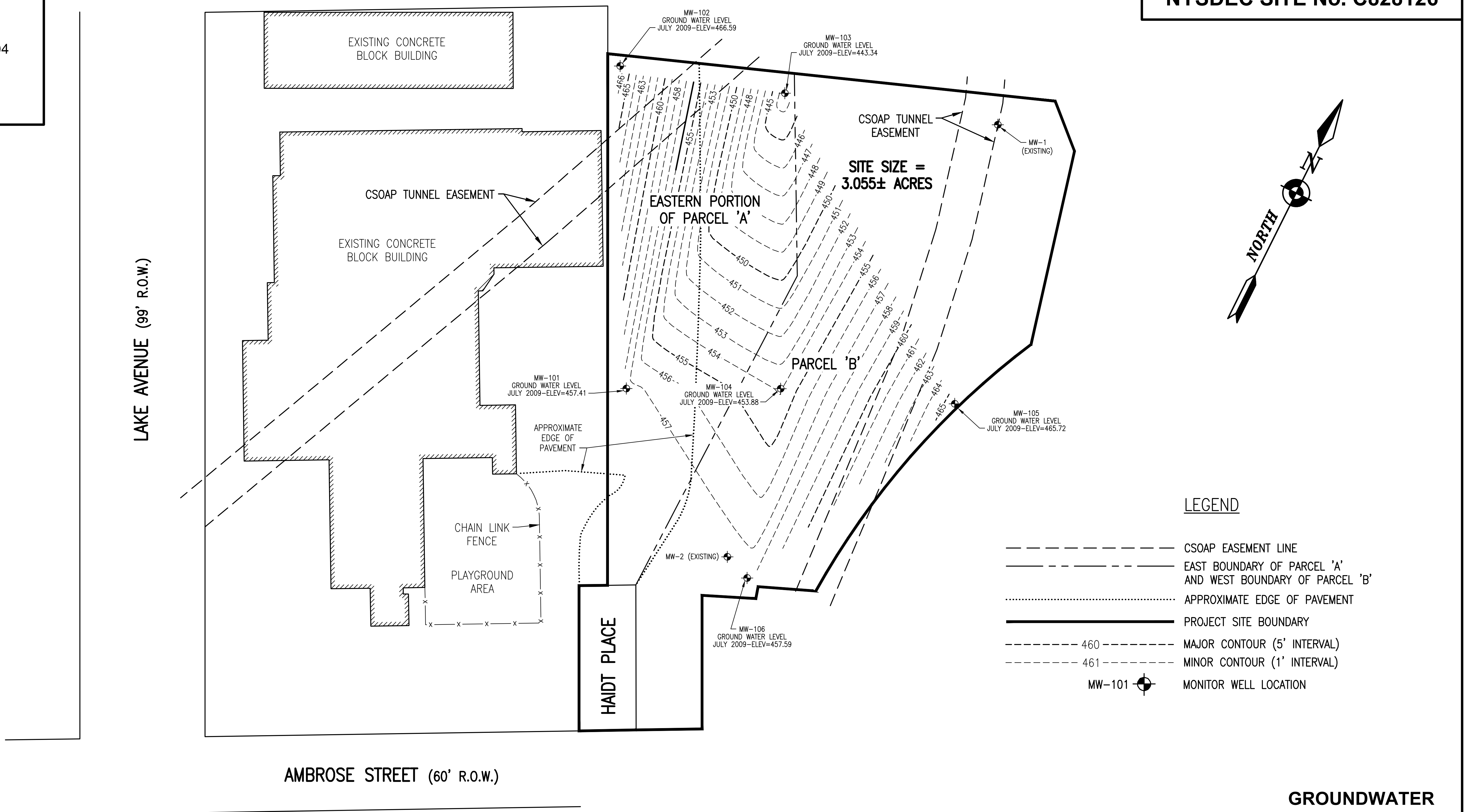
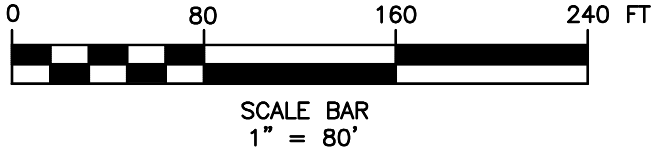


NOTES:

1) EXISTING FEATURES, EXISTING TESTING AND SAMPLING INFORMATION WERE OBTAINED FROM MAPS PREPARED BY BERGMANN ASSOCIATES, PC. TITLED "VOLUNTEERS OF AMERICA, WESTERN NEW YORK, NEW FACILITY, 214 LAKE AVENUE" BERGMANN PROJECT #3091.00, DATED FEB. 10, 1998.

2) COMBINED SEWER OVERFLOW ABATEMENT PROGRAM (CSOAP), MAINTAINED BY MONROE COUNTY.



GROUNDWATER POTENTIOMETRIC SURFACE MAP
JULY 27, 2009

FIGURE 6

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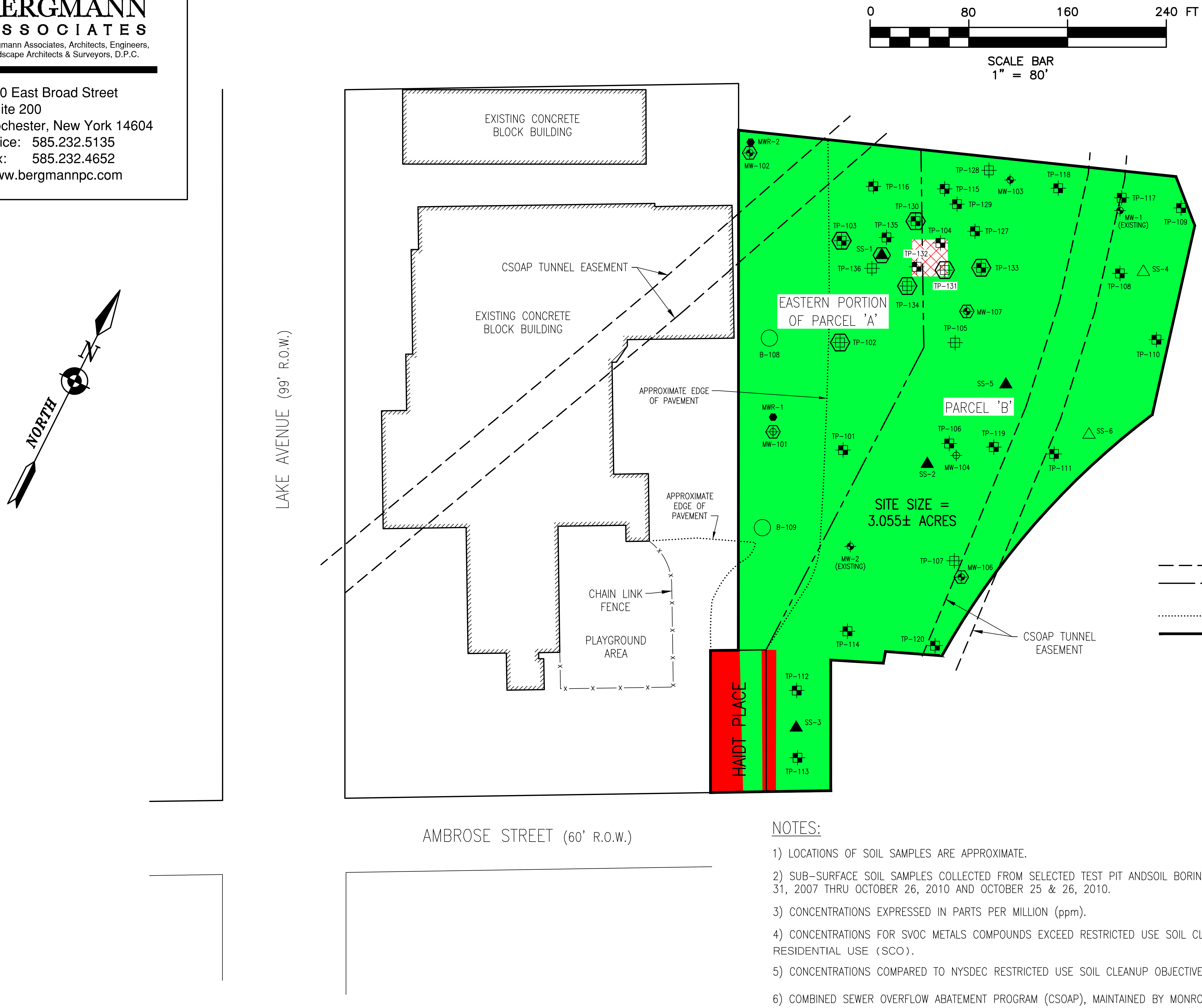

LEGEND

TP-101 ✚ TEST PIT LOCATIONS
B-107 ○ SOIL BORING LOCATION
MWR-2 ⬢ BEDROCK MONITOR WELL LOCATION
MW-101 ⊕ OVERBURDEN MONITOR WELL LOCATION
SS-3 ▲ APPROXIMATE LOCATION OF SURFACE SOIL SAMPLES THAT EXCEED COMMERCIAL CLEAN UP SVOC STANDARDS
SS-6 △ APPROXIMATE LOCATION OF SURFACE SOIL SAMPLES THAT ARE BELOW COMMERCIAL CLEAN UP SVOC STANDARDS
⊕ ✚ ALL SUB-SURFACE SOIL SAMPLES THAT EXCEED COMMERCIAL CLEAN UP SVOC STANDARDS
⊕ ⊞ ALL SUB-SURFACE SOIL SAMPLES THAT ARE BELOW COMMERCIAL CLEAN UP SVOC STANDARDS
⬡ METALS THAT EXCEED COMMERCIAL CLEAN UP STANDARDS
— — — CSOAP EASEMENT LINE
— - — EAST BOUNDARY OF PARCEL 'A' AND WEST BOUNDARY OF PARCEL 'B'
······ APPROXIMATE EDGE OF PAVEMENT
━━━ PROJECT SITE BOUNDARY
🟩 = REMAINING SOILS THAT EXCEED UNRESTRICTED USE SCO LEVELS
🟥 = COMPLY WITH UNRESTRICTED SCOs TO 2 FEET BELOW GROUND SURFACE
▨ = 0 TO 18 FEET EXCEEDS COMMERCIAL SCO FOR SVOCs AND METALS AND NUISANCE CHARACTERISTICS

NOTES:

1) LOCATIONS OF SOIL SAMPLES ARE APPROXIMATE.
2) SUB-SURFACE SOIL SAMPLES COLLECTED FROM SELECTED TEST PIT ANDSOIL BORING EXPLORATIONS OCTOBER 31, 2007 THRU OCTOBER 26, 2010 AND OCTOBER 25 & 26, 2010.
3) CONCENTRATIONS EXPRESSED IN PARTS PER MILLION (ppm).
4) CONCENTRATIONS FOR SVOC METALS COMPOUNDS EXCEED RESTRICTED USE SOIL CLEANUP OBJECTS FOR RESIDENTIAL USE (SCO).
5) CONCENTRATIONS COMPARED TO NYSDEC RESTRICTED USE SOIL CLEANUP OBJECTIVE FOR RESIDENTIAL USE.
6) COMBINED SEWER OVERFLOW ABATEMENT PROGRAM (CSOAP), MAINTAINED BY MONROE COUNTY.

REMAINING SOIL SAMPLE LEVELS AND EXCEEDANCES

FIGURE 7

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SITE MANAGEMENT PLAN
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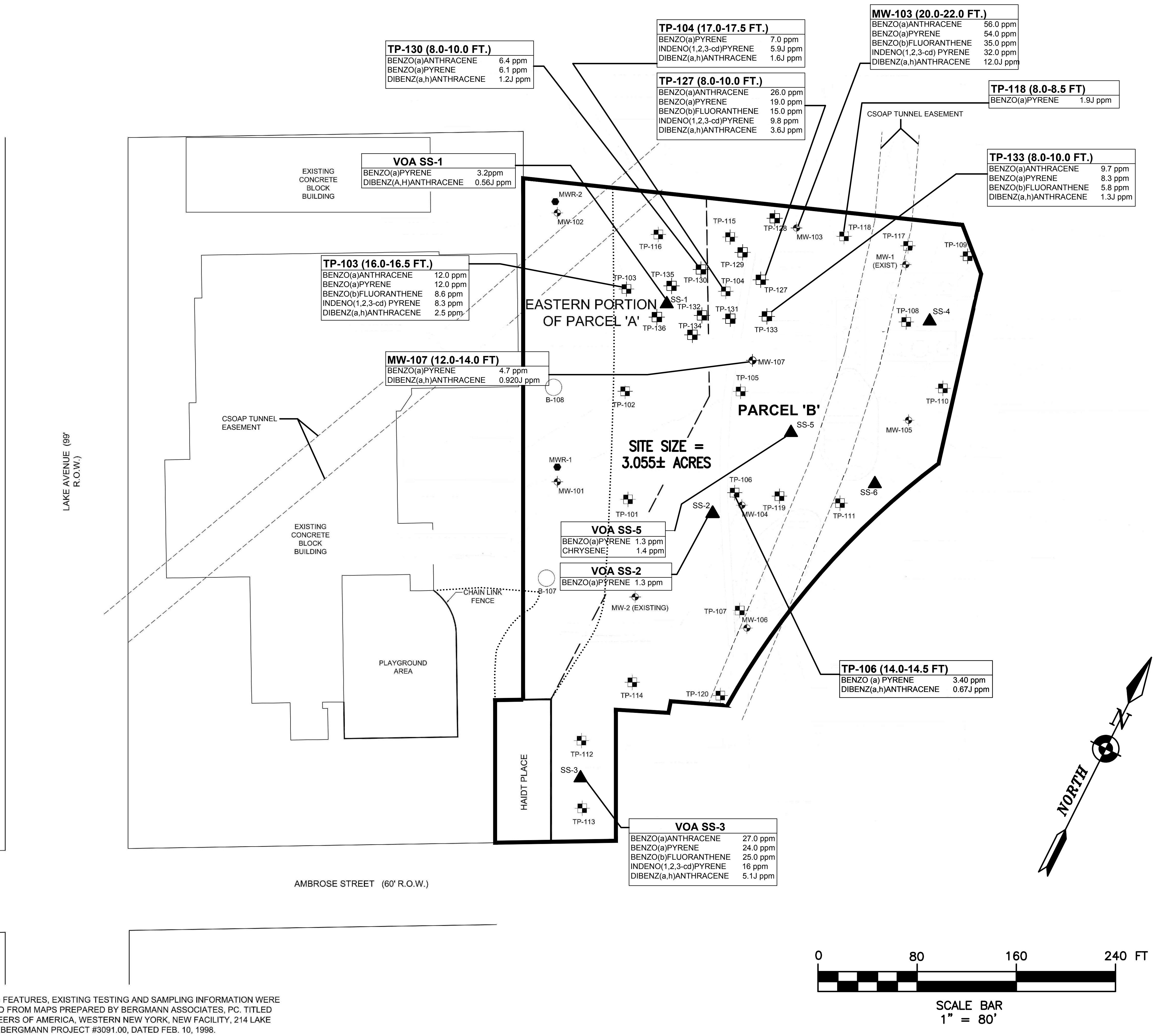

LEGEND:

───	EXISTING BUILDING
━━━	PROJECT SITE BOUNDARY
— — —	EAST BOUNDARY OF PARCEL 'A' AND WEST BOUNDARY OF PARCEL 'B'
MW-101 ⊕	MONITOR WELL LOCATION
TP-101 ▚	TEST PIT LOCATIONS
B-107 ○	SOIL BORING LOCATION
SS-# ▲	APPROXIMATE LOCATION OF SURFACE SOIL SAMPLE
···········	APPROXIMATE EDGE OF PAVEMENT

NOTES:

1) LOCATIONS OF SUBSURFACE LOCATIONS ARE APPROXIMATE.

2) SEE TEST BORING LOGS AND ENVIRONMENTAL TEST PIT LOGS FOR SUBSURFACE DESCRIPTIONS.

3) TEST PIT SOIL SAMPLES COLLECTED FROM OCTOBER 31, 2007 THROUGH NOVEMBER 2, 2017. MONITORING WELL/TEST BORING SAMPLES COLLECTED FROM JUNE 27, JULY 2 AND JULY 3, 2008.

4) COMBINED SEWER OVERFLOW ABATEMENT PROGRAM (CSOAP), MAINTAINED BY MONROE COUNTY.

EXISTING FEATURES, EXISTING TESTING AND SAMPLING INFORMATION WERE OBTAINED FROM MAPS PREPARED BY BERGMANN ASSOCIATES, PC. TITLED 'VOLUNTEERS OF AMERICA, WESTERN NEW YORK, NEW FACILITY, 214 LAKE AVENUE' BERGMANN PROJECT #3091.00, DATED FEB. 10, 1998.

I:\VOA\008726.05 VOA-214 LAKE AVE NYS TITLE 14 BROWNFIELD\3.0 Design\3.8 Reports\Site Management Plan\Final SMP\Figures\Figure 7A.dwg

EXCEEDANCES OF UNRESTRICTED SOIL CLEANUP OBJECTIVES

FIGURE 7A

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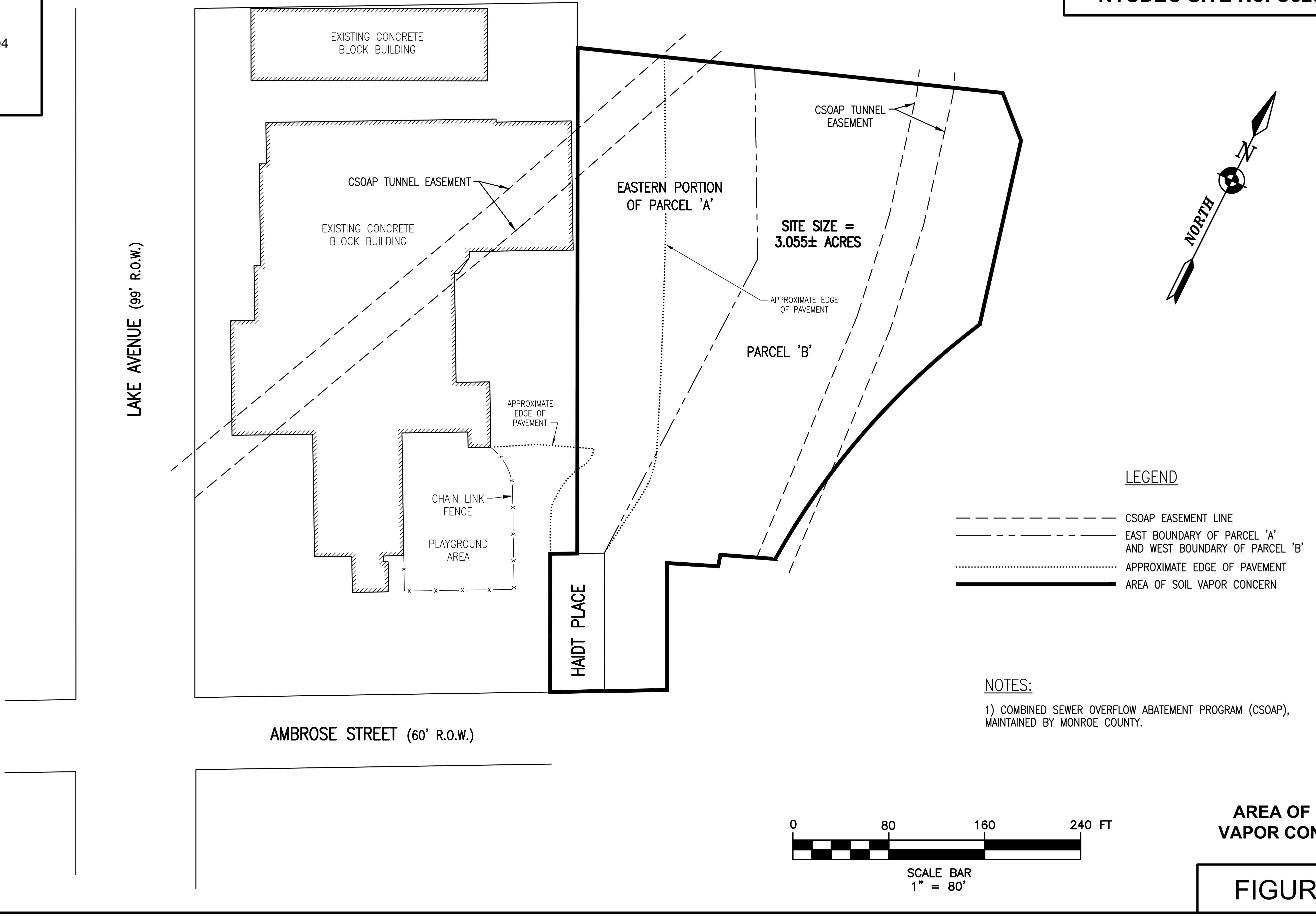

NOTES:

1) COMBINED SEWER OVERFLOW ABATEMENT PROGRAM (CSOAP), MAINTAINED BY MONROE COUNTY.

AREA OF SOIL VAPOR CONCERN

FIGURE 8

I:\VOA\008726.05 VOA-214 LAKE AVE NYS TITLE 14 BROWNFIELD\3.0 Design\3.8 Reports\Site Management Plan\Final SMP\Figures\Figure 8.dwg

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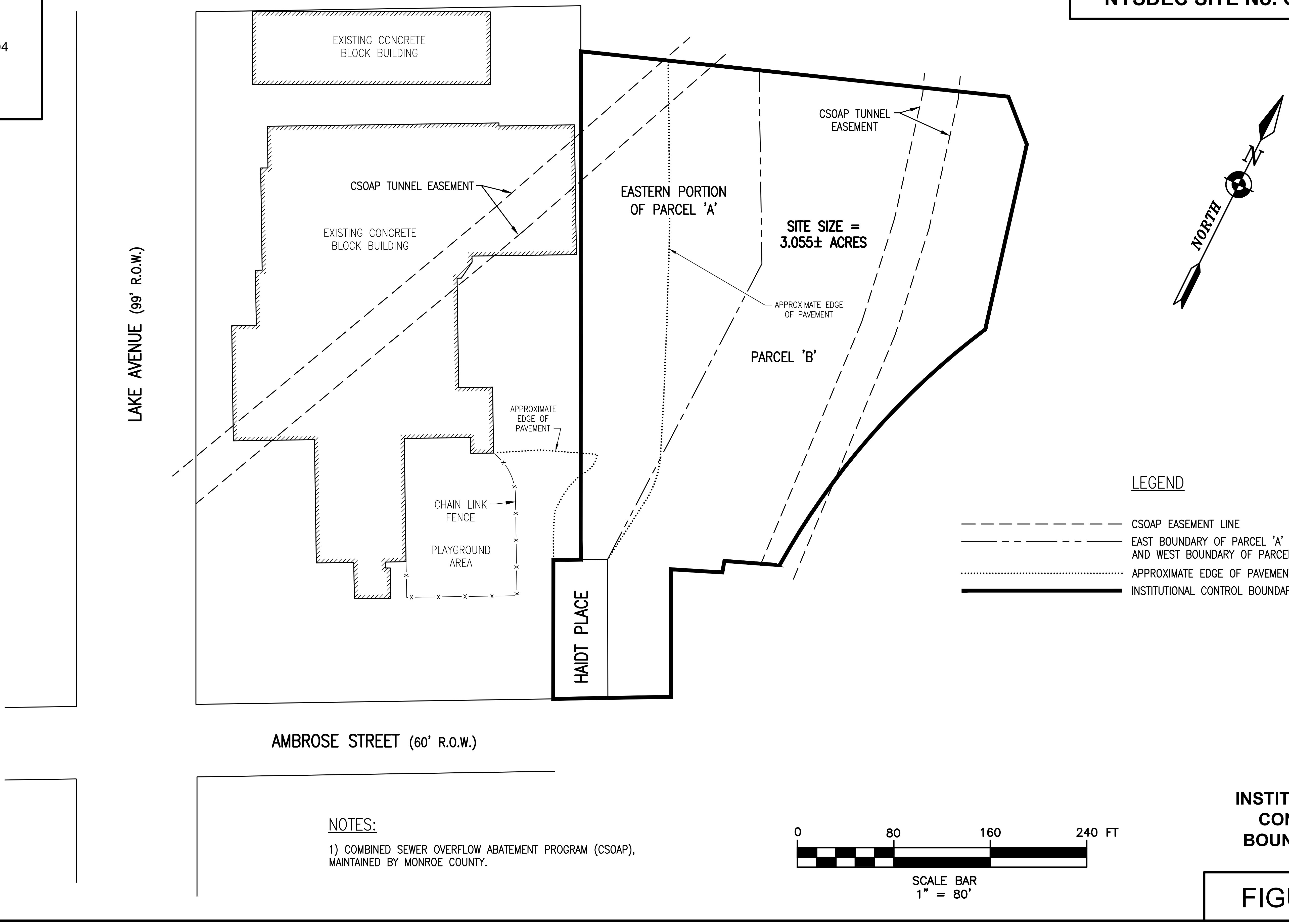
SITE MANAGEMENT PLAN VOLUNTEERS OF AMERICA BACK LOT SITE NYSDEC SITE No. C828126



NOTES:

1) COMBINED SEWER OVERFLOW ABATEMENT PROGRAM (CSOAP), MAINTAINED BY MONROE COUNTY.

INSTITUTIONAL CONTROL BOUNDARIES

FIGURE 9

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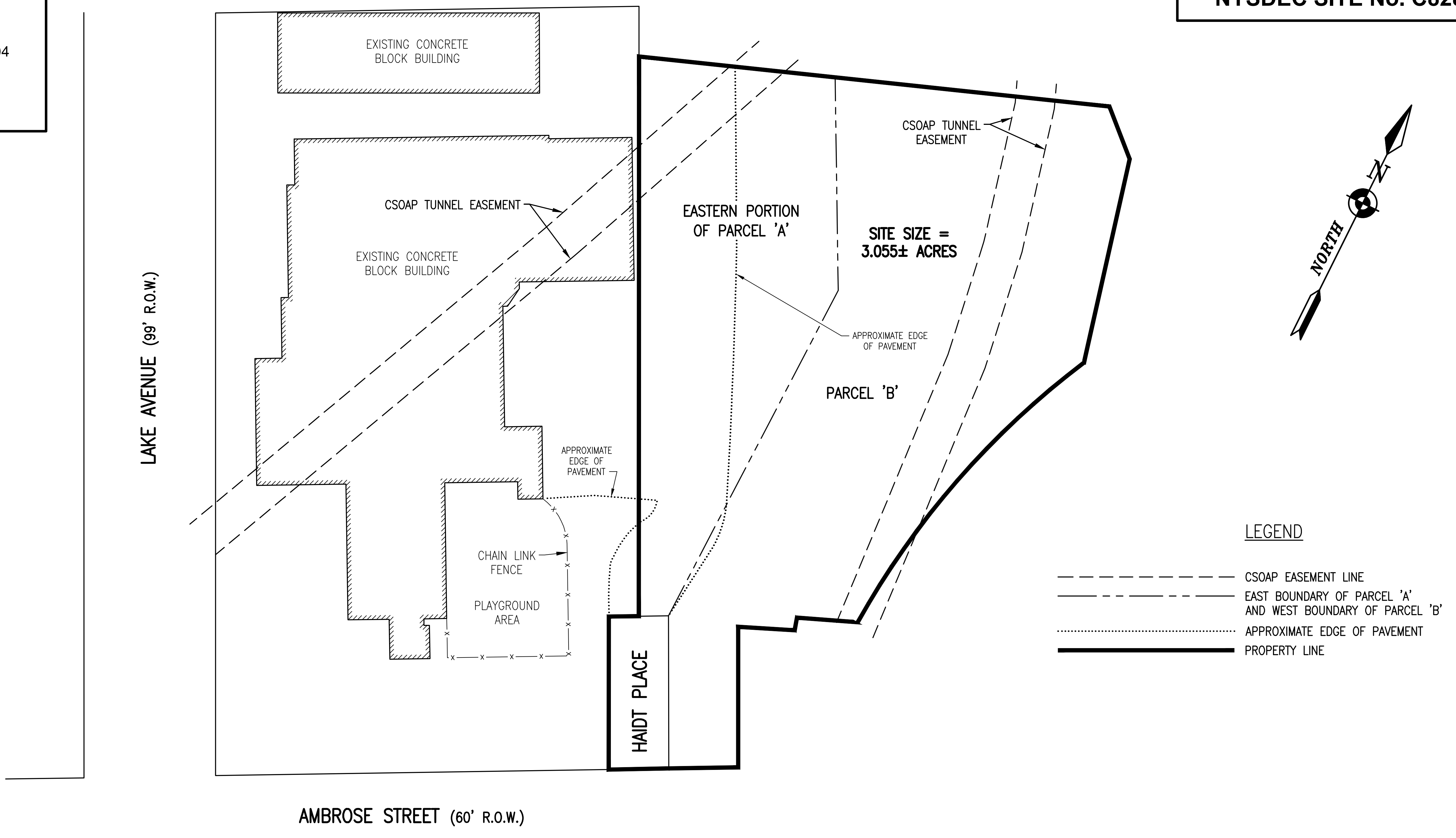


LEGEND

- — — — CSOAP EASEMENT LINE
- — - — EAST BOUNDARY OF PARCEL 'A' AND WEST BOUNDARY OF PARCEL 'B'
- ········ APPROXIMATE EDGE OF PAVEMENT
- ━━━ PROPERTY LINE

NOTES:

1) IS THE ENTIRE COVER SYSTEM AND STORM WATER SYSTEM ON THE SITE.

2) COMBINED SEWER OVERFLOW ABATEMENT PROGRAM (CSOAP), MAINTAINED BY MONROE COUNTY.

0 80 160 240 FT

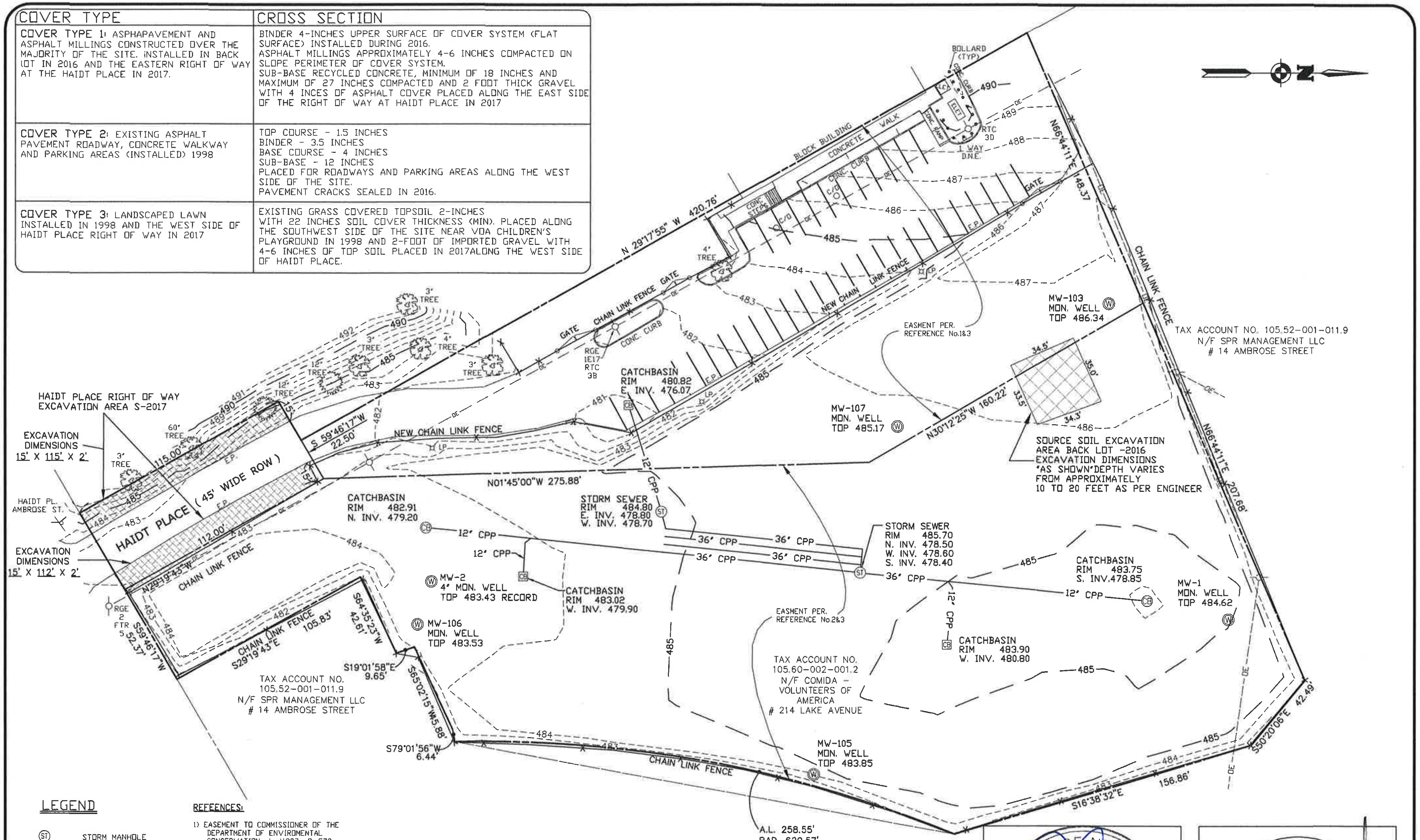
SCALE BAR
1" = 80'

ENGINEERING
CONTROL
LOCATION

FIGURE 10

I:\VOA\008726.05 VOA-214 LAKE AVE NYS TITLE 14 BROWNFIELD\3.0 Design\3.8 Reports\Site Management Plan\Final SMP\Figures\Figure 10.dwg

COVER TYPE	CROSS SECTION
COVER TYPE 1: ASPHAPAVEMENT AND ASPHALT MILLINGS CONSTRUCTED OVER THE MAJORITY OF THE SITE. INSTALLED IN BACK LOT IN 2016 AND THE EASTERN RIGHT OF WAY AT THE HAIDT PLACE IN 2017.	BINDER 4-INCHES UPPER SURFACE OF COVER SYSTEM (FLAT SURFACE) INSTALLED DURING 2016. ASPHALT MILLINGS APPROXIMATELY 4-6 INCHES COMPACTED ON SLOPE PERIMETER OF COVER SYSTEM. SUB-BASE RECYCLED CONCRETE, MINIMUM OF 18 INCHES AND MAXIMUM OF 27 INCHES COMPACTED AND 2 FOOT THICK GRAVEL WITH 4 INCES OF ASPHALT COVER PLACED ALONG THE EAST SIDE OF THE RIGHT OF WAY AT HAIDT PLACE IN 2017
COVER TYPE 2: EXISTING ASPHALT PAVEMENT ROADWAY, CONCRETE WALKWAY AND PARKING AREAS (INSTALLED) 1998	TOP COURSE - 1.5 INCHES BINDER - 3.5 INCHES BASE COURSE - 4 INCHES SUB-BASE - 12 INCHES PLACED FOR ROADWAYS AND PARKING AREAS ALONG THE WEST SIDE OF THE SITE. PAVEMENT CRACKS SEALED IN 2016.
COVER TYPE 3: LANDSCAPED LAWN INSTALLED IN 1998 AND THE WEST SIDE OF HAIDT PLACE RIGHT OF WAY IN 2017	EXISTING GRASS COVERED TOPSOIL 2-INCHES WITH 22 INCHES SOIL COVER THICKNESS (MIN). PLACED ALONG THE SOUTHWEST SIDE OF THE SITE NEAR VOA CHILDREN'S PLAYGROUND IN 1998 AND 2-FOOT OF IMPORTED GRAVEL WITH 4-6 INCHES OF TOP SOIL PLACED IN 2017ALONG THE WEST SIDE OF HAIDT PLACE.



LEGEND

(ST)	STORM MANHOLE
CB	CATCHBASIN
(W)	MONITORING WELL
⦶	UTILITY POLE
⏀	SIGN
C/O	SANITARY CLEAN-OUT
✿	DECIDUOUS TREE
✹	CONIFEROUS TREE
▨	SOURCE AREA REMOVAL EXCAVATION AREA APPROXIMATELY 35'x35' BACK LOT 2016 DEPTH VARIES FROM 10-20 FT.
▨	HAIDT PLACE RIGHT OF WAY EXCAVATION AREAS EAST 15' X 112' X 2' WEST 15' X 115' X 2'

REFEENCES:

1) EASEMENT TO COMMISSIONER OF THE DEPARTMENT OF ENVIROMENTAL CONSERVATION L. 11937 P. 573.
2) EASEMENT TO COMMISSIONER OF THE DEPARTMENT OF ENVIROMENTAL CONSERVATION L. 11937 P. 563.
3) MAP ENTITLED 'BCP SITE ENVIROMENTAL EASEMENT AREA' PASSERO ASSOCIATES DATED: MAY 2016

0 50 100

SCALE: 1" = 50'

JAMES CHARLES BASILE 080472

12/12/17

N.Y.S.P.E.

DANIEL JAMES MACDONALD 050613

N.Y.S.P.L.S.

FINAL ENGINEERING REPORT
VOLUNTEERS OF AMERICA
BACK LOT SITE
No. C 828126

DATE	REVISIONS	BY
11/3/17	ADDITONAL AS-BUILT TOPO	DJM

DRAWING ALTERATION

Note: It is a violation of law for any person, unless they are acting under the direction of a licensed professional engineer, architect, landscape architect or land surveyor to alter an item in any way. If an item bearing the stamp of a licensed professional is altered, the altering engineer, architect, landscape architect or land surveyor shall stamp the document and include the notation "altered by" followed by their signature, the date of such alteration, and a specific description of the alteration.

MACDONALD ENGINEERING

BY: ________
DATE: ________

199 WYCLIFF DRIVE
WEBSTER, NY 14580
(585)747-3334
Fax: (585) 545-4368
www.macdonaldlse.com

PROJECT:

Volunteers of America
214 Lake Avenue
rochester, NY 14608

CLIENT:

TREC Enviromental
1018 Washinington Street
Spencerport, NY 14559

DRAWING TITLE:

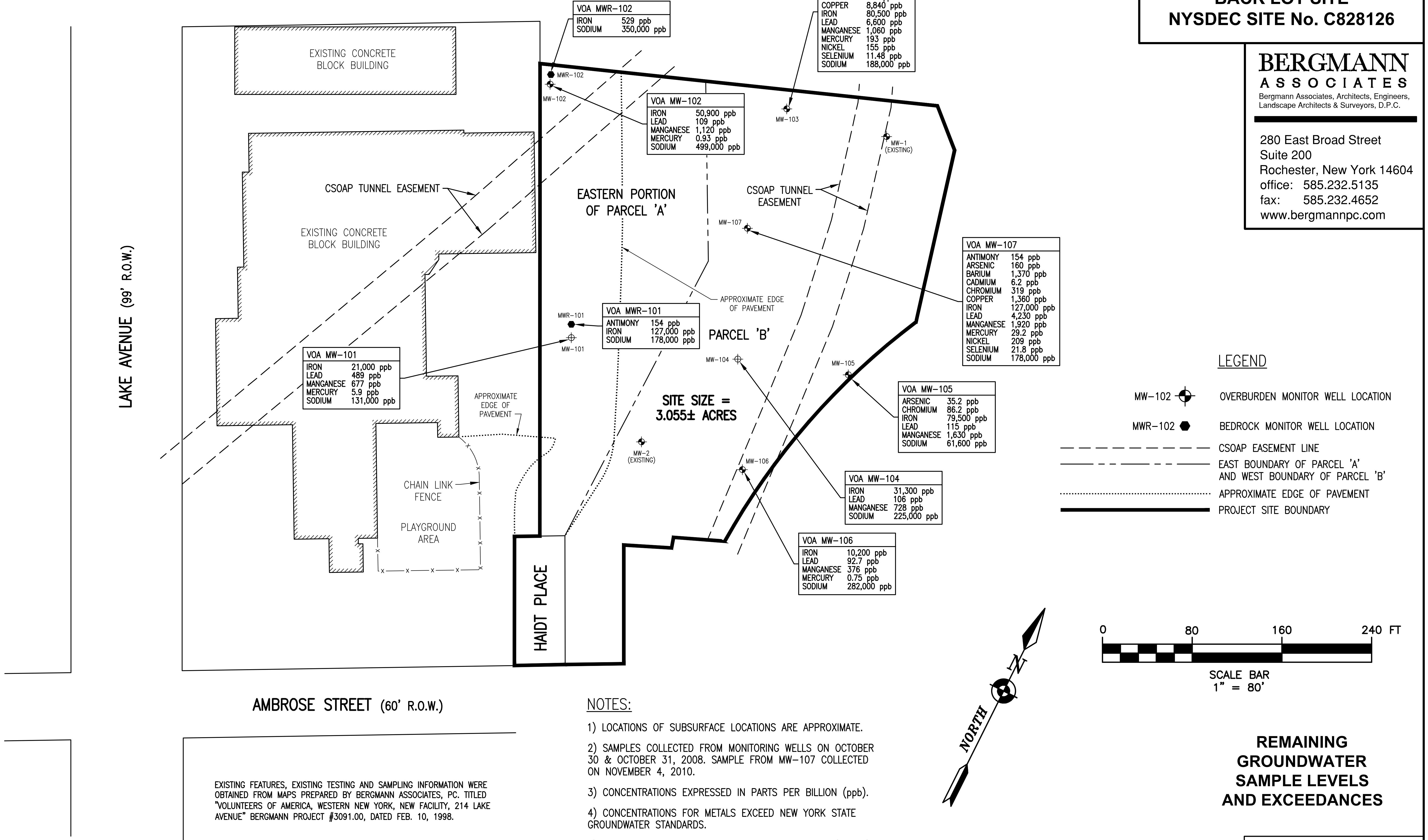
Soil Excavation
As-Built
Figure 11

DESIGNED BY:	SCALE: 1"=50'
DRAWN BY: CTJ	DATE: 10/12/2016
CHECKED BY: DJM	PROJECT No. 1013-01

SITE MANAGEMENT PLAN
VOLUNTEERS OF AMERICA
BACK LOT SITE
NYSDEC SITE No. C828126

BERGMANN
ASSOCIATES
Bergmann Associates, Architects, Engineers,
Landscape Architects & Surveyors, D.P.C.

280 East Broad Street
Suite 200
Rochester, New York 14604
office: 585.232.5135
fax: 585.232.4652
www.bergmannpc.com



EXISTING FEATURES, EXISTING TESTING AND SAMPLING INFORMATION WERE OBTAINED FROM MAPS PREPARED BY BERGMANN ASSOCIATES, PC. TITLED "VOLUNTEERS OF AMERICA, WESTERN NEW YORK, NEW FACILITY, 214 LAKE AVENUE" BERGMANN PROJECT #3091.00, DATED FEB. 10, 1998.

NOTES:

1) LOCATIONS OF SUBSURFACE LOCATIONS ARE APPROXIMATE.

2) SAMPLES COLLECTED FROM MONITORING WELLS ON OCTOBER 30 & OCTOBER 31, 2008. SAMPLE FROM MW-107 COLLECTED ON NOVEMBER 4, 2010.

3) CONCENTRATIONS EXPRESSED IN PARTS PER BILLION (ppb).

4) CONCENTRATIONS FOR METALS EXCEED NEW YORK STATE GROUNDWATER STANDARDS.

5) COMBINED SEWER OVERFLOW ABATEMENT PROGRAM (CSOAP), MAINTAINED BY MONROE COUNTY.

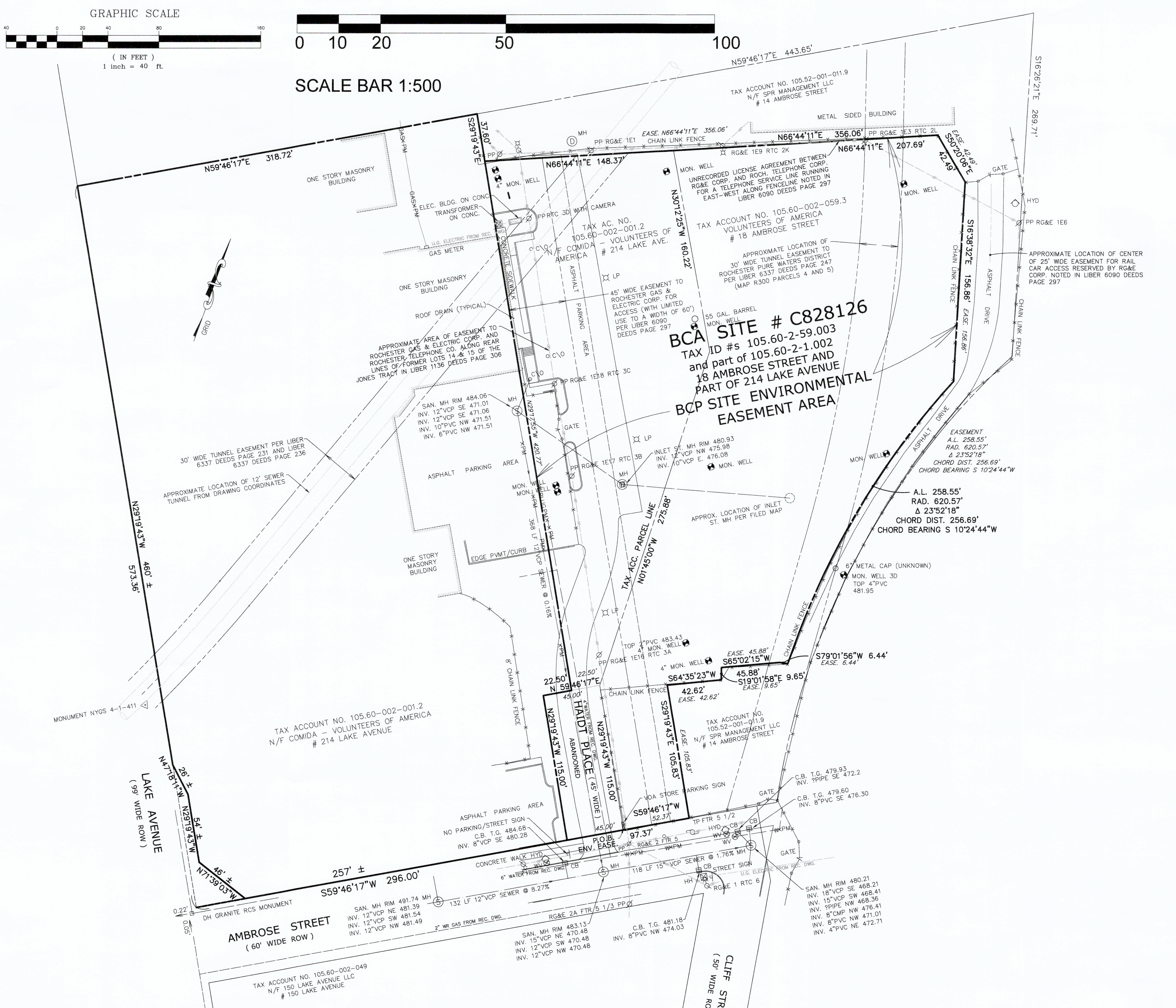
REMAINING GROUNDWATER SAMPLE LEVELS AND EXCEEDANCES

FIGURE 12

I:\VOA\008726.05 VOA-214 LAKE AVE NYS TITLE 14 BROWNFIELD\3.0 Design\3.8 Reports\Site Management Plan\Final SMP\Figures\Figure 12.dwg

APPENDICES

APPENDIX 1
ENVIRONMENTAL EASEMENT



SURVEY NOTES:

1.) THE HORIZONTAL DATUM IS REFERENCED TO THE N.Y.S. PLANE COORDINATE SYSTEM, WEST ZONE, TRANSVERSE MERCATOR SYSTEM.

2.) DISTANCES SHOWN HEREON ARE GROUND DISTANCES.

3.) SURVEY FIELD WORK ON THIS SURVEY WAS DONE TO AN ACCURACY GREATER THAN ONE PART IN 10,000, (1:10,000), USING ESTABLISHED CONTROL MONUMENTS REFERENCED HEREON.

C&GS MONUMENT BROWN	NORTHING 1,153,536.20	EASTING 1,405,356.40	NAD 83	ELEV. 495.33 CITY DATUM
C&GS MONUMENT SPILBERG	NORTHING 1,154,859.17	EASTING 1,404,203.30		

REFERENCES:

1. MAP PREPARED BY BERGMANN ASSOCIATES, ENGINEERS, ARCHITECTS, SURVEYORS, P.C. ENTITLED "VOLUNTEERS OF AMERICA SUBDIVISION MAP" FILED IN THE MONROE COUNTY CLERKS OFFICE IN LIBER 297 OF MAPS PAGE 53.
2. MAP PREPARED BY EDWIN A SUMMERHAYS, LAND SURVEYOR ENTITLED "SUBDIVISION MAP SHOWING 238 LAKE AVENUE AND 14 AMBROSE STREET" FILED IN THE MONROE COUNTY CLERKS OFFICE.
3. PERMANENT EASEMENT FOR TUNNEL PURPOSES WITHOUT SURFACE RIGHTS TO ROCHESTER PURE WATERS DISTRICT AS SHOWN ON MAP R-300 PARCELS 4 & 5, DEED RECORDED IN THE MONROE COUNTY CLERKS OFFICE, LIBER 6337 PAGE 247.
4. DEED RECORDED IN THE MONROE COUNTY CLERKS OFFICE IN LIBER 9054 PAGE 129.
5. DEED RECORDED IN THE MONROE COUNTY CLERKS OFFICE IN LIBER 6090 PAGE 297.
6. DEED RECORDED IN THE MONROE COUNTY CLERKS OFFICE IN LIBER 9124 PAGE 064.
7. DEED RECORDED IN THE MONROE COUNTY CLERKS OFFICE IN LIBER 6337 PAGE 231.
8. DEED RECORDED IN THE MONROE COUNTY CLERKS OFFICE IN LIBER 6337 PAGE 234.
9. DEED RECORDED IN THE MONROE COUNTY CLERKS OFFICE IN LIBER 6337 PAGE 247.
10. DEED RECORDED IN THE MONROE COUNTY CLERKS OFFICE IN LIBER 8942 PAGE 173.
11. CITY OF ROCHESTER DES/ENGINEERING SERVICES MAPS AND SURVEY RECORD INFORMATION FOR THE RIGHT OF WAYS OF LAKE AVENUE AND AMBROSE STREET.

NO ABSTRACT OF TITLE HAS BEEN PROVIDED FOR THE COMPLETION OF THIS SURVEY.

ENTIRE ENVIRONMENTAL EASEMENT DESCRIPTION:

ALL THAT TRACT OR PARCEL OF LAND, SITUATED IN LOT 46, 20,000 ACRE TRACT, TOWNSHIP 1, SHORT RANGE, MILL SEAT TRACT, PHELPS & GORHAM PURCHASE, IN THE CITY OF ROCHESTER, COUNTY OF MONROE, STATE OF NEW YORK, AND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT ON THE NORTHERLY RIGHT-OF-WAY OF AMBROSE STREET, (60' ROW), AT ITS INTERSECTION WITH THE EASTERLY RIGHT-OF-WAY OF HAIDT PLACE, (45' ROW); THENCE,

1. SOUTH 59°46'17" WEST, ALONG THE NORTHERLY RIGHT-OF-WAY LINE OF AMBROSE STREET EXTENDED WESTERLY, A DISTANCE OF 45.00 FEET TO A POINT; THENCE,

2. NORTH 29°19'43" WEST, ALONG THE WESTERLY RIGHT-OF-WAY LINE OF HAIDT PLACE, A DISTANCE OF 115.00 FEET TO A POINT; THENCE,

3. NORTH 59°46'17" EAST, ALONG THE NORTHERLY RIGHT-OF-WAY LINE OF HAIDT PLACE, A DISTANCE OF 22.50 FEET TO A POINT; THENCE

4. NORTH 29°17'55" WEST, A DISTANCE OF 420.77 FEET TO A POINT; THENCE,

5. NORTH 66°44'11" EAST, A DISTANCE OF 356.06 FEET TO A POINT; THENCE,

6. SOUTH 50°20'06" EAST, A DISTANCE OF 42.49 FEET TO A POINT; THENCE,

7. SOUTH 16°38'32" EAST, A DISTANCE OF 156.86 FEET TO A POINT; THENCE,

8. SOUTHWESTERLY, ALONG A CURVE TO THE LEFT, HAVING A CENTRAL ANGLE OF 23°52'18", A RADIUS OF 620.57 FEET, AN ARC LENGTH OF 258.55 FEET, A CHORD BEARING OF SOUTH 10°24'44" WEST, AND A CHORD DISTANCE OF 256.69 FEET TO A POINT; THENCE,

9. SOUTH 79°01'56" WEST, A DISTANCE OF 6.44 FEET TO A POINT; THENCE,

10. SOUTH 65°02'15" WEST, A DISTANCE OF 45.88 FEET TO A POINT; THENCE,

11. SOUTH 19°01'58" EAST, A DISTANCE OF 9.65 FEET TO A POINT; THENCE,

12. SOUTH 64°35'23" WEST, A DISTANCE OF 42.62 FEET TO A POINT; THENCE,

13. SOUTH 29°19'43" EAST, A DISTANCE OF 105.83 FEET TO A POINT ON THE NORTHERLY RIGHT-OF-WAY OF AMBROSE STREET; THENCE,

14. SOUTH 59°46'17" WEST, ALONG SAID NORTHERLY RIGHT-OF-WAY LINE, A DISTANCE OF 52.37 FEET TO THE POINT OF BEGINNING, CONTAINING 133,088 SQUARE FEET OR 3.055 ACRES, MORE OR LESS.

18 AMBROSE ENVIRONMENTAL EASEMENT AREA DESCRIPTION

ALL THAT TRACT OR PARCEL OF LAND, SITUATED IN LOT 46, 20,000 ACRE TRACT, TOWNSHIP 1, SHORT RANGE, MILL SEAT TRACT, PHELPS & GORHAM PURCHASE, IN THE CITY OF ROCHESTER, COUNTY OF MONROE, STATE OF NEW YORK, AND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT ON THE NORTHERLY RIGHT-OF-WAY OF AMBROSE STREET, (60' ROW), AT ITS INTERSECTION WITH THE WESTERLY RIGHT-OF-WAY OF HAIDT PLACE, (45' ROW); THENCE,

1. NORTH 29°19'43" WEST, ALONG THE WESTERLY RIGHT-OF-WAY LINE OF HAIDT PLACE, A DISTANCE OF 115.00 FEET TO A POINT; THENCE,
2. NORTH 59°46'17" EAST, ALONG THE NORTHERLY RIGHT-OF-WAY LINE OF HAIDT PLACE A DISTANCE OF 45.00 FEET TO A POINT; THENCE
3. NORTH 01°45'00" WEST, A DISTANCE OF 275.88 FEET TO A POINT; THENCE,
4. NORTH 30°12'25" WEST, A DISTANCE OF 160.22 FEET TO A POINT; THENCE,
5. NORTH 66°44'11" EAST, A DISTANCE OF 207.69 FEET TO A POINT; THENCE,
6. SOUTH 50°20'06" EAST, A DISTANCE OF 42.49 FEET TO A POINT; THENCE,
7. SOUTH 16°38'32" EAST, A DISTANCE OF 156.86 FEET TO A POINT; THENCE,
8. SOUTHWESTERLY, ALONG A CURVE TO THE LEFT, HAVING A CENTRAL ANGLE OF 23°52'18", A RADIUS OF 620.57 FEET, AN ARC LENGTH OF 258.55 FEET, A CHORD BEARING OF SOUTH 10°24'44" WEST, AND A CHORD DISTANCE OF 256.69 FEET TO A POINT; THENCE,
9. SOUTH 79°01'56" WEST, A DISTANCE OF 6.44 FEET TO A POINT; THENCE,
10. SOUTH 65°02'15" WEST, A DISTANCE OF 45.88 FEET TO A POINT; THENCE,
11. SOUTH 19°01'58" EAST, A DISTANCE OF 9.65 FEET TO A POINT; THENCE,
12. SOUTH 64°35'23" WEST, A DISTANCE OF 42.62 FEET TO A POINT; THENCE,
13. SOUTH 29°19'43" EAST, A DISTANCE OF 105.83 FEET TO A POINT ON THE NORTHERLY RIGHT-OF-WAY LINE OF AMBROSE STREET; THENCE,
14. SOUTH 59°46'17" WEST, ALONG SAID NORTHERLY RIGHT-OF-WAY LINE, A DISTANCE OF 97.37 FEET TO THE POINT OF BEGINNING, CONTAINING 1.997 ACRES ±

ALL AS SHOWN ON A MAP, PREPARED BY PASSERO ASSOCIATES, ENTITLED "BROWNFIELD AREA MAP", PROJECT NUMBER 20121554.0005, DATED OCTOBER 19, 2014, AND REVISED ON APRIL 20, 2017.

214 LAKE AVENUE ENVIRONMENTAL EASEMENT AREA DESCRIPTION

ALL THAT TRACT OR PARCEL OF LAND, SITUATED IN LOT 46, 20,000 ACRE TRACT, TOWNSHIP 1, SHORT RANGE, MILL SEAT TRACT, PHELPS & GORHAM PURCHASE, IN THE CITY OF ROCHESTER, COUNTY OF MONROE, STATE OF NEW YORK, AND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT ON THE EASTERLY RIGHT-OF-WAY LINE OF HAIDT PLACE, (45' ROW), SAID POINT BEING NORTH 29°19'43" WEST, 115.00 FEET FROM THE INTERSECTION OF SAID EASTERLY RIGHT-OF-WAY LINE OF HAIDT PLACE WITH THE NORTHERLY RIGHT-OF-WAY LINE OF AMBROSE STREET, (60' ROW); THENCE,

1. SOUTH 59°46'17" WEST, ALONG THE NORTHERLY RIGHT-OF-WAY LINE OF HAIDT PLACE, A DISTANCE OF 22.50 FEET TO A POINT; THENCE,
2. NORTH 29°17'55" WEST, A DISTANCE OF 420.77 FEET TO A POINT; THENCE,
3. NORTH 66°44'11" EAST, A DISTANCE OF 148.37 FEET TO A POINT; THENCE,
4. SOUTH 30°12'25" EAST, A DISTANCE OF 160.22 FEET TO A POINT; THENCE,
5. SOUTH 01°45'00" EAST, A DISTANCE OF 275.88 FEET TO THE POINT OF BEGINNING.

CONTAINING 1.058 ACRES ±

ALL AS SHOWN ON A MAP, PREPARED BY PASSERO ASSOCIATES, ENTITLED "BROWNFIELD AREA MAP", PROJECT NUMBER 20121554.0005, DATED OCTOBER 19, 2014, AND REVISED ON APRIL 20, 2017.

THIS PROPERTY IS SUBJECT TO AN 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

CERTIFICATION:

WE, PASSERO ASSOCIATES, CERTIFY THAT THIS MAP WAS PREPARED ON SEPTEMBER 10, 2012 USING PORTIONS OF THE REFERENCE MATERIAL LISTED HEREON AND FROM NOTES OF A BOUNDARY AND TOPOGRAPHIC SURVEY COMPLETED ON AUGUST 13, 2012. PARCEL WAS REINSPECTED ON MAY 04, 2016 WITH CHANGES AND/OR ADDITIONS SHOWN HEREON. THIS PARCEL IS SUBJECT TO ANY EASEMENTS OR ENCUMBRANCES OF RECORD. NO CERTIFICATION IS EXTENDED TO RECORD INFORMATION NOT REFERENCED. THIS CERTIFICATION IS MADE TO:

ROBERT A. VENTO 49701

Robert A. Vento

ROBERT A. VENTO N.Y.S.P.L.S. NO. 049701

PASSERO ASSOCIATES

Engineering • Architecture

www.passero.com

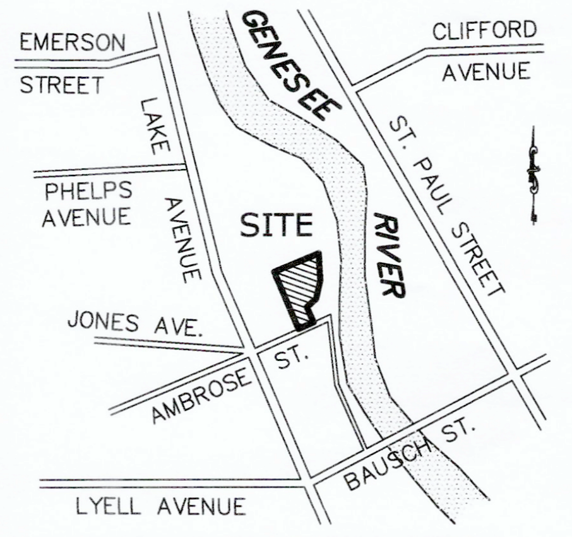
ONLY COPIES FROM THE ORIGINAL OF THIS SURVEY MARKED WITH AN ORIGINAL INKED OR EMBOSSED SEAL AND INKED SIGNATURE SHALL BE CONSIDERED A TRUE AND VALID COPY.

CERTIFICATION INDICATED HEREON SHALL RUN ONLY TO THE PERSON FOR WHOM THE SURVEY IS PREPARED, AND ON HIS BEHALF TO THE AGENCIES LISTED HEREON. CERTIFICATIONS ARE NOT TRANSFERABLE TO ADDITIONAL INSTITUTIONS OR SUBSEQUENT OWNERS.

LEGEND	
⊟ CB	*Catchbasin*
○ c/o	*Cleanout*
⊗ GV	*Gas Valve*
HYD	*Hydrant*
LP	*Lightpole*
◯ MH	*Manhole (Unkown Type)*
Ⓔ MH	*Manhole Electric*
MH	*Manhole Inlet Storm Drainage*
Ⓓ MH	*Manhole Storm Drainage*
Ⓢ MH	*Manhole Sanitary Sewer*
	Sign Post (Single)
ØPP	*Utility Pole*
	Utility Pole Anchor Wire
Ø	*Utility Pole with Light*
⊘ CC	*Water Service*
⊗ WV	*Water Valve*
⊘ SP	*Traffic Light Span Pole*
E	*Utility Marker Flag – Electric*
T	*Utility Marker Flag – Telephone*
G	*Utility Marker Flag – Gas*
▨	*Wall Line of Building*
- - - -	*Easement Line*

Revisions

No.	Date	By	Description
1.	11.18.14	DS	Revisions per Review Letter
2.	05.04.16	DS	Update Survey to NYSDEC mapping requirements
3.	05.09.16	BV	Revised per comments.
4.	08.05.16	BV	Added legal descrptions.
5.	04.20.17	BV	Revised to include Haidt Place



CITY OF ROCHESTER

Passero Associates

22 West Main Street Suite 100
Rochester, NY 14614
(585) 325-1000
Fax: (585) 325-1691

Principal-in-Charge John F. Caruso, P.E.
Project Manager Robert A. Vento, P.L.S.
Drafted by D. Sauve

Volunteers of America
of Western New York, Inc.
214 Lake Ave. Admin. Bldg. C
Rochester, N.Y. 14608

BCP Site Environmental Easement Area
BCA Site # C828126
Volunteers of America
18 Ambrose Street and
Part of 214 Lake Avenue
Tax Acct. No. 105.60-002-059.003
and Part of 105.60-002-001.002
Lot 46, 20,000 Acre Tract, Twp. 1, Short Range
City of Rochester, Monroe County, New York

Project No.	20121554.0005
Drawing No.	Ea-1
Sheet No.	1 of 1
Scale:	1" = 40'
Date	May 2016

MONROE COUNTY CLERK'S OFFICE

ROCHESTER, NY

THIS IS NOT A BILL. THIS IS YOUR RECEIPT

Receipt # 1686612

Index DEEDS

Book 11937 Page 573

No. Pages : 10

Instrument EASEMENT AGREEMENT

Date : 10/24/2017

Time : 12:49:22PM

Control # **201710240496**

TT # TT0000005374

Ref 1 #

Employee : TracyC

Return To:
KNAUF SHAW LLP
1400 CROSSROADS BUILDING
2 STATE STREET
ROCHESTER, NY 14607-

COUNTY OF MONROE INDUSTRIAL DEVELOPMENT AGENCY

NYSDEC
COMMISSIONER OF THE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

COUNTY FEE TP584	$	5.00
COUNTY FEE NUMBER PAGES	$	45.00
RECORDING FEE	$	45.00
STATE FEE TRANSFER TAX	$	0.00
Total	$	95.00

State of New York

MONROE COUNTY CLERK'S OFFICE

WARNING - THIS SHEET CONSTITUTES THE CLERKS ENDORSEMENT, REQUIRED BY SECTION 317-a(5) & SECTION 319 OF THE REAL PROPERTY LAW OF THE STATE OF NEW YORK. DO NOT DETACH OR REMOVE.

<u>TRANSFER AMT</u>

TRANSFER AMT	$1.00

ADAM J BELLO
MONROE COUNTY CLERK

PI182-201710240496-10

9

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

THIS INDENTURE made this 16th day of October, 2017 between Owner(s) County of Monroe Industrial Development Agency, having an office at CityPlace, Suite 8100, 50 West Main Street, Rochester, NY 14614, County of Monroe, 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 214 Lake Avenue in the City of Rochester, County of Monroe and State of New York, known and designated on the tax map of the County Clerk of Monroe as tax map parcel numbers: Section 105.60 Block 2 Lot 1.002, being a portion of the property conveyed to Grantor by deed dated August 25, 1998 and recorded in the Monroe County Clerk's Office in Liber and Page 9054/129. The property subject to this Environmental Easement (the "Controlled Property") comprises approximately 1.058 acres +/- acres, and is hereinafter more fully described in the Land Title Survey dated October 19, 2014 and last revised April 20, 2017 prepared by Robert A. Vento, P.L.S. of Passero Associates, 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 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: B8-0688-05-04 as last amended September 27, 2017, 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:

Restricted Residential as described in 6 NYCRR Part 375-1.8(g)(2)(ii), 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 Monroe 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 purposes as defined in 6NYCRR 375-1.8(g)(2)(i), 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: C828126
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.

Remainder of Page Intentionally Left Blank

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

County of Monroe Industrial Development Agency:

By: ____________________

Print Name: JEFFREY R. ADAIR

Title: Executive Director Date: 10/4/17

Grantor's Acknowledgment

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

On the 4th day of October, in the year 20 __, before me, the undersigned, personally appeared Jeffrey Adair, 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.

____
Notary Public - State of New York

Lori A. Palmer
Notary Public, State of New York
Qualified in Monroe County
Commission Expires May 31, 2019

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: ______________________________
Robert W. Schick, Director
Division of Environmental Remediation

Grantee's Acknowledgment

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

On the 16th day of October, in the year 2017 before me, the undersigned, personally appeared Robert W. Schick, 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, 2018

SCHEDULE "A" PROPERTY DESCRIPTION

ENVIRONMENTAL EASEMENT AREA
ON PART OF 214 LAKE AVENUE (COMIDA)

ALL THAT TRACT OR PARCEL OF LAND, SITUATED IN LOT 46, 20,000 ACRE TRACT, TOWNSHIP 1, SHORT RANGE, MILL SEAT TRACT, PHELPS & GORHAM PURCHASE, IN THE CITY OF ROCHESTER, COUNTY OF MONROE, STATE OF NEW YORK, AND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT ON THE EASTERLY RIGHT-OF-WAY OF HAIDT PLACE, (45' ROW), SAID POINT BEING NORTH 29°19'43" WEST, 115.00 FEET FROM THE INTERSECTION OF SAID EASTERLY RIGHT-OF-WAY LINE OF HAIDT PLACE WITH THE NORTHERLY RIGHT-OF-WAY LINE OF AMBROSE STREET, (60' ROW); THENCE,

1. SOUTH 59°46'17" WEST, ALONG THE NORTHERLY RIGHT-OF-WAY LINE OF HAIDT PLACE, A DISTANCE OF 22.50 FEET TO A POINT; THENCE,
2. NORTH 29°17'55" WEST, A DISTANCE OF 420.77 FEET TO A POINT; THENCE,
3. NORTH 66°44'11" EAST, A DISTANCE OF 148.37 FEET TO A POINT; THENCE,
4. SOUTH 30°12'25" EAST, A DISTANCE OF 160.22 FEET TO A POINT; THENCE,
5. SOUTH 01°45'00" EAST, A DISTANCE OF 275.88 FEET TO THE POINT OF BEGINNING.

CONTAINING 1.058 ACRES ±

ALL AS SHOWN ON A MAP, PREPARED BY PASSERO ASSOCIATES, ENTITLED "BROWNFIELD AREA MAP", PROJECT NUMBER 20121554.0005, DATED OCTOBER 19, 2014, AND REVISED ON APRIL 20, 2017.

MONROE COUNTY CLERK'S OFFICE

ROCHESTER,NY

THIS IS NOT A BILL. THIS IS YOUR RECEIPT

Receipt # 1686612

Index DEEDS

Book 11937 Page 563

No. Pages : 10

Instrument EASEMENT AGREEMENT

Date : 10/24/2017

Time : 12:49:22PM

Control # 201710240495

TT # TT0000005373

Ref 1 #

Employee : TracyC

Return To:
KNAUF SHAW LLP
1400 CROSSROADS BUILDING
2 STATE STREET
ROCHESTER,NY 14607-

VOLUNTEERS OF AMERICA OF WESTERN NEW YORK INC

COMMISSIONER OF THE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
NYSDEC

COUNTY FEE TP584	$	5.00
COUNTY FEE NUMBER PAGES	$	45.00
RECORDING FEE	$	45.00
STATE FEE TRANSFER TAX	$	0.00

Total	$	95.00

State of New York

MONROE COUNTY CLERK'S OFFICE

WARNING - THIS SHEET CONSTITUTES THE CLERKS ENDORSEMENT, REQUIRED BY SECTION 317-a(5) & SECTION 319 OF THE REAL PROPERTY LAW OF THE STATE OF NEW YORK. DO NOT DETACH OR REMOVE.

ADAM J BELLO
MONROE COUNTY CLERK

TRANSFER AMT

TRANSFER AMT	$1.00

PI182-201710240495-10

a

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

THIS INDENTURE made this 16th day of October, 2017, between Owner(s) Volunteers of America of Western New York, Inc., having an office at 214 Lake Ave, Rochester, NY 14608, County of Monroe, 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 18 Ambrose Street in the City of Rochester, County of Monroe and State of New York, known and designated on the tax map of the County Clerk of Monroe as tax map parcel numbers: Section 105.60 Block 2 Lot 59.003, being a portion of the property conveyed to Grantor by deed dated November 13, 1997 and recorded in the Monroe County Clerk's Office in Liber and Page 8942/173.

WHEREAS, Grantor, is the owner of the eastern half of the former right-of-way known as Haidt Place in the City of Rochester, County of Monroe and State of New York, being the same as that property conveyed to Grantor by a formal abandonment in City of Rochester Ordinance No. 2017-93 which was duly passed by the Council of the City of Rochester on April 25, 2017 and approved by the Mayor of the City of Rochester on April 26, 2017.

WHEREAS, Grantor, is the owner of the western half of the former right-of-way known as Haidt Place in the City of Rochester, County of Monroe and State of New York, being the same as that property conveyed to Grantor by deed dated April 26, 2017 and recorded in the Monroe County Clerk's Office in Liber and Page 11916/1.

WHEREAS, the property subject to this Environmental Easement (the "Controlled Property") comprises approximately 1.997 acres +/- acres, and is hereinafter more fully described in the Land Title Survey dated October 19, 2014 and last revised April 20, 2017 prepared by Robert A. Vento, P.L.S. of Passero Associates, 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 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: B8-0688-05-04 as last amended September 27, 2017, 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:

Restricted Residential as described in 6 NYCRR Part 375-1.8(g)(2)(ii), 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 Monroe 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 purposes as defined in 6NYCRR 375-1.8(g)(2)(i), 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: C828126
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.

Remainder of Page Intentionally Left Blank

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

Volunteers of America of Western New York, Inc.:

By: ______________________

Print Name: Kimberly A. Brumber

Title: President & CEO Date: 10.6.17

Grantor's Acknowledgment

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

STEPHANIE MONTI
Notary Public - State of New York
No. 01MO6359151
Qualified in Monroe County
My Commission Expires May 22, 2021

On the 6 day of October, in the year 2017, before me, the undersigned, personally appeared Kimberly Brumber, 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.

Stephanie Monti
Notary Public - State of New York

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: ________________________________
Robert W. Schick, Director
Division of Environmental Remediation

Grantee's Acknowledgment

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

On the 16th day of October, in the year 2017, before me, the undersigned, personally appeared Robert W. Schick, 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, 2018

SCHEDULE "A" PROPERTY DESCRIPTION

ENVIRONMENTAL EASEMENT AREA
18 AMBROSE STREET (VOLUNTEERS OF AMERICA)

ALL THAT TRACT OR PARCEL OF LAND, SITUATED IN LOT 46, 20,000 ACRE TRACT, TOWNSHIP 1, SHORT RANGE, MILL SEAT TRACT, PHELPS & GORHAM PURCHASE, IN THE CITY OF ROCHESTER, COUNTY OF MONROE, STATE OF NEW YORK, AND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT ON THE NORTHERLY RIGHT-OF-WAY OF AMBROSE STREET, (60' ROW), AT ITS INTERSECTION WITH THE WESTERLY RIGHT-OF-WAY OF HAIDT PLACE, (45' ROW); THENCE,

1. NORTH 29°19'43" WEST, ALONG THE WESTERLY RIGHT-OF-WAY LINE OF HAIDT PLACE, A DISTANCE OF 115.00 FEET TO A POINT; THENCE,
2. NORTH 59°46'17" EAST, ALONG THE NORTHERLY RIGHT-OF-WAY LINE OF HAIDT PLACE, A DISTANCE OF 45.00 FEET TO A POINT; THENCE
3. NORTH 01°45'00" WEST, A DISTANCE OF 275.88 FEET TO A POINT; THENCE,
4. NORTH 30°12'25" WEST, A DISTANCE OF 160.22 FEET TO A POINT; THENCE,
5. NORTH 66°44'11" EAST, A DISTANCE OF 207.69 FEET TO A POINT; THENCE,
6. SOUTH 50°20'06" EAST, A DISTANCE OF 42.49 FEET TO A POINT; THENCE,
7. SOUTH 16°38'32" EAST, A DISTANCE OF 156.86 FEET TO A POINT; THENCE,
8. SOUTHWESTERLY, ALONG A CURVE TO THE LEFT, HAVING A CENTRAL ANGLE OF 23°52'18", A RADIUS OF 620.57 FEET, AN ARC LENGTH OF 258.55 FEET, A CHORD BEARING OF SOUTH 10°24'44" WEST, AND A CHORD DISTANCE OF 256.69 FEET TO A POINT; THENCE,
9. SOUTH 79°01'56" WEST, A DISTANCE OF 6.44 FEET TO A POINT; THENCE,
10. SOUTH 65°02'15" WEST, A DISTANCE OF 45.88 FEET TO A POINT; THENCE,
11. SOUTH 19°01'58" EAST, A DISTANCE OF 9.65 FEET TO A POINT; THENCE,
12. SOUTH 64°35'23" WEST, A DISTANCE OF 42.62 FEET TO A POINT; THENCE,
13. SOUTH 29°19'43" EAST, A DISTANCE OF 105.83 FEET TO A POINT ON THE NORTHERLY RIGHT-OF-WAY LINE OF AMBROSE STREET; THENCE,
14. SOUTH 59°46'17" WEST, ALONG SAID NORTHERLY RIGHT-OF-WAY LINE, A DISTANCE OF 97.37 FEET TO THE POINT OF BEGINNING, CONTAINING 1.997 ACRES ±

ALL AS SHOWN ON A MAP, PREPARED BY PASSERO ASSOCIATES, ENTITLED "BROWNFIELD AREA MAP", PROJECT NUMBER 20121554.0005, DATED OCTOBER 19, 2014, AND REVISED ON APRIL 20, 2017.

APPENDIX 2
EXCAVATION WORK PLAN

TABLE OF CONTENTS

TABLES

FIGURES

1.0 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. Below presents the contact information for the above notification. The information will be updated as necessary to provide accurate contact information. A full listing of site-related contact information is provided in Appendix 3.

Ms. Charlotte Theobald
Division of Environmental Remediation Project Manager
New York State Department of Environmental Conservation
6274 East Avon Lima Road
Avon, New York 14414
charlotte.theobald@dec.ny.gov

Volunteers of America of Upstate New York
Kim Brumber, President and CEO
275 Lake Avenue
Rochester, New York 14608
(585) 647-1150
kbrumber@voaupny.org

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

This notification will include:

1. A detailed description of the work to be performed, including the location and areal extent of excavations, 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.
2. 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.
3. A schedule for the work, detailing the start and completion of all intrusive work.
4. A summary of the applicable components of this EWP.
5. A statement that the work will be performed in compliance with this EWP and 29 Code of Federal Regulations (CFR) 1910.120.
6. A copy of the contractor’s health and safety plan (HASP), in electronic format, if it differs from the HASP provided in Appendix 8 of this SMP.
7. Identification of disposal facilities for potential waste streams.
8. Identification of sources of any anticipated backfill, along with all required chemical testing results.

2.0 Soil Screening Methods

Visual, olfactory and instrument-based soil screening (e.g., photoionization detector [PID]) 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 underground utility work after issuance of the Certificate of Completion (COC).

Soils will be segregated based on previous environmental data and screening results into material that requires off-site disposal, material that requires testing to determine if the soil/fill material can be reused on-site as fill material below the cover system demarcation layer or if the material can be used as cover material. A PID screening level of 5 parts per million (PPM) will be used to segregate excavated soil/fill material. Further discussion of off-site disposal of materials and on-site reuse is provided in Section 7 of this Appendix.

3.0 Soil Staging Methods

Soil stockpiles of excavated materials will be placed on 12 mil plastic sheeting and 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 or 12 mil plastic sheeting. Stockpiles will be routinely inspected and damaged tarp covers/poly sheeting 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, maintained at the Site, and available for inspection by NYSDEC.

4.0 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 work and other work performed under this SMP. Contactor will use portable water and odor suppressant to control dust and vapors during all excavation and load-out activities.

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 New York State Department of Transportation (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 inspected, 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 off-site in an appropriate manner and in accordance with all applicable local, State, and Federal regulations.

If a truck wash area is not appropriate then a decontamination area will be established of sufficient size to accommodate all equipment (e.g., haul trucks) involved in the excavation activities. All equipment will enter the decontamination area prior to exiting the Site. The equipment will have all soil/fill material removed from the equipment. At the end of the excavation activities, the decontamination area and all material accumulated will be removed and disposed off-site in accordance with all applicable local, State, and Federal regulations.

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/soils 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.

5.0 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 New York Codes, Rules, and Regulations (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.

All trucks loaded with Site materials will exit the vicinity of the Site using the approved truck route shown on Figure 1 – Truck Route. 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; (f) overall safety in transport; and (g) community input (where necessary).

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/soil and other materials during Site remediation and development. Queuing of trucks will be performed on-site in order minimize off-site disturbance. Off-site queuing will be prohibited.

6.0 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 of 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, Construction/Demolition 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 Soil Clean-up Objectives (SCOs) is prohibited from being taken to a New York State recycling facility (6NYCRR Part 360-16 Registration Facility).

7.0 Materials Reuse On-Site

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 re-use 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.

Based on the testing outcome, soil may be re-used on-site as cover or off-site in the following manner:

- Soil that meets the Unrestricted Use SCOs for all constituents set forth in 6 NYCRR Part 375, DER-10 Appendix 5 Allowable Constituent Levels for Imported Fill or Soil and does not contain any evidence of impacts (staining, PID readings greater than 5 ppm, odors) may be re-used without restrictions on-site (e.g., backfill, cover) or off-site. Part 375, DER-10 Appendix 5 is included in Appendix 13 in the SMP.

- Soil that meets the Restricted Residential Use SCOs set forth in 6 NYCRR Part 375, DER-10 Appendix 5 for all constituents and does not contain any evidence of impacts (staining, PID readings greater than 5 ppm, odors) may be re-used on-site without restriction (i.e., may be re-used on-site as cover material or backfill). Part 375, DER-10 Appendix 5 is included in Appendix 13.

- Soil that exceeds Restricted Residential Use SCOs set forth in 6 NYCRR Part 375, DER-10 Appendix 5 Allowable Constituent Levels for Imported Fill or Soil that is included in Appendix 13 or contains any evidence of impacts (staining, PID readings greater than 5 ppm, odors) may be re-used on-site; however, it must be: placed below the existing cover system; or placed below a new cover system meeting NYSDEC requirements. The location where it is re-used must be documented.

Soil/fill material excavated at the Site will be screened and staged in accordance with Section 2 and 3 of this EWP. The sampling of soil/fill material to be re-used on-site will be analyzed for the full suite of analytical parameters. The full suite of analytical parameters includes TCL VOCs plus TICs, TCL SVOCs plus TICs, TAL metals, Cyanide, PCBs, and Pesticides. The number of soil/fill material samples to be collected for laboratory analysis see Table A below.

Table A
Soil/Fill Sampling Frequency

Recommended Number of Soil Samples			
Contaminant	**VOCs**	**SVOCs, Inorganics & PCBs/Pesticides**	
Soil Quantity (Cubic yards)	**Discrete Samples**	**Composite**	**Discrete Samples/Composite**
0-50	1	1	3-5 discrete samples from different locations in the fill being provided will comprise a composite sample for analysis.
50-100	2	1	
100-200	3	1	
200-300	4	1	
300-400	4	2	
400-500	5	2	
500-800	6	2	
800-1000	7	2	
➢ 1000	Add additional 2 VOC and 1 composite for each additional 1000 cubic yards or consult with the DER project manager.		

Any demolition material proposed for reuse on-site will be sampled for asbestos and the results will be reported to the NYSDEC for acceptance prior to reuse onsite. 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.

8.0 Fluids Management

All liquids to be removed from the Site, including but not limited to excavation dewatering, decontamination waters, groundwater from monitoring well purge and development waters, will be handled, transported, and disposed in accordance with applicable local, State, and Federal regulations. Dewatering, purge and development 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.

9.0 Cover System Restoration

After the completion of soil/fill material 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 is comprised of a minimum of 24 inches of clean soil as well as impervious cover consisting of asphalt and concrete.

The demarcation layer or orange snow fence, consisting of black geo-textile 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 Site Management Plan. Figure 11 of the Site Management Plan provides the as-built of the site's current cover system. 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 update to the Site Management Plan.

10.0 **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). Based on an evaluation of the land use, protection of groundwater, and protection of ecological criteria, the resulting soil quality standards are SCOs for restricted residential use provided in Appendix 13 of this SMP "Restricted Residential Use". Soil to be imported to the Site must meet the SCOs for all constituents listed in Appendix 13. Soil imported to a site for use in cover system, soil cover or as backfill will be analyzed for the full suite of analytical parameters: TCL VOCs plus TICs, TCL SVOCs plus TICS, TAL Metals, Cyanide, pesticides and PCBs in accordance with Section 7 of this EWP.

Imported fill material must be staged on and covered with 12 mil poly sheeting to prevent wind and precipitation erosion.

Consistent with DER-10, Section 5.4(e), the following material may be imported, without chemical testing provided that it contains less than 10% by weight material which would pass through a size 80 sieve and consists of: gravel, rock or stone, consisting of virgin material from a permitted mine or quarry; or recycled concrete or brick from a NYSDEC registered construction and demolition debris processing facility if the material conforms to the requirements of Section 304 of the New York State Department of Transportation Standard Specifications Construction and Materials Volume 1 (2002).

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.

11.0 Stormwater Pollution Prevention

Any future excavations and/or development will comply with New York State Division of Water guidelines and New York State regulations. In the event that the area of disturbance exceeds the acreage criteria for New York (currently 1-acre) or the local municipality criteria, a Storm water Pollution Prevention Plan (SWPPP) will be prepared. The storm water practices to be implemented are summarized below.

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 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.

12.0 Excavation Contingency Plan

If underground tanks or 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 for a full list of analytes (Target Analyte List [TAL] metals; Target Compound List [TCL] volatiles and semi-volatiles, TCL Pesticides/PCBs) unless Site history and previous sampling results that provide sufficient justification to limit the list of analytes. In this case, a reduced list of analytes will be proposed to the NYSDEC for approval prior to sampling.

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 also be included in the subsequent Periodic Review Reports.

13.0 Community Air Monitoring Plan

A Community Air Monitoring Plan (CAMP) will be implemented during all intrusive activities. The applicable CAMP is provided in the Appendix 9 of this SMP.

A figure showing the location of air sampling stations based on generally prevailing wind conditions is shown in Figure 2 – Air Monitoring Station Locations. These locations will be adjusted on a daily or more frequent basis based on actual wind directions to provide an upwind and at least two downwind monitoring stations. If a sensitive receptor, such as a school, day care or residential area is adjacent to the site, fixed monitoring station(s) will be located at that site perimeter, regardless of wind direction and will be operated until all intrusive activities have been completed.

Exceedances of action levels listed in the CAMP will be reported to NYSDEC and New York State Department of Health (NYSDOH) Project Managers.

14.0 Odor Control Plan

This odor control plan is capable of controlling emissions of nuisance odors off-site and on-site, if there are residents or tenants on the property. Specific odor control methods to be used on a routine basis will include:

1. Performing activities that may generate odors during normal working hours.
2. Covering vehicles transporting materials on-site when possible and in accordance with Department of Transportation requirements when transporting materials offsite.
3. Maintaining covered/tarped stockpiles on site with covering at the end of each work shift, at a minimum.
4. Loading trucks such that material will not be dropped from heights above the truck body.
5. Cleaning excavated material spills immediately.
6. Reporting and addressing odor complaints accordingly with appropriate follow- up.

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 Remediation Engineer, and any measures that are implemented will be discussed in the subsequent Periodic Review Report.

All necessary means will be employed to prevent onsite and offsite 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 offsite 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.

15.0 **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:

1. 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 soil surface and/or off-road areas including excavations and stockpiles.
2. Clearing and grubbing of larger sites will be done in stages to limit the area of exposed, un-vegetated soils vulnerable to dust production.
3. Gravel will be used on roadways to provide a clean and dust-free road surface.
4. On-site roads will be limited in total area to minimize the area required for water truck sprinkling.
5. Implement the CAMP.
6. Placement of a fabric to cover the east and north fence that surrounds the children's outdoor playground must be in place prior to any excavation on the Site.

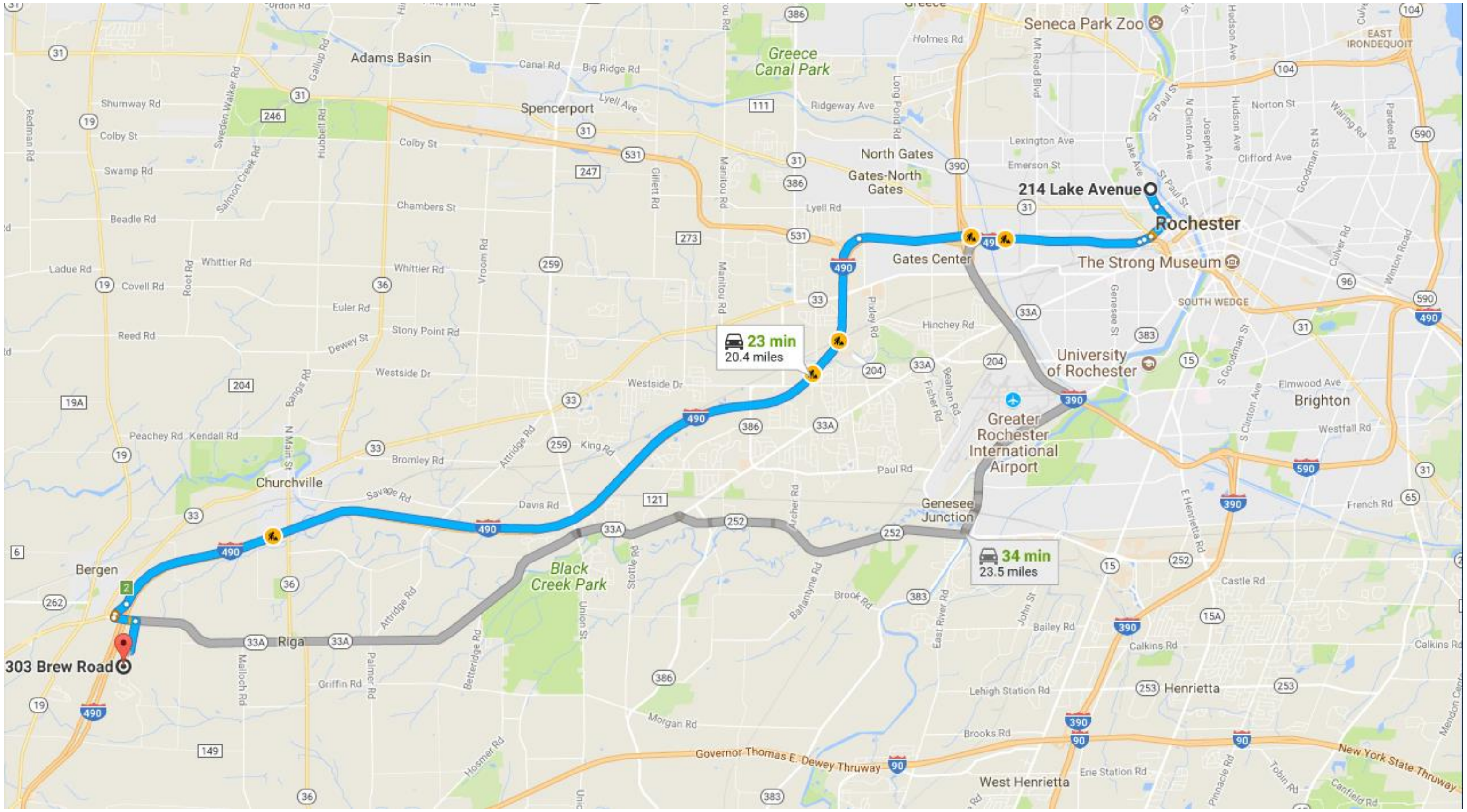
16.0 **Other Nuisances**

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 ordinances.

Truck Route to Waste Management Mill Seat Landfill

214 Lake Ave. Rochester, NY to 303 Brew Road Bergen, New York



1. Head south on Lake Ave
2. Turn left to stay on Lake Ave
3. Continue onto Sate St
4. Turn right onto Brown St
5. Take the ramp to I-490 W
6. Take exit 2 for NY-33/New York 33 A toward Bergen/Batavia
7. Keep left at the fork, follow signs for New York 33 a E
8. Turn left onto NY-33A E
9. Turn right onto Brew Rd. Destination will be on the right

BERGMANN
ASSOCIATES

Figure 1
Truck Route
Site Management Plan
Volunteers of America- NYDEC site No. C828126

▬ Truck Route

BERGMANN
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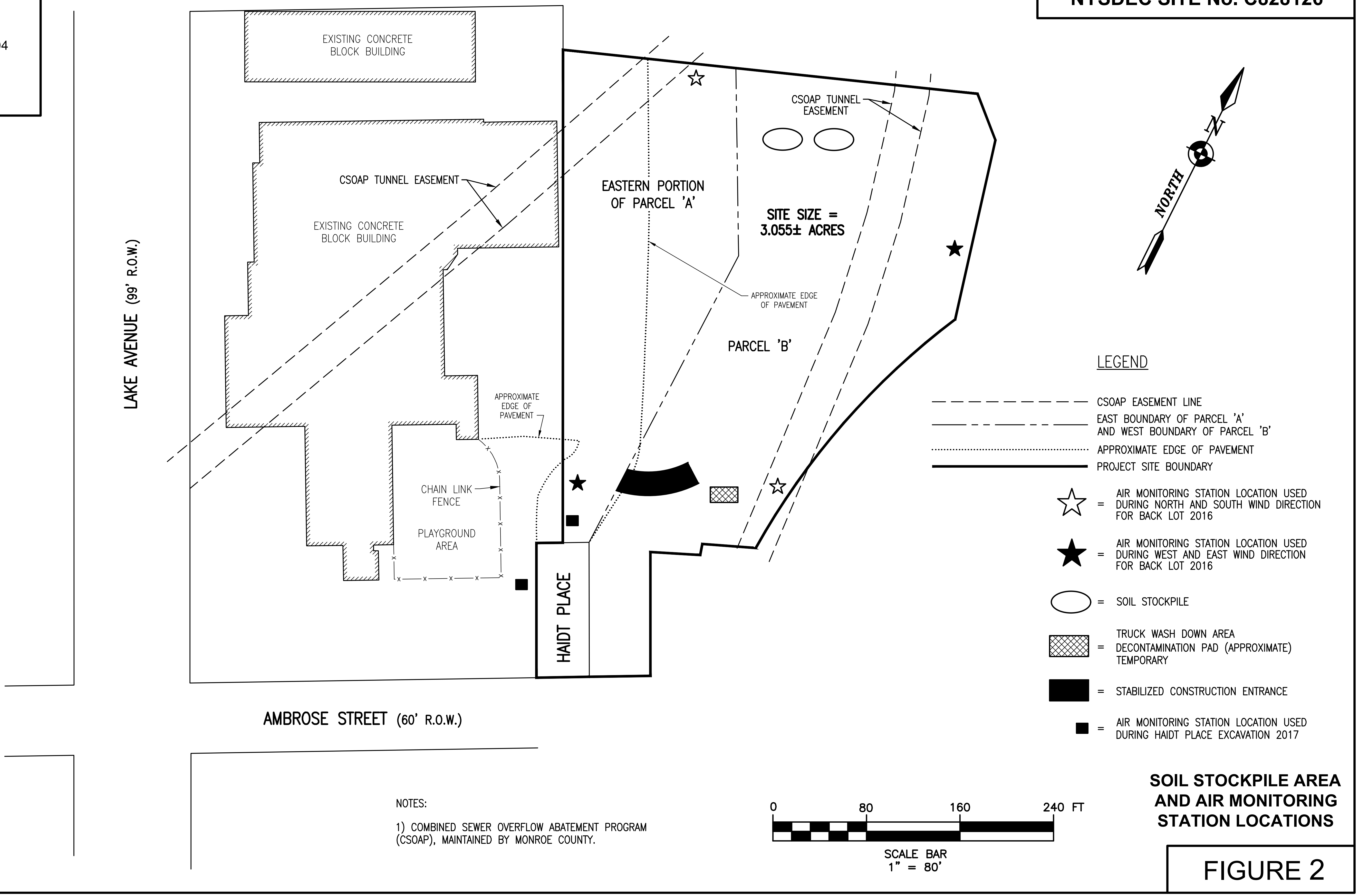
FINAL ENGINEERING REPORT
VOLUNTEERS OF AMERICA
BACK LOT SITE
NYSDEC SITE No. C828126



LEGEND

- - - - - = CSOAP EASEMENT LINE
— - — = EAST BOUNDARY OF PARCEL 'A' AND WEST BOUNDARY OF PARCEL 'B'
······ = APPROXIMATE EDGE OF PAVEMENT
━━ = PROJECT SITE BOUNDARY
☆ = AIR MONITORING STATION LOCATION USED DURING NORTH AND SOUTH WIND DIRECTION FOR BACK LOT 2016
★ = AIR MONITORING STATION LOCATION USED DURING WEST AND EAST WIND DIRECTION FOR BACK LOT 2016
⬭ = SOIL STOCKPILE
▨ = TRUCK WASH DOWN AREA DECONTAMINATION PAD (APPROXIMATE) TEMPORARY
█ = STABILIZED CONSTRUCTION ENTRANCE
■ = AIR MONITORING STATION LOCATION USED DURING HAIDT PLACE EXCAVATION 2017

NOTES:

1) COMBINED SEWER OVERFLOW ABATEMENT PROGRAM (CSOAP), MAINTAINED BY MONROE COUNTY.

SOIL STOCKPILE AREA AND AIR MONITORING STATION LOCATIONS

FIGURE 2

I:\VOA\008726.05 VOA-214 LAKE AVE NYS TITLE 14 BROWNFIELD\3.0 Design\3.8 Reports\Final Engineering Report\Final FER December\Final FER\Figures\Figure 7.dwg

APPENDIX 3
SITE CONTACT LIST

APPENDIX 3 - Site Contact List

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APPENDIX 4
MAINTENANCE PLAN

APPENDIX 4

MAINTENANCE PLAN

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1.0 DESCRIPTION OF MAINTENANCE PLAN

This document is the Maintenance Plan for engineering controls that include: site-wide engineered cover system (cover system), security fencing, and stormwater collection system at the Volunteers of America Back Lot Site (Site) located at 214 Lake Avenue and 18 Ambrose Street in accordance with the requirements of Decision Document and SMP. The maintenance activities relate to post-remediation tasks to ensure the integrity of the cover system, security fencing and storm water collection system occupying the area over the remaining contaminated soil and groundwater on-site. Theses physical engineering controls require annual inspections and maintenance over time. Annual certifications of these controls will be made and certified by a NYS Professional Engineer through visual inspections to ensure that:

- The cover system is performing the function of properly capping subsurface soils;
- Site stormwater collection system is functioning as designed; and
- Security fencing is in place and free of significant damage.

2.0 DESCRIPTION OF SITE-WIDE ENGINEERED COVER SYSTEM

The cover system over the contaminated Historic fill materials (contaminated soils) and groundwater serve as a barrier to prevent direct human contact with residual soil contamination that might otherwise pose a threat to human health and the environment. The cover system also acts as a partial infiltration barrier to minimize future soil-to-groundwater contamination migration that would further impact groundwater. Based on the future restricted residential or commercial use of the property, the cover system should function as intended unless disturbed. The cover system was installed in 2016 and 2017 across the entire Site as shown on Figure 12. The cover type varies across the Site based on existing improvements and consists of the following:

Cover System Details

Cover Type	Cross-Section
Cover Type 1: Asphalt pavement and Asphalt millings constructed over the majority of the Site (Installed 2016) and the western right of way at Haidt Place 2017.	2016 Installation: A subbase-recycled concrete, minimum of 18 inches and maximum of 27 inches compacted above black geo-textile demarcation layer. Binder 4-inches upper surface of cover system (flat surface) installed. Asphalt millings approximately 4 to 6 inches thick compacted on slope perimeter of cover system. 2017 Haidt Place:2- foot thick Crusher Run #2 with 4-inches of asphalt cover placed along the eastern right of way.
Cover Type 2: Existing Asphalt Pavement roadway, concrete walkway and parking areas (Installed 1998)	Top Course-1.5 inches Binder-3.5 inches Base Course-4 inches Subbase-12 inches Placed for roadways and parking areas along the west side of the Site. Pavement cracks sealed in 2016.
Cover Type 3: Landscaped lawn (Installed1998) and in the west side of the Haidt Place right of way 2017.	1998 Landscaped Lawn: Existing grass covered topsoil 2-inches, with 12 inches soil cover thickness (min) placed along the southwest side of the Site near VOA children's playground in 1998. 2017 Haidt Place: 2- foot of imported Crusher Run #2 with 4 to 6-inches of top soil place in 2017 along the west side of Haidt Place.

* Recycled concrete thickness varies due to underlying impacted re-used Site soils.
* Demarcation layer represented by orange snow fence on Haidt Place 2017

The majority of the cover system is asphalt. The area of the western side of the Site has existing pavement roadway / parking lot and grass cover areas associated with the VOA Human Service Complex and were installed during the redevelopment of VOA's Human Service Complex facility during 1998. The existing pavement cover areas had cracks in the pavement sealed during 2016 and will remain as pavement areas that are part of the cover system. The limited existing grass cover areas will remain in place. The Haidt place Right of Way has a grass cover system (Cover Type 3) installed on the west side of the Right of way and an asphalt cover system on the east side (Cover Type 1) of the Right of Way. The Haidt Place roadway is existing pavement and subbase installed in 1989 (Cover Type 2). The area of the cover system is shown on Figure 12.

2.1 DESCRIPTION OF STORM WATER COLLECTION SYSTEM

The storm water collection system (storm sewer network) consists of a network of pipes, inlets and manholes that connect to the existing combined sewer governed by Monroe County Pure Waters (MCPW). The connection to the combined sewer lateral is made by the installation of a 5-foot diameter pre-cast manhole conforming to the MCPW details.

Runoff on top of the cover system in the back lot fenced in area of the Site, sheet drains to either the catch basins or inlet manholes located at the top of the cover system in the pavement surface. There are two (2) catch basins and two (2)-inlet manholes that collect the runoff in the Area. Runoff entering the catch basins or inlet manholes is act as an underground storm water storage-system. Approximately 667 linear feet of 36-inch diameter HDPE pipe is connected together with manholes and tees. Storm water discharge is controlled by the connection to the existing MCPW 10-inch diameter lateral located within the existing pavement cover system in the parking area/roadway at the Site. This connection is made by a 5-foot diameter manhole at the downstream side of the storm water collection system and the intersection of the existing lateral, Manhole D-1 on drawing C102. The existing manhole at the 10-inch lateral also receives run-off from the balance of the Site from existing pavement areas. The installation details shown on Figure 9 conforms to City of Rochester and MCPW Standards and Specifications. The location of the storm water collection system is shown on Figure 12.

2.2 DESCRIPTION OF SECURITY FENCE

The majority of the Site is fenced to reduce access to the cover system, storm water collection system and monitoring wells. The fence height is 8 foot and 6 foot along the perimeter of this area. The roadway, parking lot areas and grass cover / pavement cover along the Haidt Place right-of way are not fenced. These areas area along the western side of the Site.

3.0 ANNUAL MAINTAINANCE

Maintaining the integrity and effectiveness of the cover system will be based on the results of annual inspections to provide recommendations for making repairs to the cover system as necessary to correct the effects of weathering, settlement, subsidence, erosion, or other events, and preventing run-on and run-off from eroding the cover system. Inspections are performed for the items noted below. The inspection frequencies are scheduled to properly detect any issues so that repairs can be performed before damage occurs that may impact the integrity and effectiveness of the cover system. The elements of the cover system are described below:

Pavement Surface: The entire pavement surface (asphalt), including the final (top) surface and side-slopes (pavement millings), will be inspected for, settlement, subsidence, cracks, displacement and presence of vegetation. The roadway and parking areas of the cover system will also be impacted for the same conditions.

Grass Cover: The limited grass cover areas of the cover system will be inspected for erosion, displacement, vegetation other than grasses. These areas are along the west side of the Haidt place Right of Way, in areas that adjoin the fenced VOA children's playground, and in planters within the parking lot and roadways.

Final Cover Surface: The final cover surface will be inspected for any ponding of water or flat areas. Due to the design contours required to achieve the final cover grade, special attention will be focused to ensure that no settlement, subsidence, erosion, depressions or flat areas exist and that no water is allowed to pond on the surface of the cover system.

Based upon the facility inspections, maintenance and repairs to engineering controls during post-remediation will be performed as discussed below and in accordance with the Site Management Plan.

- **Erosion Damage Repair:** Any areas exhibiting erosion will be repaired by replacing and compacting the material in-kind to design grade/specifications, and reseeding the area to the specifications. Applications of additional fertilizer, selective herbicides, rodent control measures, etc. will be implemented as necessary. In the selection of fertilizers and herbicides, ensure their use will not impact the groundwater negatively. Follow-up monitoring of the repaired area will be conducted to ascertain the integrity of the repair.

- **Settlement, Subsidence, and Displacement:** Any areas at the Site exhibiting evidence of settlement, subsidence, or displacement will be examined to determine the cause of the movement. If backfilling or placing additional fill material is needed to maintain the integrity of the closed structure, it will be performed in accordance with the site/closure specifications, including seeding. If the condition reoccurs or persists, or if the severity of the condition initially is judged to warrant it, a detailed investigation of the cause will be performed and remedial action will be performed. Repairs will be made as necessary. Follow-up monitoring of the area will be performed to ascertain that the problem has been corrected.

- **Cover System Surface:** Any areas that show signs of ponding water or flat contours will be examined and rectified. Due to the design contours required to achieve the final cap grade, special attention will be focused on the cap surface to ensure that any areas that hold water are re-graded to promote drainage, re-seeded to promote vegetative growth, and maintained to ensure that the ponding of water does not persist.

The groundwater monitoring system will be inspected for the general integrity of the wells, well casings and well protective casings during the inspection of the cover system. Any damaged portions of the monitoring wells and/or their protective casings will be replaced in-kind. Assessment of the interior of monitoring wells will be in accordance with the SMP and in accordance with the requirements of QAQP Plan.

- **Storm water Collection System:** The surface drainage system, including channels, culverts, slope drains, etc., will be inspected for erosion, integrity of channel lining, ponding, and accumulated sediment. The low areas of the cover system pavement surface are designed to route surface run-off to the catch basins of the storm water collection system in the cover system. Maintenance of the surface water drainage system will consist of removing sediment and/or undesirable vegetation from the surface water runoff control system (channels and culverts) as required.

4.0 MAINTAINANCE CONTACTS

The name, address, and telephone number of the persons to contact about mainteance related concerns or requirements for the Site during the post remediation period are listed below.

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5.0 ANNUAL INSPECTION

The cover system overlying the contaminated historic fill materials (soils) and groundwater will be inspected once a year when the cover system is free of snow cover and ice for deterioration, cracks and other potential problems that can cause compromise of the cover system, infiltration or exposure to underlying soils. The inspections will be performed by representative Qualified Environmental Professional as defined in the Site Management Plan. The inspections will be performed to observe and evaluate damage due to settling, exposure to the weather, wear from traffic, increasing age and other factors. Any area where soils have become or are likely to become exposed and where infiltration from the surface will not be effectively minimized will be documented. A log of each inspection will be recorded on the Annual Maintenance Inspection Form (see Appendix 7 in the SMP). This form will include recommendations for necessary repair of any areas where the cover system surface is damaged and or underlying soils are exposed and where infiltration from the surface will not be effectively minimized. The form also has items to inspect for the storm water collection system and security fence. A copy of this form will be provided in the Periodic Review Report.

APPENDIX 5

QUALITY ASSURANCE / QUALITY CONTROL PLAN

APPENDIX 5 - Quality Assurance and Quality Control

Quality Assurance and Quality Control

Media monitoring includes soil and groundwater sampling and waste characterization sampling (e.g., soil, groundwater, decontamination fluids) and any additional sample analysis required in accordance with the Site Management Plan, Excavation Work Plan and NYSDEC DER-10. Media monitoring will be collected by or under the supervision of a professional engineer (PE) or qualified environmental professional (QEP) designated by Volunteers of America of Upstate New York or Site owner. Sample collection will follow the guidelines presented in this section.

Sample Collection

Quality Assurance/Quality Control (QA/QC) samples will be collected with any post-certificate of completion (COC) sampling activities. QA/QC samples will be collected at the Site in order to: (1) check sample bottle preparation; (2) evaluate contamination introduced during transport; (3) evaluate the effectiveness of field decontamination procedures; and (4) evaluate the “reproducibility and accuracy of the laboratory analytical procedures”. QA/QC samples will be collected as specified in NYSDEC’s DER-10. QA/QC samples will consist of a trip blank per shipment of samples for VOC analysis, temperature blanks in each cooler, field blanks of distilled water collected off of decontaminated field equipment, and duplicate sample sets. One field blank and one duplicate sample will be collected for every 20 grab samples collected.

Labeling of Samples

After collection of appropriate samples, the following information shall be legibly and indelibly written on the sample labels:

1. Site name.
2. Sample date.
3. Time of collection.
4. Sample location.
5. Sample identification number.
6. Type of sample.
7. Sample collector’s initials.
8. Preservatives used, if any.
9. Analysis to be performed.

Each sample shall be given a unique sample number. This system will provide a tracking number to allow for identification of the sample location and date of collection and to allow for cross-referencing of sample information.

Quality Control (QC) samples and duplicate samples will also be numbered in accordance with the numbering system.

Equipment Decontamination

To avoid cross contamination, sampling equipment (defined as any piece of equipment which may contact a sample) will be decontaminated according to the procedures outlined below.

Non-Dedicated Reusable Equipment

Non-dedicated reusable equipment such as hand augers, stainless steel mixing bowls and spoons, pumps used for groundwater evacuation and sampling, will require field decontamination. Acids and solvents will not be used in the field decontamination of such equipment. Decontamination will be accomplished by scrubbing/washing with a laboratory grade detergent (e.g., Alconox™ or equivalent) to remove visible contamination, followed by potable (tap) water and analyte-free water rinses. Tap water may be used from any treated municipal water system. The use of an untreated potable water supply is not an acceptable substitute. Equipment will be allowed to dry prior to use. Steam cleaning or high pressure hot water cleaning may be used in the initial removal of gross, visible contamination.

Disposable Sampling Equipment

Disposable sampling equipment includes polyethylene sampling spatulas and disposable bailers, string, tubing associated with groundwater sampling/purging pumps (if applicable). Such equipment will not be field-decontaminated and will be disposed of as non-hazardous solid waste in accordance with all applicable local, State, and Federal regulations.

Chain of Custody and Shipping

Project personnel receiving the sample containers from the laboratory will check each cooler for the condition and integrity of the bottles prior to field work. Chain-of-custody forms to trace the path of sample containers from the collection site to the laboratory will be utilized throughout the Project. The Project manager will notify the laboratory of upcoming field sampling events and the subsequent transfer of samples. This notification will include information concerning the number and type of samples and the anticipated date of arrival. Once the sample containers are filled, they will be immediately placed in the cooler with ice (in Ziploc plastic bags to prevent leaking) or synthetic ice packs to maintain the samples at 4°C. The field sampler will indicate the sample designation/location number in the space provided on the chain-of-custody form for each sample. Insulated sample shipping containers (typically coolers) will be provided by the laboratory for shipping samples. All sample bottles within each shipping container will be individually labeled with an adhesive identification label provided by the laboratory. The chain of custody forms will be signed and placed in a sealed plastic Ziploc bag in the cooler. The completed shipping container will be closed for transport with nylon strapping or a shipping tape of similar strength. One paper custody seal will be affixed to the lid. This seal must be placed such that it is broken when the cooler is opened and will indicate tampering if the seal is broken before receipt at the laboratory. A label may be affixed identifying the cooler as containing "Environmental Samples" and the cooler will be picked up from the Site by the courier supplied by the laboratory or shipped by an overnight delivery service to the laboratory. When the laboratory receives the coolers, the custody seals will be checked and lab personnel will sign the chain-of-custody form. The following typical Chain-Of-Custody procedures will be implemented during the soil sampling:

A. The samples are under custody of the field personnel if:

1. They are in his/her possession;
2. They are in view after being in possession;
3. They are locked up or sealed securely to prevent tampering; or
4. They are in a designated secure area.

B. The original of the chain-of-custody form must accompany the samples at all times after collection until receipt at the analytical laboratory. A copy of the chain-of-custody form will be kept by the sampling collector until it is filed in the Project file.

C. When the possession of samples is transferred, the individuals relinquishing and receiving the samples will sign, date, and note the time on the Chain-Of-Custody form.

D. When samples are shipped, the courier name and air bill number, if applicable, will be noted on the Chain-Of-Custody form. Prior to shipping, coolers will be secured with signed custody seals so the laboratory may confirm coolers were not opened during shipping. The chain-of-custody form will contain information to distinguish each sample from any other sample. This information will include:

- Project name and address for which sampling is being conducted;
- Name(s) and signature(s) of sampler(s);
- Sample identifier;
- Matrix being sampled (groundwater, soil, etc.);
- Sampling date and time;
- Number of containers and the volume of sample collected; and
- Analytical method to be performed.

The chain-of-custody form record is a color-coded, three copy form. Chain-of-custody copies are distributed as follows:

1. White Copy, Original: Accompanies samples
2. Yellow Copy: Maintained by the Laboratory
3. Pink Copy: Retained by the Sample Collector

Groundwater Level Measurement Procedures

I. Introduction

Water levels will be measured using an electronic well probe. Water level readings will be made twice at each location to verify accuracy.

II. Materials

- Photoionization detector (PID).
- Appropriate health and safety equipment as specified in the Health and Safety Plan.
- Water level probe with 0.01-inch gradations.
- Laboratory-type non-phosphate detergent (Alconox or equivalent).
- Distilled water.
- Plastic sheeting (optional).

III. Procedures

A. A detailed procedure for obtaining water levels will be as follows:

1. Identify the site and well number, the date, time, personnel, and weather conditions in the bound field book.
2. Use safety equipment as specified in the Health and Safety Plan.
3. Clean the water level probe tape with a detergent (Alconox) water rinse followed by a distilled water rinse. All decontamination waste and/or wastewater generated at the Site will be containerized and characterized for disposal purposes.
4. Put clean plastic sheeting on the ground next to the well if necessary to prevent the probe tape from contacting the ground.
5. Establish a background reading with the PID.
6. Open the well cover while standing up-wind from the well. Place the well cap on the plastic sheeting. Monitor the air in the breathing zone above the well casing with the PID. If the PID meter reads greater than 1 ppm meter units, move up wind from the well and allow the air inside the casing to vent for

approximately 5 minutes. Repeat PID reading. If above 1 ppm, follow instructions in the Health and Safety Plan.

7. The measurement reference point is the PVC well casing. All down hole measurements will be taken from the top of the PVC well casing.
8. Lower the water level indicator probe until it indicates the top of water. Measure to the nearest 0.01-foot and record the depth to water from the reference point.
9. Lower the water level probe to the bottom of the well. Measure to the nearest hundredth of a foot and record the depth of the well from the reference point.
10. Remove probe from the well.
11. Repeat Step 8 and record.
12. Clean the water level probe and cable that extended into the well with a detergent (Alconox or equivalent) water rinse followed by a distilled water rinse. Discard rinse water on the ground adjacent to the well unless contamination is evident.
13. Compare depth of well to previous records.
14. Place the cap on the well and lock or bolt roadway cover into place when all activities are completed.

Low-Flow Groundwater Sampling Procedures

I. Introduction

This protocol describes the procedures to be used to collect groundwater samples. During heavy precipitation events, groundwater sampling will be discontinued until precipitation ceases.

II. Materials

The following materials, as required, shall be available during groundwater sampling:

- Photoionization detector (PID)
- Appropriate health and safety equipment as specified in the Health and Safety Plan.
- Plastic sheeting (for each sampling location)
- New dedicated, disposable, translucent bailers
- Polypropylene line
- Buckets to measure purge water volume
- Water level probe
- Horiba U-10 Water Quality Checker (meter for pH, temperature, electrolytic conductivity, and turbidity)
- Low-flow submersible, peristaltic or bladder pump
- Polyethylene tubing
- Oil-water interface probe
- Glass bowl
- Laboratory-supplied sample jars
- Appropriate transport containers (coolers) with ice and labeling, packing, and shipping materials.
- Chain of custody forms
- Indelible ink pens
- Site map showing well locations
- Well keys

III. Procedures

Low-flow procedures will be used to both purge and sample the Site monitoring wells. The appropriate protocol is as follows:

1. Review materials check list (Part II) to ensure the appropriate equipment has been acquired.
2. Record the following information:
   - Project name and number
   - Date and time
   - Sampling personnel
   - Well number
   - Weather conditions
3. Label all sample containers in accordance with the procedures listed above in Labeling of Samples section.
4. Place plastic sheeting adjacent to well to use as a clean work area.
5. Establish background reading with the PID.
6. Remove lock from well and, if rusted or broken, replace.
7. Unlock and open the well cover while standing upwind of the well. Remove well cap and place on plastic sheeting. Insert PID probe in the breathing zone above the well casing. Proceed if PID reading is below 1 ppm. If PID reading is above 1 ppm, move upwind from well 5 minutes to allow the well headspace volatiles to dissipate. Repeat PID reading. If above 1 ppm, follow instructions in the Health and Safety Plan.
8. Lay the sample collection and field parameter measurement equipment out on the plastic sheeting.
9. Obtain water level and bottom of well depth measurements using an electric interface probe. Clean the probe after each use. (Note: liquid levels should be measured at all wells prior to initiating any sampling activities).
10. Obtain depth of LNAPL and DNAPL layers using a translucent bailer. LNAPL is measured before sampling by lowering a clean, translucent bailer carefully into the water column and removing a sample of standing water. Pour the sample into a glass bowl. Observe the sample and note the sample turbidity and the presence or absence of a sheen. An assessment of DNAPL presence is made after sampling is complete by carefully lowering the translucent bailer to the bottom of the well and repeating the procedure.
11. Calculate the number of gallons of water in the well using the length of water column (in feet).
12. Check the calibration of the water quality meter and then measure and record pH, temperature, conductivity, and turbidity of the sample following the manufacturer’s procedures for operation of the Horiba U-10 Water Quality Checker.
13. Using a low-flow pump, purge water from the well and monitor groundwater parameters for each liter of water removed. The following parameters (with their associated guidelines) will be measured in the field using appropriate equipment such as a water level meter and Horiba U10 or equivalent. Parameter measurements shall be obtained after each purge of one liter of groundwater, or more frequently, up to ten liters.
    - Drawdown not to exceed 3.9 inches.
    - Turbidity: three (3) successive readings ± 10% and a final value between 5 and 10 NTUs.
    - Specific Conductance: three (3) successive readings ± 3%.
    - pH: three (3) successive readings ± 0.1 pH units.
    - Temperature: three (3) successive readings ± 3%.
    - Dissolved Oxygen: three (3) successive readings ± 10%.
    - Oxidation Reduction Potential: three (3) successive readings ± 10 mv.

    The purge water for the monitoring wells, and disposal sampling equipment/material and PPE will be containerized in NYSDOT-approved, 55-gallon drums for characterization prior to disposal. The purge and decontamination water will be disposed off-site in accordance with all applicable local, State, and Federal regulations.

14. After the stabilization of field parameters, obtain the groundwater sample needed for analysis with the pump directly from the pump discharge into the appropriate sampling containers and tightly

screw on the caps. The preferred order of sample collection after purging is as follows: TCL volatile organics, TCL SVOCs, and TAL metals.

15. Check for the presence of DNAPL as explained in item 10.
16. Replace the well cap and lock well.
17. Record the sampling time.
18. Clean the non-dedicated sampling equipment in the Equipment Cleaning Section above. Place all disposable sampling materials (plastic sheeting and health and safety equipment) in a garbage bag for appropriate disposal following completion of the field activities.
19. Complete sample packaging, shipping, handling, and chain-of-custody procedures.

Handling of Field Work Generated Wastes

Field work-generated wastes generally fall within the categories of drilling wastes (drilling fluids, soil and rock cuttings, drilling equipment decontamination wastes), well development waste fluids, sampling equipment decontamination waste fluids, abandoned well casings and related material, and personal protective clothing waste. The general requirements for handling (containment and disposal) of these categories of waste are discussed below.

Waste Containment

1. *Drilling Fluids*

Drilling re-circulating fluid will be changed and disposed after each day of drilling. This procedure is followed to avoid groundwater contamination by the drilling fluid as the borehole is advanced. The waste drilling fluid will be collected in an appropriate container, such as D.O.T. 55-gallon drums, and will be characterized based upon analytical data. Environmental contractors will transport the containers (drums), when full, to the appropriate disposal facility in accordance with local, State and Federal laws.

2. *Drilling Equipment Decontamination Wastes*

The decontamination wastes will be contained in appropriate containers (D.O.T. 55-gallon drums). The collected decontamination wastes will be characterized when the containers are full based upon analytical data and will be disposed according to disposal facility requirements and in accordance with local, State and Federal laws.

3. *Soil and Rock Cuttings*

The soil and rock cuttings from the drilling procedures will be collected in D.O.T. 55-gallon drums. The containers will be characterized prior to transportation for storage and disposal according to disposal facility requirements and in accordance with local, State and Federal laws. Boreholes not used for the installation of groundwater monitoring wells will be grouted to the surface. Investigation-derived soils may be returned to the Site upon the NYSDEC's approval. NYSDEC approval must be obtained prior to returning soils to the Site.

4. *Well Development Waste Fluids*

Groundwater and waste fluids generated by well development activities, including wastewaters generated by slug tests, will be collected in appropriate containers (D.O.T.-approved, 55-gallon drums). The contents of the containers will be characterized based upon analytical data. The containers will be transported for disposal according to disposal facility requirements and in accordance with local, State and Federal laws. NYSDEC approval must be obtained prior to any discharged adjacent to the well locations.

5. *Sampling Equipment Decontamination Waste Fluids*

Waste fluids generated by decontamination of soil/sediment or groundwater/surface water sampling equipment will be collected in appropriate containers (D.O.T.-approved, 55-gallon drums). The contents of the containers will be characterized prior to transportation for disposal according to disposal facility requirements and in accordance with local, State and Federal laws.

6. Abandoned Well Casings and Related Material

Abandoned well casings and related well construction materials will be cut and/or dismantled and collected in appropriate containers. At the end of each workday, the containers will be transported for disposal according to disposal facility requirements and in accordance with local, State and Federal laws.

7. Excavated Historic Fill Materials

Any Historic fill materials (soils) excavated below the demarcation layer will be disposed of off-site or placed back into the excavation below the demarcation layer. If transported off-site these soils will be characterized for disposal at an approved sanitary landfill in accordance with landfill requirements and local, State and Federal laws.

8. Personal Protective Clothing Waste

The waste personal protective clothing worn during field operations (the level of protection to be determined by specifications in the Health and Safety Plan) will be disposed daily in D.O.T. 55-gallon drums or other appropriate containers. The containers will be transported for disposal facility requirements and in accordance with local, State and Federal laws.

Waste Disposal

Selection of appropriate procedures for disposal of wastes generated as part of fieldwork activities or future re-development will depend upon analytical laboratory results for soil and groundwater derived wastes. If a waste fluid is generated, the contractor executing the specific work will contain the waste as described in the Excavation Work Plan. Prior to disposal of a generated waste, a Waste Profile will be completed and approved by the generator of the waste (Client representative). The waste profile information will be submitted to the waste disposal facility.

All soil/ fill material and/or waste material will be disposed at a permitted landfill facility in accordance with all applicable local, State, and Federal regulations.

All hazardous waste fluids and solid waste materials generated by field activity will be manifested according to federal regulations described in 40 CFR 262.20 and 40 CFR 262.30. These regulations state the manifest requirements for a generator who transports, or offers for transportation of, hazardous waste for off-site treatment, storage, or disposal. The generator (Client) must prepare a Uniform Hazardous Waste Manifest on EPA form 8700-22, and, if necessary, EPA form 8700-22A, according to the instructions included in the Appendix to 40 CFR Part 262.

New York State regulations (described in 6 NYCRR Part 364) apply when the generated hazardous wastes are treated, stored, or disposed within New York State. In these situations, a NYSDEC Hazardous Waste Manifest (Form 48-14-1 (3/89)-7f, modified from EPA Form 8700-22) will be used to the exclusion of the EPA Uniform Hazardous Waste Manifest.

APPENDIX 6

QUALITY ASSURANCE PROJECT PLAN

Quality Assurance Project Plan

Title: Site Management Plan- Quality Assurance Project Plan (QAPP) Brownfield Cleanup Program (BCP) BCP Index No. 8-0688-05-04

Project Name/Property Name: – 214 Lake Avenue Back lot Site, NYSDEC Site No. C828126
Property/Site Location: 214 Lake Avenue and 18 Ambrose Street, Rochester, NY

Revision Number: **Rev. 1**
Revision Date: **October 31, 2017**

BCP Agreement Number: _ 8-0688-05-04

Ms. Kim Brumber - Volunteers of America of Upstate New York

Brownfield Cleanup Recipient

Stephen DeMeo, Bergmann Associates, 280 E. Broad Street, Suite 200, Rochester,
New York 14604, 585-498-7805, sdemeo@bergmannpc.com

Preparer's Name and Organizational Affiliation
Preparer's Address, Telephone Number, and E-mail Address

October 31, 2017

Preparation Date (Day/Month/Year)

Brownfield Cleanup Manager: ______________________

Stephen DeMeo / Bergmann Associates – July 20, 2017

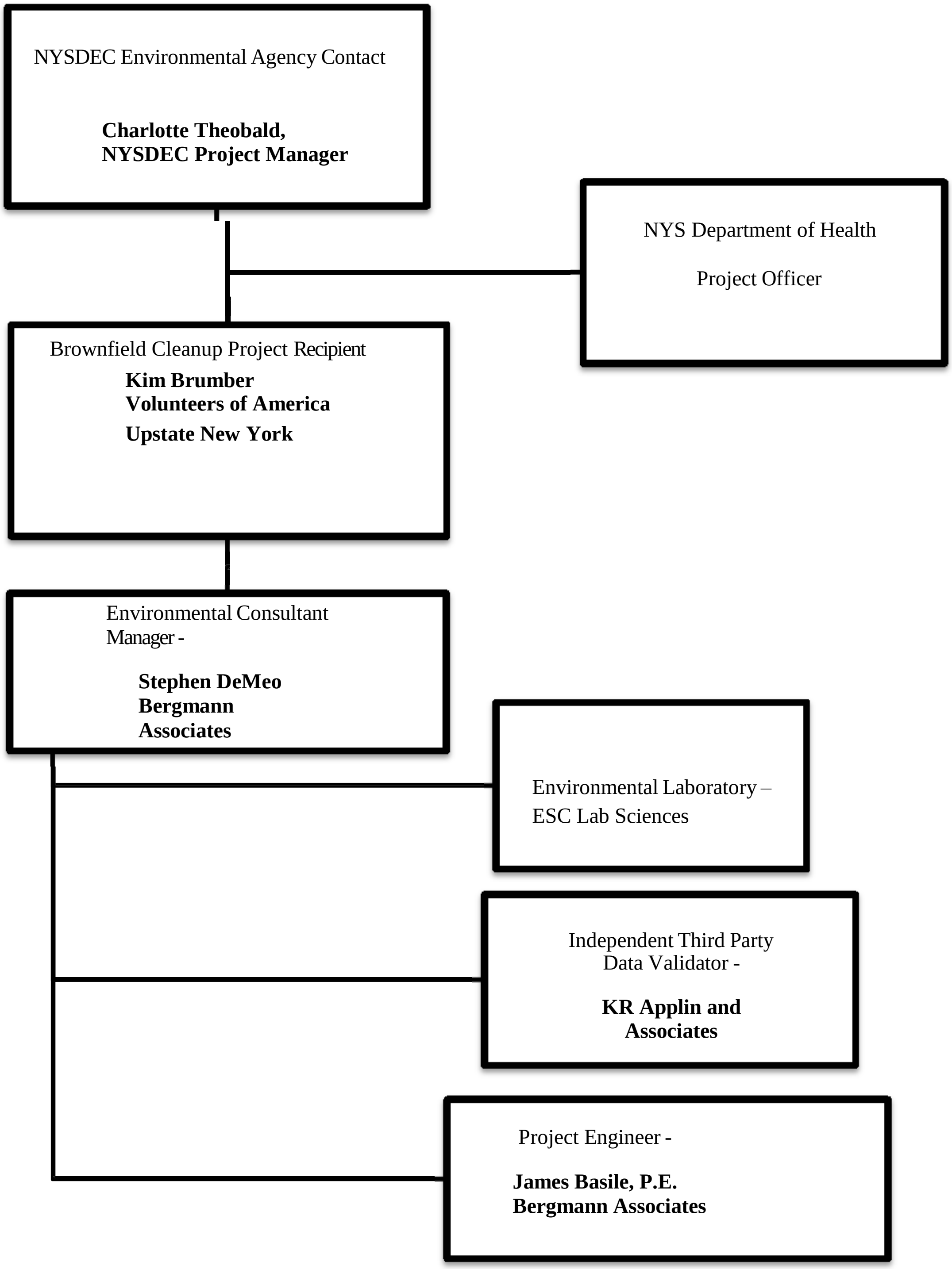
Printed Name/Organization/Date

Environmental Consultant Quality Assurance Officer:
(QAO) ______________________

Stephen DeMeo Bergmann Associates – October 31, 2017

Printed Name/Organization/Date

Project Organizational Chart



Brownfields QAPP

Personnel Responsibilities

Name	Title	Telephone Number	Organizational Affiliation	Responsibilities[1]
Mr. Stephen DeMeo	Environmental Consultant Project Manager	585-498-7805	Bergmann Associates	Oversight of execution of all project elements and preparation of all project deliverables.
Mr. Stephen DeMeo	Sampling Assistance	585-498-7805	Bergmann Associates	Management of field sampling program and subcontractors, data management and report preparation.
Ms. Kim Brumber	Brownfields Recipient Program Manager	585- 647-1150	Volunteers of America Upstate New York	Brownfield Cleanup Project Recipient
Mr. Stephen DeMeo	Project Manager	585-498-7805	Bergmann Associates	Overall management of Brownfield projects
Ms. Charlotte Theobald, P.E.	State Brownfields Contact	585-226-2466	New York State Department of Environmental Conservation	Oversight of remediation under Brownfield Cleanup Program
Mr. Alan Harvill	Environmental Laboratory Contact	615-773-9787	ESC Lab Sciences	Analytical Laboratory services coordination and reporting.
Mr. Ken Applin	Third Party Data Validator	518-251-4429	KR Applin and Associates	All data validation DUSR-related services
Mr. James Basile P.E	Project Engineer Contactor / Project Engineer	585-251-4429	Bergmann Associates	Maintenance and Inspections

Problem Definition/Project Description

I. PROBLEM DEFINITION

This QAPP is appended the Site Management Plan (SMP) as a required element of the remedial program for the Volunteers of America 214 Lake East Avenue Back Lot Site located in the City of Rochester, New York (hereinafter referred to as the “Site”). The Site located at 214 Lake Avenue and 18 Ambrose Street is currently in the New York State Environmental Brownfield Cleanup

Program (BCP) Site No. C828126 which is administered by New York State Department of Environmental Conservation (NYSDEC).

Volunteers of America of Western New York, Inc. (VOA) as Volunteer entered into a Brownfield Cleanup Agreement (BCA), on June 15, 2005, as amended May 27, 2016, with the NYSDEC to remediate the Site. A figure showing the Site location and boundaries of this Site is provided in Figure 2 – Site Layout. The boundaries of the Site are more fully described in the metes and bounds site description that is part of the two Environmental Easements provided in SMP Appendix 1 – Environmental Easement.

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 Monroe County Clerk, requires compliance with this SMP and all ECs and ICs placed on the Site.

This SMP was prepared to manage remaining contamination at the Site until the Environmental Easement is extinguished in accordance with ECL Article 71, Title 36. This plan has been approved by the NYSDEC, and compliance with this plan is required by the grantor of the Environmental Easement and the grantor's successors and assigns. This SMP may only be revised with the approval of the NYSDEC. The goal of the project is to remediate subsurface conditions sufficiently to facilitate future sale and re-development of the property for restricted residential or commercial uses.

II. PROJECT DESCRIPTION

A. Site Location and Description

The site is located in the City of Rochester, Monroe County, and is identified as Section 106.76 Block 1 and Lot 44 on the Monroe County Tax Map (See Figure ISM-01 in Appendix 1). The Site is approximately 0.622 acres area and is bounded by residential properties to the north and east with commercial buildings to the west and south (See Figure 2 - Site Layout Map). The boundaries of the Site are more fully described in Appendix 1 – Environmental Easement. The owner(s) of the site parcel(s) at the time of the issuance of this SMP is the City of Rochester.

B. Implementation of the SMP and Sampling Considerations

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 SAC (Contract No.: C303, Site No.: B00129-8) for the Site, and thereby subject to applicable penalties.

All reports associated with the Site can be viewed by contacting the NYSDEC or its successor agency managing environmental issues in New York State. A list of contacts for persons involved with the Site is provided in Appendix 3 – Site Contact List of this SMP.

This SMP was prepared by Bergmann Associates, Inc., on behalf of the City of Rochester, in accordance with the requirements of the NYSDEC's DER-10 ("Technical Guidance for Site Investigation and Remediation"), dated May 3, 2010. This SMP addresses the means for implementing the ICs and/or ECs that are required by the Environmental Easement for the Site.

Successful implementation of these project elements will result in issuance by NYSDEC of Site closure.

Soil and groundwater samples will be submitted to a laboratory accredited through the New York State Department of Health Environmental Laboratory Accreditation Program (ELAP). Specific analyses to be used are listed in the sections below.

<u>Sampling Considerations:</u>

1. Future Site Excavations

Prior to performing excavations during future re-development all of the conditions in the Excavation Work Plan provided in Appendix 2 of the SMP should be reviewed. During excavation, soil will be screened with a calibrated photoionization detector (PID). The required soil samples will be collected and submitted for laboratory analysis for:

- Part 375 and NYSDEC CP-51 List volatile organic compounds (VOCs) plus Tentatively Identified Compounds (TICs), USEPA Method 8260C; and
- PART 375 and NYSDEC CP-51 List Semi volatile Organic Compounds (SVOCs) plus TICs, USEPA Method 8270D.

2. Groundwater Sampling

The future sampling will be performed using low-flow methodology to facilitate accurate measurement of the field parameters dissolved oxygen (DO) and temperature, specific conductance, and turbidity. Samples will be submitted to an ELAP-certified laboratory for the following analyses:

- Part 375 and CP-51 List VOCs plus TICs, USEPA Method 8260C;
- Part 375 and CP-51 List SVOCs plus TICs, USEPA Method 8270D; and
- TPH, USEPA Method 8015D.

A DUSR will only be generated for the final round of groundwater sampling.

3. Groundwater Elevation Measurement

After water levels have equilibrated, static water levels will be measured in each well with an electronic water level indicator to the nearest 0.01 ft. The potential presence of petroleum product will also be monitored with an interface probe.

4. Survey of Exploration and Sample Locations

Horizontal coordinates of excavations, test borings, monitoring wells and relevant Site features have been established with GPS equipment. The relative elevation of the top of each monitoring well casing has been established by a licensed surveyor using City of Rochester datum on the Site.

5. Decontamination

Sampling methods and equipment have been chosen to minimize the need for decontamination. All non-dedicated or non-disposable equipment will be decontaminated prior to and following each use. Decontamination of soil sampling equipment will consist of a wash with Alconox (or equivalent) solution and a potable water rinse. Following decontamination, direct contact between sampling equipment and the ground surface will not be permitted. Decontamination fluids will be managed as IDW (see discussion, next section).

C. Project Decision Statements

Future development of the Site is uncertain. The property is likely to remain zoned for mixed Residential and Commercial.

The criteria to be used to compare analytical results for soil samples will established based on the future re-use for soil cleanup objectives (SCOs) that will include: Unrestricted use, Restricted residential use, Commercial use and Protection of Groundwater contained in NYSDEC’s 6NYCRR Part 375 regulations.

Project “If/Then” statements:

1. If confirmatory sample results for future excavations indicate residual soil contamination is present at levels above applicable SCOs for Site re-use, then the excavation will be expanded to the extent practicable to remove the residual impacts, See Appendix 2- Excavation work plan in the SMP.

2. If, after the prescribed time period for post-remedial groundwater monitoring, contaminant concentrations exceed the groundwater standards contained in NYSDEC’s TOGS 1.1.1 Guidance Document, then it will be proposed to conduct groundwater monitoring until asymptotic conditions for VOCs are attained for a one-year period. At that time, it would also be proposed that the institutional and engineering controls be used to provide conditions protective of public health and the environment for the intended and reasonably anticipated use of the Site.

Project Quality Objectives/Systematic Planning Process Statements

Overall Project Quality Objectives (PQO) include:

The primary objectives of the soil management and groundwater monitoring are to:

- Excavate (if encountered) and dispose / re-use remaining Site soils that are impacted with petroleum-related contaminants in excess of applicable SCOs during future redevelopment or maintenance to underground utilities and/or soils which exhibit nuisance characteristics;
- Remove (if encountered), treat, and or discharge residually impacted groundwater to the combined sewer from excavations; and
- Perform groundwater monitoring and achieve groundwater quality sufficient for regulatory closure of this ERP site.

Soil will be analyzed for:

- Part 375 and NYSDEC CP-51 List volatile organic compounds (VOCs) plus Tentatively Identified Compounds (TICs), USEPA Method 8260C; and
- PART 375 and NYSDEC CP-51 List Semi-volatile Organic Compounds (SVOCs) plus TICs, USEPA Method 8270D.

- Target Analyze List [TAL] metals, Methods EPA 6010C, EPA 7471B and EPA 3050B TAL Metals.

Groundwater will be analyzed for:

- Part 375 and NYSDEC CP-51 List volatile organic compounds (VOCs) plus Tentatively Identified Compounds (TICs), USEPA Method 8260C; and
- PART 375 and NYSDEC CP-51 List Semi-volatile Organic Compounds (SVOCs) plus TICs, USEPA Method 8270D.

Who will use the data?

The data will be used by The City of Rochester, which is the current owner and NYSDEC ERP Recipient, and NYSDEC.

What will the data be used for?

The data will determine whether groundwater has been remediated sufficiently to allow closure by NYSDEC.
Soil sample data from future re-development of the Site will be used as required in the SMP and Excavation Work Plan (EWP).

What types of data are needed?

- Laboratory Analytical Data for both soil and groundwater will include:

- Part 375 and NYSDEC CP-51 List volatile organic compounds (VOCs) plus Tentatively Identified Compounds (TICs), USEPA Method 8260C; and
- PART 375 and NYSDEC CP-51 List Semi-volatile Organic Compounds (SVOCs) plus TICs, USEPA Method 8270D.
- EPA 6010C, EPA 7471B and EPA 3050B TAL Metals (for soil samples only).

- Field Data include:
  - Requirements for collection of soil samples in the SMP and EWP.
  - Excavation limits (X,Y, Z coordinates) of future excavations were impacted soils are removed.
  - For groundwater sampling, each sample will be collected using the EPA low flow sampling SOP; Field parameters to be measured during purging would include pH, temperature, specific conductance, oxidation reduction potential and dissolved oxygen.
  - Groundwater levels will be measured in monitoring wells to the nearest 0.01 ft using an electronic water level indicator.

How much data are needed?

Including the five QA/QC samples, it is currently estimated that up to approximately 20 total analyses will be performed for each future quarterly groundwater monitoring event.

Where, when, and how should the data be collected/generated?

- Soil waste pre-characterization samples will be obtained from areas of soil that may need to be removed from the Site during future re-development or maintenance for underground utilities;
- Confirmation soil samples will be obtained from each excavation sidewall and each excavation bottom;
- Groundwater samples will be collected from each of the monitoring wells (MW-1 through MW-6, MW-7R, MW-8, MW-9R, MW-10 through MW-14, MW-15R and MW-16 will remain after completion of the FER.

Who will collect and generate the data?

Bergmann Associates and or City of Rochester DEQ will collect all samples, perform all field screening for soils using a calibrated PID, and measure field parameters while sampling groundwater during future quarterly monitoring events and final round of sampling.

How will the data be reported?

- Field data will be recorded in a field book, on field diagrams, and on Groundwater Sampling Reports.
- Laboratory data will reported by the laboratory in “Category B” deliverables. In addition,

electronic data deliverables (EDDs) will be provided by the laboratory in a format compatible with NYSDEC's requirements for EDDs. All laboratory-generated soil and groundwater data will undergo independent review by an experienced data validator who will prepare Data Usability Summary Reports (DUSRs) for each sample delivery group. For groundwater, a DUSR will be generated only for the final groundwater monitoring sampling round.

How will the data be archived?

- As discussed above, all future groundwater data will be included in quarterly groundwater monitoring reports to the City of Rochester and NYSDEC. These reports will be provided in electronic format to both parties, and in hard copies, if requested. The future Site owners must submit soil and groundwater laboratory analytical data to NYSDEC.
- The laboratory analytical data will also be provided in electronic data deliverable format. The EDD file will be compatible with NYSDEC EDD requirements as detailed in its Electronic Data Deliverable Manual (April 2013). Once the SMP and FER are finalized the EDD file will be uploaded to NYSDEC's Environmental Information Management System for permanent archiving.

Project Schedule/Timeline

List all project activities that will be performed during the course of the project. Include the anticipated start and completion dates.

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Estimated Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
COC	NYSDEC	12/20/17	12/31/17	Written Approval by NYSDEC	12/31/17
Procurement of Equipment	Bergmann Associates	1/4/18	1/8/18	N/A	1/8/18
Laboratory Request	Bergmann Associates	1/11/18	1/15/18	N/A	1/15/18
Collection of Field Samples	Bergmann Associates	1/25/18	2/22/18	N/A	2/22/18
Laboratory Package Received	Bergmann Associates	1/27/18	3/14/18	Unvalidated data package, Preliminary EDD[2]	3/14/18
DUSR (Validation) of Laboratory Results	KR Applin and Associates	3/15/18	4/5/18	Validated data Packages, Updated EDD	4/5/18
Data Evaluation/ Preparation of Groundwater Monitoring Reports	Bergmann Associates	1/17/18	4/31/18	Final Report	4/31/18

Data validation to be performed by third party – independent to project (can be within Environmental Consulting firm or subcontracted to data validation firm).

EDD = Electronic Data Deliverable

COC= Certification of Completion

Sampling Methods and Locations

Matrix	Sampling Location(s)	Depth (ft)	Analytical Group[1]	No. of Samples[2]	Sampling SOP Reference	Rationale for Sampling Location
Soil	Unknown Possible future Site location	Unknown	VOCs	Unknown Number Dup + MS/MSD	SMP and EWP (Appendix 2 in SMP)	Actual number of samples and locations to be determined based on observations, excavation limits and field screening results. Confirm the number of samples required with NYSDEC.
Soil	Unknown Possible future Site location	Unknown	SVOCs	Unknown Number Dup + MS/MSD		
Soil	Unknown Possible future Site location	Unknown	Metals	Unknown Number Dup + MS/MSD		
Groundwater	Wells MW-1 through MW-6, MW-7R, MW-8, MW-9R, MW-10 through MW-14, MW-15R, and MW-16 See Figure 2 in SMP.	See Appendix 10 in the SMP for well depths.	VOCs	3 + Field Dup + MS/MSD + trip blank	EPA Low Flow Sampling SOP	Sample all monitoring wells as required for Quarterly groundwater monitoring. - -
Groundwater	Wells MW-1 through MW-6, MW-7R, MW-8, MW-9R, MW-10 through MW-14, MW-15R, and MW-16 See Figure 2 in SMP.	See Appendix 10 in the SMP for well depths.	SVOCs	3 + Field Dup + MS/MSD+ trip blank		

[1] Analytical Groups include: volatiles, semi volatiles, total metals for future soil samples.

[2] The number of groundwater samples will include 16 from the monitoring wells and 5 QA/QC samples.

[3] Metals to be analyzed only in future soil samples.

Analytical Methods and Requirements

Matrix	**Analytical Group**	**[1]Concentration Level**	**Analytical & Preparation Method/ SOP Reference**	**Sample Volume**	**Containers (*number, size, type*)**	**Preservation Requirements (*chemical, temperature, light protected)***	**Maximum Holding Time (*preparation/ analysis)***
Groundwater	VOCs	Low	SW-846 Method 8260	80 ml	(2) 40 ml VOA vials w/Teflon lined septum	1:1 HCl to pH<2; cool to 4°C	14 days
Groundwater	SVOCs	Low	SW-846 Method 8270	2000 ml	(2) 1000 ml glass bottles with w/Teflon lined cap	cool to 4°C	7 days to extraction, 40 days to analysis
Soil	VOCs	Low	SW-846 Method 8260	10 g	4oz glass jar with Teflon lined cap	cool to 4°C	14 days
Soil	SVOCs	Low	SW-846 Method 8270	30 g	8 oz glass jar w/Teflon lined cap	cool to 4°C	14 days until extraction, 40 days until analysis
Soil	Metals & mercury	Low	SW-846 Method 6010/7471	5 g	4 oz glass jar w/Teflon lined cap	cool to 4°C	180 days (28 days for mercury)

[1] Concentration Level refers to Trace; Low; Medium; High of the sample.

Reference Limits and Evaluation Table

GROUNDWATER

Matrix *Aqueous*	
Analytical Group ***VOCs – SW-846 8260***	
Concentration Level *Low*	

Analyte	CAS Number	NYSDEC TOGS 1.1.1 Groundwater Standards (µg/L)	Achievable Lab Method Detection Limit (µg/L)	Achievable Lab Reporting Limit µg/L)
1,1,1-Trichloroethane	71-55-6	5	0.5	5
1,1,2,2-Tetrachloroethane	79-34-5	5	0.42	5
1,1,2-Trichloroethane	79-00-5	1	0.38	5
1,1-Dichloroethane	75-34-3	5	0.25	5
1,1-Dichloroethene	75-35-4	5	0.39	5
1,2,3-Trichlorobenzene	87-61-6	5	0.33	5
1,2,4-Trichlorobenzene	120-82-1	5	0.26	5
1,2-Dibromo-3-chloropropane	96-12-8	0.04	0.75	5
1,2-Dibromoethane	106-93-4	ns	0.5	5
1,2-Dichlorobenzene	95-50-1	3	0.33	5
1,2-Dichloroethane	107-06-2	0.6	0.41	5
1,2-Dichloropropane	78-87-5	1	0.61	5
1,3-Dichlorobenzene	541-73-1	3	0.29	5
1,4-Dichlorobenzene	106-46-7	3	0.4	5
2-Butanone	78-93-3	50	2.1	5
2-Hexanone	591-78-6	ns	1.7	5
4-Methyl-2-pentanone	108-10-1	ns	0.82	5
Acetone	67-64-1	50	2.2	5
Benzene	71-43-2	1	0.33	5
Bromochloromethane	74-97-5	ns	0.43	5
Bromodichloromethane	75-27-4	50	0.26	5
Bromoform	75-25-2	50	0.77	5
Bromomethane	74-83-9	5	0.8	5
Carbon disulfide	75-15-0	60	0.34	5
Carbon tetrachloride	56-23-5	5	0.54	5
Chlorobenzene	108-90-7	5	0.26	5
Chloroethane	75-00-3	5	0.48	5
Chloroform	67-66-3	7	0.33	5
Chloromethane	74-87-3	5	0.26	5
cis-1,2-Dichloroethene	156-59-2	5	0.48	5
cis-1,3-Dichloropropene	10061-01-5	0.4	0.45	5
Dibromochloromethane	124-48-1	50	0.57	5

Dichlorodifluoromethane	75-71-8	5	0.66	5
Ethylbenzene	100-41-4	5	0.35	5
Isopropylbenzene	98-82-8	5	0.38	5
m,p-Xylene	179601-23-1	5	0.77	5
Methyl tert-butyl ether	1634-04-4	10	0.24	5
Methylene chloride	75-09-2	5	0.41	5
o-Xylene	95-47-6	5	0.36	5
Styrene	100-42-5	5	0.5	5
Tetrachloroethene	127-18-4	5	0.65	5
Toluene	108-88-3	5	0.32	5
trans-1,2-Dichloroethene	156-60-5	5	0.65	5
trans-1,3-Dichloropropene	10061-02-6	0.4	0.48	5
Trichloroethene	79-01-6	5	0.36	5
Trichlorofluoromethane	75-69-4	5	0.54	5
Vinyl chloride	75-01-4	2	0.5	5
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	ns	0.82	5
1,4-Dioxane	123-91-1	ns	34	100
Cyclohexane	110-82-7	ns	0.71	5
Methyl acetate	79-20-9	ns	0.29	5
Methylcyclohexane	108-87-2	ns	0.76	5

Matrix *Aqueous*

Analytical Group *SVOCs - __SW-846 8270__*

Concentration Level *Low*

Analyte	CAS Number	NYSDEC TOGS 1.1.1 Groundwater Standards (µg/L)	Achievable Lab Method Detection Limit (µg/L)	Achievable Lab Reporting Limit µg/L)
2,2´-oxybis(1-Chloropropane)	108-60-1	ns	0.78	10
2,4-Dichlorophenol	120-83-2	5	0.57	10
2,4-Dimethylphenol	105-67-9	50	1.8	10
2,4-Dinitrophenol	51-28-5	10	3.5	20
2,4-Dinitrotoluene	121-14-2	5	0.41	10
2,6-Dinitrotoluene	606-20-2	5	0.52	10
2-Chloronaphthalene	91-58-7	10	0.81	10
2-Chlorophenol	95-57-8	ns	0.61	10
2-Methylnaphthalene	91-57-6	ns	0.94	10
2-Methylphenol	95-48-7	ns	0.96	10
2-Nitroaniline	88-74-4	5	0.71	20
2-Nitrophenol	88-75-5	ns	0.6	10
3,3´-Dichlorobenzidine	91-94-1	5	1.7	10
3-Nitroaniline	99-09-2	5	0.97	20
4,6-Dinitro-2-methylphenol	534-52-1	ns	0.79	20
4-Bromophenyl-phenylether	101-55-3	ns	0.54	10
4-Chloro-3-methylphenol	59-50-7	ns	0.6	10
4-Chloroaniline	106-47-8	5	2	10
4-Chlorophenyl-phenylether	7005-72-3	ns	0.41	10
4-Methylphenol	106-44-5	ns	1.4	10

4-Nitroaniline	100-01-6	5	0.96	20
4-Nitrophenol	100-02-7	ns	0.53	20
Acenaphthene	83-32-9	20	0.65	10
Acenaphthylene	208-96-8	ns	0.42	10
Anthracene	120-12-7	50	0.48	10
Benzo(a)anthracene	56-55-3	0.002	0.4	10
Benzo(a)pyrene	50-32-8	ns	1.2	10
Benzo(b)fluoranthene	205-99-2	0.002	0.94	10
Benzo(g,h,i)perylene	191-24-2	ns	0.39	10
Benzo(k)fluoranthene	207-08-9	0.002	1.2	10
Bis(2-chloroethoxy)methane	111-91-1	5	1.1	10
Bis(2-chloroethyl)ether	111-44-4	1	0.75	10
Bis(2-ethylhexyl)phthalate	117-81-7	5	1.3	10
Butylbenzylphthalate	85-68-7	50	0.32	10
Carbazole	86-74-8	ns	0.64	10
Chrysene	218-01-9	0.002	0.42	10
Di-n-butylphthalate	84-74-2	50	0.48	10
Di-n-octylphthalate	117-84-0	ns	0.47	10
Dibenzo(a,h)anthracene	53-70-3	ns	0.44	10
Dibenzofuran	132-64-9	ns	0.52	10
Diethylphthalate	84-66-2	50	0.45	10
Dimethylphthalate	131-11-3	50	0.37	10
Fluoranthene	206-44-0	50	0.33	10
Fluorene	86-73-7	0.04	0.44	10
Hexachlorobenzene	118-74-1	0.04	0.44	10
Hexachlorobutadiene	87-68-3	0.5	0.75	10
Hexachlorocyclopentadiene	77-47-4	5	1	10
Hexachloroethane	67-72-1	5	0.55	10
Indeno(1,2,3-cd)pyrene	193-39-5	0.002	0.38	10
Isophorone	78-59-1	50	0.47	10
N-Nitroso-di-n-propylamine	621-64-7	ns	0.63	10
N-Nitrosodiphenylamine	86-30-6	50	1.1	10
Naphthalene	91-20-3	10	0.96	10
Nitrobenzene	98-95-3	0.4	1.6	10
Pentachlorophenol	87-86-5	1	1.7	20
Phenanthrene	85-01-8	50	0.45	10
Phenol	108-95-2	1	0.75	10
Pyrene	129-00-0	50	0.44	10
1,1´-Biphenyl	92-52-4	5	0.65	10
2,4,5-Trichlorophenol	95-95-4	ns	0.26	20
2,4,6-Trichlorophenol	88-06-2	ns	0.53	10
1,2,4,5-Tetrachlorobenzene	95-94-3	ns	0.92	10
2,3,4,6-Tetrachlorophenol	58-90-2	ns	0.65	25
Acetophenone	98-86-2	ns	0.51	10
Atrazine	1912-24-9	ns	1.3	10
Benzaldehyde	100-52-7	ns	0.51	10
Caprolactam	105-60-2	ns	1.1	10

Matrix *Soil*
Analytical Group ***<u>VOCs – SW-846 8260</u>***
Concentration Level *Low*

Analyte	**CAS Number**	**NYSDEC Part 375 Soil Cleanup Objectives for Protection of Groundwater (µg/kg)**	**Achievable Lab Method Detection Limit (µg/kg)**	**Achievable Lab Reporting Limit (µg/kg)**
1,1,1-Trichloroethane	71-55-6	680	0.53	5
1,1,2,2-Tetrachloroethane	79-34-5	1,000,000	0.68	5
1,1,2-Trichloroethane	79-00-5	1,000,000	0.48	5
1,1-Dichloroethane	75-34-3	270	0.67	5
1,1-Dichloroethene	75-35-4	330	0.95	5
1,2,3-Trichlorobenzene	87-61-6	ns	0.64	5
1,2,4-Trichlorobenzene	120-82-1	1,000,000	0.63	5
1,2-Dibromo-3-chloropropane	96-12-8	ns	1.3	5
1,2-Dibromoethane	106-93-4	ns	0.74	5
1,2-Dichlorobenzene	95-50-1	1,100	0.62	5
1,2-Dichloroethane	107-06-2	20	0.54	5
1,2-Dichloropropane	78-87-5	1,000,000	0.69	5
1,3-Dichlorobenzene	541-73-1	2,400	0.7	5
1,4-Dichlorobenzene	106-46-7	1,800	0.8	5
2-Butanone	78-93-3	120	2	5
2-Hexanone	591-78-6	1,000,000	0.83	5
4-Methyl-2-pentanone	108-10-1	ns	0.73	5
Acetone	67-64-1	50	1.6	5
Benzene	71-43-2	60	0.61	5
Bromochloromethane	74-97-5	ns	0.76	5
Bromodichloromethane	75-27-4	1,000,000	0.97	5
Bromoform	75-25-2	1,000,000	2	5
Bromomethane	74-83-9	1,000,000	1.1	5
Carbon disulfide	75-15-0	1,000,000	0.3	5
Carbon tetrachloride	56-23-5	760	0.33	5
Chlorobenzene	108-90-7	1,100	0.51	5
Chloroethane	75-00-3	1,000,000	1	5
Chloroform	67-66-3	370	0.64	5
Chloromethane	74-87-3	1,000,000	0.8	5
cis-1,2-Dichloroethene	156-59-2	250	0.75	5
cis-1,3-Dichloropropene	10061-01-5	1,000,000	0.67	5
Dibromochloromethane	124-48-1	1,000,000	0.65	5
Dichlorodifluoromethane	75-71-8	ns	0.98	5
Ethylbenzene	100-41-4	1,000	0.5	5
Isopropylbenzene	98-82-8	1,000,000	0.58	5
m,p-Xylene	179601-23-1	1,600	1.6	5
Methyl tert-butyl ether	1634-04-4	930	0.61	5
Methylene chloride	75-09-2	50	1.3	5
o-Xylene	95-47-6	1,600	0.47	5

Styrene	100-42-5	1,000,000	0.52	5
Tetrachloroethene	127-18-4	1,300	0.62	5
Toluene	108-88-3	700	0.47	5
trans-1,2-Dichloroethene	156-60-5	190	0.53	5
trans-1,3-Dichloropropene	10061-02-6	1,000,000	0.68	5
Trichloroethene	79-01-6	470	0.62	5
Trichlorofluoromethane	75-69-4	ns	0.42	5
Vinyl chloride	75-01-4	20	0.63	5
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	ns	3	5
1,4-Dioxane	123-91-1	100	61	100
Cyclohexane	110-82-7	ns	1.7	5
Methyl acetate	79-20-9	ns	1.4	5
Methylcyclohexane	108-87-2	ns	1.8	5

Matrix *Soil*

Analytical Group ***SVOCs – SW-846 8270***

Concentration Level *Low*

Analyte	**CAS Number**	**NYSDEC Part 375 Soil Cleanup Objectives for Protection of Groundwater (µg/kg)**	**Achievable Lab Method Detection Limit (µg/kg)**	**Achievable Lab Reporting Limit (µg/kg)**
2,2´-oxybis(1-Chloropropane)	108-60-1		51	330
2,4-Dichlorophenol	120-83-2	1,000,000	38	330
2,4-Dimethylphenol	105-67-9	1,000,000	36	330
2,4-Dinitrophenol	51-28-5	1,000,000	180	670
2,4-Dinitrotoluene	121-14-2	1,000,000	23	330
2,6-Dinitrotoluene	606-20-2	1,000,000	28	330
2-Chloronaphthalene	91-58-7	1,000,000	38	330
2-Chlorophenol	95-57-8	1,000,000	41	330
2-Methylnaphthalene	91-57-6	1,000,000	42	330
2-Methylphenol	95-48-7	1,000,000	38	330
2-Nitroaniline	88-74-4	1,000,000	21	670
2-Nitrophenol	88-75-5	1,000,000	36	330
3,3´-Dichlorobenzidine	91-94-1	1,000,000	35	330
3-Nitroaniline	99-09-2	1,000,000	24	670
4,6-Dinitro-2-methylphenol	534-52-1	ns	25	670
4-Bromophenyl-phenylether	101-55-3	ns	32	330
4-Chloro-3-methylphenol	59-50-7	1,000,000	26	330
4-Chloroaniline	106-47-8	1,000,000	24	330
4-Chlorophenyl-phenylether	7005-72-3	1,000,000	40	330
4-Methylphenol	106-44-5	ns	35	330
4-Nitroaniline	100-01-6	1,000,000	25	670
4-Nitrophenol	100-02-7	1,000,000	22	670
Acenaphthene	83-32-9	98,000	39	330
Acenaphthylene	208-96-8	107,000	37	330
Anthracene	120-12-7	1,000,000	27	330
Benzo(a)anthracene	56-55-3	1000	33	330

Benzo(a)pyrene	50-32-8	22,000	31	330
Benzo(b)fluoranthene	205-99-2	1,700	40	330
Benzo(g,h,i)perylene	191-24-2	100,000	38	330
Benzo(k)fluoranthene	207-08-9	1,700	43	330
Bis(2-chloroethoxy)methane	111-91-1	1,000,000	39	330
Bis(2-chloroethyl)ether	111-44-4	1,000,000	42	330
Bis(2-ethylhexyl)phthalate	117-81-7	1,000,000	29	330
Butylbenzylphthalate	85-68-7	1,000,000	26	330
Carbazole	86-74-8	1,000,000	28	330
Chrysene	218-01-9	1,000	29	330
Di-n-butylphthalate	84-74-2	1,000,000	28	330
Di-n-octylphthalate	117-84-0	1,000,000	28	330
Dibenzo(a,h)anthracene	53-70-3	1,000,000	35	330
Dibenzofuran	132-64-9	210,000	36	330
Diethylphthalate	84-66-2	1,000,000	24	330
Dimethylphthalate	131-11-3	1,000,000	30	330
Fluoranthene	206-44-0	1,000,000	29	330
Fluorene	86-73-7	386,000	33	330
Hexachlorobenzene	118-74-1	3,200	32	330
Hexachlorobutadiene	87-68-3	1,000,000	45	330
Hexachlorocyclopentadiene	77-47-4	1,000,000	96	330
Hexachloroethane	67-72-1	1,000,000	35	330
Indeno(1,2,3-cd)pyrene	193-39-5	8,200	37	330
Isophorone	78-59-1	1,000,000	34	330
N-Nitroso-di-n-propylamine	621-64-7	1,000,000	32	330
N-Nitrosodiphenylamine	86-30-6	1,000,000	29	330
Naphthalene	91-20-3	12,000	41	330
Nitrobenzene	98-95-3	1,000,000	38	330
Pentachlorophenol	87-86-5	800	140	670
Phenanthrene	85-01-8	1,000,000	26	330
Phenol	108-95-2	330	37	330
Pyrene	129-00-0	1,000,000	32	330
1,1´-Biphenyl	92-52-4	ns	42	330
2,4,5-Trichlorophenol	95-95-4	1,000,000	37	670
2,4,6-Trichlorophenol	88-06-2	1,000,000	39	330
1,2,4,5-Tetrachlorobenzene	95-94-3	ns	59	330
2,3,4,6-Tetrachlorophenol	58-90-2	ns	31	330
Acetophenone	98-86-2	ns	31	330
Atrazine	1912-24-9	ns	47	330
Benzaldehyde	100-52-7	ns	44	330
Caprolactam	105-60-2	ns	21	330

Analytical Laboratory Sensitivity and Project Criteria

Matrix Aqueous	
Analytical Group VOCs	
Concentration Level Low	

Analytical Method/SOP	**Data Quality Indicators[1]**	**Performance Criteria (related to analytical method)**	**QC Sample such as Duplicate, Matrix Spike, Surrogates etc.) Used To Assess Performance Criteria**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
8260 90.0012	Precision	RPD <20	Field Duplicate	S & A
	Accuracy / Representativeness	<=10 degrees C	Cooler Temperature	S
	Accuracy / Contamination	Analytes < = QL	Field Equipment Blank	S
	Accuracy / Contamination	Analytes < = QL, or less than 1/10 sample concentration, common lab contaminants <=2X QL	Method Blank	A
	Accuracy	Laboratory In-house Limits	Laboratory Control Sample	A
	Accuracy / Precision	Laboratory In-house Limits, 40% RPD	Matrix Spike / Matrix Spike Duplicate	A
	Accuracy	Factor of two (-50% to +100%) from most recent calibration	Internal Standards	A
	Accuracy	Laboratory In-house Limits	Surrogate Standards	A

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[1] Defined as Precision; Accuracy/Bias; Sensitivity/Quantitation Limits, Representativeness; Comparability, Completeness

Matrix Soil
Analytical Group VOCs
Concentration Level Low

Analytical Method/SOP	**Data Quality Indicators**[1]	**Performance Criteria (related to analytical method)**	**QC Sample such as Duplicate, Matrix Spike, Surrogates etc.) Used To Assess Performance Criteria**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
8260 90.0012	Precision	RPD <20	Field Duplicate	S & A
	Accuracy / Representativeness	<=10 degrees C	Cooler Temperature	S
	Accuracy / Contamination	Analytes < = QL	Field Equipment Blank	S
	Accuracy / Contamination	Analytes < = QL, or less than 1/10 sample concentration, common lab contaminants <=2X QL	Method Blank	A
	Accuracy	Laboratory In-house Limits	Laboratory Control Sample	A
	Accuracy / Precision	Laboratory In-house Limits, 40% RPD	Matrix Spike / Matrix Spike Duplicate	A
	Accuracy	Factor of two (-50% to +100%) from most recent calibration	Internal Standards	A
	Accuracy	Laboratory In-house Limits	Surrogate Standards	A

[1] Defined as Precision; Accuracy/Bias; Sensitivity/Quantitation Limits, Representativeness; Comparability, Completeness

Matrix Aqueous
Analytical Group SVOCs
Concentration Level Low

Analytical Method/SOP	Data Quality Indicators[1]	Performance Criteria (related to analytical method)	QC Sample such as Duplicate, Matrix Spike, Surrogates etc.) Used To Assess Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
8270 70.0011	Precision	RPD <20	Field Duplicate	S & A
	Accuracy / Representativeness	<=10 degrees C	Cooler Temperature	S
	Accuracy / Contamination	Analytes < = QL	Field Equipment Blank	S
	Accuracy / Contamination	Analytes < = QL, or less than 1/10 sample concentration, Common lab contaminants <=5X QL	Method Blank	A
	Accuracy	Laboratory In-house Limits	Laboratory Control Sample	A
	Accuracy / Precision	Laboratory In-house Limits, RPD 40%	Matrix Spike / Matrix Spike Duplicate	A
	Accuracy	Factor of two (-50% to +100%) from most recent calibration	Internal Standards	A
	Accuracy	Laboratory In-house Limits	Surrogate Standards	A

[1] Defined as Precision; Accuracy/Bias; Sensitivity/Quantitation Limits, Representativeness; Comparability, Completeness

Matrix Soil	
Analytical Group SVOCs	
Concentration Level Low	

Analytical Method/SOP	Data Quality Indicators[1]	Performance Criteria (related to analytical method)	QC Sample such as Duplicate, Matrix Spike, Surrogates etc.) Used To Assess Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
8270 70.0011	Precision	RPD <20	Field Duplicate	S & A
	Accuracy / Representativeness	<=10 degrees C	Cooler Temperature	S
	Accuracy / Contamination	Analytes < = QL	Field Equipment Blank	S
	Accuracy / Contamination	Analytes < = QL, or less than 1/10 sample concentration, Common lab contaminants <=5X QL	Method Blank	A
	Accuracy	Laboratory In-house Limits	Laboratory Control Sample	A
	Accuracy / Precision	Laboratory In-house Limits, RPD 40%	Matrix Spike / Matrix Spike Duplicate	A
	Accuracy	Factor of two (-50% to +100%) from most recent calibration	Internal Standards	A
	Accuracy	Laboratory In-house Limits	Surrogate Standards	A

[1] Defined as Precision; Accuracy/Bias; Sensitivity/Quantitation Limits, Representativeness; Comparability, Completeness

Matrix Soil	
Analytical Group Metals	
Concentration Level Low	

Analytical Method/SOP	**Data Quality Indicators**[1]	**Performance Criteria (related to analytical method)**	**QC Sample such as Duplicate, Matrix Spike, Surrogates etc.) Used To Assess Performance Criteria**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
Method 6010/7471	Precision	RPD <20	Field Duplicate	S & A
	Accuracy / Representativeness	<=10 degrees C	Cooler Temperature	S
	Accuracy / Contamination	Analytes < = QL	Field Equipment Blank	S
	Accuracy / Contamination	Analytes < = QL, or less than 1/10 sample concentration, Common lab contaminants <=5X QL	Method Blank	A
	Accuracy	Laboratory In-house Limits	Laboratory Control Sample	A
	Accuracy / Precision	Laboratory In-house Limits, RPD 40%	Matrix Spike / Matrix Spike Duplicate	A
	Accuracy	Factor of two (-50% to +100%) from most recent calibration	Internal Standards	A
	Accuracy	Laboratory In-house Limits	Surrogate Standards	A

[1] Defined as Precision; Accuracy/Bias; Sensitivity/Quantitation Limits, Representativeness; Comparability, Completeness

Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Site-Specific Environmental Conditions	Phase II ESA GZA GeoEnvironmental Report, 1996	GZA GeoEnvironmental – Soil and Groundwater analytical data	Site information relative to features and locations that may be source areas of contamination.	No Soil or Groundwater sampling results Per DUSR report
Site-Specific Environmental Conditions	Supplemental Phase II ESA GZA GeoEnvironmental Report, 1997	GZA GeoEnvironmental – Additional Soil and Groundwater analytical data	Site information relative to features and locations that may be source areas, and extent of contamination.	No Soil or Groundwater sampling results Per DUSR report

Project Specific Method and Standard Operating Procedures (SOPs) Reference Table

ANALYTICAL METHOD REFERENCE (*Include document title, method name/number, revision number, date)*
1a. SW846 Method 8260C GCMS Volatiles, August 2006
2a. SW846 Method 8270D GCMS Semi volatiles, August 2006
3a. SW846 Method 6010C, ICP TAL Metals, November, 2000
ANALYTICAL LABORATORY SOPs (*Include document title, date, revision number, and originator=s name)*
Version 15.0 8/1/2016 ESC LAB
FIELD SAMPLING SOPs[1] (*Include document title, date, revision number, and originator=s name)*
1c. USEPA Region II Low Flow Groundwater Sampling Procedure, March 16, 1998
2c. *Site Management Plan, 214 Lake Ave, Rochester, NY,* by Bergman Associates, 2017

[1] Project Sampling SOPs include sample collection, sample preservation, equipment decontamination, preventive maintenance, etc.

Field Equipment Calibration, Maintenance, Testing, and Inspection

Field Equipment	Calibration Activity	Maintenance Activity	Testing/ Inspection Activity	Frequency	Acceptance Criteria		Corrective Action	SOP Reference
YSI (or equivalent) flow-through cell	Calibrate with standard solutions	NA	NA	Prior to day's activities; end of day's activities; anytime anomaly suspected	pH Meter	+/- 0.1 units	Clean probe, replace battery, replace membrane, replace probe	EPA Region II Low Flow Groundwater Sampling Procedure, March 16, 1998
					Dissolved Oxygen	± 3%		
					Specific Conductivity	± 1%		
					Temperature	± 0.1 °C		
					Turbidity	± 2 NTU		
MiniRAE 2000 Photoionization Detector	Calibrate with isobutylene	Charge the monitor before use	NA	Prior to day's activities	0-2000 ppm: ± 2 ppm or 10% of reading 2000 ppm: ± 20% of reading		Charge or replace battery, clean sensor module or lamp housing, replace water trap filter	MiniRAE 2000 Operation and Maintenance Manual

Analytical Laboratory Instrument and

Equipment Maintenance, Testing, and Inspection

Instrument/ Equipment	Maintenance Activity	Testing/Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	Analytical SOP Reference
GCMS-VOC, SVOC	Check for leaks, replace gas line filters, recondition or replace trap, replace column, clean injection port/liner and replace septum as needed, replace Electron Mulitplier	Tune (BFB or DFTPP), Continuing Calibration Verification	Tune, CCV after every 12 hours of operation	Ion abundance within acceptance limits for tune, CCV %D ≤20%	As needed, replace connections, gas line filters, trap, or GC column. Clip column, replace injection port liner, clean injection port, clean source. Repeat tune, calibration or CCV and any affected samples. See Attachment in SOP for more details.	Chemtech Department Supervisor	90.0012; 70.0011
GC/FID -	Check for leaks, replace gas line filters, clip end of column, recondition or replace column, clean injection port/liner, replace septum	Continuing Calibration Verification	Daily, after every 20 Samples	%D <20%	As needed, check GC conditions, check for leaks, clip column, clean/replace injection port/ liner. Repeat calibration or CCV and affected samples. See Attachment 1 of SOP for more details.	Chemtech Department Supervisor	60.0050

Instrument/ Equipment	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Responsible Person	Analytical SOP Reference
GC/MS – VOCs, SVOCs	ICAL - 5-point calibration	Instrument receipt, instrument change (new column, source cleaning, etc.), when CCV is out of criteria.	%RSD <20% with a maximum of 10% of the target analytes and/or surrogate compounds allowed %RSD <50%. Relative Retention Times must meet ±0.06 RRT units for each compound and surrogate. Minimum RRFs are suggested in Table 4 of the method (and SOP).	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze data.	Chemtech Department Supervisor	90.0012, 70.0011
GC/MS – VOCs, SVOCs	ICV (Second Source)	Once after each ICAL.	The %R must be within 70-130% for all target compounds.	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat ICAL unless problem can be verified as due to ICV solution and not ICAL.	Chemtech Department Supervisor	90.0012, 70.0011

GC/MS – VOCs, SVOCs	CCV	Analyze a standard at the beginning of each 12-hour shift after tune.	%D <20% with a maximum of 20% of the target analytes and/or surrogate compounds allowed %D < 50% D. Minimum RRFs are suggested in Table 4 of the method.	Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since last acceptable CCV.	Chemctech Department Supervisor	90.0012, 70.0011
GC/MS – VOCs, SVOCs	Instrument Tune (BVB for VOCs, DFTPP for SVOCs)	Prior to ICAL and every 12 hours.	Criteria listed in Section 8.2.2, of current revision of SOPs 90.0012 and 70.0011.	Retune and/or clean source.	Chemtech Department Supervisor	90.0012, 70.0011

Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): Bergmann Environmental Technician or City of Rochester DEQ
Sample Packaging (Personnel/Organization): Bergmann Environmental Technician or City of Rochester DEQ
Sample Packaging (Personnel/Organization): Bergmann Environmental Technician or City of Rochester DEQ
Type of Shipment/Carrier: Fed Ex ground or Private Courier
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Sample receiving staff/Chemtech
Sample Custody and Storage (Personnel/Organization): Sample receiving staff/Chemtech
Sample Preparation (Personnel/Organization): Sample Preparation Technicians (Organics, Inorganics)/Chemtech
Sample Determinative Analysis (Personnel/Organization): Instrument Lab Staff (Organics, Inorganics)/Chemtech
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): Samples to be shipped at the end of each sampling day, and arrive at laboratory within 48 hours (2 days) of sample shipment.
Sample Extract/Digestate Storage (No. of days from extraction/digestion): Six months from delivery of final laboratory report.
SAMPLE DISPOSAL
Personnel/Organization: Sample receiving staff/Chemtech
Number of Days from Analysis: 30 days from delivery of final laboratory report.

Sample Custody Requirements

Sample Identification Procedures:

Sample identification documents include field records, sample labels, custody seals, and chain-of-custody records. The sample labels are placed on the bottles so as not to obscure any QA/QC lot numbers on the bottles. Sample information is printed in a legible manner using waterproof ink. To minimize handling of sample containers, labels will be filled out prior to sample collection to the extent possible. The sample label will be firmly affixed to the sample containers and will include information of the name or initials of sampler, date (and time if possible) of collection, sample number, intended analysis, and preservation performed.

Each sample will have a unique ID number that will refer to the sample location, media type, and depth interval (if applicable).

Each sample shall be given a unique sample number. This system will provide a tracking number to allow for identification of the sample location and date of collection and to allow for cross- referencing of sample information. The sample numbering system is described as follows:

Example: S-101001-AA-XXX

Where: S = Designates sample type

(S = Soil, SS = surface soil, GW = groundwater, SS = surface water sample)

101001: Sample Date (month/day/year)
AA: Initials of the sampler
XXX: Unique sample number

Quality Control (QC) samples and duplicate samples will also be numbered in accordance with the numbering system.

Field Sample Custody/Tracking Procedures (sample collection, packaging, shipment, and delivery to laboratory):

Field quality control samples will be collected to verify reproducibility of the sampling and analytical methods. Field duplicates will be obtained at a rate of one per 20 original field samples. Trip blanks will be used to assess whether groundwater has been exposed to volatile constituents during sample storage and transport. The trip blanks will remain unopened throughout the sampling event and will only be analyzed for volatile organics. Sample bottles will be obtained pre-cleaned by the laboratory and shipped to the sampling personnel in charge of the field activities. Coolers or boxes containing cleaned bottles should be sealed with a custody tape seal during transport to the field or while in storage prior to use. Transportation and handling of samples must be accomplished in a manner that not only protects the integrity of the sample, but also prevents any detrimental effects due to the possible hazardous nature of samples.

Laboratory Sample Custody/Tracking Procedures (receipt of samples, archiving, and disposal):

Laboratory sample custody procedures (receipt of samples, archiving, and disposal) will be used according Chemtech standard procedures. Coolers are received and checked for proper temperature. A sample cooler receipt form will be filled out to note conditions and any discrepancies. The chain-of-custody form will be checked against the sample containers for accuracy. Samples will be logged into the laboratory information management system and given a unique log number which can be tracked through processing. The laboratory project manager will notify the client verbally or via email immediately if any problems are identified. Discrepancies and resolutions will be documented on the sample receiving checklist. Samples will remain under custody until the completion of analysis, and following analysis until sample remnants are ultimately disposed. The Chem Tech Analytical laboratory facility is a secured, limited access facility.

Chain-of-Custody Procedures:

After samples have been obtained, chain-of-custody procedures will be followed to establish a written record concerning sample movement between the sampling site and the testing laboratory. Each shipping container will have a chain-of-custody form completed in triplicate by the site sampling personnel preparing the samples for shipment. The chain-of-custody form for each shipping container will be completed and sealed in the container. The sampler will maintain one (1) copy of this form, and the other two (2) copies will accompany the samples. One of the laboratory copies will become a part of the permanent record for the sample and will be returned with the sample analysis, and the third copy will be maintained on file at the laboratory.

The following packaging and labeling requirements for the sample materials are appropriate for shipping the samples to the testing laboratory.

1. Place samples in a cooler.
2. Preserve samples with ice or “blue ice” type coolers. No dry ice will be used.
3. Package samples so that they do not leak, spill or vaporize from its packaging.
4. Attach completed chain-of-custody forms inside the sample shipment cooler.
5. Seal the cooler with tape.
6. Label the cooler with the following information:

- Sample collector’s name, address and telephone number;
- Laboratory name, address and telephone number;
- Description of samples;
- Quantity of samples; and
- Date of Shipment.

After collection, each sample will be maintained in the sampler's custody until formally transferred to another party (e.g., Fed Ex or Private Courier). For all samples collected, chain-of-custody forms will document the date and time of sample collection, the sampler's name, and the names of all others who subsequently held custody of the sample. Specifications for chemical analyses will also be documented on the chain-of-custody form. After collection, each sample will be maintained in the sampler's custody until formally transferred to another party (e.g., FedEx).

Field and Analytical Laboratory Quality Control Summary

Matrix	**Groundwater**
Analytical Group	**VOCs**
Concentration Level	Low/Medium - mg/kg (ppm)
Sampling SOP(s)	EPA Region 2 Low Flow Groundwater Sampling Procedure
Analytical Method/SOP Reference	EPA Method 8260 / 90.0012
Sampler's Name	Bergmann Associates Environmental Technician and or City of Rochester DEQ
Field Sampling Organization	Bergmann Associates or City of Rochester DEQ
Analytical Organization	Chemtech
No. of Sample Locations	16 Groundwater Monitoring Wells

Quality Control (QC) Sample:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Field Duplicate		RPD <20			Precision	RPD <20
Cooler Temperature	1 per shipping cooler	<=10 deg. C	Note in report		Accuracy / Representativeness	<=10 deg. C
Field Equipment Blank		Analytes < = QL			Accuracy / Contamination	Analytes < = QL
Method Blank	One per batch of <=20 samples	Analytes < = QL, or less than 1/10 sample concentration, common lab contaminants <=2X QL	If sufficient holding time remains, reanalyze batch. If insufficient holding time, flag result, note in narrative	Chem Tech Department Supervisor	Accuracy / Contamination	Analytes < = QL, or less than 1/10 sample concentration, common lab contaminants <=2X QL

Laboratory Control Sample	One per batch of <=20 samples	Laboratory In-house Limits	If sufficient holding time remains, reanalyze batch. If insufficient holding time, flag result, note in narrative	Chem Tech Department Supervisor	Accuracy	Laboratory In-house Limits
Matrix Spike / Matrix Spike Duplicate	One set per 20 samples, as determined by sampler	Laboratory In-house Limits, 40% RPD	flag result, note in narrative	Chem Tech Department Supervisor	Accuracy / Precision	Laboratory In-house Limits, 40% RPD
Internal Standards	Every sample, standard, QC sample	Factor of two (-50% to +100%) from most recent calibration	Reanalyze sample. If determined to be matrix interference, note in narrative.	Chem Tech Department Supervisor	Accuracy	Factor of two (-50% to +100%) from most recent calibration
Surrogate Standards	Every sample, standard, QC sample	Laboratory in-house limits. No exceedances for MB or LCS, one exceedance allowed for field samples	Flag result, note in narrative	Chem Tech Department Supervisor	Accuracy	Laboratory in-house limits. No exceedances for MB or LCS, one exceedance allowed for field samples

Matrix	**Soil**
Analytical Group	**VOCs**
Concentration Level	Low/Medium - mg/kg (ppm)
Sampling SOP(s)	*Site Management Plan, 214 Lake Ave, Rochester, NY*, by Bergmann, dated August 2017
Analytical Method/SOP Reference	EPA Method 8260 / 90.0012
Sampler's Name	Bergmann Environmental Technician or City of Rochester DEQ
Field Sampling Organization	Bergman Associates or City of Rochester DEQ
Analytical Organization	Chemtech
No. of Sample Locations	Unknown (future Site re-development)

Quality Control (QC) Sample:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Field Duplicate		RPD <20			Precision	RPD <20
Cooler Temperature	1 per shipping cooler	<=10 deg. C	Note in report		Accuracy / Representa-tiveness	<=10 deg. C
Field Equipment Blank		Analytes < = QL			Accuracy / Contamina-tion	Analytes < = QL
Method Blank	One per batch of <=20 samples	Analytes < = QL, or less than 1/10 sample concentration, common lab contaminants <=2X QL	If sufficient holding time remains, reanalyze batch. If insufficient holding time, flag result, note in narrative	Chemtech Department Supervisor	Accuracy / Contamina-tion	Analytes < = QL, or less than 1/10 sample concentration, common lab contaminants <=2X QL
Laboratory Control Sample	One per batch of <=20 samples	Laboratory In-house Limits	If sufficient holding time remains, reanalyze batch. If insufficient holding time, flag result, note in narrative	Chemtech Department Supervisor	Accuracy	Laboratory In-house Limits
Matrix Spike / Matrix Spike Duplicate	One set per 20 samples, as determined by sampler	Laboratory In-house Limits, 40% RPD	flag result, note in narrative	Chemtech Department Supervisor	Accuracy / Precision	Laboratory In-house Limits, 40% RPD

Internal Standards	Every sample, standard, QC sample	Factor of two (-50% to +100%) from most recent calibration	Reanalyze sample. If determined to be matrix interference, note in narrative.	Chemtech Department Supervisor	Accuracy	Factor of two (-50% to +100%) from most recent calibration
Surrogate Standards	Every sample, standard, QC sample	Laboratory in-house limits. No exceedances for MB or LCS, one exceedance allowed for field samples	Flag result, note in narrative	Chemtech Department Supervisor	Accuracy	Laboratory in-house limits. No exceedances for MB or LCS, one exceedance allowed for field samples

Matrix	**Groundwater**
Analytical Group	**Semivolatile Organic Compounds**
Concentration Level	Low/Medium - mg/kg (ppm)
Sampling SOP(s)	EPA Region 2 Low Flow Groundwater Sampling Procedure
Analytical Method/SOP Reference	EPA Method 8270 / 70.0011
Sampler's Name	Bergmann Environmental Technician or City of Rochester DEQ
Field Sampling Organization	Bergmann Associates
Analytical Organization	Chemtech
No. of Sample Locations	16 Groundwater Monitoring Wells

Quality Control (QC) Sample:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Field Duplicate		RPD <20			Precision	RPD <20
Cooler Temperature	1 per shipping cooler	<=10 deg. C	Note in report		Accuracy / Representativeness	<=10 deg. C
Field Equipment Blank		Analytes < = QL			Accuracy / Contamination	Analytes < = QL
Method Blank	One per preparation batch of <=20 samples	Analytes < = QL, or less than 1/10 sample concentration , common lab contaminants <=5X QL	If sufficient holding time remains, reprepare batch. If insufficient holding time, flag result, note in narrative	Chemtech Department Supervisor	Accuracy / Contamination	Analytes < = QL, or less than 1/10 sample concentration, common lab contaminants <=5X QL
Laboratory Control Sample	One per preparation batch of <=20 samples	Laboratory In-house Limits	If sufficient holding time remains, reprepare batch. If insufficient holding time, flag result, note in narrative	Chemtech Department Supervisor	Accuracy	Laboratory In-house Limits
Matrix Spike / Matrix Spike Duplicate	One set per 20 samples, as determined by sampler	Laboratory In-house Limits, 40% RPD	flag result, note in narrative	Chemtech Department Supervisor	Accuracy / Precision	Laboratory In-house Limits, 40% RPD

Internal Standards	Every sample, standard, QC sample	Factor of two (-50% to +100%) from most recent calibration, unless obvious matrix interference	Reanalyze sample. If determined to be matrix interference, note in narrative.	Chemtech Department Supervisor	Accuracy	Factor of two (-50% to +100%) from most recent calibration, unless obvious matrix interference
Surrogate Standards	Every sample, standard, QC sample	Laboratory in-house limits. No exceedances for MB or LCS, one acid and one base/neutral exceedance allowed for field samples, unless obvious matrix interference	Flag result, note in narrative	Chemtech Department Supervisor	Accuracy	Laboratory in-house limits. No exceedances for MB or LCS, one acid and one base/neutral exceedance allowed for field samples, unless obvious matrix interference

Matrix	**Soil**
Analytical Group	**Semivolatile Organic Compounds**
Concentration Level	Low/Medium - mg/kg (ppm)
Sampling SOP(s)	*Site Management Plan, 214 Lake Ave, Rochester, NY*, by Bergmann, dated August 2017
Analytical Method/SOP Reference	EPA Method 8270
Sampler's Name	Bergmann Associates Environmental Technician or City of Rochester DEQ
Field Sampling Organization	Bergmann Associates or City of Rochester DEQ
Analytical Organization	Chemtech
No. of Sample Locations	16

Quality Control (QC) Sample:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Field Duplicate		RPD <20			Precision	RPD <20
Cooler Temperature	1 per shipping cooler	<=10 deg. C	Note in report		Accuracy / Representativeness	<=10 deg. C
Field Equipment Blank		Analytes < = QL			Accuracy / Contamination	Analytes < = QL
Method Blank	One per preparation batch of <=20 samples	Analytes < = QL, or less than 1/10 sample concentration , common lab contaminants <=5X QL	If sufficient holding time remains, reprepare batch. If insufficient holding time, flag result, note in narrative	Chemtech Department Supervisor	Accuracy / Contamination	Analytes < = QL, or less than 1/10 sample concentration, common lab contaminants <=5X QL
Laboratory Control Sample	One per preparation batch of <=20 samples	Laboratory In-house Limits	If sufficient holding time remains, reprepare batch. If insufficient holding time, flag result, note in narrative	Chemtech Department Supervisor	Accuracy	Laboratory In-house Limits
Matrix Spike / Matrix Spike Duplicate	One set per 20 samples, as determined by sampler	Laboratory In-house Limits, 40% RPD	flag result, note in narrative	Chemtech Department Supervisor	Accuracy / Precision	Laboratory In-house Limits, 40% RPD

Internal Standards	Every sample, standard, QC sample	Factor of two (-50% to +100%) from most recent calibration, unless obvious matrix interference	Reanalyze sample. If determined to be matrix interference, note in narrative.	Chemtech Department Supervisor	Accuracy	Factor of two (-50% to +100%) from most recent calibration, unless obvious matrix interference
Surrogate Standards	Every sample, standard, QC sample	Laboratory in-house limits. No exceedances for MB or LCS, one acid and one base/neutral exceedance allowed for field samples, unless obvious matrix interference	Flag result, note in narrative	Chemtech Department Supervisor	Accuracy	Laboratory in-house limits. No exceedances for MB or LCS, one acid and one base/neutral exceedance allowed for field samples, unless obvious matrix interference

Matrix	**Soil**
Analytical Group	Metals
Concentration Level	Low to medium
Sampling SOP	*Site Management Plan, 214 Lake Ave, Rochester, NY*, by Bergmann, dated August 2017
Analytical Method/SOP Reference	Methods 6010/7471
Sampler's Name	Bergmann Associates Environmental
Field Sampling Organization	Bergmann Associates or City of Rochester
Analytical Organization	Chemtech
No. of Sample Locations	Unknown – possible during future re-

Quality Control (QC) Sample:	**Frequency/Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Field Duplicate		RPD <20			Precision	RPD <20
Cooler Temperature	1 per shipping cooler	<=10 degree C	Note in report		Accuracy / Representativeness	<=10 degree C
Field Equipment Blank		Analytes < = QL			Accuracy / Contamination	Analytes < = QL
Method Blank	One per preparation batch of <=20 samples	Analytes < = QL, or less than 1/10 sample concentration	If sufficient holding time remains, reprepare batch. If insufficient holding time, flag result, note in narrative	Chemtech Department Supervisor	Accuracy / Contamination	Analytes < = QL, or less than 1/10 sample concentration
Laboratory Control Sample	One per preparation batch of <=20 samples	60% - 140%	If sufficient holding time remains, reprepare batch. If insufficient holding time, flag result, note in narrative	Chemtech Department Supervisor	Accuracy	Laboratory In-house Limits

Matrix Spike / Matrix Spike Duplicate	One set per 20 samples, as determined by sampler	50% - 150%, 40% RPD	flag result, note in narrative	Chemtech Department Supervisor	Accuracy / Precision	Laboratory In-house Limits, 30% RPD
Surrogate Standards	Every sample, standard, QC sample	Laboratory in-house limits.	Flag result, note in narrative	Chemtech Department Supervisor	Accuracy	Laboratory in-house limits. One surrogate must be within limits on at least one GC column for all field samples, otherwise reanalyze

Data Management and Documentation

Field Sample Collection Documents and Records	Analytical Laboratory Documents and Records	Data Assessment Documents and Records	Project File
• Site and field logbooks • Boring logs • Well construction diagrams • Chain-of-Custody (COC) forms • Well Sampling Forms • Field Data Sheets • Photographs	• Sample receipt logs • Internal and external COC forms • Equipment calibration logs • Sample preparation worksheets/logs • Sample analysis worksheets/run logs • Telephone/email logs • Photo documentation	• Data Usability Summary Reports • Review forms for electronic entry of data into database • Documentation of internal technical review of report(s) • Corrective action documentation	• The laboratory will maintain its project files for a minimum of 10 years • Bergmann Associates will maintain its project files for a minimum of 10 years • The City of Rochester will maintain its project files for a minimum of 10 years

Project Reports

Type of Report	Frequency	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation	Report Recipient(s)
Status reports	Monthly	January - March 2017	Stephen DeMeo, Sr. Geologist, Bergmann Associates	Jane Forbes Environ. Specialist, City of Rochester DEQ
Data Usability Summary Report (DUSR)	Per sample	April 5, 2017	Ken Applin- Data Validation Services	Jane Forbes – Sr. Environ. Specialist, City of Rochester DEQ; Charlotte Theobald, P.E. - Engineer, NYSDEC
Remedial Construction/ Closure Report	One Time	April 31, 2015	Stephen DeMeo – Sr. Geologist, Bergmann Associates	Jane Forbes – Sr. Environ. Specialist, City of Rochester DEQ; Charlotte Theobald, P.E. - Engineer, NYSDEC

Planned Project Assessments Table

<table>
<tr><th>Assessment Type</th><th>Frequency</th><th>Internal or External</th><th>Organization Performing Assessment</th><th>Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation)</th><th>Person(s) Responsible for Responding to Assessment Findings (Title and Organizational Affiliation)</th><th>Person(s) Responsible for Identifying and Implementing Corrective Actions (Title and Organizational Affiliation)</th><th>Person(s) Responsible for Monitoring Effectiveness of Corrective Actions (Title and Organizational Affiliation)</th></tr>
<tr><td colspan="8"><i>Due to the short time frame for project completion,
these types of assessments are not applicable.</i></td></tr>
</table>

Assessment Findings and Corrective Action Responses

<table>
<tr><th>Assessment Type</th><th>Nature of Deficiencies Documentation</th><th>Individual(s) Notified of Findings (Name, Title, Organization)</th><th>Timeframe of Notification</th><th>Nature of Corrective Action Response Documentation</th><th>Individual(s) Receiving Corrective Action Response (Name, Title, Org.)</th><th>Timeframe for Response</th></tr>
<tr><td colspan="7"><i>Due to the short time frame for project completion,
these types of assessments are not applicable.</i></td></tr>
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</table>

Project Data Verification Process (Step I) [1]

Verification Input	Description	Internal/ External[2]	Responsible for Verification
Site/Field Logbooks	Field notes will be prepared daily by the Environmental Consultant Field Personnel and will be complete, appropriate, legible and pertinent. Upon completion of field work, logbooks will be placed in the project files.	I	Stephen DeMeo - Bergmann
Chains of custody	COC forms will be reviewed against the samples packed in the specific cooler prior to shipment. The reviewer will initial the form. An original COC will be sent with the samples to the laboratory, while copies are retained for (1) the Sampling Trip Report and (2) the project files.	I	Stephen DeMeo - Bergmann
Laboratory analytical data package	Data packages will be reviewed/verified internally by the laboratory performing the work for completeness and technical accuracy prior to submittal.	I	Chemtech
Laboratory analytical data package	Data packages will be reviewed as to content and sample information upon receipt by the Environmental Consultant Project Manager and the Third Party Data Validation Personnel.	I/E	Stephen DeMeo - Bergmann Associates; Ken Applin - Data Validation Services[2]
Remedial Construction/ Completion Report	The project data results will be compiled in a summary report for the project. Entries will be reviewed/verified against hardcopy information.	I	Stephen DeMeo - Bergmann

[1] Step I – Completeness Check

[2] Internal or External is in relation to the data generator.

Project Data Validation Process (Steps IIa and IIb) [1]

Step IIa/IIb[1]	Validation Input	Description	Responsible for Validation (Name, Organization)
IIa	SOPs	Ensure that the sampling methods/procedures outlined in QAPP were followed, and that any deviations were noted/approved.	Steve DeMeo – Bergmann Associates
IIb	SOPs	Determine potential impacts from noted/approved deviations, in regard to PQOs.	Stephen DeMeo - Bergmann Associates
IIa	Chains of custody	Examine COC forms against QAPP and laboratory contract requirements (e.g., analytical methods, sample identification, etc.).	Ken Applin - Data Validation Services
IIa	Laboratory data package	Examine packages against QAPP and laboratory contract requirements, and against COC forms (e.g., holding times, sample handling, analytical methods, sample identification, data qualifiers, QC samples, etc.).	Ken Applin - Data Validation Services
IIb	Laboratory data package	Determine potential impacts from noted/approved deviations, in regard to PQOs. Examples include PQLs and QC sample limits (precision/accuracy).	Stephen DeMeo - Bergmann Associates ; Ken Applin - Data Validation Services
IIb	Field duplicates	Compare results of field duplicate (or replicate) analyses with RPD criteria	Stephen DeMeo - Bergmann Associates; Ken Applin - Data Validation Services

[1] Step IIa – Compliance with Methods, Procedures, and Contracts

[1] Step IIb – Comparison with Performance Criteria in QAPP

Project Matrix and Analytical Validation (Steps IIa and IIb)[1] Summary

Step IIa/IIb[1]	Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator (title and organizational affiliation)
IIa / IIb	Soil/Sediment/ Aqueous	VOCs, SVOCs, TPH	Low and Medium	USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Organic Data Review (October 1999)	Ken Applin, Data Validation Services

[1] Step IIa – Compliance with Methods, Procedures, and Contracts

[1] Step IIb – Comparison with Performance Criteria in QAPP

Usability Assessment (Step III)[1]

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used:

Determine if any detectable amounts of contaminant(s) are present. If no detectable amounts are indicated and all data are acceptable for the verification and validation, then the data is usable.
If verification and validation are not acceptable then take corrective action (determine cause, data impact, evaluate the impact and document the rationale for resampling).

Describe the evaluative procedures used to assess overall measurement error associated with the project:

Determine if the quality control data is within the performance criteria (precision, accuracy, etc) through validation process IIb (Validation Activities).

Identify the personnel responsible for performing the usability assessment:

Project Management Team – Consisting of the Environmental Consultant Project Manager (Steve DeMeo); Data Validator (Ken Applin – Data Validation Services; Brownfields Recipient Project Manager (Jane Forbes – City of Rochester).

Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies:

The Data Usability Summary Report (DUSR) will describe the rationale for the data and the presentation of any data limitations. For example, if the performance criteria are not usable to address the regulatory requirements or support the project-decision for the ERP Recipient, then the Owner will address how this problem will be resolved and discuss any alternative approaches.

---

[1] Step III – Usability Assessment

Table 13d-1

Data Elements for Data Review Process

Item	Step I - Data Verification	Step IIa - Data Validation	Step IIb - Data Validation	Step III -Data Usability
Planning Documents				
Evidence of approval of QAPP	X			Use outputs from previous steps
Identification of personnel	X			
Laboratory name	X			
Methods (sampling & analytical)	X	X	X	
Performance requirements (including QC criteria)	X	X		
Project quality objectives	X		X	
Reporting forms	X	X		
Sampling plans – locations, maps grids, sample ID numbers	X	X		
Site identification	X			
SOPs (sampling & analytical)	X	X		
Staff training & certification	X			
List of project-specific analytes	X	X		
Analytical Data Package				
Case narrative	X	X	X	Use outputs from previous steps
Internal lab chain of custody	X	X		
Sample condition upon receipt, & storage records	X	X		
Sample chronology (time of receipt, extraction/digestion, analysis)	X	X		
Identification of QC samples (sampling /lab)	X	X		
Associated PE sample results	X	X	X	
Communication Logs	X	X		
Copies of lab notebook, records, prep sheets	X	X		
Corrective action reports	X	X		
Definition of laboratory qualifiers	X	X	X	
Documentation of corrective action results	X	X	X	
Documentation of individual QC results (e.g., spike, duplicate, LCS)	X	X	X	
Documentation of laboratory method deviations	X	X	X	
Electronic data deliverables	X	X		
Instrument calibration reports	X	X	X	
Laboratory name	X	X		
Laboratory sample identification no.	X	X		

QC sample raw data	X	X	X	
QC summary report	X	X	X	

Data Elements for Data Review Process				
Raw data	X	X	X	Use outputs from previous steps
Reporting forms, completed with actual results	X	X	X	
Signatures for laboratory sign-off (e.g., laboratory QA manager)	X	X		
Standards traceability records (to trace standard source form NIST, for example)	X	X	X	
Sampling Documents				
Chain of custody	X	X		Use outputs from previous steps
Communication logs	X	X		
Corrective action reports	X	X	X	
Documentation of corrective action results	X	X	X	
Documentation of deviation from methods	X	X	X	
Documentation of internal QA review	X	X	X	
Electronic data deliverables	X	X		
Identification of QC samples	X	X	X	
Meteorological data from field (e.g., wind, temperature)	X	X	X	
Sampling instrument decontamination records	X	X		
Sampling instrument calibration logs	X	X		
Sampling location and plan	X	X	X	
Sampling notes & drilling logs	X	X	X	
Sampling report (from field team leader to project manager describing sampling activities)	X	X	X	
External Reports				
External audit report	X	X	X	Use outputs from previous steps
External PT sample results	X	X		
Laboratory assessment	X	X		
Laboratory QA plan	X	X		
MDL study information	X	X	X	
NELAP accreditation	X	X		

Quality assurance glossary. Quality assurance terms and definitions presented in this subdivision must be used in preparing all documents related to quality assurance or control.

1. "Alteration" means altering a sample collected for analysis in any way other than by adding a preservative, such as nitric acid to lower pH. Examples of alteration include, but are not limited to: filtering, settling and decanting, centrifuging and decanting and acid extracting.

2. A Analytical Services Protocol or "ASP" means DEC’s compilation of approved EPA laboratory methods for sample preparation, analysis and data handling procedures.

3. A Correlation sample@ means a sample taken, when using a field-testing technology, to be analyzed by an ELAP-certified laboratory to determine the correlation between the laboratory and field analytical results.

4. "Effective solubility" means the theoretical aqueous solubility of an organic constituent in groundwater that is in chemical equilibrium with a separate-phase (NAPL) mixed product (product containing several organic chemicals). The effective solubility of a particular organic chemical can be estimated by multiplying its mole fraction in the product mixture by its pure-phase solubility.

5. An Environmental Laboratory Accreditation Program@ or AELAP@ means a program conducted by the NYSDOH which certifies environmental laboratories through on-site inspections and evaluation of principles of credentials and proficiency testing. Information regarding ELAP is available at the NYSDOH Wadsworth Laboratory website.

6. "Filtration" means the filtering of a groundwater or surface water sample, collected for metals analysis, at the time of collection and prior to preservation. Filtering includes but is not limited to the use of any membrane, fabric, paper or other filter medium, irrespective of pore size, to remove particulates from suspension.

7. A Final delineation sample@ means a sample taken to make a decision regarding the extent of contamination at a site during the investigation and the design of the remedy or confirmation/documentation sampling during remedial construction, which is to be analyzed by an ELAP-certified laboratory.

8. An Intermediate sample@ means a sample taken during the investigation or remediation process that will be followed by another sampling event to confirm that remediation was successful or to confirm that the extent of contamination has been defined to below a level of concern.

9. "Method detection limit" or "MDL" means the minimum concentration of a substance that can be measured and reported with a 99 percent confidence that the analyte concentration is greater than zero and is determined from the analysis of a sample in a given matrix containing the analyte.

10. A Minimum reporting limit@ means the lowest concentration at which an analyte can be detected and which can be reported with a reasonable degree of accuracy. It is the lowest concentration that can be measured, a lab-specific number, developed from minimum detection limits, and is also referred to as the practical quantitation limit (PQL).

11. A Nephelometric Turbidity Unit@ or "NTU" is the unit by which turbidity in a sample is measured.

12. "Preservation" means preventing the degradation of a sample due to precipitation, biological action, or other physical/chemical processes between the time of sample collection and analysis. The most common examples involve refrigeration at 4 degrees Celsius and lowering sample pH by the addition of acid to keep dissolved metals in solution or to reduce the biodegradation of dissolved organic analytes.

13. "Target analyte list" or "TAL" means the list of inorganic compounds/elements designated for analysis as contained in the version of the *EPA Contract Laboratory Program Statement of Work for Inorganics Analysis, Multi-Media, Multi-Concentration* in effect as of the date on which the laboratory is performing the analysis. For the purpose of this chapter, a Target Analyte List scan means the analysis of a sample for Target Analyte List compounds/elements.

14. "Targeted compound" means a contaminant for which a specific analytical method is designed to detect that potential contaminant both qualitatively and quantitatively.

15. "Target compound list plus 30" or "TCL+30" means the list of organic compounds designated for analysis (TCL) as contained in the version of the EPA *Contract Laboratory Program Statement of Work for Organics Analysis*, *Multi-Media, Multi-Concentration* in effect as of the date on which the laboratory is performing the analysis, and up to 30 non-targeted organic compounds (plus 30) as detected by gas chromatography/mass spectroscopy (GC/MS) analysis.

16. "Tentatively identified compound or TIC" means a chemical compound that is not on the target compound list but is detected in a sample analyzed by a GC/MS analytical method. TICs are only possible with methods using mass spectrometry as the detection technique. The compound is tentatively identified using a mass spectral instrumental electronic library search and the concentration of the compound estimated.

Quality Assurance Manual

ESC

L·A·B S·C·I·E·N·C·E·S

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Version 15.0 8/1/16

COMPREHENSIVE QUALITY ASSURANCE MANUAL

for

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The ESC QAM has been prepared in accordance with the following standards: AIHA-LAP, A2LA, ISO/IEC 17025-2005, 2003 NELAC Standard, 2009 TNI Standard, and DOD QSM.

Disclaimer

This Quality Assurance Manual for ESC Lab Sciences is a living document. It is reviewed at least annually and revised when needed. The information stated herein is subject to change at any time due to updates to QC Limits, methods, operations, equipment, staff, etc.

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Quality Manual: Table of Contents

Tables and Figures

1.0 GENERAL PURPOSE OF THIS QUALITY MANUAL

This quality manual documents the laboratory's management system and demonstrates the ability to execute the indicated tests and/or procedures and to meet regulatory requirements.

This manual establishes laboratory compliance with ISO (International Organization for Standardization) 17025, The NELAC Institute (TNI), Department of Defense Quality Systems Manual (DOD QSM), and the American Industrial Hygiene Association Laboratory Accreditation Program (AIHA-LAP).

2.0 LABORATORY BACKGROUND

2.1 ACTIVITIES

2.1.1 Analytical Support and Service Areas

ESC Lab Sciences is an environmental analytical firm providing technical and support services to customers nationwide. Specific service areas include the following:

- drinking water analysis
- industrial wastewater analysis
- hazardous waste characterization and identification
- groundwater analysis
- air analysis
- regulatory document guidance
- biological assessments
- mold identification
- solid/soil analysis and characterization
- industrial hygiene/environmental lead
- aquatic toxicity analysis
- cryptosporidium/giardia

2.1.2 Regulatory Compliance and Quality Standards

ESC is devoted to providing reliable and accurate data recognizing the necessity to establish sound, objective, and legally defensible positions or opinions for customers regarding compliance with governing regulations. ESC maintains quality systems that are compliant with the following Quality Standards: AIHA-LAP, A2LA, ANSI/ISO/IEC 17025, The TNI Standard, DOD QSM. The effectiveness of the quality system is measured by accreditation maintenance, internal and external audits, management reviews, proficiency sample testing, and an active preventive/corrective action system.

2.1.3 Analytical Capabilities:

Where mandated, only approved procedures are used for environmental analyses. ESC utilizes a number of method sources to accomplish project requirements. For NPDES and SDWA, methodologies are taken directly from 40 CFR parts 136 and 141.

For industrial hygiene analytical procedures, ESC utilizes guidance from NIOSH and OSHA published methods.

The following list is an example of the methodology ESC routinely performs:

Routine Methodology and Programs	
PROGRAM	***METHOD SOURCE***
NPDES	*EPA 821/R-93-010-A* *Methods for the Determination of Nonconventional Pesticides in Municipal and Industrial Wastewater, Volume I. Revision 1, August 1993.*
	40 CFR part 136
	Methods for Chemical Analysis of Water and Wastes (March 1983)
	Standard Methods for the Examination of Water and Wastewater (20th through 22nd editions)
AQUATIC TOXICITY	*7-Day Fathead Minnow (Pimephales promelas) Larval Survival and Growth Test; Test Method 1000.0 from "Short Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms" (EPA 821-R-02-013).*
	3-Brood Ceriodaphnia dubia Survival and Reproduction Test; Test Method 1002.0 from "Short Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms" (EPA 821-R-02-013).
	Fathead Minnow (Pimephales promelas) Acute Toxicity Test (24, 48 or 96 hour duration); referenced in "Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms" (EPA 821-R-02-012, 10-02).
	Ceriodaphnia dubia Acute Toxicity Test (24, 48 or 96 hour duration); referenced in "Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms" (EPA 821-R-02-012, 10-02).
SDWA	40 CFR parts 141
	Methods for Chemical Analysis of Water and Wastes (March 1983)
	Standard Methods for the Examination of Water and Wastewater (20th through 22nd editions)
	Methods for the Determination of Organic Compounds in Drinking Water - EPA/600/4-88/039 - December 1988 (Revised July 1991)
	Methods for the Determination of Organic Compounds in Drinking Water Supplement I, EPA/600/4-90/020 - July 1990
	Methods for the Determination of Organic Compounds in Drinking Water Supplement II, EPA/600/R-92/129 - August 1992
	EPA. Method 1622: *Cryptosporidium in Water by Filtration/IMS/FA, December 2005.*
	EPA. Method 1623: *Cryptosporidium and Giardia in Water by Filtration/IMS/FA, December 2005.*
RCRA	*SW-846, Test Methods for Evaluating Solid Wastes (3rd, 4th and online editions)*

Routine Methodology and Programs	
PROGRAM	***METHOD SOURCE***
AIR	*Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air*
	Emission Measurement Center (Air Emissions Methods)
	NIOSH Manual of Analytical Methods (4th edition)
	Journal of Chromatographic Science, Vol. 36, May 1998.
	OSHA Sampling and Analytical Methods (online)
CLP	*USEPA CONTRACT LABORATORY PROGRAM - STATEMENT OF WORK FOR ORGANICS ANALYSIS Multi-Media, Multi-Concentration OLM04.3*
	USEPA CONTRACT LABORATORY PROGRAM - STATEMENT OF WORK FOR INORGANIC ANALYSIS Multi-Media, Multi-Concentration ILM05.3
MOLD	*American Industrial Hygiene Association*
Miscellaneous	*American Society for Testing and Materials (ASTM)*
	State Specific Methodologies from the following: *Florida, Oregon, Iowa, Washington, Texas, Arizona, Massachusetts, North Carolina, Louisiana, Missouri, Kansas, Wisconsin, Ohio*
Miscellaneous	*Analytical Methods for the Determination of Pollutants in Pharmaceutical Manufacturing Industry Wastewater, Revision A EPA-821-B-98-016 - July 1998 (Approved at 40 CFR Part 136, Not Approved at Part 141)*

2.2 HISTORY

ESC Lab Sciences was founded in 1970 by Dr. Arthur Schulert, a professor of Biochemistry at Vanderbilt University Medical School. The laboratory's first location was a 2,000 square foot building located in Mt. Juliet, TN.

ESC initially conducted several research contracts for the National Science Foundation. EPA Clean Water and Safe Drinking Water legislation of the early 1970s provided an additional market of Tennessee utilities and industries. ESC grew slowly for several years by increasing the share of the drinking and wastewater markets in Tennessee. In the late 1980s, ESC expanded its capabilities to include Underground Storage Tank testing and Biomonitoring/Toxicity testing.

Strategic expansion of the laboratory allowed ESC to provide support to large RCRA sites and add capabilities to offer analytical support for air and mold analyses. ESC is currently the nation's largest, single-location environmental laboratory operating in all US states. Our staff of over 300 employees works out of our 100,000 square feet, eleven-building facility approximately 20 minutes east of Nashville International Airport.

3.0 INTRODUCTION, SCOPE, AND DEFINITIONS

3.1 SCOPE OF CAPABILITIES

A list of approved and certified analytical capabilities can be found at the end of this section in Table 3.3b.

3.2 TABLE OF CONTENTS, REFERENCES AND APPENDICES

The table of contents is found at the beginning of this Manual. This Quality Manual uses the references from the 2003 NELAC Standard, Chapter 5, Appendix A and the 2009 TNI Standard (EL-V1M2-ISO-2009, Section 3.0).

3.3 DEFINITIONS AND TERMINOLOGY

The source of some of the definitions is indicated previous to the actual definition.

Table 3.3a Definitions

Acceptance Criteria	TNI and DoD- Specified limits placed on characteristics of an item, process, or service defined in requirement documents.
Accreditation	TNI and DoD- The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory.
Accrediting Authority	DoD- The Territorial, State or Federal agency having responsibility and accountability for environmental laboratory accreditation and which grants accreditation.
Accrediting (or Accreditation) Body	DoD- Authoritative body that performs accreditation.
Accuracy	TNI and DoD- The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that are due to sampling and analytical operations; a data quality indicator.
Aliquot	DoD- A discrete, measured, representative portion of a sample taken for analysis.
Analysis Sequence	A compilation of all samples, standards and quality control samples run during a specific amount of time on a particular instrument in the order they are analyzed.
Analyst	TNI and DoD- The designated individual who performs the “hands-on” analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.
Analyte	DoD- The specific chemicals or components for which a sample is analyzed; it may be a group of chemicals that belong to the same chemical family, and which are analyzed together.
Analytical Reagent Grade	Designation for the high purity of certain chemical reagents and solvents assigned by the American Chemical Society.

Analytical Sensitivity	The lowest concentration that can be detected by the method. (e.g., for methods involving a count = 1 raw count calculated to the reporting units). Analytical sensitivity is commonly used in Mold analysis.
Analytical Uncertainty	TNI- A subset of Measurement Uncertainty that includes all laboratory activities performed as part of the analysis.
Assessment	TNI - The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its system to defined criteria (to the standards and requirements of laboratory accreditation). DoD- The evaluation process used to measure the performance or effectiveness of a system and its elements against specific criteria. Note: In this standard (DoD), assessment is an all-inclusive term used to denote any of the following: audit, performance evaluation, peer review, inspection, or surveillance.
Atomic Absorption Spectrometer	Instrument used to measure concentration in metals samples.
Atomization	DoD- A process in which a sample is converted to free atoms.
Audit	TNI- A systematic and independent examination of facilities, equipment, personnel, training, procedures, record-keeping, data validation, data management, and reporting aspects of a system to determine whether QA/QC and technical activities are being conducted as planned and whether these activities will effectively achieve quality objectives. DoD- A systematic evaluation to determine the conformance to quantitative and qualitative specifications of some operational function or activity.
Batch	TNI and DoD- Environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A **preparation batch** is composed of one to 20 environmental samples of the same quality systems matrix, meeting the above-mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) which are analyzed together as a group. An analytical batch can include prepared samples originating from various quality system matrices and can exceed 20 samples.
Bias	TNI- The systematic or persistent distortion of a measurement process, which causes errors in one direction (i.e., the expected sample measurement is different from the sample's true value).
Blank	TNI and DoD- A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results.
Blind Sample	DoD- A sub-sample for analysis with a composition known to the submitter. The analyst/laboratory may know the identity of the sample but not its composition. It is used to test the analyst's or laboratory's proficiency in the execution of the measurement process.
BNA (Base Neutral Acid compounds)	A list of semi-volatile compounds typically analyzed by mass spectrometry methods. Named for the way they can be extracted out of environmental samples in an acidic, basic or neutral environment.
BOD (Biochemical Oxygen Demand)	Chemical procedure for determining how fast biological organisms use up oxygen in a body of water.

Calibration	TNI and DoD- A set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by standards. 1) In calibration of support equipment, the values realized by standards are established through the use of reference standards that are traceable to the International System of Units (SI); 2) In calibration according to test methods, the values realized by standards are typically established through the use of Reference Materials that are either purchased by the laboratory with a certificate of analysis or purity, or prepared by the laboratory using support equipment that has been calibrated or verified to meet specifications.
Calibration Curve	TNI- The mathematical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response. DoD- The graphical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response.
Calibration Factor	The ratio of the detector response (peak areas or peak heights) to the amount (mass) of analyte in the calibration standard.
Calibration Method	DoD- A defined technical procedure for performing a calibration.
Calibration Range	DoD- The range of values (concentrations) between the lowest and highest calibration standards of a multi-level calibration curve. For metals analysis with a single-point calibration, the low-level calibration check standard and the high standard establish the linear calibration range, which lies within the linear dynamic range.
Calibration Standard	TNI- A substance or reference material used for calibration. DoD- A substance or reference material used to calibrate an instrument.
Certified Reference Material (CRM)	TNI- Reference material accompanied by a certificate, having a value, measurement uncertainty, and stated metrological traceability chain to a national metrology institute. DoD- A reference material one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body.
Chain of Custody	DoD- An unbroken trail of accountability that verifies the physical security of samples, data, and records.
Chain of custody Form (COC)	TNI and DoD- Record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and type of containers; the mode of collection, the collector, time of collection; preservation; and requested analyses.
Chemical Oxygen Demand (COD)	A test commonly used to indirectly measure the amount of organic compounds in water.
Client (referred to by ISO as Customer)	DoD- Any individual or organization for whom items or services are furnished or work performed in response to defined requirements and expectations.
Code of Federal Regulations (CFR)	A codification of the general and permanent rules published in the Federal Register by agencies of the federal government.
Comparability	An assessment of the confidence with which one data set can be compared to another. Comparable data are produced through the use of standardized procedures and techniques.

Completeness	The percent of valid data obtained from a measurement system compared to the amount of valid data expected under normal conditions. The equation for completeness is: % Completeness = (Valid Data Points/Expected Data Points)*100
Confirmation	TNI and DoD- Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to: second-column confirmation; alternate wavelength; derivatization; mass spectral interpretation; alternative detectors; or additional cleanup procedures.
Conformance	DoD- An affirmative indication or judgment that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements.
Congener	DoD- A member of a class of related chemical compounds (e.g., PCBs, PCDDs).
Consensus Standard	DoD- A standard established by a group representing a cross-section of a particular industry or trade, or a part thereof.
Continuing Calibration Blank (CCB)	A blank sample used to monitor the cleanliness of an analytical system at a frequency determined by the analytical method.
Continuing Calibration Check Compounds (CCC)	Compounds listed in mass spectrometry methods that are used to evaluate an instrument calibration from the standpoint of the integrity of the system. High variability would suggest leaks or active sites on the instrument column.
Continuing Calibration Verification	DoD- The verification of the initial calibration that is required during the course of analysis at periodic intervals. Continuing calibration verification applies to both external and internal standard calibration techniques, as well as to linear and non-linear calibration models.
Continuing Calibration Verification (CCV) Standard	Also referred to as a CVS in some methods, it is a standard used to verify the initial calibration of compounds in an analytical method. CCVs are analyzed at a frequency determined by the analytical method.
Continuous Emission Monitor (CEM)	A flue gas analyzer designed for fixed use in checking for environmental pollutants.
Contract Laboratory Program (CLP)	A national network of EPA personnel, commercial labs, and support contractors whose fundamental mission is to provide data of known and documented quality.
Contract Required Detection Limit (CRDL)	Detection limit that is required for EPA Contract Laboratory Program (CLP) contracts.
Contract Required Quantitation Limit (CRQL)	Quantitation limit (reporting limit) that is required for EPA Contract Laboratory Program (CLP) contracts.
Control Chart	A graphic representation of a series of test results, together with limits within which results are expected when the system is in a state of statistical control (see definition for Control Limit)
Control Limit	A range within which specified measurement results must fall to verify that the analytical system is in control. Control limit exceedances may require corrective action or require investigation and flagging of non-conforming data.
Corrective Action	DoD- The action taken to eliminate the causes of an existing non-conformity, defect, or other undesirable situation in order to prevent recurrence.

Corrective and Preventative Action (CAPA)	The primary management tools for bringing improvements to the quality system, to the management of the quality system's collective processes, and to the products or services delivered which are an output of established systems and processes.
Data Audit	DoD- A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data are of acceptable quality (i.e. that they meet specified acceptance criteria).
Data Quality Objective (DQO)	Systematic strategic planning tool based on the scientific method that identifies and defines the type, quality, and quantity of data needed to satisfy a specified use or end user.
Data Reduction	TNI- The process of transforming the number of data items by arithmetic or statistical calculation, standard curves, and concentration factors, and collating them into a more usable form. DoD- The process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more useable form.
Definitive Data	DoD- Analytical data of known quality, concentration and level of uncertainty. The levels of quality and uncertainty of the analytical data are consistent with the requirements for the decision to be made. Suitable for final decision-making.
Demonstration of Capability	TNI- A procedure to establish the ability of the analyst to generate analytical results of acceptable accuracy and precision. DoD- A procedure to establish the ability of the analyst to generate acceptable accuracy.
Detection Limit (DL)	DoD- The smallest analyte concentration that can be demonstrated to be different than zero or a blank concentration at the 99% level of confidence. At the DL, the false positive rate is 1%.
Diesel Range Organics (DRO)	A range of compounds that denote all the characteristic compounds that make up diesel fuel (range can be state or program specific).
Digestion	DoD- A process in which a sample is treated (usually in conjunction with heat) to convert the sample to a more easily measured form.
Document Control	DoD- The act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly and controlled to ensure use of the correct version at the location where the prescribed activity is performed.
Dry Weight	The weight after drying in an oven at a specified temperature.
Duplicate (also known as Replicate or Laboratory Duplicate)	DoD- The analyses or measurements of the variable of interest performed identically on two subsamples of the same sample. The results of duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory.
Electron Capture Detector (ECD)	Device used in GC methods to detect compounds that absorb electrons (e.g., PCB compounds).
Electronic Data Deliverable (EDD)	A summary of environmental data (usually in spreadsheet form) which customers request for ease of data review and comparison to historical results.
Eluent	DoD- A solvent used to carry the components of a mixture through a stationary phase.
Elute	DoD- To extract, specifically, to remove (absorbed material) from an absorbent by means of a solvent.
Elution	DoD- A process in which solutes are washed through a stationary phase by movement of a mobile phase.

Environmental Data	DoD- Any measurements or information that describe environmental processes, locations, or conditions; ecological or health effects and consequences; or the performance of environmental technology.
Environmental Monitoring	DoD- The process of measuring or collecting environmental data.
Environmental Sample	A representative sample of any material (aqueous, non-aqueous, or multimedia) collected from any source for which determination of composition or contamination is requested or required. Environmental samples can generally be classified as follows: • Air and Emissions – Gas or vapor collected in Tedlar bags, SUMMA canisters, sorbant tubes, impingers, filters, or other devices. • Non Potable Water (Includes surface water, ground water, effluents, water treatment chemicals, and TCLP leachates or other extracts) • Drinking Water - Delivered (treated or untreated) water designated as potable water • Water/Wastewater - Raw source waters for public drinking water supplies, ground waters, municipal influents/effluents, and industrial influents/effluents • Sludge - Municipal sludges and industrial sludges. • Soil - Predominately inorganic matter ranging in classification from sands to clays. • Waste - Aqueous and non-aqueous liquid wastes, chemical solids, and industrial liquid and solid wastes
Equipment Blank	A sample of analyte-free media used to rinse common sampling equipment to check effectiveness of decontamination procedures.
External Calibration Model	Comparison of instrument responses from the sample to the responses from the target compounds in the calibration standards. Sample peak areas (or peak heights) are compared to peak areas (or heights) of the corresponding analytes in calibration standards.
Facility	A distinct location within the company that has unique certifications, personnel and waste disposal identifications.
False Negative	DoD- An analyte incorrectly reported as absent from the sample, resulting in potential risks from their presence.
False Positive	DoD- An item incorrectly identified as present in the sample, resulting in a high reporting value for the analyte of concern.
Field Blank	A blank sample prepared in the field by filling a clean container with reagent water and appropriate preservative, if any, for the specific sampling activity being undertaken.
Field Measurement	Determination of physical, biological, or radiological properties, or chemical constituents that are measured on-site, close in time and space to the matrices being sampled/measured, following accepted test methods. This testing is performed in the field outside of a fixed-laboratory or outside of an enclosed structure that meets the requirements of a mobile laboratory.
Field of Accreditation	TNI- Those matrix, technology/method, and analyte combinations for which the accreditation body offers accreditation.

Finding	TNI- An assessment conclusion referenced to a laboratory accreditation standard and supported by objective evidence that identifies a deviation from a laboratory accreditation standard requirement. DoD- An assessment conclusion that identifies a condition having a significant effect on an item or activity. An assessment finding may be positive or negative and is normally accompanied by specific examples of the observed condition. Note: For DoD, the finding must be linked to a specific requirement.
Flame Atomic Absorption Spectrometer (FAA)	Instrumentation used to measure the concentration of metals in an environmental sample based on the fact that ground state metals absorb light at different wavelengths. Metals in a solution are converted to the atomic state by use of a flame.
Flame Ionization Detector (FID)	A type of gas detector used in GC analysis where samples are passed through a flame which ionizes the sample so that various ions can be measured.
Gas Chromatography (GC)	Instrumentation which utilizes a mobile carrier gas to deliver an environmental sample across a stationary phase with the intent to separate compounds out and measure their retention times.
Gas Chromatograph/ Mass Spectrometry (GC/MS)	In conjunction with a GC, this instrumentation utilizes a mass spectrometer which measures fragments of compounds and determines their identity by their fragmentation patterns (mass spectra).
Gasoline Range Organics (GRO)	A range of compounds that denote all the characteristic compounds that make up gasoline (range can be state or program specific).
Graphite Furnace Atomic Absorption Spectrometry (GFAA)	Instrumentation used to measure the concentration of metals in an environmental sample based on the absorption of light at different wavelengths that are characteristic of different analytes.
High Pressure Liquid Chromatography (HPLC)	Instrumentation used to separate, identify and quantitate compounds based on retention times which are dependent on interactions between a mobile phase and a stationary phase.
Holding Time	TNI- The maximum time that can elapse between two specified activities. 40 CFR Part 136- The maximum time that samples may be held prior to preparation and/or analysis as defined by the method and still be considered valid or not compromised. For sample prep purposes, hold times are calculated using the time of the start of the preparation procedure. DoD- The time elapsed from the time of sampling to the time of extraction or analysis, or from extraction to analysis, as appropriate.
Homogeneity	The degree to which a property or substance is uniformly distributed throughout a sample.
Homologue	DoD- One in a series of organic compounds in which each successive member has one more chemical group in its molecule than the next preceding member. For instance, methanol, ethanol, propanol, butanol, etc., form a homologous series.
Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES)	Analytical technique used for the detection of trace metals which uses plasma to produce excited atoms that emit radiation of characteristic wavelengths.

Inductively Coupled Plasma- Mass Spectrometry (ICP/MS)	An ICP-AES that is used in conjunction with a mass spectrometer so that the instrument is not only capable of detecting trace amounts of metals and non-metals but is also capable of monitoring isotopic speciation for the ions of choice.
Infrared Spectrometer (IR)	An instrument that uses infrared light to identify compounds of interest.
Initial Calibration (ICAL)	The process of analyzing standards, prepared at specified concentrations, to define the quantitative response relationship of the instrument to the analytes of interest. Initial calibration is performed whenever the results of a calibration verification standard do not conform to the requirements of the method in use or at a frequency specified in the method.
Initial Calibration Blank (ICB)	A blank sample used to monitor the cleanliness of an analytical system at a frequency determined by the analytical method. This blank is specifically run in conjunction with the Initial Calibration Verification (ICV) where applicable.
Initial Calibration Verification (ICV)	DoD- A standard obtained or prepared from a source independent of the source of the standards for the initial calibration. Its concentration should be at or near the middle of the calibration range. It is done after the initial calibration.
Inspection	DoD- An activity such as measuring, examining, testing, or gauging one or more characteristics of an entity and comparing the results with specified requirements in order to establish whether conformance is achieved for each characteristic.
Instrument Blank	DoD- A clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination.
Instrument Detection Limits (IDLs)	Limits determined by analyzing a series of reagent blank analyses to obtain a calculated concentration. IDLs are determined by calculating the average of the standard deviations of three runs on three non-consecutive days from the analysis of a reagent blank solution with seven consecutive measurements per day.
Interference, spectral	DoD- Occurs when particulate matter from the atomization scatters incident radiation from the source or when the absorption or emission from an interfering species either overlaps or is so close to the analyte wavelength that resolution becomes impossible.
Interference, chemical	DoD- Results from the various chemical processes that occur during atomization and later the absorption characteristics of the analyte.
Interference Check Sample (ICS)	A series of two solutions, used in ICP and ICPMS analysis, to verify that inter-element interferences are compensated for correctly. This standard is referred to as the Spectra Interference Check (SIC) in EPA Method 200.7 • ICSA – A solution containing only the interfering analytes at high concentrations. • ICSAB – A solution containing interferents plus other method analytes at the level of concern, which corresponds to the project specific action limits. ICSA and ICSAB provide an adequate test of inter-element correction (IEC) factors.
Internal Calibration Model	Internal standard calibration involves the comparison of instrument responses from the target compounds in the sample to the responses of specific internal standard analytes added to the sample or sample extract prior to injection.
Internal Standards	TNI and DoD- A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical method.
Intermediate Standard Solution	Reference solutions prepared by dilution of the stock solutions with an appropriate solvent.

International System of Units (SI)	DoD- The coherent system of units adopted and recommended by the General Conference on Weights and Measures.
Ion Chromatography (IC)	Instrumentation or process that allows the separation of ions and molecules based on the charge properties of the molecules.
Isomer	DoD- One of two or more compounds, radicals, or ions that contain the same number of atoms of the same element but differ in structural arrangement and properties. For example, hexane (C6H14) could be n-hexane, 2-methylpentane, 3-methylpentane, 2,3-dimethylbutane, 2,2-dimethylbutane.
Laboratory	DoD- A body that calibrates and/or tests.
Laboratory Control Sample (LCS)	TNI and DoD- (however named, such as laboratory fortified blank, spiked blank, or QC check sample): A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes and taken through all sample preparation and analytical steps of the procedure unless otherwise noted in a reference method. It is generally used to establish intra-laboratory or analyst-specific precision and bias or to evaluate the performance of all or a portion of the measurement system.
Laboratory Duplicate	DoD- Aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently.
Laboratory Information Management System (LIMS)	A computer system that is used to maintain all sample information from sample receipt, through preparation and analysis and including sample report generation.
Legal Chain-of-Custody Protocols	TNI- Procedures employed to record the possession of samples from the time of sampling through the retention time specified by the customer or program. These procedures are performed at the special request of the customer and include the use of a Chain-of-Custody Form that documents the collection, transport, and receipt of compliance samples by the laboratory. In addition, these protocols document all handling of the samples within the laboratory.
Limit(s) of Detection (LOD)	TNI- A laboratory's estimate of the minimum amount of an analyte in a given matrix that an analytical process can reliably detect in their facility. DoD- The smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the LOD, the false negative rate is 1%.
Limit(s) of Quantitation (LOQ)	TNI- The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. DoD- The lowest concentration that produces a quantitative result within specified limits of precision and bias. For DoD projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard.
Lot	A quantity of bulk material of similar composition processed or manufactured at the same time.
Management	DoD- Those individuals directly responsible and accountable for planning, implementing, and assessing work.
Management System	DoD- System to establish policy and objectives and to achieve those objectives.
Manager (however named)	DoD- The individual designated as being responsible for the overall operation, all personnel, and the physical plant of the environmental laboratory. A supervisor may report to the manager. In some cases, the supervisor and the manager may be the same individual.

Matrix	TNI and DoD- The substrate of a test sample. For information is provided in the definition of Quality System Matrix below.
Matrix Duplicate	TNI- A replicate matrix prepared in the laboratory and analyzed to obtain a measure of precision.
Matrix Spike (MS) (spiked sample or fortified sample)	TNI- A sample prepared, taken through all sample preparation and analytical steps of the procedure unless otherwise noted in a referenced method, by adding a known amount of target analyte to a specified amount of sample for which an independent test result of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency. DoD- A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.
Matrix Spike Duplicate (MSD) (spiked sample or fortified sample duplicate)	TNI and DoD- A replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte.
Measurement System	TNI and DoD- A test method, as implemented at a particular laboratory, and which includes the equipment used to perform the test and the operator(s).
Method	TNI- A body of procedures and techniques for performing an activity (e.g., sampling, chemical analysis, quantification), systematically presented in the order in which they are to be executed.
Method Blank	TNI and DoD- A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses.
Method Detection Limit (MDL)	DoD- One way to establish a Detection Limit; defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.
Method Quantitation Limit (MQL)	TX TRRP - The lowest non-zero concentration standard in the laboratory's initial calibration curve and is based on the final volume of extract (or sample) used by the laboratory.
Method of Standard Additions	DoD- A set of procedures adding one or more increments of a standard solution to sample aliquots of the same size in order to overcome inherent matrix effects. The procedures encompass the extrapolation back to obtain the sample concentration.
MintMiner	Software used to review large amounts of chromatographic data to monitor for errors or data integrity issues.
Mobile Laboratory	TNI- A portable enclosed structure with necessary and appropriate accommodation and environmental conditions for a laboratory, within which testing is performed by analysts. Examples include but are not limited to trailers, vans, and skid-mounted structures configured to house testing equipment and personnel.
National Institute of Standards and Technology (NIST)	TNI- A federal agency of the US Department of Commerce's Technology Administration that is designed as the United States national metrology institute (or NMI).

National Pollutant Discharge Elimination System (NPDES)	A permit program that controls water pollution by regulating point sources that discharge pollutants into U.S. waters.
Negative Control	DoD- Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results.
Nitrogen Phosphorus Detector (NPD)	A detector used in GC analyses that utilizes thermal energy to ionize an analyte. With this detector, nitrogen and phosphorus can be selectively detected with a higher sensitivity than carbon.
Nonconformance	DoD- An indication or judgment that a product or service has not met the requirement of the relevant specifications, contract, or regulation; also the state of failing to meet the requirements.
Not Detected (ND)	The result reported for a compound when the detected amount of that compound is less than the method reporting limit.
Percent Recovery	A comparison between the observed value and the true value of a known spiked concentration, represented as a percentage. This evaluation applies to the calculation of ICV, CCV, LCS, MS/MSD, Surrogates, etc.
Performance Audit	DoD- The routine comparison of independently obtained qualitative and quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory.
Performance Based Measurement System (PBMS)	An analytical system wherein the data quality needs, mandates or limitations of a program or project are specified and serve as criteria for selecting appropriate test methods to meet those needs in a cost-effective manner.
Photo-ionization Detector (PID)	An ion detector which uses high-energy photons, typically in the ultraviolet range, to break molecules into positively charged ions.
Polychlorinated Biphenyls (PCB)	A class of organic compounds that were used as coolants and insulating fluids for transformers and capacitors. The production of these compounds was banned in the 1970's due to their high toxicity.
Positive Control	DoD- Measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects.
Post-Digestion Spike	A sample prepared for metals analyses that has analytes spike added to determine if matrix effects may be a factor in the results.
Power of Hydrogen (pH)	The measure of acidity or alkalinity of a solution.
Practical Detection Limit (PDL)	Another term for method detection limit (MDL) or limit of detection (LOD). However, a PDL might not be statically derived and could be set using an in-house protocol.
Practical Quantitation Limit (PQL)	Another term for a method reporting limit or limit of quantitation (LOQ). The lowest reportable concentration of a compound based on parameters set up in an analytical method and the laboratory's ability to reproduce those conditions.
Precision	TNI and DoD- The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms.
Preservation	TNI- Any conditions under which a sample must be kept in order to maintain chemical and/or biological integrity prior to analysis. DoD- Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample.

Procedure	TNI- A specified way to carry out an activity or process. Procedures can be documented or not.
Proficiency Testing	TNI and DoD- A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source.
Proficiency Testing Program	TNI and DoD- The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories.
Proficiency Testing Sample (PT)	TNI- A sample, the composition of which is unknown to the laboratory and is provided to test whether the laboratory can produce analytical results within the specified acceptance criteria. DoD- A sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria.
Protocol	TNI and DoD- A detailed written procedure for field and/or laboratory operation (e.g., sampling, analysis) that must be strictly followed.
Quality Assurance (QA)	TNI- An integrated system of management activities involving planning, implementation, assessment, reporting and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the customer. DoD- An integrated system of activities involving planning, quality control, quality assessment, reporting, and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence.
Quality Assurance Manual (QAM)	A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users.
Quality Assurance Project Plan (QAPP)	DoD- A formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved.
Quality Control (QC)	TNI- The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality; also the system of activities and checks used to ensure that measurement systems are maintained within prescribed limits, providing protection against "out of control" conditions and ensuring that the results are of acceptable quality. DoD- The overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of the users.
Quality Control Sample (QCS)	TNI- A sample used to assess the performance of all or a portion of the measurement system. One of any number of samples, such as Certified Reference Materials, a quality system matrix fortified by spiking, or actual samples fortified by spiking, intended to demonstrate that a measurement system or activity is in control. DoD- A sample used to assess the performance of all or a portion of the measurement system. One of any number of samples, such as Certified Reference Materials, a quality system matrix fortified by spiking, or actual samples fortified by spiking.

Quality Manual	TNI and DoD- A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users.
Quality System	TNI and DoD- A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required quality assurance and quality control activities.
Quality System Matrix	TNI and DoD- These matrix definitions are to be used for purposes of batch and quality control requirements: • **Air and Emissions**: Whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbant tube, impinger solution, filter, or other device • **Aqueous**: Any aqueous sample excluded from the definition of Drinking Water or Saline/Estuarine. Includes surface water, groundwater effluents, and TCLP or other extracts. • **Biological Tissue**: Any sample of a biological origin such as fish tissue, shellfish or plant material. Such samples shall be grouped according to origin. • **Chemical Waste**: A product or by-product of an industrial process that results in a matrix not previously defined. • **Drinking Water**: Any aqueous sample that has been designated a potable or potentially potable water source. • **Non-aqueous liquid**: Any organic liquid with <15% settleable solids • **Saline/Estuarine**: Any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake. • **Solids**: Includes soils, sediments, sludges, and other matrices with >15% settleable solids.
Quantitation Range	DoD- The range of values in a calibration curve between the LOQ and the highest successively analyzed initial calibration standard. The quantitation range lies within the calibration range.
Random Error	The EPA has established that there is a 5% probability that the results obtained for any one analyte will exceed the control limits established for the test due to random error. As the number of compounds measured increases in a given sample, the probability for statistical error also increases.

Raw Data	TNI- The documentation generated during sampling and analysis. This documentation includes, but is not limited to, field notes, electronic data, magnetic tapes, untabulated sample results, QC sample results, print outs of chromatograms, instrument outputs, and handwritten records. DoD- Any original factual information from a measurement activity or study recorded in a laboratory notebook, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfiche copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments. If exact copies of raw data have been prepared (e.g., tapes which have been transcribed verbatim, data and verified accurate by signature), the exact copy or exact transcript may be submitted.
Reagent Blank (method reagent blank)	DoD- A sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps.
Reagent Grade	Analytical reagent (AR) grade, ACS reagent grade, and reagent grade are synonymous terms for reagents that conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.
Reference Material	TNI- Material or substance one or more of whose property values are sufficiently homogenized and well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. DoD- A material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials.
Reference Standard	TNI- Standard used for the calibration of working measurement standards in a given organization or at a given location. DoD- A standard, generally of the highest metrological quality available at a given location, from which measurements made at that location are derived.
Reference Toxicant	DoD- The toxicant used in performing toxicity tests to indicate the sensitivity of a test organism and to demonstrate the laboratory's ability to perform the test correctly and obtain consistent results.
Relative Percent Difference (RPD)	A measure of precision defined as the difference between two measurements divided by the average concentration of the two measurements.
Replicate Sample	The analytical measurement of a sample that has been split after it has been processed through the preparation stage. A replicate can also originate from a single sample that has been sub-sampled two or more times during the same analytical process time.
Reporting Limit (RL)	The level at which method, permit, regulatory and customer-specific objectives are met. The reporting limit may never be lower than the Limit of Detection (i.e. statistically determined MDL). Reporting limits are corrected for sample amounts, including the dry weight of solids, unless otherwise specified. There must be a sufficient buffer between the Reporting Limit and the MDL. DoD- A customer-specified lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

Reporting Limit Verification Standard (or otherwise named)	A standard analyzed at the reporting limit for an analysis to verify the laboratory's ability to report to that level.
Representativeness	A quality element related to the ability to collect a sample reflecting the characteristics of the part of the environment to be assessed. Sample representativeness is dependent on the sampling techniques specified in the project work plan.
Requirement	DoD- Denotes a mandatory specification; often designated by the term "shall".
Response Factor (RF)	A measure of the relative response area of an analyte compared to its internal standard. The response factor is determined by the equation below, and if the calculated value meets the method guidelines it can be used to determine concentration for organic analyses.
Retention Time	DoD- The time between sample injection and the appearance of a solute peak at the detector.
Sample	DoD- Portion of material collected for analysis, identified by a single, unique alphanumeric code. A sample may consist of portions in multiple containers, if a single sample is submitted for multiple or repetitive analysis.
Sample Blank (or Turbidity Blank)	The purpose of a sample blank is to account for spectrophotometric interferences such as sample color, cloudiness, viscosity, etc. The sample blank must be analyzed at the same dilution as the sample. The sample blank is analyzed without any addition of reagents.
Sample Delivery Group (SDG)	A unit within a single project that is used to identify a group of samples for delivery. An SDG is a group of 20 or fewer field samples within a project, received over a period of up to 14 calendar days. Data from all samples in an SDG are reported concurrently.
Sample Detection Limit (SDL)	TX TRRP – The Method Detection Limit (MDL) adjusted to reflect sample-specific actions, such as dilution or use of smaller aliquot sizes than prescribed in the analytical method, and takes into account sample characteristics, sample preparation, and analytical adjustments. The term is analogous to the sample-specific detection limit.
Sample Tracking	Procedures employed to record the possession of the samples from the time of sampling until analysis, reporting and archiving. These procedures include the use of a Chain of custody Form that documents the collection, transport, and receipt of compliance samples to the laboratory. In addition, access to the laboratory is limited and controlled to protect the integrity of the samples.
Sampling	TNI- Activity related to obtaining a representative sample of the object of conformity assessment, according to a procedure.
Secondary Source Calibration Verification (SSCV)	A mid-point or low standard made from the secondary source (lot or manufacturer) that is not used to construct the calibration curve. The SSCV is used to represent the calibration accuracy of the instrument and must perform within method stated guidelines. This sample is used to document calibration accuracy. The SSCV can be the same solution as the LCS, but is analyzed as an instrument standard, rather than a method prepared standard.
Selective Ion Monitoring (SIM)	A mode of analysis in mass spectrometry where the detector is set to scan over a very small mass range, typically one mass unit. The narrower the range, the more sensitive the detector.

Selectivity	TNI- The ability to analyze, distinguish, and determine a specific analyte or parameter from another component that may be a potential interferent or that may behave similarly to the target analyte or parameter within the measurement system. DoD- The capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances.
Sensitivity	TNI and DoD- The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest.
Serial Dilution	The stepwise dilution of a substance in a solution.
Shall	Denotes a requirement that is mandatory whenever the criterion for conformance with the specification requires that there be no deviation. This does not prohibit the use of alternative approaches or methods for implementing the specification as long as the requirement is fulfilled.
Should	Denotes a guideline or recommendation whenever noncompliance with the specification is permissible.
Signal-to-Noise Ratio	DoD- The signal carries information about the analyte, while noise is made up of extraneous information that is unwanted because it degrades the accuracy and precision of an analysis and also places a lower limit on the amount of analyte that can be detected. In most measurements, the average strength of the noise is constant and independent of the magnitude of the signal. Thus, the effect of noise on the relative error of a measurement becomes greater and greater as the quantity being measured (producing the signal) decreases in magnitude.
Spike	DoD- A known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.
Standard (Document)	TNI and DoD- The document describing the elements of a laboratory accreditation that has been developed and established within the consensus principles of standard setting and meets the approval requirements of standard adoption organizations procedures and policies.
Standard (Chemical)	DoD- Standard samples are comprised of a known amount of standard reference material in the matrix undergoing analysis. A standard reference material is a certified reference material produced by US NIST and characterized for absolute content, independent of analytical test method.
Standard Blank (or Reagent Blank)	A calibration standard consisting of the same solvent/reagent matrix used to prepare the calibration standards without the analytes. It is used to construct the calibration curve by establishing instrument background.
Standard Method	DoD- A test method issued by an organization generally recognized as competent to do so.
Standard Operating Procedure (SOP)	TNI- A written document that details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps. SOPs are officially approved as the methods for performing certain routine or repetitive tasks. DoD- A written document which details the method of an operation, analysis or action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks.
Standard Reference Material (SRM)	DoD- A certified reference material produced by the US NIST or other equivalent organization and characterized for absolute content, independent of analytical method.
Statement of Qualifications (SOQ)	A document that lists information about a company, typically the qualifications of that company to compete on a bid for services.

Stock Standard	A concentrated reference solution containing one or more analytes prepared in the laboratory using an assayed reference compound or purchased from a reputable commercial source.
Supervisor	DoD- The individual(s) designated as being responsible for a particular area or category of scientific analysis. This responsibility includes direct day-to-day supervision of technical employees, supply and instrument adequacy and upkeep, quality assurance/quality control duties and ascertaining that technical employees have the required balance of education, training and experience to perform the required analyses.
Surrogate	DoD- A substance with properties that mimic the analyte of interest. It is unlikely to be found in environmental samples and is added to them for quality control purposes.
SUMMA Canister	A SUMMA canister is a stainless steel electropolished (or "SUMMA" polished) that enriches the nickel and chromium surface and makes it more inert than untreated stainless steel. These canisters are used to collect air or vapor samples.
Systems Audit	An on-site inspection or assessment of a laboratory’s quality system.
Target Analytes	DoD- Analytes specifically named by a customer (also called project-specific analytes).
Technical Director	DoD- Individual(s) who has overall responsibility for the technical operation of the environmental testing laboratory.
Technology	TNI- A specific arrangement of analytical instruments, detection systems, and/or preparation techniques.
Tedlar Bags	Bags made from polyvinyl fluoride (PVF) film that are used to collect air or vapor samples.
Tentatively Identified Compound (TIC)	Compounds detected in samples that are not target compounds, internal standards, system monitoring compounds, or surrogates. TICs can be tentatively identified using mass spectrometers in spectral comparisons with NBS library searches. Quantitation of TICs provides a rough approximation of the concentration of these non-target analytes.
Test	DoD- A technical operation that consists of the determination of one or more characteristics or performance of a given product, material, equipment, organism, physical phenomenon, process or service according to a specified procedure. The result of a test is normally recorded in a document sometimes called a test report or a test certificate.
Test Method	DoD- An adoption of a scientific technique for performing a specific measurement as documented in a laboratory SOP or as published by a recognized authority.
Test Methods for Evaluating Solid Waste, Physical/ Chemical (SW-846)	EPA Waste’s official compendium of analytical and sampling methods that have been evaluated and approved for use in complying with RCRA regulations.
Total Petroleum Hydrocarbons (TPH)	A term used to denote a large family of several hundred chemical compounds that originate from crude oil. Compounds may include gasoline components, jet fuel, volatile organics, etc.
Toxicity Characteristic Leaching Procedure (TCLP)	A solid sample extraction method for chemical analysis employed as an analytical method to simulate leaching of compounds through a landfill.

Traceability	TNI- The ability to trace the history, application, or location of an entity by means of recorded identifications. In a calibration sense, traceability relates measuring equipment to national or international standards, primary standards, basic physical conditions or properties, or reference materials. In a data collection sense, it relates calculations and data generated throughout the project back to the requirements for the quality of the project. DoD- The property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons.
Training Document	A training resource that provides detailed instructions to execute a specific method or job function.
Trip Blank	This blank sample is used to detect sample contamination from the container and preservative during transport and storage of the sample. A cleaned sample container is filled with laboratory reagent water and the blank is stored, shipped, and analyzed with its associated samples.
Tuning	DoD- A check and/or adjustment of instrument performance for mass spectrometry as required by the method.
Ultraviolet Spectrophotometer (UV)	Instrument routinely used in quantitative determination of solutions of transition metal ions and highly conjugated organic compounds.
Unadjusted Method Quantitation Limit (Unadj. MQL)	TX TRRP – The Method Quantitation Limit (MQL) that has not been adjusted based on sample specific actions such as dilution.
Uncertainty Measurement	The parameter associated with the result of a measurement that characterized the dispersion of the values that could be reasonably attributed to the measurand (i.e. the concentration of an analyte).
Validation	DoD- The confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled.
Verification	TNI and DoD- Confirmation by examination and objective evidence that specified requirements have been met. Note: In connection with the management of measuring equipment, verification provides a means for checking that the deviations between values indicated by a measuring instrument and corresponding known values of a measured quantity are consistently smaller than the maximum allowable error defined in a standard, regulation or specification peculiar to the management of the measuring equipment. The result of verification leads to a decision either to restore in service, to perform adjustment, to repair, to downgrade, or to declare obsolete. In all cases, it is required that a written trace of the verification performed shall be kept on the measuring instrument's individual record.
Whole Effluent Toxicity (WET)	The aggregate toxic effect to aquatic organisms from all pollutants contained in a facility's wastewater (effluent).

Table 3.3b
Analytical Capabilities

AE=Air Emissions, DW=Drinking Water, NPW=Non-potable Water, SCM=Solid Chemical Materials

The information listed is subject to change.
Always check with the laboratory for the most updated information.

Matrix	Method	Parameter
AE	EPA TO-15	Ethanol
AE	EPA TO-15	Gasoline range organic
AE	EPA TO-15	Naphthalene
AE	EPA TO-15	Allyl chloride
AE	EPA TO-15	Chlorotoluene (2-)
AE	EPA TO-15	Isopropylbenzene
AE	EPA TO-15	Methyl methacrylate
AE	EPA TO-15	Tetrahydrofuran
AE	EPA TO-15	Vinyl bromide
AE	EPA TO-15	Dibromoethane (1,2-) (EDB)
AE	EPA TO-15	Dichloroethene (1,1-)
AE	EPA TO-15	Hexachlorobutadiene (1,3-)
AE	EPA TO-15	Hexanone (2-)
AE	EPA TO-15	Acetone
AE	EPA TO-15	Chloromethane
AE	EPA TO-15	Dibromochloromethane
AE	EPA TO-15	Dichlorodifluoromethane
AE	EPA TO-15	Dichloroethene (cis-1,2-)
AE	EPA TO-15	Dichloroethene (trans-1,2-)
AE	EPA TO-15	Dichloropropene (trans-1,3-)
AE	EPA TO-15	Dichlorotetrafluoroethane (1,2-)
AE	EPA TO-15	Ethylbenzene
AE	EPA TO-15	Ethyltoluene (4-)
AE	EPA TO-15	Isopropanol
AE	EPA TO-15	Trichlorofluoromethane
AE	EPA TO-15	Trimethylpentane (2,2,4-)
AE	EPA TO-15	Vinyl chloride
AE	EPA TO-15	Benzene
AE	EPA TO-15	Benzyl chloride
AE	EPA TO-15	Bromodichloromethane
AE	EPA TO-15	Bromoform
AE	EPA TO-15	Bromomethane

Matrix	Method	Parameter
AE	EPA TO-15	Butadiene (1,3-)
AE	EPA TO-15	Carbon disulfide
AE	EPA TO-15	Carbon tetrachloride
AE	EPA TO-15	Chlorobenzene
AE	EPA TO-15	Chloroethane
AE	EPA TO-15	Chloroform
AE	EPA TO-15	Cyclohexane
AE	EPA TO-15	Dichlorobenzene (1,2-)
AE	EPA TO-15	Dichlorobenzene (1,3-)
AE	EPA TO-15	Dichlorobenzene (1,4-)
AE	EPA TO-15	Dichloroethane (1,1-)
AE	EPA TO-15	Dichloroethane (1,2-)
AE	EPA TO-15	Dichloropropane (1,2-)
AE	EPA TO-15	Dichloropropene (cis-1,3-)
AE	EPA TO-15	Dioxane (1,4-)
AE	EPA TO-15	Heptane (n-)
AE	EPA TO-15	Hexane (n-)
AE	EPA TO-15	Methyl ethyl ketone
AE	EPA TO-15	Methyl isobutyl ketone (MIBK)
AE	EPA TO-15	Methyl tert-butyl ether
AE	EPA TO-15	Methylene chloride (Dichloromethane)
AE	EPA TO-15	Styrene
AE	EPA TO-15	Trichlorobenzene (1,2,4-)
AE	EPA TO-15	Trimethylbenzene (1,3,5-)
AE	EPA TO-15	Trimethylbenzene (1,2,4-)
AE	EPA TO-15	Tetrachloroethane (1,1,2,2-)
AE	EPA TO-15	Tetrachloroethene
AE	EPA TO-15	Toluene
AE	EPA TO-15	Trichloroethane (1,1,1-)
AE	EPA TO-15	Trichloroethane (1,1,2-)
AE	EPA TO-15	Trichloroethene
AE	EPA TO-15	Trichloro (1,1,2-) trifluoroethane (1,2,2-)
AE	EPA TO-15	Vinyl acetate
AE	EPA TO-15	Xylene (m-)
AE	EPA TO-15	Xylene (o-)
AE	EPA TO-15	Xylene (p-)
AE	EPA TO-15	Xylenes (total)
AE/NPW	8015M/ RSK-175	Ethane
AE/NPW	8015M/ RSK-175	Ethene
AE/NPW	8015M/ RSK-175	Methane

Matrix	Method	Parameter
AE/NPW	8015M/ RSK-175	Propane
AE/NPW	8015M/ RSK-175	Acetylene
DW	EPA 150.1	pH
DW	EPA 1622	Cryptosporidium
DW	EPA 1623	Cryptosporidium
DW	EPA 1623	Giardia
DW	EPA 180.1	Turbidity
DW	EPA 200.7	Aluminum
DW	EPA 200.7	Antimony
DW	EPA 200.7	Arsenic
DW	EPA 200.7	Barium
DW	EPA 200.7	Beryllium
DW	EPA 200.7	Boron
DW	EPA 200.7	Cadmium
DW	EPA 200.7	Calcium
DW	EPA 200.7	Calcium-hardness
DW	EPA 200.7	Total hardness
DW	EPA 200.7	Chromium
DW	EPA 200.7	Cobalt
DW	EPA 200.7	Copper
DW	EPA 200.7	Iron
DW	EPA 200.7	Lead
DW	EPA 200.7	Magnesium
DW	EPA 200.7	Manganese
DW	EPA 200.7	Molybdenum
DW	EPA 200.7	Nickel
DW	EPA 200.7	Potassium
DW	EPA 200.7	Selenium
DW	EPA 200.7	Silica
DW	EPA 200.7	Silver
DW	EPA 200.7	Sulfur
DW	EPA 200.7	Sodium
DW	EPA 200.7	Strontium
DW	EPA 200.7	Thallium
DW	EPA 200.7	Tin
DW	EPA 200.7	Titanium
DW	EPA 200.7	Vanadium
DW	EPA 200.7	Zinc
DW	EPA 200.8	Aluminum
DW	EPA 200.8	Antimony

Matrix	Method	Parameter
DW	EPA 200.8	Arsenic
DW	EPA 200.8	Barium
DW	EPA 200.8	Beryllium
DW	EPA 200.8	Boron
DW	EPA 200.8	Cadmium
DW	EPA 200.8	Calcium
DW	EPA 200.8	Chromium
DW	EPA 200.8	Cobalt
DW	EPA 200.8	Copper
DW	EPA 200.8	Iron
DW	EPA 200.8	Lead
DW	EPA 200.8	Magnesium
DW	EPA 200.8	Manganese
DW	EPA 200.8	Molybdenum
DW	EPA 200.8	Nickel
DW	EPA 200.8	Potassium
DW	EPA 200.8	Selenium
DW	EPA 200.8	Silver
DW	EPA 200.8	Sodium
DW	EPA 200.8	Strontium
DW	EPA 200.8	Thallium
DW	EPA 200.8	Thorium
DW	EPA 200.8	Tin
DW	EPA 200.8	Titanium
DW	EPA 200.8	Uranium
DW	EPA 200.8	Vanadium
DW	EPA 200.8	Zinc
DW	EPA 218.6	Chromium (VI)
DW	EPA 218.7	Chromium (VI)
DW	EPA 245.1	Mercury
DW	EPA 300.0	Nitrite
DW	EPA 300.0	Nitrate
DW	EPA 300.0	Fluoride
DW	EPA 300.0	Sulfate
DW	EPA 300.0	Bromide
DW	EPA 300.0	Chloride
DW	EPA 314.0	Perchlorate
DW	EPA 335.4	Cyanide
DW	EPA 350.1	Ammonia
DW	EPA 353.2	Nitrate

Matrix	Method	Parameter
DW	EPA 353.2	Nitrite
DW	EPA 504.1	Dibromoethane (1,2-) (EDB)
DW	EPA 504.1	Dibromo-3-chloropropane (1,2-)
DW	EPA 507	Alachlor
DW	EPA 507	Butachlor
DW	EPA 507	Metolachlor
DW	EPA 507	Metribuzin
DW	EPA 507	Atrazine
DW	EPA 507	Simazine
DW	EPA 524.2	Tetrahydrofuran
DW	EPA 524.2	Dichloro-2-butene (trans-1,4-)
DW	EPA 524.2	Hexachloroethane
DW	EPA 524.2	Acetone
DW	EPA 524.2	Butanone (2-)
DW	EPA 524.2	Carbon disulfide
DW	EPA 524.2	Hexanone (2-)
DW	EPA 524.2	Pentanone (4-methyl-2-) (MIBK)
DW	EPA 524.2	Trichlorobenzene (1,3,5-)
DW	EPA 524.2	Bromochloromethane
DW	EPA 524.2	Bromoform
DW	EPA 524.2	Chloroform
DW	EPA 524.2	Dibromochloromethane
DW	EPA 524.2	Bromodichloromethane
DW	EPA 524.2	Benzene
DW	EPA 524.2	Carbon tetrachloride
DW	EPA 524.2	Chlorobenzene
DW	EPA 524.2	Dichlorobenzene (1,2-)
DW	EPA 524.2	Dichlorobenzene (1,3-)
DW	EPA 524.2	Dichlorobenzene (1,4-)
DW	EPA 524.2	Dichloroethane (1,1-)
DW	EPA 524.2	Dichloroethane (1,2-)
DW	EPA 524.2	Dichloroethene (cis-1,2-)
DW	EPA 524.2	Dichloroethene (trans-1,2-)
DW	EPA 524.2	Methylene chloride (Dichloromethane)
DW	EPA 524.2	Dichloropropane (1,2-)
DW	EPA 524.2	Ethylbenzene
DW	EPA 524.2	Methyl tert-butyl ether
DW	EPA 524.2	Naphthalene
DW	EPA 524.2	Styrene
DW	EPA 524.2	Tetrachloroethane (1,1,2,2-)

Matrix	Method	Parameter
DW	EPA 524.2	Tetrachloroethene
DW	EPA 524.2	Trichloroethane (1,1,1-)
DW	EPA 524.2	Trichloroethene
DW	EPA 524.2	Toluene
DW	EPA 524.2	Trichlorobenzene (1,2,4-)
DW	EPA 524.2	Dichloroethene (1,1-)
DW	EPA 524.2	Trichloroethane (1,1,2-)
DW	EPA 524.2	Vinyl chloride
DW	EPA 524.2	Xylenes (total)
DW	EPA 524.2	Bromobenzene
DW	EPA 524.2	Bromomethane
DW	EPA 524.2	Butyl benzene (n-)
DW	EPA 524.2	Sec-butylbenzene
DW	EPA 524.2	Tert-butylbenzene
DW	EPA 524.2	Chloroethane
DW	EPA 524.2	Chloromethane
DW	EPA 524.2	Chlorotoluene (2-)
DW	EPA 524.2	Chlorotoluene (4-)
DW	EPA 524.2	Dibromo-3-chloropropane (1,2-)
DW	EPA 524.2	Dibromoethane (1,2-) (EDB)
DW	EPA 524.2	Dibromomethane
DW	EPA 524.2	Dichlorodifluoromethane
DW	EPA 524.2	Dichloropropane (1,3-)
DW	EPA 524.2	Dichloropropane (2,2-)
DW	EPA 524.2	Dichloropropene (1,1-)
DW	EPA 524.2	Dichloropropene (cis-1,3-)
DW	EPA 524.2	Dichloropropene (trans-1,3-)
DW	EPA 524.2	Hexachlorobutadiene (1,3-)
DW	EPA 524.2	Isopropylbenzene
DW	EPA 524.2	Isopropyltoluene (4-)
DW	EPA 524.2	Propylbenzene (n-)
DW	EPA 524.2	Tetrachloroethane (1,1,1,2-)
DW	EPA 524.2	Trichlorobenzene (1,2,3-)
DW	EPA 524.2	Trichlorofluoromethane
DW	EPA 524.2	Trichloropropane (1,2,3-)
DW	EPA 524.2	Trimethylbenzene (1,2,4-)
DW	EPA 524.2	Trimethylbenzene (1,3,5-)
DW	EPA 552.2	Bromochloroacetic acid
DW	EPA 552.2	Dibromoacetic acid
DW	EPA 552.2	Dichloroacetic acid

Matrix	Method	Parameter
DW	EPA 552.2	Monobromoacetic acid (MBAA)
DW	EPA 552.2	Monochloroacetic acid (MCAA)
DW	EPA 552.2	Trichloroacetic acid
DW	SM 2120 B	Color
DW	SM 2130 B	Turbidity
DW	SM 2150 B	Odor
DW	SM 2320 B	Alkalinity
DW	SM 2340 B	Total hardness
DW	SM 2340 C	Total hardness
DW	SM 2510 B	Conductivity
DW	SM 2540 C	Total dissolved solids (TDS)
DW	SM 3120 B	Total hardness
DW	SM 4110 B	Bromide
DW	SM 4110 B	Nitrite
DW	SM 4110 B	Nitrate
DW	SM 4110 B	Fluoride
DW	SM 4110 B	Sulfate
DW	SM 4110 B	Chloride
DW	SM 4500-Cl G	Chlorine - residual
DW	SM 4500-CN C,E	Cyanide
DW	SM 4500-CN C,G	Cyanide
DW	SM 4500-H B	pH
DW	SM 4500-NH3 G	Ammonia
DW	SM 4500-NO3 F	Nitrate
DW	SM 4500-NO3 F	Nitrite
DW	SM 4500-P E	Orthophosphate
DW	SM 5310 B	Total organic carbon (TOC)
DW	SM 5310 C	Dissolved organic carbon (DOC)
DW	SM 5310 C	Total organic carbon (TOC)
DW	SM 5320 B	Total organic halides (TOX)
DW	SM 5540 C	Foaming agents
DW	SM 5910 B	UV-absorbing compounds
DW	SM 9215B (Pour Plate)	Heterotropic Bacteria
DW	SM 9223 B (Colilert)	Total coliform / E. coli
DW	User Defined 524.2	Diisopropyl Ether [DIPE]
NPW	ASTM D6503	Enterococci
NPW	ASTM F1647-02A	Total organic carbon (TOC)
NPW	EPA 1000.0	Toxicity - chronic, FW organism
NPW	EPA 1002.0	Toxicity - chronic, FW organism

Matrix	Method	Parameter
NPW	EPA 120.1	Specific conductance
NPW	EPA 130.1	Hardness - total as CaCO3
NPW	EPA 160.4	Residue - volatile
NPW	EPA 1657	Phorate
NPW	EPA 1657	Bolstar
NPW	EPA 1657	Chlorpyrifos
NPW	EPA 1657	Coumaphos
NPW	EPA 1657	Dichlorvos
NPW	EPA 1657	Dimethoate
NPW	EPA 1657	EPN
NPW	EPA 1657	Fensulfothion
NPW	EPA 1657	Fenthion
NPW	EPA 1657	Naled
NPW	EPA 1657	Parathion ethyl
NPW	EPA 1657	Parathion methyl
NPW	EPA 1657	Ronnel
NPW	EPA 1657	Stirofos
NPW	EPA 1657	Sulfotepp
NPW	EPA 1657	TEPP
NPW	EPA 1657	Tokuthion [Protothiofos]
NPW	EPA 1657	Trichloronate
NPW	EPA 1658	D (2,4-)
NPW	EPA 1658	Dalapon
NPW	EPA 1658	Dichlorprop
NPW	EPA 1664A & B	Oil & grease - hem-SPE
NPW	EPA 1664A & B	Oil & grease - non polar
NPW	EPA 1664A & B	Oil & grease - hem-LL
NPW	EPA 1664A & B	Oil & grease - sgt-non polar-SPE
NPW	EPA 180.1	Turbidity
NPW	EPA 200.7	Aluminum
NPW	EPA 200.7	Antimony
NPW	EPA 200.7	Arsenic
NPW	EPA 200.7	Barium
NPW	EPA 200.7	Beryllium
NPW	EPA 200.7	Boron
NPW	EPA 200.7	Cadmium
NPW	EPA 200.7	Calcium
NPW	EPA 200.7	Calcium-hardness
NPW	EPA 200.7	Total hardness
NPW	EPA 200.7	Chromium

Matrix	Method	Parameter
NPW	EPA 200.7	Cobalt
NPW	EPA 200.7	Copper
NPW	EPA 200.7	Iron
NPW	EPA 200.7	Lead
NPW	EPA 200.7	Lithium
NPW	EPA 200.7	Magnesium
NPW	EPA 200.7	Manganese
NPW	EPA 200.7	Molybdenum
NPW	EPA 200.7	Nickel
NPW	EPA 200.7	Potassium
NPW	EPA 200.7	Selenium
NPW	EPA 200.7	Silica
NPW	EPA 200.7	Silver
NPW	EPA 200.7	Sulfur
NPW	EPA 200.7	Sodium
NPW	EPA 200.7	Strontium
NPW	EPA 200.7	Thallium
NPW	EPA 200.7	Tin
NPW	EPA 200.7	Titanium
NPW	EPA 200.7	Vanadium
NPW	EPA 200.7	Zinc
NPW	EPA 200.8	Aluminum
NPW	EPA 200.8	Antimony
NPW	EPA 200.8	Arsenic
NPW	EPA 200.8	Barium
NPW	EPA 200.8	Beryllium
NPW	EPA 200.8	Boron
NPW	EPA 200.8	Cadmium
NPW	EPA 200.8	Calcium
NPW	EPA 200.8	Chromium
NPW	EPA 200.8	Cobalt
NPW	EPA 200.8	Copper
NPW	EPA 200.8	Iron
NPW	EPA 200.8	Lead
NPW	EPA 200.8	Magnesium
NPW	EPA 200.8	Manganese
NPW	EPA 200.8	Molybdenum
NPW	EPA 200.8	Nickel
NPW	EPA 200.8	Potassium
NPW	EPA 200.8	Selenium

Matrix	Method	Parameter
NPW	EPA 200.8	Silver
NPW	EPA 200.8	Sodium
NPW	EPA 200.8	Strontium
NPW	EPA 200.8	Thallium
NPW	EPA 200.8	Thorium
NPW	EPA 200.8	Tin
NPW	EPA 200.8	Titanium
NPW	EPA 200.8	Uranium
NPW	EPA 200.8	Vanadium
NPW	EPA 200.8	Zinc
NPW	EPA 2000.0	Toxicity - acute, FW organism
NPW	EPA 2002.0	Toxicity - acute, FW organism
NPW	EPA 218.6	Chromium (VI)
NPW	EPA 245.1	Mercury
NPW	EPA 300.0	Guanidine nitrate
NPW	EPA 300.0	Bromide
NPW	EPA 300.0	Chloride
NPW	EPA 300.0	Fluoride
NPW	EPA 300.0	Nitrate
NPW	EPA 300.0	Nitrite
NPW	EPA 300.0	Sulfate
NPW	EPA 300.0	Nitrate - nitrite
NPW	EPA 310.2	Alkalinity as CaCO3
NPW	EPA 314.0	Perchlorate
NPW	EPA 335.4	Cyanide
NPW	EPA 350.1	Ammonia
NPW	EPA 351.1, .2 - 350.1	Organic nitrogen
NPW	EPA 351.2	Kjeldahl nitrogen - total
NPW	EPA 353.2	Nitrate - nitrite
NPW	EPA 365.1	Total Phosphorus
NPW	EPA 365.4	Total Phosphorus
NPW	EPA 410.4	Chemical oxygen demand
NPW	EPA 420.4	Phenols
NPW	EPA 507	Alachlor
NPW	EPA 507	Metribuzin
NPW	EPA 507	Ethoprop
NPW	EPA 507	Merphos
NPW	EPA 507	Mevinphos
NPW	EPA 602	Benzene
NPW	EPA 602	Ethylbenzene

Matrix	Method	Parameter
NPW	EPA 602	Methyl tert-butyl ether
NPW	EPA 602	Tert-butyl alcohol
NPW	EPA 602	Toluene
NPW	EPA 602	Xylenes (total)
NPW	EPA 608	Chloroneb
NPW	EPA 608	Chlorothalonil
NPW	EPA 608	Chlordane (alpha)
NPW	EPA 608	Chlordane (gamma)
NPW	EPA 608	Hexachlorobenzene
NPW	EPA 608	PCB 1016
NPW	EPA 608	PCB 1221
NPW	EPA 608	PCB 1232
NPW	EPA 608	PCB 1242
NPW	EPA 608	PCB 1248
NPW	EPA 608	PCB 1254
NPW	EPA 608	PCB 1260
NPW	EPA 608	Aldrin
NPW	EPA 608	Alpha BHC
NPW	EPA 608	Beta BHC
NPW	EPA 608	Delta BHC
NPW	EPA 608	Lindane (gamma BHC)
NPW	EPA 608	Chlordane
NPW	EPA 608	DDD (4,4'-)
NPW	EPA 608	DDE (4,4'-)
NPW	EPA 608	DDT (4,4'-)
NPW	EPA 608	Dieldrin
NPW	EPA 608	Endosulfan I
NPW	EPA 608	Endosulfan II
NPW	EPA 608	Endosulfan sulfate
NPW	EPA 608	Endrin
NPW	EPA 608	Endrin aldehyde
NPW	EPA 608	Endrin ketone
NPW	EPA 608	Heptachlor
NPW	EPA 608	Heptachlor epoxide
NPW	EPA 608	Methoxychlor
NPW	EPA 608	Toxaphene
NPW	EPA 610	Acenaphthene
NPW	EPA 610	Acenaphthylene
NPW	EPA 610	Anthracene
NPW	EPA 610	Benzo(a)anthracene

Matrix	Method	Parameter
NPW	EPA 610	Benzo(a)pyrene
NPW	EPA 610	Benzo(b)fluoranthene
NPW	EPA 610	Benzo(ghi)perylene
NPW	EPA 610	Benzo(k)fluoranthene
NPW	EPA 610	Chrysene
NPW	EPA 610	Dibenzo(a,h)anthracene
NPW	EPA 610	Fluoranthene
NPW	EPA 610	Fluorene
NPW	EPA 610	Indeno(1,2,3-cd)pyrene
NPW	EPA 610	Naphthalene
NPW	EPA 610	Phenanthrene
NPW	EPA 610	Pyrene
NPW	EPA 615	Dicamba
NPW	EPA 615	DB (2,4-)
NPW	EPA 615	Dinoseb
NPW	EPA 615	Dalapon
NPW	EPA 615	Dichlorprop
NPW	EPA 615	D (2,4-)
NPW	EPA 615	T (2,4,5-)
NPW	EPA 615	TP (2,4,5-) (Silvex)
NPW	EPA 615	MCPA
NPW	EPA 615	MCPP
NPW	EPA 622	Coumaphos
NPW	EPA 622	Demeton (o-)
NPW	EPA 622	Demeton (s-)
NPW	EPA 622	Dimethoate
NPW	EPA 622	Parathion ethyl
NPW	EPA 622	Parathion methyl
NPW	EPA 622	Stirofos
NPW	EPA 622	Sulfotepp
NPW	EPA 622	TEPP
NPW	EPA 622	Tokuthion [Protothiofos]
NPW	EPA 622	Trichloronate
NPW	EPA 624	Amyl alcohol (n-)
NPW	EPA 624	Propionitrile
NPW	EPA 624	Trimethylbenzene (1,2,3-)
NPW	EPA 624	Allyl chloride
NPW	EPA 624	Bromoethane
NPW	EPA 624	Butanone (2-)
NPW	EPA 624	Butadiene (2-chloro-1,3-)

Matrix	Method	Parameter
NPW	EPA 624	Carbon disulfide
NPW	EPA 624	Cyclohexanone
NPW	EPA 624	Dichloro-2-butene (cis-1,4-)
NPW	EPA 624	Dichloro-2-butene (trans-1,4-)
NPW	EPA 624	Diethyl ether (Ethyl ether)
NPW	EPA 624	Trichloro (1,1,2-) trifluoroethane (1,2,2-)
NPW	EPA 624	Vinyl acetate
NPW	EPA 624	Acetonitrile
NPW	EPA 624	Cyclohexane
NPW	EPA 624	Hexanone (2-)
NPW	EPA 624	Methylcyclohexane
NPW	EPA 624	Methyl iodide
NPW	EPA 624	Ethyl-tert-butyl Ether [ETBE]
NPW	EPA 624	Diisopropyl Ether [DIPE]
NPW	EPA 624	Dioxane (1,4-)
NPW	EPA 624	Butanol (1-)
NPW	EPA 624	Ethanol
NPW	EPA 624	Ethyl methacrylate
NPW	EPA 624	Iso-butyl alcohol
NPW	EPA 624	Methacrylonitrile
NPW	EPA 624	Methyl methacrylate
NPW	EPA 624	Octane (-n)
NPW	EPA 624	Pentachloroethane
NPW	EPA 624	tert-Amylmethyl ether [TAME]
NPW	EPA 624	Acrolein
NPW	EPA 624	Acrylonitrile
NPW	EPA 624	Bromobenzene
NPW	EPA 624	Bromochloromethane
NPW	EPA 624	Butyl benzene (n-)
NPW	EPA 624	Chlorotoluene (2-)
NPW	EPA 624	Chlorotoluene (4-)
NPW	EPA 624	Dibromo-3-chloropropane (1,2-)
NPW	EPA 624	Dibromoethane (1,2-) (EDB)
NPW	EPA 624	Dibromomethane
NPW	EPA 624	Dichlorodifluoromethane
NPW	EPA 624	Dichloroethene (cis-1,2-)
NPW	EPA 624	Dichloropropane (1,3-)
NPW	EPA 624	Dichloropropane (2,2-)
NPW	EPA 624	Dichloropropene (1,1-)
NPW	EPA 624	Hexane (n-)

Matrix	Method	Parameter
NPW	EPA 624	Methyl isobutyl ketone (MIBK)
NPW	EPA 624	Tetrahydrofuran
NPW	EPA 624	Styrene
NPW	EPA 624	Tetrachloroethane (1,1,1,2-)
NPW	EPA 624	Xylene (m-)
NPW	EPA 624	Xylene (o-)
NPW	EPA 624	Xylene (p-)
NPW	EPA 624	Hexachlorobutadiene (1,3-)
NPW	EPA 624	Isopropylbenzene
NPW	EPA 624	Isopropyltoluene (4-)
NPW	EPA 624	Naphthalene
NPW	EPA 624	Propylbenzene (n-)
NPW	EPA 624	Sec-butylbenzene
NPW	EPA 624	Tert-butylbenzene
NPW	EPA 624	Trichlorobenzene (1,2,3-)
NPW	EPA 624	Trichlorobenzene (1,2,4-)
NPW	EPA 624	Trichloropropane (1,2,3-)
NPW	EPA 624	Trimethylbenzene (1,2,4-)
NPW	EPA 624	Trimethylbenzene (1,3,5-)
NPW	EPA 624	Acetone
NPW	EPA 624	Ethyl acetate
NPW	EPA 624	Methyl tert-butyl ether
NPW	EPA 624	Tert-butyl alcohol
NPW	EPA 624	Xylenes (total)
NPW	EPA 624	Benzene
NPW	EPA 624	Bromodichloromethane
NPW	EPA 624	Bromoform
NPW	EPA 624	Bromomethane
NPW	EPA 624	Carbon tetrachloride
NPW	EPA 624	Chlorobenzene
NPW	EPA 624	Chloroethane
NPW	EPA 624	Chloroethyl vinyl ether (2-)
NPW	EPA 624	Chloroform
NPW	EPA 624	Chloromethane
NPW	EPA 624	Dibromochloromethane
NPW	EPA 624	Dichlorobenzene (1,2-)
NPW	EPA 624	Dichlorobenzene (1,3-)
NPW	EPA 624	Dichlorobenzene (1,4-)
NPW	EPA 624	Dichloroethane (1,1-)
NPW	EPA 624	Dichloroethane (1,2-)

Matrix	Method	Parameter
NPW	EPA 624	Dichloroethene (1,1-)
NPW	EPA 624	Dichloroethene (trans-1,2-)
NPW	EPA 624	Dichloropropane (1,2-)
NPW	EPA 624	Dichloropropene (cis-1,3-)
NPW	EPA 624	Dichloropropene (trans-1,3-)
NPW	EPA 624	Ethylbenzene
NPW	EPA 624	Methylene chloride (Dichloromethane)
NPW	EPA 624	Tetrachloroethane (1,1,2,2-)
NPW	EPA 624	Tetrachloroethene
NPW	EPA 624	Toluene
NPW	EPA 624	Trichloroethane (1,1,1-)
NPW	EPA 624	Trichloroethane (1,1,2-)
NPW	EPA 624	Trichloroethene
NPW	EPA 624	Trichlorofluoromethane
NPW	EPA 624	Vinyl chloride
NPW	EPA 625	Tetrachlorophenol (2,3,4,6-)
NPW	EPA 625	Hexachlorophene
NPW	EPA 625	Decane (n-)
NPW	EPA 625	Octadecane (n-)
NPW	EPA 625	Chloronaphthalene (1-)
NPW	EPA 625	Famphur
NPW	EPA 625	Hexachloropropene
NPW	EPA 625	Kepone
NPW	EPA 625	Napththylamine (1-)
NPW	EPA 625	Napththylamine (2-)
NPW	EPA 625	Pentachloroethane
NPW	EPA 625	Methylnaphthalene (2-)
NPW	EPA 625	Chloroaniline (4-)
NPW	EPA 625	Nitroaniline (2-)
NPW	EPA 625	Nitroaniline (3-)
NPW	EPA 625	Nitroaniline (4-)
NPW	EPA 625	Pentachlorobenzene
NPW	EPA 625	Tetrachlorobenzene (1,2,4,5-)
NPW	EPA 625	Methylphenol (4-)
NPW	EPA 625	Acetophenone
NPW	EPA 625	Aniline
NPW	EPA 625	Dichloroaniline (2,3-)
NPW	EPA 625	Diphenylhydrazine (1,2-)
NPW	EPA 625	Methylphenol (2-)
NPW	EPA 625	N-Nitroso-di-n-butylamine

Matrix	Method	Parameter
NPW	EPA 625	N-Nitrosodiethylamine
NPW	EPA 625	N-Nitrosopyrrolidine
NPW	EPA 625	Hexachlorocyclopentadiene
NPW	EPA 625	N-Nitrosodimethylamine
NPW	EPA 625	N-Nitrosodiphenylamine
NPW	EPA 625	Dibenzofuran
NPW	EPA 625	Methylphenol (2-)
NPW	EPA 625	Methylphenol (4-)
NPW	EPA 625	Trichlorophenol (2,4,5-)
NPW	EPA 625	Benzoic acid
NPW	EPA 625	Benzidine
NPW	EPA 625	Carbazole
NPW	EPA 625	Pyridine
NPW	EPA 625	Acenaphthene
NPW	EPA 625	Acenaphthylene
NPW	EPA 625	Anthracene
NPW	EPA 625	Benzo(a)anthracene
NPW	EPA 625	Benzo(b)fluoranthene
NPW	EPA 625	Benzo(k)fluoranthene
NPW	EPA 625	Benzo(a)pyrene
NPW	EPA 625	Benzo(g,h,i)perylene
NPW	EPA 625	Butyl benzyl phthalate
NPW	EPA 625	Bis (2-chloroethyl) ether
NPW	EPA 625	Bis (2-chloroethoxy) methane
NPW	EPA 625	Bis (2-ethylhexyl) phthalate
NPW	EPA 625	Bis (2-chloroisopropyl) ether
NPW	EPA 625	Bromophenyl-phenyl ether (4-)
NPW	EPA 625	Chloronaphthalene (2-)
NPW	EPA 625	Chlorophenyl-phenyl ether (4-)
NPW	EPA 625	Chrysene
NPW	EPA 625	Dibenzo(a,h)anthracene
NPW	EPA 625	Di-n-butyl phthalate
NPW	EPA 625	Dichlorobenzidine (3,3'-)
NPW	EPA 625	Diethyl phthalate
NPW	EPA 625	Dimethyl phthalate
NPW	EPA 625	Dinitrotoluene (2,4-)
NPW	EPA 625	Dinitrotoluene (2,6-)
NPW	EPA 625	Di-n-octyl phthalate
NPW	EPA 625	Fluoranthene
NPW	EPA 625	Fluorene

Matrix	Method	Parameter
NPW	EPA 625	Hexachlorobenzene
NPW	EPA 625	Hexachlorobutadiene (1,3-)
NPW	EPA 625	Hexachloroethane
NPW	EPA 625	Indeno(1,2,3-c,d)pyrene
NPW	EPA 625	Isophorone
NPW	EPA 625	Naphthalene
NPW	EPA 625	Nitrobenzene
NPW	EPA 625	N-Nitroso-di-n-propylamine
NPW	EPA 625	Phenanthrene
NPW	EPA 625	Pyrene
NPW	EPA 625	Trichlorobenzene (1,2,4-)
NPW	EPA 625	Methyl phenol (4-chloro-3-)
NPW	EPA 625	Chlorophenol (2-)
NPW	EPA 625	Dichlorophenol (2,4-)
NPW	EPA 625	Dimethylphenol (2,4-)
NPW	EPA 625	Dinitrophenol (2,4-)
NPW	EPA 625	Dinitrophenol (2-methyl-4,6-)
NPW	EPA 625	Nitrophenol (2-)
NPW	EPA 625	Nitrophenol (4-)
NPW	EPA 625	Pentachlorophenol
NPW	EPA 625	Phenol
NPW	EPA 625	Trichlorophenol (2,4,6-)
NPW	Other FL - PRO	Petroleum Organics
NPW	Other IA - OA-1	Petroleum Organics
NPW	Other IA - OA-2	Petroleum Organics
NPW	Other NJ-OQA-QAM-025	Petroleum Organics
NPW	Other NJ-OQA-QAM-025, Rev. 7	Petroleum Organics
NPW	Other NJ-OQA-QAM-025, Rev. 7	Petroleum Organics
NPW	Other NJ DEP EPH 10/08, Rev 3	Petroleum Organics
NPW	Other USDA-LOI (Loss on ignition)	Total organic carbon (TOC)
NPW	Other Walkley Black	Total organic carbon (TOC)
NPW	SM 2120 B-11	Color
NPW	SM 2130 B-11	Turbidity
NPW	SM 2310 B-11	Acidity as CaCO3
NPW	SM 2320 B-11	Alkalinity as CaCO3
NPW	SM 2340 B-11	Hardness - total as CaCO3
NPW	SM 2340 C-11	Hardness - total as CaCO3

Matrix	Method	Parameter
NPW	SM 2510 B-11	Specific conductance
NPW	SM 2540 B-11	Residue - total
NPW	SM 2520 B-11	Salinity
NPW	SM 2540 C-11	Residue - filterable (TDS)
NPW	SM 2540 D-11	Residue - nonfilterable (TSS)
NPW	SM 2540 F-11	Residue - settleable
NPW	SM 2540 G SM 18th Ed.	Total, fixed, and volatile solids (SQAR)
NPW	SM 2550 B-00	Temperature
NPW	SM 3500-Cr B-11	Chromium (VI)
NPW	SM 3500-Cr C-11	Chromium (VI)
NPW	SM 3500-Fe B-11	Iron, Ferrous
NPW	SM 4110 B or C-11	Nitrate - nitrite
NPW	SM 4110 B or C-11	Chloride
NPW	SM 4110 B or C-11	Fluoride
NPW	SM 4110 B or C-11	Nitrate
NPW	SM 4110 B or C-11	Nitrite
NPW	SM 4110 B or C-11	Sulfate
NPW	SM 4500-Cl G-11	Chlorine
NPW	SM 4500-Cl G-11	Chlorine
NPW	SM 4500-CN B or C-11 plus E-11	Cyanide
NPW	SM 4500-CN B or C-11 and G-11	Cyanide - amenable to Cl2
NPW	SM 4500-H B-11	pH
NPW	SM 4500-N Org B or C-11 plus NH3 B-11 plus NH3 C-11	Kjeldahl nitrogen - total
NPW	SM 4500-NH3 B plus G-11	Ammonia
NPW	SM 4500-NH3 B, C, D, E, F, G, H-11	Organic nitrogen
NPW	SM 4500-NO3 F-11	Nitrate - nitrite
NPW	SM 4500-O C-11	Oxygen (dissolved)
NPW	SM 4500-O G-11	Oxygen (dissolved)
NPW	SM 4500-P B5-11 plus E-11	Phosphorus (total)
NPW	SM 4500-P E-11	Orthophosphate
NPW	SM 4500-S B, C plus D-11	Sulfides
NPW	SM 4500-SO3 B-11	Sulfite - SO3
NPW	SM 5210 B-11	Carbonaceous BOD (CBOD)
NPW	SM 5210 B-11	Biochemical oxygen demand

Matrix	Method	Parameter
NPW	SM 5220 D-11	Chemical oxygen demand
NPW	SM 5310 B, C or D-11	Dissolved organic carbon (DOC)
NPW	SM 5310 B-11	Total organic carbon (TOC)
NPW	SM 5320 B-11	Total organic halides (TOX)
NPW	SM 5520 B-11	Oil & grease - total recov
NPW	SM 5520 B-11	Oil & grease - hem-LL
NPW	SM 5540 C-11	Surfactants
NPW	SM 6200 B-97	Propionitrile
NPW	SM 6200 B-97	Trimethylbenzene (1,2,3-)
NPW	SM 6200 B-97	Allyl chloride
NPW	SM 6200 B-97	Bromoethane
NPW	SM 6200 B-97	Butadiene (2-chloro-1,3-)
NPW	SM 6200 B-97	Cyclohexanone
NPW	SM 6200 B-97	Dichloro-2-butene (cis-1,4-)
NPW	SM 6200 B-97	Dichloro-2-butene (trans-1,4-)
NPW	SM 6200 B-97	Diethyl ether (Ethyl ether)
NPW	SM 6200 B-97	Isopropanol
NPW	SM 6200 B-97	Ethyl-tert-butyl Ether [ETBE]
NPW	SM 6200 B-97	Diisopropyl Ether [DIPE]
NPW	SM 6200 B-97	Dioxane (1,4-)
NPW	SM 6200 B-97	Ethanol
NPW	SM 6200 B-97	Ethyl methacrylate
NPW	SM 6200 B-97	Iso-butyl alcohol
NPW	SM 6200 B-97	Methacrylonitrile
NPW	SM 6200 B-97	Methyl methacrylate
NPW	SM 6200 B-97	Pentachloroethane
NPW	SM 6200 B-97	tert-Amylmethyl ether [TAME]
NPW	SM 6200 B-97	Acrolein
NPW	SM 6200 B-97	Acrylonitrile
NPW	SM 6200 B-97	Bromobenzene
NPW	SM 6200 B-97	Bromochloromethane
NPW	SM 6200 B-97	Butyl benzene (n-)
NPW	SM 6200 B-97	Chlorotoluene (2-)
NPW	SM 6200 B-97	Chlorotoluene (4-)
NPW	SM 6200 B-97	Dibromo-3-chloropropane (1,2-)
NPW	SM 6200 B-97	Dibromomethane
NPW	SM 6200 B-97	Dichlorodifluoromethane
NPW	SM 6200 B-97	Dichloropropane (1,3-)
NPW	SM 6200 B-97	Dichloropropane (2,2-)
NPW	SM 6200 B-97	Dichloropropene (1,1-)

Matrix	Method	Parameter
NPW	SM 6200 B-97	Hexane (n-)
NPW	SM 6200 B-97	Methyl isobutyl ketone (MIBK)
NPW	SM 6200 B-97	Tetrahydrofuran
NPW	SM 6200 B-97	Tetrachloroethane (1,1,1,2-)
NPW	SM 6200 B-97	Xylene (m-)
NPW	SM 6200 B-97	Xylene (p-)
NPW	SM 6200 B-97	Hexachlorobutadiene (1,3-)
NPW	SM 6200 B-97	Isopropylbenzene
NPW	SM 6200 B-97	Isopropyltoluene (4-)
NPW	SM 6200 B-97	Propylbenzene (n-)
NPW	SM 6200 B-97	Sec-butylbenzene
NPW	SM 6200 B-97	Tert-butylbenzene
NPW	SM 6200 B-97	Trichlorobenzene (1,2,3-)
NPW	SM 6200 B-97	Trichloropropane (1,2,3-)
NPW	SM 6200 B-97	Trimethylbenzene (1,2,4-)
NPW	SM 6200 B-97	Trimethylbenzene (1,3,5-)
NPW	SM 6200 B-97	Acetone
NPW	SM 6200 B-97	Ethyl acetate
NPW	SM 6200 B-97	Methyl tert-butyl ether
NPW	SM 6200 B-97	Tert-butyl alcohol
NPW	SM 6200 B-97	Benzene
NPW	SM 6200 B-97	Bromodichloromethane
NPW	SM 6200 B-97	Bromoform
NPW	SM 6200 B-97	Bromomethane
NPW	SM 6200 B-97	Carbon tetrachloride
NPW	SM 6200 B-97	Chlorobenzene
NPW	SM 6200 B-97	Chloroethane
NPW	SM 6200 B-97	Chloroform
NPW	SM 6200 B-97	Chloromethane
NPW	SM 6200 B-97	Dibromochloromethane
NPW	SM 6200 B-97	Dichlorobenzene (1,2-)
NPW	SM 6200 B-97	Dichlorobenzene (1,3-)
NPW	SM 6200 B-97	Dichlorobenzene (1,4-)
NPW	SM 6200 B-97	Dichloroethane (1,1-)
NPW	SM 6200 B-97	Dichloroethane (1,2-)
NPW	SM 6200 B-97	Dichloroethene (1,1-)
NPW	SM 6200 B-97	Dichloroethene (trans-1,2-)
NPW	SM 6200 B-97	Dichloropropane (1,2-)
NPW	SM 6200 B-97	Dichloropropene (cis-1,3-)
NPW	SM 6200 B-97	Dichloropropene (trans-1,3-)

Matrix	Method	Parameter
NPW	SM 6200 B-97	Ethylbenzene
NPW	SM 6200 B-97	Methylene chloride (Dichloromethane)
NPW	SM 6200 B-97	Tetrachloroethane (1,1,2,2-)
NPW	SM 6200 B-97	Tetrachloroethene
NPW	SM 6200 B-97	Toluene
NPW	SM 6200 B-97	Trichloroethane (1,1,1-)
NPW	SM 6200 B-97	Trichloroethane (1,1,2-)
NPW	SM 6200 B-97	Trichloroethene
NPW	SM 6200 B-97	Trichlorofluoromethane
NPW	SM 6200 B-97	Vinyl chloride
NPW	SM 6200 B-97	Naphthalene
NPW	SM 6200 B-97	Trichlorobenzene (1,2,4-)
NPW	SM 6410 B-00	Tetrachlorophenol (2,3,4,6-)
NPW	SM 6410 B-00	Hexachlorophene
NPW	SM 6410 B-00	Decane (n-)
NPW	SM 6410 B-00	Octadecane (n-)
NPW	SM 6410 B-00	Biphenylamine (4-)
NPW	SM 6410 B-00	Chloronaphthalene (1-)
NPW	SM 6410 B-00	Famphur
NPW	SM 6410 B-00	Hexachloropropene
NPW	SM 6410 B-00	Kepone
NPW	SM 6410 B-00	Napththylamine (1-)
NPW	SM 6410 B-00	Napththylamine (2-)
NPW	SM 6410 B-00	Pentachloroethane
NPW	SM 6410 B-00	Napthoquinone (1,4-)
NPW	SM 6410 B-00	Methylphenol (4-)
NPW	SM 6410 B-00	Acetophenone
NPW	SM 6410 B-00	Alpha - terpineol
NPW	SM 6410 B-00	Aniline
NPW	SM 6410 B-00	Dichloroaniline (2,3-)
NPW	SM 6410 B-00	Methylphenol (2-)
NPW	SM 6410 B-00	Hexachlorocyclopentadiene
NPW	SM 6410 B-00	N-Nitrosodimethylamine
NPW	SM 6410 B-00	N-Nitrosodiphenylamine
NPW	SM 6410 B-00	Benzoic acid
NPW	SM 6410 B-00	Benzidine
NPW	SM 6410 B-00	Carbazole
NPW	SM 6410 B-00	Pyridine
NPW	SM 6410 B-00	Acenaphthene
NPW	SM 6410 B-00	Acenaphthylene

Matrix	Method	Parameter
NPW	SM 6410 B-00	Anthracene
NPW	SM 6410 B-00	Benzo(a)anthracene
NPW	SM 6410 B-00	Benzo(b)fluoranthene
NPW	SM 6410 B-00	Benzo(k)fluoranthene
NPW	SM 6410 B-00	Benzo(a)pyrene
NPW	SM 6410 B-00	Benzo(ghi)perylene
NPW	SM 6410 B-00	Butyl benzyl phthalate
NPW	SM 6410 B-00	Bis (2-chloroethyl) ether
NPW	SM 6410 B-00	Bis (2-chloroethoxy) methane
NPW	SM 6410 B-00	Bis (2-ethylhexyl) phthalate
NPW	SM 6410 B-00	Bis (2-chloroisopropyl) ether
NPW	SM 6410 B-00	Bromophenyl-phenyl ether (4-)
NPW	SM 6410 B-00	Chloronaphthalene (2-)
NPW	SM 6410 B-00	Chlorophenyl-phenyl ether (4-)
NPW	SM 6410 B-00	Chrysene
NPW	SM 6410 B-00	Dibenzo(a,h)anthracene
NPW	SM 6410 B-00	Di-n-butyl phthalate
NPW	SM 6410 B-00	Dichlorobenzidine (3,3'-)
NPW	SM 6410 B-00	Diethyl phthalate
NPW	SM 6410 B-00	Dimethyl phthalate
NPW	SM 6410 B-00	Dinitrotoluene (2,4-)
NPW	SM 6410 B-00	Dinitrotoluene (2,6-)
NPW	SM 6410 B-00	Di-n-octyl phthalate
NPW	SM 6410 B-00	Fluoranthene
NPW	SM 6410 B-00	Fluorene
NPW	SM 6410 B-00	Hexachlorobenzene
NPW	SM 6410 B-00	Hexachlorobutadiene (1,3-)
NPW	SM 6410 B-00	Hexachloroethane
NPW	SM 6410 B-00	Indeno(1,2,3-cd)pyrene
NPW	SM 6410 B-00	Isophorone
NPW	SM 6410 B-00	Naphthalene
NPW	SM 6410 B-00	Nitrobenzene
NPW	SM 6410 B-00	N-Nitroso-di-n-propylamine
NPW	SM 6410 B-00	Phenanthrene
NPW	SM 6410 B-00	Pyrene
NPW	SM 6410 B-00	Trichlorobenzene (1,2,4-)
NPW	SM 6410 B-00	Methyl phenol (4-chloro-3-)
NPW	SM 6410 B-00	Chlorophenol (2-)
NPW	SM 6410 B-00	Dichlorophenol (2,4-)
NPW	SM 6410 B-00	Dimethylphenol (2,4-)

Matrix	Method	Parameter
NPW	SM 6410 B-00	Dinitrophenol (2,4-)
NPW	SM 6410 B-00	Dinitrophenol (2-methyl-4,6-)
NPW	SM 6410 B-00	Nitrophenol (2-)
NPW	SM 6410 B-00	Nitrophenol (4-)
NPW	SM 6410 B-00	Pentachlorophenol
NPW	SM 6410 B-00	Phenol
NPW	SM 6410 B-00	Trichlorophenol (2,4,6-)
NPW	SM 6440 B-00	Acenaphthene
NPW	SM 6440 B-00	Acenaphthylene
NPW	SM 6440 B-00	Anthracene
NPW	SM 6440 B-00	Benzo(a)anthracene
NPW	SM 6440 B-00	Benzo(a)pyrene
NPW	SM 6440 B-00	Benzo(b)fluoranthene
NPW	SM 6440 B-00	Benzo(ghi)perylene
NPW	SM 6440 B-00	Benzo(k)fluoranthene
NPW	SM 6440 B-00	Chrysene
NPW	SM 6440 B-00	Dibenzo(a,h)anthracene
NPW	SM 6440 B-00	Fluoranthene
NPW	SM 6440 B-00	Fluorene
NPW	SM 6440 B-00	Indeno(1,2,3-cd)pyrene
NPW	SM 6440 B-00	Naphthalene
NPW	SM 6440 B-00	Phenanthrene
NPW	SM 6440 B-00	Pyrene
NPW	SM 6630 B-00	Trifluralin
NPW	SM 6630 B-00	Aldrin
NPW	SM 6630 B-00	Alpha BHC
NPW	SM 6630 B-00	Lindane (gamma BHC)
NPW	SM 6630 B-00	Chlordane
NPW	SM 6630 B-00	DDD (4,4'-)
NPW	SM 6630 B-00	DDE (4,4'-)
NPW	SM 6630 B-00	DDT (4,4'-)
NPW	SM 6630 B-00	Dieldrin
NPW	SM 6630 B-00	Endosulfan I
NPW	SM 6630 B-00	Endosulfan II
NPW	SM 6630 B-00	Endrin
NPW	SM 6630 B-00	Heptachlor
NPW	SM 6630 B-00	Heptachlor epoxide
NPW	SM 6630 B-00	Methoxychlor
NPW	SM 6630 B-00	Toxaphene
NPW	SM 6630C-00	Etridiazole

Matrix	Method	Parameter
NPW	SM 6630C-00	Aldrin
NPW	SM 6630C-00	Alpha BHC
NPW	SM 6630C-00	Beta BHC
NPW	SM 6630C-00	Delta BHC
NPW	SM 6630C-00	Lindane (gamma BHC)
NPW	SM 6630C-00	Chlordane
NPW	SM 6630C-00	DDD (4,4'-)
NPW	SM 6630C-00	DDE (4,4'-)
NPW	SM 6630C-00	DDT (4,4'-)
NPW	SM 6630C-00	Dieldrin
NPW	SM 6630C-00	Endosulfan I
NPW	SM 6630C-00	Endosulfan II
NPW	SM 6630C-00	Endosulfan sulfate
NPW	SM 6630C-00	Endrin
NPW	SM 6630C-00	Heptachlor
NPW	SM 6630C-00	Heptachlor epoxide
NPW	SM 6630C-00	Methoxychlor
NPW	SM 6630C-00	Toxaphene
NPW	SM 6640 B-01	D (2,4-)
NPW	SM 6640 B-01	Dalapon
NPW	SM 6640 B-01	T (2,4,5-)
NPW	SM 6640 B-01	TP (2,4,5-) (Silvex)
NPW	SM 9215 B-00	Heterotrophic plate count
NPW	SM 9222 B-97	Total coliform
NPW	SM 9222 D-97	Fecal coliform
NPW	SM 9222D-97 (Class B only) plus EPA 625/R-92/013 App. F	Fecal coliform
NPW	SW-846 1010	Ignitability
NPW	SW-846 1010A	Ignitability
NPW	SW-846 1110	Corrosiviety toward steel
NPW	SW-846 1110A	Corrosivity toward steel
NPW	SW-846 1310A	Metals - organics
NPW	SW-846 1310B	Metals - organics
NPW	SW-846 1311	Volatile organics
NPW	SW-846 1311	Semivolatile organics
NPW	SW-846 1311	Metals
NPW	SW-846 1312	Metals - organics
NPW	SW-846 1320	Metals - organics
NPW	SW-846 3005A	Metals, Total Rec and Dissolved

Matrix	Method	Parameter
NPW	SW-846 3010A	Metals, Total
NPW	SW-846 3015	Metals
NPW	SW-846 3015A	Metals
NPW	SW-846 3020A	Metals
NPW	SW-846 3510C	Semivolatile organics
NPW	SW-846 3511	Semivolatile organics
NPW	SW-846 3520C	Semivolatile organics
NPW	SW-846 5030B	Volatile organics
NPW	SW-846 6010B	Aluminum
NPW	SW-846 6010B	Antimony
NPW	SW-846 6010B	Arsenic
NPW	SW-846 6010B	Barium
NPW	SW-846 6010B	Beryllium
NPW	SW-846 6010B	Boron
NPW	SW-846 6010B	Cadmium
NPW	SW-846 6010B	Calcium
NPW	SW-846 6010B	Calcium-hardness
NPW	SW-846 6010B	Total hardness
NPW	SW-846 6010B	Chromium
NPW	SW-846 6010B	Cobalt
NPW	SW-846 6010B	Copper
NPW	SW-846 6010B	Iron
NPW	SW-846 6010B	Lead
NPW	SW-846 6010B	Lithium
NPW	SW-846 6010B	Magnesium
NPW	SW-846 6010B	Manganese
NPW	SW-846 6010B	Molybdenum
NPW	SW-846 6010B	Nickel
NPW	SW-846 6010B	Potassium
NPW	SW-846 6010B	Selenium
NPW	SW-846 6010B	Silica
NPW	SW-846 6010B	Silver
NPW	SW-846 6010B	Sulfur
NPW	SW-846 6010B	Sodium
NPW	SW-846 6010B	Strontium
NPW	SW-846 6010B	Thallium
NPW	SW-846 6010B	Tin
NPW	SW-846 6010B	Titanium
NPW	SW-846 6010B	Vanadium
NPW	SW-846 6010B	Zinc

Matrix	Method	Parameter
NPW	SW-846 6010C	Antimony
NPW	SW-846 6010C	Arsenic
NPW	SW-846 6010C	Barium
NPW	SW-846 6010C	Beryllium
NPW	SW-846 6010C	Boron
NPW	SW-846 6010C	Cadmium
NPW	SW-846 6010C	Calcium
NPW	SW-846 6010C	Calcium-hardness
NPW	SW-846 6010C	Total hardness
NPW	SW-846 6010C	Chromium
NPW	SW-846 6010C	Cobalt
NPW	SW-846 6010C	Copper
NPW	SW-846 6010C	Iron
NPW	SW-846 6010C	Lead
NPW	SW-846 6010C	Lithium
NPW	SW-846 6010C	Magnesium
NPW	SW-846 6010C	Manganese
NPW	SW-846 6010C	Molybdenum
NPW	SW-846 6010C	Nickel
NPW	SW-846 6010C	Potassium
NPW	SW-846 6010C	Selenium
NPW	SW-846 6010C	Silica
NPW	SW-846 6010C	Silver
NPW	SW-846 6010C	Sulfur
NPW	SW-846 6010C	Sodium
NPW	SW-846 6010C	Strontium
NPW	SW-846 6010C	Thallium
NPW	SW-846 6010C	Tin
NPW	SW-846 6010C	Titanium
NPW	SW-846 6010C	Vanadium
NPW	SW-846 6010C	Zinc
NPW	SW-846 6020	Aluminum
NPW	SW-846 6020	Antimony
NPW	SW-846 6020	Arsenic
NPW	SW-846 6020	Barium
NPW	SW-846 6020	Beryllium
NPW	SW-846 6020	Boron
NPW	SW-846 6020	Cadmium
NPW	SW-846 6020	Calcium
NPW	SW-846 6020	Chromium

Matrix	Method	Parameter
NPW	SW-846 6020	Cobalt
NPW	SW-846 6020	Copper
NPW	SW-846 6020	Iron
NPW	SW-846 6020	Lead
NPW	SW-846 6020	Magnesium
NPW	SW-846 6020	Manganese
NPW	SW-846 6020	Molybdenum
NPW	SW-846 6020	Nickel
NPW	SW-846 6020	Potassium
NPW	SW-846 6020	Selenium
NPW	SW-846 6020	Silver
NPW	SW-846 6020	Sodium
NPW	SW-846 6020	Strontium
NPW	SW-846 6020	Thallium
NPW	SW-846 6020	Thorium
NPW	SW-846 6020	Tin
NPW	SW-846 6020	Titanium
NPW	SW-846 6020	Uranium
NPW	SW-846 6020	Vanadium
NPW	SW-846 6020	Zinc
NPW	SW-846 6020A	Aluminum
NPW	SW-846 6020A	Antimony
NPW	SW-846 6020A	Arsenic
NPW	SW-846 6020A	Barium
NPW	SW-846 6020A	Beryllium
NPW	SW-846 6020A	Boron
NPW	SW-846 6020A	Cadmium
NPW	SW-846 6020A	Calcium
NPW	SW-846 6020A	Chromium
NPW	SW-846 6020A	Cobalt
NPW	SW-846 6020A	Copper
NPW	SW-846 6020A	Iron
NPW	SW-846 6020A	Lead
NPW	SW-846 6020A	Magnesium
NPW	SW-846 6020A	Manganese
NPW	SW-846 6020A	Molybdenum
NPW	SW-846 6020A	Nickel
NPW	SW-846 6020A	Potassium
NPW	SW-846 6020A	Selenium
NPW	SW-846 6020A	Silver

Matrix	Method	Parameter
NPW	SW-846 6020A	Sodium
NPW	SW-846 6020A	Strontium
NPW	SW-846 6020A	Thallium
NPW	SW-846 6020A	Thorium
NPW	SW-846 6020A	Tin
NPW	SW-846 6020A	Titanium
NPW	SW-846 6020A	Uranium
NPW	SW-846 6020A	Vanadium
NPW	SW-846 6020A	Zinc
NPW	SW-846 7196A	Chromium (VI)
NPW	SW-846 7199	Chromium (VI)
NPW	SW-846 7470A	Mercury - liquid waste
NPW	SW-846 8011	Dibromoethane (1,2-) (EDB)
NPW	SW-846 8011	Dibromo-3-chloropropane (1,2-)
NPW	SW-846 8015B	Ethylene glycol
NPW	SW-846 8015B	Propylene glycol
NPW	SW-846 8015B	Gasoline range organic
NPW	SW-846 8015B	Diesel range organic
NPW	SW-846 8015C	Ethylene glycol
NPW	SW-846 8015C	Propylene glycol
NPW	SW-846 8015D	Ethylene glycol
NPW	SW-846 8015D	Propylene glycol
NPW	SW-846 8015D	Gasoline range organic
NPW	SW-846 8015D	Diesel range organic
NPW	SW-846 8021B	Xylenes (total)
NPW	SW-846 8021B	Methyl tert-butyl ether
NPW	SW-846 8021B	Benzene
NPW	SW-846 8021B	Ethylbenzene
NPW	SW-846 8021B	Toluene
NPW	SW-846 8021B	Xylene (o-)
NPW	SW-846 8021B	Xylene (m-)
NPW	SW-846 8021B	Xylene (p-)
NPW	SW-846 8081A	Alachlor
NPW	SW-846 8081A	Chlordane (alpha)
NPW	SW-846 8081A	Chlordane (gamma)
NPW	SW-846 8081A	Chloroneb
NPW	SW-846 8081A	Chlorothalonil
NPW	SW-846 8081A	Etridiazole
NPW	SW-846 8081A	Hexachlorobenzene
NPW	SW-846 8081A	Hexachlorocyclopentadiene

Matrix	Method	Parameter
NPW	SW-846 8081A	Permethrin
NPW	SW-846 8081A	Propachlor
NPW	SW-846 8081A	Trifluralin
NPW	SW-846 8081A	Aldrin
NPW	SW-846 8081A	Alpha BHC
NPW	SW-846 8081A	Beta BHC
NPW	SW-846 8081A	Delta BHC
NPW	SW-846 8081A	Lindane (gamma BHC)
NPW	SW-846 8081A	Chlordane (technical)
NPW	SW-846 8081A	DDD (4,4'-)
NPW	SW-846 8081A	DDE (4,4'-)
NPW	SW-846 8081A	DDT (4,4'-)
NPW	SW-846 8081A	Dieldrin
NPW	SW-846 8081A	Endosulfan I
NPW	SW-846 8081A	Endosulfan II
NPW	SW-846 8081A	Endosulfan sulfate
NPW	SW-846 8081A	Endrin
NPW	SW-846 8081A	Endrin aldehyde
NPW	SW-846 8081A	Endrin ketone
NPW	SW-846 8081A	Heptachlor
NPW	SW-846 8081A	Heptachlor epoxide
NPW	SW-846 8081A	Methoxychlor
NPW	SW-846 8081A	Toxaphene
NPW	SW-846 8081B	Alachlor
NPW	SW-846 8081B	Chlordane (alpha)
NPW	SW-846 8081B	Chlordane (gamma)
NPW	SW-846 8081B	Chloroneb
NPW	SW-846 8081B	Chlorothalonil
NPW	SW-846 8081B	Etridiazole
NPW	SW-846 8081B	Hexachlorobenzene
NPW	SW-846 8081B	Hexachlorocyclopentadiene
NPW	SW-846 8081B	Permethrin
NPW	SW-846 8081B	Propachlor
NPW	SW-846 8081B	Trifluralin
NPW	SW-846 8081B	Aldrin
NPW	SW-846 8081B	Alpha BHC
NPW	SW-846 8081B	Beta BHC
NPW	SW-846 8081B	Delta BHC
NPW	SW-846 8081B	Lindane (gamma BHC)
NPW	SW-846 8081B	Chlordane (technical)

Matrix	Method	Parameter
NPW	SW-846 8081B	DDD (4,4'-)
NPW	SW-846 8081B	DDE (4,4'-)
NPW	SW-846 8081B	DDT (4,4'-)
NPW	SW-846 8081B	Dieldrin
NPW	SW-846 8081B	Endosulfan I
NPW	SW-846 8081B	Endosulfan II
NPW	SW-846 8081B	Endosulfan sulfate
NPW	SW-846 8081B	Endrin
NPW	SW-846 8081B	Endrin aldehyde
NPW	SW-846 8081B	Endrin ketone
NPW	SW-846 8081B	Heptachlor
NPW	SW-846 8081B	Heptachlor epoxide
NPW	SW-846 8081B	Methoxychlor
NPW	SW-846 8081B	Toxaphene
NPW	SW-846 8082	PCB 1016
NPW	SW-846 8082	PCB 1221
NPW	SW-846 8082	PCB 1232
NPW	SW-846 8082	PCB 1242
NPW	SW-846 8082	PCB 1248
NPW	SW-846 8082	PCB 1254
NPW	SW-846 8082	PCB 1260
NPW	SW-846 8082A	PCB 1016
NPW	SW-846 8082A	PCB 1221
NPW	SW-846 8082A	PCB 1232
NPW	SW-846 8082A	PCB 1242
NPW	SW-846 8082A	PCB 1248
NPW	SW-846 8082A	PCB 1254
NPW	SW-846 8082A	PCB 1260
NPW	SW-846 8141A	Azinphos methyl
NPW	SW-846 8141A	Chlorpyrifos
NPW	SW-846 8141A	Demeton (o-)
NPW	SW-846 8141A	Demeton (s-)
NPW	SW-846 8141A	Disulfoton
NPW	SW-846 8141A	Bolstar
NPW	SW-846 8141A	Coumaphos
NPW	SW-846 8141A	Dichlorvos
NPW	SW-846 8141A	Dimethoate
NPW	SW-846 8141A	EPN
NPW	SW-846 8141A	Ethoprop
NPW	SW-846 8141A	Fensulfothion

Matrix	Method	Parameter
NPW	SW-846 8141A	Fenthion
NPW	SW-846 8141A	Merphos
NPW	SW-846 8141A	Mevinphos
NPW	SW-846 8141A	Naled
NPW	SW-846 8141A	Parathion
NPW	SW-846 8141A	Parathion methyl
NPW	SW-846 8141A	Phorate
NPW	SW-846 8141A	Ronnel
NPW	SW-846 8141A	Stirofos
NPW	SW-846 8141A	Sulfotepp
NPW	SW-846 8141A	TEPP
NPW	SW-846 8141A	Tokuthion [Protothiofos]
NPW	SW-846 8141A	Trichloronate
NPW	SW-846 8141A	Diazinon
NPW	SW-846 8141A	Malathion
NPW	SW-846 8141B	Azinphos methyl
NPW	SW-846 8141B	Chlorpyrifos
NPW	SW-846 8141B	Demeton (o-)
NPW	SW-846 8141B	Demeton (s-)
NPW	SW-846 8141B	Disulfoton
NPW	SW-846 8141B	Bolstar
NPW	SW-846 8141B	Coumaphos
NPW	SW-846 8141B	Dichlorvos
NPW	SW-846 8141B	Dimethoate
NPW	SW-846 8141B	EPN
NPW	SW-846 8141B	Ethoprop
NPW	SW-846 8141B	Fensulfothion
NPW	SW-846 8141B	Fenthion
NPW	SW-846 8141B	Merphos
NPW	SW-846 8141B	Mevinphos
NPW	SW-846 8141B	Naled
NPW	SW-846 8141B	Parathion
NPW	SW-846 8141B	Parathion methyl
NPW	SW-846 8141B	Phorate
NPW	SW-846 8141B	Ronnel
NPW	SW-846 8141B	Stirofos
NPW	SW-846 8141B	Sulfotepp
NPW	SW-846 8141B	TEPP
NPW	SW-846 8141B	Tokuthion [Protothiofos]
NPW	SW-846 8141B	Trichloronate

Matrix	Method	Parameter
NPW	SW-846 8141B	Diazinon
NPW	SW-846 8141B	Malathion
NPW	SW-846 8151A	Dicamba
NPW	SW-846 8151A	DB (2,4-)
NPW	SW-846 8151A	Dinoseb
NPW	SW-846 8151A	Dalapon
NPW	SW-846 8151A	Dichlorprop
NPW	SW-846 8151A	D (2,4-)
NPW	SW-846 8151A	T (2,4,5-)
NPW	SW-846 8151A	TP (2,4,5-) (Silvex)
NPW	SW-846 8151A	MCPA
NPW	SW-846 8151A	MCPP
NPW	SW-846 8260B	Methyl alcohol (Methanol)
NPW	SW-846 8260B	Ethyl alcohol
NPW	SW-846 8260B	Hexane (n-)
NPW	SW-846 8260B	Trimethylpentane (2,2,4-)
NPW	SW-846 8260B	Methylnaphthalene (1-)
NPW	SW-846 8260B	Methylnaphthalene (2-)
NPW	SW-846 8260B	Butanol (3,3-Dimethyl-1-)
NPW	SW-846 8260B	Trimethylpentane (2,2,4-)
NPW	SW-846 8260B	Trimethylbenzene (1,2,3-)
NPW	SW-846 8260B	Cyclohexane
NPW	SW-846 8260B	Butanol (1-)
NPW	SW-846 8260B	Nitropropane (2-)
NPW	SW-846 8260B	Butyl formate (t-)
NPW	SW-846 8260B	Methyl acetate
NPW	SW-846 8260B	Pentanol (2-Methyl-2-)
NPW	SW-846 8260B	Amyl alcohol (t-)
NPW	SW-846 8260B	Methylcyclohexane
NPW	SW-846 8260B	Octane (-n)
NPW	SW-846 8260B	tert-Amylmethyl ether [TAME]
NPW	SW-846 8260B	Bromoethane
NPW	SW-846 8260B	Cyclohexanone
NPW	SW-846 8260B	Diisopropyl Ether [DIPE]
NPW	SW-846 8260B	Tetrahydrofuran
NPW	SW-846 8260B	Ethyl-tert-butyl Ether [ETBE]
NPW	SW-846 8260B	Safrole
NPW	SW-846 8260B	Xylene (m-)
NPW	SW-846 8260B	Xylene (o-)
NPW	SW-846 8260B	Xylene (p-)

Matrix	Method	Parameter
NPW	SW-846 8260B	Dichloro-2-butene (cis-1,4-)
NPW	SW-846 8260B	Diethyl ether (Ethyl ether)
NPW	SW-846 8260B	Dichloro-2-butene (trans-1,4-)
NPW	SW-846 8260B	Ethanol
NPW	SW-846 8260B	Trichloro (1,1,2-) trifluoroethane (1,2,2-)
NPW	SW-846 8260B	Vinyl acetate
NPW	SW-846 8260B	Pentachloroethane
NPW	SW-846 8260B	Tert-butyl alcohol
NPW	SW-846 8260B	Dioxane (1,4-)
NPW	SW-846 8260B	Bromobenzene
NPW	SW-846 8260B	Butyl benzene (n-)
NPW	SW-846 8260B	Sec-butylbenzene
NPW	SW-846 8260B	Tert-butylbenzene
NPW	SW-846 8260B	Chlorotoluene (2-)
NPW	SW-846 8260B	Chlorotoluene (4-)
NPW	SW-846 8260B	Isopropylbenzene
NPW	SW-846 8260B	Propylbenzene (n-)
NPW	SW-846 8260B	Isopropyltoluene (4-)
NPW	SW-846 8260B	Trichlorobenzene (1,2,3-)
NPW	SW-846 8260B	Trimethylbenzene (1,2,4-)
NPW	SW-846 8260B	Trimethylbenzene (1,3,5-)
NPW	SW-846 8260B	Allyl chloride
NPW	SW-846 8260B	Bromochloromethane
NPW	SW-846 8260B	Butadiene (2-chloro-1,3-)
NPW	SW-846 8260B	Dibromoethane (1,2-) (EDB)
NPW	SW-846 8260B	Dibromomethane
NPW	SW-846 8260B	Dibromo-3-chloropropane (1,2-)
NPW	SW-846 8260B	Dichloropropane (1,3-)
NPW	SW-846 8260B	Dichloropropane (2,2-)
NPW	SW-846 8260B	Dichloropropene (1,1-)
NPW	SW-846 8260B	Trichloropropane (1,2,3-)
NPW	SW-846 8260B	Ethyl acetate
NPW	SW-846 8260B	Ethyl methacrylate
NPW	SW-846 8260B	Methacrylonitrile
NPW	SW-846 8260B	Methyl acrylate
NPW	SW-846 8260B	Methyl methacrylate
NPW	SW-846 8260B	Methyl iodide
NPW	SW-846 8260B	Iso-butyl alcohol
NPW	SW-846 8260B	Isopropanol
NPW	SW-846 8260B	N-Nitroso-di-n-butylamine

Matrix	Method	Parameter
NPW	SW-846 8260B	Propionitrile
NPW	SW-846 8260B	Acetonitrile
NPW	SW-846 8260B	Benzene
NPW	SW-846 8260B	Chlorobenzene
NPW	SW-846 8260B	Dichlorobenzene (1,2-)
NPW	SW-846 8260B	Dichlorobenzene (1,3-)
NPW	SW-846 8260B	Dichlorobenzene (1,4-)
NPW	SW-846 8260B	Ethylbenzene
NPW	SW-846 8260B	Toluene
NPW	SW-846 8260B	Xylenes (total)
NPW	SW-846 8260B	Bromodichloromethane
NPW	SW-846 8260B	Bromoform
NPW	SW-846 8260B	Bromomethane
NPW	SW-846 8260B	Carbon tetrachloride
NPW	SW-846 8260B	Chloroethane
NPW	SW-846 8260B	Chloroethyl vinyl ether (2-)
NPW	SW-846 8260B	Chloroform
NPW	SW-846 8260B	Chloromethane
NPW	SW-846 8260B	Dichloropropene (trans-1,3-)
NPW	SW-846 8260B	Dibromochloromethane
NPW	SW-846 8260B	Dichlorodifluoromethane
NPW	SW-846 8260B	Dichloroethane (1,1-)
NPW	SW-846 8260B	Dichloroethane (1,2-)
NPW	SW-846 8260B	Dichloroethene (1,1-)
NPW	SW-846 8260B	Dichloroethene (trans-1,2-)
NPW	SW-846 8260B	Dichloroethene (cis-1,2-)
NPW	SW-846 8260B	Dichloropropane (1,2-)
NPW	SW-846 8260B	Dichloropropene (cis-1,3-)
NPW	SW-846 8260B	Methylene chloride (Dichloromethane)
NPW	SW-846 8260B	Tetrachloroethane (1,1,2,2-)
NPW	SW-846 8260B	Tetrachloroethene
NPW	SW-846 8260B	Trichloroethane (1,1,1-)
NPW	SW-846 8260B	Trichloroethane (1,1,2-)
NPW	SW-846 8260B	Trichloroethene
NPW	SW-846 8260B	Trichlorofluoromethane
NPW	SW-846 8260B	Vinyl chloride
NPW	SW-846 8260B	Acetone
NPW	SW-846 8260B	Carbon disulfide
NPW	SW-846 8260B	Butanone (2-)
NPW	SW-846 8260B	Hexanone (2-)

Matrix	Method	Parameter
NPW	SW-846 8260B	Pentanone (4-methyl-2-) (MIBK)
NPW	SW-846 8260B	Methyl tert-butyl ether
NPW	SW-846 8260B	Acrolein
NPW	SW-846 8260B	Acrylonitrile
NPW	SW-846 8260B	Hexachlorobutadiene (1,3-)
NPW	SW-846 8260B	Hexachloroethane
NPW	SW-846 8260B	Naphthalene
NPW	SW-846 8260B	Styrene
NPW	SW-846 8260B	Tetrachloroethane (1,1,1,2-)
NPW	SW-846 8260B	Trichlorobenzene (1,2,4-)
NPW	SW-846 8260C	Methyl alcohol (Methanol)
NPW	SW-846 8260C	Ethyl alcohol
NPW	SW-846 8260C	Trimethylpentane (2,2,4-)
NPW	SW-846 8260C	Methylnaphthalene (1-)
NPW	SW-846 8260C	Methylnaphthalene (2-)
NPW	SW-846 8260C	Butanol (3,3-Dimethyl-1-)
NPW	SW-846 8260C	Trimethylbenzene (1,2,3-)
NPW	SW-846 8260C	Cyclohexane
NPW	SW-846 8260C	Butanol (1-)
NPW	SW-846 8260C	Nitropropane (2-)
NPW	SW-846 8260C	Butyl formate (t-)
NPW	SW-846 8260C	Methyl acetate
NPW	SW-846 8260C	Pentanol (2-Methyl-2-)
NPW	SW-846 8260C	Amyl alcohol (t-)
NPW	SW-846 8260C	Methylcyclohexane
NPW	SW-846 8260C	Octane (-n)
NPW	SW-846 8260C	tert-Amylmethyl ether [TAME]
NPW	SW-846 8260C	Bromoethane
NPW	SW-846 8260C	Cyclohexanone
NPW	SW-846 8260C	Diisopropyl Ether [DIPE]
NPW	SW-846 8260C	Tetrahydrofuran
NPW	SW-846 8260C	Ethyl-tert-butyl Ether [ETBE]
NPW	SW-846 8260C	Xylene (m-)
NPW	SW-846 8260C	Xylene (o-)
NPW	SW-846 8260C	Xylene (p-)
NPW	SW-846 8260C	Dichloro-2-butene (cis-1,4-)
NPW	SW-846 8260C	Diethyl ether (Ethyl ether)
NPW	SW-846 8260C	Dichloro-2-butene (trans-1,4-)
NPW	SW-846 8260C	Ethanol
NPW	SW-846 8260C	Trichloro (1,1,2-) trifluoroethane (1,2,2-)

Matrix	Method	Parameter
NPW	SW-846 8260C	Vinyl acetate
NPW	SW-846 8260C	Pentachloroethane
NPW	SW-846 8260C	Tert-butyl alcohol
NPW	SW-846 8260C	Dioxane (1,4-)
NPW	SW-846 8260C	Bromobenzene
NPW	SW-846 8260C	Butyl benzene (n-)
NPW	SW-846 8260C	Sec-butylbenzene
NPW	SW-846 8260C	Tert-butylbenzene
NPW	SW-846 8260C	Chlorotoluene (2-)
NPW	SW-846 8260C	Chlorotoluene (4-)
NPW	SW-846 8260C	Isopropylbenzene
NPW	SW-846 8260C	Propylbenzene (n-)
NPW	SW-846 8260C	Isopropyltoluene (4-)
NPW	SW-846 8260C	Trichlorobenzene (1,2,3-)
NPW	SW-846 8260C	Trimethylbenzene (1,2,4-)
NPW	SW-846 8260C	Trimethylbenzene (1,3,5-)
NPW	SW-846 8260C	Allyl chloride
NPW	SW-846 8260C	Bromochloromethane
NPW	SW-846 8260C	Butadiene (2-chloro-1,3-)
NPW	SW-846 8260C	Dibromoethane (1,2-) (EDB)
NPW	SW-846 8260C	Dibromomethane
NPW	SW-846 8260C	Dibromo-3-chloropropane (1,2-)
NPW	SW-846 8260C	Dichloropropane (1,3-)
NPW	SW-846 8260C	Dichloropropane (2,2-)
NPW	SW-846 8260C	Dichloropropene (1,1-)
NPW	SW-846 8260C	Trichloropropane (1,2,3-)
NPW	SW-846 8260C	Ethyl acetate
NPW	SW-846 8260C	Ethyl methacrylate
NPW	SW-846 8260C	Methacrylonitrile
NPW	SW-846 8260C	Methyl acrylate
NPW	SW-846 8260C	Methyl methacrylate
NPW	SW-846 8260C	Methyl iodide
NPW	SW-846 8260C	Iso-butyl alcohol
NPW	SW-846 8260C	Isopropanol
NPW	SW-846 8260C	N-Nitroso-di-n-butylamine
NPW	SW-846 8260C	Propionitrile
NPW	SW-846 8260C	Acetonitrile
NPW	SW-846 8260C	Benzene
NPW	SW-846 8260C	Chlorobenzene
NPW	SW-846 8260C	Dichlorobenzene (1,2-)

Matrix	Method	Parameter
NPW	SW-846 8260C	Dichlorobenzene (1,3-)
NPW	SW-846 8260C	Dichlorobenzene (1,4-)
NPW	SW-846 8260C	Ethylbenzene
NPW	SW-846 8260C	Toluene
NPW	SW-846 8260C	Xylenes (total)
NPW	SW-846 8260C	Bromodichloromethane
NPW	SW-846 8260C	Bromoform
NPW	SW-846 8260C	Bromomethane
NPW	SW-846 8260C	Carbon tetrachloride
NPW	SW-846 8260C	Chloroethane
NPW	SW-846 8260C	Chloroethyl vinyl ether (2-)
NPW	SW-846 8260C	Chloroform
NPW	SW-846 8260C	Chloromethane
NPW	SW-846 8260C	Dichloropropene (trans-1,3-)
NPW	SW-846 8260C	Dibromochloromethane
NPW	SW-846 8260C	Dichlorodifluoromethane
NPW	SW-846 8260C	Dichloroethane (1,1-)
NPW	SW-846 8260C	Dichloroethane (1,2-)
NPW	SW-846 8260C	Dichloroethene (1,1-)
NPW	SW-846 8260C	Dichloroethene (trans-1,2-)
NPW	SW-846 8260C	Dichloroethene (cis-1,2-)
NPW	SW-846 8260C	Dichloropropane (1,2-)
NPW	SW-846 8260C	Dichloropropene (cis-1,3-)
NPW	SW-846 8260C	Methylene chloride (Dichloromethane)
NPW	SW-846 8260C	Tetrachloroethane (1,1,2,2-)
NPW	SW-846 8260C	Tetrachloroethene
NPW	SW-846 8260C	Trichloroethane (1,1,1-)
NPW	SW-846 8260C	Trichloroethane (1,1,2-)
NPW	SW-846 8260C	Trichloroethene
NPW	SW-846 8260C	Trichlorofluoromethane
NPW	SW-846 8260C	Vinyl chloride
NPW	SW-846 8260C	Acetone
NPW	SW-846 8260C	Carbon disulfide
NPW	SW-846 8260C	Butanone (2-)
NPW	SW-846 8260C	Hexanone (2-)
NPW	SW-846 8260C	Pentanone (4-methyl-2-) (MIBK)
NPW	SW-846 8260C	Methyl tert-butyl ether
NPW	SW-846 8260C	Acrolein
NPW	SW-846 8260C	Acrylonitrile
NPW	SW-846 8260C	Hexachlorobutadiene (1,3-)

Matrix	Method	Parameter
NPW	SW-846 8260C	Hexachloroethane
NPW	SW-846 8260C	Naphthalene
NPW	SW-846 8260C	Styrene
NPW	SW-846 8260C	Tetrachloroethane (1,1,1,2-)
NPW	SW-846 8260C	Trichlorobenzene (1,2,4-)
NPW	SW-846 8270C	Biphenyl (1,1'-)
NPW	SW-846 8270C	Benzaldehyde
NPW	SW-846 8270C	Caprolactam
NPW	SW-846 8270C	Atrazine
NPW	SW-846 8270C	Phenanthrene
NPW	SW-846 8270C	Pyrene
NPW	SW-846 8270C	Acenaphthene
NPW	SW-846 8270C	Acenaphthylene
NPW	SW-846 8270C	Anthracene
NPW	SW-846 8270C	Benzo(ghi)perylene
NPW	SW-846 8270C	Chrysene
NPW	SW-846 8270C	Methylnaphthalene (1-)
NPW	SW-846 8270C	Methylnaphthalene (2-)
NPW	SW-846 8270C	Naphthalene
NPW	SW-846 8270C	Fluoranthene
NPW	SW-846 8270C	Fluorene
NPW	SW-846 8270C	Methylnaphthalene (1-)
NPW	SW-846 8270C	Nitrodiphenylamine (2-)
NPW	SW-846 8270C	Nitrodiphenylamine (2-)
NPW	SW-846 8270C	Hexachlorophene
NPW	SW-846 8270C	Diphenylhydrazine (1,2-)
NPW	SW-846 8270C	Decane (n-)
NPW	SW-846 8270C	Octadecane (n-)
NPW	SW-846 8270C	Benzo(a)anthracene
NPW	SW-846 8270C	Benzo(a)pyrene
NPW	SW-846 8270C	Benzo(b)fluoranthene
NPW	SW-846 8270C	Benzo(k)fluoranthene
NPW	SW-846 8270C	Dibenzo(a,h)anthracene
NPW	SW-846 8270C	Indeno(1,2,3-cd)pyrene
NPW	SW-846 8270C	Benzal chloride
NPW	SW-846 8270C	Benzo(j)fluoranthene
NPW	SW-846 8270C	Benzotrichloride
NPW	SW-846 8270C	Benzyl chloride
NPW	SW-846 8270C	Chlorobenzilate
NPW	SW-846 8270C	Dibenz(a,h)acridine

Matrix	Method	Parameter
NPW	SW-846 8270C	Dibenzo(a,h)pyrene
NPW	SW-846 8270C	Dibenzo(a,i)pyrene
NPW	SW-846 8270C	Dibenzo(c,g)carbazole (7H-)
NPW	SW-846 8270C	Pentachloroethane
NPW	SW-846 8270C	Tetrachlorobenzene (1,2,3,4-)
NPW	SW-846 8270C	Tetrachlorobenzene (1,2,3,5-)
NPW	SW-846 8270C	Benzyl alcohol
NPW	SW-846 8270C	Acetophenone
NPW	SW-846 8270C	Acetylaminofluorene (2-)
NPW	SW-846 8270C	Aminobiphenyl (4-)
NPW	SW-846 8270C	Aramite
NPW	SW-846 8270C	Chloronaphthalene (1-)
NPW	SW-846 8270C	Diallate (cis)
NPW	SW-846 8270C	Diallate (trans)
NPW	SW-846 8270C	Dibenzo(a,e)pyrene
NPW	SW-846 8270C	Dibenz(a,j)acridine
NPW	SW-846 8270C	Dichlorophenol (2,6-)
NPW	SW-846 8270C	Dimethoate
NPW	SW-846 8270C	Dimethylaminoazobenzene
NPW	SW-846 8270C	Dimethylbenz(a)anthracene (7,12-)
NPW	SW-846 8270C	Dimethyl benzidine (3,3-)
NPW	SW-846 8270C	Dinitrobenzene (1,3-)
NPW	SW-846 8270C	Dinoseb
NPW	SW-846 8270C	Disulfoton
NPW	SW-846 8270C	Famphur
NPW	SW-846 8270C	Hexachloropropene
NPW	SW-846 8270C	Isodrin
NPW	SW-846 8270C	Isosafrole (cis-)
NPW	SW-846 8270C	Isosafrole (trans-)
NPW	SW-846 8270C	Kepone
NPW	SW-846 8270C	Methanesulfonate (Ethyl-)
NPW	SW-846 8270C	Methanesulfonate (Methyl-)
NPW	SW-846 8270C	Methapyrilene
NPW	SW-846 8270C	Methylcholanthrene (3-)
NPW	SW-846 8270C	Napthoquinone (1,4-)
NPW	SW-846 8270C	Napththylamine (1-)
NPW	SW-846 8270C	Napththylamine (2-)
NPW	SW-846 8270C	N-Nitroso-di-n-butylamine
NPW	SW-846 8270C	N-Nitrosomorpholine
NPW	SW-846 8270C	N-Nitrosopiperidine

Matrix	Method	Parameter
NPW	SW-846 8270C	Parathion
NPW	SW-846 8270C	Parathion methyl
NPW	SW-846 8270C	Pentachlorobenzene
NPW	SW-846 8270C	Pentachloronitrobenzene
NPW	SW-846 8270C	Phenacetin
NPW	SW-846 8270C	Phenylenediamine (1,4-)
NPW	SW-846 8270C	Phenylethylamine (alpha, alpha-Dimethyl)
NPW	SW-846 8270C	Phorate
NPW	SW-846 8270C	Phosphorothioate (O,O,O-triethyl)
NPW	SW-846 8270C	Phosphorothioate (O,O-diethyl-O-2-pyrazinyl) [Thionazin]
NPW	SW-846 8270C	Picoline (2-)
NPW	SW-846 8270C	Pronamide
NPW	SW-846 8270C	Quinoline -1-Oxide (4-Nitro)
NPW	SW-846 8270C	Safrole
NPW	SW-846 8270C	Sulfotepp
NPW	SW-846 8270C	Tetrachlorobenzene (1,2,4,5-)
NPW	SW-846 8270C	Tetrachlorophenol (2,3,4,6-)
NPW	SW-846 8270C	Toluidine (2-) (2-Methylaniline)
NPW	SW-846 8270C	Toluidine (5-nitro-2-)
NPW	SW-846 8270C	Trinitrobenzene (1,3,5-)
NPW	SW-846 8270C	N-Nitrosodiethylamine
NPW	SW-846 8270C	N-Nitrosopyrrolidine
NPW	SW-846 8270C	Diphenylamine
NPW	SW-846 8270C	Carbazole
NPW	SW-846 8270C	Dichlorobenzene (1,2-)
NPW	SW-846 8270C	Dichlorobenzene (1,3-)
NPW	SW-846 8270C	N-Nitrosodimethylamine
NPW	SW-846 8270C	N-Nitroso-di-n-propylamine
NPW	SW-846 8270C	N-Nitrosomethylethylamine
NPW	SW-846 8270C	Benzidine
NPW	SW-846 8270C	Aniline
NPW	SW-846 8270C	Hexachloropropene
NPW	SW-846 8270C	Dibenzofuran
NPW	SW-846 8270C	Benzoic acid
NPW	SW-846 8270C	N-Nitrosodiphenylamine
NPW	SW-846 8270C	Dichlorobenzidine (3,3'-)
NPW	SW-846 8270C	Chloroaniline (4-)
NPW	SW-846 8270C	Nitroaniline (2-)
NPW	SW-846 8270C	Nitroaniline (3-)

Matrix	Method	Parameter
NPW	SW-846 8270C	Nitroaniline (4-)
NPW	SW-846 8270C	Chloronaphthalene (2-)
NPW	SW-846 8270C	Hexachlorobenzene
NPW	SW-846 8270C	Hexachlorobutadiene (1,3-)
NPW	SW-846 8270C	Hexachlorocyclopentadiene
NPW	SW-846 8270C	Hexachloroethane
NPW	SW-846 8270C	Trichlorobenzene (1,2,4-)
NPW	SW-846 8270C	Bis (2-chloroethoxy) methane
NPW	SW-846 8270C	Bis (2-chloroethyl) ether
NPW	SW-846 8270C	Bis (2-chloroisopropyl) ether
NPW	SW-846 8270C	Chlorophenyl-phenyl ether (4-)
NPW	SW-846 8270C	Bromophenyl-phenyl ether (4-)
NPW	SW-846 8270C	Dinitrotoluene (2,4-)
NPW	SW-846 8270C	Dinitrotoluene (2,6-)
NPW	SW-846 8270C	Isophorone
NPW	SW-846 8270C	Nitrobenzene
NPW	SW-846 8270C	Butyl benzyl phthalate
NPW	SW-846 8270C	Bis (2-ethylhexyl) phthalate
NPW	SW-846 8270C	Diethyl phthalate
NPW	SW-846 8270C	Dimethyl phthalate
NPW	SW-846 8270C	Di-n-butyl phthalate
NPW	SW-846 8270C	Di-n-octyl phthalate
NPW	SW-846 8270C	Acenaphthene
NPW	SW-846 8270C	Anthracene
NPW	SW-846 8270C	Acenaphthylene
NPW	SW-846 8270C	Benzo(a)anthracene
NPW	SW-846 8270C	Benzo(a)pyrene
NPW	SW-846 8270C	Benzo(b)fluoranthene
NPW	SW-846 8270C	Benzo(ghi)perylene
NPW	SW-846 8270C	Benzo(k)fluoranthene
NPW	SW-846 8270C	Chrysene
NPW	SW-846 8270C	Dibenzo(a,h)anthracene
NPW	SW-846 8270C	Fluoranthene
NPW	SW-846 8270C	Fluorene
NPW	SW-846 8270C	Indeno(1,2,3-cd)pyrene
NPW	SW-846 8270C	Methylnaphthalene (2-)
NPW	SW-846 8270C	Naphthalene
NPW	SW-846 8270C	Phenanthrene
NPW	SW-846 8270C	Pyrene
NPW	SW-846 8270C	Methyl phenol (4-chloro-3-)

Matrix	Method	Parameter
NPW	SW-846 8270C	Chlorophenol (2-)
NPW	SW-846 8270C	Dichlorophenol (2,4-)
NPW	SW-846 8270C	Dimethylphenol (2,4-)
NPW	SW-846 8270C	Dinitrophenol (2,4-)
NPW	SW-846 8270C	Dinitrophenol (2-methyl-4,6-)
NPW	SW-846 8270C	Methylphenol (2-)
NPW	SW-846 8270C	Methylphenol (4-)
NPW	SW-846 8270C	Nitrophenol (2-)
NPW	SW-846 8270C	Nitrophenol (4-)
NPW	SW-846 8270C	Pentachlorophenol
NPW	SW-846 8270C	Phenol
NPW	SW-846 8270C	Trichlorophenol (2,4,5-)
NPW	SW-846 8270C	Trichlorophenol (2,4,6-)
NPW	SW-846 8270C	Dichlorobenzene (1,4-)
NPW	SW-846 8270C	Pyridine
NPW	SW-846 8270C	Dioxane (1,4-)
NPW	SW-846 8270D	Biphenyl (1,1'-)
NPW	SW-846 8270D	Benzaldehyde
NPW	SW-846 8270D	Caprolactam
NPW	SW-846 8270D	Atrazine
NPW	SW-846 8270D	Phenanthrene
NPW	SW-846 8270D	Pyrene
NPW	SW-846 8270D	Acenaphthene
NPW	SW-846 8270D	Acenaphthylene
NPW	SW-846 8270D	Anthracene
NPW	SW-846 8270D	Benzo(ghi)perylene
NPW	SW-846 8270D	Chrysene
NPW	SW-846 8270D	Methylnaphthalene (1-)
NPW	SW-846 8270D	Methylnaphthalene (2-)
NPW	SW-846 8270D	Naphthalene
NPW	SW-846 8270D	Fluoranthene
NPW	SW-846 8270D	Fluorene
NPW	SW-846 8270D	Methylnaphthalene (1-)
NPW	SW-846 8270D	Nitrodiphenylamine (2-)
NPW	SW-846 8270D	Hexachlorophene
NPW	SW-846 8270D	Diphenylhydrazine (1,2-)
NPW	SW-846 8270D	Decane (n-)
NPW	SW-846 8270D	Octadecane (n-)
NPW	SW-846 8270D	Benzo(a)anthracene
NPW	SW-846 8270D	Benzo(a)pyrene

Matrix	Method	Parameter
NPW	SW-846 8270D	Benzo(b)fluoranthene
NPW	SW-846 8270D	Benzo(k)fluoranthene
NPW	SW-846 8270D	Dibenzo(a,h)anthracene
NPW	SW-846 8270D	Indeno(1,2,3-cd)pyrene
NPW	SW-846 8270D	Benzal chloride
NPW	SW-846 8270D	Benzo(j)fluoranthene
NPW	SW-846 8270D	Benzotrichloride
NPW	SW-846 8270D	Benzyl chloride
NPW	SW-846 8270D	Chlorobenzilate
NPW	SW-846 8270D	Dibenz(a,h)acridine
NPW	SW-846 8270D	Dibenzo(a,h)pyrene
NPW	SW-846 8270D	Dibenzo(a,i)pyrene
NPW	SW-846 8270D	Dibenzo(c,g)carbazole (7H-)
NPW	SW-846 8270D	Pentachloroethane
NPW	SW-846 8270D	Tetrachlorobenzene (1,2,3,4-)
NPW	SW-846 8270D	Tetrachlorobenzene (1,2,3,5-)
NPW	SW-846 8270D	Benzyl alcohol
NPW	SW-846 8270D	Acetophenone
NPW	SW-846 8270D	Acetylaminofluorene (2-)
NPW	SW-846 8270D	Aminobiphenyl (4-)
NPW	SW-846 8270D	Aramite
NPW	SW-846 8270D	Chloronaphthalene (1-)
NPW	SW-846 8270D	Diallate (cis)
NPW	SW-846 8270D	Diallate (trans)
NPW	SW-846 8270D	Dibenzo(a,e)pyrene
NPW	SW-846 8270D	Dibenz(a,j)acridine
NPW	SW-846 8270D	Dichlorophenol (2,6-)
NPW	SW-846 8270D	Dimethoate
NPW	SW-846 8270D	Dimethylaminoazobenzene
NPW	SW-846 8270D	Dimethylbenz(a)anthracene (7,12-)
NPW	SW-846 8270D	Dimethyl benzidine (3,3-)
NPW	SW-846 8270D	Dinitrobenzene (1,3-)
NPW	SW-846 8270D	Dinoseb
NPW	SW-846 8270D	Disulfoton
NPW	SW-846 8270D	Famphur
NPW	SW-846 8270D	Isodrin
NPW	SW-846 8270D	Isosafrole (cis-)
NPW	SW-846 8270D	Isosafrole (trans-)
NPW	SW-846 8270D	Kepone
NPW	SW-846 8270D	Methanesulfonate (Ethyl-)

Matrix	Method	Parameter
NPW	SW-846 8270D	Methanesulfonate (Methyl-)
NPW	SW-846 8270D	Methapyrilene
NPW	SW-846 8270D	Methylcholanthrene (3-)
NPW	SW-846 8270D	Napthoquinone (1,4-)
NPW	SW-846 8270D	Napththylamine (1-)
NPW	SW-846 8270D	Napththylamine (2-)
NPW	SW-846 8270D	N-Nitroso-di-n-butylamine
NPW	SW-846 8270D	N-Nitrosomorpholine
NPW	SW-846 8270D	N-Nitrosopiperidine
NPW	SW-846 8270D	Parathion
NPW	SW-846 8270D	Parathion methyl
NPW	SW-846 8270D	Pentachlorobenzene
NPW	SW-846 8270D	Pentachloronitrobenzene
NPW	SW-846 8270D	Phenacetin
NPW	SW-846 8270D	Phenylenediamine (1,4-)
NPW	SW-846 8270D	Phenylethylamine (alpha, alpha-Dimethyl)
NPW	SW-846 8270D	Phorate
NPW	SW-846 8270D	Phosphorothioate (O,O,O-triethyl)
NPW	SW-846 8270D	Phosphorothioate (O,O-diethyl-O-2-pyrazinyl) [Thionazin]
NPW	SW-846 8270D	Picoline (2-)
NPW	SW-846 8270D	Pronamide
NPW	SW-846 8270D	Quinoline -1-Oxide (4-Nitro)
NPW	SW-846 8270D	Safrole
NPW	SW-846 8270D	Sulfotepp
NPW	SW-846 8270D	Tetrachlorobenzene (1,2,4,5-)
NPW	SW-846 8270D	Tetrachlorophenol (2,3,4,6-)
NPW	SW-846 8270D	Toluidine (2-) (2-Methylaniline)
NPW	SW-846 8270D	Toluidine (5-nitro-2-)
NPW	SW-846 8270D	Trinitrobenzene (1,3,5-)
NPW	SW-846 8270D	N-Nitrosodiethylamine
NPW	SW-846 8270D	N-Nitrosopyrrolidine
NPW	SW-846 8270D	Diphenylamine
NPW	SW-846 8270D	Carbazole
NPW	SW-846 8270D	Dichlorobenzene (1,2-)
NPW	SW-846 8270D	Dichlorobenzene (1,3-)
NPW	SW-846 8270D	N-Nitrosodimethylamine
NPW	SW-846 8270D	N-Nitroso-di-n-propylamine
NPW	SW-846 8270D	N-Nitrosomethylethylamine
NPW	SW-846 8270D	Benzidine

Matrix	Method	Parameter
NPW	SW-846 8270D	Aniline
NPW	SW-846 8270D	Hexachloropropene
NPW	SW-846 8270D	Dibenzofuran
NPW	SW-846 8270D	Benzoic acid
NPW	SW-846 8270D	N-Nitrosodiphenylamine
NPW	SW-846 8270D	Dichlorobenzidine (3,3'-)
NPW	SW-846 8270D	Chloroaniline (4-)
NPW	SW-846 8270D	Nitroaniline (2-)
NPW	SW-846 8270D	Nitroaniline (3-)
NPW	SW-846 8270D	Nitroaniline (4-)
NPW	SW-846 8270D	Chloronaphthalene (2-)
NPW	SW-846 8270D	Hexachlorobenzene
NPW	SW-846 8270D	Hexachlorobutadiene (1,3-)
NPW	SW-846 8270D	Hexachlorocyclopentadiene
NPW	SW-846 8270D	Hexachloroethane
NPW	SW-846 8270D	Trichlorobenzene (1,2,4-)
NPW	SW-846 8270D	Bis (2-chloroethoxy) methane
NPW	SW-846 8270D	Bis (2-chloroethyl) ether
NPW	SW-846 8270D	Bis (2-chloroisopropyl) ether
NPW	SW-846 8270D	Chlorophenyl-phenyl ether (4-)
NPW	SW-846 8270D	Bromophenyl-phenyl ether (4-)
NPW	SW-846 8270D	Dinitrotoluene (2,4-)
NPW	SW-846 8270D	Dinitrotoluene (2,6-)
NPW	SW-846 8270D	Isophorone
NPW	SW-846 8270D	Nitrobenzene
NPW	SW-846 8270D	Butyl benzyl phthalate
NPW	SW-846 8270D	Bis (2-ethylhexyl) phthalate
NPW	SW-846 8270D	Diethyl phthalate
NPW	SW-846 8270D	Dimethyl phthalate
NPW	SW-846 8270D	Di-n-butyl phthalate
NPW	SW-846 8270D	Di-n-octyl phthalate
NPW	SW-846 8270D	Acenaphthene
NPW	SW-846 8270D	Anthracene
NPW	SW-846 8270D	Acenaphthylene
NPW	SW-846 8270D	Benzo(a)anthracene
NPW	SW-846 8270D	Benzo(a)pyrene
NPW	SW-846 8270D	Benzo(b)fluoranthene
NPW	SW-846 8270D	Benzo(ghi)perylene
NPW	SW-846 8270D	Benzo(k)fluoranthene
NPW	SW-846 8270D	Chrysene

Matrix	Method	Parameter
NPW	SW-846 8270D	Dibenzo(a,h)anthracene
NPW	SW-846 8270D	Fluoranthene
NPW	SW-846 8270D	Fluorene
NPW	SW-846 8270D	Indeno(1,2,3-cd)pyrene
NPW	SW-846 8270D	Methylnaphthalene (2-)
NPW	SW-846 8270D	Naphthalene
NPW	SW-846 8270D	Phenanthrene
NPW	SW-846 8270D	Pyrene
NPW	SW-846 8270D	Methyl phenol (4-chloro-3-)
NPW	SW-846 8270D	Chlorophenol (2-)
NPW	SW-846 8270D	Dichlorophenol (2,4-)
NPW	SW-846 8270D	Dimethylphenol (2,4-)
NPW	SW-846 8270D	Dinitrophenol (2,4-)
NPW	SW-846 8270D	Dinitrophenol (2-methyl-4,6-)
NPW	SW-846 8270D	Methylphenol (2-)
NPW	SW-846 8270D	Methylphenol (4-)
NPW	SW-846 8270D	Nitrophenol (2-)
NPW	SW-846 8270D	Nitrophenol (4-)
NPW	SW-846 8270D	Pentachlorophenol
NPW	SW-846 8270D	Phenol
NPW	SW-846 8270D	Trichlorophenol (2,4,5-)
NPW	SW-846 8270D	Trichlorophenol (2,4,6-)
NPW	SW-846 8270D	Dichlorobenzene (1,4-)
NPW	SW-846 8270D	Pyridine
NPW	SW-846 8270D	Dioxane (1,4-)
NPW	SW-846 8310	Acenaphthene
NPW	SW-846 8310	Acenaphthylene
NPW	SW-846 8310	Anthracene
NPW	SW-846 8310	Benzo(a)anthracene
NPW	SW-846 8310	Benzo(a)pyrene
NPW	SW-846 8310	Benzo(b)fluoranthene
NPW	SW-846 8310	Benzo(ghi)perylene
NPW	SW-846 8310	Benzo(k)fluoranthene
NPW	SW-846 8310	Chrysene
NPW	SW-846 8310	Dibenzo(a,h)anthracene
NPW	SW-846 8310	Fluoranthene
NPW	SW-846 8310	Fluorene
NPW	SW-846 8310	Indeno(1,2,3-cd)pyrene
NPW	SW-846 8310	Naphthalene
NPW	SW-846 8310	Phenanthrene

Matrix	Method	Parameter
NPW	SW-846 8310	Pyrene
NPW	SW-846 8330	Nitroglycerine
NPW	SW-846 8330	Guanidine nitrate
NPW	SW-846 8330	PETN
NPW	SW-846 8330	HMX
NPW	SW-846 8330	RDX
NPW	SW-846 8330	Trinitrobenzene (1,3,5-)
NPW	SW-846 8330	Dinitrobenzene (1,3-)
NPW	SW-846 8330	Tetryl
NPW	SW-846 8330	Nitrobenzene
NPW	SW-846 8330	Trinitrotoluene (2,4,6-)
NPW	SW-846 8330	Dinitrotoluene (4-amino-2,6-)
NPW	SW-846 8330	Dinitrotoluene (2-amino-4,6-)
NPW	SW-846 8330	Dinitrotoluene (2,4-)
NPW	SW-846 8330	Dinitrotoluene (2,6-)
NPW	SW-846 8330	Nitrotoluene (2-)
NPW	SW-846 8330	Nitrotoluene (3-)
NPW	SW-846 8330	Nitrotoluene (4-)
NPW	SW-846 8330A	Nitroglycerine
NPW	SW-846 8330A	PETN
NPW	SW-846 8330A	HMX
NPW	SW-846 8330A	RDX
NPW	SW-846 8330A	Trinitrobenzene (1,3,5-)
NPW	SW-846 8330A	Dinitrobenzene (1,3-)
NPW	SW-846 8330A	Tetryl
NPW	SW-846 8330A	Nitrobenzene
NPW	SW-846 8330A	Trinitrotoluene (2,4,6-)
NPW	SW-846 8330A	Dinitrotoluene (4-amino-2,6-)
NPW	SW-846 8330A	Dinitrotoluene (2-amino-4,6-)
NPW	SW-846 8330A	Dinitrotoluene (2,4-)
NPW	SW-846 8330A	Dinitrotoluene (2,6-)
NPW	SW-846 8330A	Nitrotoluene (2-)
NPW	SW-846 8330A	Nitrotoluene (3-)
NPW	SW-846 8330A	Nitrotoluene (4-)
NPW	SW-846 9010C	Cyanide - amenable to Cl2
NPW	SW-846 9010C	Cyanide
NPW	SW-846 9012B	Cyanide
NPW	SW-846 9020B	Total organic halides (TOX)
NPW	SW-846 9030B	Sulfides, acid sol. & insol.
NPW	SW-846 9034	Sulfides, acid sol. & insol.

Matrix	Method	Parameter
NPW	SW-846 9040B	Corrosivity - pH waste, >20% water
NPW	SW-846 9040B	pH
NPW	SW-846 9040C	Corrosivity - pH waste, >20% water
NPW	SW-846 9040C	pH
NPW	SW-846 9040C	pH - waste, >20% water
NPW	SW-846 9050A	Specific conductance
NPW	SW-846 9056	Bromide
NPW	SW-846 9056	Nitrite
NPW	SW-846 9056	Sulfate
NPW	SW-846 9056	Nitrate
NPW	SW-846 9056	Chloride
NPW	SW-846 9056	Fluoride
NPW	SW-846 9056A	Bromide
NPW	SW-846 9056A	Nitrite
NPW	SW-846 9056A	Sulfate
NPW	SW-846 9056A	Nitrate
NPW	SW-846 9056A	Chloride
NPW	SW-846 9056A	Fluoride
NPW	SW-846 9060	Total organic carbon (TOC)
NPW	SW-846 9060A	Total organic carbon (TOC)
NPW	SW-846 9066	Phenols
NPW	User Defined 5030C	Volatile organics
NPW	User Defined 8260C	Hexane (n-)
NPW	User Defined 9010B	Cyanide - amenable to Cl_2
NPW	User Defined 9010B	Cyanide
NPW	User Defined 9012A	Cyanide
NPW	User Defined ASTM D93	Ignitability
NPW	User Defined CA LUFT - diesel	Petroleum Organics
NPW	User Defined CA LUFT - diesel	Petroleum Organics
NPW	User Defined EPA 1657	Parathion ethyl
NPW	User Defined EPA 1657	Azinphos methyl
NPW	User Defined EPA 1657	Demeton (o-)
NPW	User Defined EPA 1657	Demeton (s-)
NPW	User Defined EPA 1657	Diazinon
NPW	User Defined EPA 1657	Disulfoton
NPW	User Defined EPA 1657	Malathion
NPW	User Defined EPA 1657	Parathion methyl
NPW	User Defined EPA	Nitrocellulose

Matrix	Method	Parameter
	353.2 Modified	
NPW	User Defined EPA 624	Dichlorodifluoromethane
NPW	User Defined LUFT	Xylene (m-)
NPW	User Defined LUFT	Xylene (o-)
NPW	User Defined LUFT	Xylene (p-)
NPW	User Defined LUFT	Benzene
NPW	User Defined LUFT	Ethylbenzene
NPW	User Defined LUFT	Toluene
NPW	User Defined LUFT	Xylenes (total)
NPW	User Defined LUFT	Methyl tert-butyl ether
NPW	User Defined MA-DEP-EPH, TN-EPH, WI DRO, NW TPH Dx	Diesel range organic
NPW	User Defined MA-DEP-VPH, WI GRO, NW TPH Gx	Gasoline range organic
NPW	User Defined NWTPH-Dx, NWTPH-Gx, NWTPHID	Petroleum Organics
NPW	User Defined SM 6200 B-97	Butanone (2-)
NPW	User Defined SM 6200 B-97	Carbon disulfide
NPW	User Defined SM 6200 B-97	Isopropanol
NPW	User Defined SM 6200 B-97	Trichloro (1,1,2-) trifluoroethane (1,2,2-)
NPW	User Defined SM 6200 B-97	Vinyl acetate
NPW	User Defined SM 6200 B-97	Acetonitrile
NPW	User Defined SM 6200 B-97	Hexanone (2-)
NPW	User Defined SM 6200 B-97	Methyl iodide
NPW	User Defined SM 6200 B-97	Dibromoethane (1,2-) (EDB)
NPW	User Defined SM 6200 B-97	Dichlorodifluoromethane
NPW	User Defined SM 6200 B-97	Dichloroethene (cis-1,2-)
NPW	User Defined SM 6200 B-97	Hexane (n-)
NPW	User Defined SM 6200 B-97	Methyl isobutyl ketone (MIBK)

Matrix	Method	Parameter
NPW	User Defined SM 6200 B-97	Tetrahydrofuran
NPW	User Defined SM 6200 B-97	Styrene
NPW	User Defined SM 6200 B-97	Xylene (o-)
NPW	User Defined SM 6200 B-97	Acetone
NPW	User Defined SM 6200 B-97	Ethyl acetate
NPW	User Defined SM 6200 B-97	Methyl tert-butyl ether
NPW	User Defined SM 6200 B-97	Tert-butyl alcohol
NPW	User Defined SM 6200 B-97	Xylenes (total)
NPW	User Defined SM 6200 B-97	Benzene
NPW	User Defined SM 6200 B-97	Bromodichloromethane
NPW	User Defined SM 6200 B-97	Bromoform
NPW	User Defined SM 6200 B-97	Bromomethane
NPW	User Defined SM 6200 B-97	Carbon tetrachloride
NPW	User Defined SM 6200 B-97	Chlorobenzene
NPW	User Defined SM 6200 B-97	Chloroethane
NPW	User Defined SM 6200 B-97	Chloroethyl vinyl ether (2-)
NPW	User Defined SM 6200 B-97	Chloroform
NPW	User Defined SM 6200 B-97	Chloromethane
NPW	User Defined SM 6200 B-97	Dibromochloromethane
NPW	User Defined SM 6200 B-97	Dichlorobenzene (1,2-)
NPW	User Defined SM 6200 B-97	Dichlorobenzene (1,3-)
NPW	User Defined SM 6200 B-97	Dichlorobenzene (1,4-)
NPW	User Defined SM 6200 B-97	Dichloroethane (1,1-)
NPW	User Defined SM 6200	Dichloroethane (1,2-)

Matrix	Method	Parameter
	B-97	
NPW	User Defined SM 6200 B-97	Dichloroethene (1,1-)
NPW	User Defined SM 6200 B-97	Dichloroethene (trans-1,2-)
NPW	User Defined SM 6200 B-97	Dichloropropane (1,2-)
NPW	User Defined SM 6200 B-97	Dichloropropene (cis-1,3-)
NPW	User Defined SM 6200 B-97	Dichloropropene (trans-1,3-)
NPW	User Defined SM 6200 B-97	Ethylbenzene
NPW	User Defined SM 6200 B-97	Methylene chloride (Dichloromethane)
NPW	User Defined SM 6200 B-97	Tetrachloroethane (1,1,2,2-)
NPW	User Defined SM 6200 B-97	Tetrachloroethene
NPW	User Defined SM 6200 B-97	Toluene
NPW	User Defined SM 6200 B-97	Trichloroethane (1,1,1-)
NPW	User Defined SM 6200 B-97	Trichloroethane (1,1,2-)
NPW	User Defined SM 6200 B-97	Trichloroethene
NPW	User Defined SM 6200 B-97	Trichlorofluoromethane
NPW	User Defined SM 6200 B-97	Vinyl chloride
NPW	User Defined SM 6200C-97	Benzene
NPW	User Defined SM 6200C-97	Ethylbenzene
NPW	User Defined SM 6200C-97	Methyl tert-butyl ether
NPW	User Defined SM 6200C-97	Tert-butyl alcohol
NPW	User Defined SM 6200C-97	Toluene
NPW	User Defined SM 6200C-97	Xylenes (total)
NPW	User Defined SM 6630C-00	Chlordane (alpha)
NPW	User Defined SM 6630C-00	Chlordane (gamma)

Matrix	Method	Parameter
NPW	User Defined SM 6630C-00	Hexachlorobenzene
NPW	User Defined SM 6630C-00	Endrin aldehyde
NPW	User Defined SM 6630C-00	Endrin ketone
NPW	User Defined SM 6640B-01	Dinoseb
NPW	User Defined SM 6640B-01	Dicamba
NPW	User Defined SW846 8260B & 8260C	Gasoline range organic
NPW	User Defined SW-846 8330	Nitroguanidine
NPW	User Defined TX 1005, TX 1006, CT ETPH, NW TPH ID	Petroleum Organics
SCM	EPA 314.0-mod	Perchlorate
SCM	ASTM D240	Heat of combustion (BTU)
SCM	ASTM D5468 and D482	% ash
SCM	ASTM F1647-02A	Total organic carbon (TOC)
SCM	EPA 300.0	Guanidine nitrate
SCM	Other FL - PRO	Petroleum Organics
SCM	Other IA - OA-1	Petroleum Organics
SCM	Other IA - OA-2	Petroleum Organics
SCM	Other NJ DEP EPH 10/08, Rev. 3	Extractable Petroleum Hydrocarbons
SCM	Other NJ-OQA-QAM-025, Rev. 7	Petroleum Organics
SCM	Other USDA-LOI (Loss on ignition)	Total organic carbon (TOC)
SCM	Other Walkley Black	Total organic carbon (TOC)
SCM	SM 2540 G SM 18th Ed.	Total, fixed, and volatile solids (SQAR)
SCM	SM 9222D-97 (Class B only) plus EPA 625/R-92/013 App. F	Fecal coliform
SCM	SW-846 1010	Ignitability
SCM	SW-846 1010A	Ignitability
SCM	SW-846 1030	Ignitability of solids
SCM	SW-846 1110	Corrosivity toward steel
SCM	SW-846 1110A	Corrosivity toward steel
SCM	SW-846 1310A	Metals - organics
SCM	SW-846 1310B	Metals - organics

Matrix	Method	Parameter
SCM	SW-846 1311	Volatile organics
SCM	SW-846 1311	Semivolatile organics
SCM	SW-846 1311	Metals
SCM	SW-846 1312	Metals - organics
SCM	SW-846 1320	Metals - organics
SCM	SW-846 3031	Metals
SCM	SW-846 3040A	Metals
SCM	SW-846 3050B	Metals
SCM	SW-846 3051	Metals
SCM	SW-846 3051A	Metals
SCM	SW-846 3052	Metals
SCM	SW-846 3060A	Metals
SCM	SW-846 3540C	Semivolatile organics
SCM	SW-846 3546	Semivolatile organics
SCM	SW-846 3550B	Semivolatile organics
SCM	SW-846 3550C	Semivolatile organics
SCM	SW-846 3580A	Organics
SCM	SW-846 3585	Organics
SCM	SW-846 3610B	Semivolatile organics
SCM	SW-846 3611B	Semivolatile organics
SCM	SW-846 3620B	Semivolatile organics
SCM	SW-846 3620C	Semivolatile organics
SCM	SW-846 3630C	Semivolatile organics
SCM	SW-846 3660B	Semivolatile organics
SCM	SW-846 3665A	Semivolatile organics
SCM	SW-846 5035A-H	Volatile organics - high conc.
SCM	SW-846 5035A-L	Volatile organics - low conc.
SCM	SW-846 5035H	Volatile organics - high conc.
SCM	SW-846 5035L	Volatile organics - low conc.
SCM	SW-846 6010B	Aluminum
SCM	SW-846 6010B	Antimony
SCM	SW-846 6010B	Arsenic
SCM	SW-846 6010B	Barium
SCM	SW-846 6010B	Beryllium
SCM	SW-846 6010B	Boron
SCM	SW-846 6010B	Cadmium
SCM	SW-846 6010B	Calcium
SCM	SW-846 6010B	Calcium-hardness
SCM	SW-846 6010B	Total hardness
SCM	SW-846 6010B	Chromium

Matrix	Method	Parameter
SCM	SW-846 6010B	Cobalt
SCM	SW-846 6010B	Copper
SCM	SW-846 6010B	Iron
SCM	SW-846 6010B	Lead
SCM	SW-846 6010B	Lithium
SCM	SW-846 6010B	Magnesium
SCM	SW-846 6010B	Manganese
SCM	SW-846 6010B	Molybdenum
SCM	SW-846 6010B	Nickel
SCM	SW-846 6010B	Potassium
SCM	SW-846 6010B	Selenium
SCM	SW-846 6010B	Silica
SCM	SW-846 6010B	Silver
SCM	SW-846 6010B	Sulfur
SCM	SW-846 6010B	Sodium
SCM	SW-846 6010B	Strontium
SCM	SW-846 6010B	Thallium
SCM	SW-846 6010B	Tin
SCM	SW-846 6010B	Titanium
SCM	SW-846 6010B	Vanadium
SCM	SW-846 6010B	Zinc
SCM	SW-846 6010C	Aluminum
SCM	SW-846 6010C	Antimony
SCM	SW-846 6010C	Arsenic
SCM	SW-846 6010C	Barium
SCM	SW-846 6010C	Beryllium
SCM	SW-846 6010C	Boron
SCM	SW-846 6010C	Cadmium
SCM	SW-846 6010C	Calcium
SCM	SW-846 6010C	Calcium-hardness
SCM	SW-846 6010C	Total hardness
SCM	SW-846 6010C	Chromium
SCM	SW-846 6010C	Cobalt
SCM	SW-846 6010C	Copper
SCM	SW-846 6010C	Iron
SCM	SW-846 6010C	Lead
SCM	SW-846 6010C	Lithium
SCM	SW-846 6010C	Magnesium
SCM	SW-846 6010C	Manganese
SCM	SW-846 6010C	Molybdenum

Matrix	Method	Parameter
SCM	SW-846 6010C	Nickel
SCM	SW-846 6010C	Potassium
SCM	SW-846 6010C	Selenium
SCM	SW-846 6010C	Silica
SCM	SW-846 6010C	Silver
SCM	SW-846 6010C	Sulfur
SCM	SW-846 6010C	Sodium
SCM	SW-846 6010C	Strontium
SCM	SW-846 6010C	Thallium
SCM	SW-846 6010C	Tin
SCM	SW-846 6010C	Titanium
SCM	SW-846 6010C	Vanadium
SCM	SW-846 6010C	Zinc
SCM	SW-846 6020	Aluminum
SCM	SW-846 6020	Antimony
SCM	SW-846 6020	Arsenic
SCM	SW-846 6020	Barium
SCM	SW-846 6020	Beryllium
SCM	SW-846 6020	Boron
SCM	SW-846 6020	Cadmium
SCM	SW-846 6020	Calcium
SCM	SW-846 6020	Chromium
SCM	SW-846 6020	Cobalt
SCM	SW-846 6020	Copper
SCM	SW-846 6020	Iron
SCM	SW-846 6020	Lead
SCM	SW-846 6020	Magnesium
SCM	SW-846 6020	Manganese
SCM	SW-846 6020	Molybdenum
SCM	SW-846 6020	Nickel
SCM	SW-846 6020	Potassium
SCM	SW-846 6020	Selenium
SCM	SW-846 6020	Silver
SCM	SW-846 6020	Sodium
SCM	SW-846 6020	Strontium
SCM	SW-846 6020	Thallium
SCM	SW-846 6020	Thorium
SCM	SW-846 6020	Tin
SCM	SW-846 6020	Titanium
SCM	SW-846 6020	Uranium

Matrix	Method	Parameter
SCM	SW-846 6020	Vanadium
SCM	SW-846 6020	Zinc
SCM	SW-846 6020A	Aluminum
SCM	SW-846 6020A	Antimony
SCM	SW-846 6020A	Arsenic
SCM	SW-846 6020A	Barium
SCM	SW-846 6020A	Beryllium
SCM	SW-846 6020A	Boron
SCM	SW-846 6020A	Cadmium
SCM	SW-846 6020A	Calcium
SCM	SW-846 6020A	Chromium
SCM	SW-846 6020A	Cobalt
SCM	SW-846 6020A	Copper
SCM	SW-846 6020A	Iron
SCM	SW-846 6020A	Lead
SCM	SW-846 6020A	Magnesium
SCM	SW-846 6020A	Manganese
SCM	SW-846 6020A	Molybdenum
SCM	SW-846 6020A	Nickel
SCM	SW-846 6020A	Potassium
SCM	SW-846 6020A	Selenium
SCM	SW-846 6020A	Silver
SCM	SW-846 6020A	Sodium
SCM	SW-846 6020A	Strontium
SCM	SW-846 6020A	Thallium
SCM	SW-846 6020A	Thorium
SCM	SW-846 6020A	Tin
SCM	SW-846 6020A	Titanium
SCM	SW-846 6020A	Uranium
SCM	SW-846 6020A	Vanadium
SCM	SW-846 6020A	Zinc
SCM	SW-846 7.3.3.2	Reactivity
SCM	SW-846 7.3.4.2	Reactivity
SCM	SW-846 7196A	Chromium (VI)
SCM	SW-846 7199	Chromium (VI)
SCM	SW-846 7471A	Mercury - solid waste
SCM	SW-846 7471B	Mercury - solid waste
SCM	SW-846 8011	Dibromoethane (1,2-) (EDB)
SCM	SW-846 8011	Dibromo-3-chloropropane (1,2-)
SCM	SW-846 8015B	Ethylene glycol

Matrix	Method	Parameter
SCM	SW-846 8015B	Propylene glycol
SCM	SW-846 8015B	Gasoline range organic
SCM	SW-846 8015B	Diesel range organic
SCM	SW-846 8015C	Ethylene glycol
SCM	SW-846 8015C	Propylene glycol
SCM	SW-846 8015D	Ethylene glycol
SCM	SW-846 8015D	Propylene glycol
SCM	SW-846 8015D	Gasoline range organic
SCM	SW-846 8015D	Diesel range organic
SCM	SW-846 8021B	Xylenes (total)
SCM	SW-846 8021B	Methyl tert-butyl ether
SCM	SW-846 8021B	Benzene
SCM	SW-846 8021B	Ethylbenzene
SCM	SW-846 8021B	Toluene
SCM	SW-846 8021B	Xylene (o-)
SCM	SW-846 8021B	Xylene (m-)
SCM	SW-846 8021B	Xylene (p-)
SCM	SW-846 8081A	Alachlor
SCM	SW-846 8081A	Chlordane (alpha)
SCM	SW-846 8081A	Chlordane (gamma)
SCM	SW-846 8081A	Chloroneb
SCM	SW-846 8081A	Chlorothalonil
SCM	SW-846 8081A	Etridiazole
SCM	SW-846 8081A	Hexachlorobenzene
SCM	SW-846 8081A	Hexachlorocyclopentadiene
SCM	SW-846 8081A	Permethrin
SCM	SW-846 8081A	Propachlor
SCM	SW-846 8081A	Trifluralin
SCM	SW-846 8081A	Aldrin
SCM	SW-846 8081A	Alpha BHC
SCM	SW-846 8081A	Beta BHC
SCM	SW-846 8081A	Delta BHC
SCM	SW-846 8081A	Lindane (gamma BHC)
SCM	SW-846 8081A	Chlordane (technical)
SCM	SW-846 8081A	DDD (4,4'-)
SCM	SW-846 8081A	DDE (4,4'-)
SCM	SW-846 8081A	DDT (4,4'-)
SCM	SW-846 8081A	Dieldrin
SCM	SW-846 8081A	Endosulfan I
SCM	SW-846 8081A	Endosulfan II

Matrix	Method	Parameter
SCM	SW-846 8081A	Endosulfan sulfate
SCM	SW-846 8081A	Endrin
SCM	SW-846 8081A	Endrin aldehyde
SCM	SW-846 8081A	Endrin ketone
SCM	SW-846 8081A	Heptachlor
SCM	SW-846 8081A	Heptachlor epoxide
SCM	SW-846 8081A	Methoxychlor
SCM	SW-846 8081A	Toxaphene
SCM	SW-846 8081B	Alachlor
SCM	SW-846 8081B	Chlordane (alpha)
SCM	SW-846 8081B	Chlordane (gamma)
SCM	SW-846 8081B	Chloroneb
SCM	SW-846 8081B	Chlorothalonil
SCM	SW-846 8081B	Etridiazole
SCM	SW-846 8081B	Hexachlorobenzene
SCM	SW-846 8081B	Hexachlorocyclopentadiene
SCM	SW-846 8081B	Permethrin
SCM	SW-846 8081B	Propachlor
SCM	SW-846 8081B	Trifluralin
SCM	SW-846 8081B	Aldrin
SCM	SW-846 8081B	Alpha BHC
SCM	SW-846 8081B	Beta BHC
SCM	SW-846 8081B	Delta BHC
SCM	SW-846 8081B	Lindane (gamma BHC)
SCM	SW-846 8081B	Chlordane (technical)
SCM	SW-846 8081B	DDD (4,4'-)
SCM	SW-846 8081B	DDE (4,4'-)
SCM	SW-846 8081B	DDT (4,4'-)
SCM	SW-846 8081B	Dieldrin
SCM	SW-846 8081B	Endosulfan I
SCM	SW-846 8081B	Endosulfan II
SCM	SW-846 8081B	Endosulfan sulfate
SCM	SW-846 8081B	Endrin
SCM	SW-846 8081B	Endrin aldehyde
SCM	SW-846 8081B	Endrin ketone
SCM	SW-846 8081B	Heptachlor
SCM	SW-846 8081B	Heptachlor epoxide
SCM	SW-846 8081B	Methoxychlor
SCM	SW-846 8081B	Toxaphene
SCM	SW-846 8082	PCB 1016

Matrix	Method	Parameter
SCM	SW-846 8082	PCB 1221
SCM	SW-846 8082	PCB 1232
SCM	SW-846 8082	PCB 1242
SCM	SW-846 8082	PCB 1248
SCM	SW-846 8082	PCB 1254
SCM	SW-846 8082	PCB 1260
SCM	SW-846 8082A	PCB 1016
SCM	SW-846 8082A	PCB 1221
SCM	SW-846 8082A	PCB 1232
SCM	SW-846 8082A	PCB 1242
SCM	SW-846 8082A	PCB 1248
SCM	SW-846 8082A	PCB 1254
SCM	SW-846 8082A	PCB 1260
SCM	SW-846 8141A	Azinphos methyl
SCM	SW-846 8141A	Chlorpyrifos
SCM	SW-846 8141A	Demeton (o-)
SCM	SW-846 8141A	Demeton (s-)
SCM	SW-846 8141A	Disulfoton
SCM	SW-846 8141A	Bolstar
SCM	SW-846 8141A	Coumaphos
SCM	SW-846 8141A	Dichlorvos
SCM	SW-846 8141A	Dimethoate
SCM	SW-846 8141A	EPN
SCM	SW-846 8141A	Ethoprop
SCM	SW-846 8141A	Fensulfothion
SCM	SW-846 8141A	Fenthion
SCM	SW-846 8141A	Merphos
SCM	SW-846 8141A	Mevinphos
SCM	SW-846 8141A	Naled
SCM	SW-846 8141A	Parathion
SCM	SW-846 8141A	Parathion methyl
SCM	SW-846 8141A	Phorate
SCM	SW-846 8141A	Ronnel
SCM	SW-846 8141A	Stirofos
SCM	SW-846 8141A	Sulfotepp
SCM	SW-846 8141A	TEPP
SCM	SW-846 8141A	Tokuthion [Protothiofos]
SCM	SW-846 8141A	Trichloronate
SCM	SW-846 8141A	Diazinon
SCM	SW-846 8141A	Malathion

Matrix	Method	Parameter
SCM	SW-846 8141B	Azinphos methyl
SCM	SW-846 8141B	Chlorpyrifos
SCM	SW-846 8141B	Demeton (o-)
SCM	SW-846 8141B	Demeton (s-)
SCM	SW-846 8141B	Disulfoton
SCM	SW-846 8141B	Bolstar
SCM	SW-846 8141B	Coumaphos
SCM	SW-846 8141B	Dichlorvos
SCM	SW-846 8141B	Dimethoate
SCM	SW-846 8141B	EPN
SCM	SW-846 8141B	Ethoprop
SCM	SW-846 8141B	Fensulfothion
SCM	SW-846 8141B	Fenthion
SCM	SW-846 8141B	Merphos
SCM	SW-846 8141B	Mevinphos
SCM	SW-846 8141B	Naled
SCM	SW-846 8141B	Parathion
SCM	SW-846 8141B	Parathion methyl
SCM	SW-846 8141B	Phorate
SCM	SW-846 8141B	Ronnel
SCM	SW-846 8141B	Stirofos
SCM	SW-846 8141B	Sulfotepp
SCM	SW-846 8141B	TEPP
SCM	SW-846 8141B	Tokuthion [Protothiofos]
SCM	SW-846 8141B	Trichloronate
SCM	SW-846 8141B	Diazinon
SCM	SW-846 8141B	Malathion
SCM	SW-846 8151A	Dicamba
SCM	SW-846 8151A	DB (2,4-)
SCM	SW-846 8151A	Dinoseb
SCM	SW-846 8151A	Dalapon
SCM	SW-846 8151A	Dichlorprop
SCM	SW-846 8151A	D (2,4-)
SCM	SW-846 8151A	T (2,4,5-)
SCM	SW-846 8151A	TP (2,4,5-) (Silvex)
SCM	SW-846 8151A	MCPA
SCM	SW-846 8151A	MCPP
SCM	SW-846 8015M	Methyl alcohol (Methanol)
SCM	SW-846 8260B	Ethyl alcohol
SCM	SW-846 8260B	Hexane (n-)

Matrix	Method	Parameter
SCM	SW-846 8260B	Methylnaphthalene (1-)
SCM	SW-846 8260B	Methylnaphthalene (2-)
SCM	SW-846 8260B	Butanol (3,3-Dimethyl-1-)
SCM	SW-846 8260B	Trimethylpentane (2,2,4-)
SCM	SW-846 8260B	Trimethylbenzene (1,2,3-)
SCM	SW-846 8260B	Cyclohexane
SCM	SW-846 8260B	Butanol (1-)
SCM	SW-846 8260B	Nitropropane (2-)
SCM	SW-846 8260B	Butyl formate (t-)
SCM	SW-846 8260B	Methyl acetate
SCM	SW-846 8260B	Amyl alcohol (t-)
SCM	SW-846 8260B	Methylcyclohexane
SCM	SW-846 8260B	Octane (-n)
SCM	SW-846 8260B	tert-Amyl Methyl Ether [TAME]
SCM	SW-846 8260B	Bromoethane
SCM	SW-846 8260B	Cyclohexanone
SCM	SW-846 8260B	Diisopropyl Ether [DIPE]
SCM	SW-846 8260B	Tetrahydrofuran
SCM	SW-846 8260B	Ethyl-tert-butyl Ether [ETBE]
SCM	SW-846 8260B	Xylene (m-)
SCM	SW-846 8260B	Xylene (o-)
SCM	SW-846 8260B	Xylene (p-)
SCM	SW-846 8260B	Dichloro-2-butene (cis-1,4-)
SCM	SW-846 8260B	Diethyl ether (Ethyl ether)
SCM	SW-846 8260B	Dichloro-2-butene (trans-1,4-)
SCM	SW-846 8260B	Ethanol
SCM	SW-846 8260B	Trichloro (1,1,2-) trifluoroethane (1,2,2-)
SCM	SW-846 8260B	Vinyl acetate
SCM	SW-846 8260B	Pentachloroethane
SCM	SW-846 8260B	Tert-butyl alcohol
SCM	SW-846 8260B	Dioxane (1,4-)
SCM	SW-846 8260B	Bromobenzene
SCM	SW-846 8260B	Butyl benzene (n-)
SCM	SW-846 8260B	Sec-butylbenzene
SCM	SW-846 8260B	Tert-butylbenzene
SCM	SW-846 8260B	Chlorotoluene (2-)
SCM	SW-846 8260B	Chlorotoluene (4-)
SCM	SW-846 8260B	Isopropylbenzene
SCM	SW-846 8260B	Propylbenzene (n-)
SCM	SW-846 8260B	Isopropyltoluene (4-)

Matrix	Method	Parameter
SCM	SW-846 8260B	Trichlorobenzene (1,2,3-)
SCM	SW-846 8260B	Trimethylbenzene (1,2,4-)
SCM	SW-846 8260B	Trimethylbenzene (1,3,5-)
SCM	SW-846 8260B	Allyl chloride
SCM	SW-846 8260B	Bromochloromethane
SCM	SW-846 8260B	Butadiene (2-chloro-1,3-)
SCM	SW-846 8260B	Dibromoethane (1,2-) (EDB)
SCM	SW-846 8260B	Dibromomethane
SCM	SW-846 8260B	Dibromo-3-chloropropane (1,2-)
SCM	SW-846 8260B	Dichloropropane (1,3-)
SCM	SW-846 8260B	Dichloropropane (2,2-)
SCM	SW-846 8260B	Dichloropropene (1,1-)
SCM	SW-846 8260B	Trichloropropane (1,2,3-)
SCM	SW-846 8260B	Ethyl acetate
SCM	SW-846 8260B	Ethyl methacrylate
SCM	SW-846 8260B	Methacrylonitrile
SCM	SW-846 8260B	Methyl acrylate
SCM	SW-846 8260B	Methyl methacrylate
SCM	SW-846 8260B	Iso-butyl alcohol
SCM	SW-846 8260B	Isopropanol
SCM	SW-846 8260B	N-Nitroso-di-n-butylamine
SCM	SW-846 8260B	Propionitrile
SCM	SW-846 8260B	Acetonitrile
SCM	SW-846 8260B	Benzene
SCM	SW-846 8260B	Chlorobenzene
SCM	SW-846 8260B	Dichlorobenzene (1,2-)
SCM	SW-846 8260B	Dichlorobenzene (1,3-)
SCM	SW-846 8260B	Dichlorobenzene (1,4-)
SCM	SW-846 8260B	Ethylbenzene
SCM	SW-846 8260B	Toluene
SCM	SW-846 8260B	Xylenes (total)
SCM	SW-846 8260B	Bromodichloromethane
SCM	SW-846 8260B	Bromoform
SCM	SW-846 8260B	Bromomethane
SCM	SW-846 8260B	Carbon tetrachloride
SCM	SW-846 8260B	Chloroethane
SCM	SW-846 8260B	Chloroethyl vinyl ether (2-)
SCM	SW-846 8260B	Chloroform
SCM	SW-846 8260B	Chloromethane
SCM	SW-846 8260B	Dichloropropene (trans-1,3-)

Matrix	Method	Parameter
SCM	SW-846 8260B	Dibromochloromethane
SCM	SW-846 8260B	Dichlorodifluoromethane
SCM	SW-846 8260B	Dichloroethane (1,1-)
SCM	SW-846 8260B	Dichloroethane (1,2-)
SCM	SW-846 8260B	Dichloroethene (1,1-)
SCM	SW-846 8260B	Dichloroethene (trans-1,2-)
SCM	SW-846 8260B	Dichloroethene (cis-1,2-)
SCM	SW-846 8260B	Dichloropropane (1,2-)
SCM	SW-846 8260B	Dichloropropene (cis-1,3-)
SCM	SW-846 8260B	Methylene chloride (Dichloromethane)
SCM	SW-846 8260B	Tetrachloroethane (1,1,2,2-)
SCM	SW-846 8260B	Tetrachloroethene
SCM	SW-846 8260B	Trichloroethane (1,1,1-)
SCM	SW-846 8260B	Trichloroethane (1,1,2-)
SCM	SW-846 8260B	Trichloroethene
SCM	SW-846 8260B	Trichlorofluoromethane
SCM	SW-846 8260B	Vinyl chloride
SCM	SW-846 8260B	Acetone
SCM	SW-846 8260B	Carbon disulfide
SCM	SW-846 8260B	Butanone (2-)
SCM	SW-846 8260B	Hexanone (2-)
SCM	SW-846 8260B	Pentanone (4-methyl-2-) (MIBK)
SCM	SW-846 8260B	Methyl tert-butyl ether
SCM	SW-846 8260B	Acrolein
SCM	SW-846 8260B	Acrylonitrile
SCM	SW-846 8260B	Hexachlorobutadiene (1,3-)
SCM	SW-846 8260B	Hexachloroethane
SCM	SW-846 8260B	Naphthalene
SCM	SW-846 8260B	Styrene
SCM	SW-846 8260B	Tetrachloroethane (1,1,1,2-)
SCM	SW-846 8260B	Trichlorobenzene (1,2,4-)
SCM	SW-846 8260C	Ethyl alcohol
SCM	SW-846 8260C	Methylnaphthalene (1-)
SCM	SW-846 8260C	Methylnaphthalene (2-)
SCM	SW-846 8260C	Butanol (3,3-Dimethyl-1-)
SCM	SW-846 8260C	Trimethylbenzene (1,2,3-)
SCM	SW-846 8260C	Cyclohexane
SCM	SW-846 8260C	Butanol (1-)
SCM	SW-846 8260C	Nitropropane (2-)
SCM	SW-846 8260C	Butyl formate (t-)

Matrix	Method	Parameter
SCM	SW-846 8260C	Methyl acetate
SCM	SW-846 8260C	Pentanol (2-Methyl-2-)
SCM	SW-846 8260C	Amyl alcohol (t-)
SCM	SW-846 8260C	Methylcyclohexane
SCM	SW-846 8260C	Octane (-n)
SCM	SW-846 8260C	tert-Amylmethyl ether [TAME]
SCM	SW-846 8260C	Bromoethane
SCM	SW-846 8260C	Cyclohexanone
SCM	SW-846 8260C	Diisopropyl Ether [DIPE]
SCM	SW-846 8260C	Tetrahydrofuran
SCM	SW-846 8260C	Ethyl-tert-butyl Ether [ETBE]
SCM	SW-846 8260C	Xylene (m-)
SCM	SW-846 8260C	Xylene (o-)
SCM	SW-846 8260C	Xylene (p-)
SCM	SW-846 8260C	Dichloro-2-butene (cis-1,4-)
SCM	SW-846 8260C	Diethyl ether (Ethyl ether)
SCM	SW-846 8260C	Dichloro-2-butene (trans-1,4-)
SCM	SW-846 8260C	Trichloro (1,1,2-) trifluoroethane (1,2,2-)
SCM	SW-846 8260C	Vinyl acetate
SCM	SW-846 8260C	Pentachloroethane
SCM	SW-846 8260C	Tert-butyl alcohol
SCM	SW-846 8260C	Dioxane (1,4-)
SCM	SW-846 8260C	Bromobenzene
SCM	SW-846 8260C	Butyl benzene (n-)
SCM	SW-846 8260C	Sec-butylbenzene
SCM	SW-846 8260C	Tert-butylbenzene
SCM	SW-846 8260C	Chlorotoluene (2-)
SCM	SW-846 8260C	Chlorotoluene (4-)
SCM	SW-846 8260C	Isopropylbenzene
SCM	SW-846 8260C	Propylbenzene (n-)
SCM	SW-846 8260C	Isopropyltoluene (4-)
SCM	SW-846 8260C	Trichlorobenzene (1,2,3-)
SCM	SW-846 8260C	Trimethylbenzene (1,2,4-)
SCM	SW-846 8260C	Trimethylbenzene (1,3,5-)
SCM	SW-846 8260C	Allyl chloride
SCM	SW-846 8260C	Bromochloromethane
SCM	SW-846 8260C	Butadiene (2-chloro-1,3-)
SCM	SW-846 8260C	Dibromoethane (1,2-) (EDB)
SCM	SW-846 8260C	Dibromomethane
SCM	SW-846 8260C	Dibromo-3-chloropropane (1,2-)

Matrix	Method	Parameter
SCM	SW-846 8260C	Dichloropropane (1,3-)
SCM	SW-846 8260C	Dichloropropane (2,2-)
SCM	SW-846 8260C	Dichloropropene (1,1-)
SCM	SW-846 8260C	Trichloropropane (1,2,3-)
SCM	SW-846 8260C	Ethyl acetate
SCM	SW-846 8260C	Ethyl methacrylate
SCM	SW-846 8260C	Methacrylonitrile
SCM	SW-846 8260C	Methyl acrylate
SCM	SW-846 8260C	Methyl methacrylate
SCM	SW-846 8260C	Iso-butyl alcohol
SCM	SW-846 8260C	Isopropanol
SCM	SW-846 8260C	N-Nitroso-di-n-butylamine
SCM	SW-846 8260C	Propionitrile
SCM	SW-846 8260C	Acetonitrile
SCM	SW-846 8260C	Benzene
SCM	SW-846 8260C	Chlorobenzene
SCM	SW-846 8260C	Dichlorobenzene (1,2-)
SCM	SW-846 8260C	Dichlorobenzene (1,3-)
SCM	SW-846 8260C	Dichlorobenzene (1,4-)
SCM	SW-846 8260C	Ethylbenzene
SCM	SW-846 8260C	Toluene
SCM	SW-846 8260C	Xylenes (total)
SCM	SW-846 8260C	Bromodichloromethane
SCM	SW-846 8260C	Bromoform
SCM	SW-846 8260C	Bromomethane
SCM	SW-846 8260C	Carbon tetrachloride
SCM	SW-846 8260C	Chloroethane
SCM	SW-846 8260C	Chloroethyl vinyl ether (2-)
SCM	SW-846 8260C	Chloroform
SCM	SW-846 8260C	Chloromethane
SCM	SW-846 8260C	Dichloropropene (trans-1,3-)
SCM	SW-846 8260C	Dibromochloromethane
SCM	SW-846 8260C	Dichlorodifluoromethane
SCM	SW-846 8260C	Dichloroethane (1,1-)
SCM	SW-846 8260C	Dichloroethane (1,2-)
SCM	SW-846 8260C	Dichloroethene (1,1-)
SCM	SW-846 8260C	Dichloroethene (trans-1,2-)
SCM	SW-846 8260C	Dichloroethene (cis-1,2-)
SCM	SW-846 8260C	Dichloropropane (1,2-)
SCM	SW-846 8260C	Dichloropropene (cis-1,3-)

Matrix	Method	Parameter
SCM	SW-846 8260C	Methylene chloride (Dichloromethane)
SCM	SW-846 8260C	Tetrachloroethane (1,1,2,2-)
SCM	SW-846 8260C	Tetrachloroethene
SCM	SW-846 8260C	Trichloroethane (1,1,1-)
SCM	SW-846 8260C	Trichloroethane (1,1,2-)
SCM	SW-846 8260C	Trichloroethene
SCM	SW-846 8260C	Trichlorofluoromethane
SCM	SW-846 8260C	Vinyl chloride
SCM	SW-846 8260C	Acetone
SCM	SW-846 8260C	Carbon disulfide
SCM	SW-846 8260C	Butanone (2-)
SCM	SW-846 8260C	Hexanone (2-)
SCM	SW-846 8260C	Pentanone (4-methyl-2-) (MIBK)
SCM	SW-846 8260C	Methyl tert-butyl ether
SCM	SW-846 8260C	Acrolein
SCM	SW-846 8260C	Acrylonitrile
SCM	SW-846 8260C	Hexachlorobutadiene (1,3-)
SCM	SW-846 8260C	Hexachloroethane
SCM	SW-846 8260C	Naphthalene
SCM	SW-846 8260C	Styrene
SCM	SW-846 8260C	Tetrachloroethane (1,1,1,2-)
SCM	SW-846 8260C	Trichlorobenzene (1,2,4-)
SCM	SW-846 8270C	Biphenyl (1,1'-)
SCM	SW-846 8270C	Caprolactam
SCM	SW-846 8270C	Atrazine
SCM	SW-846 8270C	Phenanthrene
SCM	SW-846 8270C	Pyrene
SCM	SW-846 8270C	Acenaphthene
SCM	SW-846 8270C	Acenaphthylene
SCM	SW-846 8270C	Anthracene
SCM	SW-846 8270C	Benzo(g,h,i)perylene
SCM	SW-846 8270C	Chrysene
SCM	SW-846 8270C	Methylnaphthalene (1-)
SCM	SW-846 8270C	Methylnaphthalene (2-)
SCM	SW-846 8270C	Naphthalene
SCM	SW-846 8270C	Fluoranthene
SCM	SW-846 8270C	Fluorene
SCM	SW-846 8270C	Methylnaphthalene (1-)
SCM	SW-846 8270C	Nitrodiphenylamine (2-)
SCM	SW-846 8270C	Nitrodiphenylamine (2-)

Matrix	Method	Parameter
SCM	SW-846 8270C	Hexachlorophene
SCM	SW-846 8270C	Diphenylhydrazine (1,2-)
SCM	SW-846 8270C	Decane (n-)
SCM	SW-846 8270C	Octadecane (n-)
SCM	SW-846 8270C	Benzo(a)anthracene
SCM	SW-846 8270C	Benzo(a)pyrene
SCM	SW-846 8270C	Benzo(b)fluoranthene
SCM	SW-846 8270C	Benzo(k)fluoranthene
SCM	SW-846 8270C	Dibenzo(a,h)anthracene
SCM	SW-846 8270C	Indeno(1,2,3-c,d)pyrene
SCM	SW-846 8270C	Benzal chloride
SCM	SW-846 8270C	Benzo(j)fluoranthene
SCM	SW-846 8270C	Benzotrichloride
SCM	SW-846 8270C	Benzyl chloride
SCM	SW-846 8270C	Chlorobenzilate
SCM	SW-846 8270C	Dibenz(a,h)acridine
SCM	SW-846 8270C	Dibenzo(a,h)pyrene
SCM	SW-846 8270C	Dibenzo(a,i)pyrene
SCM	SW-846 8270C	Dibenzo(c,g)carbazole (7H-)
SCM	SW-846 8270C	Pentachloroethane
SCM	SW-846 8270C	Tetrachlorobenzene (1,2,3,4-)
SCM	SW-846 8270C	Tetrachlorobenzene (1,2,3,5-)
SCM	SW-846 8270C	Benzyl alcohol
SCM	SW-846 8270C	Acetophenone
SCM	SW-846 8270C	Acetylaminofluorene (2-)
SCM	SW-846 8270C	Aminobiphenyl (4-)
SCM	SW-846 8270C	Aramite
SCM	SW-846 8270C	Chloronaphthalene (1-)
SCM	SW-846 8270C	Diallate (cis)
SCM	SW-846 8270C	Diallate (trans)
SCM	SW-846 8270C	Dibenzo(a,e)pyrene
SCM	SW-846 8270C	Dibenz(a,j)acridine
SCM	SW-846 8270C	Dichlorophenol (2,6-)
SCM	SW-846 8270C	Dimethoate
SCM	SW-846 8270C	Dimethylaminoazobenzene
SCM	SW-846 8270C	Dimethylbenz(a)anthracene (7,12-)
SCM	SW-846 8270C	Dimethyl benzidine (3,3-)
SCM	SW-846 8270C	Dinitrobenzene (1,3-)
SCM	SW-846 8270C	Dinoseb
SCM	SW-846 8270C	Disulfoton

Matrix	Method	Parameter
SCM	SW-846 8270C	Famphur
SCM	SW-846 8270C	Hexachloropropene
SCM	SW-846 8270C	Isodrin
SCM	SW-846 8270C	Isosafrole (cis-)
SCM	SW-846 8270C	Isosafrole (trans-)
SCM	SW-846 8270C	Kepone
SCM	SW-846 8270C	Methanesulfonate (Ethyl-)
SCM	SW-846 8270C	Methanesulfonate (Methyl-)
SCM	SW-846 8270C	Methapyrilene
SCM	SW-846 8270C	Methylcholanthrene (3-)
SCM	SW-846 8270C	Napthoquinone (1,4-)
SCM	SW-846 8270C	Napththylamine (1-)
SCM	SW-846 8270C	Napththylamine (2-)
SCM	SW-846 8270C	N-Nitroso-di-n-butylamine
SCM	SW-846 8270C	N-Nitrosomorpholine
SCM	SW-846 8270C	N-Nitrosopiperidine
SCM	SW-846 8270C	Parathion
SCM	SW-846 8270C	Parathion methyl
SCM	SW-846 8270C	Pentachlorobenzene
SCM	SW-846 8270C	Pentachloronitrobenzene
SCM	SW-846 8270C	Phenacetin
SCM	SW-846 8270C	Phenylenediamine (1,4-)
SCM	SW-846 8270C	Phenylethylamine (alpha, alpha-Dimethyl)
SCM	SW-846 8270C	Phorate
SCM	SW-846 8270C	Phosphorothioate (O,O,O-triethyl)
SCM	SW-846 8270C	Phosphorothioate (O,O-diethyl-O-2-pyrazinyl) [Thionazin]
SCM	SW-846 8270C	Picoline (2-)
SCM	SW-846 8270C	Pronamide
SCM	SW-846 8270C	Quinoline -1-Oxide (4-Nitro)
SCM	SW-846 8270C	Safrole
SCM	SW-846 8270C	Sulfotepp
SCM	SW-846 8270C	Tetrachlorobenzene (1,2,4,5-)
SCM	SW-846 8270C	Tetrachlorophenol (2,3,4,6-)
SCM	SW-846 8270C	Toluidine (2-) (2-Methylaniline)
SCM	SW-846 8270C	Toluidine (5-nitro-2-)
SCM	SW-846 8270C	Trinitrobenzene (1,3,5-)
SCM	SW-846 8270C	N-Nitrosodiethylamine
SCM	SW-846 8270C	N-Nitrosopyrrolidine
SCM	SW-846 8270C	Diphenylamine

Matrix	Method	Parameter
SCM	SW-846 8270C	Carbazole
SCM	SW-846 8270C	Dichlorobenzene (1,2-)
SCM	SW-846 8270C	Dichlorobenzene (1,3-)
SCM	SW-846 8270C	N-Nitrosodimethylamine
SCM	SW-846 8270C	N-Nitroso-di-n-propylamine
SCM	SW-846 8270C	N-Nitrosomethylethylamine
SCM	SW-846 8270C	Benzidine
SCM	SW-846 8270C	Aniline
SCM	SW-846 8270C	Hexachloropropene
SCM	SW-846 8270C	Dibenzofuran
SCM	SW-846 8270C	Benzoic acid
SCM	SW-846 8270C	N-Nitrosodiphenylamine
SCM	SW-846 8270C	Dichlorobenzidine (3,3'-)
SCM	SW-846 8270C	Chloroaniline (4-)
SCM	SW-846 8270C	Nitroaniline (2-)
SCM	SW-846 8270C	Nitroaniline (3-)
SCM	SW-846 8270C	Nitroaniline (4-)
SCM	SW-846 8270C	Chloronaphthalene (2-)
SCM	SW-846 8270C	Hexachlorobenzene
SCM	SW-846 8270C	Hexachlorobutadiene (1,3-)
SCM	SW-846 8270C	Hexachlorocyclopentadiene
SCM	SW-846 8270C	Hexachloroethane
SCM	SW-846 8270C	Trichlorobenzene (1,2,4-)
SCM	SW-846 8270C	Bis (2-chloroethoxy) methane
SCM	SW-846 8270C	Bis (2-chloroethyl) ether
SCM	SW-846 8270C	Bis (2-chloroisopropyl) ether
SCM	SW-846 8270C	Chlorophenyl-phenyl ether (4-)
SCM	SW-846 8270C	Bromophenyl-phenyl ether (4-)
SCM	SW-846 8270C	Dinitrotoluene (2,4-)
SCM	SW-846 8270C	Dinitrotoluene (2,6-)
SCM	SW-846 8270C	Isophorone
SCM	SW-846 8270C	Nitrobenzene
SCM	SW-846 8270C	Butyl benzyl phthalate
SCM	SW-846 8270C	Bis (2-ethylhexyl) phthalate
SCM	SW-846 8270C	Diethyl phthalate
SCM	SW-846 8270C	Dimethyl phthalate
SCM	SW-846 8270C	Di-n-butyl phthalate
SCM	SW-846 8270C	Di-n-octyl phthalate
SCM	SW-846 8270C	Acenaphthene
SCM	SW-846 8270C	Anthracene

Matrix	Method	Parameter
SCM	SW-846 8270C	Acenaphthylene
SCM	SW-846 8270C	Benzo(a)anthracene
SCM	SW-846 8270C	Benzo(a)pyrene
SCM	SW-846 8270C	Benzo(b)fluoranthene
SCM	SW-846 8270C	Benzo(g,h,i)perylene
SCM	SW-846 8270C	Benzo(k)fluoranthene
SCM	SW-846 8270C	Chrysene
SCM	SW-846 8270C	Dibenzo(a,h)anthracene
SCM	SW-846 8270C	Fluoranthene
SCM	SW-846 8270C	Fluorene
SCM	SW-846 8270C	Indeno(1,2,3-c,d)pyrene
SCM	SW-846 8270C	Methylnaphthalene (2-)
SCM	SW-846 8270C	Naphthalene
SCM	SW-846 8270C	Phenanthrene
SCM	SW-846 8270C	Pyrene
SCM	SW-846 8270C	Methyl phenol (4-chloro-3-)
SCM	SW-846 8270C	Chlorophenol (2-)
SCM	SW-846 8270C	Dichlorophenol (2,4-)
SCM	SW-846 8270C	Dimethylphenol (2,4-)
SCM	SW-846 8270C	Dinitrophenol (2,4-)
SCM	SW-846 8270C	Dinitrophenol (2-methyl-4,6-)
SCM	SW-846 8270C	Methylphenol (2-)
SCM	SW-846 8270C	Methylphenol (4-)
SCM	SW-846 8270C	Nitrophenol (2-)
SCM	SW-846 8270C	Nitrophenol (4-)
SCM	SW-846 8270C	Pentachlorophenol
SCM	SW-846 8270C	Phenol
SCM	SW-846 8270C	Trichlorophenol (2,4,5-)
SCM	SW-846 8270C	Trichlorophenol (2,4,6-)
SCM	SW-846 8270C	Dichlorobenzene (1,4-)
SCM	SW-846 8270C	Pyridine
SCM	SW-846 8270D	Biphenyl (1,1'-)
SCM	SW-846 8270D	Benzaldehyde
SCM	SW-846 8270D	Caprolactam
SCM	SW-846 8270D	Atrazine
SCM	SW-846 8270D	Phenanthrene
SCM	SW-846 8270D	Pyrene
SCM	SW-846 8270D	Acenaphthene
SCM	SW-846 8270D	Acenaphthylene
SCM	SW-846 8270D	Anthracene

Matrix	Method	Parameter
SCM	SW-846 8270D	Benzo(g,h,i)perylene
SCM	SW-846 8270D	Chrysene
SCM	SW-846 8270D	Methylnaphthalene (1-)
SCM	SW-846 8270D	Methylnaphthalene (2-)
SCM	SW-846 8270D	Naphthalene
SCM	SW-846 8270D	Fluoranthene
SCM	SW-846 8270D	Fluorene
SCM	SW-846 8270D	Methylnaphthalene (1-)
SCM	SW-846 8270D	Nitrodiphenylamine (2-)
SCM	SW-846 8270D	Hexachlorophene
SCM	SW-846 8270D	Diphenylhydrazine (1,2-)
SCM	SW-846 8270D	Decane (n-)
SCM	SW-846 8270D	Octadecane (n-)
SCM	SW-846 8270D	Benzo(a)anthracene
SCM	SW-846 8270D	Benzo(a)pyrene
SCM	SW-846 8270D	Benzo(b)fluoranthene
SCM	SW-846 8270D	Benzo(k)fluoranthene
SCM	SW-846 8270D	Dibenzo(a,h)anthracene
SCM	SW-846 8270D	Indeno(1,2,3-c,d)pyrene
SCM	SW-846 8270D	Benzal chloride
SCM	SW-846 8270D	Benzo(j)fluoranthene
SCM	SW-846 8270D	Benzotrichloride
SCM	SW-846 8270D	Benzyl chloride
SCM	SW-846 8270D	Chlorobenzilate
SCM	SW-846 8270D	Dibenz(a,h)acridine
SCM	SW-846 8270D	Dibenzo(a,h)pyrene
SCM	SW-846 8270D	Dibenzo(a,i)pyrene
SCM	SW-846 8270D	Dibenzo(c,g)carbazole (7H-)
SCM	SW-846 8270D	Pentachloroethane
SCM	SW-846 8270D	Tetrachlorobenzene (1,2,3,4-)
SCM	SW-846 8270D	Tetrachlorobenzene (1,2,3,5-)
SCM	SW-846 8270D	Benzyl alcohol
SCM	SW-846 8270D	Acetophenone
SCM	SW-846 8270D	Acetylaminofluorene (2-)
SCM	SW-846 8270D	Aminobiphenyl (4-)
SCM	SW-846 8270D	Aramite
SCM	SW-846 8270D	Chloronaphthalene (1-)
SCM	SW-846 8270D	Diallate (cis)
SCM	SW-846 8270D	Diallate (trans)
SCM	SW-846 8270D	Dibenzo(a,e)pyrene

Matrix	Method	Parameter
SCM	SW-846 8270D	Dibenz(a,j)acridine
SCM	SW-846 8270D	Dichlorophenol (2,6-)
SCM	SW-846 8270D	Dimethoate
SCM	SW-846 8270D	Dimethylaminoazobenzene
SCM	SW-846 8270D	Dimethylbenz(a)anthracene (7,12-)
SCM	SW-846 8270D	Dimethyl benzidine (3,3-)
SCM	SW-846 8270D	Dinitrobenzene (1,3-)
SCM	SW-846 8270D	Dinoseb
SCM	SW-846 8270D	Disulfoton
SCM	SW-846 8270D	Famphur
SCM	SW-846 8270D	Isodrin
SCM	SW-846 8270D	Isosafrole (cis-)
SCM	SW-846 8270D	Isosafrole (trans-)
SCM	SW-846 8270D	Kepone
SCM	SW-846 8270D	Methanesulfonate (Ethyl-)
SCM	SW-846 8270D	Methanesulfonate (Methyl-)
SCM	SW-846 8270D	Methapyrilene
SCM	SW-846 8270D	Methylcholanthrene (3-)
SCM	SW-846 8270D	Napthoquinone (1,4-)
SCM	SW-846 8270D	Napththylamine (1-)
SCM	SW-846 8270D	Napththylamine (2-)
SCM	SW-846 8270D	N-Nitroso-di-n-butylamine
SCM	SW-846 8270D	N-Nitrosomorpholine
SCM	SW-846 8270D	N-Nitrosopiperidine
SCM	SW-846 8270D	Parathion
SCM	SW-846 8270D	Parathion methyl
SCM	SW-846 8270D	Pentachlorobenzene
SCM	SW-846 8270D	Pentachloronitrobenzene
SCM	SW-846 8270D	Phenacetin
SCM	SW-846 8270D	Phenylenediamine (1,4-)
SCM	SW-846 8270D	Phenylethylamine (alpha, alpha-Dimethyl)
SCM	SW-846 8270D	Phorate
SCM	SW-846 8270D	Phosphorothioate (O,O,O-triethyl)
SCM	SW-846 8270D	Phosphorothioate (O,O-diethyl-O-2-pyrazinyl) [Thionazin]
SCM	SW-846 8270D	Picoline (2-)
SCM	SW-846 8270D	Pronamide
SCM	SW-846 8270D	Quinoline -1-Oxide (4-Nitro)
SCM	SW-846 8270D	Safrole
SCM	SW-846 8270D	Sulfotepp

Matrix	Method	Parameter
SCM	SW-846 8270D	Tetrachlorobenzene (1,2,4,5-)
SCM	SW-846 8270D	Tetrachlorophenol (2,3,4,6-)
SCM	SW-846 8270D	Toluidine (2-) (2-Methylaniline)
SCM	SW-846 8270D	Toluidine (5-nitro-2-)
SCM	SW-846 8270D	Trinitrobenzene (1,3,5-)
SCM	SW-846 8270D	N-Nitrosodiethylamine
SCM	SW-846 8270D	N-Nitrosopyrrolidine
SCM	SW-846 8270D	Diphenylamine
SCM	SW-846 8270D	Carbazole
SCM	SW-846 8270D	Dichlorobenzene (1,2-)
SCM	SW-846 8270D	Dichlorobenzene (1,3-)
SCM	SW-846 8270D	N-Nitrosodimethylamine
SCM	SW-846 8270D	N-Nitroso-di-n-propylamine
SCM	SW-846 8270D	N-Nitrosomethylethylamine
SCM	SW-846 8270D	Benzidine
SCM	SW-846 8270D	Aniline
SCM	SW-846 8270D	Hexachloropropene
SCM	SW-846 8270D	Dibenzofuran
SCM	SW-846 8270D	Benzoic acid
SCM	SW-846 8270D	N-Nitrosodiphenylamine
SCM	SW-846 8270D	Dichlorobenzidine (3,3'-)
SCM	SW-846 8270D	Chloroaniline (4-)
SCM	SW-846 8270D	Nitroaniline (2-)
SCM	SW-846 8270D	Nitroaniline (3-)
SCM	SW-846 8270D	Nitroaniline (4-)
SCM	SW-846 8270D	Chloronaphthalene (2-)
SCM	SW-846 8270D	Hexachlorobenzene
SCM	SW-846 8270D	Hexachlorobutadiene (1,3-)
SCM	SW-846 8270D	Hexachlorocyclopentadiene
SCM	SW-846 8270D	Hexachloroethane
SCM	SW-846 8270D	Trichlorobenzene (1,2,4-)
SCM	SW-846 8270D	Bis (2-chloroethoxy) methane
SCM	SW-846 8270D	Bis (2-chloroethyl) ether
SCM	SW-846 8270D	Bis (2-chloroisopropyl) ether
SCM	SW-846 8270D	Chlorophenyl-phenyl ether (4-)
SCM	SW-846 8270D	Bromophenyl-phenyl ether (4-)
SCM	SW-846 8270D	Dinitrotoluene (2,4-)
SCM	SW-846 8270D	Dinitrotoluene (2,6-)
SCM	SW-846 8270D	Isophorone
SCM	SW-846 8270D	Nitrobenzene

Matrix	Method	Parameter
SCM	SW-846 8270D	Butyl benzyl phthalate
SCM	SW-846 8270D	Bis (2-ethylhexyl) phthalate
SCM	SW-846 8270D	Diethyl phthalate
SCM	SW-846 8270D	Dimethyl phthalate
SCM	SW-846 8270D	Di-n-butyl phthalate
SCM	SW-846 8270D	Di-n-octyl phthalate
SCM	SW-846 8270D	Acenaphthene
SCM	SW-846 8270D	Anthracene
SCM	SW-846 8270D	Acenaphthylene
SCM	SW-846 8270D	Benzo(a)anthracene
SCM	SW-846 8270D	Benzo(a)pyrene
SCM	SW-846 8270D	Benzo(b)fluoranthene
SCM	SW-846 8270D	Benzo(g,h,i)perylene
SCM	SW-846 8270D	Benzo(k)fluoranthene
SCM	SW-846 8270D	Chrysene
SCM	SW-846 8270D	Dibenzo(a,h)anthracene
SCM	SW-846 8270D	Fluoranthene
SCM	SW-846 8270D	Fluorene
SCM	SW-846 8270D	Indeno(1,2,3-c,d)pyrene
SCM	SW-846 8270D	Methylnaphthalene (2-)
SCM	SW-846 8270D	Naphthalene
SCM	SW-846 8270D	Phenanthrene
SCM	SW-846 8270D	Pyrene
SCM	SW-846 8270D	Methyl phenol (4-chloro-3-)
SCM	SW-846 8270D	Chlorophenol (2-)
SCM	SW-846 8270D	Dichlorophenol (2,4-)
SCM	SW-846 8270D	Dimethylphenol (2,4-)
SCM	SW-846 8270D	Dinitrophenol (2,4-)
SCM	SW-846 8270D	Dinitrophenol (2-methyl-4,6-)
SCM	SW-846 8270D	Methylphenol (2-)
SCM	SW-846 8270D	Methylphenol (4-)
SCM	SW-846 8270D	Nitrophenol (2-)
SCM	SW-846 8270D	Nitrophenol (4-)
SCM	SW-846 8270D	Pentachlorophenol
SCM	SW-846 8270D	Phenol
SCM	SW-846 8270D	Trichlorophenol (2,4,5-)
SCM	SW-846 8270D	Trichlorophenol (2,4,6-)
SCM	SW-846 8270D	Dichlorobenzene (1,4-)
SCM	SW-846 8270D	Pyridine
SCM	SW-846 8310	Acenaphthene

Matrix	Method	Parameter
SCM	SW-846 8310	Acenaphthylene
SCM	SW-846 8310	Anthracene
SCM	SW-846 8310	Benzo(a)anthracene
SCM	SW-846 8310	Benzo(a)pyrene
SCM	SW-846 8310	Benzo(b)fluoranthene
SCM	SW-846 8310	Benzo(g,h,i)perylene
SCM	SW-846 8310	Benzo(k)fluoranthene
SCM	SW-846 8310	Chrysene
SCM	SW-846 8310	Dibenzo(a,h)anthracene
SCM	SW-846 8310	Fluoranthene
SCM	SW-846 8310	Fluorene
SCM	SW-846 8310	Indeno(1,2,3-c,d)pyrene
SCM	SW-846 8310	Naphthalene
SCM	SW-846 8310	Phenanthrene
SCM	SW-846 8310	Pyrene
SCM	SW-846 8330	Nitroglycerine
SCM	SW-846 8330	Guanidine nitrate
SCM	SW-846 8330	PETN
SCM	SW-846 8330	HMX
SCM	SW-846 8330	RDX
SCM	SW-846 8330	Trinitrobenzene (1,3,5-)
SCM	SW-846 8330	Dinitrobenzene (1,3-)
SCM	SW-846 8330	Tetryl
SCM	SW-846 8330	Nitrobenzene
SCM	SW-846 8330	Trinitrotoluene (2,4,6-)
SCM	SW-846 8330	Dinitrotoluene (4-amino-2,6-)
SCM	SW-846 8330	Dinitrotoluene (2-amino-4,6-)
SCM	SW-846 8330	Dinitrotoluene (2,4-)
SCM	SW-846 8330	Dinitrotoluene (2,6-)
SCM	SW-846 8330	Nitrotoluene (2-)
SCM	SW-846 8330	Nitrotoluene (3-)
SCM	SW-846 8330	Nitrotoluene (4-)
SCM	SW-846 8330A	Nitroglycerine
SCM	SW-846 8330A	PETN
SCM	SW-846 8330A	HMX
SCM	SW-846 8330A	RDX
SCM	SW-846 8330A	Trinitrobenzene (1,3,5-)
SCM	SW-846 8330A	Dinitrobenzene (1,3-)
SCM	SW-846 8330A	Tetryl
SCM	SW-846 8330A	Nitrobenzene

Matrix	Method	Parameter
SCM	SW-846 8330A	Trinitrotoluene (2,4,6-)
SCM	SW-846 8330A	Dinitrotoluene (4-amino-2,6-)
SCM	SW-846 8330A	Dinitrotoluene (2-amino-4,6-)
SCM	SW-846 8330A	Dinitrotoluene (2,4-)
SCM	SW-846 8330A	Dinitrotoluene (2,6-)
SCM	SW-846 8330A	Nitrotoluene (2-)
SCM	SW-846 8330A	Nitrotoluene (3-)
SCM	SW-846 8330A	Nitrotoluene (4-)
SCM	SW-846 8440	Total rec. petroleum hydrocarbons
SCM	SW-846 9010C	Cyanide - amenable to Cl2
SCM	SW-846 9010C	Cyanide
SCM	SW-846 9012B	Cyanide
SCM	SW-846 9013	Cyanide
SCM	SW-846 9023	Extractable organic halides (EOX)
SCM	SW-846 9030B	Sulfides, acid sol. & insol.
SCM	SW-846 9034	Sulfides, acid sol. & insol.
SCM	SW-846 9040B	Corrosivity - pH waste, >20% water
SCM	SW-846 9040C	Corrosivity - pH waste, >20% water
SCM	SW-846 9045C	pH - soil and waste
SCM	SW-846 9045D	pH - soil and waste
SCM	SW-846 9056	Bromide
SCM	SW-846 9056	Nitrite
SCM	SW-846 9056	Sulfate
SCM	SW-846 9056	Nitrate
SCM	SW-846 9056	Chloride
SCM	SW-846 9056	Fluoride
SCM	SW-846 9056	Orthophosphate
SCM	SW-846 9056A	Bromide
SCM	SW-846 9056A	Nitrite
SCM	SW-846 9056A	Sulfate
SCM	SW-846 9056A	Nitrate
SCM	SW-846 9056A	Chloride
SCM	SW-846 9056A	Fluoride
SCM	SW-846 9056A	Orthophosphate
SCM	SW-846 9060	Total organic carbon (TOC)
SCM	SW-846 9060A	Total organic carbon (TOC)
SCM	SW-846 9071B	Oil & grease - sludge-hem-npm
SCM	SW-846 9071B	Oil & grease - sludge-hem
SCM	SW-846 9095	Free liquid
SCM	SW-846 9095B	Free liquid

Matrix	Method	Parameter
SCM	User Defined 8260C	Hexane (n-)
SCM	User Defined 9010B	Cyanide - amenable to Cl2
SCM	User Defined 9010B	Cyanide
SCM	User Defined 9012A	Cyanide
SCM	User Defined 9013A	Cyanide
SCM	User Defined 9095A	Free liquid
SCM	User Defined ASTM D93	Ignitability
SCM	User Defined CA LUFT - diesel	Petroleum Organics
SCM	User Defined CA LUFT - diesel	Petroleum Organics
SCM	User Defined LUFT	Xylene (m-)
SCM	User Defined LUFT	Xylene (o-)
SCM	User Defined LUFT	Xylene (p-)
SCM	User Defined LUFT	Benzene
SCM	User Defined LUFT	Ethylbenzene
SCM	User Defined LUFT	Toluene
SCM	User Defined LUFT	Xylenes (total)
SCM	User Defined LUFT	Methyl tert-butyl ether
SCM	User Defined MA-DEP-EPH, TN-EPH, WI DRO, NW TPH Dx	Diesel range organic
SCM	User Defined MA-DEP-VPH, WI GRO, NW TPH Gx	Gasoline range organic
SCM	User Defined NWTPH-Dx, NWTPH-Gx, NWTPHID	Petroleum Organics
SCM	User Defined SW846 8260B & 8260C	Gasoline range organic
SCM	User Defined SW-846 8330	Nitroguanidine
SCM	User Defined TX 1005, TX 1006, CT ETPH, NW TPH ID	Petroleum Organics

3.4 ABBREVIATIONS/ACRONYMS

The quality department is responsible for setting up and maintaining a list of abbreviations used in the quality manual.

ABBREVIATION	***DESCRIPTION***
A2LA	*AMERICAN ASSOCIATION FOR LABORATORY ACCREDITATION*
AIHA	*AMERICAN INDUSTRIAL HYGIENE ASSOCIATION*
AIHA-LAP	*AIHA's LABORATORY ACCREDITATION PROGRAM*
AIHA-PAT	*AIHA's PROFICIENCY ANALYICAL TESTING PROGRAM*
BLANK	*See FIELD, TRIP, METHOD, EQUIPMENT, INSTRUMENT, REAGENT*
CAL	*CALIBRATION*
CCB	*CONTINUING CALIBRATION BLANK*
CCV	*CONTINUING CALIBRATION VERIFICATION*
CDOC	*CONTINUING DEMONSTRATION OF CAPABILITY*
COC	*CHAIN OF CUSTODY*
CA	*CORRECTIVE ACTION*
CRM	*CERTIFIED REFERENCE MATERIAL*
DQO	*DATA QUALITY OBJECTIVES*
DUP	*DUPLICATE*
EB	*EQUIPMENT BLANK*
FB	*FIELD BLANK*
GC	*GAS CHROMATOGRAPHY*
GCMS	*GAS CHROMATOGRAPHY MASS SPECTROMETRY*
HPLC	*HIGH PRESSURE LIQUID CHROMATOGRAPHY*
IB	*INSTRUMENT BLANK*
IC	*ION CHROMATOGRAPHY*
ICP	*INDUCTIVELY COUPLED PLASMA*
ICPMS	*INDUCTIVELY COUPLED PLASMA MASS SPECTROMETRY*
ICS	*INTERFERENCE CHECK SAMPLE*
ICV – See SSCV	*INITIAL CALIBRATION VERIFICATION*
IDOC	*INITIAL DEMONSTRATION OF CAPABILITY (SEE ALSO CDOC)*
IDL	*INSTRUMENT DETECTION LIMIT*
ISTD	*INTERNAL STANDARD*
LCS	*LABORATORY CONTROL SAMPLE (Typically* 2^{ND} *Source)*
LCSD	*LABORATORY CONTROL SAMPLE DUPLICATE*
LOD	*LIMIT OF DETECTION*
LOQ	*LIMIT OF QUANTITATION*
LDR	*LINEAR DYNAMIC RANGE*
MAT	*MATRIX*
MS	*MATRIX SPIKE*
MSD	*MATRIX SPIKE DUPLICATE*

ABBREVIATION	***DESCRIPTION***
MDL	*METHOD DETECTION LIMIT*
MB	*METHOD BLANK*
NC	*NEGATIVE CONTROL*
% Rec	*PERCENT RECOVERY*
PC	*POSITIVE CONTROL*
PDL	*PRACTICAL DETECTION LIMIT*
PQL	*PRACTICAL QUANTITATION LIMIT also See Reporting Limit (RL)*
PT	*PROFICIENCY TEST SAMPLE*
QUAL	*QUALIFIER*
QA	*QUALITY ASSURANCE*
QAM	*QUALITY ASSURANCE MANUAL*
QAO	*QUALITY ASSURANCE OFFICER*
QC	*QUALITY CONTROL*
RF	*RESPONSE FACTOR*
RB	*REAGENT BLANK*
RL	*REPORTING LIMIT*
RLV	*REPORTING LIMIT VERIFICATION*
RPD	*RELATIVE PERCENT DIFFERENCE*
RSD	*RELATIVE STANDARD DEVIATION*
SSCV	*SECONDARY SOURCE CALIBRATION VERIFICAION*
SOP	*STANDARD OPERATING PROCEDURE*
SRM	*STANDARD REFERENCE MATERIAL*
SURR	*SURROGATE*
SVOC	*SEMI-VOLATILE ORGANIC COMPOUND*
TNI	*THE NELAC INSTITUTE*
UV	*ULTRAVIOLET*
VOC	*VOLATILE ORGANIC COMPOUND*

4.0 MANAGEMENT REQUIREMENTS

4.1 ORGANIZATION

4.1.1 Legal identity

The laboratory is authorized under Title 62 of the Tennessee Code Annotated and is identified as Environmental Science Corporation (d.b.a. ESC Lab Sciences) located at 12065 Lebanon Road, Mount Juliet, TN 37122

4.1.2 Organization

The laboratory is a public entity and is structured to provide environmental support services in compliance with numerous federal, state, and local regulations as well as to meet the analytical needs of the customer.

4.1.3 Facilities Under Management System

The scope of the ESC management system is comprehensive and covers all technical and supporting work conducted at all facilities including the primary Lebanon Road location as well as customer support and shipping operations across the US.

4.1.4 Independence

ESC Lab Sciences is an independent analytical facility, and is not a part of another organization.

4.1.5 Laboratory Managerial Polices

ESC Lab Sciences must have the following:

- Managerial and technical personnel have the authority and resources needed to carry out their duties. Management bears the specific responsibility for the implementation, maintenance, and improvement of the laboratory’s management system. This includes the identification of any departures from the management system or standard operating procedures, and to initiate actions to prevent or minimize such departures.
- Management and personnel that are free from any undue pressures and influences that may adversely affect the quality of their work. The organizational structure indicated in this section is designed to minimize the potential for conflicts or undue stresses that might influence the technical judgment of analytical personnel. Analytical personnel are generally isolated from customer contact as much as practical. In addition, the laboratory workload is continually reviewed and managed in such a way as to reduce the potential for undue production pressure on analytical personnel.

- Policies and procedures to ensure the protection of its customers' confidentiality. The laboratory's confidentiality policy is to not divulge or release any information to a third party without proper written authorization. All information pertaining to a particular customer will remain confidential. Data will be released to outside agencies only with written authorization from the customer or where federal or state law requires the laboratory to do so. Samples are generally identified with laboratory identification numbers, and access to electronic records and reports is password protected. Confidentiality statements are applied to fax and e-mail communications. All personnel, including contract and temporary, are required to sign an "Attestation of Ethics and Confidentiality" at the time of employment and during annual refresher training. Violations of this document result in serious consequences, including prosecution and termination, if necessary. For more information see the ESC Policy Manual and SOP #010102, *Ethics, Data Integrity, and Confidentiality*.

- Policies and procedures to avoid involvement in any activities that would diminish confidence in its competence, impartiality, judgment or operational integrity. For more information see the ESC Policy Manual and SOP #010102, Ethics, Data Integrity, and Confidentiality. The laboratory's data integrity system is also discussed in Section 4.2.8 below.

- A defined organization and management structure. The laboratory's organizational chart can be found at the end of this section.

- Specifications of the responsibility, authority, and interrelationships of all personnel who manage, perform, or verify work affecting the quality of the analytical results. Job descriptions are documented and maintained by the Human Resources department. It is the laboratory's policy that each individual understands his or her particular responsibilities and how to report problems when they occur.

- Adequate supervision provided to all analytical staff, including trainees, by persons familiar with the analytical methods and procedures.

- Technical management which has overall responsibility for the technical operations. This includes providing the resources needed to ensure the required quality of laboratory operations is met as per the policies and procedures documented in this Quality Assurance Manual. This technical management includes the Chief Executive Officer, the President, the Director of Operations, the Organics Manager, the Inorganics Manager, and each individual department supervisor.

- Quality management which has the responsibility and authority for ensuring that the management system related to quality is implemented and followed at all times. Currently the Compliance Director and the Quality Assurance Director have been appointed for this task. These staff members have direct access to the highest level of management at which decisions are made on laboratory policy and resources.

- Appointed deputies for key managerial personnel. The following table defines who assumes the responsibilities of key personnel in their absence:

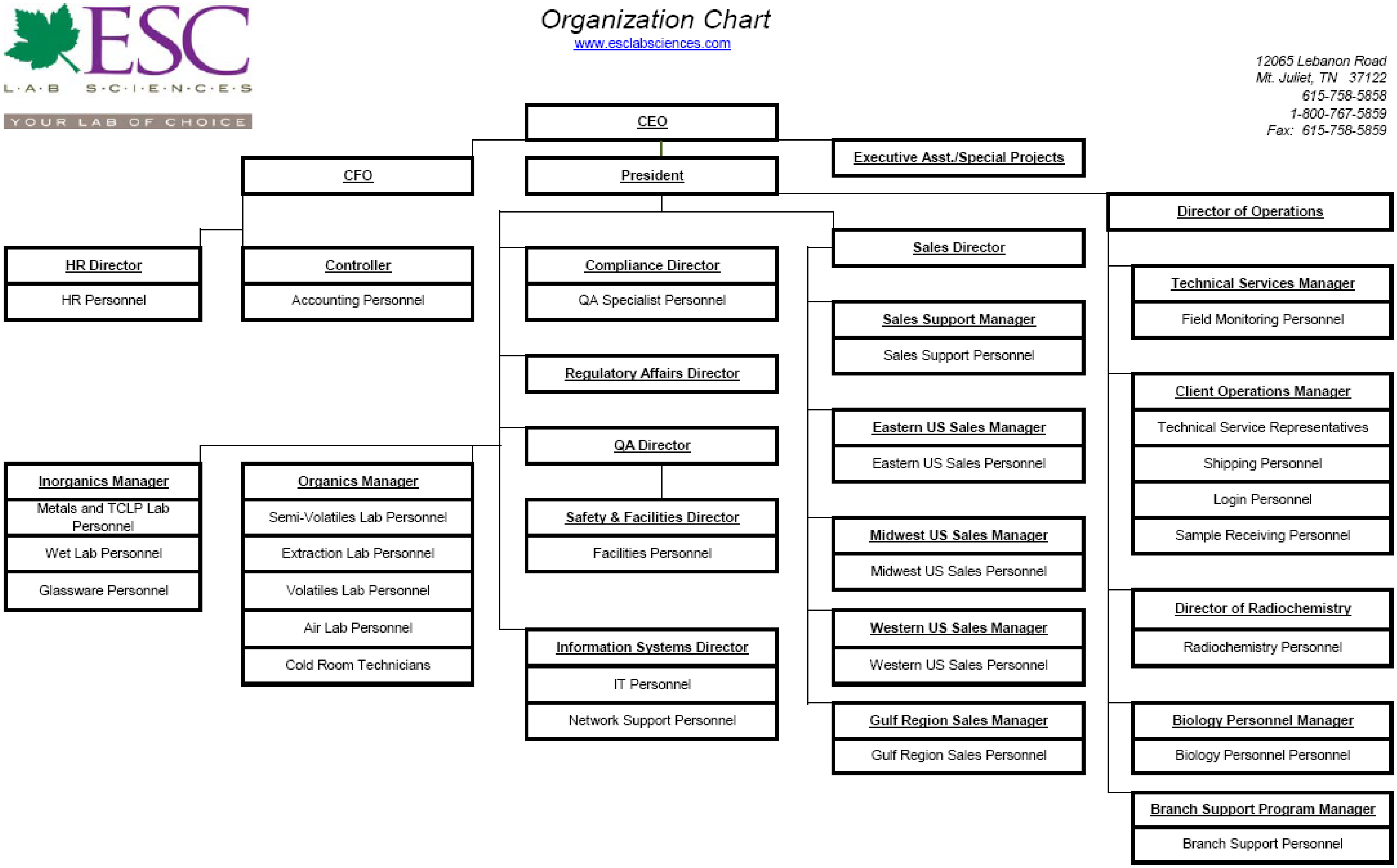
PRIMARY	DEPUTY
Chief Executive Officer	President
President	Chief Executive Officer
Director of Operations	Technical Services Manager
Organics Manager	President and Department Supervisors/Leads
Inorganics Manager	President and Department Supervisors/Leads
Compliance Director	Quality Assurance Director
Quality Assurance Director	Compliance Director
Information Systems Director	Ad Hoc (Applicable IT personnel as needed)

- Personnel that are aware of the relevance and importance of their activities and how they contribute to the achievement of the objectives of the management system. Laboratory management ensures that all personnel are aware that their job is needed, and how each role contributes to the laboratory’s business goals. All personnel are required to familiarize themselves with the quality documentation relevant to their position and implement these policies and procedures in their work. All personnel must ensure that the generation and reporting of quality analytical data is a fundamental priority.

4.1.6 Laboratory Communication

Laboratory management ensures that appropriate communication processes are established within the laboratory and that communication takes place regarding the effectiveness of the management system. Laboratory personnel (including supervisors and managers) communicate as needed through meetings, memos, and/or e-mails.

<u>Figure 4.1 Organizational Chart (*Subject to change*)</u>



4.2 Management System

4.2.1 General

ESC Lab Sciences has established, implemented, and maintains a management system appropriate to the scope of its activities. ESC Lab Sciences has documented its policies and procedures to the extent necessary to assure the quality of the analytical test results. The ESC Lab Sciences management system's documentation is communicated to, understood by, available to, and implemented by the appropriate laboratory personnel.

4.2.2 Management’s Quality Policy Statement

ESC Lab Sciences has a diverse accreditation/certification program which represents greater than 48 separate state and national accreditations. This requires commitment to the laboratory’s quality system, and it also requires continuous improvement to comply with all the applicable state, federal, and industry standards. ISO 17025 is maintained as the minimum foundation to meet each program requirement.

ESC Lab Sciences management is committed to providing our customers reliable data of known quality that meets their requirements by following the quality system that is documented in this Quality Assurance Manual. Management is committed to using good professional practices and demonstrates its commitment to quality by providing the personnel, equipment, and facilities necessary to ensure the laboratory gives our customers the highest possible standard of service.

The primary responsibility for quality rests with each individual within ESC Lab Sciences. All personnel are required to familiarize themselves with the quality documentation relevant to their position and implement these policies and procedures in their work. All personnel must ensure that the generation and reporting of quality analytical data is a fundamental priority. This focus on quality is applied to initial project planning, continued through all field and laboratory activities, and is ultimately included in the final report generation.

4.2.3 Management’s Commitment to the Management System

ESC’s management is committed to the development, implementation, and continual improvement of the laboratory’s management system. Evidence of this commitment can be found in the policies and procedures that are included in this Quality Assurance Manual which includes, but is not limited to, records of management review meetings as per section 4.15 below.

4.2.4 Communication of Customer and Regulatory Requirements

ESC’s management communicates to the organization the importance of meeting customer and regulatory requirements. This is accomplished in writing through this Quality Assurance Manual, ESC's Policy Manual, and through ESC's Standard Operating Procedures. This is also accomplished verbally through staff meetings.

4.2.5 Supporting and Technical Procedures

The full list of supporting and technical procedures used by the laboratory is maintained by the Quality Assurance Department. This list can be provided upon request. This Quality Assurance Manual contains references to these procedures where applicable, and outlines the structure of the documentation used in the laboratory's management system.

4.2.6 Management Roles and Responsibilities

The roles and responsibilities of some technical and quality management are defined below. More information can be found in the job descriptions that are maintained by the Human Resources department. All managers and supervisors are responsible to ensure that their respective departments comply with all the applicable state, federal, and industry standards.

Chief Executive Officer

Peter Schulert, Bachelor of Science in Chemistry, is the laboratory's Chief Executive Officer (CEO). He joined ESC in 1987 after the completion of his service with the United States Naval Submarine Service. In his five years of nuclear submarine experience in the Navy, Mr. Schulert qualified as an Officer of the Deck. This qualification included supervision of nuclear reactors and power plant operations. His vision for automation and customer services has been a key component of ESC's rise to the top ranks of the industry. Under his leadership, ESC has become a large single location laboratory, with a comprehensive national certification program and industry leading data management tools. In his absence, all responsibilities are delegated to the ESC President.

President

John Mitchell, Bachelor of Science in Chemistry, is the laboratory's President. He joined ESC in 2014 after gaining over 25 years of experience in commercial laboratory operations and management. He has served as a National Program Director for Oil and Gas Programs for several years, assisting exploration and production industrial customers with the establishment and management of risk-based analytical programs to ensure compliance with regulatory requirements and to develop additional strategies to reduce long term environmental impact liability. He directed emergency response actions, leading the laboratory response for multiple large scale mobilizations across the country. Mr. Mitchell is responsible for developing and executing ESC's strategic plan. In his absence, all operational responsibilities are delegated to the Chief Executive Officer.

Director of Operations

Eric Johnson, B.S. in Chemistry, is the laboratory's Director of Operations and is primarily responsible for the Project Management, Branch Support, Shipping, and Receiving departments. He has been involved in many aspects of environmental analyses since 1991, and has vast experience in managing the daily laboratory and customer service operations of ESC Lab Sciences. He focuses his background and experience on the improvement of existing systems in order to improve quality and maximize efficiency. He reports directly to the President. In his absence, his responsibilities are delegated to the Technical Services Manager and then to individual department managers.

Organics Manager

Chris Johnson, B.S. in Biology, is the Organics Manager. He has more than 15 years of laboratory experience which includes supervising laboratory personnel and also performing analyses for metals, volatile organic compounds, and semi-volatile organic compounds in support of the Safe Drinking Water Act, Clean Water Act, Resource Conservation and Recovery Act, and numerous other state and regulatory programs. His responsibilities are to share the vision and direction of laboratory management with the organic departments, effectively communicate with laboratory management and to personnel within the organic departments, to develop goals within the organic departments, to provide the information and resources necessary to reach each goal, and for ensuring the organic departments are providing accurate analytical data in the most efficient manner possible within regulatory guidelines. He is also responsible for the research, evaluation, implementation, and validation of new instrumentation and methodologies. In his absence, his responsibilities are delegated to the President then to individual department supervisors and/or leads.

Inorganics Manager

Johnny Davis, B.S. in Biology, is the Inorganics Manager. He has 13 years of laboratory experience which includes supervising laboratory personnel and also performing analyses for metals and semi-volatile organic compounds in support of the Safe Drinking Water Act, Clean Water Act, Resource Conservation and Recovery Act, and numerous other state and regulatory programs. His responsibilities are to share the vision and direction of laboratory management with the inorganic departments, effectively communicate with laboratory management and to personnel within the inorganic departments, to develop goals within the inorganic departments, to provide the information and resources necessary to reach each goal, and for ensuring the inorganic departments are providing accurate analytical data in the most efficient manner possible within regulatory guidelines. He is also responsible for the research, evaluation, implementation, and validation of new instrumentation and methodologies. In his absence, his responsibilities are delegated to the President then to individual department supervisors and/or leads.

Compliance Director

Jim Brownfield, B.S. in Chemistry, is the Compliance Director. His primary responsibility is to ensure regulatory compliance of the laboratory. He is also responsible for managing the implementation, monitoring, and development of the laboratory’s Quality Assurance Systems; maintaining the laboratory’s Quality Assurance Manual; and ensuring all laboratory personnel are strictly adhering to the laboratory’s ethics policy. He also performs other Quality Assurance activities including method validation, technical writing, and participation in internal and external assessments. In addition, he oversees the QA data review team. He has more than 15 years of experience in various supervisory and managerial roles in the environmental laboratory industry. Over the years he has gained an extensive and detailed understanding of regulatory and accreditation requirements of federal and various state accreditation agencies. He has successfully designed, developed, implemented, and maintained Quality Assurance Systems in multiple laboratories. In his absence, all responsibilities are delegated to the Quality Assurance Director.

Quality Assurance Director

Steve Miller, B.S. in Microbiology, is the laboratory Quality Assurance Director and is responsible for managing the implementation, monitoring, and development of the laboratory’s Quality Assurance Systems. In this role, he also oversees safety, waste management, internal and external audits, and new method implementation. He has been involved in many aspects of the environmental industry since 1990. He has an in-depth knowledge of GC and GCMS methods and instrumentation having hands-on experience with MS, PID/FID, FID, and ECD detectors. He has years of experience validating all types of environmental data. He has served as technical support for many environmental site investigation and/or remediation projects, primary author of several project-specific Quality Assurance Project Plans, support for RCRA-permitted activities at major oil refineries (including permit modification), and primary author of the first hazardous waste delisting petition approved by U.S. EPA Region 8. In his absence, all responsibilities are delegated to the Compliance Director.

Information Systems Director

Nick Parker, B.S. in Plant and Soil Science, is the laboratory’s Information Systems Director. He has more than 15 years of laboratory experience in Organic analytical methods/instrumentation in the production laboratory environment and an expertise within information technologies and process automation. Mr. Parker is responsible for ESC's data management, information security, and software development while leading a team of developers, specialists, and Database Administrators. His unique understanding of laboratory operations and environmental methodology contributes to ESC's well managed software development and deployment within all laboratory and quality departments. In his absence, all responsibilities are delegate to applicable personnel in the IT department.

4.2.7 Management of System Changes

Top management ensures that the integrity of the management system is maintained when changes to the management system are planned and implemented. This includes ensuring that quality system documentation is updated as needed.

4.2.8 Data Integrity System

ESC Lab Sciences is committed to ensuring the integrity of its data and providing valid data of known and documented quality to its customers. ESC is also committed to creating and maintaining a culture of quality throughout the organization. The elements in ESC's data integrity system include:

- A standardized data integrity training program that is given to all new employees and a yearly refresher course is also presented to all employees.
- All ESC personnel, including contract and temporary, are required to sign an "Attestation of Ethics and Confidentiality" at the time of employment and during annual refresher training.
- An in-depth periodic monitoring of data integrity which includes, but is not limited to, the following: peer data review, internal audits, QA data review of raw data, and proficiency testing studies.
- A process that allows for confidential reporting of alleged data integrity issues. Currently, an anonymous hotline is available to all employees that is managed by an outside vendor. Messages are collected, documented, reviewed, and will be followed up on by senior management to resolve the matter. Comments made on this hotline are confidential, and callers will remain anonymous.

Anonymous Hotline Number: 1-800-398-1496

Additional information about the laboratory's data integrity system can be found in SOP# 010102 *Ethics, Data Integrity, and Confidentiality*. This SOP is signed by top management and is reviewed at least annually.

4.2.9 Policy for Use and Control of Electronic Signatures

Electronic signatures must be controlled by the individual as electronic files. Electronic signature files must be stored in a secure password protected environment, and are not sent to or used by other individuals. Electronic signatures carry the same weight as handwritten signatures with regards to document approval.

4.3 DOCUMENT MANAGEMENT

This section describes procedures for document management, which includes controlling, distributing, reviewing, and accepting modifications. The purpose of document management is to ensure that adequate instruction is readily available for laboratory employees and to preclude the use of invalid and/or obsolete documents.

4.3.1 Document Control Procedure

ESC has an established procedure for managing documents that are part of the quality system. The list of managed documents includes, but is not limited to, Standard Operating Procedures (both technical and non-technical), the Quality Assurance Manual, policy statements, work-processing documents, charts, and forms that have a direct bearing on the quality system.

Documents required by the management system are managed per the SOP #010103, *Document Control and Distribution*.

4.3.2 Document Approval and Issue

Documents are reviewed and approved for use by authorized personnel prior to issue. A master list of all managed documents is maintained identifying the current revision status and distribution of the controlled documents. This establishes that there are no invalid or obsolete documents in use.

The SOP #010103, *Document Control and Distribution* ensures:

- Only currently approved document versions are available at points of use
- Documents are reviewed periodically and revised if necessary
- Invalid or obsolete documents are promptly removed from general use
- Obsolete documents retained for audit or knowledge preservation purposes are suitably marked and/or isolated to prevent accidental use

Documents that are generated internally by the laboratory are uniquely identified with the following:

- Date of issue and/or revision identification
- Page numbering
- Total number of pages or a mark to indicate the end of the document
- The issuing authority(ies)

4.3.3 Changes to Controlled Documents

Document changes are reviewed and approved by the original approving authority(ies) unless specifically designated otherwise. Designated authorities are required to have pertinent background information upon which to base their review and approval.

Where practicable, the altered text or new text in the draft is identified during the revision or review process to provide for easy identification of the modifications. Minor SOP changes that occur in the interim of each major revision of the procedure are indicated in the ESC SOP/Minor Revision Form that is attached to the SOP. All SOPs contain a revision history that provides details of changes during periodic reviews and/or major SOP revisions.

The document management process allows for “minor revisions” or amendments to SOPs where changes are not sufficient to cause a full procedure change. Minor revisions may take the form of handwritten or typed notes on an approved SOP Minor Revision form. Approval of these minor revisions are indicated by the initials of the approval authorities. The modified document is then distributed, and obsolete documents are removed. Minor revisions to documents are incorporated into the next full revision as soon as practical.

Electronic documents, such as the Quality Assurance Manual and SOPs, are maintained electronically on protected directories. All laboratory personnel have access to directories that contain the currently approved versions, but edit rights are restricted to authorized personnel only. Obsolete versions of electronic documents are maintained in directories that can only be accessed be authorized personnel.

4.3.4 Quality Assurance Manual

The Compliance Director is responsible for maintaining the currency of the Quality Assurance Manual.

The Quality Assurance Manual is reviewed/revised annually or whenever a change is deemed necessary by laboratory management to ensure it still reflects current practices and meets the requirements of any applicable regulations or customer specifications.

The Quality Assurance Manual contains the following required items as defined by the 2009 TNI Standard (V1:M2, Section 4.2.8.3):

- A document title
- The laboratory's full name and address
- The name, address (if different from above), and telephone number of individual(s) responsible for the laboratory;
- The identification of all major organizational units which are to be covered by this quality manual and the effective date of the version
- Identification of the laboratory's approved signatories;
- The signed and dated concurrence (with appropriate names and titles), of all responsible parties including the quality manager, technical manager(s), and the agent who is in charge of all laboratory activities, such as the laboratory director or laboratory manager.
- The objectives of the management system and contain or reference the laboratory’s policies and procedures
- The laboratory’s official quality policy statement, which shall include management system objectives and management’s commitment to ethical laboratory practices and to upholding the requirements of ISO 17025 and the TNI Standard
- Table of contents, and applicable lists of references, glossaries and appendices.

This Quality Assurance Manual also contains or references the following required items as defined by the 2009 TNI Standard (V1:M2, Section 4.2.8.4):

- All maintenance, calibration and verification procedures used by the laboratory in conducting tests
- Major equipment and reference measurement standards used as well as the facilities and services used by the laboratory in conducting tests
- Verification practices, which may include inter-laboratory comparisons, proficiency testing programs, use of reference materials and internal quality control schemes
- Procedures for reporting analytical results
- The organization and management structure of the laboratory, its place in any parent organization, and relevant organizational charts

- Procedures to ensure that all records required under ISO 17025:2005 and the TNI Standard are retained, as well as procedures for control and maintenance of documentation through a document control system that ensures that all standard operating procedures (SOPs), manuals, or documents clearly indicate the time period during which the procedure or document was in force
- Job descriptions of key staff and reference to the job descriptions of other laboratory staff
- Procedures for achieving traceability of measurements
- A list of all methods under which the laboratory performs its accredited testing
- Procedures for ensuring that the laboratory reviews all new work to ensure that it has the appropriate facilities and resources before commencing such work
- Procedures for handling samples
- Procedures to be followed for feedback and corrective action whenever testing discrepancies are detected, or departures from documented policies and procedures occur
- Policy for permitting departures from documented policies and procedures or from standard specifications
- Procedures for dealing with complaints
- Procedures for protecting confidentiality and proprietary rights
- Procedures for audits and data review
- Procedures for establishing that personnel are adequately experienced in the duties they are expected to carry out and are receiving any needed training;
- Policy addressing the use of unique electronic signatures

The Quality Assurance Manual may not be reproduced, in part or in full, without written consent of ESC Lab Sciences. The Quality Assurance Manual may not be altered in any way. Whether distributed internally or as a courtesy copy to customers or regulatory agencies, this document is considered confidential and proprietary information. The Quality Assurance Manual can only be deemed official if proper signatures are present. All copies in use within ESC Lab Sciences have been reviewed, approved, and are properly controlled. Any distributed copies outside of ESC Lab Sciences are uncontrolled, unless a controlled copy is specifically requested.

4.3.5 Standard Operating Procedures

Standard Operating Procedures (SOPs) are written procedures that describe in detail how to accurately and consistently reproduce laboratory processes or provide additional direction for laboratory personnel. Copies of all SOPs are accessible to all personnel. SOPs consist of three types:

- Technical SOPs, pertaining to a laboratory process which have specifically required details
- Administrative SOPs which document the more general organizational procedures.
- Quality SOPs that provide background and process for quality policy.

Each SOP indicates the effective date, the revision number, and the issuing authority(ies). Department Supervisor approval is required on technical procedures. Detailed information can be found in SOP# 010100, *Writing, Revising, and Maintaining Standard Operating Procedures*

Deviations from SOPs and Quality documents are not allowed without the permission of the Compliance Director, or designee. In the event that a deviation is requested, the circumstance is considered and the procedure is evaluated for necessary change and allowance.

The laboratory has SOPs for all analytical methods within its scope of accreditation. Any deviation from a method is documented in the method modifications section of the respective SOP, including both a description of the change made and a technical justification.

Each determinative method SOP includes or references (as applicable) the following:

- Scope and Application;
- Method Summary and Definitions;
- Health and Safety;
- Sample Preservation, Containers, Handling and Storage;
- Interferences;
- Equipment and Supplies;
- Reagents and Standards;
- Procedure;
- Data Analysis and Calculations;
- Quality Control and Method Performance;
- Data Validation and Corrective Action;
- Pollution Prevention and Waste Management;
- Method Modifications/Clarifications;
- References;
- Procedure Revision/Review History;

SOPs may not be reproduced, in part or in full, without written consent of ESC Lab Sciences. SOPs may not be altered in any way. Whether distributed internally or as a courtesy copy to customers or regulatory agencies, SOPs are considered confidential and proprietary information. Any copies in use within ESC Lab Sciences have been reviewed, approved, and properly controlled. Any copies of SOPs distributed outside of ESC Lab Sciences are uncontrolled, unless a customer or regulator specifically requests a controlled copy.

4.4 REVIEW OF REQUESTS, TENDERS, AND CONTRACTS

4.4.1 Procedure for Requests, Tenders, and Contracts Review

When ESC enters into a contract to provide laboratory services, it follows SOP# 020303, *Contract Review*. Upon receipt of a request or invitation to tender a bid/proposal, the customers' requirements are examined by the contract review personnel to establish that the necessary details are adequately outlined and that the laboratory is able and willing to meet them.

For routine/non-complex projects, a review by appropriate customer service personnel is considered adequate. Customer service confirms that the laboratory can meet the customer’s data quality objectives, and the laboratory has any required certifications. Customer service will also confirm that the laboratory has the capacity to meet the customer’s turn-around time needs.

4.4.2 Records of Reviews

Records of reviews of requests, tenders and contracts (including significant changes) are maintained. Records are also maintained of pertinent discussions with the customer relating to the customer's requirements and the results of the work during the period of execution of the contract.

4.4.3 Subcontracted Work

The review described above also encompasses any work that will need to be subcontracted to another laboratory. See section 4.5 below for more information about subcontracting work.

4.4.4 Deviations from the Contract

Applicable customers are informed of any deviation from any contract.

4.4.5 Contract Amendments

If a contract requires amendment after work has commenced, the same contract review process is repeated and any amendments are communicated to all affected parties.

4.5 SUBCONTRACTING

4.5.1 Subcontractor Competence

ESC only performs analytical techniques that are within its documented capability, when this is not possible, the laboratory follows SOP# 030209, *Subcontracting.* Subcontracting also occurs in the special circumstances where technical, safety, or efficiency issues dictate need. When subcontracting analytical services, the laboratory assures work requiring specific accreditation is placed with an accredited laboratory or one that meets applicable statutory and regulatory requirements of the project/customer. As part of the subcontractor approval process, a copy of the applicable certificates and scopes for subcontractor's accreditations is maintained as evidence of compliance.

4.5.2 Customer Notification

ESC notifies the customer of the intent to subcontract the work in writing. The laboratory typically gains the approval of the customer to subcontract their work prior to implementation, preferably in writing.

4.5.3 ESC Responsibility

ESC assumes responsibility for the qualifications of the subcontractor except when the customer or an authority specifies the subcontractor.

4.5.4 Subcontractor List

ESC maintains a list of all approved subcontract laboratories.

4.5.5 Identification of Subcontracted Work

All analytical reports, which contain data from subcontracted laboratories, include a statement which references the subcontractor laboratory/service.

4.6 PURCHASING SERVICES AND SUPPLIES

4.6.1 Purchasing Policies and Procedures

ESC maintains SOP# 030210, *Materials Procurement for Analytical Processes*, which describes the purchasing process, including vendor selection and acceptance criteria, for the purchase, storage, and evaluation of supplies and services. When relevant to the measurement integrity of analyses, ESC uses only services and supplies of adequate quality.

4.6.2 Quality of Purchased Items

Department supervisors are responsible for ensuring only supplies/chemicals that meet specified requirements are ordered. Where assurance of the quality of services or supplies is unavailable, the laboratory uses these items only after they have been inspected or otherwise verified for adequate quality. Records of inspections and verifications are maintained in the laboratory.

4.6.3 Purchasing Documents

Purchasing documents are maintained and they contain information that describes the services and supplies that were ordered. These purchasing documents are reviewed and approved by applicable personnel prior to release.

4.6.4 Approved Supplier List

Suppliers of critical services and supplies are evaluated. An approved list of material/service suppliers is maintained where products/services purchased affect the quality of data generated by the laboratory.

4.7 SERVICE TO THE CUSTOMER

ESC's Customer Service Department provides specific project service through the use of Technical Service Representatives (TSRs). The TSR is responsible for all contract requirements and laboratory/customer communication, including information concerning schedules, delays, and major deviations in the testing process.

4.7.1 Meeting Customer Expectations

ESC is willing to cooperate with its customers. The TSR works closely with the customer to clarify the customer's requests and to monitor the laboratory's performance in relation to the work requested, while ensuring confidentiality to other customers. The laboratory confidentiality policy prohibits divulging or releasing any information to a third party without proper authorization. See SOP# 010102, *Ethics, Data Integrity, and Confidentiality*. All electronic data (storage or transmissions) are kept confidential, based on technology and laboratory limitations, as required by customer or regulation. All electronic transmissions contain a confidentiality notice that represents the following:

Notice: This communication and any attached files may contain privileged or other confidential information. If you have received this in error, please contact the sender immediately via reply email and immediately delete the message and any attachments without copying or disclosing the contents. Thank you.

For additional information see SOP# 020301, *TSR (Project Management).*

4.7.2 Customer Feedback

ESC seeks customer feedback (both positive and negative) through various means including surveys and personal communication. This feedback is utilized to improve the management system, quality system, testing and calibration activities and customer services.

4.7.3 Customer Access to the Laboratory

Upon customer request, ESC provides reasonable access to relevant areas of the laboratory for witnessing capability and analytical performance. Confidentiality of all customers during this process is maintained.

4.7.4 Providing Supplemental Information

Upon request customers are provided supplementary information and records as needed. This includes, but is not limited to, the following: sample preparation records, packaging information, verification of calibrations, and analytical reference material information.

4.7.5 Communication with the Customer

ESC's Technical Service Representatives are required to maintain good communication with customers. Customers are informed of any delays or major deviations in the analytical work of the laboratory.

4.8 COMPLAINTS

Complaints are taken very seriously, and are typically initially addressed by customer service or sales. Other applicable laboratory personnel can be involved during the corresponding investigations and any needed corrective actions to provide customer support. Records of all complaints, investigations, and corrective actions are maintained. For more information see section 4.11 below for corrective actions and SOP #020302, *Client Complaint Resolution.*

4.9 CONTROL OF NON-CONFORMING WORK

4.9.1 Identification of Non-Conforming Work

Non-conforming work is work that does not conform to customer requirements, standard specifications, or documented laboratory policies/procedures. Some examples of non-conformances are departures from SOPs/test methods or quality control results that do not meet acceptance criteria. Identification of non-conforming work can come through various sources which include, but is not limited to; results of quality control samples and instrument calibrations, observations of laboratory personnel, data review, and internal audits.

4.9.2 Policies and Procedures

Many types of non-conformances are listed in the applicable SOPs along with the responsibilities and actions that are needed. Any needed corrections for these non-conformance events are taken immediately together with any decision about the acceptability of the nonconforming work.

In the event that a non-conformance is likely to reoccur or that there is doubt about the compliance of the laboratory's operations with its own policies or procedures; laboratory personnel will investigate the significance of the non-conformance and document corrective actions if applicable. When quality of the analytical data has been adversely affected, customers are notified and work is recalled as necessary. For more information see section 4.11 below for corrective actions and the SOP #030208, *Corrective and Preventive Action*.

Customer requests for departures must be pre-approved by appropriate laboratory personnel. These planned and pre-approved departures/non-conformances do not require reviews/investigations; however, they still must be documented. When necessary, planned and pre-approved non-conformances are noted in the final analytical report to advise the data user of any ramification to data quality.

4.9.3 Release of Nonconforming Work

The laboratory allows the release of nonconforming data only with approval on a case-by-case basis by the department supervisor, or their designee. Permitted non-conformances, such as QC failures, are fully documented and include the reason for the deviation and the impact of the departure on the data. Where necessary, customer service will notify the customer of the situation and will advise of any ramifications to data quality. Also where necessary, non-conformances are noted in the final analytical report to advise the data user of any ramification to data quality.

4.9.4 Stop Work Procedures

The Compliance Director and the Quality Assurance Director have the responsibility and authority to ensure the Quality System is implemented and followed at all times. In circumstances where a laboratory is not meeting the established level of quality or not following the policies set forth in this Quality Manual, the Compliance Director and the Quality Assurance Director have the authority to halt laboratory operations should he or she deem such an action necessary. The Compliance Director and/or the Quality Assurance Director will immediately communicate the halting of operations to the laboratory senior management and will keep them posted on the progress of corrective actions.

The department supervisors and members of senior management also have the authority to halt laboratory operations should they deem this action necessary. If this is done they will notify the Compliance Director and/or the Quality Assurance Director, and they will keep them informed about the progress of corrective actions.

All laboratory personnel have the authority to halt laboratory operations in the event that a situation impacts data validity or safety. When this action is deemed necessary, then the applicable supervisor must be notified of the situation as soon as possible. The supervisor and/or members of senior management will evaluate the severity of the situation for further decision making.

Once a stop work order has been approved and implemented, the Compliance Director and/or the Quality Assurance Director have the responsibility of ensuring the effectiveness of the corrective actions taken and authorizing the resumption of work.

4.10 IMPROVEMENT

Laboratory management demonstrates its commitment to quality by providing the resources (including facilities, equipment, and personnel) to ensure the adherence to the policies and procedures documented in this Quality Assurance Manual; and to promote the continuous improvement of the quality system. Continuous improvement of the quality system is also achieved by the implementation of the various aspects of this Quality Assurance Manual which include the following:

- The quality policy and objectives
- The internal and external auditing practices
- The review and analysis of data
- The corrective action process
- The preventive action process
- The managerial review process where the various aspects of the management/quality system are summarized, evaluated, and plans for improvement are developed.

4.11 CORRECTIVE ACTIONS

During the day-to-day laboratory operations, certain occurrences may warrant the necessity of corrective actions. These occurrences may take the form of analyst errors, deficiencies in quality control, method deviations, or other unusual circumstances. The laboratory's quality system provides systematic procedures for the documentation, monitoring, completion of corrective actions, and follow-up verification of the effectiveness of these corrective actions. This is done using the laboratory's Corrective Action and Preventative Action (CAPA) system that lists at a minimum; the deficiency by issue number, the deficiency source, responsible party, root cause, resolution, due date, and date resolved.

4.11.1 General Corrective Action Procedure

The following items are examples of sources of laboratory deviations or non-conformances that warrant some form of documented corrective action:

- Internal and External Audit Deficiencies
- Unacceptable Proficiency Testing (PT) Results
- Data or Records Review Deficiencies
- Customer Complaints
- Holding Time Violations

Documentation of corrective actions may be in the form of a qualifier or comment in the analytical data and/or on the final report that explains the deficiency. Corrective actions involving sample receiving are recorded on non-conformance forms and are attached to the applicable chain of custody. Documentation of corrective actions may also be a more formal corrective action report that is entered into the laboratory's Corrective Action and Preventative Action (CAPA) system. This depends on the extent of the deficiency, method requirements, the impact on the data, and any customer requirements for documentation.

The person who discovers the deficiency or non-conformance initiates the corrective action process. If a formal corrective action report is warranted, then the person initiating the corrective action must document the issue, the affected projects/samples, any known causes of the issue, and the corrective actions that they have taken. After this documentation is completed, the corrective action report is routed to the supervisor and/or to applicable personnel for notification of the issue and review. After the corrective action report is reviewed by the supervisor and/or applicable personnel, then it is routed to the quality assurance department for final review, verification, and signoff of the corrective action.

For more information see SOP #030208, *Corrective and Preventive Action.*

4.11.2 Root Cause Analysis

It is necessary that corrective actions taken address the root cause of the issue in order to prevent reoccurrences. In some cases, an identified cause equals to the "root cause" of the issue. In other cases, an identified cause is actually the outcome or symptoms of an underlying "root cause". Root cause analysis is the key and sometimes the most difficult part in the corrective action procedure. Often the root cause is not obvious and thus a careful analysis of all potential causes of the problem is required. Potential causes could include customer requirements, the samples, sample specifications, methods and procedures, staff skills and training, consumables, or equipment and its calibration.

In the event that the root cause is not obvious, laboratory personnel and management staff will start a root cause analysis by going through an investigative process. During this process, the following general steps must be taken into account: defining the non-conformance, assigning responsibilities, determining if the condition is significant, and investigating the root cause of the nonconformance. General non-conformance investigative techniques follow the path of the sample through the process looking at each individual step in detail. The root cause must be documented within the laboratory's Corrective Action and Preventative Action (CAPA) system.

4.11.3 Selection and Implementation of Corrective Actions

Where uncertainty arises regarding the best corrective action approach for addressing the root cause of an issue, appropriate laboratory personnel will recommend corrective actions that are appropriate to the magnitude and risk of the problem that will most likely eliminate the problem and prevent recurrence. If needed, senior laboratory management will then decide the best course of action needed. The corrective action that is chosen will then be implemented and documented in the laboratory's Corrective Action and Preventative Action (CAPA) system.

4.11.4 Monitoring of Corrective Actions

Personnel in the quality assurance department are responsible for monitoring the implementation and documentation of corrective actions to ensure that the corrective actions taken are effective. This verification of the corrective actions effectiveness is documented laboratory's Corrective Action and Preventative Action (CAPA) system.

4.11.5 Additional Audits

When the identification of non-conformances or departures casts doubt on compliance with the laboratory's policies, procedures, or regulatory requirements; laboratory management ensures that appropriate areas of activity are audited in accordance with Section 4.14.1 as soon as possible. These additional audits can be short and focused to follow-up with the implementation of the corrective actions to confirm their effectiveness. Additional full-scale audits are only necessary when a serious issue or risk to the laboratory's business is identified.

4.12 PREVENTIVE ACTIONS

Preventive action is a pro-active process to identify opportunities for improvement rather than a reaction to the identification of problems or complaints. ESC takes advantage of several information sources to identify opportunities for improvement in all its systems including technical, managerial, and quality systems. These sources include, but are not limited to, the following:

- Identification of trends during data review
- Staff meetings
- Customer feedback, including complaints
- Managerial reviews

Some examples of preventative action include, but are not limited to, the following:

- Scheduled instrument maintenance (Preventative maintenance)
- Adding additional staff
- Acquisition of new equipment
- Training activities

All laboratory personnel have the authority to offer suggestions for improvements and to recommend preventive actions. However, it is ultimately the responsibility of laboratory management for implementing preventive action. When improvement opportunities are identified or if preventative action is required; then action plans are developed, implemented, and monitored to reduce the likelihood of the occurrence of non-conformities and/or to take advantage of the opportunities for improvement.

For more information see SOP #030208, *Corrective and Preventive Action.*

4.13 CONTROL OF RECORDS

Records are usually data recordings that include annotations, such as daily refrigerator temperatures, posted to laboratory forms, lists, spreadsheets, or analyst notes on a chromatogram. Records may be on any form of media, including electronic and hardcopy. Records allow for the historical reconstruction of laboratory activities related to sample handling and analysis.

4.13.1 General

Technical and quality assurance records are established and maintained to provide evidence of conformity to requirements and of the effective operation of the quality system. Mechanisms are established for records to remain legible, readily identifiable and retrievable. The laboratory maintains a record system appropriate to its needs, records all laboratory activities, and complies with applicable standards or regulations as required.

The laboratory has defined the length of time various records, pertaining to the management system and examination results, are to be retained. Retention time is defined by the nature of examination or specifically for each record. The laboratory retains all original observations, calculations and derived data, calibration records, chain of custody and a copy of the test report for a minimum of ten years, unless otherwise required by regulatory authority.

Documented records procedures SOP# 010103, *Document Control and Distribution Procedure*, and SOP# 020304, *Protection and Transfer of Records*, are established to define the means needed for the identification, storage, protection, retrieval, retention time, transfer, and/or disposition of records.

4.13.2 Technical and Quality Records

NOTE: ALL records/data are stored for a minimum of 10 years, unless otherwise noted.

All hardcopy department logbooks, such as temperature, maintenance, and preparation logs are placed into storage boxes and archived via a unique numbering system, to the ESC storage facility. Additional information regarding reagents/standards can be found in the Standards Logger (Tree) digital archive system. This digital system is backed up according to the ESC IT backup procedure.

Archived information and access logs are protected against fire, theft, loss, environmental deterioration, vermin, and in the case of electronic records, electronic or magnetic sources.

Data Storage Criteria	
Data Type	**Storage Criteria**
Manual Data Wet Chemistry	All manually generated data are stored in specific laboratory analysis workbooks. Each individual analysis is located in a separate notebook which contains all data relating to the test including, calibration curves/data, QC charts/limits, SOP, and completed analysis sheets. These notebooks are centrally located and contain completed data that is filed by analysis and date analyzed. Monthly – Data is removed from the notebook and placed in a dedicated filing cabinet. Semi-annually – Data is removed from the filing cabinet, placed in storage boxes and archived, via a unique numbering system, in the ESC storage facility
Manual Data Prep Labs	All logbooks utilized in manually recording sample preparation information are placed into storage boxes and archived, via a unique numbering system, in the ESC storage facility. This includes organic prep, metals prep, and TCLP.
Manual Data Env. Micro, Mold	All manually generated data is stored in specific laboratory files and notebooks. These files are centrally located and contain completed data that is filed by analysis and date analyzed. Data is placed into storage boxes and (when full) archived, via a unique numbering system, in the ESC storage facility.
All Data Aquatic Toxicity	All manually generated data is stored in specific laboratory files and notebooks. These files are centrally located and contain completed data that is filed by analysis and date analyzed. Data is placed into storage boxes and (when full) archived, via a unique numbering system, in the ESC storage facility. Final reports and Reference Toxicant results are also scanned into ESC's electronic document management system. The data storage device on which this data resides is backed up daily. Data files are archived on to magnetic tape and retained per laboratory policy.
Computerized Data - Organic Dept.	Injection logs are printed to PDF file and maintained with the data. The instrument data is printed to a secure server and remains in a format that cannot be changed after printed. Upon printing, the data in the original file is generated. This storage system is backed up nightly utilizing a seven-day rotation cycle. The data is immediately available for up to two years. After two years, raw instrument data files are archived onto a separate secure server and kept a minimum of ten years. Original raw data files cannot be edited.
Computerized Data – Inorganic Metals Dept.	All data produced by metals instrumentation is backed up to a secure drive, nightly, utilizing a seven-day rotation cycle. All data is archived on a network attached storage device and is immediately available for up to two years. After two years, raw instrument data files are archived on to a separate secure server and kept a minimum of ten years. Original raw data files cannot be edited.
Final Report Storage - LIMS	The LIMS facilitates access to any finished data and sample information by customer code, sample number, and parameter run number. Furthermore, any data pertaining to a sample or customer can be obtained. The LIMS also contains the information from the COC such as sample description, time and date collected, sampler ID, container type, preservative, sample receipt data, finished/approved analytical data, analyst, etc. The LIMS Oracle Database is backed up daily on tape. The back up tape is kept in secure storage. While all LIMS data are accessible, data older than six months is moved from the active production database and is available in an archive database.
Final Report Storage - PDF	Copies of all reports are stored according to customer code in PDF format on a network attached storage device and are immediately available for up to ten years. After ten years data files are archived onto magnetic tape and kept an additional ten years. These reports include chain of custody forms, login confirmation reports, the final approved printed report, invoices and any other associated documents. Samples that require subcontract work also have a copy of the final report in the customer file.
Misc. Data Storage	Company records that are not stored on a secure electronic device are placed in storage boxes and archived, via a unique numbering system, in the ESC storage facility. This includes quality records, such as audits, state certifications, PT results, internal audits, corrective actions, training files, logbooks, etc.

4.13.3 Records Disposal

Records that have exceeded the required storage requirement are disposed of through the use of professional records destruction firm or as required by regulatory or customer requirements. ESC retains the manifest of documents destroyed and files the verification receipt that is generated at the time of destruction. Additional guidance for records disposal is provided in the ESC SOP#020304, *Protection and Transfer of Laboratory Records*.

4.13.4 Records Transfer

In the event that corporate ownership is transferred or that laboratory activities are terminated for any reason, all records become property of the transferee in accordance with ESC SOP# 020304, *Protection and Transfer of Laboratory Records*.

4.14 AUDITS

Audits measure laboratory performance and verify compliance with accreditation and project requirements. Audits specifically provide management with an on-going assessment of the management system. They are also instrumental in identifying areas where improvement in the management/quality system will increase the reliability of data. Laboratory management is promptly notified of any finding that is of ethical concern.

4.14.1 Internal Audits

The quality assurance department is responsible for designing and/or conducting internal audits in accordance with a predetermined schedule and procedure. The purpose of these internal audits is to verify compliance with policies and procedures, and also to verify the on-going effectiveness of the laboratory's management system. Since internal audits represent an independent assessment of laboratory functions, the auditor must be functionally independent from laboratory operations to ensure objectivity. The auditor must be trained, qualified, and familiar enough with the objectives, principles, and procedures of laboratory operations to be able to perform a thorough and effective evaluation.

The complete internal audit process consists of the following sections:

- System and Method Audits – These are the traditional internal audit function and include analyst interviews to help determine whether laboratory practice matches method requirements and SOP language. Applicable raw analytical data and/or final report reviews are usually conducted in conjunction with these traditional internal audits. These audits are conducted according to a predetermined schedule.
- Compliance Data Reviews – These are thorough raw data and record reviews conducted by the quality assurance department that include (but are not limited to) sample receipt records, sample preparation records, analytical records, and the final analytical reports. A portion of the analytical data produced by the laboratory is randomly selected to undergo a compliance data review. These reviews are outside of the laboratory production environment which allows the data to be very closely examined without the pressure of time constraints.
- Corrective action follow-up audits are conducted on an as needed basis to ensure that documented corrective actions are implemented and to verify their effectiveness.

Full descriptions of the system and method internal audits are composed to include the following: identification of the section audited, the audit date, and the observations/findings of the audit. Findings from all internal audit processes will be routed to the applicable laboratory personnel for corrective action. The responsible party will propose a plan of correction in a timely manner to correct all of the cited deficiencies. The proposed plan should include a time frame for the competition of the corrective actions. This time frame should depend on the complexity of the deficiencies and the amount of resources needed to properly correct the deficiency. The quality department reviews the responses to the internal audit findings. If the responses are determined to be adequate, then the quality department will use the action plan with the given time frame for verifying the completion of the corrective action(s). If the responses are determined to be inadequate, then the response is returned to the responsible party for modification. To complete the internal audit process, the quality department performs a re-examination of the areas where deficiencies were found to verify that all proposed corrective actions have been implemented. An audit deficiency is considered closed once implementation of the necessary corrective action has been audited and verified. If corrective action cannot be verified, the associated deficiency remains open until that action is completed.

In addition to the scheduled internal audits, unscheduled internal audits are conducted whenever doubts are cast on the laboratory's compliance with regulatory requirements or its own policies and procedures. These unscheduled internal audits may be conducted at any time and may be performed without an announcement to laboratory personnel.

When internal audit findings cast doubt on the validity of the laboratory’s testing results, the laboratory will take immediate corrective action and any affected customers should be notified in writing within one week of the discovery of the issue. If the issue is complex and the full scope of affected customers is not easily determined, then additional time might be required. However, this additional timeframe for customer notification of complex issues should not exceed one month of discovery.

All investigations resulting from data integrity issues are conducted in a confidential manner until they are completed. These investigations are documented, as well as any notifications made to clients receiving any affected data.

Additional information can be found in the SOP #010104, *Internal Audits.*

4.14.2 External Audits

It is the laboratory's policy to cooperate and assist with all external audits, whether performed by customers or an accrediting body. Management ensures that all areas of the laboratory are accessible to auditors as applicable and that appropriate personnel are available to assist in conducting the audit.

Audit teams external to the laboratory's organization will review the laboratory to assess the effectiveness of systems and degree of technical expertise. The quality department personnel will host the audit team and assist in facilitation of the audit process. Audit teams will usually prepare a formalized audit report listing deficiencies, recommendations, and/or observations. In some cases items of concern are discussed during an audit debrief that is conducted at the end of the external audit.

The laboratory personnel develop corrective action plans to address any external audit deficiencies with the assistance/guidance of the quality department. Laboratory management will ensure that the necessary resources are provided to effectively develop and implement the corrective action plans. The quality department collates this information and provides a written response to the audit team. The response contains the corrective action plan and expected completion dates for each element of the plan. The quality department is also responsible for following-up with laboratory personnel to ensure corrective actions are implemented and they are effective.

4.14.3 Performance Audits and Proficiency Testing

Performance audits are conducted periodically. Examples of performance audits include Proficiency Test (PT) sample analysis, internal single-blind sample analysis, and the analysis of double-blind samples that are submitted through a provider or a customer. Anything that tests the performance of the analyst and/or the method is considered to be a performance audit.

The laboratory participates in various proficiency testing samples (PT) as required by each accreditation, and obtains test samples from approved providers. Some exceptions are made for analytes where there is no PT available from an approved PT provider.

PT samples are treated as typical customer samples, utilizing the same staff, methods, equipment, facilities, and frequency of analysis. PT samples are included in the laboratory's normal analytical processes and do not receive extraordinary attention due to their nature.

The laboratory does not share PT samples with other laboratories, does not communicate with other laboratories regarding current PT sample results, and does not attempt to obtain the assigned value of any PT sample from the PT provider.

The laboratory initiates an investigation and corrective action plan whenever PT results are deemed unacceptable by the PT provider. Additional PTs will be analyzed and reported as needed for accreditation purposes.

Additional information can be found in the SOP #030212, *Proficiency Testing Program*.

4.15 MANAGEMENT REVIEW

Laboratory management reviews the management system on an annual basis at a minimum. This allows for assessing program effectiveness and introducing changes and/or improvements.

At a minimum, following topics are reviewed and discussed:

- The suitability of policies and procedures
- Reports from managerial and supervisory personnel
- The outcome of recent internal audits
- Corrective and preventive actions
- Assessments by external bodies
- The results of interlaboratory comparisons or proficiency tests
- Changes in the volume and type of the work
- Customer feedback, including complaints
- Recommendations for improvement
- Other relevant factors, such as quality control activities, resources, and staff training

This managerial review must be documented for future reference. The results of the managerial review must feed into the laboratory planning system and must include goals, objectives, and action plans. Laboratory management ensures that any actions identified during the review are carried out within an appropriate and agreed upon timescale.

For more information see the SOP #010105, *Management Review*.

5.0 TECHNICAL REQUIREMENTS

5.1 GENERAL

5.1.1 ESC Lab Sciences recognizes that many factors determine the correctness and reliability of the analyses performed by a laboratory. These factors include contributions from:

- Human factors (See Section 5.2)
- Accommodations and environmental conditions (See Section 5.3)
- Test methods and method validation (See Section 5.4)
- Equipment (See Section 5.5)
- Measurement traceability (See Section 5.6)
- Sampling (See Section 5.7)
- Handling of samples (See Section 5.8).

5.1.2 The extent to which the factors contribute to the total uncertainty of measurement differs considerably between types of analyses. ESC Lab Sciences takes into account these factors in developing analytical procedures, in the training and qualifications of personnel, and in the selection and calibration of the equipment utilized.

5.2 PERSONNEL

5.2.1 General Personnel Management

ESC management ensures the competency of all who operate specific equipment, who perform analyses, and who evaluate results and approve data reports. Personnel performing specific tasks are qualified on the basis of appropriate education, training, experience, and/or demonstrated skills, as required.

5.2.2 Training

All personnel are trained and competent in their assigned tasks before they contribute to functions that can affect data quality. It is management's responsibility to ensure personnel are appropriately trained. All training and education requirements are outlined in SOP #030205, *Technical Training and Personnel Qualifications* and in SOP #350355, *Technical Training and Personnel Qualifications for Biology*. Training requirements for safety and health are listed in the *Chemical Hygiene Plan*. These procedures are reviewed/updated periodically by laboratory management. Training records are maintained by the laboratory for a minimum of 10 years.

5.2.2.1 Demonstration of Capability (DOC)

Analysts complete an initial demonstration of capability (IDOC) study prior to performing a method or when there is a change in instrument type, personnel, or test method. IDOCs are also performed when a method has not been performed by the laboratory or analyst in a 12-month period. The mean recovery and standard deviation of each analyte, taken from 4 replicates of laboratory control samples, is calculated and compared to method criteria or established laboratory criteria for evaluation of acceptance. For methods or procedures that do not lend themselves to the “4-replicate” approach, the demonstration of capability requirements will be specified in the applicable SOP. Copies of all demonstrations of capability are maintained for future reference.

Demonstrations of capability are verified on an annual basis. These are Continuing Demonstrations of Capability (CDOC). For CDOCs Performance Testing (PT) samples may be used in lieu of the 4-replicate approach listed above.

For more information see the SOP #030205, *Technical Training and Personnel Qualifications* and SOP #350355, *Technical Training and Personnel Qualifications for Biology*.

5.2.2.2 Training for New Staff

New staff members are given the following training, where appropriate:

- Ethics and Data Integrity
- ESC Policy Manual
- ESC Quality Assurance Manual
- Chemical Hygiene Plan (safety)
- Applicable standard operating procedures
- Basic laboratory tasks such as balance, thermometer, and pipette operations
- Use of laboratory records
- Any other specific training as appropriate to their function

Analysts must complete training satisfactory before they can work independently. When staff members undergo training, adequate and appropriate supervision by fully trained analysts is provided. Only when a new analyst has successfully passed their Initial Demonstration of Capability (IDOC) described above, may he or she conduct testing of customer samples.

For more information see the SOP #030205, *Technical Training and Personnel Qualifications* and SOP #350355, *Technical Training and Personnel Qualifications for Biology*.

5.2.2.3 Ongoing Training

Staff members are given the following ongoing training:

- Ethics and Data Integrity Training
- Safety Training
- Routine Training – Routine training may become necessary for a person to perform a particular job effectively. This includes any changes in policies and procedures as appropriate.
- Special Training – Special training may become required as a result of new technologies, contracts, expanding markets, company-wide improvement programs, new method development, etc.

Analysts must satisfactorily perform Continuing Demonstrations of Capability (CDOC) on an annual basis.

For more information see the SOP #030205, *Technical Training and Personnel Qualifications* and SOP #350355, *Technical Training and Personnel Qualifications for Biology*.

5.2.2.4 Ethics and Data Integrity Training

Data integrity training is provided to all new employees (including contract and temporary), and a refresher is given at least annually for all employees. Employees are required to understand that any infractions of the laboratory data integrity procedures shall result in a detailed investigation that could lead to very serious consequences including immediate termination, debarment, or civil/criminal prosecution. The initial data integrity training and the annual refresher training needs to have a signature attendance sheet or other form of documentation that demonstrates all staff have participated and understand their obligations related to data integrity.

All ESC personnel, including contract and temporary, are required to sign an “Attestation of Ethics and Confidentiality” at the time of employment and during annual refresher training. This document clearly identifies inappropriate and questionable behavior. Violations of this document result in serious consequences, including prosecution and termination, if necessary. The ESC Policy Manual addresses this subject in detail. Also see SOP# 010102, *Ethics, Data Integrity, and Confidentiality* for more information.

Data integrity training emphasizes the importance of proper written narration on the part of the analyst with respect to those cases where analytical data may be useful, but are in one sense or another partially deficient. The following topics and activities are covered:

- ESC’s mission and its relationship to the critical need for honesty and full disclosure in all analytical reporting

- How and when to report data integrity issues
- Record keeping
- Training, including discussion regarding all data integrity procedures
- Data integrity training documentation
- In-depth data monitoring and data integrity procedure documentation
- Specific examples of breaches of ethical behavior such as improper data manipulations, adjustments of instrument time clocks, and inappropriate changes in concentrations of standards.

5.2.2.5 Identification of Training Needs

In order to ensure personnel are appropriately trained, laboratory management is responsible for identifying training needs for both current and future anticipated laboratory tasks. This includes (but is not limited to) the following:

- Evaluation of routine quality control data
- Proficiency testing results
- Findings of internal and external audits
- Management reviews
- Periodic performance reviews

5.2.2.6 Evaluation of the Effectiveness of Training

In order to ensure personnel are appropriately trained, laboratory management is responsible for evaluating the effectiveness of the training program. This includes (but is not limited to) the following:

- Evaluations of Demonstrations of Capability (DOCs)
- Monitoring ongoing quality control data
- Proficiency testing results

5.2.3 Competency and Supervision of Personnel

Laboratory management ensures all personnel (including part-time, temporary, contracted, and administrative personnel) are competent, appropriately supervised, and work in accordance to the established management system. This includes training in policies, procedures, ethics, laboratory quality assurance, and safety as applicable to their role in the laboratory.

5.2.4 Job Descriptions

Employee qualification requirements are maintained by the Human Resources Department and are facilitated through the use of written job descriptions. Educational requirements and experience are included in the job description. Laboratory management determines the specific education and experience requirements for individual positions within the laboratory based on the specific department needs.

5.2.5 Authorization of Technical Personnel

Laboratory management authorizes specific personnel to perform particular technical duties. Records of the relevant authorization(s), education, and experience of all technical personnel are maintained by the Human Resources Department. Confirmation of competence of all technical personnel is required initially by successfully performing a demonstration of capability. All technical personnel are also required to continue to demonstrate their capability at least annually to produce reliable results through accurate analysis of certified reference materials, proficiency testing samples, and/or routine quality control samples to remain authorized to perform particular technical duties.

5.3 ACCOMMODATION & FACILITY DESIGN

5.3.1 Laboratory Facilities

The design of the laboratory supports good laboratory practices and does not adversely affect measurement integrity.

5.3.2 Environmental Conditions

All ESC laboratory facilities, analytical areas, energy sources, lighting, heating, and ventilation facilitate proper performance of calibrations and tests. The laboratory ensures that housekeeping, electromagnetic interference, humidity, line voltage, temperature, sound and vibration levels are appropriately controlled to ensure the integrity of specific measurement results and to prevent adverse effects on accuracy or increases in the uncertainty of each measurement.

Environmental conditions are monitored, controlled, and recorded as required by the relevant specifications, methods, and procedures. Laboratory operations are stopped if it is discovered that the laboratory's environmental conditions jeopardize the analytical results.

5.3.3 Separation of Incompatible Activities

ESC Lab Sciences maintains multiple buildings on its campus. This allows for physical separation of incompatible analytical activities. For example, the analysis for volatile organic compounds is in a separate building from where samples are extracted for semi-volatile organic compounds.

Each laboratory structure is specifically designed for the type of analytical activity that it contains. The air handling systems, power supplies, and gas supplies are specific for each laboratory department.

5.3.4 Laboratory Security

Laboratory security is maintained by controlled access and through video surveillance. Entrance into any ESC building requires an electronic ID badge with appropriate assigned access. Access is controlled to each area depending on the required personnel, the sensitivity of the operations performed, and possible safety concerns. The main entrance is kept unlocked during normal business hours for visitors, and is continuously monitored by laboratory staff. All visitors must sign a visitor's log, and a staff member must accompany them during the duration of their stay.

5.3.5 Good Housekeeping

ESC ensures good housekeeping practices in all facilities to maintain a standard of cleanliness necessary for analytical integrity and personnel health and safety. Where necessary, areas are periodically monitored to detect and resolve specific contamination and/or possible safety issues.

5.4 TEST METHODS AND VALIDATION

5.4.1 General

ESC Lab Sciences uses appropriate methods and procedures for all analyses within its scope. These include sampling, handling, transport, storage, and preparation of samples to be analyzed, and, where appropriate, an estimation of the associated measurement uncertainty as well as statistical techniques for analysis of data.

ESC Lab Sciences has instructions (SOPs) on the use and operation of all relevant equipment and on the handling and preparation of samples for analysis, where the absence of such instructions could jeopardize the results. All instructions, standards, manuals and reference data relevant to the work of the laboratory are maintained current and are readily available to personnel (see section 4.3). Deviations from methods occur only if the deviation has been documented, technically justified, authorized, and accepted by the customer.

5.4.2 Selection of Methods

ESC Lab Sciences uses analytical methods, including methods for sampling, which meet the needs of the customer and are appropriate for the analyses performed. Methods utilized are preferably those published as international, regional, or national standards. The laboratory ensures that it uses the latest valid edition of a method unless it is not appropriate or possible to do so or unless regulatory requirements dictate specific revision use. Methods are supplemented with Standard Operating Procedures that list additional details to ensure consistent application.

When a customer does not specify the method to be used, the laboratory selects appropriate and approved methods that have been designated by the project's regulatory program. The customer is informed as to the method chosen.

The laboratory confirms that it can properly operate published analytical methods before analyzing samples (see section 5.4.5). If there is a change in the published analytical method, then the confirmation is repeated.

ESC Lab Sciences will inform customers when methods they choose are considered inappropriate and/or out of date.

5.4.3 Laboratory Developed Methods

Introduction of analytical methods developed by the laboratory for its own use is a planned activity and is assigned to qualified personnel equipped with adequate resources.

Plans are updated as development proceeds and effective communication is maintained with all personnel involved in the development process.

5.4.4 Non-Standard Methods

When it is necessary to employ methods not published and/or approved by industry standards, these are subject to agreement with the customer and must include a clear specification of the customer's requirements and the purpose of the analysis. The method developed must be validated appropriately before use.

For new non-standard analytical methods, procedures are developed prior to the analysis of samples and contain at least the following information:

- Appropriate identification
- Scope
- Description of the type of item to be analyzed
- Parameters or quantities and ranges to be determined
- Apparatus and equipment, including technical performance requirements
- Reference standards and reference materials required
- Environmental conditions required and any stabilization period needed
- Description of the procedure, including:
  - Affixing identification marks, handling, transporting, storing and preparing of items
  - Checks to be made before the work is started

  - Verifying equipment function and, where required, calibrating and/or adjusting the equipment before each use
  - Method of recording the observations and results
  - Any safety measures to be observed
- Criteria and/or requirements for approval/rejection
- Data to be recorded and method of analysis and presentation
- Uncertainty or procedure for estimating uncertainty

5.4.5 Validation of Methods (Also see SOP #030211, *Method Validation*)

5.4.5.1 Validation Description

Validation is a process of confirmation by examination and the provision of objective evidence that the stated requirements for a specific method/procedure are fulfilled.

5.4.5.2 Validation Summary

The laboratory validates all analytical methods used to some degree. The validation is as extensive as is necessary to meet the needs in the given application or field of application. The laboratory records the results obtained, the procedure used for the validation, and a statement as to whether the method is fit for the intended use.

5.4.5.3 Validation for Customer Need

The range and accuracy of the values obtainable from validated methods are assessed for the intended use as relevant to the customers' needs. Examples of this assessment include examining the uncertainty of the results, detection limit, selectivity of the method, linearity, limit of repeatability and/or reproducibility, robustness against external influences, and/or cross sensitivity against interference from the matrix of the sample.

5.4.5.4 Method Detection Limits and Reporting Limits

Descriptions of analytes, preparative and analytical methods, matrices, accuracy and precision targets, and MDLs and RLs are presented in the QA Manual Appendices.

Limits of Detection (LODs)/Method Detection Limits (MDLs)

Detection limits are determined annually (or after any major changes to the analytical system and/or procedures) and are comparable to those established by the EPA and are not typically lower than recommended detection limits. To determine whether the EPA detection limit is being achieved, an MDL study is performed according to 40 CFR Part 136, Appendix B or the currently accepted and approved guidance. When using the Appendix B guidance, the standard deviation of, at least, seven replicate standards at or near the expected detection limit is calculated. MDLs are determined such that the risk of reporting a false positive is less than 1%. The method detection limit (MDL) is calculated as follows:

$$\text{MDL} = T \times S$$

where: S = Standard Deviation of replicate measurements
T = Student's t value appropriate for a 99% confidence level and a standard deviation estimate with n-1 degrees of freedom.

If the MDL is higher than the EPA-method-suggested MDL, the calculated value is used as a basis for establishing the reporting limit (RL) for reporting. MDLs are re-calculated on an annual basis or sooner if a material change in the instrumentation or method is enacted, or a change in the calibration response factor is noted. Additional studies may also be conducted to enhance the program.

Published MDLs may be set higher than experimentally determined MDLs to: 1) avoid observed positive interferences from matrix effects or common reagent contaminants or 2) for reporting convenience (i.e., to group common compounds with similar but slightly different experimentally determined MDLs).

Method detection limit studies may also utilize additional study components to better reflect practices to produce a more realistic detection limit as approved by regulatory guidance/requirements. Blank background studies yielding a value for the blank contributions at low level quantitations during routine analysis may be utilized to calculate detection limits that further ensure that the incidence of reporting false positives and false negatives is greatly reduced in some applications.

Any alternate or modified method for the determination of MDL studies utilized at ESC must be approved for the application for which it is used and be technically justified in its use to provide an improvement in the data being generated within the study.

For more information see SOP# 030206, *Method Detection Limits*

Limits of Quantitation (LOQs)/Reporting Limits (RLs)

A limit of quantitation (LOQ) for every analyte of concern must be determined. The LOQ must be higher than the MDL/LOD and are typically set 3 -10 times the calculated MDL determined above. The LOQ is often referred to as the Reporting Limit (RL). This RL is based on the lowest calibration standard concentration that is used in each initial calibration. Results below this level are not allowed to be reported without qualification since the results would not be substantiated by a calibration standard. For methods with a determined LOD, results can be reported out below the LOQ but above the LOD if they are properly qualified (e.g. J flag).

5.4.5.5 Demonstration of Capability

Analysts complete an initial demonstration of capability (IDOC) study prior to performing a method or when there is a change in instrument type, personnel, or test method. IDOCs are also performed when a method has not been performed by the laboratory or analyst in a 12-month period. The mean recovery and standard deviation of each analyte, taken from 4 replicates of laboratory control samples, is calculated and compared to method criteria or established laboratory criteria for evaluation of acceptance. For methods or procedures that do not lend themselves to the “4-replicate” approach, the demonstration of capability requirements will be specified in the applicable SOP. Copies of all demonstrations of capability are maintained for future reference.

Demonstrations of capability are verified on an annual basis. These are Continuing Demonstrations of Capability (CDOC). For CDOCs Performance Testing (PT) samples may be used in lieu of the 4-replicate approach listed above.

For more information see the SOP #030205, *Technical Training and Personnel Qualifications* and SOP #350355, *Technical Training and Personnel Qualifications for Biology*.

5.4.6 Measurement Uncertainty

When required, or upon customer request, ESC Lab Sciences can provide an estimate of the analytical uncertainty of test results.

The exact nature of some test methods may preclude rigorous, statistically valid estimation of analytical uncertainty. In these cases the laboratory attempts to identify all components of analytical uncertainty and make a reasonable estimation, and ensures that the form of data reporting does not give a wrong impression of the uncertainty. A reasonable estimation shall be based on knowledge of method performance and previous experience. When estimating the analytical uncertainty, all uncertainty components which are of importance in the given situation shall be taken into account.

In those cases where a well-recognized test method specifies limits to the values of the major source of uncertainty of measurement and specifies the form of presentation of calculated results, the laboratory is considered to have satisfied the requirements on analytical uncertainty by following the test method and reporting instructions.

For more information about the estimation of analytical measurement uncertainty see SOP #030221, *Measurement of Uncertainty*

5.4.7 Control of Data

5.4.7.1 Calculations and Data Transfer Checks

To ensure that data is protected from inadvertent changes or unintentional destruction, the laboratory uses procedures to check calculations and data transfers. This includes (but is not limited to) the following:

- Peer data review and internal audits of raw data
- Calculations on electronic benchsheets/spreadsheets are password protected
- Where possible, audit trail software features are utilized
- Where possible, data is uploaded directly from the instrument
- Electronic data files are backed-up routinely

5.4.7.2 Automated Acquisition

When computers or automated equipment are used for the acquisition, processing, recording, reporting, storage or retrieval of data, the laboratory ensures that:

- Computer software developed by the laboratory is documented in sufficient detail and suitably validated as being adequate for use
- Procedures are established and implemented for protecting the data. Such procedures include (but are not be limited to) integrity and confidentiality of data entry or collection, data storage, data transmission, and data processing
- Computers and automated equipment are maintained to ensure proper function and are provided with the environmental and operating conditions necessary to maintain the integrity of data
- Individual user names and passwords are required for all Laboratory Information Management Systems (LIMS)
- Upon employment, laboratory employees are provided initial training in computer security awareness and ongoing refresher training is conducted an annual basis
- Periodic inspections of LIMS are performed to ensure the integrity of electronic data
- Customers are notified prior to changes in LIMS software or hardware configurations that will adversely affect the customer’s electronic data
- Spreadsheets used for calculations are verified before initial use and after any changes to equations or formulas, including software revision upgrades. Formula cells are write-protected to minimize inadvertent changes to the formulas.
- Procedures have been established for:
    - Methods of software development that are based on the size and nature of the software being developed
    - Testing and QC methods to ensure that all software accurately performs its intended functions, including:
        - Acceptance criteria
        - Tests to be used
        - Personnel responsible for conducting the tests
        - Records of test results
        - Frequency of continuing verification of the software
        - Test review and approvals
    - Software change control methods that include instructions for requesting, authorizing, requirements to be met by the software change, testing, QC, approving, implementing changes, and establishing priority of change requests

  - Software version control methods that record the software version currently used. Data sets are recorded with the date and time of generation and/or the software version used to generate the data set;
  - Maintaining a historical file of software, software operating procedures, software changes, and software version numbers
  - Defining the acceptance criteria, testing, records, and approval required for changes to LIMS hardware and communication equipment.
- Records maintained in the laboratory to demonstrate the validity of laboratory generated software include:
  - Software description and functional requirements
  - Listing of algorithms and formulas
  - Testing and QA records
  - Installation, operation and maintenance records
- Electronic data security measures ensure the following:
  - Individual user names and passwords have been implemented
  - Operating system privileges and file access safeguards are implemented to restrict the user of the LIMS data to users with authorized access
  - All LIMS users are trained in computer awareness security on an annual basis
  - System events, such as log-on failures or break-in attempts are monitored
  - The electronic data management system is protected from the introduction of computer viruses
  - System backups occur on a regular and published schedule and can be performed by more than just one person
  - Testing of the system backups must be performed and recorded to demonstrate that the backup systems contain all required data
  - Physical access to the servers is limited by security measures
- Commercial “off the shelf” software, e.g., word processing, database and statistical programs in general use within its designed application range may be considered sufficiently validated. However, laboratory software configuration/modifications are validated as above.

ESC Software Systems

Table 5.4.7a LIMS

System	**Description**
LIMS	The LIMS is a computerized database for data management. Access to the system is protected by coded password and access is granted based on user need.
Security	Level 1. Login, sample status, shipping/sample kits. General access, every station has access. Level 2. Data Review, data approval, edit data. The secondary review team, lab supervisors, and QA have access to this level.
Hardcopy Records	All paper records are retained by ESC and/or are stored within ESC's Document Management System (Cyberlab/Openlab) in pdf and/or excel format. As the pages become historical (prior to the current working range of log numbers), they are removed from the logbook, prep book, or workbook in sequential order and permanently bound for storage in banker's boxes and/or are stored within ESC's Document Management System (Cyberlab/Openlab) in pdf and/or excel format. They are cross-referenced by sample log number, date and storage number.
Data Records	*Data* is available on electronic media. *Revisions* to the LIMS software are documented within the code. Each revision indicates the change in function, programmer's initials, and date of change. Programming has limited access and is accessible only by approved individuals through the use of passwords.
Calculations	All calculations performed by the LIMS are approved and submitted by the Laboratory Supervisors. Each calculation is tested parallel to manual calculations to ensure proper function.
Automatic Data Transfer	Data is transferred electronically from instrumentation by way of ESC customized software (Tree) directly to the LIMS. Data is also transferred electronically by way of ESC customized software (Prep Data) that transfers/saves Prep Data directly into the LIMS Database. Once the data has been transferred, it undergoes a screen review to ensure it has been transferred properly.

Table 5.4.7b AUXILIARY SOFTWARE

System	**Description**
Auxiliary	Auxiliary Computer and Software Used to Generate and Validate Data
General	Several instruments have their own dedicated single computer and manufacturer-designed software to run them. Instruction manuals and other documentation provided by each manufacturer are maintained. ESC receives updates as they become available from the manufacturer. All raw and filtered data is stored on media (with uniquely titled data files on floppy discs) and all associated printouts and paperwork is filed. The original raw data is not accessed again unless it is subjected to uncertainty.
Method Files	Creation of any method or analyte files, necessary to run the appropriate analyses is the responsibility of the Department Supervisor. The Supervisor verifies that the compounds, wavelengths, retention time windows, calculation criteria, and other relevant parameters are correctly input into the specific method file. Analysts may only use the method files that have been specifically generated by the Supervisor.
Supplier Info	All purchased software that is used in conjunction with software specific instruments is guaranteed by the supplier to function as required. The supplier of the software performs all troubleshooting or software upgrades and revisions.
Validation	Computer software is validated for proper performance. The result of the validation is recorded, when in-house programming is the source of the calculation.

5.4.7.3 Data Reduction and Review

All analytical data must undergo a multi-tiered review process prior to being reported to the customer. Data review is the process of examining data and accepting or rejecting it based on pre-defined criteria. These review steps are designed to ensure that reported data is free from errors and any non-conformances are properly documented. The laboratory's multi-tiered data review process is discussed below. Additional information regarding the data reduction and review process can be found in SOP #030201, *Data Handling & Reporting* and SOP #030227, *Data Review*.

Primary Data Review – Analysts performing the analysis are responsible for the initial data reduction and review, and have the primary responsibility for the quality of the data produced. The analysts initiate the data review process by reviewing and accepting/rejecting the data. This includes, but is not limited to; confirming all samples were prepared/analyzed according to the appropriate method and laboratory SOP, verifying dilutions are calculating properly, ensuring good chromatography, verifying proper spectral interpretations, evaluating quality control data, verifying that any customer/project specific requirements are met, and noting any non-conformances. The primary analyst is also responsible for compiling the initial data package for further data review.

Secondary Data Review – After the analyst have completed the primary data review process, the data package is then available for secondary data review that is performed by a qualified reviewer. This reviewer provides an independent technical assessment of the data. This includes, but is not limited to; confirming all samples were prepared/analyzed according to the appropriate method and laboratory SOP, verifying dilutions are calculating properly, ensuring good chromatography, verifying proper spectral interpretations, evaluating quality control data, verifying that any customer/project specific requirements are met, and noting any non-conformances. Secondary data reviews must also verify that all manual entries of raw data are accurate and there are no transcription errors.

Final Administrative Review – All final reports receive a final administrative review of some degree. Once the data have been technically reviewed and approved in the secondary data review process, authorization for release of the data from the analytical section is indicated in the LIMS. A Technical Service Representatives (TSR) will then perform a final administrative review of the data which includes examining the report for method appropriateness, detection limit/QC acceptability, and any other apparent errors. If no errors are found, the TSR approves the report in LIMS and the customer has the reports emailed to them. If errors are noted, the data is returned to the department for correction and resubmission to the TSR. In the case of DoD work, 100% of all packages must have a final administrative review to confirm that primary and secondary reviews were recorded properly and the data package is complete.

Compliance Data Review – Compliance data reviews are performed by the Quality Department staff and are considered to be part of the overall internal audit program of the laboratory. These reviews are typically performed after the data has been released to the customer. A list is produced weekly from LIMS showing all methods run by the laboratory and how many batches were analyzed the previous week. Some of these data packages will undergo a compliance data review as per a schedule set by this department. For DoD work, at least 10% of all data packages will reviewed for technical completeness/accuracy.

5.5 EQUIPMENT

5.5.1 Availability of Equipment

Laboratory management ensures that the laboratory is furnished with all the equipment required for the correct performance of the analytical tests it performs. In cases where the laboratory needs to use equipment outside its permanent control, the laboratory ensures that all requirements related to calibration, maintenance, and records are satisfied.

5.5.2 Calibration of Equipment

The laboratory ensures that equipment and its software used for sampling and analysis is capable of achieving the accuracy required and complies with specifications relevant to the methods concerned. Calibration procedures are established for instruments and equipment that have a significant effect on the analytical results. Before being placed into service, newly obtained equipment (including that used for sampling) is calibrated and/or verified to establish that it meets the laboratory's specification requirements and complies with the method specifications. All analytical equipment is calibrated and/or verified before use.

For analytical instrumentation, the most appropriate curve fitting model from among the following choices must be utilized (given in the order of preference):

- Average Response Factor
- Linear – No Weighting
- Linear – 1/X Weighting
- Linear – $1/X^2$ Weighting
- Quadratic

When second order (quadratic) curves are evaluated, acceptability must include an assessment of a graphic representation of the curve to confirm that this fit type is not being used to mask detector saturation and that the curve (which defines a parabola) does not result in two concentrations for one response. Higher order polynomial curves (i.e., third-order and greater) are not allowed at ESC.

5.5.3 Operation of Equipment

Analytical equipment is operated only by authorized personnel. Up-to-date instructions and procedures for the use and maintenance of analytical equipment are readily available for use by the appropriate laboratory personnel. This includes any relevant equipment manuals provided by the manufacturer.

5.5.4 Identification of Equipment

Analytical equipment used that is significant to the analytical results is uniquely identified when practical.

5.5.5 Records of Equipment

Records are maintained for analytical equipment used that is significant to the analytical results. These records include at least the following:

- Identity of the equipment (and software if applicable)
- Manufacturer's name, type of equipment, and serial number or other unique identification
- Checks that equipment complies with specifications (see 5.5.2)
- Current location, where appropriate
- Manufacturer's instructions, if available, or reference to their location
- Dates, results, and reports of all calibrations, adjustments, acceptance criteria, and the due date of next calibration where appropriate
- Maintenance carried out to date. Also, the maintenance plan where appropriate
- Any damage, malfunction, modification, or repair to the equipment
- Date placed in service
- Condition when received (e.g., new, used, reconditioned)
- Operational status
- Instrument configuration and settings

5.5.6 Handling of Equipment

The laboratory has established procedures for the safe handling, transport, storage, use, and any planned maintenance of analytical equipment to ensure proper functioning and in order to prevent contamination or deterioration. These procedures include the checks necessary to ensure proper functionality when analytical equipment is returned from being used outside of the permanent control of the laboratory.

5.5.7 Out of Service Equipment

Equipment that has been subjected to overloading, mishandling, gives suspect results, has been shown to be defective, or is performing outside of specified limits is taken out of service. Out of service equipment is isolated and/or clearly labeled to prevent accidental use until it has been repaired and shown to perform correctly. When analytical equipment is taken out of service, the laboratory examines the potential effect it may have had on previous analytical results to identify any non-conforming work (see section 4.9 above).

5.5.8 Calibration Status of Equipment

Whenever practicable, all laboratory equipment requiring calibration is labelled, coded, or otherwise identified to indicate the status of calibration, including the date when last calibrated and the date or expiration criteria when recalibration is due. This requirement is mostly applicable to support equipment such as balances, mechanical pipettes, and temperature reading devices which require periodic calibration. Major analytical equipment that is calibrated and/or verified at time of use does not need to be labeled with its calibration status. Calibration records described in section 5.5.5 above are sufficient to indicate the calibration status.

5.5.9 Returned Equipment Checks

When, for whatever reason, equipment goes outside the direct control of the laboratory, the laboratory ensures that the function and calibration status of the equipment are checked and shown to be satisfactory before the equipment is returned to service.

5.5.10 Equipment Intermediate Checks

When intermediate checks are needed to maintain confidence in the calibration status of the equipment, these checks are carried out according to a defined procedure. These intermediate checks include continuing calibration verification checks performed on major analytical equipment, and also periodic checks of support equipment such as balances and pipettes.

5.5.11 Equipment Correction Factors

Where calibrations give rise to a set of correction factors, the laboratory has procedures to ensure that copies (e.g., in computer software) are correctly updated.

5.5.12 Safeguarding of Equipment Integrity

Analytical and supporting equipment is protected from inadvertent adjustments that could affect the integrity of the laboratory results. Instruments are located in access-protected areas. Software is tested and approved before use. Spreadsheets used in the calculation of analytical results are tested, approved, and locked before being placed into service.

Table 5.5 General Equipment Calibration

Equipment	**Activity**	**Frequency**	**Record Type**
Balances	Verified with Class I NIST traceable weights when used	Daily, before use	Logbook – Located in each respective lab
Balances	• Clean • Check alignment • Service Contract Top-loading balances are allowed a tolerance of ±1%, while analytical balances are allowed a tolerance of ±0.1%.	At least once annually by a qualified vendor	Certificates from contractor.
Weights – Class I	• Only use for the intended purpose • Use plastic forceps to handle • Keep in case • Store in desiccator • Re-calibrate	Checked for accuracy by an external source, at least every 5 years, or sooner if necessary.	Certificates from contractor.
pH meters	Calibration: • pH buffer aliquot are used only once • Buffers used for calibration bracket the pH of the media, reagent, or sample analyzed. • Check must perform within 0.05 pH units. Temperature correction is performed either automatically by the instrument or manually depending upon the instrument used. Automatic temperature compensation probes are verified annually.	Before use	Calibrations are recorded in a logbook.
Automatic pipettes	Verify for accuracy and precision using reagent water and analytical balance	In-house – Monthly Contract – Semi Annually Tolerance is set at 2.0%, (ASTM standard = 3%).	Monthly verifications are recorded in a logbook. Semi-annual cal. is verified by certificates from the cal. service.
Refrigerators, Freezers, Hot plates and BOD incubators	• Thermometers are immersed in liquid to the appropriate immersion line • The thermometers are graduated in increments of 1°C or less • Temperature ranges are listed in app. SOPs	Temperatures are recorded each day in use	Logbook
Ovens	• Thermometers are immersed in sand to provide even measurement • The thermometers are graduated in increments of 1°C or less	Temperatures are recorded each day in use	Logbook

Table 5.5 General Equipment Calibration

Equipment	**Activity**	**Frequency**	**Record Type**
Thermometers	ESC NIST-certified thermometers	Calibrated at least every 5 years, or sooner if necessary by a NIST calibration service, accredited to ISO/IEC 17025 and ANSI/NCSL Z540-1.	Calibration certificates from the calibration service.
	All working thermometers	Verified at least annually against NIST-certified thermometers by an outside service.	"Accuracy Assurance Program Test Data Sheets" provided by the servicer. All thermometers are tagged with current tolerances. Internal daily checks are recorded in a logbook.
DO Meter	Calibrated according to manufacturer's specifications. Using the recorded temperature and barometric pressure the meter is calibrated to the air saturation of dissolved oxygen using a conversion chart provided by the manufacturer.	Before use	Calibration of each meter is recorded in a separate logbook.
Specific Conductivity Meter	The conductivity meter is calibrated according to manufacturer's specifications. Temperature correction is performed either automatically by the instrument or manually depending upon the instrument used. • Biomonitoring, potassium chloride with a conductivity value of 100 and 1000µmhos/cm is used as the calibration standard. • Wet Lab, potassium chloride with a value of 1413µmhos/cm is purchased from NSI for calibration purposes.	Before use	Calibration of each meter is recorded in separate daily logbooks.
Fume Hoods	Check quarterly and must meet the OSHA minimum recommended face velocity of 60 – 100fpm.	Quarterly	Electronic log

5.6 MEASUREMENT TRACEABILITY

5.6.1 General

All analytical equipment used, including support equipment, having a significant effect on the accuracy or validity of the result of the analysis, calibration or sampling is calibrated before being put into service. The laboratory has established procedures for the calibration and/or verification of this equipment. See the applicable analytical SOPs for more information.

5.6.2 Specific Requirements

The laboratory retains all pertinent information for standards, reagents, and chemicals to ensure that calibrations and measurements are traceable to a national standard. This includes documentation of purchase, receipt, preparation, and use. If traceability of measurements to a national standard is not possible or not relevant, evidence for correlation of results through inter-laboratory comparisons, proficiency testing, or independent analysis is provided.

5.6.3 Reference Standards and Reference Materials

Reference standards and materials are used to derive the laboratory's analytical measurements; therefore, it is essential that the reference standards and materials used are of very high quality.

5.6.3.1 Reference Standards

The laboratory uses ASTM Class 1 reference weights and NIST traceable reference thermometers which are calibrated and/or verified for accuracy by an ISO 17025 (or equivalent) accredited vendor that can provide traceability to national or international standards at a minimum frequency of every 5 years. All working thermometers are calibrated or verified at least annually using a NIST traceable thermometer.

5.6.3.2 Reference Materials

Whenever possible, reference materials must be purchased from a vendor that is accredited to ISO 17034 or Guide 34. Purchased reference materials require a Certificate of Analysis (COA) where available. If a reference material cannot be purchased with a Certificate of Analysis (COA), it must be verified by analysis and comparison to a certified reference material and/or there must be a demonstration of capability for characterization.

Upon receipt, all purchased reference material standards are recorded into a database and are assigned a unique identification number. Theses entries include the chemical name, manufacturer name, manufacturer’s identification numbers, receipt date, and expiration date. The vendor’s certificates of analysis for all standards, reagents, or chemicals are retained for future reference.

Subsequent preparations of intermediate or working solutions are also recorded and given unique identification numbers. These entries include the stock standard identification, the solvent identification used for preparation, method of preparation, preparation date, expiration date, and the preparer’s initials. The unique identification numbers of the reference material standards are used in any applicable sample preparation or analysis records so the standard can be traced back to the standard preparation record. This process ensures traceability back to the national standard.

5.6.3.3 Intermediate Checks

Reference material standards used for instrument calibration are verified by using a second source of the material. The second source materials are from a different manufacturer or different lot from the same manufacturer. Reference material standards are checked frequently and replaced if degradation or evaporation is suspected.

The laboratory also provides satisfactory evidence of correlation of results by participation in a suitable program of inter-laboratory comparisons or proficiency testing whenever possible.

5.6.3.4 Transport and Storage

The laboratory handles and transports reference standards and materials in a manner that protects the integrity of the materials. Reference standard and material integrity is protected by separation from incompatible materials and/or minimizing exposure to degrading environments or materials. Standards and reference materials are stored separately from samples, extracts, and digestates. All standards are stored according to the manufacturer’s recommended conditions. Temperatures colder than the manufacturer’s recommendation are acceptable if it does not compromise the integrity of the material (e.g. remains in liquid state and does not freeze solid). In the event a standard is made from more than a single source with different storage conditions, the standard will be stored according to the conditions specified in the analytical method.

See the applicable analytical SOPs for specific reference material storage protocols.

5.6.3.5 Documentation and Labeling

The laboratory retains records for all standards, reagents, and reference materials. These records include the manufacturer/vendor, the manufacturer's Certificate of Analysis or purity (if available), the date of receipt, and recommended storage conditions. These records also include manufacturer lot numbers when applicable.

For the original containers, the expiration date provided by the manufacturer is recorded on the container if the expiration date is not already present. If an expiration date is not provided then no expiration date labeling is required.

All prepared standard or reagent containers include the laboratory's unique identification number, the standard or chemical name, the date of preparation, the date of expiration, and the preparer's initials. For containers that are too small to accommodate labels that list all of the above information associated with a standard, the minimum required information will be the laboratory's unique identification number and expiration date. This assures that no standard will be used past its assigned expiration date.

Standards, reference materials, and reagents are not used after their expiration dates unless their reliability is thoroughly documented and verified by the laboratory. If a standard exceeds its expiration date and is not re-certified, the laboratory removes the standard and/or clearly designates it as acceptable for qualitative/troubleshooting purposes only. All prepared standards, reference materials, and reagents are verified to meet the requirements of the test method through routine analyses of quality control samples.

5.7 SAMPLING

5.7.1 Sampling Plans and Procedures

Sampling plans and written sampling procedures are used for sampling substances, materials, or products for testing. The sampling plans and procedures are made available at the sampling location. Sampling plans are, whenever reasonable, based on appropriate governing methods. The sampling process addresses the factors to be controlled to ensure the validity of the analytical results.

See Appendix III of this document for more information regarding field sampling protocols.

5.7.2 Customer Requested Deviations

When the customer requires deviations, additions, or exclusions from the documented laboratory sampling plan and/or procedure, these are recorded in detail with the appropriate sampling data and are included in the final report. These deviations are also communicated to the appropriate laboratory personnel.

5.7.3 Sampling Records

Sampling records are maintained that include the sampling procedure used, any deviations from the procedure, the date and time of sampling, the identification of the sampler, environmental conditions (if relevant), and the sampling location.

See Appendix III of this document for more information regarding field sampling protocols.

5.7.4 Laboratory Subsampling

In order for analysis results to be representative of the sample collected in the field, the laboratory has subsampling procedures. For more information see SOP #030220, *Sample Homogenization*.

5.8 SAMPLE MANAGEMENT

5.8.1 Sample Management Procedures

Procedures have been established for the transportation, receipt, handling, protection, storage, retention, and disposal of samples. These procedures include provisions necessary to protect the integrity of the samples, and to protect the interests of the laboratory and our customers. For more information see the following SOPs; 060105 *Sample Receiving*, 060106 *Sample Storage and Disposal*, 060108 *Return Sample Shipping*, 060110 *Sample Shipping*, and 060112 *Cold Storage Management*.

5.8.1.1 Chain of Custody

A chain of custody (COC) provides documentation of the possession of samples from time of collection to receipt in the laboratory. This record generally includes: the number and types of containers; the mode of collection; the collector; time of collection; preservation; and requested analyses.

Laboratory field personnel or customer representatives must complete a chain of custody for all samples that are received by the laboratory. The importance of complete chain of custody records is stressed to the samplers and is critical to insure the requested methods are used to analyze the correct samples. If sample shipments are not accompanied by complete chain of custody records, then Sample Receiving personnel will notify applicable personnel in Customer Services. Customer services then obtains the correct documentation/information from the customer in order for the analysis of samples to proceed.

Chain of custody records are filled out completely and legibly with indelible ink. Errors are corrected by drawing a single line through the initial entry and initialing and dating the change. All transfers of samples are recorded on the chain of custody in the "relinquished" and "received by" sections.

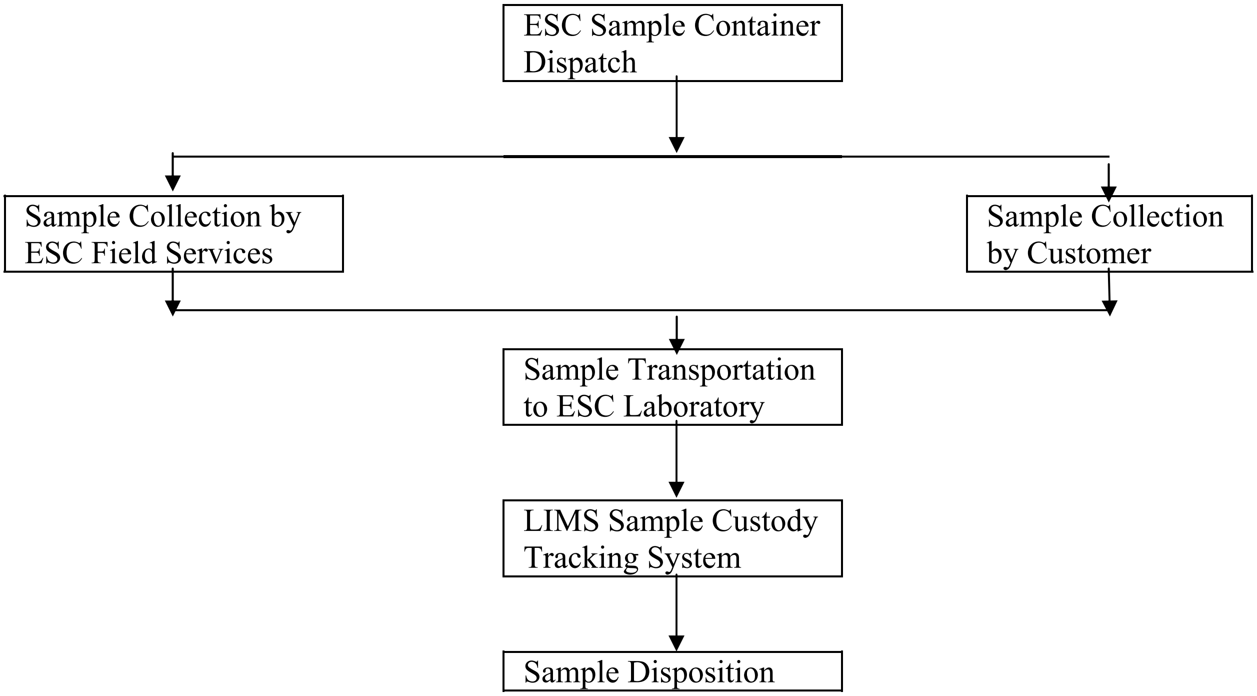
5.8.1.2 Legal Chain of Custody

Legal chain of custody procedures are performed at the special request of the customer, or if there are program requirements that mandate these procedures.

The legal chain of custody (COC) protocol establishes an intact, continuous record of the physical possession, storage, and disposal of samples. This includes the collected samples, sample aliquots, and sample extracts/digestates. Legal COC records account for all time periods associated with the samples, and identifies all individuals who physically handled individual samples. Legal COC shall begin at the point established by the federal or state oversight program. This may begin at the point that cleaned sample containers are provided by the laboratory or the time sample collection occurs.

Figure 5.8.1 below represents a flow diagram of the legal chain of custody process.

FIGURE 5.8.1
LEGAL CHAIN OF CUSTODY PROCESS



5.8.2 Sample Identification and Labeling

A unique sample identification number is generated for each sample submitted to the laboratory and is used throughout the analytical and disposal cycle. A record of all samples is established and maintained.

Each sample is assigned a unique and consecutive log number. After a sample is entered into the Laboratory Information Management System (LIMS) database it is assigned a specific log number identifier. The LIMS automatically assigns the next consecutive number any subsequent samples. Log numbers are not available for reuse and cannot be altered.

A durable laboratory sample label with the log number is printed from LIMS and is affixed to the sample. Each label contains a unique container ID, represents the sample ID number, and is clearly marked with preservative and requested analysis.

5.8.3 Sample Receipt, Inspection, and Login

Upon receipt of samples, departures from method or regulatory specified conditions are recorded. When these departures occur, the laboratory contacts the customer for further instructions before proceeding with the analysis. Records of these discussions are maintained.

5.8.3.1 Sample Acceptance Policy

In accordance with regulatory guidelines, ESC Lab Sciences complies with the following sample acceptance policy for all samples received.

If the samples do not meet the sample receipt acceptance criteria outlined below, the laboratory is required to document all non-compliances, contact the customer, and either reject the samples or fully document any decisions to proceed with analyses of samples which do not meet the criteria. Any results reported from samples not meeting these criteria are appropriately qualified on the final report.

All samples must:

- Have unique client identification that are clearly marked with durable waterproof labels on the sample containers and that match the chain of custody.
- Have clear documentation on the chain of custody related to the location of the sampling site with the time and date of sample collection.
- Have all requested analyses clearly designated on the COC.
- Be in appropriate sample containers with clear documentation of the preservatives used.
- Be correctly preserved unless the method allows for laboratory preservation.

- Be received within holding time. Any samples with hold times that are exceeded will not be processed without prior customer approval.
- Have sufficient sample volume to proceed with the analytical testing. If insufficient sample volume is received, analysis will not proceed without customer approval.
- Be received within appropriate temperature ranges (not frozen but ≤6°C) unless program requirements or customer contractual obligations mandate otherwise. The cooler temperature is recorded directly on the COC. Samples that are delivered to the laboratory immediately after collection are considered acceptable if there is evidence that the chilling process has been started. For example, by the arrival of the samples on ice. If samples arrive that are not compliant with these temperature requirements, the customer will be notified. The analysis will NOT proceed unless otherwise directed by the customer. If less than 72 hours remain in the hold time for the analysis, the analysis may be started while the customer is contacted to avoid missing the hold time. Data associated with any deviations from the above sample acceptance policy requirements will be appropriately qualified.

Samples for drinking water analysis that are improperly preserved, or are received past holding time, are rejected at the time of receipt, with the exception of VOA samples that are tested for pH at the time of analysis.

5.8.3.2 Sample Receipt and Inspection

All samples are verified upon receipt as meeting its description and being free from damage. In the event of a sample being lost, damaged or otherwise unsuitable for use, full details of the incident are recorded and reported to the customer by the Technical Service Representative via a nonconformance form, prior to any analytical action being taken. Any further action taken is at the direction of the customer.

Login Technicians are responsible for sample login and assessing sample container integrity, documentation, and identification. Samples are inspected and noted for temperature, pH using narrow-range pH paper, headspace, proper container type, container integrity (broken or leaking), and volume levels. Samples requiring thermal preservation at 4°C must arrive at the laboratory above freezing but ≤6°C. If the samples are not appropriately preserved, the problem is noted on a sample nonconformance form, the customer is notified, and, if the lab is instructed to proceed, proper preservation is performed. The sample nonconformance sheet becomes a permanent part of the COC. Samples, which require refrigeration, are placed in a laboratory cooler immediately after login.

Login Technicians are trained to recognize analyses with immediate, 24-hour, and 48-hour holding times. Those samples are designated as “short-holds”. When short-hold samples arrive at the laboratory, the Login procedure for those samples takes place immediately. All analysts are trained to assess incoming samples for holding time limitations.

If a sample has a holding time limitation, the LIMS issues a due date on the bench sheet to ensure that the extraction or analysis is completed within the time allowed. In the event that a holding time is exceeded, the TSR contacts the customer, informs them of the situation, and requests further direction. If instructed by the customer to proceed with the analysis, a qualifier is added to the benchsheet, which is then carried on to reporting. The final report bears the explanation in the form of a qualifier.

5.8.3.3 Nonconformance Issues

- If there are problems with the samples, the event details are documented on the sample nonconformance form/COC; then, the sampler and/or customer is notified.
- If the customer insists on proceeding with analyses, even with full knowledge of the possible invalidity of the sample, a qualifier detailing the problem is added in the LIMS and it is also noted on the nonconformance form.
- The TSR, affected chemists, and reporting personnel are also notified.

5.8.3.4 Sample Login

After sample inspection, all sample information on the chain of custody is entered into the Laboratory Information Management System (LIMS). This permanent record documents receipt of all sample containers including:

- Customer name and contact information
- The laboratory’s unique sample identification numbers
- Sample descriptions
- Due dates
- List of analyses requested
- Date and time of laboratory receipt
- Field ID code
- Date and time of collection
- Any comments resulting from inspection for sample rejection

5.8.4 Sample Storage and Protection

The samples are stored according to method and regulatory requirements as per the applicable analytical SOPs. While in storage, samples are stored by sample ID and analyses required. Samples are stored away from all standards, reagents, or other potential sources of contamination. Samples are stored in a manner that prevents cross contamination. Volatile samples are stored separately from other samples. All sample fractions, extracts, leachates, and other sample preparation products are stored in the same manner as actual samples or as specified by the analytical method.

Refrigerated storage areas are maintained at ≤6°C (but not frozen) and freezer storage areas are maintained at <-10°C (unless otherwise required per method or program). The temperature of each storage area is checked and documented at least once for each day of use. If the temperature falls outside the acceptable limits, then corrective actions are taken and appropriately documented.

The laboratory is operated under controlled access protocols to ensure sample and data integrity. Visitors must register at the front desk and be properly escorted at all times. Samples are taken to the appropriate storage location immediately after sample receipt and login procedures are completed. All sample storage areas have limited access. Samples are removed from storage areas by designated personnel and returned to the storage areas as soon as possible after the required sample quantity has been taken.

5.8.4.1 Sample Retention and Disposal

Samples, extracts, digestates, and leachates are retained by the laboratory for the period of time necessary to protect the interests of the laboratory and the customer. Unused portions of samples are retained by the laboratory based on program or customer requirements for sample retention and storage. The minimum sample retention time is 45 days after sample receipt. Samples may be stored at ambient temperature when all analyses are complete, the hold time is expired, the report has been delivered, and/or allowed by the customer or program. Samples requiring storage beyond the minimum sample retention time due to special requests or contractual obligations may be stored at ambient temperature unless the laboratory has sufficient capacity and their presence does not compromise the integrity of other samples.

After this period expires, non-hazardous samples are properly disposed of as non-hazardous waste. The preferred method for disposition of hazardous samples is to return the excess sample to the customer. If it is not feasible to return samples, or the customer requires the laboratory to dispose of excess samples, proper arrangements will be made for disposal by an approved contractor.

For more information about sample storage and disposal see Section 6 of this document, SOP #060106, *Sample Storage and Disposal*, and SOP #060112, *Cold Storage Management*.

5.9 QUALITY CONTROL

5.9.1 Quality Control Procedures

ESC Lab Sciences has established quality control procedures for monitoring the validity of the testing it performs. Quality control samples are processed in the same manner as customer samples. The quality control results are recorded in such a way that trends are detectable, and where practicable, are statistically evaluated. This monitoring is planned and reviewed, and includes the utilization of certified reference materials (where available), participation in proficiency testing programs, replicate or confirmation analyses, correlation of results from related analyses, comparison to historical data, etc.

5.9.2 Quality Control Evaluation

The quality control data is evaluated and, when found to be outside pre-defined criteria, action is taken to correct the problem and to prevent incorrect results from being reported. For more information see the applicable analytical SOPs.

5.9.3 Essential Quality Control Procedures

Below are some general essential quality control procedures used in the laboratory. Additional information can be found in the applicable analytical SOPs.

5.9.3.1 Initial Calibration Verification (ICV) or Second Source Verification (SSV)

It is possible for a calibration curve to meet method criteria but still not have the ability to obtain accurate results because all calibration points are from the same source. To assess the accuracy of new calibration curves relative to the purity of the standards, a single standard from a secondary source is analyzed. This secondary source must be from an alternative vendor or from a different lot if the same vendor is used for the preparation of the calibration standards. The laboratory follows specific guidelines for ICV/SSV recoveries and further information can be found in the applicable laboratory SOP.

5.9.3.2 Continuing Calibration Verification (CCV)

Analytical instrumentation is checked periodically to determine if the analytical response has changed significantly since the initial calibration was established. The values obtained from the analysis of the CCV are compared to the true values and a percent change calculated. The laboratory follows specific guidelines for CCV frequency and recoveries. Further information can be found in the applicable laboratory SOP.

5.9.3.3 Method Blank

A method blank is used to evaluate contamination in the preparation/analysis system and is processed through all preparation and analytical steps with its associated samples. A method blank is processed at a minimum frequency of one per batch of up to twenty samples.

The method blank consists of a matrix similar to the associated samples that is known to be free of analytes of interest. Method blanks are not applicable for certain analyses, such as pH, conductivity, flash point and temperature.

Each method blank is evaluated for contamination. The source of any contamination is investigated and documented corrective action is taken when the concentration of any target analyte is detected above the reporting limit and is greater than 1/10 of the amount of that analyte found in any associated sample. Some programs may require evaluating their method blanks down to ½ the reporting limit as opposed to the reporting limit itself. Corrective actions for blank contamination may include the re-preparation and re-analysis of all samples (where possible) and quality control samples. Data qualifiers must be applied to results that are considered affected by contamination in a method blank.

5.9.3.4 Laboratory Control Sample

The Laboratory Control Sample (LCS) is used to evaluate the performance of the entire analytical system including preparation and analysis. An LCS is processed at a minimum frequency of one per batch of up to twenty samples.

The LCS consists of a matrix similar to the associated samples that is known to be free of the analytes of interest that is then spiked with known concentrations of target analytes. An LCS is not applicable for certain analyses where spiking procedures are not practical such as dissolved oxygen, odor, and temperature.

The LCS is evaluated against the method default or laboratory-derived acceptance criteria. Any compound that is outside of these limits is considered to be ‘out of control’ and must be qualified appropriately. Any associated sample containing an ‘out-of-control’ compound must either be re-analyzed with a successful LCS or reported with the appropriate data qualifier. An exception to this is when the acceptance criteria for the LCS are exceeded high and there are associated samples that are non-detects, then those non-detects can be reported. Another exception is when the acceptance criteria are exceeded low, those associated sample results may be reported if they exceed the maximum regulatory limit or decision level.

For LCSs containing a large number of analytes, it is statistically likely that a few recoveries will be outside of control limits. This does not necessarily mean that the system is out of control, and therefore no corrective action would be necessary (except for proper documentation). TNI has allowed for a minimum number of marginal exceedances, defined as recoveries that are beyond the LCS control limits (3X the standard deviation) but less than the marginal exceedance limits (4X the standard deviation). The number of allowable exceedances depends on the number of compounds in the LCS. If more analyte recoveries exceed the LCS control limits than is allowed (see below) or if any one analyte exceeds the marginal exceedance limits, then the LCS is considered non-compliant and corrective actions are necessary. The number of allowable exceedances is as follows:

Number of Target Analytes	**Allowable Marginal Exceedance Outliers**
>90	5 analytes allowed in the ME limit
71-90	4 analytes allowed in the ME limit
51-70	3 analytes allowed in the ME limit
31-50	2 analytes allowed in the ME limit
11-30	1 analytes allowed in the ME limit
<10	0 analytes allowed in the ME limit

5.9.3.5 Matrix Spike

A matrix spike (MS) is used to determine the effect of the sample matrix on compound recovery for a particular method. The information from these spikes is sample or matrix specific and is not used to determine the acceptance of an entire batch. A MS consists of the sample matrix that is then spiked with known concentrations of target analytes.

A Matrix Spike/Matrix Spike Duplicate (MS/MSD) set is processed at a frequency specified in the applicable laboratory SOP or as determined by a specific customer request. Typically, an MS/MSD set is analyzed once per batch of up to twenty samples.

The MS/MSD set is evaluated against the method or laboratory derived criteria. Any compound that is outside of these limits is considered to be ‘out of control’ and must be qualified appropriately. Batch acceptance, however, is based on method blank and LCS performance, not on MS/MSD recoveries. The spike recoveries give the data user a better understanding of the final results based on their site specific information.

5.9.3.6 Sample Duplicate

A sample duplicate is a second portion of sample that is prepared and analyzed in the laboratory along with the first portion. It is used to measure the precision associated with preparation and analysis. A sample duplicate is processed at a frequency specified by the particular method or as determined by a specific customer.

The sample and duplicate are evaluated against the method or laboratory derived criteria for relative percent difference (RPD). Any duplicate that is outside of these limits is considered to be 'out of control' and must be qualified appropriately.

5.9.3.7 Surrogates

Surrogates are compounds that reflect the chemistry of target analytes, but are not expected to occur naturally in field samples. The purpose of the surrogates is to assess sample preparation, analytical efficiency, and to monitor the effect of the sample matrix on compound recovery.

The surrogates are evaluated against the method or laboratory derived acceptance criteria or against project-specific acceptance criteria specified by the customer. Any surrogate compound that is outside of these limits is considered to be 'out of control' and must be qualified appropriately. Samples with surrogate failures can be re-extracted and/or re-analyzed to confirm that the out-of-control value was caused by the matrix of the sample and not by some other systematic error.

5.9.3.8 Internal Standards

Internal Standards are compounds not expected to occur naturally in field samples. They are added to every standard and sample at a known concentration prior to analysis for the purpose of adjusting the response factor used in quantifying target analytes. The laboratory follows specific guidelines for the treatment of internal standard recoveries and further information can be found in the applicable laboratory SOP.

5.9.3.9 Proficiency Testing (PT) Studies

The laboratory participates in proficiency testing programs. PT samples are obtained from approved providers and analyzed and reported at a minimum of two times per year for the relevant fields of testing per matrix. PT samples are treated as typical customer samples. They are included in the laboratory's normal analytical processes and do not receive extraordinary attention due to their nature.

The laboratory does not share PT samples with other laboratories, does not communicate with other laboratories regarding current PT sample results, and does not attempt to obtain the assigned value of any PT sample from the PT provider.

The laboratory initiates an investigation and corrective action plan whenever PT results are deemed unacceptable by the PT provider. Additional PTs will be analyzed and reported as needed for certification purposes.

Additional information can be found in the SOP# 030212, *Proficiency Testing Program*

5.10 DATA REPORTING

5.10.1 General

The results of each analysis carried out by the laboratory are reported accurately, clearly, unambiguously, objectively, and in accordance with any specific instructions in regulatory requirements, analytical method(s), and/or laboratory standard operating procedures. The analytical data is reported in an analytical report that is issued to the customer. Analytical reports include all information requested by the customer, any necessary information for the interpretation of the results, and all information required by the analytical method(s) used.

Final reports are prepared according to the level of reporting required by the customer and can be transmitted to the customer via hardcopy and/or electronic data deliverables.

5.10.2 Analytical Reports

In the case of a written agreement with the customer, the analytical results may be reported in a non-standard way. In these cases, all information contained in the standard analytical reports is maintained by the laboratory and is readily available.

Standard analytical reports contain the following information:

- A title (e.g. Analytical Report)
- ESC Lab Sciences name and address
- Telephone number and name of a laboratory contact to where questions can be referred
- A unique identification number for the report. The pages of the report are numbered and a total number of pages are indicated.
- Name and address of the customer
- Identification of the analytical methods used
- The unique laboratory’s identification of the samples analyzed as well as customer’s identification of the samples
- The condition of the samples received and the identification of any sample that did not meet acceptable sampling requirements such as improper sample containers, holding times missed, sample temperature, etc.
- Dates and times of sample collection, sample receipt by the laboratory, sample preparation, and sample analysis
- Reference to the sampling plan and sampling procedures used if sampling was conducted by the laboratory

- The analytical results with the units of measurement and reporting limits.
- The name, title, and signature of the person authorizing the analytical report
- A statement about the results relate only to the items tested
- Deviations from the analytical methods. These can include failed quality control parameters, deviations caused by the matrix of the sample, etc. This can be part of the case narrative or as defined footnotes to the analytical data.
- For Whole Effluent Toxicity, identification of the statistical method used to provide data
- Date report was issued
- For solid samples, identification of whether results are on a dry weight or wet weight basis
- Identification of all test results provided by a subcontracted laboratory or other outside source
- Any non-accredited tests are identified as such
- Identification of results obtained outside of quantitation levels
- In conjunction with Ohio VAP projects, a signed affidavit is also required.

5.10.3 Additional Analytical Report Items

In addition to the requirements listed above, final reports also contain the following items when necessary for the interpretation of results:

- Deviations from, additions to, or exclusions from the analytical method(s) used. Also where relevant, information on specific analytical conditions such as environmental conditions
- Where relevant, a statement of compliance/non-compliance with requirements and/or specifications (e.g. TNI Standard)
- Where applicable, a statement on the estimated uncertainty of measurement; information on uncertainty is needed in test reports when it is relevant to the validity or application of the test results, when a customer’s instruction so requires, or when the uncertainty affects compliance to a specification limit;
- Where appropriate and needed, opinions and interpretations (see section 5.10.5 below)

In addition to the requirements listed above, analytical reports containing the results of samples collected by the laboratory include the following, where necessary for the interpretation of test results:

- The date of sampling
- Unambiguous identification of the substance, material or product sampled
- The location of sampling, including any diagrams, sketches or photographs
- A reference to the sampling plan and procedures used

- Details of any environmental conditions during sampling that may affect the interpretation of the test results
- Any standard or other specification for the sampling method or procedure, and deviations, additions to or exclusions from the specification concerned.

5.10.4 Calibration Certificates

ESC Lab Sciences is an analytical laboratory that does not perform calibration activities for customers; therefore, no calibration certificates are issued to customers.

5.10.5 Opinions and Interpretations

When opinions and interpretations are included in the analytical reports, the laboratory documents the basis upon which the opinions and interpretations have been made. These may include opinions on the compliance/non-compliance of the results with regulatory requirements, fulfillment of contractual requirements, and recommendations on how to use the results. Opinions and interpretations are clearly marked as such in the analytical report and are contained in the case narrative.

5.10.6 Results from Subcontractors

When the analytical reports contain results of tests performed by subcontractors, these results are clearly identified. When analytical work has been subcontracted, the subcontracted laboratory issues analytical reports to ESC Lab Sciences in writing and/or electronically. Copies of analytical reports from subcontracted laboratories are made available to customers.

5.10.7 Electronic Transmission of Results

Customer data that requires transmission by electronic means undergoes appropriate steps to include all the required reporting information and to adequately maintain data integrity and confidentiality.

5.10.8 Format of Analytical Reports

The format of the laboratory’s analytical reports are designed to accommodate each type of analytical test carried out by the laboratory and to minimize the possibility of misunderstanding or misuse of analytical results.

5.10.9 Amendments to Analytical Reports

Analytical reports that are amended after issue to the customer are clearly identified as such and include a reference to the original report. This process is described in SOP 030223, *Report Revision*.

6.0 WASTE MINIMIZATION/DISPOSAL AND REAGENT STORAGE

ESC's sample disposal policy is founded on RCRA [40 CFR Part 261.4 (d)] and CWA [40 CFR Part 403 (Pretreatment)]. Part 261.4 (Figure 6.4) excludes a sample of waste while it is a sample; however, once no longer fitting the description of a sample, it becomes waste again. The policy is further strengthened by information found in “Less is Better” published by the ACS and developed by the ACS Task Force on RCRA.

The EPA requires that laboratory waste management practice to be conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes must be characterized and disposed of in an acceptable manner. Refer to ESC SOP #030309, *Waste Management Plan* for detailed information.

6.1 QUARANTINED SOIL SAMPLES

ESC maintains a permit to receive and analyze soils from foreign or quarantined areas. All non-hazardous soil samples are disposed of as originating from a quarantined area. All unconsumed soil samples and containers are sterilized in accordance with the current USDA regulations found in 7 CFR 301.81. Both container and contents are dry-heated at 450°F for two minutes, then crushed prior to disposal into a sanitary landfill. For further information refer to SOP# 030309, *Waste Management Plan*.

6.2 MOLD/BIOHAZARD SAMPLE DISPOSAL

The laboratory has contracted a local licensed medical waste removal and disposal firm to remove all biohazard and medical waste generated by the laboratory. All waste arriving at the treatment facility is incinerated or steam sterilized complying with all Federal, State, County and local rules, regulations and ordinances. The medical waste containers are picked up at least weekly and confirmation records are available in the laboratory.

All wastes classified as non-biohazard are disposed of via the sanitary sewer following treatment with a disinfectant, such as Chlorox (hypochlorite). The disinfectant and waste liquid is one part disinfectant and five parts waste liquid. Waste disposal records indicating the disposal method are available in the laboratory.

6.3 REAGENTS, STORAGE AND WASTE DISPOSAL

6.3.1 Reagents:

- All chemicals are at least ACS reagent-grade or better.
- All reagents and chemicals are checked for quality, purity and acceptability upon arrival in the laboratory.
- Each chemical container displays the following information: date opened and the expiration date.

- All reagent solutions prepared in-house are documented in Standards Logger and labels contain the following information: unique ESC identifier, date prepared, analyst initials, expiration date, and reagent name. In house reagents are recorded with the same information in Standards Logger.
- Purchased reagent solutions are labeled with a unique identifier assigned in Standards Logger when received, opened and with the expiration date.

6.3.2 Storage:

- Reagents requiring refrigeration are stored in the area of use in a suitable refrigerated storage that is separate from field sample storage.
- Reagents and standards used for volatile organic analysis are stored in a separate refrigerator and are not stored with field samples.
- See the following table for more information regarding reagent storage.

Item	**Reagent Storage**
Acids	Designated acid storage cabinets, in original container.
Organic Reagents - Flammables	Stored in flammables cabinet on separate air handling system from volatiles analysis.
Liquid Bases	Stored in designated cabinet, away from acids.
Solid Reagents	General cabinet storage.
Refrigerated Aqueous Reagents/Standards	Stored in walk-in cooler on designated shelves, away from field samples.
Stable Standard Solutions	Storage cabinet designated in each laboratory for standards.
Dehydrated Media	Dehydrated media is stored at an even temperature in a cool dry place away from direct sunlight. Media is discarded if it begins to cake, discolor or show signs of deterioration. If the manufacturer establishes an expiration date, the media is discarded after that date. The time limit for unopened bottles is 2 years at room temperature. Where needed comparisons of recovery of newly purchased lots of media against proven lots, using recent pure-culture isolates and natural samples, are performed.
Pure Biological Cultures	All organisms are stored on Tryptic Soy Agar at 4°C in a dedicated refrigerator located in the biology department

6.3.3 Disposal:

- All excess, out of date or unneeded chemicals, reagents and standards are sent to the ESSH Office to ensure proper disposal. Excess chemicals designated as hazardous waste are lab packed and disposed of according to local, State and Federal regulations. Final disposal method is dependant on the classification of each individual chemical. Some sample extracts, chemicals or standards designated as hazardous waste may be disposed of into appropriate satellite accumulation areas.

Any additional EPA waste codes resulting from addition of standard are applied to the satellite container, if applicable.

- ESSH prohibits the sink disposal of chemicals, the intentional release of chemicals through chemical fume hoods and mixing of nonhazardous lab trash with hazardous waste.
- Sample and reagent/solvent disposal is handled in different ways according to toxicity.
  - ➢ Solvents, reagents, samples and wastes are segregated according to base/acid, reactive/non-reactive, flammable/non-flammable, hazardous/non-hazardous, soil/liquid etc. Samples are grouped together relevant to these categories and are disposed of accordingly.
  - ➢ Table 6.3 lists waste disposal methods for various test by-products.
- Upon receipt and login, each sample is coded by sample matrix type. The codes divide samples into the following groups: air, industrial hygiene, wastewater, cake sludge, soil, drinking water and miscellaneous. As laboratory personnel review the data reported, the method of disposal is also determined.
- The TSR is notified if samples are to be returned to the customer.

6.4 CONTAMINATION CONTROL

6.4.1 VOCs

The VOC Lab is physically separated from the Extraction Laboratory in order to eliminate contamination caused by the use of extraction solvents. Contamination is monitored daily through the use of instrument/method blanks. Refrigerator blanks are also used to ensure that cross contamination does not occur during volatile field sample storage.

6.4.2 Biological Lab

The aquatic toxicity testing, mold testing, and all other biological determinations are performed in the administrative building and are therefore physically separated from processes involving solvent or other chemical use that could negatively impact biological organisms. The mold lab conducts monthly analyses to ensure that the laboratory environment is contaminant free. All critical areas are included and a record is kept of the sampling plan (including locations) and results.

TABLE 6.4 - WASTE DISPOSAL

NOTE: This information is a general guide and is not intended to be inclusive of all waste or hazardous samples.

PARAMETER	WASTE PRODUCTS	WASTE CLASSIFICATION	DISPOSAL METHOD
Acidity	slightly alkaline water	none	neutralize-sanitary sewer
Alkalinity	slightly acidic	none	neutralize-sanitary sewer
BOD, 5-day	Sample waste only	none	sanitary sewer
COD	acid waste, Hg, Ag, Cr+6	corrosive, toxic	dispose via haz waste regulations
Conductivity	Sample waste only	none	sanitary sewer
Cyanide, Total	acidic waste	corrosive	neutralize-sanitary sewer
Cyanide, Amenable	acidic waste	corrosive	neutralize-sanitary sewer
Flashpoint	Misc. Organic waste containing Chlorobenzene	Flammable	Dispose via haz waste regulations
Hardness, Total	pH 10.0 alkaline waste	none	neutralize-sanitary sewer
Extraction/prep	methylene chloride and hexane	toxic solvents	Reclaim for resale
Methylene Blue Active Sub.	Acidic Chloroform Waste	toxic & acidic	dispose via haz waste regulations
Nitrogen-Ammonia	alkaline liquids	corrosive	neutralize-sanitary sewer
Nitrogen-Total Kjeldahl	Trace Hg in alkaline liquid	corrosive toxic	neutralize-sanitary sewer
Nitrogen-Nitrate, Nitrite	mild alkaline waste	none	sanitary sewer
Oil & Grease and Petroleum/Mineral Oil & Grease	Hexane	Toxic solvent	dispose via haz waste regulations
pH	Sample waste only	none	sanitary sewer
Phenols	slightly alkaline, non-amenable CN-	none	sanitary sewer
Phosphate-Total and Ortho	combined reagent	listed	sanitary sewer
Reactive CN & S	Acidic waste	corrosive	Neutralize - sanitary sewer; waste is monitored for CN
Solids, Total/ Suspended/Dissolved	Sample waste only	none	sanitary sewer
Turbidity	Sample waste only	none	sanitary sewer
Metals	acids, metal solutions	corrosive, toxic	highly toxic metal standards and samples - dispose via haz waste regulations
Volatile Organics	methanol	toxic solvents	dispose via haz waste regulations
Extractable Organics	solvents, standards	toxic solvents	dispose via haz waste regulations
Biological Non-biohazardous Waste	Gloves, plastic containers	none	Standard refuse

40 CFR PART 261-IDENTIFICATION AND LISTING OF HAZARDOUS WASTE

Subpart A-General Sec.
261.1 Purpose and scope.
261.2 Definition of solid waste.
261.3 Definition of hazardous waste.

261.4	Exclusions.
261.5	Special requirements for hazardous waste generated by conditionally exempt small quantity generators.
261.6	Requirements for recyclable materials.
261.7	Residues of hazardous waste in empty containers.
261.8	PCB wastes regulated under Toxic Substance Control Act.
261.9	Requirements for Universal Waste.

Sec.261.4 Exclusions.
(d) *Samples.* (1) Except as provided in paragraph (d)(2) of this section, a sample of solid waste or a sample of water, soil, or air, which is collected for the sole purpose of testing to determine its characteristics or composition, is not subject to any requirements of this part or parts 262 through 268 or part 270 or part 124 of this chapter or to the notification requirements of section 3010 of RCRA, when:

(i) The sample is being transported to a laboratory for the purpose of testing; or
(ii) The sample is being transported back to the sample collector after testing; or
(iii) The sample is being stored by the sample collector before transport to a laboratory for testing; or
(iv) The sample is being stored in a laboratory before testing; or
(v) The sample is being stored in a laboratory after testing but before it is returned to the sample collector; or
(vi) The sample is being stored temporarily in the laboratory after testing for a specific purpose (for example, until conclusion of a court case or enforcement action where further testing of the sample may be necessary).
(2) In order to qualify for the exemption in paragraphs (d)(1) (i) and (ii) of this section, a sample collector shipping samples to a laboratory and a laboratory returning samples to a sample collector must:
(i) Comply with U.S. Department of Transportation (DOT), U.S. Postal Service (USPS), or any other applicable shipping requirements; or
(ii) Comply with the following requirements if the sample collector determines that DOT, USPS, or other shipping requirements do not apply to the shipment of the sample:
(A) Assure that the following information accompanies the sample:
(*1*) The sample collector's name, mailing address, and telephone number;
(*2*) The laboratory's name, mailing address, and telephone number;
(*3*) The quantity of the sample;
(*4*) The date of shipment; and
(*5*) A description of the sample.
(B) Package the sample so that it does not leak, spill, or vaporize from its packaging.
(3) This exemption does not apply if the laboratory determines that the waste is hazardous but the laboratory is no longer meeting any of the conditions stated in paragraph (d)(1) of this section.

7.0 Common Calculations

- Percent Recovery (%REC)

$$\%REC = \frac{(MeasuredValue - SampleConc)}{TrueValue} * 100$$

where:
TrueValue = Amount spiked
MeasuredValue = Amount measured
SampleConc = Amount measured in source sample (Used for %REC in MS calculations)
NOTE: The SampleConc is zero (0) for LCS and Surrogate Calculations

- Relative Percent Difference (RPD)

$$RPD = \frac{|(R1 - R2)|}{(R1 + R2)/2} * 100$$

where:
R1 = Result of Sample 1
R2 = Result of Sample 2

- Percent Difference (%D)

$$\%D = \frac{MeasuredValue - TrueValue}{TrueValue} * 100$$

where:
TrueValue = Amount spiked (can also be the CF or RF of the ICAL Standards)
Measured Value = Amount measured (can also be the CF or RF of the CCV)

- Percent Drift

$$\%Drift = \frac{CalculatedConcentration - TheoreticalConcentration}{TheoreticalConcentrtion} * 100$$

- Average

$$Average = \frac{\sum_{n=1}^{i} X_i}{n}$$

where:
n = number of data points
X_i = individual data point

- Calibration Factor (CF)

$$CF = \frac{A_s}{C_s}$$

where:
A_s = Average Peak Area over the number of peaks used for quantitation
C_s = Concentration of the analyte in the standard.

- Response Factor (RF)

$$RF = \frac{(Conc._{IStd})(Area_{Analyte})}{(Conc._{analyte})(Area_{IStd})}$$

where:
A_s = Response for analyte to be measured
A_{is} = Response for the internal standard
C_{is} = Concentration of the internal standard
C_s = Concentration of the analyte to be measured

- Standard Deviation (S)

$$S = \sqrt{\sum_{i=1}^{n} \frac{(X_i - X_{ave})^2}{(n-1)}}$$

where:
n = number of data points
X_i = individual data point
X_{ave} = average of all data points

- Relative Standard Deviation (RSD)

$$RSD = \frac{S}{X_{ave}} * 100$$

where:
S = Standard Deviation of the data points
X_{ave} = average of all data points

- Minimum Detectable Activity (MDA)

  The MDA is used for radiological analysis and is calculated with the following equations:

MDA with Blank Population

$$MDA = \frac{3.29 \times S_b}{KT_s} + \frac{3}{KT_s}$$

Where:
K = E × V × R × Y × F × 2.22
    E = efficiency
    V = sample volume
    R = tracer recovery
    Y = gravimetric carrier recovery
    F = ingrowth or decay factor
    2.22 = conversion from dpm to pCi
T_s = count time of sample in minutes
S_b = standard deviation of the blank population

MDA without Blank Population

$$MDA = \frac{3.29 \times \sqrt{\frac{b}{T_s} + \frac{b}{T_b}}}{K} + \frac{3}{KT_s}$$

Where:
b = background count rate in cpm
T_b = Count time of background in minutes

8.0 Revisions

The Regulatory Affairs Department has an electronic version of this Quality Assurance Manual with tracked changes detailing all revisions made to the previous version. This version is available upon request. Revisions to the previous version of the Quality Assurance Manual are summarized in the table below.

Document	**Revision**
Quality Assurance Manual Version 15.0	General – Replaced the term “client” with the term “customer” throughout this document. Also changed references to AIHA to AIHA-LAP or AIHA-PAT as appropriate. Section 1.0 – Limited scope of this section to just a general purpose. Removed Index and Revision Status section. Section 2.2 – Updated the current number of employees, the current square footage, and the current number of buildings. Section 3.3 – Added definitions of the TX TRRP terms SQL, MQL, and Unadj. MQL. Added air and emissions to the definition of Environmental Sample. Added definitions of SUMMA canisters and Tedlar bags. Section 3.4 – Added the descriptions of abbreviations AIHA-LAP and AIHA-PAT. Section 4.1.4 – Reworded section for clarity Section 4.1.5 – Reworded section for clarity Section 4.1.6 – Reworded section for clarity Figure 4.1 – Updated Org Chart Section 4.2 – Reworded entire section for clarity Section 4.2.2 – Rewrote the quality policy statement Section 4.2.6 – Renamed Lab Director to Director of Operations and reworded responsibilities. Removed Technical Director. Added Organics Manager and Inorganics Manager. Renamed QA Manager to QA Director. Section 4.2.8 – Added Data Integrity System section Section 4.3 – Reworded entire section for clarity Section 4.3.4 – Added section for Quality Assurance Manual which was previously in 4.2.4 Section 4.4.1 – Added some language about review of routine/non-complex projects Section 4.4.3 – Reworded section for clarity Section 4.5.5 – Added Identification of Sub Work section. Language was previously in 4.5.3 Section 4.6.2 – Reworded section for clarity Section 4.6.3 – Reworded section for clarity Section 4.7 – Reworded some subsections for clarity Section 4.8 – Reworded entire section for clarity Section 4.9 – Reworded entire section for clarity Section 4.10 – Reworded entire section for clarity Section 4.11 – Reworded entire section for clarity Section 4.12 – Reworded entire section for clarity Section 4.14 – Reworded entire section for clarity Section 4.15 – Reworded entire section for clarity Section 5.2.2 – Reworded entire section for clarity Section 5.2.2.4 – Added section for data integrity training Section 5.2.2.5 – Added section for identification of training needs Section 5.2.2.6 – Added section for evaluation of training effectiveness Section 5.2.3 – Reworded section for clarity Section 5.2.5 – Reworded section for clarity Section 5.3.2 – Reworded section for clarity Section 5.3.3 – Reworded section for clarity Section 5.3.4 – Reworded section for clarity Section 5.4.5.4 – Reworded section for clarity Section 5.4.5.5 – Reworded section for clarity Section 5.4.6 – Reworded section for clarity Section 5.4.7.1 – Reworded section for clarity

Document	Revision
	Section 5.4.7.2 – Added in some DoD required items Section 5.4.7.3 – Added data reduction and review section. Language was previously in section 5.11 and section 5.12 Table 5.4.7a – Revised the levels of LIMS security Section 5.5 – Reworded entire section for clarity Section 5.5.2 – Added appropriate calibration curve models, quadratic curve evaluation, and added language about higher order polynomial curves (i.e., third-order and greater) are not allowed at ESC. Section 5.6 – Reworded entire section for clarity Section 5.7 – Reworded entire section for clarity Section 5.7.4 – Added section for laboratory subsampling Section 5.8 – Reorganized and reworded entire section for clarity 5.8.3.1 – Revised Sample Rejection Policy to a Sample Acceptance Policy and changed the criteria that needs to be met. Section 5.9.1 – Reworded section for clarity Section 5.9.2 – Reworded section for clarity Section 5.10 – Reworded entire section for clarity Section 6.4 – Removed language about wipe testing in Metals for lead Section 7 – Added calculations for MDA used in radiological analysis

ESC Site Plan
QUALITY ASSURANCE MANUAL

APPENDIX I TO THE ESC QUALITY ASSURANCE MANUAL

for

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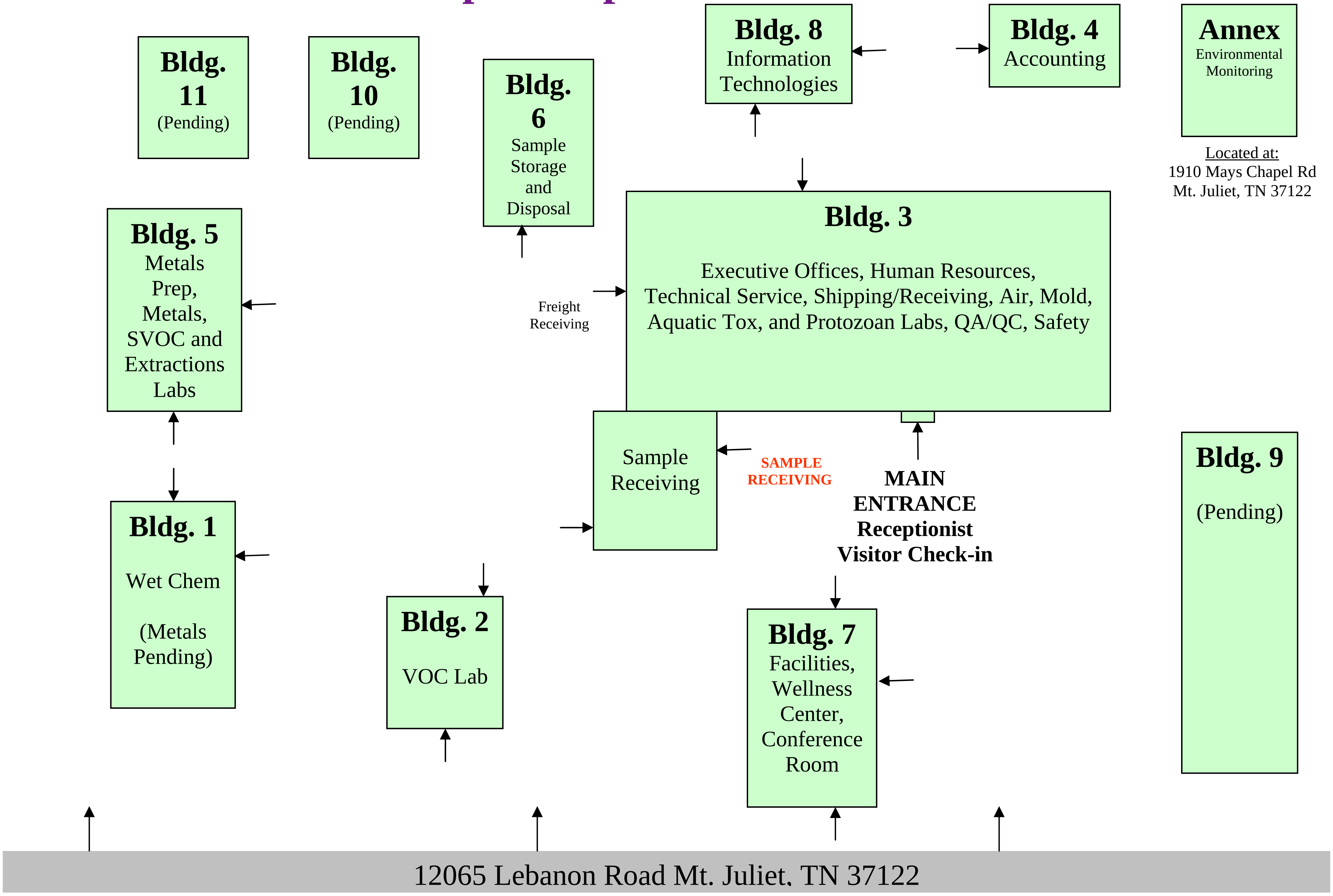
Campus Map


Bldg. 11
(Pending)
Bldg. 10
(Pending)
Bldg. 6
Sample Storage and Disposal
Bldg. 8
Information Technologies
Bldg. 4
Accounting
Annex
Environmental Monitoring
Located at:
1910 Mays Chapel Rd
Mt. Juliet, TN 37122
Bldg. 5
Metals Prep, Metals, SVOC and Extractions Labs
Freight Receiving
Bldg. 3
Executive Offices, Human Resources, Technical Service, Shipping/Receiving, Air, Mold, Aquatic Tox, and Protozoan Labs, QA/QC, Safety
Sample Receiving
SAMPLE RECEIVING
MAIN ENTRANCE
Receptionist
Visitor Check-in
Bldg. 9
(Pending)
Bldg. 1
Wet Chem
(Metals Pending)
Bldg. 2
VOC Lab
Bldg. 7
Facilities, Wellness Center, Conference Room
12065 Lebanon Road Mt. Juliet, TN 37122

ESC Certifications
QUALITY ASSURANCE MANUAL

APPENDIX II TO THE ESC QUALITY ASSURANCE MANUAL

for

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Updated 6/8/16 (May be revised without notice)
Scopes of accreditation are on file in the Regulatory Affairs Department and are available upon request.

State/Agency	Certificate Number	Expiration Date/Status	Certified Programs	Approved Programs[6]	Cert.Type	Cert. Authority
Alabama	**40660**	**6/30/2016**	DW	WW, RCRA, UST	Reciprocity	TN
Alaska	**UST-080**	**1/11/2017**	UST	UST	AK	AK
Arizona	**AZ0612**	**6/25/2017**	AIR, DW, WW, RCRA, UST		Audit	AZ
Arkansas	**88-0469**	**1/21/2017**	WW, RCRA, UST, Bioassay		NELAP	NJ
California	**2932**	**8/31/2016**	WW, RCRA, UST		NELAP	NJ
Colorado	**None**	**3/31/2017**	DW	WW, RCRA, UST	Reciprocity	TN
Connecticut	**PH-0197**	**3/31/2017**	DW, WW, RCRA, UST		Reciprocity	NJ
Florida	**E87487**	**6/30/2016**	AIR, DW, WW, RCRA, UST		NELAP	NJ
Georgia DW	**923**	**6/16/2016**	DW		Reciprocity	TN
Georgia	**None**	**11/30/2017**	WW, RCRA, UST		NELAP	NJ
Georgia DW Crypto	**923**	**6/30/2016**	DW		Reciprocity	NJ
Idaho	**TN00003**	**6/16/2016**	DW	WW, RCRA, UST	NELAP	NJ
Illinois	**200008**	**11/30/2016**	DW, WW, RCRA, UST		NELAP	NJ
Indiana	**C-TN-01**	**6/16/2016**	DW	WW, RCRA, UST	Reciprocity	TN
Iowa	**364**	**5/1/2016**	WW, RCRA, UST		Audit	IA
Kansas	**E-10277**	**10/31/2016**	DW, WW, RCRA, UST		NELAP	NJ
Kentucky DW	**90010**	**12/31/2016**	DW	RCRA	Reciprocity	TN
Kentucky UST	**16**	**11/30/2017**	UST		Audit	A2LA
Kentucky WW	**90010**	**12/31/2016**	WW		Reciprocity	NJ
Louisiana	**Agency ID 30792**	**6/30/2016**	WW, RCRA, UST, AIR		NELAP	NJ
Louisiana DW	**LA150002**	**12/31/2016**	DW		NELAP	NJ
Maine	**TN0002**	**7/5/2017**	DW, WW, RCRA, UST		Reciprocity	TN, NJ
Maryland	**324**	**12/31/2016**	DW		Reciprocity	TN
Massachusetts	**M-TN003**	**6/30/2016**	DW,WW	RCRA, UST	Reciprocity	TN
Michigan	**9958**	**6/16/2016**	DW	WW, RCRA, UST	Reciprocity	TN
Minnesota	**047-999-395**	**12/31/2016**	WW, RCRA, UST		Audit	MN
Mississippi	**None**	**6/16/2016**	DW	WW, RCRA, UST	Reciprocity	NJ
Missouri	**340**	**6/16/2016**	DW	WW, RCRA, UST	Reciprocity	NJ
Montana	**CERT0086**	**1/1/2017**	DW	WW, RCRA, UST	Reciprocity	TN
Nebraska	**NA**	**6/30/2016**	DW	WW, RCRA, UST	Reciprocity	TN
Nevada	**TN-03-2002-34**	**7/31/2016**	WW, DW, RCRA, UST		NELAP	NJ
New Hampshire	**2975**	**5/20/2017**	DW, WW, RCRA, UST		NELAP	NJ
New Jersey - NELAP	**TN002**	**6/30/2016**	DW, WW, RCRA, UST, AIR		NELAP	NJ
New Mexico	**None**	**Renewal**	DW	WW, RCRA, UST	NELAP	NJ
New York	**11742**	**4/1/2017**	WW, RCRA, UST, AIR		NELAP	NJ
North C. Aquatic Tox	**41**	**11/1/2016**	Aquatic Toxicity		Audit	NC
North Carolina DW	**DW21704**	**7/31/2016**	DW		Audit	NC
North Carolina	**Env375**	**12/31/2016**	WW, RCRA, UST		Audit	NC
North Dakota	**R-140**	**6/30/2016**	DW, WW, RCRA		Reciprocity	TN, WI
Ohio VAP	**CL0069**	**7/22/2017**	WW, RCRA, UST, AIR		Audit	OH
Oklahoma	**9915**	**8/31/2016**	WW, RCRA, UST, BIOASSAY		NELAP	NJ
Oklahoma DW			DW – Volatiles & Metals		NELAP	NJ
Oregon	**TN200002**	**1/15/2017**	DW, WW, RCRA, UST		NELAP	NJ

State/Agency	Certificate Number	Expiration Date/Status	Certified Programs	Approved Programs[6]	Cert.Type	Cert. Authority
Pennsylvania	**68-02979**	**12/31/2016**	DW, WW, RCRA, UST	0	NELAP	NJ
Rhode Island	**221**	**12/30/2016**	DW	WW, RCRA, UST	Reciprocity	TN
South Carolina	**84004**	**6/30/2016**	WW, RCRA, UST		NELAP	NJ
South Dakota	**Pending**	**Pending**				
Tennessee DW	**2006**	**6/16/2016**	DW	WW, RCRA, UST	Audit	TN
Tennessee DW Micro	**2006**	**10/12/2018**	DW Micro		Audit	TN
Texas - Env.	**T 104704245-07-TX**	**10/31/2016**	DW, WW, RCRA, AIR		Reciprocity	NJ
Texas - Mold	**LAB0152**	**3/10/2017**	MOLD		NA	TX
Utah	**6157585858**	**7/31/2016**	DW, WW, RCRA, UST		NELAP	NJ
Vermont	**VT2006**	**1/5/2017**	DW	WW, RCRA, UST	Reciprocity	TN
Virginia VELAP	**460132**	**6/14/2016**	DW, WW, RCRA, UST		NELAP	NJ
Washington	**C1915**	**8/19/2016**	DW, WW, RCRA, UST, AIR		Audit	A2LA
West Virginia	**233**	**2/28/2017**	WW, RCRA, UST		Audit	WV
West Virginia Crypto	**9966 M**	**12/31/2016**	DW		Reciprocity	NJ
Wisconsin	**998093910**	**8/31/2016**	WW, RCRA, UST, Bioassay		Audit	WI
Wyoming	**A2LA**	**11/30/2017**	UST	WW, RCRA	Audit	A2LA
A2LA[1]	**1461.01**	**11/30/2017**	DW, WW, RCRA, UST, AIR, MICRO		Audit	A2LA
AIHA-LAP[2]	**100789**	**7/1/2016**	EMLAP[4]		Audit	AIHA
DOD	**1461.01**	**11/30/2017**	RCRA, UST		Audit	A2LA
EPA[8]	**TN00003**	**None**	Cryptospiridium		Audit	EPA
EPA[8] Region 8		**7/15/2016**	Drinking Water		Reciprocity	TN
USDA[5]	**S-67674**	**9/3/2018**	Quarantine Permit		Audit	USDA

(1) A2LA = American Association for Laboratory Accred.
(2) AIHA-LAP = American Industrial Hygiene Association Lab Accred. Program
(3) NELAP = National Environmental Laboratory Accred. Program
(4) EMLAP = Environmental Microbiology Laboratory Accreditation Program
(5) USDA = United States Department of Agriculture
(6) Approved Programs = The state does not have a formal certification program.
(7) Pending = The state is processing our application.
(8) EPA = Environmental Protection Agency

1.0 SIGNATORY APPROVALS

SAMPLING PROTOCOL QUALITY ASSURANCE MANUAL

APPENDIX III TO THE ESC QUALITY ASSURANCE MANUAL

for

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2.0 APPENDIX TABLE OF CONTENTS

3.0 SCOPE AND APPLICATION

This appendix discusses the standard practices and procedures utilized by ESC personnel for site selection and sample collection of various matrices. Topics addressed include field QA/QC procedures, together with equipment care and calibration for field sampling activities. Proper collection and handling of samples is of the utmost importance to insure that collected samples are representative of the sampling site. With this goal, proper sampling, handling, preservation, and quality control techniques for each matrix must be established and strictly followed. Precise identification of the collected samples and complete field documentation including a chain of custody are also vital.

ESC Lab Sciences does not provide sampling services for Industrial Hygiene and Environmental Lead analyses. We do require that all samples collected for these programs be sampled using the guidelines established by NIOSH, OSHA or other published protocol.

In addition, ESC Lab Sciences personnel do not conduct sampling in conjunction with the Ohio Voluntary Action Program (VAP).

4.0 LIST OF SAMPLING CAPABILITIES

• **Parameter Group**	• **Sample Source**
Extractable Organics	Surface water, wastewater, groundwater, stormwater runoff, drinking water, sediments, soils, chemical/ hazardous wastes, domestic wastewater sludge, hazardous waste sludge
Volatile Organic Compounds (VOCs)	Surface water, wastewater, groundwater, stormwater runoff, drinking water, sediments, soils, chemical/ hazardous wastes, domestic wastewater sludge, hazardous waste sludge
Metals	Surface water, wastewater, groundwater, stormwater runoff, drinking water, sediments, soils, chemical/ hazardous wastes, domestic wastewater sludge, hazardous waste sludge
Inorganic Anions	Surface water, wastewater, groundwater, stormwater runoff, drinking water, sediments, soils, chemical/ hazardous wastes, domestic wastewater sludge, hazardous waste sludge
Organics	Surface water, wastewater, groundwater, stormwater runoff, drinking water, sediments, soils, chemical/ hazardous wastes, domestic wastewater sludge, hazardous waste sludge
Physical Properties	Surface water, wastewater, groundwater, stormwater runoff, drinking water, sediments, soils, chemical/ hazardous wastes, domestic wastewater sludge, hazardous waste sludge
Cyanide	Surface water, wastewater, groundwater, stormwater runoff, drinking water, sediments, soils, chemical/ hazardous wastes, domestic wastewater sludge, hazardous waste sludge

• **Parameter Group**	• **Sample Source**
Microbiology	Surface water, groundwater, drinking water, wastewater
Macro Invertebrate Identification	Surface water, wastewater, sediments
Biotoxicity	Surface water and wastewater

5.0 GENERAL CONSIDERATIONS

The following procedures are used in all of ESC's sampling activities. These procedures must be considered in relation to the objectives and scope of each sampling event.

5.1 SELECTING A REPRESENTATIVE SAMPLING SITE

Selecting a representative sampling site is dependent upon the matrix to be sampled and type of analyses required. These matrix specific procedures are discussed in subsequent sections.

5.2 SELECTION AND PROPER PREPARATION OF SAMPLING EQUIPMENT

The type of sampling equipment to be used is specific to the sample matrix and the analyses to be conducted. These are discussed later in this section. Section 12.0 describes the equipment cleaning procedures utilized by ESC personnel.

5.3 SAMPLING PROCEDURES FOR INDUSTRIAL HYGIENE AND ENVIRONMENTAL LEAD SAMPLES

ESC does not provide sampling services for industrial hygiene and/or environmental lead analyses. Experienced laboratory personnel can assist with advice on sampling; however, the adequacy and accuracy of sample collection is the customer's responsibility.

5.4 SAMPLING EQUIPMENT CONSTRUCTION MATERIALS

To prevent direct contamination or cross-contamination of the collected sample, great attention must be given to the construction material used for sampling equipment. Materials must be inert, non-porous and easy to clean. Preferred materials include Teflon®, glass, stainless steel and plastic. Plastics may not be used for collections where organics are the analytes of interest. Stainless steel may not be used where metallic compounds will be analyzed.

5.5 SELECTION OF PARAMETERS BEING ANALYZED

Parameters for analysis are usually dictated by and based on regulated monitoring conditions (i.e. NPDES or RCRA permits). If these do not apply, analyses are selected by ESC or the customer based on federal regulations specific to the matrix being investigated.

5.6 ORDER OF SAMPLE COLLECTION

Unless field conditions demand otherwise, the order of sample collection is as follows:

1. Volatile organic compounds (VOCs)
2. Extractable Organics (includes Total Recoverable Petroleum Hydrocarbons [TRPH], Oil & Grease, Pesticides and Herbicides)
3. Total metals
4. Dissolved metals
5. Microbiological
6. Inorganic (includes Nutrients, Demand, and Physical Properties)
7. Radionuclides

5.7 SPECIAL PRECAUTIONS FOR TRACE CONTAMINANT SAMPLING

Many contaminants can be detected in the parts per billion or parts per trillion range and extreme care must be taken to prevent cross-contamination. Therefore, extra precautions apply where samples are collected for trace contaminants. These precautions include:

- A new pair of disposable latex gloves must be worn at each sampling location.
- Sample containers for samples suspected of containing high concentrations of contaminants are sealed in separate plastic bags immediately after collection and preservation.
- If possible, background samples and source samples should be collected by different field sampling teams. If different field teams are not possible, all background samples are collected first and placed in separate ice chests or shipping containers. Samples of waste or highly contaminated samples are not be placed in the same container as environmental samples. Ice chests or shipping containers for source samples or samples that are suspected to contain high concentrations of contaminants are discarded after use.
- If possible, one member of the field team should handle all data recording, while the other members collect samples.
- When sampling surface waters, water samples should always be collected before sediment samples are collected.
- Sample collection activities should proceed from the suspected area of least contamination to the suspected area of greatest contamination.
- ESC personnel uses equipment constructed of Teflon®, stainless steel, or glass that has been properly pre-cleaned (Sections 12.3 & 12.4) for collecting samples for trace metals or organic compounds analyses. Teflon®, glass, or plastic is preferred for collecting samples where trace metals are of concern. Equipment constructed of plastic or PVC are <u>not</u> be used to collect samples for trace organic compounds analyses.
- When fuel powered units are utilized, they are placed downwind and away from any sampling activities.
- Monitoring wells with free product are not sampled for trace contaminant analysis.

5.8 SAMPLE HANDLING AND MIXING

Sample handling should be kept to a minimum. ESC personnel must use extreme care to avoid sample contamination. If samples are placed in an ice chest, personnel should ensure that sample containers do not become submerged or tip over as this may result in cross-contamination. Small sample containers (e.g., VOCs or bacterial samples) are placed in airtight plastic bags to prevent cross-contamination.

Once a sample has been collected, it may have to be split into separate containers for different analyses. A liquid sample is split by shaking the container or stirring the sample contents with a clean pipette or pre-cleaned Teflon® rod. Then the contents are alternately poured into respective sample containers. Items used for stirring must be cleaned in accordance with the guidelines set forth in Section 12.0. Samples for VOCs, Cyanide, Total Phenol, and Oil & Grease must be collected as discrete grabs.

A soil sample may be split but must first be homogenized as thoroughly as possible to ensure representative sub-samples of the parent material. This is accomplished using the quartering method. The soil is placed in a sample pan and divided into quarters. Each quarter is mixed separately then all quarters are mixed together. This is repeated several times until the sample is uniformly mixed. If a round bowl is used, mixing is achieved by stirring the material in a circular fashion with occasional inversion of the material.

Soil and sediment samples collected for volatile organic compounds are not be mixed. The appropriate sample container should be filled completely, allowing little to no headspace.

Moisture content inversely affects the accuracy of mixing and splitting a soil sample.

5.9 QUALITY CONTROL SAMPLES

Quality control samples must be collected during all sampling events to demonstrate that the sample materials have not been contaminated by sampling equipment, chemical preservatives, or procedures relating to the sample collection, transportation and storage. A summary of the recommended frequency for collecting field quality control samples is presented in the following:

5.9.1 Quality Control Samples

Number of samples	**Pre-cleaned equipment blank**[1]	**Field cleaned equipment blank**	**Trip blank (VOCs)**	**Duplicate**
10 or more	minimum of 1 then 5%	minimum of 1 then 5%	one per cooler[2]	minimum one then 10%[3]
5 - 9	one	one	one per cooler[2]	one
less than 5	one	one	one per cooler[2]	Not required, but recommend a minimum of one. USACE projects require one. Customer specific QAPP requirements must be considered.

[1] Pre-cleaned blanks are to be collected after the initial decontamination procedure has been completed but before the first sample is collected. Only one pre-cleaned or field-cleaned blank is required if less than 10 samples are collected. Only analyte-free water as defined in this document will be used in the preparation of any field and/or equipment blank.

[2] Where VOC methods are analyzed simultaneously, such as 601/602, only one (1) trip blank is required per cooler.

[3] Duplicate samples are collected for all VOC samples.

5.10 VOLATILE ORGANIC COMPOUND SAMPLING

Water Samples

Generally, groundwater, drinking water and wastewater samples for the analysis of volatile organic compounds are collected in duplicate pre-labeled 40mL vials. During bottle kit preparation in the laboratory, 200µL of concentrated HCl is added to each clean and empty vial. A Teflon® septum is placed in each cap and a cap is placed securely on each vial.

The sampler should check the water being sampled for residual chlorine content. This is done with residual chlorine testing strips. If no chlorine is present, the prepared vials may be filled as needed. If residual chlorine is present, add sodium thiosulfate ($Na_2S_2O_3$) to each vial prior to sampling.

To fill the vial properly, the sample is poured slowly down the inside wall of the vial until a convex meniscus is formed. Care should be taken to minimize turbulence. The cap is then applied to the bottle with the Teflon® side of the septum contacting the sample. Some overflow is lost; however air space in the bottle should be eliminated. Check for air bubbles by inverting the capped vial and tapping against the heel of the hand. This will dislodge bubbles hidden in the cap. If any bubbles are present, repeat the procedureusing a clean vial and re-sample with a new preserved and septum. At a minimum, duplicate vials should always be collected from each sample location.

For analysis using EPA Method 524.2, samples that are suspected to contain residual chlorine, 25mg of ascorbic acid per 40mL of sample is added to each sample vial prior to sampling. Additionally, if analytes that are gases at room temperature (i.e. vinyl chloride, etc.) or any of the analytes in following table are not to be determined, 3mg of sodium thiosulfate is recommended for use to remove residual chlorine during sampling. If residual chlorine is present in the field sample at >5mg/L, then add additional 25mg or ascorbic acid or 3mg of sodium thiosulfate for each 5mg/L of residual chlorine present. Sample vials are filled as previously described. Following collection and dechlorination, Method 524.2 samples are adjusted to a pH of <2 with HCl.

Acetone	Acrylonitrile	Allyl chloride
2-Butanone	Carbon disulfide	Chloroacetonitrile
1-Chlorobutane	t-1,2-Dichloro-2-butene	1,1-Dichloropropanone
Diethyl ether	Ethyl methacrylate	Hexachloroethane
2-Hexanone	Methacrylonitrile	Methylacrylate
Methyl iodide	Methylmethacrylate	4-Methyl-2-pentanone
Methyl-tert-butyl ether	Nitrobenzene	2-Nitropropane
Pentachloroethane	Propionitrile	Tetrahydrofuran

For more detailed instructions, see the published method.

Soil Samples

Option 1 – Core Sampling Device
Soil samples for volatile organic analysis are sampled using traditional core sampling methods. Once the core sample is collected, additional samples should be taken using an Encore™ sampler, either 5g or 25g, capped, sealed, and immediately cooled. The holding time for this method is 48 hours.

Option 2 – Pre-weighed Vial
In the other option for volatile soil sampling, 40mL vials with cap, Teflon® lined septum, preservative (5mL sodium bisulfate solution), and stir bar are pre-weighed, either by the user or the manufacturer. The vial is weighed on a balance capable of measuring to 0.01g and labeled with the pre-weighed value. In the field, place roughly 5g of sample into a pre-weighed vial, cap, and then immediately place on ice to achieve a temperature of ≤6ºC. Exact soil weights can be measured using the pre-weight of the vial and the post-sampling weight. The difference represents the actual weight of the soil sample. The holding time for this method is 14 days.

Unless specifically permitted by the regulatory authority, VOC samples (liquid or solid) should never be mixed or composited.

5.11 OIL AND GREASE SAMPLING

Aqueous samples collected for oil and grease analyses must be collected as discrete grab samples. Sample containers should not be rinsed with sample water prior to sample collection and samples should be collected directly into the sample container. Intermediate vessels should only be used where it is impossible to collect the sample directly into the sample container and, in this case, only Teflon® beakers should be used. Samples should be taken from well-mixed areas.

5.12 CYANIDE SAMPLING

Cyanide is a very reactive and unstable compound and should be analyzed as soon as possible after collection. Samples are collected in polyethylene or glass containers and are pretreated and preserved in the manner specified in the following paragraphs.

5.12.1 Test for Oxidizing Agents

1. Test the sample with residual chlorine indicator strips.
2. Add a few crystals of ascorbic acid and test until negative.
3. Add an additional 0.6 grams of ascorbic acid for each liter sampled to remove residual chlorine.
4. Preserve the pretreated sample by to a pH > 12.0 with NaOH and cool to 4 ± 2°C. Verify the pH of the samples as per Section 14.2.
5. Equipment blanks must be handled in the same manner as described in steps 1 through 4.

5.12.2 Test for Sulfide

1. Test the sample for sulfide using the sulfide test strip (formally HACH KIT).
2. If sulfide is not removed by the procedure below, the sample must be preserved with NaOH to pH > 12.0 and analyzed by the laboratory within 24 hours.
3. Sulfide should be removed by filtering visible particulate. Retain filter (filter #1).
4. Remove the sulfide by adding lead carbonate powder to the filtrate to cause the sulfide to precipitate out.
5. Test the filtrate for the presence of sulfide. If sulfides are present, repeat steps 1 and 4 until no sulfides are shown present.
6. The precipitate can now be filtered from the sample and this filter is discarded.
7. The sample is then reconstituted by adding the sediment collected on filter #1 back to the filtrate.
8. Preserve the pretreated sample to a pH > 12.0 with NaOH and cool to 4 ± 2°C. Verify the pH of the samples as per Section 14.2
9. Equipment blanks must be handled in the same manner as described in steps 1 through 9.

5.13 BIOMONITORING SAMPLING

Aqueous samples collected for Bioassay can be collected in either glass or HDPE plastic. There is no chemical preservation for this type of sample and the required volume varies with each type of analysis. Following sampling, all samples must be cooled to 0-6°C and can be held for a maximum of 36 hours from the time of collection. Grab and composite sample protocols are utilized for acute and chronic bioassays and are chosen according to permit requirements. Samples are collected with minimum aeration during collection and the container are filled allowing no headspace. Samples may be shipped in one or more 4L (l gal.) CUBITAINERS® or unused plastic "milk" jugs. All sample containers should be rinsed with source water before being filled with sample. Containers are not reused. If the sample is a chlorinated effluent, total residual chlorine must be measured immediately following sample collection.

5.14 PROCEDURES FOR IDENTIFYING POTENTIALLY HAZARDOUS SAMPLES

Any sample either known, or suspected, to be hazardous are identified as such on the chain of custody. Information explaining the potential hazard (i.e., corrosive, flammable, poison, etc.) are also be listed.

5.15 COLLECTION OF AUXILIARY DATA

All auxiliary data are entered in the field records. Auxiliary data relative to a particular sampling location should be recorded concurrent with the sample event. Matrix specific auxiliary data are discussed later in this section.

5.16 TIME RECORDS

All records of time are kept using local time in the military (24 hour) format and are recorded to the nearest minute.

5.17 REFERENCES

ESC maintains copies of the various sampling references in the sample equipment room. Pertinent pages of these documents may be photocopied and taken to the field during sampling investigations. A bibliography of references used in the development of this section is presented in Section 17.

6.0 ANCILLARY EQUIPMENT AND SUPPLIES

The equipment used to collect samples and conduct necessary purging activities is listed in subsequent sections for each type of sample. However, Section 6.1 lists some of the ancillary field equipment and instruments that may be required.

6.1 ANCILLARY EQUIPMENT AND SUPPLIES

Flow Measurement:	ISCO Continuous Flow Meters 3230, 3210, 2870; Flo-Poke pipe insert
Personal Protective Equipment:	Hard Hats, Face Shields, Rubber and Latex Gloves, Tyvex protective coveralls, rubber boots, safety glasses
Field Instruments:	Water Level Indicator, Continuous Recording pH Meter, Portable pH/Temperature Meters, Hach DR-100 Chlorine Analyzer, Hach CEL/700 Portable Laboratory, YSI Field Dissolved Oxygen/Temperature Meter w/ Submersible Probe, Portable Field Specific Conductance Meter, Hach 2100P Portable Turbidimeter
Chemical Supplies & Reagents:	Deionized Water, Tap Water, Liquinox Detergent, Isopropanol, Nitric Acid, Hydrochloric Acid, Sulfuric Acid, Sodium Hydroxide, Ascorbic acid, Sodium Thiosulfate, Ascorbic Acid, Zinc Acetate, pH calibration buffers (4.0, 7.0, and 10.0), Hach Sulfide Kit, lead carbonate powder, Specific Conductance Standard, Turbidity Standards
Tools:	Pipe Wrench, Bung Wrench, Crowbar, Hammer, Assorted Screwdrivers, Tape Measures, Channel Lock Pliers, Vise Grip Pliers, Duct Tape, Vinyl Pull Ties
Miscellaneous:	Cellular Phones, Pagers, Walkie Talkies, 12 Volt Batteries, Flashlights, Extension Cords, Brushes, Plastic sheeting, Fire extinguishers, Water Squeeze Bottles, First Aid Kit, lengths of rigid PVC conduit, aquatic sampling nets (Wildco)

7.0 WASTEWATER SAMPLING

7.1 SAMPLING EQUIPMENT

Type	Use	Materials	Permissible Parameter Groups
Continuous Wastewater Samplers- Peristaltic Pump	Sampling	Tygon tubing; glass or plastic sample container	All parameter groups except oil & grease, extractable organics, and VOCs
	Sampling	Teflon® tubing; glass sample container	All parameter groups except VOCs

7.2 GENERAL CONSIDERATIONS

The procedures used by ESC are generally those outlined in the *NPDES Compliance Inspection Manual*. Additional guidance is given in the EPA *Handbook for Monitoring Industrial Wastewater*. Some important considerations for obtaining a representative wastewater sample include:

- The sample should be collected where the wastewater is well mixed.
- Samples should not be collected directly from the surface/bottom of the wastestream.
- In sampling from wide conduits, cross-sectional sampling should be considered.
- If manual compositing is employed, the individual sample bottles must be thoroughly mixed before pouring the individual aliquot into the composite container.

7.3 SAMPLING SITE SELECTION

Wastewater samples should be collected at the location specified in the NPDES or sewer use permit if such exists. If the specified sampling location proves unacceptable, the project manager shall select an appropriate location based on site-specific conditions. An attempt should be made to contact the regulatory authorities for their approval. The potential for this type of issue highlights the need for a site inspection prior to the scheduled sampling event.

7.3.1 Influent

Influent wastewaters should be sampled at points of high turbulence and mixing. These points are: (1) the upflow siphon following a comminutor (in absence of grit chamber); (2) the upflow distribution box following pumping from main plant wet well; (3) aerated grit chamber; (4) flume throat; or (5) pump wet well when the pump is operating. Raw wastewater samples should be collected upstream of sidestream returns.

7.3.2 Effluent

Effluent samples should be collected at the site specified in the permit or, if no site is specified, at the most representative site downstream from all entering wastewater streams prior to final discharge.

7.3.3 Pond and Lagoon Sampling

Composite samples of pond and lagoon effluent are preferred over grabs due to the potential for ponds and lagoons to short circuit the projected flow paths. However, if dye studies or facility data indicate a homogeneous discharge, grab samples may be taken.

7.4 SAMPLING TECHNIQUES: GENERAL

The choice of a flow-proportional or time-proportional composite sampling program depends upon the variability of flow, equipment availability, sampling point configuration and accessibility. Flow metered sampling is necessary for complete wastewater characterization and should be utilized where possible. If not feasible, a time-proportional composite sample is acceptable.

A time-proportional composite sample consists of aliquots collected at constant time intervals and can be collected either manually or with an automatic sampler.

A flow proportional composite sample consists of aliquots collected automatically at constant flow intervals with an automatic sampler and a flow-measuring device. Prior to flow-proportional sampling, the flow measuring system (primary flow device, totalizer, and recorder) should be examined. The sampler may have to install flow measurement instrumentation if automatic sampling is to be used.

7.5 USE OF AUTOMATIC SAMPLERS

7.5.1 General

Automatic samplers are used when several points are sampled at frequent intervals, with limited personnel, or when a continuous sample is required. Automatic samplers used by ESC must meet the following requirements:

- Must be properly cleaned to avoid cross-contamination from prior sampling events.
- No plastic or metal parts shall come into contact with the sample when parameters to be analyzed could be impacted by these materials.
- Must be able to provide adequate refrigeration. Commercially available ice is placed in the sampler base and packed around the container approximately half way up the sample container.
- Must be able to collect a large enough sample for all required analyses. Composite sample containers (glass or plastic) hold up to 10 liters.
- A minimum of 100 milliliters should be collected each time the sampler is activated.
- Should provide a lift of at least 20 feet and be adjustable so that sample volume is not a function of pumping head.
- Pumping velocity must be adequate to transport solids without settling.
- The intake line must be purged a minimum of one time before each sample is collected.
- The minimum inside diameter of the intake line should be 1/4 inch.
- Have a power source adequate to operate the sampler for 48 hours at 15-minute sampling intervals.
- Facility electrical outlets may be used if available.

- Facility automatic samplers may be used for conventional parameters if they meet ESC QA/QC criteria.

Specific operating instructions, capabilities, capacities, and other pertinent information for automatic samplers presently used by ESC are included in the respective operating manuals and are not presented here.

All data relative to the actual use of automatic equipment on a specific job is recorded in sampling logbooks.

7.5.2 Equipment Installation

7.5.2.1 Conventional Sampling

Automatic samplers may be used to collect time-proportional composite or flow-proportional composite samples. In the flow-proportional mode, the samplers are activated by a compatible flow meter. Flow-proportional samples can also be collected using a discrete sampler and a flow recorder and manually compositing the individual aliquots in flow-proportional amounts.

Installation procedures include cutting and installing the proper length of tubing, positioning it in the wastewater stream, and sampler programming. All new tubing (Dow® Corning Medical Grade Silastic, or equal, in the pump and Tygon®, or equal, in the sample train) will be used for each sampler installation.

For a time-proportional composite, the sampler should be programmed to collect 100mL samples at 15-minute intervals into a refrigerated 10L plastic or glass jug, as appropriate for the particular parameters being analyzed.

For a flow-proportional composite, the sampler should be programmed to collect a minimum of 100mL for each sample interval. The sampling interval should be based on the flow of the waste stream.

7.5.3 Automatic Sampler Maintenance, Calibration, and Quality Control

To ensure proper operation of automatic samplers, the procedures outlined in this section are used to maintain and calibrate ESC automatic samplers. Any variance from these procedures is documented.

Proper sampler operation is checked by ESC personnel prior to each sampling event. This includes checking operation through three cycles of purge-pump-purge; checking desiccant and replacing if necessary; checking charge date on NiCad batteries to be used; and repairing or replacing any damaged items.

Prior to beginning sampling, the purge-pump-purge cycle is checked at least once. The sample volume is calibrated using a graduated cylinder at least twice, and the flow pacer that activates the sampler is checked to be sure it operates properly.

Upon return from a field trip, the sampler is examined for damage. The operation is checked and any required repairs are performed and documented. The sampler is then cleaned as outlined in Section 12.

7.6 MANUAL SAMPLING

Manual sampling is normally used for collecting grab samples and for immediate in-situ field analyses. Manual sampling may also be used when it is necessary to evaluate unusual waste stream conditions. If possible, manually collected samples are collected in the actual sample container that is submitted to the laboratory. This minimizes the possibility of contamination from an intermediate collection container.

Manual samples are collected by (1) submerging the container neck first into the water; (2) inverting the bottle so that the neck is upright and pointing into the direction of wastewater flow; (3) quickly returning the sample container to the surface; (4) shake to rinse. Pour the contents out downstream of sample location; (5) collect sample as described in steps 1, 2, and 3; pour out a few mL of sample downstream of sample collection. This allows for addition of preservatives and sample expansion.

Exceptions to the above procedure occur when preservatives are present in the sampling container or when oil & grease, microbiological, and/or VOC analyses are required. In these cases, samples are collected directly into the container with no pre-rinsing.

If the water or wastewater stream cannot be physically or safely reached, an intermediate collection container may be used. This container must be properly cleaned (Section 12) and made of an acceptable material. A separate collection container should be used at each sampling station to prevent cross-contamination between stations. The sample is collected by lowering a properly cleaned Teflon®, plastic, or glass collection vessel into the waste stream. The intermediate vessel may be lowered by hand, pole or rope.

7.7 SPECIAL SAMPLE COLLECTION PROCEDURES

7.7.1 Trace Organic Compounds and Metals

Due to the ability to detect trace organic compounds and metals in extremely low concentrations, care must be taken to avoid contamination of the sample. All containers, composite bottles, tubing, etc., used in sample collection for trace organic compounds and metals analyses should be prepared as described in Section 12.

Personnel handling the sample should wear a new pair of disposable latex gloves with each set of samples collected to prevent cross-contamination. A more detailed discussion is given in Section 5.7 under special precautions for trace contaminant sampling.

7.7.2 Bacterial Analysis

Samples for bacterial analysis are always collected directly into the prepared glass or plastic sample bottle. The sample bottle should be kept closed until immediately prior to sampling and never rinsed with sample. When the container is opened, care should be taken not to contaminate the cap or the inside of the bottle. The bottle should be held near the base and plunged, neck downward, below the surface and turned until the neck points upward and upstream. The bottle should be filled to within one-inch of the top and capped immediately.

Section 14 presents preservation procedures and holding times. As holding times are limited to 6 hours for microbiological analyses, special arrangements may be required to ensure that these samples reach the laboratory within this timeframe.

7.7.3 Immiscible Liquids/Oil and Grease

Oil and grease may be present in wastewater as a surface film, emulsion, solution, or a combination of these forms. A representative sample for oil and grease analysis is difficult to collect. The sampler must carefully evaluate the location of the sampling point to find the area of greatest mixing. Quiescent areas should be avoided.

Because losses of oil and grease will occur on sampling equipment, collection by composite sampler is not practical. Intermediate sampling vessels should not be used if possible. If intermediate collection vessels are required they should be made of Teflon® and be rinsed with the sample three times before transferring any sample to the sample container. Sample containers, however, should never be rinsed.

7.7.4 Volatile Organic Compounds Analyses

Water samples to be analyzed for volatile organic compounds are collected in 40mL pre-preserved (200uL of concentrated HCl) vials with screw caps. A Teflon®-silicone septum is placed in each cap prior to the sampling event. The Teflon® side must be facing the sample.

Sampling containers with preservatives are pre-labeled prior to any field activities to reduce the chances of confusion during sampling activities. A complete list of sample preservatives, containers, holding times, and volumes is found in Section 14.

The sampler should check the water to be sampled for chlorine. This is done with residual chlorine indicator strips. If no chlorine is found, the vials may be filled. If residual chlorine is present, the sampling and preservation procedures listed in Section 5.10 of this manual must be performed.

7.8 AUXILIARY DATA COLLECTION

While conducting wastewater sampling, the following information may also be gathered:

- Field measurements -- pH, DO, conductivity, temperature
- Flows associated with the samples collected -- continuous flows with composite samples and instantaneous flows with grab samples
- Diagrams and/or written descriptions of the sample locations
- Photographs of pertinent wastewater-associated equipment, such as flow measuring devices, treatment units, etc.
- Completion of applicable forms required during specific investigations.

All observations, measurements, diagrams, etc., are entered in field logbooks or attached thereto.

8.0 SURFACE WATER AND SEDIMENT SAMPLING

8.1 EQUIPMENT

Equipment Type	Use	Material	Permissible Parameter Groups
Surface Water Sampling			
Kemmerer Sampler	Depth sampling	PVC	All parameter groups except extractable organics, VOCs, and oil & grease
Automatic Samplers	Sampling	Teflon®	All parameter groups except VOCs, oil & grease, & micro
	Sampling	PVC	All parameter groups except extractable organics, VOCs, oil & grease, and micro
Sample Collection Container	Sampling	Stainless steel	All parameter groups
Bailers	Sampling	Teflon®	All parameter groups
	Sampling	PVC	All parameter groups except extractable organics, VOCs, and oil & grease
Sediment Sampling			
Hand Augers	Sampling	Carbon Steel	Demand, nutrients, and extractable organics (for hard packed soils only)
Sediment Core Sampler	Sampling	Stainless Steel, Teflon®	All parameter groups
Encore™	Sampling	Teflon®	VOC Sediment/soil
Scoops	Sampling	Teflon® coated	All parameter groups

Equipment Type	Use	Material	Permissible Parameter Groups
Mixing Bowl	Compositing	Glass	All parameter groups except VOCs
Spoons, spatula	Sampling, compositing	Stainless Steel	All parameter groups

8.2 GENERAL

Selection of surface water sampling locations for water quality studies are determined by the objective of the study and waterway type. Factors that impact and alter water quality and characteristics (dams, bridges, discharges, etc.) must be considered. Accessibility is important.

8.3 SAMPLE SITE SELECTION

Fresh water environments are commonly divided into two types: (1) rivers, streams, and creeks; and (2) lakes, ponds, and impoundments. Since these waterways differ considerably in general characteristics, site selection must be adapted to each.

Prior to conducting a sampling event, an initial survey should be conducted to locate prime sampling points. Bridges and piers provide ready access to sampling points across a body of water. However, they should only be used when found not to be detrimentally impacting stream characteristics.

If wading for water samples must be done, caution should be used to avoid disturbing bottom deposits that could result in increased sediment in the sample. Shallow areas may be best for sediment sampling.

8.3.1 Rivers, Streams, and Creeks

Sampling sites should be located in areas possessing the greatest degree of cross-sectional homogeneity. Such points are easily found directly downstream of a riffle or rapid. These locations are also good for sediment sampling. In the absence of turbulent areas, a site that is clear of immediate point sources, such as tributaries and effluent discharges, may be used.

Typical sediment deposition areas are located at the inside of river bends and down-stream of islands or other obstructions. Sites immediately upstream or downstream from the confluence of two streams or rivers should be avoided due to inadequate mixing of the combining flows. Also, backflow can upset normal flow patterns.

Great attention should be given to site selection along a stream reach:

- Sites should be spaced at intervals based on time-of-water-travel. Sampling sites may be located at about one-half day time-of-water-travel for the first three days downstream of a waste source for the first six sites and then approximately one day for the remaining distance.

- If the study data is for comparison to previous study data, the same sampling sites should be used.
- Sites should be located at marked physical changes in the stream channel.
- Site locations should isolate major discharges as well as major tributaries.

Dams and weirs usually create quiet, deep pools in river reaches that would otherwise be swift and shallow. When times of travel through them are long, sites should be established within them.

Some structures, such as dams, permit overflow that may cause significant aeration of oxygen deficient water. Sites should be located short distances upstream and downstream of these structures to measure the rapid, artificial increase in dissolved oxygen (DO), which is not representative of natural aeration.

A minimum of three sites should be located between any two points of major change in a stream, even if the time-of-travel between the points of change is short. Major changes include, but are not limited to, a waste discharge, a tributary inflow, or a significant change in channel characteristics. Sampling three sites is also important when testing rates of change of unstable constituents. Results from two of three sites will usually support each other and indicate the true pattern of water quality in the sampled zone. If the effect of certain discharges or tributary streams of interest is desired, sites should be located both upstream and downstream of these points.

Due to the tendency of the influent from a waste discharge or tributary to slowly mix, cross-channel, with the main stream, it is nearly impossible to measure their effect immediately downstream of the source. Thus, samples from quarter points may miss the wastes and only indicate the quality of water above the waste source. Conversely, samples taken directly in the stream portion containing the wastes would indicate excessive effects of the wastes with respect to the river as a whole.

Tributaries should be sampled as near the mouth as possible. Often, these may be entered from the main stream for sampling by boat. Care should be taken to avoid collecting water from the main stream that may flow back into the tributary as a result of density differences created by temperature, salinity, or turbidity differences.

Actual sampling locations vary with the size and amount of turbulence in the stream or river. Generally, with streams less than 20 feet wide, well mixed areas and sampling sites are readily found. In such areas, a single grab sample taken at mid-depth at the center of the channel is adequate. A sediment sample can also be collected at the center of the channel. For slightly larger streams, at least one vertical composite should be taken from mid-stream. It should be composed of at least one sub-surface, mid-depth, and above the bottom sample. Dissolved oxygen, pH, temperature, conductivity, etc. should be measured on each aliquot of the vertical composite. Several locations should be sampled across the channel width on the larger rivers. Vertical composites across the channel width should be located proportional to flow, i.e., closer together toward mid-channel where flow is greater and less toward the banks where the flow proportionally lower.

The field crew will determine the number of vertical composites and sampling depths for each area. They should base their decisions upon two considerations.

1. The larger the number of sub-samples, the more nearly the composite sample will represent the water body.
2. Taking sub-samples is time consuming and expensive, and increases the chance of contamination.

A number of sediment samples should be collected along a cross-section of a river or stream to adequately characterize the bed material. The normal procedure is to sample at quarter points along the cross-section of the site. When the sampling technique or equipment requires that the samples be extruded or transferred at the site, they can be combined into a single composite sample. However, samples of dissimilar composition should not be combined. They should be kept separate for analysis in the laboratory. To ensure representative samples, coring tubes are employed. The quantity of each sub-sample that is composited shall be recorded.

8.3.2 Lakes, Ponds, and Impoundments

Lakes, ponds, and impoundments have a much greater tendency to stratify than rivers and streams. This lack of mixing requires that more samples be obtained from the different strata. Occasionally, extreme turbidity differences occur vertically where a highly turbid river enters a lake. This stratification is caused by temperature differences where the cooler, heavier river water flows beneath the warmer lake water. A temperature profile of the water column and visual observation of lake samples can detect these layers. Each layer of the stratified water column should be sampled.

The number of sampling sites on a lake, pond, or impoundment is determined by the objectives of the investigation dimensions of the basin. In small bodies of water, a single vertical composite at the deepest point may be sufficient. Dissolved oxygen, pH, temperature, etc., should be conducted on each vertical composite aliquot. In naturally formed ponds, the deepest point is usually near the center; in impoundments, the deepest point is usually near the dam.

In lakes and larger impoundments, several vertical sub-samples should be composited to form a single sample. These vertical sampling locations should be along a transaction or grid. The field crew will determine the number of vertical composites and sampling depths for each area. In some cases, separate composites of epilimnetic and hypolimnetic zones may be required. Additional separate composite samples may be needed to adequately represent water quality in a lake possessing an irregular shape or numerous bays and coves. Additional samples should always be taken where discharges, tributaries, agriculture, and other such factors are suspected of influencing water quality.

When collecting sediment samples in lakes, pond, and reservoirs, the sample site should be as near as possible to the center of the water mass, especially for impoundments of rivers or streams. Generally, coarser grained sediments are deposited at the headwaters of a reservoir, and the finer sediments are near the center. The shape, inflow pattern, bathymetry, and circulation affect the location of sediment sampling sites in large bodies of water.

8.3.3 Control Sites

The collection of samples from control sites is necessary to compile a basis of comparison of water quality. A control site above the point of interest is as important as the sites below, and must be chosen with equal care. Two or three sites above the waste inflow may be necessary to establish the rate at which any unstable material is changing. The time of travel between the sites should be sufficient to permit accurate measurement of the change in the material under consideration.

8.4 SAMPLING EQUIPMENT AND TECHNIQUES

8.4.1 General

Any equipment or sampling techniques used to collect a sample must not alter the integrity of the sample and must be capable of providing a representative sample.

8.4.2 Water Sampling Equipment/Techniques

The physical location of the collector dictates the type of equipment needed to collect samples. Surface water samples may be collected directly into the sample container when possible. Pre-preserved sample containers shall never be used as intermediate collection containers. Samples collected in this manner use the methods specified in Section 7.6 of this manual. If wading into the stream is required, care should be taken not to disturb bottom deposits, which could be unintentionally collected, and bias the sample. Also, the sample should be collected directly into the sample bottle and **up current** of the wader. If wading is not possible or the sample must be collected from more than one depth, additional sampling equipment may be used. If sampling from a powerboat, samples must be collected upwind and upstream of the motor.

8.4.2.1 Sampling Procedure Using a Teflon® or PVC Bailer

If data requirements of surface water sampling do not necessitate sampling from a strictly discrete interval of the water column, Teflon® or PVC constructed bailers can be used for sampling. The type bailer used is dependent on the analytical requirements. A closed top bailer utilizing a bottom check valve is sufficient for many surface water studies. Water is continually displaced through the bailer as it is lowered down through the water column until the specified depth is attained. At this point, the bailer is retrieved back to the surface. There is the possibility of contamination to the bailer as it is lowered through the upper water layers. Also, this method may not be successful in situations where strong currents are found or where a discrete sample at a specified depth is needed.

If depth specific, discrete samples are needed and the parameters do not require Teflon® coated sampling equipment, a standard Kemmerer sampler may be used. A plastic bucket can also be used to collect surface samples if parameters to be analyzed do not preclude its use. The bucket shall always be rinsed twice with the sample water prior to collection and the rinse water be disposed of downstream from the sample collection point. All field equipment will be cleaned using standard cleaning procedures.

8.4.2.2 Sampling Procedure Using a Kemmerer Sampler

Due to the PVC construction of the Kemmerer sampler, it shall not be used to collect samples for extractable organics, VOCs, and/or oil & grease analysis. The general collection procedure is as follows:

1. Securely attach a suitable line to the Kemmerer bottle.
2. Lock stoppers located at each end of the bottle on the open position. This allows the water to be drawn around the bottom end seal and into the cylinder at the specified depth.
3. The bottle is now in the set position. A separate "messenger" is required to activate the trip mechanism that releases the stopper and closes the bottle.
4. When the bottle is lowered to the desired depth, the messenger is dropped. This unlocks the trip mechanism and forces the closing of both end seals.
5. Raise the sampler, open one of the end seal, and carefully transfer the sample to the appropriate sample container.

8.4.2.3 Sampling Procedures Using Sample Collection Containers

In most cases, sample collection containers are used to collect surface water from easily accessible sampling points. This means that the sample is collected manually, always upstream of the sampling person's position. An extension may be added to the container to make the sampling point more accessible for manual sampling. Extensions can be constructed of aluminum, PVC, steel, or any other suitable material. The sample container is normally attached to the extension using a clamp, vinyl pull ties, or duct tape. Samples collected in this way are done so in the following manner:

1. Place the inverted sample container into the water and lower to the desired depth. Never use a pre-preserved container as an intermediate sample collection device.
2. Re-invert the container with the mouth facing into the direction of flow and at the appropriate depth to collect the desired sample.
3. Carefully bring the container to the surface and transfer to the appropriate container.

8.4.3 Sediment Sampling Equipment/Techniques

A variety of methods can be used to collect sediment samples from a streambed. ESC utilizes corers and scoops. Precautions must be taken to ensure that the sample collected is representative of the streambed. These methods are discussed in the following paragraphs.

8.4.3.1 Sediment Core Samplers

Core sampling is used to collect vertical columns of sediment from the stream or lakebed. Many types of coring devices are available for use depending on the depth of water from which the sample is obtained, the type of bottom material, and the length of the core to be collected. Some devices are weight or gravity driven while others are simple hand push tubes. These devices minimize the loss of fine particles and should always be used when collecting sediment samples from flowing waters.

Coring devices are particularly useful in pollutant monitoring because the shock wave created by sampler descent is minimized and the fines at the sediment-water interface are only slightly disturbed. The sample can be withdrawn primarily intact removing only the layers of interest. Core liners manufactured of Teflon® or plastic can be purchased. These liners reduce the possibility of contamination and can be delivered to the laboratory in the tube they were collected in. Coring devices sample small surface areas and small sample sizes and often require repetitive sampling to obtain a sufficient amount of sample. This is the primary disadvantage to these devices but they are recommended in the sampling of sediments for trace organic compounds or metals analyses.

When sampling sediments in shallow water, the direct use of a core liner is recommended. Stainless steel push tubes are also used because they provide a better cutting edge and higher tensile strength than Teflon® or plastic. One advantage to using the Teflon® or plastic tubes is the elimination of possible metals contamination of the sample from the core barrels or cutting heads. The length of the corer tube should correspond to the desired depth of the layer being sampled. In general, soft sediments adhere better to the inside of the tube and a larger diameter tube can be used. Coarser sediments require the use of a smaller diameter tube of two inches or less to prevent the sample from falling out of the tube. The inside bottom wall of the tube can be filed down to allow easier entry into the substrate.

When samples are obtained by wading, caution should be used to minimize disturbance in the area sampled. Core tubes are pushed directly down into softer substrates until four inches or less of the tube is above the sediment-water interface. A slight rotation of the tube may be necessary to facilitate ease of entry into harder substrates and reduce compaction of the sample. The tube is then capped and slowly extracted and the bottom of the corer is capped before it is pulled above the water surface.

Sub-sampling is performed for VOC samples using an Encore™ type sampling device. This device is used to collect soil/sediment samples, while preventing container headspace. Once the core sample is collected, additional samples should be taken using an Encore™ type sampler, either 5g or 25g, capped, sealed, and immediately chilled to 4ºC. The holding time for this sampling method is 48 hours. Alternatively, weigh 5g of sample into a pre-weighed vial (with a Teflon® lined screw cap) containing, 5mL sodium bisulfate solution and a magnetic stir bar, cap, and then ice to 4ºC. The holding time for this method is 14 days.

8.4.3.2 Scooping Samples

The easiest and quickest way to collect a sediment sample in shallow water is with a Teflon® coated scoop or stainless steel spoon. This type of sampling should be limited to quiescent (i.e., non-flowing) waters such as lakes or reservoirs.

8.4.3.3 Mixing

As specified in Section 5.8, sediment samples, collected for chemical analysis, should be thoroughly mixed (except for volatile organic compounds analysis) before being placed in the sample containers.

8.5 SPECIAL SAMPLE COLLECTION TECHNIQUES

8.5.1 Trace Organic Compounds and Metals

Samples for trace pollutant analyses in surface water should be collected by dipping the sample containers directly into the water. Sometimes samples are split for enforcement or quality control purposes. A sufficient volume of sample for all containers should be collected in a large glass container and then, while mixing, be alternately dispensed into the appropriate bottles. This cannot be done for volatile organic compound samples due to potential loss of target analytes.

Only Teflon® or stainless steel should be used in sediment sampling for trace contaminant analyses. Teflon® coring tubes are the preferred technique.

8.5.2 Bacterial Analysis

Samples for bacteriological examination must be collected in sterilized bottles and protected against contamination. The preferred technique is to collect sample directly into the sample bottle. Hold the bottle near the base and plunge, neck downward, below the surface. The container is then turned with the neck pointed slightly upward and the mouth directed toward the current. The bottle is filled to about ½ inch from the top and recapped immediately. While the bottle is open, extreme care should be used to protect both the bottle and stopper against contamination. The ½ inch air space is left in the bottle to facilitate subsequent shaking in the laboratory.

If sampling with an intermediate sampling device (i.e. bailer), the device shall be thoroughly rinsed with sample water prior to collecting the sample. For this reason, microbiological samples are among the final samples collected from a sampling site. Begin pouring sample out of the sampling device before collecting into the sterilized container. Continue pouring sample out of the device, place the container under the flowing stream, and fill the container to ½ inch from the top. Flow should remain continuous before and during the filling process.

When sampling from a bridge, the sterilized sample bottle can be weighted and lowered to the water on a rope. Collectors must be careful not to dislodge debris from the bridge that could fall into the bottle.

8.6 AUXILIARY DATA COLLECTION

A field logbook is used to record data pertinent to sampling activities. This data describes all sampling locations and techniques, lists photographs taken, visual observations, etc. Visual observations of sample site conditions, including weather and overall stream conditions, recorded during the investigation can be valuable in interpreting water quality study results.

8.7 SPLIT AND DUPLICATE SAMPLE COLLECTION

Split samples measure variability between analysts, methods, and laboratories and are taken as subsamples from a single sample. This is unlike duplicate samples that measure variability inherent in the collection method or waste stream and are obtained in close succession during the same sampling event.

8.7.1 Split Sample Collection

Split samples are collected as follows:

1. Sample must be collected in a properly cleaned container constructed of acceptable materials. The volume should be more than twice the volume required for one sample.
2. Add appropriate preservative where required.
3. Mix thoroughly.
4. Alternately, decant sample into subsample containers in increments of approximately 10% of total subsample volume until containers are full.
5. Seal the sample containers with appropriate, airtight caps.
6. Label each sample container with a field number and complete a chain of custody.

NOTE: Volatile organic samples are not collected in this manner. Samples for VOC's must be collected as simultaneous, discrete grab samples.

8.7.2 Duplicate Sample Collection

1. Collect two samples in rapid succession.
2. Preserve where required.
3. Mix thoroughly.
4. Seal the sample containers with appropriate, airtight caps.
5. Label each sample container with a field number and complete a chain of custody.

9.0 *GROUNDWATER AND DRINKING WATER SAMPLING*

9.1 GROUNDWATER AND DRINKING WATER SAMPLING EQUIPMENT

Equipment type	Purpose	Component(s)	Allowable Parameter Groups
Bailers (disposable and non-disposable)	Purging	Teflon® & SS	All parameter groups
	Sampling	Teflon®	All parameter groups
Peristaltic Pump[1]	Purging[2]	Tygon Tubing	All parameter groups except organics
	Purging	Teflon®	All parameter groups
		Silastic Rubber	All parameter groups except organics
ISCO Bladder Pump[3]	Sampling	Stainless Steel, Teflon®	All parameter groups

[1] New or dedicated tubing must be used at individual monitoring well sites.
[2] If sample is not collected immediately after evacuation, tubing shall be withdrawn from the well prior to pump being turned off to prevent back flowing into the well.
[3] Pump will be cleaned after each use.

9.2 GENERAL GROUNDWATER SAMPLING

Groundwater sampling is necessary for a number of purposes. These include, but are not limited to, evaluating potable or industrial water sources, mapping contaminant plume movement at a land disposal or spill site, RCRA compliance monitoring (landfills), or examining a site where groundwater contamination may have or may be occurring.

Normally, groundwater is sampled from a permanent monitoring well. However, this does not exclude collection of samples from a sinkhole, pit, or other drilling or digging site where groundwater is present.

Monitoring wells are not always at the optimum. In these situations, additional wells may need to be drilled. Experienced, knowledgeable individuals (hydrologists, geologists) are needed to site the well and oversee its installation so that representative samples of groundwater can be collected.

ESC utilizes the procedures being reviewed in this section. Further guidance is available in the *RCRA Groundwater Monitoring Technical Enforcement Guidance Document (TEGD)*; ESC field personnel, at a minimum meet, and when possible exceed, the requirements of this document.

9.3 MEASUREMENT OF WELL WATER LEVEL AND STAGNANT WATER VOLUME CALCULATION

The sampling and analysis plan provides for measurement of standing water levels in each well prior to each sampling event. Field measurements include depth to standing water surface and total depth of the well. This data is then utilized to calculate the volume of stagnant water in the well and provide a check on the integrity of the well (e.g., silt buildup). The measurement should be taken to 0.01 foot when possible. A battery powered level sensor is used to measure depth to the surface of the groundwater. Equipment shall be constructed of inert materials and will be cleaned per sample equipment cleaning procedures prior to use at another well. Field data is recorded on the Monitoring Well Data Sheet (Figure 2).

9.3.1 Procedure for Water Level Measurement

1. Clear debris from area around well or lay plastic sheathing around well pad.
2. Remove protective casing lid.
3. Open monitoring well lid.
4. Lower the clean water level indicator probe down into the well. A beep will sound upon contact with the water surface. False readings can be made from the wetted side of the well so it is necessary to check the level several times until a consistent reading is achieved. Record the distance (to the nearest 0.01 ft.) from the top of the well casing to the water surface on the Monitoring Well Data Sheet.
5. Continue to lower the probe until it reaches the well bottom. Record the distance (to the nearest 0.01 ft) from the top of the well casing to the bottom of the well on the Monitoring Well Data Sheet.
6. All water level and well depth measurements are made from the top of the well casing unless specified otherwise by the project manager or DER.
7. The wetted depth is obtained by subtracting total well depth from the surface level depth.

9.3.2 Calculating Water Volume

Total volume of standing water in a well is calculated by the following formula:

$$V = \pi r^2 h \text{ x } 7.48 \text{ gallons/ft}^3$$

where;

V = volume of standing water in the well (gallons)
r = radius of well (ft)
h = depth of water column in the well (ft)
π = 3.14
7.48 = conversion factor

9.4 WELL EVACUATION: WELLS WITHOUT IN-PLACE PLUMBING

Water standing in a well may not be representative of actual groundwater conditions. The standing water in a well should be removed to allow representative formation water to supplant the stagnant water. The evacuation method depends on the hydraulic characteristics of the well but the following general rules apply.

The total amount of water purged must be recorded. Therefore, the volume must be measured during the purging operation. This may be determined by:

1. Collecting the water in a graduated or known volume container (i.e., bucket);
2. Calculate the volume based on the pump rate; however pump rate may not be constant and field personnel should be aware of this;
3. Record the time that the actual purging begins in the field record.

Purging is considered complete if any one of the following criteria is satisfied:

1. Three well volumes are purged and field parameters (pH, temperature, conductivity) stabilize within 5% in consecutive readings at least 5 minutes apart. If field parameters have not stabilized after 5 well volumes, the purging is considered complete and sampling can begin.
2. Five well volumes are purged with no monitoring of field parameters.
3. At least one fully dry purge. A second dry purge may be necessary in some situations.

FIGURE 2
MONITORING WELL DATA SHEET

Site location:

ESC Project name/#:

Well Number	Depth to water surface (ft)	Depth to bottom of well (ft)	Length of water column (ft)	Volume of water evacuated (gal)	Time/date

Well Number	Temperature (^{0}F)	pH (S.U.)	Conductivity (Tmho/cm)	Time/Date

Well casing material / diameter:

Sampled by / signature:

NOTES / CALCULATIONS:

Except for low recovery wells, all wells are sampled within 6 hours of purging. Low recovery wells may be sampled as soon as sufficient sample matrix is available or up to 10 hours after purging. Wells that do not recover sufficiently within 10 hours should not be sampled.

Purging equipment includes Teflon® or stainless steel bailers or a peristaltic pump. Any fuel-powered pumping units are placed downwind of any sampling site. If purging equipment is reused, it is cleaned following standard procedures. Disposable latex gloves are worn by sampling personnel and changed prior to starting work at each sampling site.

If bailed water is determined to be hazardous, it should be disposed of in an appropriate manner.

The Florida Department of Environmental Regulation requires that during purging of the well, the purging device should be placed just below the surface of the water level and be lowered with the falling water level. For high yield wells, three casing volumes should be evacuated prior to collecting samples. Purging should be conducted at a rate to minimize agitation of the recharge water. Conductivity, pH, and temperature measurement during purging is necessary to monitor variability of the groundwater. **Samples should be collected within 6 hours of purging high yield wells.**

Low-yield wells (incapable of yielding three casing volumes) should be evacuated to dryness at a rate that does not cause turbulence. When the well recovers sufficiently, the first sample should be analyzed for pH, temperature, and conductivity. When recovery exceeds two hours, the sample should be collected as soon as sufficient volume is available. **If recovery is longer than 10 hours, the well should not be tested**. The project manager may wish to review available information to determine if obtaining a representative sample is possible.

9.4.1 Procedure for Well Evacuation: Teflon® Bailer

1. Clear the area around the well pad; cover with plastic if necessary.
2. Slowly lower the bailer to the water surface and remove it when full.
3. Reel or pull bailer to the surface using caution to not allow the lanyard (cable or string) to touch the ground.
4. Use the bailer volume and number of bails removed to determine volume of water removed. Excess hazardous material should be poured into a container for later disposal.
5. Repeat steps 2 and 3 until 1.5 well volumes have been removed.
6. Begin monitoring for pH, temperature, and conductivity. Record values on the Monitoring Well Data Sheet. Discard the sample into the collection pail. Purge until the change between samples of each parameter is less than 5%.
7. Continue until at least three well volumes have been evacuated and the parameters pH, temperature, and conductivity are within 5 percent, or until a low yield well has been evacuated to dryness.
8. Record date and time the well was purged on the Monitoring Well Data Sheet.

NOTE: For wells sampled in the State of Florida, three well volumes are purged prior to pH, temperature, and conductivity screening. Following evacuation of three well volumes, purge water is screened for these parameters at regular intervals until two consecutive measurements are within 5 percent. The intervals may be time-based (at least 5 min) or represent a portion of the well volume (at least 0.5 well volume).

Compliance with more stringent local, State, or Regional guidelines is observed where required.

9.4.2 Procedure for Well Evacuation: Peristaltic Pump

1. Clean area around the well pad.
2. Install the appropriate length of Tygon® or Teflon® tubing into the pump mechanism.
3. Insert the uncontaminated sampling end of the tubing into the well surface.
4. Connect the pump to the power supply.
5. Operate the pump at a flow rate that does not cause excessive agitation of the replacement water.
6. Determine the pump flow rate.
7. Purge until 1.5 well volumes have been evacuated.
8. Collect samples at a rate of one per well volume evacuated. Monitor these samples for pH, temperature, and conductivity. Record these measurements on the Monitoring Well Data Sheet. Monitor until the difference in each parameter is less than 5 percent.
9. Continue purging until three well volumes have been evacuated and the parameters pH, temperature, and conductivity are within 5 percent, or until a low yield well has been evacuated to dryness.
10. Record the date and time the well was purged on the Well Sampling Field Data Sheet.

9.5 PURGING TECHNIQUES: WELLS WITH IN-PLACE PLUMBING

9.5.1 General

The volume to be purged depends on whether the pumps are running continuously or intermittently and how close to the source samples can be collected. If storage/pressure tanks are present, a volume must be purged to totally exchange the volume of water in the tank.

9.5.2 Continuously Running Pumps

For continuously running pumps, the well should be purged by opening the valve and allowing it to flush for 15 minutes, if the well volume is unknown. If the sample is collected after a holding tank, the volume of the tank should also be purged.

9.5.3 Intermittently Running Pumps

Wells are purged at the maximum rate for at least 15 minutes. Monitoring of field parameters continues until two consecutive measurements within 5% are measured at 5-minute intervals.

9.6 SAMPLE WITHDRAWAL

Technique for withdrawal is dependent on the parameters to be analyzed. To collect a representative sample and minimize the possibility of sample contamination:

- Use Teflon® or stainless steel sampling devices when organics are an analyte of concern.
- Use dedicated tubing or samplers for each well. If a dedicated sampler is not available, clean the sampler between sampling events. Analyze equipment blanks to ensure cross-contamination has not occurred.

The preferred sample collection order is as follows (decreasing volatility):

1. Volatile organic compounds (VOCs)
2. Extractable Organics (includes Total Recoverable Petroleum Hydrocarbons [TRPH], Oil & Grease, Pesticides and Herbicides)
3. Total metals
4. Dissolved metals
5. Microbiological
6. Inorganics (includes Nutrients, demands, and Physical Properties)
7. Radionuclides

The following items are acceptable sampling devices for all parameters:

- A gas-operated, Teflon® or stainless steel squeeze pump (also referred to as a bladder pump with adjustable flow control) should be dedicated or completely cleaned between sampling events. If it is dedicated, the protocols on use, flow rates, and flow controls should be discussed.
- A Teflon® bailer with check valves and a bottom emptying device. Dedicated or disposable bailers should not be cleaned between purging and sampling operations.

ESC generally supplies sampling devices for wells sampled by ESC. However, some customers have wells equipped with dedicated sampling devices. All dedicated equipment is cleaned between sampling events with the exception of dedicated pump systems or dedicated pipes that are never removed. ESC evaluates the device and the project manager approves/disapproves of the dedicated device prior to sampling.

If sampling includes dissolved parameters, samples are filtered in the field in the following manner:

1. Use a one piece, molded, in-line high capacity disposable 1.0 micron filter when collecting samples for dissolved trace metals analysis. Use a 0.45 micron filter when sampling for all other (i.e., orthophosphorous, silica, etc.) dissolved parameters.
2. Filter material should be non-contaminating synthetic fibers.
3. Filter should be placed on the positive pressure side of the peristaltic pump.
4. If well is deeper than 25 feet; a submersible bladder pump may be necessary to bring the sample to the surface. Samples shall not be collected in an intermediate container.
5. At least one filtered equipment blank, using deionized water, must be collected and analyzed.
6. The sample is preserved as required following filtration.
7. Unfiltered samples are collected in conjunction with filtered samples.

NOTE: Filtered samples are collected only at the request of DER and will not be collected for turbid samples only.

9.6.1 Sample Removal: With In-Place Plumbing

Samples should be collected following purging from a valve or tap as near to the well as possible, and ahead of all screens, aerators, filters, etc. Samples shall be collected directly into the sampling containers. Flow rate should not exceed 500 mL/min.

9.6.2 Sample Removal: Without In-Place Plumbing

1. Following purging, collect the sample and pour it directly from the bailer into the sample container. If a peristaltic pump is used, pump the sample directly into the container. Collect the samples in order of decreasing volatility.
2. Measure the conductivity, pH, and temperature of the samples and record the results on the Monitoring Well Data Sheet.
3. If a bailer is not dedicated, clean field equipment using standard procedures. Collect blanks at a rate of one per type of equipment cleaned. If a piece of equipment is cleaned more than twenty times, collect blanks at a rate of 10 percent. An equipment blank must be taken and preserved for each analyte method group.
4. If a bailer is used to collect samples, replace the bailer string. Take precautions not to allow the string to touch the ground. Dispose of the used string properly. If Teflon® or stainless steel cable is used, clean according to standard procedures and do not let it touch the ground.
5. Replace the well cap and close and lock the protective casing lid.

9.7 SPLIT AND DUPLICATE SAMPLE COLLECTION

Split samples measure variability between analysts, methods, and laboratories and are taken as subsamples from a single sample. Duplicate samples measure variability inherent in the collection method or waste stream and are obtained in close succession during the same sampling event.

9.7.1 Split Sample Collection

1. Collect sufficient volume in a container constructed of appropriate materials. The volume should be more than twice the volume required for one sample.
2. Preserve as necessary.
3. Mix well.
4. Alternately decant 10% of the sample volume into each container and mix well.
5. Continue until each container is filled with an adequate sample volume.
6. Seal the containers, assign a field number, and complete the chain of custody.

9.7.2 Duplicate Sample Collection

1. Collect two samples in rapid succession into separate containers.
2. Preserve as necessary.
3. Mix well.
4. Seal the containers, assign a field number, and complete the chain of custody.

9.8 DRINKING WATER SAMPLING

9.8.1 General Concerns

Containers and preservatives must be selected prior to sampling.

- Containers and preservatives shall comply with Tables 1 and 2.
- It is recommended that the appropriate preservative be added to the container by the laboratory.

9.8.2 Sampling Drinking Water Wells

1. Purging and sampling should be from a spigot closest to the wellhead.
    - The spigot should be located before the holding tank and filters. If this is not possible, the holding tank must also be purged.
    - All aerators and filters should be removed if possible.
2. Depending on the running schedule of the well and the placement of the pressure tank, the system is purged as described in Section 9.5.
3. If volume of the pressure tank is not known, the well is purged for at least 15 minutes at maximum rate.
4. The flow is reduced to approximately 500 mL/minute.

5. Sample containers with no preservatives:
    - The interior of the cap or the container should not come in contact with anything.
    - The sample container is rinsed and the water is discarded.
    - Containers are not rinsed if collecting for oil and grease, total recoverable hydrocarbons, volatile organics (including trihalomethanes) or microbiologicals.
    - The container should be tilted to minimize agitation.
6. Sample containers with preservatives:
    - The above protocol is followed but **DO NOT** rinse the container.
    - The open end of the container should be held away from the face while filling.
    - The container should be gently tipped several times to mix the preservatives.
7. Place the bottle in a plastic bag and cool to 4°C.

9.8.3 Sampling Drinking Water within a Facility/Residence for the Lead/Copper Rule

1. The appropriate sampling point depends on whether the sample is being taken to monitor compliance with Drinking Water Regulations for Lead and Copper. If so, the sample must be taken from a cold water tap in the kitchen or bathroom of residential housing or from an interior tap where water is used for consumption in a non-residential building.
2. Samples must be collected after the water has stood in the pipes for at least six hours.
3. THE SYSTEM SHOULD NOT BE FLUSHED.
4. The first flush should be collected immediately into the sample container. DO NOT RINSE THE CONTAINER PRIOR TO COLLECTING THE SAMPLE.
5. The container should be tilted to minimize agitation.
6. If the container contains preservative, hold the open end away from the face.
7. If the container does not contain preservative, add preservative as needed.
8. Replace cap and gently tip the container several times to mix the preservatives.
9. Place in a plastic sample bag.

9.8.4 Sampling a Lead Service Line in a Facility/Residence for the Lead/Copper Rule

1. When sampling for compliance, the sampling point is normally designated by the permit or the municipality.

2. For Lead & Copper samples, each sample shall have stood in the line for at least six hours and shall be collected in one of the following ways:
   a. At the tap, after flushing the volume of water between the tap and the lead service line. The volume of water shall be calculated based upon the inner diameter and length of the pipe between the tap and the service line.
   b. By tapping directly into the service line.
   c. In a single-family residence, allow the water to run until a significant temperature change indicates water standing in the service line is being sampled.
3. The flow shall be reduced to less than 500 mL/min before collecting samples.
4. Test for the presence of residual chlorine using residual chlorine indicator strips or a Hach DR-100 chlorine analyzer.
5. If residual chlorine is present and the parameter being analyzed requires removal of chlorine, collect the sample in the appropriate sample container(s) using the required preservatives.
   a. Add 0.008% $Na_2S_2O_3$ or 100mg of $Na_2S_2O_3$ per 1L of sample water directly into the sample container.
   b. After replacing the cap, tip the container several times to mix the preservative.

10.0 SOIL SAMPLING

Soil samples are preserved as per Section 14. When compositing subsamples, the quantity of each subsample used is measured and recorded in the field logbook.

10.1 SAMPLING EQUIPMENT

Type	Use	Materials	Allowable Parameter Groups[1]
Hand Auger (Bucket type)	Sampling	PVC	All parameter groups except VOC's, extractables and organics
Encore™ Sampler	VOC soil subsampling	Teflon®	VOC's only
Split Spoons	Sampling	Carbon Steel	All parameter groups
Trowel, Spatula	Sampling and Compositing*	Chrome-Plated Steel	All parameter groups
Spoons	Sampling and Compositing*	Stainless Steel	All parameter groups
Shovel	Sampling	Carbon Steel	All parameter groups
Mixing Pan	Compositing*	Pyrex & Aluminum	All parameter groups except metals in aluminum pan

[1] Carbon steel & Chrome-plated steel tools may be used for collecting soils where trace metal concentrations are not a concern. When these tools are used, samples should be taken from soils not in contact with the tool surface.

* Compositing is not suitable for VOC's

10.2 HAND AUGER SAMPLING PROCEDURE

This procedure is used when only relatively shallow samples are required or when the use of heavy equipment is not practical. The hand auger may be used to collect samples of soils or other materials at various depths by adding extensions as necessary.

1. Remove surface debris from the location of the sampling hole using a clean shovel or spoon.
2. Disturbed portions of soil should be discarded and not used as part of the sample.
3. Using a clean auger, drill to the desired sample depth. Confirm depths using a tape measure or other appropriate device.
4. Use a clean planer auger to clean and level the bottom of the boring.
5. All grab samples should be mixed thoroughly prior to placement in containers (except VOCs).
6. Using a clean auger, extract the desired sample. Subsampling is performed for VOC sample collection using an Encore™ sampling device. Once the core sample is collected, additional samples should be taken using an Encore™ sampler, either 5g or 25g, capped, sealed, and immediately cooled to 4ºC. The holding time for this method is 48 hours. Alternatively, weigh 5g of sample into a pre-weighed vial (with a Teflon® lined screw cap) containing 5mL sodium bisulfate solution and a magnetic stir bar, cap, and then ice to 4ºC. The holding time for this method is 14 days.
7. If less than the collected volume of material is desired or if multiple containers are required, subsampling shall be conducted. The collected material shall be placed in a clean mixing pan and thoroughly mixed using a clean, stainless steel spoon. The mixed material will then be quartered, removed and recombined before samples are collected. For clay soils, representative aliquots of the entire sample should be removed from the auger using stainless steel spoons. Samples for chemical analyses shall not be collected from auger flights or cuttings from hollow stem auger flights. Samples used for vapor meter determinations will not be used for trace contaminant analyses.
8. Samples should then be labeled. The depth range from which the samples were taken should be included in the sample description.
9. Repeat steps (2) through (6) as necessary to obtain samples at all desired depths.
10. When preparing composite samples, the quantity of each subsample shall be measured and recorded in the field logbook.

10.3 SPLIT AND DUPLICATE SAMPLE COLLECTION

Split samples measure variability between analysts, methods, and laboratories and are taken as subsamples from a single sample. This is unlike duplicate samples that measure variability inherent in the collection method or waste stream and are obtained in close succession during the same sampling event. True split samples are difficult to collect for soils, sediment, and sludge under field conditions. Split samples for these materials are therefore considered duplicate samples.

The collection procedure is as follows:

1. Collect the appropriate volume of sample into a clean disk constructed of a non-reactive material.
2. Mix the material with a clean utensil and separate into 4 to 10 equal portions.
3. Alternate placing a portion of the subdivided material into each container.
4. Repeat until each container is filled.
5. Assign each container a field sample number and complete the chain of custody.

11.0 WASTE SAMPLING

11.1 SAMPLING EQUIPMENT

Type	Use	Materials	Allowable Parameter Groups[1]
Shovel	Sampling	Carbon Steel	All parameter groups except metals
Split Spoons	Sampling	Carbon Steel	All parameter groups except metals
Trowel, Spatula	Sampling and Compositing*	Stainless Steel	All parameter groups
Spoon	Sampling and Compositing*	Stainless Steel	All parameter groups
Drum Pump	Sampling	Polypropylene	All parameter groups
Mixing pan	Compositing*	Pyrex or aluminum	All parameter groups except metals in aluminum pan
Coliwasa	Sampling	Glass	All parameter groups

[1] Carbon steel tools may be used for collecting wastes when trace metal concentrations are not a concern.
*Compositing is not suitable for VOC's

11.2 GENERAL

This section discusses the collection of samples from drums, tank trucks, and storage tanks, and samples from waste piles and landfills. All ESC personnel consider sampling from closed containers as a hazardous operation.

11.2.1 Specific Quality Control Procedures for Sampling Equipment

Sampling equipment used during waste sampling must be cleaned as specified in Section 12 of this manual before being returned from the field to minimize contamination.

Contaminated disposable equipment must be disposed of as specified in the sampling plan.

All field equipment is cleaned and repaired before being stored at the conclusion of a field study. Special decontamination procedures may be necessary in some instances and is developed on a case-by-case basis. Any deviation from standard cleaning procedures and all field repairs is documented in field logbooks. Equipment that has not been properly cleaned must be tagged and labeled.

11.2.2 Collection of Supplementary Information

The collection of supplementary data is important when collecting waste samples. Any field analyses are recorded in field logbooks. Sketches of sampling locations and layout are documented in the logbooks. Photographs are used extensively.

11.3 OPEN AND CLOSED CONTAINER SAMPLING

11.3.1 General

When sampling containers, open containers should be sampled first since they generally present less of a hazard. Closed containers must be considered as extremely hazardous. Due to the dangers involved with container sampling, the sampling of drums or other containers containing either unknown materials or known hazardous materials are considered a hazardous duty assignment.

One problem with container sampling is stratification and/or phase separation. Care must be taken to ensure that the sample collected is representative. If only one layer or phase is sampled, this should be noted when interpreting analytical results.

If no stratification is present, representative samples may be composited by depth. When a drum or cylindrical container is standing vertically, depth compositing provides a good quantitative estimate of the containers contents. In other cases where containers are tipped, horizontal, deformed, etc., and stratification may not be present, vertical compositing provides at least a qualitative sample.

11.3.2 Sampling Equipment

The following equipment is available for use in collecting waste samples: barrel bung wrenches, adjustable wrenches, etc.; coliwasa samplers for drum sampling; and peristaltic pumps for liquid waste sampling from containers.

11.3.3 Sampling Techniques

Containers containing unknown materials or known hazardous materials are opened using only spark proof opening devices from a grounded container.

The coliwasa sampler is a single use glass sampler, consisting of an outer glass tube with one end tapered and a separate inner glass tube with a small bulb on one end. The outer tube is slowly lowered into the drum, tapered end first. Slowly lowering the tube allows the liquid phases in the drum to remain in equilibrium. The inner glass tube is inserted into the outer tube. After both inner and outer tubes are inserted into the drum to be sampled, the inner tube bulb end is pressed gently against the tapered end of the outer tube, forming a seal. Both tubes are withdrawn from the drum and the ends of the tubes are held over the sample container.

Drum samples can also be collected using a length of glass tube (1/2-inch or less inside diameter). The tube is inserted into the drum as far as possible and the open end is sealed to hold the sample in the tube. The sample is then placed in the appropriate container. Sample volumes are the absolute minimum required.

Tank truck and storage tank samples may be collected from access ports on top of these tanks or trucks using the above techniques. Tank trucks are often compartmentalized, and each compartment should be sampled. Sampling from discharge valves is not recommended due to stratification possibilities and possibilities of sticking or broken valves. If the investigator must sample from a discharge valve, the valving arrangement of the particular tank truck being sampled must be clearly understood to ensure that the contents of the compartments of interest are sampled. The investigator must realize that samples obtained from valves may not be representative.

If stratification or phase separation of waste samples is suspected, the sample collected should be representative of container contents. Samples should be depth composited when possible and number and types of layers shall be noted when interpreting analytical results.

11.4 WASTE PILES AND LANDFILLS

11.4.1 General

Waste piles consist of sludge and other solid waste, liquid waste mixed with soil, slag, or any type of waste mixed with construction debris, household garbage, etc. The sampling personnel must be aware that landfills were not and are often still not selective in the types of materials accepted. Sampling at landfills could involve sampling operations that are potentially dangerous to sampling personnel.

11.4.2 Sampling Locations

Sampling locations should be selected that yield a representative sample of the waste. Exceptions are situations in which representative samples cannot be collected safely or when the team is purposely determining worst-case scenarios.

11.4.2.1 Waste Piles

A representative sample from a small waste pile can be obtained by collecting a single sample. Collecting representative samples from large waste piles requires a statistical approach in selecting both the numbers of samples and sample location. A discussion of statistical methods is outlined in the *Test Methods for Evaluating Solid Waste (SW-846)* issued by the EPA Office of Solid Waste and Emergency Response.

11.4.2.2 Landfills

Representative samples from landfills are difficult to achieve to due to the heterogeneous nature of the wastes. A statistical approach should be used in selecting both the number of samples and the sample location. Statistical methods are given in *Test Methods for Evaluating Solid Waste (SW-846)* issued by the EPA Office of Solid Waste and Emergency Response. Landfills often generate leachate at one or more locations downgradient of the fill material that can provide some insight into the materials contained in a landfill that are migrating via groundwater.

11.4.3 Sampling Techniques

All samples collected should be placed into a Pyrex® or aluminum mixing pan and mixed thoroughly. Samples for volatile organic compounds analyses must not be mixed or composited. Stainless steel spoons or scoops should be used to clear away surface materials before samples are collected. Near surface samples can then be collected with a clean stainless steel spoon. Depth samples can be collected by digging to the desired depth with a carbon steel shovel or scoop and removing the sample with a stainless steel spoon.

12.0 STANDARD CLEANING PROCEDURES

12.1 GENERAL

12.1.1 Introduction

ESC personnel use the procedures outlined in this section to clean field equipment prior to use. Ideally, a sufficient amount of clean equipment is carried to the field so that the project can be conducted without the need for field cleaning. This is not always the case. ESC's policy regarding cleaning field equipment is as follows:

1. Equipment used in the field must be thoroughly cleaned in a controlled environment using prescribed procedures. This minimizes the potential for contaminants being transferred to equipment, vehicles, and the laboratory.
2. All equipment is rinsed immediately with tap water after use, even if it is to be field cleaned for other sites.
3. If equipment is used only once (i.e., not cleaned in the field), it is labeled as "dirty" or "contaminated equipment" in the field and transported separately from clean equipment.
4. All cleaning procedures are documented. Field decontamination is documented in the field records. These records specify the type of equipment cleaned and the specific protocols that are used. In-house cleaning records must identify the type of equipment, date it was cleaned, SOP used, and person that cleaned it.
5. Unless justified through documentation (i.e., company written protocols and analytical records) and historic data (i.e., absence of analytes of interest in equipment blanks), the protocols in Sections 12.1.2 through 12.7.11 are followed without modification.
6. All field sampling equipment is pre-cleaned in-house.

12.1.2 Cleaning Materials

Use a phosphate-free, laboratory detergent such as Liquinox®. The use of any other detergent is noted in field logbooks and summary reports.

Ten percent nitric acid solution is made from reagent-grade nitric acid and deionized water.

The standard cleaning solvent used is pesticide-grade isopropanol. Other solvents (acetone and/or hexane) may be substituted as necessary. The use of other solvents must be documented in field logbooks and summary reports.

Tap water may be used from any potable water system. Untreated water is not an acceptable substitute for tap water.

Deionized water is tap water that has been passed through a deionizing resin column and should contain no inorganic compounds at or above analytical detection limits. Organic-free water is tap water that has been de-ionized and treated with activated carbon. Organic-free water should contain no detectable levels of organic compounds, and less than 5 ug/L of VOCs.

Analyte-free water is water in which all the analytes of interest and all interferences are below the method detection limits. Analyte-free water is always used for blank preparation and for the final in-house decontamination rinse.

Substitution of a higher grade water (i.e., deionized or organic-free water for tap water) is permitted and need not be recorded. Solvent, nitric acid, detergent, and rinse water used to clean equipment shall not be reused.

12.1.3 Marking Clean Equipment

Equipment that is cleaned by these methods is marked with the date and time that the equipment was cleaned.

12.1.4 Marking Contaminated or Damaged Field Equipment

Field equipment that needs repair is tagged and repairs or symptoms noted on the tag. Field equipment that needs cleaning **will not** be stored with clean equipment. All wrapped equipment not used in the field may be placed back in stock after equipment is inspected to ensure that contamination has not taken place.

12.1.5 Decontamination of Equipment Used With Toxic or Hazardous Waste

Equipment used to collect hazardous or toxic wastes or materials from hazardous waste sites, RCRA facilities, or in-process waste streams is decontaminated prior to leaving the site. This decontamination procedure consists of washing with laboratory detergent and rinsing with tap water. More stringent procedures may be required depending on the waste sampled.
If equipment is heavily contaminated, an acetone or acetone/hexane/acetone pre-rinse may be necessary prior to regular decontamination procedures. It is not recommended that this type of cleaning be performed in the field.

12.1.6 Disposal of Cleaning Materials

See Section 16.

12.1.7 Safety Procedures for Cleaning Operations

All applicable safety procedures are followed during cleaning operations. The following precautions are taken during cleaning operations:

- Safety glasses or goggles, gloves, and protective clothing are worn during all cleaning operations.
- Solvent rinsing operations are conducted under a hood or in an open, well ventilated area.
- No eating, smoking, drinking, chewing, or hand to mouth contact is permitted during cleaning operations.

12.1.8 Storage of Field Equipment

All clean field equipment is stored in a designated, contaminant-free area.

12.2 QUALITY CONTROL PROCEDURES FOR CLEANING

12.2.1 General

This section establishes quality control methods to monitor the effectiveness of the equipment cleaning procedures. The results of these methods are monitored by the ESC Quality Assurance Department. All quality control procedures are recorded in a logbook and maintained in a quality assurance file. If contamination problems are detected, the ESC QA Department determines the cause(s) of the problem(s) and takes immediate corrective action.

12.2.2 Rinse Water

The quality of water used is monitored once per quarter by placing water in standard, pre-cleaned sample containers and submitting them to the ESC laboratory for analysis. Organic-free water is also submitted for analyses of the various organic compounds.

12.3 PROCEDURES FOR CLEANING TEFLON® OR GLASS EQUIPMENT USED IN THE COLLECTION OF SAMPLES FOR TRACE ORGANIC COMPOUNDS AND/OR METALS ANALYSES

1. Equipment is washed with laboratory detergent and hot water using a brush to remove any particulate matter or surface film. If oil, grease, or other hard to remove residues are present on the equipment, an acetone/hexane/acetone pre-wash and/or steam cleaning may be necessary.
2. Rinse the equipment with hot tap water.
3. Rinse or soak, if necessary, equipment with a 10% nitric acid solution. If nitrogen-containing compounds are analytes of concern, hydrochloric acid must be used as a substitute or subsequent equipment rinse.
4. Rinse equipment with tap water.
5. Rinse equipment with deionized water.
6. Rinse equipment twice with solvent and allow to dry.
7. If equipment cannot be cleaned effectively, discard properly.
8. Wrap equipment in aluminum foil. Seal in plastic and date.

12.4 PROCEDURES FOR CLEANING STAINLESS STEEL OR METAL SAMPLING EQUIPMENT USED IN TRACE ORGANIC AND/OR METALS SAMPLE COLLECTION

1. Equipment is washed with laboratory detergent and hot water using a brush to remove any particulate matter or surface film. If oil, grease, or other hard to remove materials are present, a acetone/hexane/acetone pre-wash and/or steam cleaning may be necessary.

2. Rinse equipment with hot tap water.
3. Rinse equipment with deionized water.
4. Rinse equipment twice with solvent and allow to dry.
5. If equipment cannot be cleaned effectively, discard properly.
6. Wrap equipment in aluminum foil. Seal in plastic and date.

12.5 CLEANING PROCEDURES FOR AUTOMATIC SAMPLING EQUIPMENT

12.5.1 General

All automatic wastewater samplers are cleaned as follows:

- The exterior and accessible interior portions of automatic samplers is washed with Liquinox and rinsed with tap water.
- The electronics casing are cleaned with a clean damp cloth.
- All vinyl sample tubing is discarded after each use.
- Teflon® tubing is cleaned using procedures found in Section 12.6.2.
- Silastic pump tubing is cleaned after each use, if possible. Tubing is cleaned using cleaning procedures specified in Section 12.6.1 of this document. Tubing is checked on a regular basis and will be changed if it has become discolored or loses elasticity.

12.5.2 Reusable Glass Composite Sample Containers

1. If containers are used to collect samples that contain hard to remove materials (i.e., oil and grease) it is rinsed as necessary with reagent grade acetone prior to the detergent wash. If material cannot be removed, the container is discarded.
2. Wash containers thoroughly with hot tap water and Liquinox and rinse thoroughly with hot tap water.
3. If metals are to be sampled, rinse with 10% nitric acid. If nutrients are to be sampled, follow with a 10% hydrochloric acid rinse.
4. Rinse thoroughly with tap water.
5. Rinse thoroughly with DI water.
6. If organics are to be sampled, rinse twice with isopropanol and allow to air dry for 24 hours or more. Cap the container with the decontaminated Teflon® lined lid.
7. After use, rinse with tap water in the field and cover to prevent drying of material onto the interior surface.
8. Containers that have a visible scale, film, or discoloration after cleaning or were used at a chemical manufacturing facility should be properly discarded at the conclusion of the sampling activities.

12.5.3 Reusable Plastic Composite Sample Containers

1. Wash containers with hot tap water and laboratory detergent using a bottlebrush to remove particulate matter and surface film.
2. Rinse containers with hot tap water.
3. Rinse containers with 10% nitric acid. If nitrogen containing compounds are analytes of concern, hydrochloric acid must be used as a substitute or subsequent equipment rinse.
4. Rinse containers with tap water.
5. Rinse containers with deionized water.
6. Cap with aluminum foil.
7. Plastic sample containers used at facilities that produce toxic compounds will be properly disposed of at the conclusion of the sampling activities. Containers that have a visible film, scale, or other discoloration remaining after cleaning will be discarded.

12.5.4 Plastic Sequential Sample Bottles for Automatic Sampler Base

1. Rinse bottles in field with potable or de-ionized water when possible.
2. Wash in dishwasher at wash cycle, using laboratory detergent cycle, followed by tap and deionized water rinse cycles. Alternatively, handwash using the same procedure.
3. Rinse with 10% nitric acid. If nitrogen containing compounds are analytes of concern, hydrochloric acid must be used as a substitute or subsequent equipment rinse.
4. Rinse with tap water.
5. Replace bottles in sampler base; cover with aluminum foil before storing.

12.6 CLEANING PROCEDURES FOR SAMPLING TUBING

12.6.1 Silastic Rubber Pump Tubing Used In Automatic Samplers

Silastic pump tubing used in automatic samplers need not be replaced in pumps where the sample does not contact the tubing, where the sampler is being used solely for purging purposes (i.e., not being used to collect samples). Tubing must be changed on a regular basis, if used for sampling purposes, and should be cleaned in this manner:

1. Flush tubing with laboratory grade detergent and hot tap water
2. Rinse thoroughly with hot tap water
3. Rinse thoroughly with DI water
4. If used to collect metals samples, the tubing is flushed with 1+5 nitric acid, followed by a thorough rinsing with DI water
5. Install the tubing in the automatic wastewater sampler
6. Cap both ends with aluminum foil or equivalent

Tubing should always be replaced at automatic sampler manufacturer's recommended frequencies. If tubing cannot be adequately cleaned, it is discarded.

12.6.2 Teflon® Tubing

New Teflon® tubing is pre-cleaned as follows:

1. Rinse outside of the tubing with pesticide-grade solvent.
2. Flush interior of the tubing with pesticide-grade solvent.
3. Let dry overnight in drying oven or equivalent.
4. Wrap tubing in aluminum foil and seal in plastic.

Reused tubing is transported to the field in pre-cut and pre-cleaned sections. Field cleaning of Teflon® is not recommended. The following steps describe in-house cleaning procedures:

1. Exterior of tubing must be cleaned first by soaking in hot, soapy water in a stainless steel or non-contaminating sink. Particulate may be removed with a brush.
2. Clean inside of tubing ends with a small bottlebrush.
3. Rinse surfaces and ends with tap water.
4. Rinse surfaces and ends with nitric acid, tap water, isopropanol, and analyte-free water.
5. Place on fresh aluminum foil, connect all sections with Teflon® couplings.
6. Cleaning configuration:
    a. Cleaning solutions are placed in a clean, 2-liter glass jar.
    b. Place one end of tubing in the solution, the other in the **INFLUENT** end of a peristaltic pump.
    c. Effluent from the pump can be recycled through the glass cleaning solution jar. All cleaning solutions can be recycled EXCEPT the final isopropanol and analyte-free water rinses.
7. The above configuration is used as follows:
    a. Pump generous amounts of hot, soapy water through the tubing.
    b. Follow this with tap water, 10% nitric acid, tap water, isopropanol, and analyte-free water.
    c. The nitric acid and isopropanol rinses should be allowed to remain in the tubing for 15 minutes with the pump shut off then continue with subsequent rinses
    d. Leave any couplings in and connect or cover the remaining ends.
8. After cleaning the interior, rinse the exterior with analyte-free water.
9. The cleaned lengths are wrapped in aluminum foil and stored in a clean, dry area until use.

12.7 FIELD EQUIPMENT CLEANING PROCEDURES

12.7.1 General

It is the responsibility of field personnel to properly clean equipment in the field. The following procedures are observed when cleaning equipment in the field.

12.7.2 Conventional Equipment Use

Remove deposits with a brush if necessary. If only inorganic anions are of interest, equipment should be rinsed with analyte-free water and with the sample at the next sampling location prior to collection. Clean equipment for the collection of samples for organic compounds or trace inorganic analyses according to Section 12.7.3.

12.7.3 Equipment Used to Collect Organic Compounds and Trace Metals Samples

1. Clean with tap water and laboratory detergent. If necessary, use a brush to remove particulate and surface films then rinse with tap water.
2. Rinse with 10 to 15% nitric acid solution followed by 10% hydrochloric acid rinse (unless equipment is made of metal) followed by tap water and DI water.
3. Rinse twice with solvent.
4. Rinse with organic-free water and allow to air dry.
5. If organic-free water is unavailable, let air dry. Do not rinse with deionized or distilled water.
6. Wrap with aluminum foil or plastic.

12.7.4 Teflon®, Glass, Stainless Steel or Metal Equipment Used to Collect Samples for Metal Analyses

1. Remove particulate matter and surface films. Clean with laboratory detergent and tap water.
2. Rinse with tap water.
3. Ten percent nitric acid solution (skip 3 and 4 if equipment is made of metal and/or stainless steel).
4. Rinse with tap water.
5. Rinse with deionized water then let air dry.

12.7.5 Instruments Used to Measure Groundwater Levels

1. Wash with laboratory detergent and tap water.
2. Rinse with tap water.
3. Rinse with deionized water.
4. Allow to dry.

12.7.6 Field Filtration Apparatus

1. A new, disposable filtration unit will be used for each site. Filter pore size is dependent on parameter being monitored as per Section 9.6.
2. The peristaltic pump is cleaned as described in Section 12.7.7.
3. Silastic pump tubing is cleaned as described in Section 12.6.1.
4. If Teflon® tubing is used, it is cleaned as described in Section 12.6.2.
5. Other tubing types must be cleaned following the appropriate regimen described in Section 12.6. In general, non-Teflon® type tubing (e.g., HDPE) will not be re-used.

12.7.7 Flow Meters, Above Ground Pumps, Bladder Pumps and Other Field Instrumentation

The exterior of equipment such as flow meters should be washed with a mild detergent and rinsed with tap water before storage. The interior of such equipment may be wiped with a damp cloth.

Other field instrumentation should be wiped with a clean, damp cloth. Meter probes should be rinsed with deionized water before storage.

Equipment desiccant should be checked and replaced as necessary.

Peristaltic pumps used for purging must be free of oil and grease on the exterior. They must be cleaned on the outside with Liquinox and rinsed with tap water followed by DI water.

12.7.8 In-Field Decontamination For Submersible Purging Pump and Tubing

ESC uses the submersible bladder pump listed in Section 9.1 only for purging and not for sample collection. The pump and tubing is decontaminated between wells in the following manner:

1. Interior of the pump and tubing is thoroughly flushed with a soapy water solution.
2. Wipe or scrub the exterior of the pump and tubing as necessary with the appropriate soap solution.
3. Rinse exterior and interior of pump and tubing thoroughly with tap water followed by a deionized water rinse.
4. Allow remaining water to drain from tubing and pump and allow to air dry as long as possible in a contaminant free area before purging the next well.

12.7.9 Shipping Containers

All reusable shipping containers are washed with laboratory detergent, rinsed with tap water, and air dried before storage or re-use. Extremely contaminated shipping containers are cleaned as thoroughly as possible and properly disposed.

12.7.10 Analyte Free Water Containers

Analyte-free water containers can be made of glass, Teflon®, polypropylene, or high density polyethylene (HDPE). Inert glass or Teflon® are recommended for holding organic-free sources of water. Polypropylene can be used when organics are not analytes of concern. HDPE is not normally recommended but is acceptable for use. Water should not be stored in these containers for extended periods. Containers of water should only be used for a single event and should be disposed of at the end of the sampling day. The procedure for cleaning analyte-free water containers is as follows:

1. For new containers, follow instructions in Section 12.3 of this manual. Delete the solvent rinse if containers are made of plastic.
2. Cap with Teflon® film, aluminum foil, or the Teflon® lined bottle cap (aluminum foil or Teflon® film may also be used as a cap liner).

If water is being stored in reused containers, the following cleaning procedures should be followed:

1. After emptying, cap the container.
2. Wash exterior of the container with Liquinox and rinse with DI water.
3. Rinse the interior twice with isopropanol unless the container is made of plastic.
4. Rinse the interior thoroughly with analyte-free water.
5. Invert and allow to dry.
6. Fill the container with analyte-free water and cap with aluminum foil, Teflon® film, or a Teflon® lined bottle cap.
7. Water is not stored prior to a sampling event for more than 3 days.

12.7.11 Vehicles

Field vehicles used by ESC personnel should be washed at the conclusion of each sampling event. This should reduce the risk of contamination due to transport on a vehicle. When vehicles are used at hazardous waste sites or on studies where pesticides, herbicides, organic compounds, or other toxic materials are known or suspected to be present, a thorough interior and exterior cleaning is mandatory at the conclusion of the site visit.

Vehicles are equipped with trash containers. ESC personnel are responsible for cleanliness of each vehicle.

13.0 SAMPLE HISTORY

Sample chronology is recorded and kept on the ESC chain of custody, field logbooks and laboratory notebooks. These are discussed in detail in Section 9.0.

14.0 SAMPLE CONTAINERS, PRESERVATION METHODS AND HOLDING TIMES

14.1 GENERAL CONSIDERATIONS

The following section contains information regarding sample containers, preservation methods, and holding times. Refer to SW-846, Table II-1 and Chapter 3, Page 3 for solid waste and RCRA projects and 40 CFR Part 136, Table II for water and wastewater projects.

The provisions of 40 CFR Part 136, Table II take precedence over requirements given in any approved method when sampling in the State of Florida for water and wastewater.

Proper sample preservation is the responsibility of the sampling team and it is their responsibility to assure that all samples are preserved according to 40 CFR Part 136. For the purposes of this manual, "immediately" is defined as within 15 minutes.

Sample preservation is accomplished either by obtaining pre-preserved containers from an acceptable source or by adding preservatives in the field.

It is the responsibility of the field team accepting pre-preserved containers to make sure that the proper preservatives are used and desired results are achieved. The laboratory also supplies additional preservatives from the same source in suitable containers.

14.2 SAMPLE PRESERVATION

The following protocols apply for sample containers preserved in the field after the sample has been added:

1. Preservatives are at least reagent grade or higher. The acid for metals is suitable for trace metals analyses.
2. Fresh preservatives are obtained prior to each sampling event. Remaining preservatives that are not sealed must be discarded in an acceptable manner.
3. Preservatives are transported in pre-measured glass ampules and added directly to the sample.
4. A corresponding amount of preservative is added to the associated equipment blanks.
5. The pH is checked on all pH preserved samples with the exception of VOC, oil and grease, and TRPH.

Effectiveness of pH adjustment is made in the following manner:

1. Narrow range pH paper is used to test a small aliquot of the preserved sample.
2. A small portion of sample is placed into a container, checked with pH paper, and compared against the color chart.
3. Discard the aliquot properly, but do not pour back into the sample container.
4. If pH is acceptable, document in field log and prepare for transport to laboratory.

If pH is unacceptable, continue to add additional preservative in measured increments using the methods described above until an acceptable pH has been reached. Record the total amount of preservative used in the field log. Always use additional preservative from the same source as the initial preservation attempt.

In some cases, an extra dummy sample can be used to test pH preservation. Content should be suitably discarded.

If equipment blanks or field blanks are used, the maximum amount of preservative that was used to preserve any single sample in the set is added to the equipment or field blank.

Samples requiring temperature preservation are cooled to 4°C. The cooler will be checked to ensure that the ice has not melted.

14.3 SAMPLE CONTAINERS

ESC does not clean and re-use sample containers. ESC purchases all sample collection containers precleaned. All used sampling containers are discarded after use. The cleaning criteria of all containers must meet EPA analyte specific requirements.

QEC provides written certification that containers do not contain analytes of concern above method detection levels

ESC maintains records for these containers (lot numbers, certification statements, date of receipt, etc.) and intended uses are documented.

14.4 FIELD REAGENT HANDLING

Reagents, cleaning materials, and preservatives that are maintained by a field team will be stored, transported, and handled in such a way as to prevent and/or minimize contamination. The following storage and use protocols will be observed:

1. Chemicals are stored in-house and transported to the field segregated by reactivity.
2. Acids are stored in an acid storage cabinet and solvents are stored in a vented, explosion proof solvent storage cabinet.
3. All chemicals transported to the field are stored in bottles and packed to avoid breaks.

4. When reagents are transferred from an original container, the transport container must be pre-cleaned and of compatible material as the original container.
5. Chemicals are separated from sample containers and samples to avoid reaction and possible contamination.
6. Analyte free water is segregated from solvents to prevent contamination.

14.4.1 Reagent and Standard Storage

Chemical	Method of Storage
Nitric acid	Stored separated from other acids in original container in vented cabinet.
Sulfuric acid	See above
Hydrochloric acid	See above
Isopropanol	Stored in original glass container in vented and explosion proof solvent storage cabinet.
pH calibration buffers, turbidity standards, conductivity standards	Stored in cabinet designated for standard and reagent storage. Stored in temperature-controlled area of laboratory.
Sodium hydroxide	Stored in original container in designated cabinet in laboratory.
Sodium thiosulfate, zinc acetate, ascorbic acid, lead acetate	Stored in original containers in designated area of laboratory. Reagent solutions made fresh prior to use.

14.5 SAMPLE TRANSPORT

In the majority of situations, samples are delivered directly to the laboratory by the field sampling team or field courier following standard chain of custody protocols. Samples are preserved immediately (i.e., within 15 minutes) and packed with ice prior to transport. The field team relinquishes custody to the login sample custodian upon arrival at the laboratory.

Certain situations require that the field sampling team ship samples to the laboratory utilizing common carrier (UPS, FEDEX, etc.). If samples are sent by common carrier, all documentation (transmittal form, chain of custody, field data, analyses request, etc.) is placed in a ziplock bag and placed inside the sample container. The container is then sealed closed and sent to the laboratory in the required time frame to meet requirements of time-sensitive analyses.

14.6 BIOMONITORING SAMPLING

Preservation and Sample Volume

Aqueous samples collected for Bioassay can be collected in either glass or HDPE plastic. There is no required chemical preservation for this type of sample but the sample must be kept at 4 ± 2°C. The required volume varies independently with each type of analysis but the minimum collected is 250mL. The samples can be held for a maximum of 36 hours from the time of collection until first use.

Sample Collection

Grab sample protocols are utilized for acute bioassay unless otherwise specified in permit requirements. Composite sampling protocols are utilized for chronic bioassays unless otherwise specified in permit requirements. (Actual sampling protocols are discussed in detail throughout this appendix) ESC field collection personnel are required to collect all bioassay samples by completely filling the sample bottle and leaving no headspace. It is important that bottles be filled completely to reduce possible aeration that may reduce the toxic properties of the sample. If a customer chooses to collect the samples, a trained ESC field collection person can explain in detail the importance of reducing aeration by filling the sample bottle completely.

14.6.1 Biomonitoring Sampling Containers

All bioassay glassware are cleaned using the following EPA protocol:

- soak for 15 minutes in hot tap water with detergent and scrub
- rinse thoroughly with hot tap water
- rinse thoroughly with dilute nitric acid (10%)
- rinse thoroughly with deionized water
- rinse thoroughly with pesticide grade acetone

TABLE 14.6: PRESERVATION, HOLDING TIME AND SAMPLE CONTAINERS

Parameter	Matrix [1]	EPA Approved Method[2]	SW846 [3]	Rec. Volume	Bottle Type	Pres.	Temp	Holding Time	Holding Time Units
AIR METHODS									
Volatiles in Ambient Air	Air	EPA TO-15	NA	Various	Canister	None	Ambient	14	Days
Volatiles in Ambient Air	Air	EPA TO-15	NA	Various	Tedlar	None	Ambient	5	Days
Volatiles in Ambient Air	Air	EPA Method 18	NA	Various	Canister	None	Ambient	14	Days
Volatiles in Ambient Air	Air	EPA Method 18	NA	Various	Tedlar	None	Ambient	5	Days
Ohio VAP EPA Method 8260B	Air	NA	EPA 8260B	Various	Canister	None	Ambient	14	Days
Ohio VAP EPA Method 8260B	Air	NA	EPA 8260B	Various	Tedlar	None	Ambient	5	Days
Methane, Ethane, Ethene, Propane	Air	RSK-175	NA	Various	Canister	None	Ambient	14	Days
Methane, Ethane, Ethene, Propane	Air	RSK-175	NA	Various	Tedlar	None	Ambient	5	Days
Fixed Gases - C_2, CO_2, CO, and CH_4	Air	ASTM D1946/D5314	NA	Various	Canister	None	Ambient	14	Days
Fixed Gases - C_2, CO_2, CO, and CH_4	Air	ASTM D1946/D5314	NA	Various	Tedlar	None	Ambient	5	Days

Parameter	Matrix[1]	EPA Approved Method[2]	SW846[3]	Rec. Volume	Bottle Type	Pres.	Temp	Holding Time	Holding Time Units
Arizona State Specific VOCs in Vapor - 8260B	Air	NA	EPA 8260B	Various	Canister	None	Ambient	30	Days
Arizona State Specific VOCs in Vapor - 8260B	Air	NA	EPA 8260B	Various	Tedlar	None	Ambient	72	Hours
Arizona State Specific VOCs in Vapor - 8015B	Air	NA	EPA 8015B	Various	Canister	None	Ambient	30	Days
Arizona State Specific VOCs in Vapor - 8015B	Air	NA	EPA 8015B	Various	Tedlar	None	Ambient	72	Hours
AQUATIC TOXICITY & RELATED									
C.dubia - Acute	NPW	2002	NA	1L/1Gal	HDPE	None	0 - 6°C	36	Hours
Minnow - Acute	NPW	2000	NA	1L/1Gal	HDPE	None	0 - 6°C	36	Hours
Toxicity C.dubia - Chronic	NPW	1002	NA	1L/1Gal	HDPE	None	0 - 6°C	36	Hours
Toxicity Minnow - Chronic	NPW	1000	NA	1L/1Gal	HDPE	None	0 - 6°C	36	Hours
BACTERIA									
Chlorophyll A/Pheophytin A	NPW	SM10200H	NA	1L	Amber Glass	None	0 - 6°C	72	Hours
Coliform, Total	NPW	SM9222B	NA	110ml	Micro	$Na_2S_2O_3$	0 - 6°C	8	Hours
E. Coli	NPW	SM9223B, Colilert	NA	110ml	Micro	$Na_2S_2O_3$	0 - 6°C	8	Hours
Enterococci	NPW	ASTM D6503-99, Enterolert	NA	110ml	Micro	$Na_2S_2O_3$	0 - 6°C	8	Hours
Fecal Coliform	NPW	SM9222D	NA	110ml	Micro	$Na_2S_2O_3$	0 - 6°C	6	Hours
Fecal Coliform	NPW	SM9221C/E	NA	110ml	Micro	$Na_2S_2O_3$	0 - 6°C	6	Hours
Heterotropic Plate Count	NPW	9215B	NA	110ml	Micro	$Na_2S_2O_3$	0 - 6°C	6	Hours
Salmonella	NPW	SM9260D	NA	110ml	Micro	$Na_2S_2O_3$	0 - 6°C	8	Hours
Cryptosporidium	PW	1622, 1623	NA	10L	LDPE	None	<20°C	96	Hours
E. Coli	PW	SM9223B	NA	110ml	Micro	$Na_2S_2O_3$	0 - 6°C	30	Hours
Fecal Coliform (MPN)	PW	9221E	NA	110ml	Micro	$Na_2S_2O_3$	0 - 6°C	30	Hours
Fecal Coliform	PW	SM9222D	NA	110ml	Micro	$Na_2S_2O_3$	0 - 6°C	30	Hours
Enterococci	PW	ASTM D6503-99	NA	110ml	Micro	$Na_2S_2O_3$	0 - 6°C	30	Hours
Heterotropic Plate Count	PW	9215B	NA	110ml	Micro	$Na_2S_2O_3$	0 - 6°C	6	Hours
Coliform, Total	PW	9222B, 9223B	NA	110ml	Plastic	$Na_2S_2O_3$	0 - 6°C	30	Hours
Coliform, Total	SS	SM9221B, 9222	NA	Sterile 125mL	Plastic	None	0 - 6°C	24	Hours
Fecal Coliform (MPN)	SS	9221E	NA	Sterile 125mL	Plastic	None	0 - 6°C	24	Hours
Fecal Coliform (Sludge)	SS	9222D	NA	Sterile 125mL	Plastic	None	0 - 6°C	24	Hours

Parameter	Matrix[1]	EPA Approved Method[2]	SW846[3]	Rec. Volume	Bottle Type	Pres.	Temp	Holding Time	Holding Time Units
Enterococci	SS	ASTM D6503-99	9230	Sterile 125mL	Plastic	None	0 - 6°C	6	Hours
Salmonella	SS	SM9260D	NA	110ml	Micro	None	0 - 6°C	6	Hours
Heterotropic Plate Count	SS	SM9215B	NA	110ml	Micro	None	0 - 6°C	6	Hours
S.O.U.R.	SS	SM 2710B	NA	1L	HDPE	None	0 - 6°C	2	Hours
INORGANIC CLASSIC									
Acidity	NPW	SM2310B, ASTM D1067	NA	250ml	HDPE	None	0 - 6°C	14	Days
Alkalinity	NPW	SM2320B	NA	500ml	HDPE	None	0 - 6°C	14	Days
Alkalinity	NPW	310.2	NA	500ml	HDPE	None	0 - 6°C	14	Days
Ammonia Nitrogen	NPW	350.1, $SM4500NH_3$ G	NA	500ml	HDPE	$H_2SO_4+Na_2S_2O_3$	0 - 6°C	28	Days
Ammonia, distilled/titration (4500)	NPW	$SM4500NH_3$ C	NA	500ml	HDPE	$H_2SO_4+Na_2S_2O_4$	0 - 6°C	28	Days
Asbestos	NPW	100.1	NA	1L	Glass	None	0 - 6°C	48	Hours
BOD/CBOD (Total & Soluble)	NPW	SM5210B	NA	1L	HDPE	None	0 - 6°C	48	Hours
Bromide	NPW	300.0, SM4110B	9056	125ml	HDPE	None	0 - 6°C	28	Days
Carbon Dioxide	NPW	SM4500CO2 D	NA	1L	HDPE	None	0 - 6°C	15	Min
Chemical Oxygen Demand (COD)	NPW	410.4, SM5220D	NA	250ml	HDPE	H_2SO_4	0 - 6°C	28	Days
Chemical Oxygen Demand (COD), Soluble	NPW	410.4, SM5220D	NA	250ml	HDPE	None	0 - 6°C	28	Days
Chloride	NPW	300.0, SM4110B	9056	125ml	HDPE	None	0 - 6°C	28	Days
Chlorine, residual	NPW	SM4500Cl-G	NA	250ml	HDPE	None	0 - 6°C	15	Min
Color	NPW	SM2120B	NA	250ml	HDPE	None	0 - 6°C	48	Hours
CTAS Surfactants	NPW	SM5540D	NA	1L	HDPE	None	0 - 6°C	48	Hours
Cyanide - Total	NPW	335.4, SM4500CNE	9012	250ml	Amber HDPE	NaOH	0 - 6°C	14	Days
Cyanide - Total	NPW	Kelada-01	NA	250ml	Amber HDPE	NaOH	0 - 6°C	14	Days
Cyanide, Amenable	NPW	SM4500CNG	9012	250ml	Amber HDPE	NaOH	0 - 6°C	14	Days
Cyanide, Free	NPW	SM4500CNE	NA	250ml	Amber HDPE	NaOH	0 - 6°C	14	Days
Cyanide, Weak Acid Dissoc.	NPW	SM4500CN-I	NA	250ml	Amber HDPE	NaOH	0 - 6°C	14	Days
Dissolved Organic Carbon (DOC)	NPW	SM5310B	9060	250ml	Amber Glass	None	0 - 6°C	28	Days

Parameter	Matrix [1]	EPA Approved Method[2]	SW846 [3]	Rec. Volume	Bottle Type	Pres.	Temp	Holding Time	Holding Time Units
Ferrous Iron	NPW	SM3500FeB	NA	250ml	Amber Glass	HCl	0 - 6°C	15	Min
Fluoride	NPW	300.0, SM4110B	9056	125ml	HDPE	None	0 - 6°C	28	Days
Hardness	NPW	200.7, SM2340B	NA	250ml	HDPE	HNO_3	0 - 6°C	180	Days
Hardness	NPW	130.1	NA	500ml	HDPE	HNO_3	0 - 6°C	180	Days
Hardness	NPW	SM2340C	NA	500ml	HDPE	HNO_3	0 - 6°C	180	Days
Iodide	NPW	345.1	NA	250ml	HDPE	None	0 - 6°C	Immed	
Kjeldahl Nitrogen, TKN	NPW	351.2, SM4500Norg B/C	NA	250ml	HDPE	H_2SO_4	0 - 6°C	28	Days
Methylene Blue Active Subst. (MBAS)	NPW	SM5540C	NA	250ml	HDPE	None	0 - 6°C	48	Hours
Nitrate	NPW	300.0, SM4110B	9056	125ml	HDPE	None	0 - 6°C	48	Hours
Nitrate + Nitrite	NPW	353.2, SM4500NO_3 F	NA	250ml	HDPE	H_2SO_4	0 - 6°C	28	Days
Nitrite	NPW	300.0, SM4110B	9056	125ml	HDPE	None	0 - 6°C	48	Hours
Oil & Grease (Hexane Extr)	NPW	1664A, SM5520B	9070	1L	Glass	HCl	0 - 6°C	28	Days
Oil & Grease, Free	NPW	1664A	9070	1L	Amber Glass	None	0 - 6°C	28	Days
Organic Nitrogen	NPW	351.2 - 350.1	NA	500ml	HDPE	H_2SO_4	0 - 6°C	28	Days
Oxygen, dissolved (DO)	NPW	SM4500O C, SM4500O G	NA	125ml	HDPE	None	0 - 6°C	15	Min
pH	NPW	SM4500H B	9040	125ml	HDPE	None	0 - 6°C	15	Min
Phenols (Total) by 4AAP	NPW	420.1, 420.4	9066	250ml	Amber Glass	H_2SO_4	0 - 6°C	28	Days
Phosphate, Ortho	NPW	365.1, SM4500P-E	NA	250ml	HDPE	None	0 - 6°C	48	Hours
Phosphorus, Total	NPW	365.1, SM4500P-B.5	NA	250ml	HDPE	H_2SO_4	0 - 6°C	28	Days
Residue, Filterable (TDS)	NPW	SM2540C	NA	250ml	HDPE	None	0 - 6°C	7	days
Residue, non-Filterable (TSS)	NPW	SM2540D	NA	1L	HDPE	None	0 - 6°C	7	Days
Residue, Settleable (SS)	NPW	SM2540F	NA	1L	HDPE	None	0 - 6°C	48	Hours
Residue, Total (TS)	NPW	SM2540B	NA	250ml	HDPE	None	0 - 6°C	7	Days
Specific Conductance (Conductivity)	NPW	120.1, SM2510B	9050	250ml	HDPE	None	0 - 6°C	28	Days
Sulfate	NPW	300.0, SM4110B	9056	125ml	HDPE	None	0 - 6°C	28	Days
Sulfide	NPW	NA	9030, 9034	500ml	HDPE	NaOH+ZnAc	0 - 6°C	7	Days

Parameter	Matrix[1]	EPA Approved Method[2]	SW846[3]	Rec. Volume	Bottle Type	Pres.	Temp	Holding Time	Holding Time Units
Sulfide	NPW	SM4500S^{2}D	NA	500ml	HDPE	NaOH+ZnAc	0 - 6^{o}C	7	Days
Sulfide, Dissolved	NPW	SM4500S^{2}D	NA	125ml	Amber Glass	NaOH+ZnAc	0 - 6^{o}C	7	Days
Sulfite	NPW	SM4500SO$_3$ B	NA	250ml	HDPE	None	0 - 6^{o}C	15	Min
Tannins and Lignins	NPW	SM5550B	NA	250ml	HDPE	None	0 - 6^{o}C	NA	
Temperature	NPW	SM2550B	NA	onsite		None	0 - 6^{o}C	15	Min
Total Organic Carbon (TOC)	NPW	SM53010B	9060	250ml	Amber Glass	HCl	0 - 6^{o}C	28	Days
Total Organic Halides (TOX)	NPW	450.1, 9020	NA	1L	Amber Glass	H$_2$SO$_4$	0 - 6^{o}C	28	Days
Total Organic Halides (TOX)	NPW	SM5320B	NA	1L	Amber Glass	H$_2$SO$_4$	0 - 6^{o}C	14	Days
Turbidity	NPW	180.1, SM2130B	NA	250ml	HDPE	None	0 - 6^{o}C	48	Hours
Volatile Solids (VS)	NPW	160.4	NA	250ml	HDPE	None	0 - 6^{o}C	7	Days
Volatile Susp. Solids (VSS)	NPW	SM2540E	NA	500ml	HDPE	None	0 - 6^{o}C	7	Days
Alkalinity	PW	2320B	NA	500ml	HDPE	None	0 - 6^{o}C	14	Days
Ammonia Nitrogen	PW	350.1, SM4500NH$_3$ G	NA	250ml	HDPE	H$_2$SO$_4$	0 - 6^{o}C	28	Days
Ammonia, distilled/titration (4500)	PW	SM4500NH$_3$ C	NA	250ml	HDPE	H$_2$SO$_4$	0 - 6^{o}C	28	Days
Asbestos	PW	100.1	NA	1L	Glass	None	0 - 6^{o}C	48	Hours
Bromide	PW	300.0, SM4110B	NA	125ml	HDPE	None	0 - 6^{o}C	28	Days
Calcium-hardness	PW	SM3500-Ca B	NA	250ml	Amber Glass	HNO$_3$	0 - 6^{o}C	180	Days
Carbon Dioxide	PW	SM4500CO2 D	NA	1L	HDPE	None	0 - 6^{o}C	15	Min
Chloride	PW	300.0, SM4110B	NA	125ml	HDPE	None	0 - 6^{o}C	28	Days
Chlorine, residual	PW	SM4500Cl-G	NA	250ml	HDPE	None	0 - 6^{o}C	15	Min
Color	PW	SM2120B	NA	250ml	HDPE	None	0 - 6^{o}C	48	Hours
Corrosivity	PW	Calc	NA		Plastic	None	0 - 6^{o}C	NA	
Cyanide - Total	PW	335.4, SM4500CNE	NA	250ml	HDPE Amber	NaOH	0 - 6^{o}C	14	Days
Cyanide - Total	PW	Kelada-01	NA	250ml	HDPE Amber	NaOH	0 - 6^{o}C	14	Days
Cyanide, Amenable	PW	SM4500CNG	NA	250ml	HDPE Amber	NaOH	0 - 6^{o}C	14	Days
Cyanide, Free	PW	SM4500CNE	NA	250ml	HDPE Amber	NaOH	0 - 6^{o}C	14	Days
Dissolved Organic Carbon (DOC)	PW	SM5310C	NA	250ml	Amber Glass	None	0 - 6^{o}C	28	Days
Dissolved Solids (TDS)	PW	SM2540C	NA	250ml	HDPE	None	0 - 6^{o}C	7	Days

Parameter	Matrix [1]	EPA Approved Method[2]	SW846 [3]	Rec. Volume	Bottle Type	Pres.	Temp	Holding Time	Holding Time Units
Fluoride	PW	300.0, SM4110B	NA	125ml	HDPE	None	0 - 6°C	28	Days
Hardness	PW	200.7, SM2340B	NA	250ml	HDPE	HNO_3	0 - 6°C	180	Days
Hardness	PW	130.1	NA	500ml	HDPE	HNO_3	0 - 6°C	180	Days
Hardness	PW	SM2340C	NA	500ml	HDPE	HNO_3	0 - 6°C	180	Days
Methylene Blue Active Subst. (MBAS)	PW	SM5540C	NA	1L	HDPE	None	0 - 6°C	48	Hours
Nitrate	PW	300.0, SM4110B	NA	125ml	HDPE	None	0 - 6°C	48	Hours
Nitrate + Nitrite	PW	353.2, SM4500NO_3 F	NA	250ml	HDPE	H_2SO_4	0 - 6°C	28	Days
Nitrite	PW	300.0, SM4110B	NA	125ml	HDPE	None	0 - 6°C	48	Hours
Odor	PW	SM2150B	NA	250ml	Amber Glass	None	0 - 6°C	24	Hours
Perchlorate	PW	314	NA	125ml	HDPE	None	0 - 6°C	28	Days
pH	PW	150.1, SM4500-H B	NA	125ml	HDPE	None	0 - 6°C	15	Min
Phosphate, Ortho	PW	SM4500P-E	NA	250ml	HDPE	None	0 - 6°C	48	Hours
Specific Conductance	PW	SM2510B	NA	250ml	HDPE	None	0 - 6°C	28	Days
Sulfate	PW	300.0, SM4110B	NA	125ml	HDPE	None	0 - 6°C	28	Days
Total Organic Carbon (TOC)	PW	SM5310C	NA	250ml	Amber Glass	H_2SO_4	0 - 6°C	28	Days
Total Organic Halides (TOX)	PW	SM5320B	NA	1L	Amber Glass	H_2SO_4	0 - 6°C	28	Days
Turbidity	PW	180.1, SM2130B	NA	250ml	HDPE	None	0 - 6°C	48	Hours
UV Absorbance at 254 nm	PW	SM5910B	NA	250ml	Amber Glass	None	0 - 6°C	48	Hours
Asbestos	SS	PLM	NA			None	0 - 6°C	NA	
Bromide	SS	NA	9056	4 oz.	Glass	None	0 - 6°C	28	Days
Chloride	SS	NA	9056	4 oz.	Glass	None	0 - 6°C	28	Days
Corrosivity	SS	NA	9045D	4 oz.	Glass	None	0 - 6°C	15	Min
Cyanide - Total	SS	NA	9010/9012	4 oz.	Glass	None	0 - 6°C	14	Days
Cyanide, Amenable	SS	NA	9010/9012	4 oz.	Glass	None	0 - 6°C	14	Days
Cyanide, Free	SS	NA	9010/9012	4 oz.	Glass	None	0 - 6°C	14	Days
Extractable Organic Halides (EOX)	SS	NA	9023	4 oz.	Glass	None	0 - 6°C	28	Days
Fluoride	SS	NA	9056	4 oz.	Glass	None	0 - 6°C	28	Days
Kjeldahl Nitrogen, TKN	SS	351.2	NA	2 oz.	Glass	None	0 - 6°C	28	Days
Nitrate	SS	NA	9056	4 oz.	Glass	None	0 - 6°C	28	Days
Nitrite	SS	NA	9056	4 oz.	Glass	None	0 - 6°C	28	Days
Oil & Grease	SS	NA	9071	4 oz.	Glass	None	0 - 6°C	28	Days

Parameter	Matrix[1]	EPA Approved Method[2]	SW846 [3]	Rec. Volume	Bottle Type	Pres.	Temp	Holding Time	Holding Time Units
pH	SS	NA	9040, 9045	2 oz.	Glass	None	0 - 6^{o}C	15	Min
Phenols by 4AAP	SS	NA	9066	4 oz.	Glass	None	0 - 6^{o}C	28	Days
Phosphate, Ortho	SS	SM4500P-E	NA	4 oz.	Glass	None	0 - 6^{o}C	48	Hours
Phosphorus, Total	SS	NA	9056	4 oz.	Glass	None	0 - 6^{o}C	28	Days
Residue, Total	SS	SM2540G	NA	4 oz.	Glass	None	0 - 6^{o}C	14	Days
Solids, Total	SS	SM2540B	NA	4 oz.	Glass	None	0 - 6^{o}C	14	Days
Specific Conductance	SS	NA	9050	4 oz.	Glass	None	0 - 6^{o}C	28	Days
Sulfate	SS	NA	9056	4 oz.	Glass	None	0 - 6^{o}C	28	Days
Sulfide	SS	NA	9030, 9034	2 oz.	Glass	none	0 - 6^{o}C	7	Days
Total Organic Carbon (TOC)	SS	NA	9060	2 oz.	Glass	None	0 - 6^{o}C	28	Days
Total Organic Carbon (TOC)	SS	ASTM F1647-02A mod	NA	4 oz.	Glass	None	0 - 6^{o}C	28	Days
Total Organic Carbon (TOC)	SS	USDA LOI	NA	4 oz.	Glass	None	0 - 6^{o}C	28	Days
INORGANIC METALS									
Chromium, Hexavalent - Cr^{+6}	NPW	SM3500CrB	7196	250ml	HDPE	None	0 - 6^{o}C	24	Hours
Chromium, Hexavalent - Cr^{+6}	NPW	SM3500CrC	7199	250ml	HDPE	None	0 - 6^{o}C	24	Hours
Chromium, Hexavalent - Cr^{+6}	NPW	218.6, SM3500CrC	NA	125ml	HDPE	$(NH_4)_2SO_4$	0 - 6^{o}C	28 [5]	Days
Mercury (Dissolved)	NPW	245.1	7470	500ml	HDPE	None	0 - 6^{o}C	28	Days
Mercury (Total)	NPW	245.1	7470	500ml	HDPE	HNO_3	0 - 6^{o}C	28	Days
Metals (Dissolved) ICP	NPW	200.7	6010	500ml	HDPE	None	NA	180	Days
Metals (Dissolved) ICPMS	NPW	200.8	6020	500nl	HDPE	None	NA	180	Days
Metals (Total) ICP	NPW	200.7	6010	500ml	HDPE	HNO_3	NA	180	Days
Metals (Total) ICPMS	NPW	200.8	6020	500ml	HDPE	HNO_3	NA	180	Days
Chromium, Hexavalent - Cr^{+6}	PW	218.7	NA	125ml	HDPE	$(NH_4)_2SO_4$/(NH4)OH	0 - 6^{o}C	14	Days
Mercury (Dissolved)	PW	245.1	NA	500ml	HDPE	None	0 - 6^{o}C	28	Days
Mercury (Total)	PW	245.1	NA	500ml	HDPE	HNO_3	0 - 6^{o}C	28	Days
Metals (Dissolved) ICP	PW	200.7	NA	500ml	HDPE	None	NA	180	Days

Parameter	Matrix[1]	EPA Approved Method[2]	SW846 [3]	Rec. Volume	Bottle Type	Pres.	Temp	Holding Time	Holding Time Units
Metals (Dissolved) ICPMS	PW	200.8	NA	500ml	HDPE	None	NA	180	Days
Metals (Total) ICP	PW	200.7	NA	500ml	HDPE	HNO_3	NA	180	Days
Metals (Total) ICPMS	PW	200.8	NA	500ml	HDPE	HNO_3	NA	180	Days
Chromium, Hexavalent - Cr^{+6}	SS	NA	3060/7196	4 oz.	Glass	None	0 - 6°C	30	Days
Chromium, Hexavalent - Cr^{+6}	SS	NA	3060/7199	4 oz.	Glass	None	0 - 6°C	30	Days
Mercury (Total)	SS	NA	7471	2 oz.	Glass	<6 C	0 - 6°C	28	Days
Metals (Total) ICP	SS	NA	6010	2 oz.	Glass	None	NA	180	Days
Metals (Total) ICPMS	SS	NA	6020	4 oz.	Glass	None	NA	180	Days
Sodium Adsorption Ratio (SAR)	SS	NA	6010	250mL	Glass	None	0 - 6°C	180	Days
Michigan Fine/Coarse Soil Sieve for Lead	SS	NA	NA	250mL	Glass	None	0 - 6°C	180	Days
PHYSICAL									
Flashpoint/ignitability (Closed Cup)	NPW	ASTM 93-07	1010	1L	Glass	None	0 - 6°C	14	Days
Flashpoint/ignitability (Open Cup)	NPW	ASTM 92-05A	NA	1L	Glass	None	0 - 6°C	14	Days
Flashpoint/ignitability (Closed Cup)	SS	ASTM 93-07	1010	4 oz.	Glass	None	0 - 6°C	14	Days
Flashpoint/ignitability (Open Cup)	SS	ASTM 92-05A	NA	4 oz.	Glass	None	0 - 6°C	NA	
Ash Content	SS	SM2540G, ASTM D2974	NA	4 oz.	Glass	None	0 - 6°C	14	Days
Cation Exchange Capacity	SS	NA	9081	4 oz.	Glass	None	0 - 6°C	180	Days
Paint Filter Test	SS	NA	9095	4 oz.	Glass	None	0 - 6°C	NA	
Permeability (Section 2.8)	SS	NA	9100	Various	Shelby Tube	None	0 - 6°C	28	Days
React. Sulf.(SW846 7.3.4.2)	SS	NA	Sec. 7.3	4 oz.	Glass	None	0 - 6°C	7	Days
Reactive CN (SW846 7.3.4.1)	SS	NA	Sec. 7.3	4 oz.	Glass	None	0 - 6°C	14	Days
Resistivity (ASTM)	SS	NA	NA	16 oz	Glass	None	0 - 6°C	28	Days
Specific Gravity	SS	NA	NA	Various	Plastic	None	0 - 6°C	14	Days

Parameter	Matrix[1]	EPA Approved Method[2]	SW846[3]	Rec. Volume	Bottle Type	Pres.	Temp	Holding Time	Holding Time Units
LEACHING METHODS									
Cal Wet (CACR Title22 Chap11 AppII)	SS	NA	NA	100g	Glass	None	0 - 6°C	14/28/180	Days
EP TOX	SS	NA	1310	100g	Glass	None	0 - 6°C	14/28/180	Days
MEP	SS	NA	1320	100g	Glass	None	0 - 6°C	14/28/180	Days
SPLP	SS	NA	1312	100g	Glass	None	0 - 6°C	14/28/180	Days
TCLP	SS	NA	1311	100g	Glass	None	0 - 6°C	14/28/180	Days
ORGANIC - SEMIVOLATILES									
Base/Neutral/Acid (BNA)	NPW	NA	8270	1L or 100mL	Amber Glass	None	0 - 6°C	7	Days
Base/Neutral/Acid (BNA)	NPW	625, SM6410B	NA	1L or 100mL	Amber Glass	$Na_2S_2O_3$	0 - 6°C	7	Days
Diesel Range Organics	NPW	NA	8015	1L, 100mL, or 40mL	Amber Glass	HCl	0 - 6°C	7	Days
Dioxin	NPW	1613	NA	1L	Amber Glass	$Na_2S_2O_3$	0 - 6°C	1	Year
EDB/DBCP	NPW	NA	8011	2 x 40 ml	Glass	$Na_2S_2O_3$	0 - 6°C	7	Days
Formaldehyde	NPW	NA	8315	1L	Amber Glass	None	0 - 6°C	3	Days
Herbicides	NPW	1658, SM6640B	8151	1L	Amber Glass	None	0 - 6°C	7	Days
Polynuclear Aromatic Hydrocarbons (PAH)	NPW	625, SM640B	8270	1L, 100mL, or 40mL	Amber Glass	None	0 - 6°C	7	Days
Polynuclear Aromatic Hydrocarbons (PAH-SIM)	NPW	NA	8270	1L, 100mL, or 40mL	Amber Glass	None	0 - 6°C	7	Days
Polynuclear Aromatic Hydrocarbons (PAH)	NPW	610, SM6440B	8310	1L	Amber Glass	None	0 - 6°C	7	Days
Pesticides - Organophos Comp	NPW	614, 622, 1657	8141	1L	Amber Glass	None	0 - 6°C	7	Days
Pesticides & PCB's	NPW	608, SM6630B, SM6630C	8081, 8082	1L or 100mL	Amber Glass	None	0 - 6°C	7	Days
Base/Neutral/Acid (BNA)	PW	525	NA	1L	Amber Glass	$HCl+Na_2S_2O_3$	0 - 6°C	7	Days
Carbamates	PW	531.1	NA	2 x 60ml	Amber Glass	AcAcid+$Na_2S_2O_3$	0 - 6°C	7	Days
Dioxin	PW	1613	NA	1L	Amber Glass	$Na_2S_2O_3$	0 - 6°C	7	Days
Diquat	PW	549	NA	1L	PVC Amber	H_2SO_4 + $Na_2S_2O_3$	0 - 6°C	7	Days
EDB/DBCP	PW	504.1	NA	2 x 40 ml	Glass	$Na_2S_2O_3$	0 - 6°C	28	Days
Endothall	PW	548	NA	250ml	Amber Glass	$Na_2S_2O_3$	0 - 6°C	7	Days

Parameter	Matrix [1]	EPA Approved Method[2]	SW846 [3]	Rec. Volume	Bottle Type	Pres.	Temp	Holding Time	Holding Time Units
Glyphosate	PW	547	NA	2 x 60ml	Glass	$Na_2S_2O_3$	0 - 6^{o}C	7	Days
Herbicides	PW	515.1, SM6640B	NA	1L	Amber Glass	$Na_2S_2O_3$	0 - 6^{o}C	7	Days
Pesticides - Nitrogen/phosphorus Comp	PW	507	NA	1L	Amber Glass	$Na_2S_2O_3$	0 - 6^{o}C	14	Days
Pesticides - Organochlorine	PW	508	NA	1L	Amber Glass	$Na_2S_2O_3$	0 - 6^{o}C	7	Days
Haloacetic acids - HAA's	PW	552.2	NA	500ml	Amber Glass	NH_4Cl	0 - 6^{o}C	28	Days
Base/Neutral/Acid (BNA)	SS	NA	8270	4 oz.	Glass	None	0 - 6^{o}C	14	Days
Dioxin	SS	NA	8290	5 oz.	Glass	None	0 - 6^{o}C	30	Days
Formaldehyde	SS	NA	8315	4 oz.	Glass	None	0 - 6^{o}C	3	Days
Herbicides	SS	NA	8151	4 oz.	Glass	None	0 - 6^{o}C	14	Days
Polynuclear Aromatic Hydrocarbons (PAH)	SS	NA	8270	4 oz.	Glass	None	0 - 6^{o}C	14	Days
Polynuclear Aromatic Hydrocarbons (PAH-SIM)	SS	NA	8270	4 oz.	Glass	None	0 - 6^{o}C	14	Days
Polynuclear Aromatic Hydrocarbons (PAH)	SS	NA	8310	4 oz.	Glass	None	0 - 6^{o}C	14	Days
Pesticides - Organophos Comp	SS	NA	8141	4 oz.	Glass	None	0 - 6^{o}C	14	Days
Pesticides & PCB's	SS	NA	8081, 8082	4 oz.	Glass	None	0 - 6^{o}C	14	Days
Total Chlorine in Oil	SS	ASTM D808-00	NA	125ml	HDPE	None	0 - 6^{o}C	24	Hours
ORGANIC - VOLATILES									
Meetac - Methanol and Ethanol	NPW	NA	EPA 8015 Mod	40ml	Amber Glass	HCl	0 - 6^{o}C	14	Days
Methane, Ethane, Ethene, Propane	NPW	RSK-175	NA	40ml	Amber Glass	HCl	0 - 6^{o}C	14	Days
BTEX (water)	NPW	602, SM6200C	8021	2 x 40 ml	Amber Glass	HCl	0 - 6^{o}C	14	Days
BTEX (water)	NPW	602, SM6200C	8021	2 x 40 ml	Amber Glass	None	0 - 6^{o}C	7	Days
Gasoline Range Organics (GRO)	NPW	NA	8015	2 x 40 ml	Amber Glass	HCl	0 - 6^{o}C	14	Days
VOC's	NPW	624, SM6200B	8260	2 x 40 ml	Amber Glass	HCl	0 - 6^{o}C	14	Days
VOC's	NPW	624, SM6200B	8260	2 x 40 ml	Amber Glass	none	0 - 6^{o}C	7	Days
VOC's	PW	524.2	NA	2 x 40 ml	Amber Glass	Ascorbic Acid+HCl	0 - 6^{o}C	14	Days

Parameter	Matrix [1]	EPA Approved Method[2]	SW846 [3]	Rec. Volume	Bottle Type	Pres.	Temp	Holding Time	Holding Time Units
Meetac - Methanol and Ethanol	SS	NA	EPA 8015 Mod	2 oz.	Glass	None	0 - 6°C	14	Days
BTEX (soil)	SS	NA	8021	4 oz.	Glass	None	0 - 6°C	14	Days
VOC's	SS	NA	8260	2 oz.	Glass	none	0 - 6°C	14	Days
VOC's	SS	NA	8260	40ml	Amber Glass	MeOH	0 - 6°C	14	Days
VOC's	SS	NA	8260	40ml	Amber Glass	$NaHSO_4$ or TSP(MO) or DI Water(FL)	0 - 6°C	14	Days
VOC's	SS	NA	8260	NA	Encore	none	0 - 6°C	48	Hours
RADIOCHEMISTRY									
Rad - Gross alpha	NPW	900	na	1L	Plastic	HNO_3	0 - 6°C	180	Days
Rad - Gross beta	NPW	900	na	1L	Plastic	HNO_3	0 - 6°C	180	Days
Rad - Radium 226	NPW	903.1	na	1L	Plastic	HNO_3	0 - 6°C	180	Days
Rad - Radium 228	NPW	904	na	1L	Plastic	HNO_3	0 - 6°C	180	Days
Rad - Gross alpha	PW	900	na	1L	HDPE	HNO_3	0 - 6°C	180	Days
Rad - Gross beta	PW	900	na	1L	HDPE	HNO_3	0 - 6°C	180	Days
Rad - Radium 226	PW	903.1	na	1L	HDPE	HNO_3	0 - 6°C	180	Days
Rad - Radium 228	PW	904	na	1L	HDPE	HNO_3	0 - 6°C	180	Days
Rad - Tritium	PW	906	na	1L	HDPE	None	0 - 6°C	180	Days
Strontium-90	PW	905	na	1L	HDPE	HNO_3	0 - 6°C	180	Days
STATE SPECIFIC PETROLEUM METHODS									
Alaska DRO	NPW	NA	AK102	100ml	Amber Glass	HCl	0 - 6°C	14	Days
Alaska DRO	SS	NA	AK102	4 oz.	Glass	None	0 - 6°C	14	Days
Alaska GRO	NPW	NA	AK101	40ml	Amber Glass	HCl	0 - 6°C	14	Days
Alaska GRO	SS	NA	AK101	60ml	Amber Glass	MeOH	0 - 6°C	28	Days
Alaska Motor Oil	NPW	NA	AK103	100ml	Glass	HCl	0 - 6°C	14	Days
Alaska Motor Oil	SS	NA	AK103	4 oz.	Glass	None	0 - 6°C	14	Days
Arizona GRO	SS	NA	AZ 8015	2 oz.	Glass	None	0 - 6°C	14 [9]	Days
Arizona TPH	SS	NA	AZ 8015	4 oz.	Glass	None	0 - 6°C	14	Days
California DRO	NPW	NA	8015	1L	Amber Glass	HCl	0 - 6°C	7	Days
California DRO	NPW	NA	8015	40ml	Amber Glass	HCl	0 - 6°C	7	Days
California DRO	SS	NA	8015	4 oz.	Glass	None	0 - 6°C	7	Days
Connecticut EPH	NPW	NA	8015	1L	Amber Glass	HCl	0 - 6°C	14	Days
Connecticut EPH	SS	NA	8015	4 oz.	Glass	None	0 - 6°C	14	Days

Parameter	Matrix [1]	EPA Approved Method[2]	SW846 [3]	Rec. Volume	Bottle Type	Pres.	Temp	Holding Time	Holding Time Units
Florida TPH	**NPW**	**NA**	**FL-Pro**	**1L**	**Amber Glass**	**HCl**	**0 - 6°C**	**7**	**Days**
Florida TPH	**SS**	**NA**	**FL-Pro**	**4 oz.**	**Glass**	**None**	**0 - 6°C**	**14**	**Days**
Indiana DRO	**NPW**	**NA**	**8015**	**1L**	**Amber Glass**	**HCl**	**0 - 6°C**	**7**	**Days**
Indiana DRO	**SS**	**NA**	**8015**	**4 oz.**	**Glass**	**None**	**0 - 6°C**	**14**	**Days**
Indiana ERO	**NPW**	**NA**	**8015**	**1L**	**Amber Glass**	**HCl**	**0 - 6°C**	**7**	**Days**
Indiana ERO	**SS**	**NA**	**8015**	**4 oz.**	**Glass**	**None**	**0 - 6°C**	**7**	**Days**
Indiana GRO	**NPW**	**NA**	**8015**	**40ml**	**Amber Glass**	**HCl**	**0 - 6°C**	**14**	**Days**
Indiana GRO	**SS**	**NA**	**8015**	**40ml**	**Amber Glass**	**MeOH**	**0 - 6°C**	**14**	**Days**
Indiana GRO	**SS**	**NA**	**8015**	**40ml**	**Amber Glass**	$NaHSO_4$	**0 - 6°C**	**14**	**Days**
Iowa GRO	**NPW**	**NA**	**OA-1**	**40ml**	**Amber Glass**	**HCl**	**0 - 6°C**	**14**	**Days**
Iowa GRO	**SS**	**NA**	**OA-1**	**4 oz.**	**Glass**	**None**	**0 - 6°C**	**14**	**Days**
Iowa DRO	**NPW**	**NA**	**OA-2**	**1L**	**Amber Glass**	**None**	**0 - 6°C**	**7**	**Days**
Iowa DRO	**SS**	**NA**	**OA-2**	**4 oz.**	**Glass**	**None**	**0 - 6°C**	**14**	**Days**
Louisiana EPH	**NPW**	**NA**	**MADEP EPH**	**1L**	**Amber Glass**	**HCl**	**0 - 6°C**	**14**	**Days**
Louisiana EPH	**SS**	**NA**	**MADEP EPH**	**4 oz.**	**Amber Glass**	**None**	**0 - 6°C**	**14**	**Days**
Louisiana VPH	**NPW**	**NA**	**MADEP VPH**	**1L**	**Amber Glass**	**HCl**	**0 - 6°C**	**14**	**Days**
Louisiana VPH	**SS**	**NA**	**MADEP VPH**	**40ml**	**Amber Glass**	**MeOH**	**0 - 6°C**	**28**	**Days**
Massachusetts EPH	**NPW**	**NA**	**MADEP EPH**	**1L**	**Amber Glass**	**HCl**	**0 - 6°C**	**14**	**Days**
Massachusetts EPH	**SS**	**NA**	**MADEP EPH**	**4 oz.**	**Amber Glass**	**None**	**0 - 6°C**	**14**	**Days**
Massachusetts VPH	**NPW**	**NA**	**MADEP VPH**	**40ml**	**Amber Glass**	**HCl**	**0 - 6°C**	**14**	**Days**
Massachusetts VPH	**SS**	**NA**	**MADEP VPH**	**40ml**	**Amber Glass**	**MeOH**	**0 - 6°C**	**28**	**Days**
Minnesota DRO	**NPW**	**NA**	**WI DRO**	**1L**	**Amber Glass**	**HCl**	**0 - 6°C**	**7**	**Days**
Minnesota DRO	**SS**	**NA**	**WI DRO**	**60ml**	**Amber Glass**	CH_3Cl	**0 - 6°C**	**47** [9]	**Days**
Minnesota GRO	**NPW**	**NA**	**WI GRO**	**40ml**	**Amber Glass**	**HCl**	**0 - 6°C**	**14**	**Days**
Minnesota GRO	**SS**	**NA**	**WI GRO**	**60ml**	**Amber Glass**	**MeOH**	**0 - 6°C**	**21** [7]	**Days**
Missouri DRO	**NPW**	**NA**	**8270**	**1L**	**Amber Glass**	**None**	**0 - 6°C**	**7**	**Days**
Missouri DRO	**SS**	**NA**	**8270**	**4 oz.**	**Glass**	**None**	**0 - 6°C**	**14**	**Days**
Missouri GRO	**NPW**	**NA**	**8260**	**40ml**	**Amber Glass**	**TSP**	**0 - 6°C**	**14**	**Days**
Missouri GRO	**SS**	**NA**	**8260**	**40ml**	**Amber Glass**	**TSP**	**0 - 6°C**	**14**	**Days**
Missouri GRO	**SS**	**NA**	**8260**	**40ml**	**Amber Glass**	**MeOH**	**0 - 6°C**	**14**	**Days**

Parameter	Matrix[1]	EPA Approved Method[2]	SW846[3]	Rec. Volume	Bottle Type	Pres.	Temp	Holding Time	Holding Time Units
Montana EPH	**NPW**	**NA**	**MT EPH**	**1L**	**Amber Glass**	**HCl**	**0 - 6°C**	**14**	**Days**
Montana EPH	**SS**	**NA**	**MT EPH**	**4 oz.**	**Amber Glass**	**None**	**0 - 6°C**	**14**	**Days**
Montana VPH	**NPW**	**NA**	**MT VPH**	**40ml**	**Amber Glass**	**HCl**	**0 - 6°C**	**14**	**Days**
Montana VPH	**SS**	**NA**	**MT VPH**	**Encore**	**Amber Glass**	**None**	**0 - 6°C**	**7**	**Days**
Montana VPH	**SS**	**NA**	**MT VPH**	**40ml**	**Amber Glass**	**MeOH**	**0 - 6°C**	**28**	**Days**
New Jersey EPH	**NPW**	**NA**	**NJ EPH**	**1L**	**Amber Glass**	**HCl**	**0 - 6°C**	**14**	**Days**
New Jersey EPH	**SS**	**NA**	**NJ EPH**	**4 oz.**	**Amber Glass**	**None**	**0 - 6°C**	**14**	**Days**
North Carolina EPH	**NPW**	**NA**	**MADEP EPH**	**1L**	**Amber Glass**	**HCl**	**0 - 6°C**	**14**	**Days**
North Carolina EPH	**SS**	**NA**	**MADEP EPH**	**4 oz.**	**Amber Glass**	**None**	**0 - 6°C**	**14**	**Days**
North Carolina VPH	**NPW**	**NA**	**MADEP VPH**	**1L**	**Amber Glass**	**HCl**	**0 - 6°C**	**14**	**Days**
North Carolina VPH	**SS**	**NA**	**MADEP VPH**	**40ml**	**Amber Glass**	**MeOH**	**0 - 6°C**	**28**	**Days**
Ohio DRO	**NPW**	**NA**	**8015**	**1L**	**Amber Glass**	**None**	**0 - 6°C**	**7**	**Days**
Ohio DRO	**NPW**	**NA**	**8015**	**100ml**	**Amber Glass**	**None**	**0 - 6°C**	**7**	**Days**
Ohio DRO	**NPW**	**NA**	**8015**	**40ml**	**Amber Glass**	**None**	**0 - 6°C**	**7**	**Days**
Ohio DRO	**SS**	**NA**	**8015**	**4 oz.**	**Glass**	**None**	**0 - 6°C**	**14**	**Days**
Ohio GRO	**NPW**	**NA**	**8015**	**40ml**	**Amber Glass**	**HCl**	**0 - 6°C**	**14**	**Days**
Ohio GRO	**SS**	**NA**	**8015**	**2 oz.**	**Glass**	**None**	**0 - 6°C**	**14**	**Days**
Ohio GRO (VAP)	**SS**	**NA**	**8015**	**Encore - Low Level**	**None**	**None**	**0 - 6°C**	**14[8]**	**Days**
Ohio GRO (VAP)	**SS**	**NA**	**8015**	**Encore - High Level**	**None**	**MeOH**	**0 - 6°C**	**14**	**Days**
Oklahoma DEQ GRO	**NPW**	**NA**	**OK DEQ GRO**	**40ml**	**Amber Glass**	**HCl**	**0 - 6°C**	**14**	**Days**
Oklahoma DEQ GRO	**SS**	**NA**	**OK DEQ GRO**	**4 oz.**	**Glass**	**None**	**0 - 6°C**	**14**	**Days**
Oklahoma DEQ DRO	**NPW**	**NA**	**OK DEQ DRO**	**1L**	**Amber Glass**	**HCl**	**0 - 6°C**	**7**	**Days**
Oklahoma DEQ DRO	**SS**	**NA**	**OK DEQ DRO**	**60ml**	**Amber Glass**	CH_3Cl	**0 - 6°C**	**7[6]**	**Days**
Oregon TPH-Gx	**NPW**	**NA**	**NWTPH-Gx**	**40ml**	**Amber Glass**	**HCl**	**0 - 6°C**	**14**	**Days**
Oregon TPH-Gx	**SS**	**NA**	**NWTPH-Gx**	**4 oz.**	**Glass**	**None**	**0 - 6°C**	**14**	**Days**
Oregon TPH-Dx	**NPW**	**NA**	**NWTPH-Dx**	**1L**	**Amber Glass**	**HCl**	**0 - 6°C**	**14**	**Days**
Oregon TPH-Dx	**SS**	**NA**	**NWTPH-Dx**	**4 oz.**	**Glass**	**None**	**0 - 6°C**	**14**	**Days**

Parameter	Matrix [1]	EPA Approved Method[2]	SW846 [3]	Rec. Volume	Bottle Type	Pres.	Temp	Holding Time	Holding Time Units
Tennessee DRO	NPW	NA	TN EPH	1L	Amber Glass	HCl	0 - 6°C	7	Days
Tennessee DRO	NPW	NA	TN EPH	100 ml	Amber Glass	HCl	0 - 6°C	7	Days
Tennessee DRO	SS	NA	TN EPH	4 oz.	Glass	None	0 - 6°C	14	Days
Tennessee GRO	NPW	NA	TN GRO	40ml	Amber Glass	HCl	0 - 6°C	7	Days
Tennessee GRO	SS	NA	TN GRO	2 oz.	Glass	None	0 - 6°C	14	Days
Texas TPH	NPW	NA	TX1005/ TX1006	60ml	Amber Glass	HCl	0 - 6°C	14	Days
Texas TPH	SS	NA	TX1005/ TX1006	4 oz.	Glass	None	0 - 6°C	14	Days
Washington TPH-Gx	NPW	NA	NWTPH-Gx	40ml	Amber Glass	HCl	0 - 6°C	14	Days
Washington TPH-Gx	SS	NA	NWTPH-Gx	4 oz.	Glass	None	0 - 6°C	14	Days
Washington TPH-Dx	NPW	NA	NWTPH-Dx	1L	Amber Glass	HCl	0 - 6°C	14	Days
Washington TPH-Dx	SS	NA	NWTPH-Dx	4 oz.	Glass	None	0 - 6°C	14	Days
Wisconsin DRO	NPW	NA	WI DRO	1L	Amber Glass	HCl	0 - 6°C	7	Days
Wisconsin DRO	NPW	NA	WI DRO	100 ml	Amber Glass	HCl	0 - 6°C	7	Days
Wisconsin DRO	SS	NA	WI DRO	60ml	Amber Glass	CH_3Cl	0 - 6°C	47 [9]	Days
Wisconsin GRO	NPW	NA	WI GRO	40ml	Amber Glass	HCl	0 - 6°C	14	Days
Wisconsin GRO	SS	NA	WI GRO	60ml	Amber Glass	MeOH	0 - 6°C	21 [7]	Days
Wyoming DRO	NPW	NA	8015	40ml	Amber Glass	HCl	0 - 6°C	7	Days
Wyoming DRO	NPW	NA	8015	1L	Amber Glass	HCl	0 - 6°C	7	Days
Wyoming DRO	SS	NA	8015	4 oz.	Glass	None	0 - 6°C	14	Days
Wyoming GRO	NPW	NA	8015	40ml	Amber Glass	HCl	0 - 6°C	14	Days
Wyoming GRO	SS	NA	8015	2 oz.	Glass	None	0 - 6°C	14	Days
INDUSTRIAL HYGIENE (IH) METHODS									
Particulates not otherwise regulated	Air	NIOSH 0500	NA	NA	2 piece 37mm PVC Pre-weighed filter	None	NA	NA	NA
Respirable Dust	Air	NIOSH 0600	NA	NA	3 piece 37mm PVC Pre-weighed filter	None	NA	NA	NA
Metals	Air	NA	EPA 6010B	NA	0.8-µm MCE or 5.0-µm PVC cassette	None	NA	NA	NA

Parameter	Matrix [1]	EPA Approved Method[2]	SW846 [3]	Rec. Volume	Bottle Type	Pres.	Temp	Holding Time	Holding Time Units
Metals	**Air**	**NIOSH 7300**	**NA**	**NA**	**0.8-µm MCE or 5.0-µm PVC cassette**	**None**	**NA**	**NA**	**NA**
Metals	**Air**	**OSHA ID-125G**	**NA**	**NA**	**0.8-µm MCE or 5.0-µm PVC cassette**	**None**	**NA**	**NA**	**NA**

Footnotes:

1) Matrix - NPW=Nonpotable Water, PW= Potable Water, SS=Solids

2) EPA Approved Method - Where applicable EPA methods are listed. Compounds/programs not regulated by EPA will have methods appropriate to their regulatory oversight.

3) SW846 Method - Where one exists, the appropriate Solid Waste method will be listed

4) Preservative Key

$(NH_4)_2SO4$ = Ammonium Sulfate

AcAcid = Acetic Acid

CH_3Cl = Methylene Chloride

H_2SO_4 = Sulfuric Acid

HCl= Hydrochloric Acid

HNO_3 = Nitric Acid

MeOH = Methanol

$Na_2S_2O_3$ = Sodium Thiosulfate

$NaHSO_4$ = Sodium Bisulfate

NH_4Cl = Ammonium Chloride

TSP = Trisodium Phosphate

ZnAc = Zinc Acetate

5) Must be field filtered to achieve the extended holding time.

6) Must be received by lab within 7 days of sampling for solvent addition.

7) Must be received by lab within 4 days of sampling for solvent addition.

8) Must be received by lab within 48 hours of sampling for freezing.

9) Must be received by lab within 72 hours of sampling for solvent addition.

14.7 SAMPLE CONTAINER PACKING PROCEDURES

ESC routinely sends sample containers to customers. Standard operating procedure determines the containers needed for the requested analyses. A sample request form is completed to document what is needed, the destination, the date prepared and the initials of the preparer. Containers are prepared, with appropriate preservatives, labels, and custody seals, and organized for the customer's convenience in a cooler. The cooler also contains a temperature blank, chain of custody, a return address label, and applicable instructions. The cooler is bound with packaging tape (and a custody seal if requested) and shipped UPS.

15.0 SAMPLE DISPATCH

Samples collected during field investigations or in response to a hazardous materials incident are classified by the project manager, prior to shipping, as either environmental or hazardous material samples. The shipment of samples, designated as environmental samples, is not regulated by the U.S. Department of Transportation.

Samples collected from certain process streams, drums, bulk storage tanks, soil, sediment, or water samples from suspected areas of high contamination may need to be shipped as hazardous. These regulations are promulgated by the US-DOT and described in the Code of Federal Regulations (49 CFR 171 through 177). The guidance for complying with US-DOT regulations in shipping environmental laboratory samples is given in the "National Guidance Package for Compliance with Department of Transportation Regulations in the Shipment of Environmental Laboratory Samples."

15.1 SHIPMENT OF ENVIRONMENTAL SAMPLES

Shipping receipts are maintained at the ESC laboratory. The shipment of preserved sample containers or bottles of preservatives (i.e., NaOH pellets, HCl, etc.) which are designated as hazardous under the US-DOT, Hazardous Materials Table, 49 CFR 171.101, must be transported pursuant to the appropriate US-DOT regulations. Samples packaged for shipment by ESC shall be segregated by sample type, preservation requirements, and potential contaminant level. During events in which large numbers of samples are collected, samples are segregated by analyses required. If multiple sites are sampled, or if specific and separate areas of interest are identified, samples are further segregated for packaging prior to shipment.

Environmental samples are packed prior to shipment using the following procedures:

1. Select a cooler (clean and strong). Line the cooler with a large heavy-duty plastic bag.
2 Allow sufficient headspace (except VOC's or others with zero headspace requirements) to compensate for any pressure and temperature changes.
3. Be sure the lids on all bottles are tight.
4. Place all bottles in appropriately sized polyethylene bags.
5. Place VOC vials in foam material transport sleeves.
6. Place foam padding in the bottom of the cooler and then place the bottles in the cooler with sufficient space to allow for the addition of more foam between the bottles.
7. Put ice on top of and/or between the samples.
8. Place chain of custody in a clean dry bag and into the cooler. Close the cooler and securely tape the cooler shut. The chain of custody seals should be affixed to the top and sides of the cooler so that the cooler cannot be opened without breaking the seal.

9. The shipping containers must be marked "THIS END UP". The name and address of the shipper shall be placed on the outside of the container. Labels used in the shipment of hazardous materials are not permitted to be on the outside of the container used to transport environmental samples and shall not be used.

16.0 INVESTIGATION WASTE

16.1 GENERAL

Field surveys conducted by ESC may generate waste materials. Some of these waste materials may be hazardous requiring proper disposal in accordance with EPA regulations.

16.1.1 Types of Investigation Derived Wastes (IDW)

Materials which may be included in the IDW category are:

- Personnel protective equipment (PPE)
- Disposable sampling equipment (DE)
- Soil cuttings
- Groundwater obtained through well purging
- Spent cleaning and decontamination fluids
- Spent calibration standards

16.1.2 Managing Non-hazardous IDW

Disposal of non-hazardous IDW should be addressed prior to initiating work at a site. Facility personnel should be consulted and wastes handled in an appropriate manner as directed by the customer.

For development and purge water generated in the State of Florida, specific disposal requirements apply. The water is contained on-site in temporary storage until it is characterized. Appropriate disposal and/or treatment methods are then determined. Possible disposal options are:

- Direct discharge on-site to infiltrate the same or a more contaminated source
- Transportation to an off-site facility

In no case shall the water be discharged into any surface water unless permitted.

16.1.3 Management of Hazardous IDW

Disposal of hazardous or suspected hazardous IDW (as defined in 40 CFR 261.30-261.33 or displaying the characteristics of ignitability, corrosivity, reactivity, or TC toxicity) must be specified in the sampling plan. Hazardous IDW must be disposed in compliance with USEPA regulations. If appropriate, these wastes may be taken to a facility waste treatment system. These wastes may also be disposed of in the source area from which they originated if state regulations permit.

If on-site disposal is not feasible, appropriate analyses must be conducted to determine if the waste is hazardous. If so, they must be properly contained and labeled. They may be stored on the site for a maximum of 90 days before they must be manifested and shipped to a permitted treatment or disposal facility. Weak acids and bases may be neutralized in lieu of disposal as hazardous wastes. Neutralized wastewaters may be flushed into a sanitary sewer.

If possible, arrangements for proper containment, labeling, transportation, and disposal/treatment of IDW should be anticipated beforehand.

Investigation derived wastes should be kept to a minimum. Most of the routine studies conducted by ESC should not produce any IDW that are hazardous. Many of the above PPE and DE wastes can be deposited in municipal dumpsters if care is taken to keep them segregated from hazardous waste contaminated materials. Disposable equipment can often be cleaned to render it nonhazardous, as can some PPE, such as splash suits. The volume of spent solvent waste produced during equipment decontamination can be reduced or eliminated by applying only the minimum amount of solvent necessary.

17.0 SAMPLING BIBLIOGRAPHY

17.1 *Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual,* February 1, 1991, US EPA Region IV, Environmental Services Division.

17.2 *RCRA Ground-Water Monitoring Technical Enforcement Guidance Document* (GPO #5500000260-6), US EPA, September 1986.

17.3 *Test Methods for Evaluating Solid Waste*, SW-846, Third Edition, Office of Solid and Emergency Response, US EPA, November 1986.

17.4 *Methods for the Determination of Organic Compounds in Drinking Water*, EPA/600/4-88/039, December 1988.

17.5 Florida Department of Environmental Regulation (DER) Quality Assurance Section (QAS) Guidance Documents:
#89-01 - Equipment Material Construction, revised April 7, 1989
#89-02 - Field QC Blanks, revised April 28, 1989
#89-03 - Teflon® /Stainless Steel Bladder Pumps, revised May 10, 1988
#89-04 - Field Cleaning Procedures, revised August 10, 1989

17.6 *DER Manual for Preparing Quality Assurance Plans*, DER-QA-001/90, revised September 30, 1992.

17.7 *NPDES Compliance Inspection Manual*, United States Environmental Protection Agency, Enforcement Division, Office of Water Enforcement and Permits, EN-338, 1988.

17.8 *Handbook for Monitoring Industrial Wastewater*, United States Environmental Protection Agency, Technology Transfer, 1973.

17.9 *EPA Primary Drinking Water Regulations*, 40 CFR 141.

17.10 *Rapid Bioassessment Protocols For Use in Streams and Rivers*, United States Environmental Protection Agency, Office of Water, EPA/841/B-99-002.

17.11 *Environmental Sampling and Analysis: A Practical Guide*. Lawrence H. Keith, Ph.D., 1991. Lewis Publishers.

17.12 *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms*. Fifth Edition. U.S. Environmental Protection Agency, Office of Water, Washington DC. EPA/821/R-02/012

17.13 *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms*. Fourth Edition. U.S. Environmental Protection Agency, Office of Water, Washington DC. EPA/821/R-02/013.

18.0 REVISIONS

The Regulatory Affairs Department has an electronic version of this Quality Assurance Manual with tracked changes detailing all revisions made to the previous version. This version is available upon request. Revisions to the previous version of this appendix are summarized in the table below.

Document	**Revision**
Quality Assurance Manual Version 15.0 (Appendix III)	General - Replaced the term “client” with the term “customer”

1.0 SIGNATORY APPROVALS

WET LAB QUALITY ASSURANCE MANUAL

APPENDIX IV TO THE ESC QUALITY ASSURANCE MANUAL

for

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Prepared by

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NOTE: The QAM has been approved by the following people.

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2.0 APPENDIX TABLE OF CONTENTS

3.0 SCOPE AND APPLICATION

This manual discusses specific QA requirements for general analytical protocols to ensure analytical data generated from the Wet Chemistry Laboratory, or Wet Lab, are scientifically valid and are of acceptable quality. Any deviations from these requirements and any deviations that result in nonconforming work must be immediately evaluated and their corrective actions documented.

4.0 LABORATORY ORGANIZATION AND RESPONSIBILITIES

ESC Lab Sciences offers diverse environmental capabilities that enable the laboratory to provide the customer with both routine and specialized services, field sampling guidance and materials, and broad laboratory expertise. A brief outline of the organization and responsibilities as they apply to the ESC Quality Assurance Program is presented in *Section 4.0 in the ESC Quality Assurance Manual.*

5.0 PERSONNEL AND TRAINING

5.1 PERSONNEL

Chris Unterstein, with a B.S. degree in Chemistry, is the Wet Chemistry Supervisor and is responsible for the overall production of this laboratory; including the management of the staff and scheduling. Mr. Unterstein has over 8 years of environmental laboratory experience. In his absence, Andrew Holt assumes responsibility for departmental decisions in Wet Chemistry laboratory.

Mr. Holt, with a B.S. in Plant and Soil Science, is proficient in wet chemistry analytical methods. Mr. Holt has 9 years of environmental laboratory experience.

5.2 TRAINING

5.2.1 All new analysts to the laboratory are trained by a Chemist or the Supervisor according to ESC protocol. ESC's training program is outlined in *SOP 030205 Technical Training and Personnel Qualifications.* Performance is documented using an initial demonstration of capability (IDOCs) and continuing demonstration of capability (CDOC). On-going acceptable capability in Wet Lab analyses is demonstrated by acceptable participation in multiple proficiency testing programs (PTs) and daily Quality Control sample analyses. Documentation of analyst training is maintained on file within the department.

6.0 FACILITIES AND LABORATORY SAFETY

6.1 FACILITIES

The main area of the Wet Chemistry laboratory has approximately 7,500 square feet of area, and contains LED lighting. The HVAC system is provided by a 15-ton Trane unit. The laboratory reagent water is generated through an Evoqua system. Waste disposal containers are located in the laboratory and Clean Harbors serves as ESC's waste disposal contractor. Waste handling is discussed in detail in Section 6.0 of the ESC Quality Assurance Manual. ESC's building information guides and site plan are shown in Appendix I.

6.2 LABORATORY SAFETY

- Laboratory access is limited when work is being performed.
- All procedures where chemicals are prepared or splashes may occur are conducted in laboratory exhaust hoods.
- ESC's laboratory safety guidelines are detailed in the *ESC Chemical Hygiene Plan.*

7.0 SAMPLING PROCEDURES

7.1 FIELD SAMPLING PROCEDURES, SAMPLE STORAGE, AND HANDLING

- Field Sampling procedure are described in Appendix III of this ESC Quality Assurance Manual. Sample information is recorded and kept on the ESC chain of custody and field logbooks.
- Matrices for Wet Lab environmental analyses include groundwater, wastewater, drinking water, soil, and sludge.
- Sample containers, preservation methods and holding times vary depending on analyses requested. Please see the determinative procedures for specific directions.

8.0 EQUIPMENT

8.1 EQUIPMENT LIST

LABORATORY EQUIPMENT LIST: MAJOR ITEMS – Wet Lab

This table is subject to revision without notice

Item	*Manufacturer*	*Model*	*Instrument Name*	*Serial #*	*Location*
Analytical Balance	Mettler	AT200	Balance 1	m26291	Wet Lab
Analytical Balance	Mettler	AG204 Delta Range	Balance 2	118420883	Wet Lab
Analytical Balance	Mettler	XP205	Balance 3	1129420141	Wet Lab
Autoanalyzer	Lachat	Quikchem 8000	Lachat 2	A83000-1027	Wet Lab
Autoanalyzer	Lachat	Quikchem 8000	Lachat 3	A83000-1638	Wet Lab
Autoanalyzer	Lachat	Quikchem 8500	Lachat 4	60900000341	Wet Lab
Autoanalyzer	Lachat	Quikchem 8500	Lachat 5	60900000342	Wet Lab
Autoanalyzer	Lachat	Quikchem 8500	Lachat 6	70500000452	Wet Lab
Autoanalyzer - digestor	Lachat	BD-46	DIG1	100700000-982	Wet Lab
Autoanalyzer - digestor	Lachat	BD-46	DIG2	1000700000-982	Wet Lab
Autoanalyzer - digestor	Lachat	BD-46	DIG1	1800-871	Wet Lab
Autoanalyzer - digestor	Lachat	BD-46	DIG2	1800-872	Wet Lab
Automated titrator	Metrohm	855 titrosampler	Titrando	3256	Wet Lab
Centrifuge	Thermo	Megafuge 40	Centrifuge	41123868	Wet Lab
Class “I” weights	Troemner	Serial #7944		7944	Wet Lab
COD Reactor	HACH	45600	COD1	10800	Wet Lab
COD Reactor	HACH	45600	COD2	10090C0036	Wet Lab
Conductivity Meter	ORION	MODEL 170	ATI Orion	32470007	Wet Lab
Distillation Unit - Cyanide	Environmental Express	Distillation 1	LMD1920-106	2270	Wet Lab
Distillation Unit - Cyanide	Environmental Express	Distillation 2	LMD1920-106	2271	Wet Lab
Distillation Unit - Cyanide	Environmental Express	Distillation 3	LMD1920-106	2272	Wet Lab
Distillation Unit - Phenol	Westco Scientific	Model EASY-DIST	Dist 1	1062	Wet Lab
Distillation Unit - Phenol	Westco Scientific	Model EASY-DIST	Dist 2	1198	Wet Lab
SimpleDist	Env. Express	SC154	SimpDist1	8940CECW3871	Wet Lab
SimpleDist	Env. Express	SC155	SimpDist2	9062CECW3952	Wet Lab
SimpleDist	Env. Express	SC156	SimpDist3	9062CECW3955	Wet Lab
Flash Point Tester	Koehler	Pensky-Martens	Manual	R07002693B	Wet Lab

LABORATORY EQUIPMENT LIST: MAJOR ITEMS – Wet Lab

This table is subject to revision without notice

Item	***Manufacturer***	***Model***	***Instrument Name***	***Serial #***	***Location***
		K16200			
Flash Point Tester	Koehler	Pensky-Martens K16201	Manual	R07002510B	Wet Lab
Flash Point Tester	LAZAR Scientific	SETA-93	Automated	1038328	Wet Lab
Hot Plate	Thermolyne Fisher	Type 2200	Hot	16237	Wet Lab
Hot Plate	Thermolyne Fisher	Type 2200	Hot	16240	Wet Lab
Hot Plate	Cole Parmer	HS19 C-P	Hot Plate	50000073	Wet Lab
Ion Chromatograph	Dionex	ICS-2000	IC5	6050731	Wet Lab
Ion Chromatograph	Dionex	ICS 1500	IC6	8100010	Wet Lab
Ion Chromatograph	Dionex	ICS 1500	IC7	8100267	Wet Lab
Ion Chromatograph	Dionex	ICS 2000	IC8	8090820	Wet Lab
Ion Chromatograph	Dionex	ICS 2100	IC9	10060822	Wet Lab
Ion Chromatograph	Dionex	ICS 2100	IC10	10091285	Wet Lab
Ion Chromatograph	Dionex	ICS 2100	IC11	11012204	Wet Lab
Ion Chromatograph	Dionex	ICS 2100	IC12	12020460	Wet Lab
Ion Chromatograph	Thermo Fisher	ICS 1600	IC13	13031204	Wet Lab
Ion Chromatograph	Thermo Fisher	ICS-2100	IC14	15030082	Wet Lab
Ion Chromatograph	Thermo Fisher	ICS-2100	IC15	15071973	Wet Lab
Ion Chromatograph	Thermo Fisher	ICS-2100	IC16	15071973	Wet Lab
Ion Chromatograph	Thermo Fisher	ICS-1600	IC17	15110462	Wet Lab
Ion Chromatograph	Thermo Fisher	ICS-2100	IC18	15120139	Wet Lab
Muffle Furnace	Thermolyne	(1) 30400	FURNACE	23231	Wet Lab
Autoanalyzer	OI Analytical	FS 3100	FS 3100-1	301831056 (NH3) 251833391 (CN)	Wet Lab
Autoanalyzer	OI Analytical	FS 3100	FS 3100-2	3168140781(NH3) 325833494 (CN)	Wet Lab
Autoanalyzer	OI Analytical	FS 3100	FS 3100-3	407831164 (NO2NO3) 403833925 (PHT)	Wet Lab
ORP Meter	YSI	ORP15	ORP	JC000114	Wet Lab
Oven - Drying	Blue M	Stabil-Therm	#1	NA	Wet Lab
Oven - Drying	Equatherm	D1576	#2	NA	Wet Lab
Oven - Drying	VWR	1305U	#3	4082804	Wet Lab
Oven - Drying	Equatherm	D1576	#4	10AW-3	Wet Lab
Oven - Drying	VWR	1305U	#5	4082104	Wet Lab
pH Meter	Fisher	AB15	AB15+	AB92329028	Wet Lab
pH Meter	Orion	410A	Orion	58074	Wet Lab

LABORATORY EQUIPMENT LIST: MAJOR ITEMS – Wet Lab

This table is subject to revision without notice

Item	***Manufacturer***	***Model***	***Instrument Name***	***Serial #***	***Location***
pH Meter	Fisher	AB15	AB15+	AB92325899	Wet Lab
pH Meter	Thermo Fisher	Orion Versa Star	Orion VS-1	V00659	Wet Lab
Refrigerated Recirculator	Polyscience	Recirculator	Recirculator1	1282	Wet Lab
Refrigerated Recirculator	Polyscience	Recirculator	Recirculator2	1608	Wet Lab
Spectrophotometer (UV/Vis)	Hach	DR 5000	DR5000-1	1381711	Wet Lab
Spectrophotometer (UV/Vis)	Hach	DR 5000	DR5000-2	1326829	Wet Lab
Spectrophotometer	Hach	DR6000	DR6000-1	1646676	Wet Lab
Spectrophotometer	Hach	DR6000	DR6000-2	1646781	Wet Lab
TOC Analyzer	Shimadzu	Model TOC-VWS	TOC2	39830572	Wet Lab
TOC Analyzer	Shimadzu	TOC-VCPH	TOC3	H51304435	Wet Lab
TOC Analyzer	OI-Analytical	Aurora 1030	TOC4	E141788082	Wet Lab
TOC Analyzer	Shimadzu	TOC-L	TOC5	H54335232035	Wet Lab
TOC Analyzer	OI Analytical	1030	TOC6	E645732519P	Wet Lab
TOX Analyzer	Mitsubishi	TOX-100	TOX2	1035	Wet Lab
TOX Analyzer	Mitsubishi	AOX-200	AOX1	E7B00107	Wet Lab
TOX Analyzer	EST	TE Xplorer	TOX3	2015-184	Wet Lab
Turbidimeter	Hach	2100N	Turbidimeter1	941100000903	Wet Lab

8.2 EQUIPMENT PREVENTIVE MAINTENANCE, EQUIPMENT CALIBRATION

INSTRUMENT	***P. M. DESCRIPTION***	***FREQUENCY***
Analytical Balances	•Check with Class "I" weights	Daily
Analytical Balances	•Service/Calibration (semi-annual contract maintenance and calibration check)	Tolerance - ±0.1%
Analytical Balances	•Service/Calibration (semiannual contract maintenance and calibration check)	Semi-annually
Refrigerators & Incubators	•Maintenance service	As needed - determined by daily temperature performance checks
Water Bath	•Check thermometer vs. NIST	Once/year
Water Bath	•Remove from service when not maintaining temperature and send off for repair or replace	As needed
Flash Point Tester	•Check thermometer vs. certified traceable	Once/year
Lachat Autoanalyzer	•Check pump tubes, change valve flares	At least 1/month
Pensky Martens	•Check fuel level, refill	As needed
Pensky Martens	•Clean cup thoroughly	Between each test and after use
TOC	•Maintain manufacturer's service contract	Renew each year
Turbidimeter - Hach 2100A	•Illumination lamp or window (alignment and/or replacement)	Erratic or poor response
pH Meters	•Reference junction & electrode replacement	As needed
pH Meters	•Probe stored in KCl	At all times when not in use
pH Meters	•Other	As described in the manufacturer's O & M manual
Ion Chromatograph	•Replace guard and analytical columns	As needed
Ion Chromatograph	•Replace the end-line filter (P/N 045987)	As needed
Ion Chromatograph	• Replace the pump piston rinse seals and piston seals	Every 6 months or as needed
Ion Chromatograph	•Replace the sampling tip and the tubing between the tip and the injection valve.	As needed
Ion Chromatograph	•Replace lines throughout the instrument	As needed
Ion Chromatograph	•Perform Preventive Maintenance using PM kit (P/N 057954)	Annual

8.3 STANDARDS AND REAGENTS

Table 8.3A lists standard sources, receipt, and preparation information. Table 8.3B is designed to provide general calibration range information. These ranges may change depending on regulatory requirements, procedural changes, or project needs. Table 8.3C indicates the procedures and frequency for the standardization of laboratory solutions used for titrations.

Table 8.3A: Standard sources, description and calibration information.

This table is subject to revision without notice

Instrument Group	Standard Source	How Received*	Source/ Storage	Preparation from Source	Lab Stock Storage	Preparation Frequency
Alkalinity, Acidity	Lab preparation	Acidity-matrix standard grade KHP	Room temp.	0.0500N	4°± 2°C	6 months
Ammonia-Nitrogen and Total Kjeldahl Nitrogen Primary Stock	Lab preparation	ACS grade NH4Cl	Room temp.	1,000ppm stock standard	Room temp.	Annually or sooner if check samples reveal a problem
Ammonia-Nitrogen and Total Kjeldahl Nitrogen	Lab preparation	Primary Stock	Room temp.	Working Standards	Not stored	Prepared fresh as needed
COD	Lab preparation	Acid grade KHP	Dessicator	Stock solution (10,000ppm)	4°± 2°C	When absorbance of curve changes or check samples are out of control
Cyanide (Autoanalyzer)	Lab preparation	KCN	Reagent shelf	Stock solution (1,000ppm)	4°± 2°C	6 months. Working dilutions prepared daily as needed
Fluoride Primary Stock	Inorganic Standard. NSI Lab preparation	ACS grade KF	Room temp.	100ppm stock solution	Room temp.	1 year or as needed when reference standard fails
Fluoride	Lab preparation	Primary Stock	Room temp.	Dilute standards	Not stored	Prepared fresh daily
Hardness	Lab preparation	Chelometric Std. $CaCO_3$	Room temp.	1mg/mL as CaCO3	Room temp.	Annually or sooner if check samples reveal a problem
IC (Chloride, Nitrate, Nitrite, Bromide, Sulfate, Fluoride)	Commercial source	Varies	4°± 2°C	Working Standards as needed per analyte	4°± 2°C	6 months or sooner if check samples reveal a problem
IC (Chloride, Nitrate, Nitrite, Bromide, Sulfate, Fluoride)	Inorganic Standards	Varies	4°± 2°C	Working Standards as needed per analyte	4°± 2°C	Midpoint standard prepared weekly or sooner if necessary
IC (Chloride, Nitrate, Nitrite, Bromide, Sulfate, Fluoride)	NSI (2nd source)	Varies	4°± 2°C	Working Standards as needed per analyte	4°± 2°C	Prepared weekly or sooner if necessary
MBAS	Lab preparation	LAS Reference Material	4°± 2°C	1,000mg/mL working standards	4°± 2°C Wet Stored	6 months or when check standards are out of control. Prepared fresh.

Table 8.3A: Standard sources, description and calibration information.

This table is subject to revision without notice

Instrument Group	Standard Source	How Received*	Source/ Storage	Preparation from Source	Lab Stock Storage	Preparation Frequency
Nitrite-Nitrate (autoanalyzer)	Lab preparation	ACS grade KNO3	Reagent shelf	Stock solution (1000ppm)	4°± 2°C	When absorbance of curve changes or check samples are out of control
pH Meter	Commercial Source	pH 4.0 Buffer	Room temp.	No prep required	NA	Annual/Expiration Date
pH Meter	Commercial Source	pH 7.0 Buffer	Room temp.	No prep required	NA	Annual/Expiration Date
pH Meter	Commercial Source	pH 10.0 Buffer	Room temp.	No prep required	NA	Annual/Expiration Date
Phenols (autoanalyzer)	Lab preparation	ACS Certified Phenol	Reagent shelf	Stock solution (1000ppm)	4°± 2°C	Every month. Working solutions prepared daily as needed.
Phosphate	(H_2O) - Prepared in Lab Total Phos. (soils) RICCA, ERA	KH2PO4	Reagent shelf	Stock solution (50ppm as P)	Room temp.	When absorbance of curve changes or check samples are out of control. Working solutions prepared daily as needed.
Specific Conductivity Meter	NSI-Primary	ACS Certified KCl	Room temp.	Working Standard (0.01M)	Room temp.	As needed
Specific Conductivity Meter	ERA-2nd Source	ACS Certified KCl	Room temp.	Working Standard (0.01M)	Room temp.	As needed
Sulfate	Inorganic Standards, NSF Prepared in Lab	Anhydrous Na2SO4	Reagent shelf	Stock solution (100ppm)	Room temp.	When visible microbiological growth or check samples are out of control
Turbidimeter	Commercial Source Hach	Hach	Room temp.	No prep required	NA	Checked daily against Formazin Standards
pH Meter	Commercial Source	pH 1.0 Buffer	Room temp.	No prep required	NA	Annual/Expiration Date
pH Meter	Commercial Source	pH 13.0 Buffer	Room temp.	No prep required	NA	Annual/Expiration

Table 8.3B: WORKING STANDARD CALIBRATION

Analysis	Calibration Standard
Alkalinity, Acidity- Titrimetric	Primary standard grade Na_2CO_3.
Alkalinity - Methyl orange Autoanalyzer	Primary standard grade Na_2CO_3: 0, 10, 25, 50,100, 250, 375, 500 mg/L
Bromide IC	Range –1.0, 5.0, 10, 50, 100, mg/L
Chloride IC	Range –1.0, 5.0, 10, 50, 100, mg/L1
Conductivity	Standard KCl solution: 1413
Cyanides	Blank, 0.0025 – 0.40ppm. Distill one standard as check with each batch.
COD	KHP (Potassium hydrogen phthalate) standards 20 – 1000 mg/L
Chromium – Hexavalent (Colorimetric)	Blank, 0.0101, 0.0202, 0.0505, 0.1010, 0.2525, 0.5050, 1.010 mg/L
Chromium – Hexavalent (IC)	Blank, 0.5, 1.0, 2.0, 10, 20, 50, 100 ug/L
Fluoride – IC	Range –0.10, 0.50, 1.0, 5.0, 10.0, mg/L
Hardness	$CaCO_3$, chelometric standard.
Hardness (Colorimetric)	Range – 30, 50, 60, 100, 150, 200, 300 mg/L
MBAS	LAS reference material: 0.0, 0.1, 0. 5, 1.0, 1.5, 2.0 mg/L
Nitrogen-Ammonia – Autoanalyzer	Calibration standards: 0, 0.10, 0.50, 1.0, 2.0, 5.0, 10, 20 mg/L
Nitrogen-Nitrate, Nitrite – Autoanalyzer	Blank, 0.1, 0.50, 1.00 5.0, 7.0, 10.0 mg/L

Table 8.3B: WORKING STANDARD CALIBRATION

Analysis	Calibration Standard
Nitrogen-Nitrate – IC	Range –0.10, 0.50, 1.0, 5.0, 10.0, mg/L
Nitrogen-Nitrite – IC	Range –0.10, 0.50, 1.0, 5.0, 10.0, mg/L
Orthophosphate, Total Phosphate	Blank, 0.025, 0.10, 0.25, 0.50, 0.75, 1.0mg/L diluted from standard KH_2PO_4
Perchlorate	Range – 0.5, 1.0, 3.0, 5.0, 10, 20, 25 mg/L
pH	Buffers1.0, 4.0, 7.0, 10, 13
Phosphate, Total	Range – 0.0, 0.1, 0.5, 1.0, 2.5, 5.0 mg/L
Phosphate – IC	Range –0.10, 0.50, 1.0, 5.0, 10.0, 15.0, 20.0 mg/L
Phenols (chloroform ext.)	Blank 0.04, 0.05, 0.10, 0.50, 1.0, 2.0mg/L Distill one standard with each batch
Solids	Gravimetric balance calibrated charts, checked with Class “I” weights in range of sample tare weights.
Sulfate – IC	Range –1.0, 5.0, 10, 50, 100, 150, 200 mg/L
Sulfide (Colormetric)	Range –0.0, 0.05, 0.1, 0.5, 1.0, 1.5, 2.0 mg/L
Sulfite	Titration
TKN	Range – 0.0, 0.1, 0.5, 1.0, 2.5, 5.0, 10, 20 mg/L
Turbidity	Range –0, 20, 200, 1000, 4000NTU
TOC	Range –0, 1.0, 2.5, 5.0, 7.5, 10, 20, 50, 75, 100 mg/L
TOX	Cell checks at 1, 20, 40 ug

Table 8.3C: STANDARDIZATION OF TITRATION SOLUTIONS

Solution	Primary Standard	Frequency
0.0200 N NaOH	0.050 N KHP	Daily as needed
0.0200 N H_2SO_4	Freshly prepared and standardized NaOH (from KHP standard)	6 months or with each new batch
0.0141 N $Hg(NO_3)_2$	Standard NaCl solution 500 ug Cl/ml	Daily as used
0.0100 M EDTA	Standard $CaCO_3$ solution 1 mg $CaCO_3$/liter	Daily as used

8.4 INSTRUMENT CALIBRATION

Total Organic Carbon Analyzer (TOC) in GW/WW – SOP Number 340356A

The TOC standard curve is prepared using a minimum of five standards. Linear regression is used for quantitation with the correlation coefficient being at least 0.995. The calibration range is 1.0mg/L to 100mg/L. During the analytical sequence, the stability of the initial calibration is verified, following every 10th sample and at the end of the sequence, by the analysis of continuing calibration verification (CCV) standards. The CCV must recover within 10% of the expected value for each analyte.
A laboratory control standard (LCS) is prepared from a source that is independent from the calibration standards and used to verify that the calibration curve is functioning properly and that the analytical system performs acceptably within a clean matrix. The LCS must recover within ±15% of the expected concentration.

Total Organic Carbon Analyzer (TOC) in DW – SOP Number 340356B

The TOC standard curve is prepared using a minimum of five standards. Linear regression is used for quantitation with the correlation coefficient being at least 0.995. The calibration range is 0.5mg/L to 5.0mg/L. During the analytical sequence, the stability of the initial calibration is verified, following every 10th sample and at the end of the sequence, by the analysis of continuing calibration verification (CCV) standards. The CCV must recover within 10% of the expected value for each analyte.

A laboratory control standard (LCS) is prepared from a source that is independent from the calibration standards and used to verify that the calibration curve is functioning properly and that the analytical system performs acceptably within a clean matrix. The LCS must recover within ±15% of the expected concentration. Dissolved organic carbon can be analyzed using this procedure by filtering the unpreserved sample using a 0.45um filter, then performing the analysis on the filtrate using the same process as the TOC procedure.

Total Organic Carbon Analyzer (TOC) in Soil (Walkley Black) – SOP Number 340368

The Walkley Black standard curve is prepared using a minimum of six standards. Linear regression is used for quantitation with the correlation coefficient being at least 0.995. The calibration range is 0.1mg/L to 5.0mg/L. During the analytical sequence, the stability of the initial calibration is verified, following every 10th sample and at the end of the sequence, by the analysis of continuing calibration verification (CCV) standards. The CCV must recover within 10% of the expected value for each analyte.

A laboratory control standard (LCS) is prepared from a source that is independent from the calibration standards and used to verify that the calibration curve is functioning properly and that the analytical system performs acceptably within a clean matrix. The LCS must recover within ±50% of the expected concentration. This method is used to determine Fractional Organic Carbon (FOC) as required by the state of Indiana.

Total Organic Halogen Analyzer (TOX) – SOP Number 340360

The cell performance of the TOX analyzer is verified at the beginning of each analytical sequence in the low, mid and high ranges. The verifications must recover within 3% of the expected target value. The instrument performs a linear regression using the values determined with the required correlation coefficient being at least 0.995. During the analytical sequence, the stability of the initial calibration is verified, following every 10th sample and at the end of the sequence, by the analysis of continuing calibration verification (CCV) standards. The CCV must recover within 10% of the expected value for each analyte.

A laboratory control standard (LCS) is prepared from a source that is independent from the calibration standards and used to verify that the calibration curve is functioning properly and that the analytical system performs acceptably within a clean matrix. The LCS must recover within ±15% of the expected concentration.

Anions by Ion Chromatography – SOP 340319

Least Squares Linear Regression is the primary method of quantitation; where a minimum of five standards is used and the correlation coefficient must be at least 0.995 for each analyte of interest. The calibration range varies depending upon the analyte(s) to be determined. During the analytical sequence, the stability of the initial calibration is verified, following every 10th sample and at the end of the sequence, by the analysis of continuing calibration verification (CCV) standards. The CCV must recover within 10% of the expected value for each analyte, except during the analysis of groundwater and soil using EPA Method 9056 that must recover within 5%.

A laboratory control standard (LCS) is prepared from a source that is independent from the calibration standards and used to verify that the calibration curve is functioning properly and that the analytical system performs acceptably within a clean matrix. The LCS must recover within ±10% for water samples and ±15% of the expected concentration for soil samples.

Hexavalent Chromium by Ion Chromatography – SOP 340372 & 340372A

These procedures are utilized to analyze for hexavalent chromium (Cr6+) by ion chromatography using a variety of published methods and the relevant SOP addresses both the common and method specific requirements for each published method. The Cr^{6+} standard curve is prepared using a minimum of five or six standards at various levels depending on the expected concentration of the field samples, the analytical method requested and the matrix. Linear regression is used for quantitation with the correlation coefficient being at least 0.995. During the analytical sequence, the stability of the initial calibration is verified, following every 10th sample and at the end of the sequence, by the analysis of continuing calibration verification (CCV) standards. The recovery of the CCV must be within 10% of the expected value for the analyte using SM 3500Cr C and EPA Method 7199. The CCV for EPA 218.6 must recover within ±5% and the mid-level CCV for EPA 218.7 must recover within ±15%.

A laboratory control standard (LCS) is prepared from a source that is independent from the calibration standards and used to verify that the calibration curve is functioning properly and that the analytical system performs acceptably within a clean matrix. The LCS must recover within ±10% of the expected concentration.

Aqueous and solid Hexavalent Chromium samples can also be analyzed by colorimetry using EPA 7196A and SM 3500Cr B – SOP 340318B & 350318C. Specific requirements for those methods are contained within the specified SOPs. Soil samples are prepared for both the IC and colorimetric method using alkaline digestion found in EPA 3060A and discussed in both soil SOPs 350318C and 340372A.

Gravimetric Analyses – Various SOPs

Gravimetric analyses are performed using several different published methods, including TDS, TSS, TVDS, TS, TVS, VSS, Settleable Solids, Total Particulates, and Respirable Particulates. Calibration for these methods require use of Class I weights and a properly performing and verified balance. Where possible, laboratory control standards are analyzed in conjunction with field sample analysis to verify that the analytical process is performing accurately. Sample duplicate analyses also provide verification that the analytical process is performing as required.

Auto-Analyzer (Lachat) – Various SOPs

The Autoanalyzer calibration curve is prepared using a minimum of five standards. For most analyses, linear regression is used for quantitation with the correlation coefficient being at least 0.995. The calibration range varies depending upon the analyte to be determined. During the analytical sequence, the stability of the initial calibration is verified, following every 10th sample and at the end of the sequence, by the analysis of continuing calibration verification (CCV) standards. Routinely, the CCV must recover within 10% of the expected value for each analyte, but is dependent on the analyte of concern, the matrix of the sample and the determinative method.

A laboratory control standard (LCS) is prepared from a source that is independent from the calibration standards and used to verify that the calibration curve is functioning properly and that the analytical system performs acceptably within a clean matrix. The LCS must recover within ±15% of the expected value, except for cyanide, ammonia, total phosphorus, NO2NO3 and TKN where ±10% applies.

Perchlorate in Drinking Water – ESC SOP 340370

The Ion Chromatograph calibration curve is prepared using a minimum of five standards. The instrument performs a linear regression using the values determined with the required correlation coefficient being at least 0.995. During the analytical sequence, the stability of the initial calibration is verified, following every 10th sample and at the end of the sequence, by the analysis of continuing calibration verification (CCV) standards. The CCV must recover within 15% of the expected value for each analyte.

A laboratory control standard (LCS) is prepared from a source that is independent from the calibration standards and used to verify that the calibration curve is functioning properly and that the analytical system performs acceptably within a clean matrix. The LCS must recover within ±10% of the expected concentration.

8.5 ACCEPTANCE/REJECTION OF CALIBRATION

All new standard curves are immediately checked with a laboratory control standard from a separate source than that used for calibration. All curves are visually reviewed to ensure that acceptable correlation represents linearity. Calibration curves may be rejected for nonlinearity, abnormal sensitivity, or poor response of the laboratory control standard. Specific criteria for each instrument are outlined in Table 8.5.

Continuing calibration is performed following every tenth sample. If a check standard does not perform within established criteria then the instrument is evaluated to determine the problem. Once the problem is corrected, all samples between the last “in control” sample and the out of control check are re-analyzed.

TABLE 8.5: INSTRUMENT CALIBRATION

Instrument (Analysis)	Calibration Type	Number of Standards	Type of Curve	Acceptance/Rejection Criteria	Frequency
pH Meter*	Initial	5 (buffers) 1 reference buffer	Log.	Third pH of a different value buffer must read within 0.05 units of true value	Daily as used
	Continuing	1 buffer (may be any certified buffer)		Buffer solution must read within 0.05 units of true value	Every 10th sample; Field**
Conductivity Meter*	Initial	1	1 point	Calculation of cell constant between 0.95 - 1.05	Daily as used
	Continuing	1		Must be within 5% of true value	Every 10th sample; Field**
Turbidimeter *	Initial	5	Linear	Formazin-confirmed Gelex standards in appropriate range. Check with second standard must be within 5%	Daily as used
	Continuing	1 reference of different value, 1 (high-level)		Must be within 5% of true value	Every 10th sample; Field**
UV/VIS Spec.	Initial	At least 5 standards calibration standards 2 laboratory control standard	Linear	Calibration Curve must have a correlation of 0.995 or better Must be within ± 15% of the calibration curve.	Daily as used Daily as used
	Continuing	1 mid-level reference std.		Must be within 90 – 110%	Every 10th sample
Total Organic Halogen Analyzer	Initial	3 calibration standards 1 laboratory control standard	Linear	Calibration Curve must have a correlation of 0.995 or better Laboratory control standard must agree within ± 15% of calibration curve	Daily as used Daily as used
	Continuing	1 mid-level reference std.		Must be within 90 – 110%	Every 10th sample
Total Organic Carbon Analyzer	Initial	5 calibration standards 2 laboratory control standard	Linear	Calibration Curve must have a correlation of 0.995 or better Laboratory control standard must agree within ± 15% of calibration curve	Every 6 months or as needed Daily as used
	Continuing	1 mid-level reference std.		Must be within 90 – 110%	Every 10th sample

Note: ESC defines a "laboratory control standard" as a standard of a different concentration and source than those stock standards used for calibration.
*This equipment is also calibrated and used in the field.
**Field equipment must be checked every 4 hours and at the end of the day.

9.0 LABORATORY PRACTICES

9.1 REAGENT GRADE WATER

Reagent grade water is obtained from either a Barnstead NANOpure Diamond system or the Millipore Milli-Q Academic A-10 system.

9.2 GLASSWARE WASHING AND STERILIZATION PROCEDURES

General

Routine laboratory glassware is washed in a non-phosphate detergent and warm tap water. Before washing all labeling and large deposits of grease are removed with acetone. Glassware is then rinsed with: tap water, "No Chromix" solution, tap water, and deionized (DI) water. Glassware is stored in designated drawers or on shelves, inverted when possible. All glassware is rinsed with the required solvent, prior to use. DI water is then used as a precaution against airborne contamination

Phosphate Glassware

Glassware involved in phosphate analysis is marked and segregated. All labels and markings are removed from the glassware prior to washing. The glassware is then washed using hot water and a non-phosphorus detergent. It is then rinsed thoroughly in hot water followed by a rinse in DI water. It is rinsed in 1:1 HCl followed by a final rinse of DI water. If the phosphate glassware has not been used recently, it is the responsibility of the analyst to rinse the glassware with warm 1+9 hydrochloric acid prior to use.

Nutrients and Minerals Glassware

All labels and markings are removed from the glassware prior to washing. The glassware is then washed using hot water and detergent. It is then rinsed thoroughly in hot water followed by a rinse in DI water. It is rinsed in 1:1 HCl followed by a final rinse of DI water.

Immediately prior to use, the ammonia glassware is rinsed in DI water. Routine blanks are run on ammonia glassware to ensure that the detergent is contaminant free.

Non-Metals (CN, COD) Glassware

All labels and markings are removed prior to washing. The glassware is soaked in hot soapy water followed by a thorough rinse with hot tap water. A final rinse of DI water is then performed.

10.0 ANALYTICAL PROCEDURES

10.1 A list of laboratory SOPs associated with the Wet Lab can be found in the following table:

TABLE 10.1: WET LAB DEPARTMENT SOPs

This table is subject to revision without notice

SOP #	Title
340300	Acidity (SM 2310B)
340301	Alkalinity (Titrimetric)
340302	Alkalinity - Lachat
340305	Chlorine, Total Residual DPD- 330.5 SM4500-CL-G
340307	Cyanide- All Forms (Colorimetric Automated UV) - Lachat
340307	Cyanide- OI Method
340309	Chemical Oxygen Demand
340310	Color by Visual Comparison (SM2120B, EPA 110.2)
340313	Density (Specific Gravity)
340317	Total Hardness (mg/l as CaCO3) - (Titrimetric)
340317	Total Hardness by Lachat Method 130.1
340318	Hexavalent Chromium (Colorimetric) Soil 3060A/7196A
340318	Hexavalent Chromium (Colorimetric) Water 7196A
340319	Ion Chromatography - Anions by 300.0, SM 4110B and 9056/9056A
340319	Ion Chromatography - Anions OH VAP
340325	MBAS (Methylene Blue Active Substances)
340327	Ammonia, Phenolate (OI)
340327	Ammonia, Phenolate (Lachat)
340328	Organic Nitrogen
340331	Threshold Odor Test
340333	Nitrate/Nitrite (Lachat Autoanalyzer)
340333	Nitrate/Nitrite (OI Autoanalyzer)
340334	Paint Filter Test
340335	pH/Corrosivity
340336	Phenol - 4AAP (Lachat Autoanalyzer)
340338	Total Phos GW/WW (365.4) Colorimetric
340338	Total Phos.(361.2, 4500P-B/F) Colorimetric
340338	Orthophosphate (365.2,4500P-E) Colorimetric
340339	Reactivity
340340	Reactive Cyanide/Sulfide Distillation
340342	Specific Conductance (120.1, 2510B)
340344	Sulfide (Colorimetric Methylene Blue) (376.2)
340344	Sulfide Acid-soluble,and acid-insoluble Method 9034
340345	Sulfite
340346	Settleable Solids
340347	Total Dissolved Solids
340348	Total Suspended Solids (Non-Filterable Residue)
340349	Total Solids/Percent Moisture

SOP #	Title
340350	Total Volatile Solids
340352	Total Kjeldahl Nitrogen
340354	Turbidity
340356	Total Organic Carbon In Soils (loss of weight on ignit.
340356	TOC for Drinking Water only
340356	Total Organic Carbon (TOC) and Total Inorganic Carbon (TIC) using Shimadzu 5000A for GW and WW
340357	Ignitability
340359	UV254
340360	TOX (total organic halides)
340361	Ferrous Iron, SM-3500-Fe-B
340362	Heat of Combustion
340365	Particles Not Otherwise Regulated, Total (PNOR) NIOSH 0500
340366	Oxidation Reduction Potential
340367	Extractable Organic Halides
340368	TOC in Soil (Walkley-Black)
340369	Carbon Dioxide by Calculation
340370	Perchlorate in DW
340371	Chlorine in Oil (ASTM D808-00)
340372	Hexavalent Chromium in Soil by IC (3060A/7199)
340372	Hexavalent Chromium in Water by IC (218.7/SM 3500Cr)
340373	Organic Matter (FOM) and Fractional Organic Carbon (FOC)
340374	Total Volatile Dissolved Solids (TVDS)
340375	Hexavalent Chromium in Air by IC
340376	Total Organic Halides in Oil (EPA 9076)
340377	Manual Nitrocellulose Analysis
340378	Volatile Suspended Solids
340379	Guanidine Nitrate by IC
340381	Ash in Petroleum Products (ASTM D482-07)

11.0 QUALITY CONTROL CHECKS

NOTE: For specific guidance on each determinative method, including required quality control and specific state requirements/modifications, refer to the relevant laboratory standard operating procedure(s).

11.1 ESC participates in proficiency testing (PTs) in support of various laboratory accreditations/recognitions. Environmental samples are purchased from Phenova. The WS, WP and solid matrix studies are completed every 6 months.

11.2 Initial Demonstrations of Capability (IDOCs) are performed during new analyst training and/or prior to acceptance and use of any new method/instrumentation. Continuing Demonstration of Capability (CDOCs) must be updated at least annually. The associated data is filed within the department and available for review.

11.3 Where appropriate, Matrix Spike and Matrix Spike Duplicates are performed on each batch of samples analyzed, depending on analytical method requested.

11.4 A Laboratory Control Sample (LCS) is analyzed once per batch of samples. Where appropriate, an LCS Duplicate may also be analyzed.

11.5 Where appropriate, a method preparation blank is performed per batch of samples processed. If one-half the reporting limit [RL] is exceeded, the laboratory shall evaluate whether reprocessing of the samples is necessary, based on the following criteria:

- The blank contamination exceeds a concentration greater than 1/10 of the measured concentration of any sample in the associated preparation batch or
- The blank contamination is greater than 1/10 of the specified regulatory limit.

The concentrations of common laboratory contaminants shall not exceed the reporting limit. Any samples associated with a blank that fail these criteria shall be reprocessed in a subsequent preparation batch, except when the sample analysis resulted in non-detected results for the failing analytes.

12.0 DATA REDUCTION, VALIDATION AND REPORTING

12.1 DATA REDUCTION

The analyst performs the data calculation functions and is responsible for the initial examination of the finished data. Data reduction steps applied to the raw data are outlined in ESC SOP #030201, *Data Handling and Reporting*. A secondary review of the data package using the ESC SOP #030227, *Data Review*. The reviewer verifies that the analysis has been performed as required and meets method criteria, all associate data is present and complete, and also ensures that any additional documentation is completed as required (i.e. Ohio VAP checklists, required qualifiers on test reports, etc.)

TABLE 12.1: Data Reduction Formulas

PARAMETER	FORMULA
Acidity, Alkalinity	$\frac{\text{mL titrant x normality titrant x 50,000}}{\text{mL sample}}$
COD, Sulfate	Concentration from curve x dilution factor
Orthophosphate, Hexavalent Chromium	Calculated by computer software as provided by HACH Corp.
Nitrogen-Nitrate, Phenols,Nitrogen-Ammonia, Total Phosphate, Nitrogen-Total Kjeldahl**	Calculated by computer software as provided by Lachat Corp.
Anions, Hexavalent Chromium	Calculated by computer software as provided by Dionex
Conductivity*, pH, Turbidity,	Directly read from instrument
Cyanide, Total and Amenable	$\frac{\mu\text{g from standard curve x mL total volume absorbing solution}}{\text{mL volume sample x mL volume of absorbing solution colored}}$ *Calculated by software as provided by Lachat Corp.*
Solids, Total and Total Dissolved	$\frac{\text{((mg wt of dried residue + dish) - mg wt of dish) x 1000}}{\text{mL sample}}$

PARAMETER	FORMULA
Solids, Total Suspended	$\frac{((\text{mg wt of dried residue + filter}) - \text{mg wt of filter}) \times 1000}{\text{mL sample}}$

12.2 VALIDATION

The validation process consists of data generation, reduction review, and reporting results. Once data reduction is complete, validation is conducted by verification that the QC samples are within acceptable QC limits and that all documentation is complete, including the analytical report and associated QC. See Table 12.3 by method for current QC targets, controls and current reporting limits.

12.3 REPORTING

Reporting procedures are documented in *SOP 030201 Data Handling and Reporting.*

Inorganic Control Limits: Inorganic QC targets are statutory. The laboratory calculated limits verify the validity of the regulatory limits. The Wet Lab QC targets for all inorganic analyses are within the range of ± 5 to 15% for accuracy, depending on determinative method requirements, and, where applicable, ≤20 RPD for precision, unless laboratory-generated data indicate that tighter control limits can be routinely maintained. When using a certified reference material for QC sample analysis, the acceptance limits used in the laboratory will conform to the provider's certified ranges for accuracy and precision.

Table 12.3: QC Targets for Wet Lab Accuracy (LCS), Precision and RLs
This table is subject to revision without notice

Analyte	Analysis Method	Matrix	Accuracy Range (%)	Precision (RPD)	RL (ppm)
Acidity	SM 2310B	w	85 - 115	<20	10
Acidity	SM 2310B	s	85 - 115	<20	10
Alkalinity	SM 2320B	w	85 - 115	<20	20
Ammonia	350.1, SM 4500-NH3-B	w	90 - 110	<20	0.25
Ammonia	350.1 (mod.)	s	Certified Values	<20	5.0
Ash	ASTM D482-07	s	90 - 110	<20	n/a
Bromide	300.0/9056/9056A/ SM 4110B	w	90 - 110	<20	1.0
Bromide	9056/9056A	s	Certified Values	<20	10
Chloride	300.0/9056/SM 4110B	w	90 - 110	<20	1.0
Chloride	9056A	w	90 - 110	<15	1.0
Chloride	300.0/9056	s	Certified Values	<20	10
Color	SM 2120B	w	n/a	<20	1 CU
Conductivity	120.1/9050A, 2510B	w	85 - 115	<20	n/a
Cyanide	335.4, 335.2 (CLP-	w	90 - 110	<20	0.005

Table 12.3: QC Targets for Wet Lab Accuracy (LCS), Precision and RLs

This table is subject to revision without notice

Analyte	Analysis Method	Matrix	Accuracy Range (%)	Precision (RPD)	RL (ppm)
	M), 9012B, SM 4500-CN-E				
Cyanide	335.2 (CLP-M), 9012B	s	Certified Values	<20	0.25
Ferrous Iron	3500FE B	w	85 - 115	<20	15
Fluoride	300.0/9056/9056A/ SM 4110B	w	90 - 110	<20	100
Fluoride	9056A	s	Certified Values	<20	1.0
Hardness	130.1	w	85 - 115	<20	30
Hardness	130.2/SM 2340C	w	85 - 115	<20	5.0
Hexavalent Chromium	SM3500 Cr B/7196A	w	85 - 115	<20	10
Hexavalent Chromium	7196A	s	Certified Values	<20	2.0
Hexavalent Chromium	7199	w	90 - 110	<20	0.0005
Hexavalent Chromium	218.7	w	85 - 115	<15	0.00002
Hexavalent Chromium	7199	s	80 - 120	<20	1.0
Ignitability	1010A	w/s	±3 degrees C	<20	n/a
Methylene Blue Active Substances	5540C SM20th	w	85 - 115	<20	0.10
Nitrate-Nitrite	300.0/9056/9056A/ SM 4110B	w	90 - 110	<20	1.0
Nitrate-Nitrite	9056A	w	90 - 110	<15	1.0
Nitrate-Nitrite	300.0/9056	s	Certified Values	<20	10
Nitrate	300.0/9056/SM 4110B	w	90 - 110	<20	0.1
Nitrate	9056A	w	90 - 110	<15	0.1
Nitrate	300.0/9056	s	Certified Values	<20	1.0
Nitrite	300.0/9056/SM 4110B	w	90 - 110	<20	0.1
Nitrite	9056A	w	90 - 110	<15	0.1
Nitrite	300.0/9056	s	Certified Values	<20	1.0
pH	SM 4500-H, 9040C	w	n/a	<1	n/a
pH	9045D	s	n/a	<1	n/a
Phosphate (ortho)	SM 4500-P E	w	85 - 115	<20	25
Phosphate (ortho)	SM 4500-P E	s	85 - 115	<20	250
Phosphorous/Total	365.1, SM 4500-P	w	90 - 110	<20	3.0
Phosphorous/Total	365.4	w	90 - 110	<20	100
Phosphorous/Total	9056	s	Certified Values	<20	1.0
Residual Chlorine	SM 4500Cl G	w	90 - 110	<20	0.1
Residue, Total (TS)	SM 2540-B, SM2540-G	w	85 - 115	<20	10
Residue, Total (TS)	SM2540-G	s	85 - 115	<20	100
Residue, Filterable	SM 2540-C	w	95 - 105	<20	10

Table 12.3: QC Targets for Wet Lab Accuracy (LCS), Precision and RLs

This table is subject to revision without notice

Analyte	Analysis Method	Matrix	Accuracy Range (%)	Precision (RPD)	RL (ppm)
(TDS)					
Residue Non-Filterable (TSS)	SM 2540-D	w	95 - 105	<20	2.5
Residue, Total Volatile (TVS)	SM 2540-E	w	80 - 120	<20	1.0 (% of TS)
Residue, Total Volatile (TVS)	160.4/SM 2540-E,	s	80 - 120	<20	1.0 (% of TS)
Sulfate	300.0/9056/SM 4110B	w	90 - 110	<20	5.0
Sulfate	9056A	w	90 - 110	<15	5.0
Sulfate	300.0/9056	s	Certified Values	<20	50
Sulfide	SM 4500S2 D	w	85 - 115	<20	20
Sulfite	SM 4500SO3 B	w	85 - 115	<20	3.0
Total Kjeldahl Nitrogen	351.2	w	90 - 110	<20	0.25
Total Kjeldahl Nitrogen	SM 4500NOrg C	s	Certified Values	<20	20
Total Organic Carbon	415.1, SM 5310B,9060A	w	85 - 115	<20	1.0
Total Organic Carbon	SM 5310C	w	85 - 115	<20	0.5
Total Organic Carbon	USDA LOI, ASTM F1647-02A	s	50 - 150	<20	10
Total Organic Carbon	Walkley-Black,	s	50 - 150	<20	100
Dissolved Organic Carbon	415.1, SM 5310B,9060A	w	85 - 115	<20	1.0
Dissolved Organic Carbon	SM 5310C	w	85 - 115	<20	0.5
Total Organic Halogens	9020A, SM 5320B	w	85 - 115	<20	0.1
EOX	9023	s	85 - 115	<20	25
Total Phenol	420.2	w	90 - 110	<20	0.04
Total Phenol	9066	w	90 - 110	<20	0.04
Total Phenol	9066	s	90 - 110	<20	0.67
Turbidity	180.1, SM 2130B	w	90 - 110	<20	0.1 NTU

13.0 CORRECTIVE ACTIONS

13.1 In the event that a nonconformance occurs in conjunction with the analytical batch, a corrective action response (CAR) form must be completed. The cause of the event is stated on the form and the measures taken to correct the nonconformance clearly defined. The effectiveness of the corrective action must be assessed and noted. The CARs are kept on file by the Regulatory Affairs Department. Corrective action procedures are documented in SOP #030208, *Corrective and Preventive Action*

13.2 Required Corrective Action

Control limits have been established for each type of analysis. When these control limits are exceeded, corrective action must be taken. Calculated sample spike control limits are also used.

All samples and procedures are governed by ESC's quality assurance program. General corrective actions are as follows; however additional and more specific direction is provided in the specific determinative procedure. For more information, see the appropriate determinative SOP.

13.2.1 Laboratory QC Criteria and Appropriate Corrective Actions

If the analytical method contains acceptance/rejection criteria and it is more stringent than those controls generated by the laboratory, the method criteria takes precedence.

13.2.2 Calibration Verification Criteria Are Not Met: Inorganic Analysis

Rejection Criteria - See Table 8.5.

Corrective Action - If a standard curve linearity is not acceptable and/or the absorbance for specific standard(s) is not analogous to historic data, the instrument settings, etc. are examined to ensure that nothing has been altered, clogged, etc. Check the standard curve for linearity and re-analyze the standards once. If the failure persists, the working standards are made fresh, intermediate dilutions are re-checked and the instrument is re-calibrated. If a problem persists, the Supervisor or Regulatory Affairs Department is notified for further action.

If the initial reference check sample is out of control, the instrument is re-calibrated and the check sample is re-analyzed. If the problem continues the check sample is re-prepared. If the problem still exists then the standards and reagent blank are re-prepared. If the problem persists, the Supervisor or Regulatory Affairs Department is notified for further action.

13.2.3 Out Of Control Blanks: Applies to Method, Trip, Rinsate & Instrument Blanks

Rejection Criteria - Blank reading is more than twice the background absorbance or more than MDL.

Corrective Action - Blanks are re-analyzed and the response is assessed. Standard curves and samples are evaluated for any obvious contamination that may be isolated or uniform throughout the run. If necessary, reagents are re-prepared. Field sample analyses are not started until the problem is identified and solved. If samples have already been partially prepared or analyzed, the Supervisor or Regulatory Affairs Department is consulted to determine if data needs to be rejected or if samples need to be re-prepped.

13.2.4 Out Of Control Laboratory Control Standards (LCS)

Rejection Criteria - If the performance of associated laboratory control sample(s) is outside of control limits either method defined or calculated as the mean of at least 20 data points ± 3 times the standard deviation of those points. (Listed in Section 12).

Corrective Action - Instrument settings are checked, LCS standard is re-analyzed. If the LCS is still out of control, re-calibration is performed, and samples affected since the last “in control” reference standard are re-analyzed. The Supervisor or Regulatory Affairs Department is consulted for further action.

13.2.5 Out Of Control Matrix Spike Samples

Rejection Criteria - If either the MS or MSD sample is outside the established control limits.

Corrective Action - Any compound that is outside of these limits is considered to be ‘out of control’ and must be qualified appropriately. Batch acceptance, however, is based on method blank and LCS performance, not on MS/MSD recoveries. Specific methods, customers, and programs may require further corrective action in some cases.

13.2.6 Out Of Control Duplicate Samples

Rejection Criteria - Lab-generated or method required maximum RPD limit (as listed under precision in Section 12)

Corrective Action - Instrument and samples are checked to see if precision variance is likely (i.e., high suspended solids content, high viscosity, etc.). They are re-analyzed in duplicate and samples just preceding and following the duplicated sample are re-analyzed. If problem still exists, the Supervisor or Regulatory Affairs Department is notified to review the analytical techniques.

13.2.7 Out Of Control Calibration Standards: ICV, CCV, SSCV

Rejection Criteria - If the performance is outside of method requirements.

Corrective Action - Instrument settings are checked, calibration verification standard is reanalyzed. If the standard is still out of control, re-calibration is performed, and samples affected since the last “in control” reference standard are re-analyzed. The Supervisor or Regulatory Affairs Department is consulted for further action.

14.0 RECORD KEEPING

Record keeping is outlined in SOP #030230, *Standards Logger, SOP #030227, Data Review* and SOP #030201, *Data Handling and Reporting*

All calibration data and graphs generated for wet chemistry are kept digitally with the following information: date prepared, calibration concentrations, correlation, and analyst initials. The analyst reviews the calibration and evaluates it against acceptance criteria before placing it in the calibration notebook. Data on initial and continuing reference standards, as well as matrix spikes and duplicates, are entered in the QC box generated on each analysis page. If a test allows the use of a previously established calibration curve then the calibration check standard is reviewed against acceptance criteria and if acceptable, analysis can proceed. In this situation the calibration date is referenced so that the curve can be easily reviewed, if necessary.

15.0 QUALITY AUDITS

System and data quality audits are outlined in the ESC Quality Assurance Manual *Version 13*.0 and *SOP #010104, Internal Audits*.

16.0 REVISIONS

The Regulatory Affairs Department has an electronic version of this Quality Assurance Manual with tracked changes detailing all revisions made to the previous version. This version is available upon request. Revisions to the previous version of this appendix are summarized in the table below.

Document	**Revision**
Quality Assurance Manual Version 15.0 (Appendix IV)	General – Replaced the term “client” with the term “customer” Section 6.1 – Updated to reflect current facilities Section 7.1 – Removed IH test Table 8.1 – Updated Equipment List Section 12.3 – Removed IH QC Table Table 12.3 – Updated RLs

1.0 SIGNATORY APPROVALS

Metals Department
QUALITY ASSURANCE MANUAL

APPENDIX V TO THE ESC QUALITY ASSURANCE MANUAL

for

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NOTE: The QAM has been approved by the following people.

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2.0 *APPENDIX TABLE OF CONTENTS*

3.0 SCOPE AND APPLICATION

This appendix discusses specific QA requirements for general analytical protocols to ensure that data generated from the Metals Laboratory is scientifically valid and is of acceptable quality. Any deviations from these requirements and any deviations that result in nonconforming work must be immediately evaluated and their corrective actions documented.

4.0 LABORATORY ORGANIZATION AND RESPONSIBILITIES

ESC Lab Sciences offers diverse environmental capabilities that enable the laboratory to provide the customer with both routine and specialized services, field sampling guidance and broad laboratory expertise. A brief outline of the organization and responsibilities as they apply to the ESC Quality Assurance Program is presented in *Section 4.0 in the ESC Quality Assurance Manual.*

5.0 PERSONNEL AND TRAINING

5.1 PERSONNEL

John Davis, with a B.S. degree in Biology, is the Department Supervisor and is responsible for the overall production of these laboratories; including the management of the staff and scheduling. Mr. Davis has 13 years of environmental laboratory experience. In his absence, Rodney Street assumes responsibility for departmental decisions in the Metals Department.

Mr. Rodney Street, with a B.S. degree in Medical Technology, is the Technical Specialist for the Metals Lab. He is proficient in inorganic analytical methods and has 34 years of environmental laboratory experience.

5.2 TRAINING

Senior Analysts or the Supervisor trains all new analysts to the laboratory according to ESC protocol. ESC's training program is outlined in *SOP 030205 Technical Training and Personnel Qualifications.* Performance is documented using an initial demonstration of capability (IDOCs) and continuing demonstration of capability (CDOC). On-going acceptable capability in metals analysis and preparation is also demonstrated by acceptable participation in multiple proficiency testing programs (PTs) and using daily Quality Control sample analyses. Documentation of analyst training is maintained on file within the department.

6.0 FACILITIES AND LABORATORY SAFETY

6.1 FACILITIES

The main area of the analysis laboratory has approximately1200 square feet with roughly 90 square feet of bench area. The main area of the metals prep laboratory has approximately 1200 square feet with 232 square feet of bench area. The main area of the Mercury/TCLP laboratory has approximately 1272 square feet with 136 square feet of bench area. The lighting standard in all three labs is fluorescence. The air system is a 15-ton make-up unit plus 15-ton HVAC with electric heat. The laboratory reagent water is provided through the US Filter deionizer system. Waste disposal containers are located in the laboratory and Clean Harbors serves as ESC's waste disposal company. ESC's building information guides and site plan are shown in Appendix I.

6.2 LABORATORY SAFETY

- Laboratory access is limited when work is being performed.
- All procedures where chemicals are prepared or splashes may occur are conducted in laboratory exhaust hoods.
- ESC's laboratory safety guidelines are detailed in *the ESC Chemical Hygiene Plan.*

7.0 SAMPLING PROCEDURES

7.1 FIELD SAMPLING PROCEDURES, SAMPLE STORAGE, AND HANDLING

- Field Sampling procedure is described in Appendix III of this ESC Quality Assurance Manual. Sample information is recorded and kept on the ESC chain of custody and field logbooks.
- Matrices for metals analysis are as follows: groundwater, wastewater, drinking water, soil, sludge, paint chips, wipes, filters, and leachates.
- Sample containers, preservation methods and holding times:
  - ➢ Glass containers are acceptable for all elements except Boron and Silicon. Plastic must be used for Boron and Silicon.
  - ➢ Water samples that are analyzed for dissolved metals must be filtered using a 0.45μm pore membrane. Water samples for total metals are not filtered. All water samples are acidified with 1+1 nitric acid to a pH<2. Filtered water samples (dissolved metals) are preserved immediately after filtration. All other water samples are preserved immediately after sampling. Water samples are not refrigerated prior to analysis.
  - ➢ Paint chips, dust wipes and filters do not require preservation.
  - ➢ Soil samples for all metals are stored not frozen but ≤6°C.
  - ➢ Hold times for all metals, except Mercury, are 180 days. Mercury has a hold time of 28 days.

8.0 EQUIPMENT

Instrument Software

- Agilent ICPMS 7700 and 7900 - Mass Hunter - Used for calibration, calculation, QC review, diagnostics, and data storage
- Thermo 7400 ICP - Qtegra - Used for calibration, calculation, QC, review, diagnostics, data storage
- Leeman Hydra II AA – Envoy - Used for calibration, calculation, QC review, diagnostics, data storage
- Perkin Elmer Fims 100- Winlab- Used for calibration, calculation, QC review, diagnostics, data storage

NOTE: All purchased software that is used in conjunction with software specific instruments is guaranteed by the supplier to function as required. The supplier of the software performs all troubleshooting or software upgrades and revisions.

8.1 EQUIPMENT LIST

Table 8.1 – LABORATORY EQUIPMENT LIST: MAJOR ITEMS - Metals Analysis and Preparation
This table is subject to revision without notice

Item	***Manufacturer***	***Model***	***Name***	***#***	***Serial number***	***Location***
Balance- Top Loading	Trobal	AGN100		1	701001026	Metals Prep Lab
Balance - Top Loading	Mettler Toledo	PB3002-5		1	1119070828	Metals Prep Lab
Balance - Top Loading	Mettler Toledo	PB3002-5		1	71242213216	Mercury Lab
Balance - Top Loading	Mettler Toledo	PB3002-5		1	1121462199	Metals Prep Lab
Hot Block	Env. Express	SC154	C	1	3994CEC1880	Metals Prep Lab
ICPMS with autosampler	Agilent	7700	ICPMS7	1	JP12482187	Metals Lab
ICPMS with autosampler	Agilent	7900	ICPMS8	1	JP14080166	Metals Lab
ICPMS with autosampler	Agilent	7900	ICPMS9	1	JP14400452	Metals Lab
ICP Simultaneous with autosampler	Thermo	7400	ICP12	1	IC74DC141801	Metals Lab
ICP Simultaneous with autosampler	Thermo	7400	ICP13	1	IC74DC143804	Metals Lab
ICP Simultaneous with autosampler	Thermo	7400	ICP14	1	IC74DC151103	Metals Lab
Hot Block	CPI	Mod Block	HGA	1	004412	Mercury Lab
Hot Block	CPI	Mod Block	HGB	1	604443	Mercury Lab
Hot Block	CPI	Mod Block	MPA	1	4430	Metals Prep Lab
Hot Block	CPI	Mod Block	MPB	1	4434	Metals Prep Lab
Mercury Auto Analyzer	Perkin Elmer	(1) FIMS 100	III	1	110156051101	Mercury Lab
Mercury Auto Analyzer	Perkin Elmer	FIMS 100	IV	1	101S11061403	Mercury Lab
Mercury Auto Analyzer	Leeman	Hydra II AA	HG5	1	Install #65043	Mercury Lab

Table 8.1 – LABORATORY EQUIPMENT LIST: MAJOR ITEMS - Metals Analysis and Preparation

This table is subject to revision without notice

Item	*Manufacturer*	*Model*	*Name*	*#*	*Serial number*	*Location*
Microwave	CEM	MARS Xpress	NA	1	MD-2861	Metals Prep Lab
Microwave	CEM	MARS Xpress	NA	1	MD-9972	Metals Prep Lab
Microwave	CEM	MARS Xpress	NA	1	MD-9640	Metals Prep Lab
Microwave	CEM	MARS Xpress	NA	1	MD-4692	Metals Prep Lab
Microwave	CEM	MARS 6	NA	1	MJ2771	Metals Prep
Microwave	CEM	MARS Xpress	NA	1	MD-7441	Metals Prep
Prep station	Seal Analytical	Deena II	NA	1	020050	Metals Prep
Prep Station	Env. Express	Automated prep station	Autoblock 3	1	AB1002-0708-001	Metals Prep Lab
TCLP Extraction Unit	Env. Express	6 Position	NA	1	NA	TCLP Lab
TCLP Extraction Unit	Env. Express	12 Position	NA	5	4803-12-542	TCLP Lab
TCLP Extraction Unit	Env. Express	12 Position	NA	5	1918-12-415	TCLP Lab
TCLP Extraction Unit	Env. Express	12 Position	NA	5	1918-12-414	TCLP Lab
TCLP Extraction Unit	Env. Express	12 Position	NA	5	5152-12-548	TCLP Lab
TCLP Extraction Unit	Env. Express	12 Position	NA	2	NA	TCLP Lab
TCLP Extraction Unit	Env. Express	12 Position	NA	2	NA	TCLP Lab
TCLP Extraction Unit	Env. Express	12 Position	NA	2	NA	TCLP Lab
TCLP Extraction Unit	Env. Express	12 Position	NA	2	NA	TCLP Lab
TCLP Extraction Unit	Env. Express	10 Position	NA	1	NA	TCLP Lab
TCLP Extraction Unit	Env. Express	Teflon Vessels	NA	12	NA	TCLP Lab
TCLP Zero Headspace Extractor	Env. Express	Vessels	NA	41	NA	TCLP Lab
Centrifuge	Thermo	Sovall ST40	NA	1	41179863	Metals Prep
Turbidimeter	HACH	2100N	NA	1	05090C020685	Metals Prep Lab
Water Purification - Nanopure	Elga	Pure Lab Ultra	NA	1	ULT00002665	Metals Prep Lab
PH Meter	Orion Versastar	VSTAR50	NA	1	V04967	TCLP Lab
Balance	Mettler Toledo			1	B246522879	TCLP Lab
Auto pipetters 1000µl to 20 µl	Oxford	Varies	NA		NA	Metals Lab
Auto pipetters	Eppendorf, Oxford	Varies	NA		NA	Metals Prep Lab
MAX/MIN Thermometer	Fischer Scientific	MAX/MIN	TCLP #1		122376671	TCLP Lab
Hotplate/Stirrer	Thermo Cimarec	SP88850100		1	C3010013111514115	TCLP Lab

8.2 EQUIPMENT PREVENTIVE MAINTENANCE, EQUIPMENT CALIBRATION

INSTRUMENT	P. M. DESCRIPTION	FREQUENCY
ICP and ICPMS	•Maintain manufacturer's service contract	Renew annually
ICP and ICPMS	•Pump tubing, torch alignment, o-ring, injector tip and torch	Check daily and adjust/change as needed
ICPMS	•Sampler and Skimmer cones	Clean or replace when needed
ICP and ICPMS	•Pump rollers	Clean and lubricate when needed
ICP and ICPMS	•Nebulizer	As needed
Mercury Analyzer	•Calibrate and check sensitivity with previous data	Daily with use
Mercury Analyzer	•Response factor problems, check tubing for leaks, particularly in pump head, and check cell for fogging	As needed
Mercury Analyzer	•Replace desiccant in tube	With each use
Mercury Analyzer	•Check rotometer for airflow, if inadequate, replace flex tubing in pump lead	As needed
TCLP Apparatus (ZHE)	•Change O-rings	As needed
Thermometer	•All working thermometers are compared to a NIST thermometer.	Semi-annually
pH Meter	•Calibrated according to manufacturer's instructions. •The slope is documented and acceptable range 95-105%	Daily
Analytical Balance	•Analytical balances are checked and calibrated by a certified technician semi-annually. •Calibration is checked daily with class S weights. Must be within 0.1% S class weights calibrated annually	Semi-annually Daily
TCLP Tumblers	•Visually timed and confirmed to be 30±2 rpm.	Monthly
Microwaves	•Checked and calibrated by a certified technician	Semi-annually, calibrated weekly by staff
Microwaves	Check cap membranes for leaks	As needed

8.3 STANDARDS AND REAGENTS

All reagents and standards must meet the requirements listed in the analytical methods.

Table 8.3A: Stock Standard sources, receipt, and preparation information.
(subject to revision as needed)

STOCK STANDARD SOURCES
****ICP metals used – Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, K, Li, Mg, Mn, Mo, Na, Ni, Pb, Sb, Se, Si, Sn, Sr, Ti, Tl, V, Zn, S***
****ICP/MS metals used – Ag, As, Ba, Be, Cd, Co, Cr, Cu, Fe, Mn, Mo, Ni, Pb, Sb, Se, Sn, Tl, V, Zn, B, U, Th, Na, Ca, Mg, K, Al, Ti, Sr***

Instrument Group/Standard	*Standard Source**	*How Received**	*Source/ Storage*	*Lab Stock Storage*	*Receipt Frequency*
ICP/CCVLL	Env. Express	4ppm-Al 2ppm- Fe 20ppm-Ca, K, Na, Mg, S 1ppm- B, Si, Zn, Sn, Ti 0.04ppm-Be, Cd 0.1ppm-Pb, Mo, Ba, Ag 0.2ppm-Cr, Co, Cu, Sb, As, Ni, Se, Tl Mn, Sr, 0.4ppm- V 0.3ppm- Li	Room temp.	2% HNO3 w/ Tr HF	Annual/Expiration Date
ICP (single element standards)	Env. Express or High Purity	1000ppm	Room temp.		Annual/Expiration Date
ICP/ICV	Inorganic Ventures	500ppm – Al. Ca, Fe, Mg, Na, K, S 50ppm – All others 20ppm - Sr	Room temp.	5% HNO3 w/ .5% HF	As needed
ICP/Calibration Standard and CCV	Env. Express/High Purity	1000ppm- Ca, K, Na 200ppm- Fe, Mg, Al 100ppm- S 40ppm- Si 20ppm-, As, B, Cu, Ni, Se, , Tl, , Mn,Ti, Li, V, Sr, Cr, Co, Zn 10ppm- Ag, Ba, Sb, Cd, Sn, Pb 5ppm- Mo 4ppm Be	Room temp.	5% HNO3 w/ Tr HF	As needed
ICP/LCS water/soil	Inorganic Ventures	1000ppm – Ca, Mg, K, Na 100ppm – all others except Li (spiked separately)	Room temp.	5% HNO3 w/Tr HF	As needed
ICP/LCS soil (only for IH)	ERA	Varies with Lot #	Room temp.	none	As needed
ICP/ICSA	Env. Express	5000ppm – Al, Ca, Mg, 2000ppm – Fe	Room temp.	10% HNO3	As needed
ICP/ICSB	Env. Express	100ppm – B, Cd, Pb, Ag, Ni, Si, Zn, 50ppm – all others except Sr, Li	Room temp.	4% HNO3 w/ Tr HF	As needed
ICP/Yttrium	Env. Express	10,000 ppm	Room temp.	4% HNO3	As needed
ICP/Indium	Env. Express	10,000ppm	Room temp.	2%HNO3	As needed
ICPMS/ICV	Inorganic Ventures	1000ppm-Ca, Mg, K, Na, Al, Fe 10ppm- all others	Room temp.	5% HNO3 w/ Tr HF	As needed

Table 8.3A: Stock Standard sources, receipt, and preparation information.

(subject to revision as needed)

STOCK STANDARD SOURCES

****ICP metals used – Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, K, Li, Mg, Mn, Mo, Na, Ni, Pb, Sb, Se, Si, Sn, Sr, Ti, Tl, V, Zn, S***

****ICP/MS metals used – Ag, As, Ba, Be, Cd, Co, Cr, Cu, Fe, Mn, Mo, Ni, Pb, Sb, Se, Sn, Tl, V, Zn, B, U, Th, Na, Ca, Mg, K, Al, Ti, Sr***

Instrument Group/Standard	***Standard Source****	***How Received****	***Source/ Storage***	***Lab Stock Storage***	***Receipt Frequency***
ICPMS/ Calibration Standard and CCV	Env. Express	100 ppm- Al, Fe 1000ppm-Mg, K, Ca, , Na 10ppm- All others	Room temp.	2% HNO3 w/ Tr HF	As needed
ICPMS/LCS water/soil	Inorganic Ventures	1000ppm – Ca, Mg, K, Na, Al, Fe 10ppm – all others	Room temp.	5% HNO3	As needed
ICPMS/LCS soil (for IH only)	ERA	Varies with Lot #	Room temp.	none	As needed
ICPMS/ICSA	Inorganic Ventures	10000ppm – Cl 2000ppm – C 1000ppm – Al, Ca, Fe, Mg, P, K, Na, S 20ppm – Mo, Ti	Room temp.	1.4% HNO3	As needed
ICPMS/ICSB	Inorganic Ventures	2ppm – Sb, As, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, Sn, Zn, B, Ba, Cr, Mn, Sr, Th, V, U	Room temp.	5%HNO3 w/ Tr HF	As needed
Hg/ICV and LCS	Inorganic Ventures	1000ppm – Hg	Room temp.	2% HNO3	As needed
Hg/Calibration Standard and CCV	Env. Express	1000ppm – Hg	Room temp.	2% HNO3	As needed

**Equivalent Providers may be utilized.*

Table 8.3B: Working standard concentration, storage and preparation information.

(subject to revision as needed)

WORKING STANDARD PREPARATION

****ICP metals used – Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, K, Li, Mg, Mn, Mo, Na, Ni, Pb, Sb, Se, Si, Sn, Sr, Ti, Tl, V, Zn, S***

****ICP/MS metals used – Ag, As, Ba, Be, Cd, Co, Cr, Cu, Fe, Mn, Mo, Ni, Pb, Sb, Se, Sn, Tl, V, Zn, B, U, Th, Na, Ca, Mg, K, Al, Ti, Sr***

Instrument Group/Standard	***How Prepared***	***Final Concentration***	***Source/ Storage***	***Expiration***
ICP/ICV	2mL Custom Stock ICV A and B, adjusted to 100mL with 10% HNO3	10ppm – Al, Ca, Fe, K, Mg, Na 1ppm – All others	Room temp.	1 month
ICP/Calibration Standard	12.5mL Stock Cal. Std. 5mL Stock Cal. Std. 1mL Stock Cal. Std. 5mL Stock LL Std.All adjusted to 100 mL with 10%HNO3	Std 4 – 0.05/1.25/2.5/3.75/5/7.5/12.5/25/125ppm Std 3 0.2/.5/1/1.5/2/3/5/10/50ppm Std 2 – .04/.1/.2/.3/.4/.6/2/10ppm Std 1 – 0.002/.005/.01/.015/.02/.03/.01/.5/1ppm	Room temp.	1 month

Table 8.3B: Working standard concentration, storage and preparation information.

(subject to revision as needed)

WORKING STANDARD PREPARATION

ICP metals used – Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, K, Li, Mg, Mn, Mo, Na, Ni, Pb, Sb, Se, Si, Sn, Sr, Ti, Tl, V, Zn, S

ICP/MS metals used – Ag, As, Ba, Be, Cd, Co, Cr, Cu, Fe, Mn, Mo, Ni, Pb, Sb, Se, Sn, Tl, V, Zn, B, U, Th, Na, Ca, Mg, K, Al, Ti, Sr

Instrument Group/Standard	*How Prepared*	*Final Concentration*	*Source/ Storage*	*Expiration*
ICP/CCV	50mL Custom Stock CCV adjusted to 1000mL with 10% HNO_3	50ppm- Ca, K, Na 10ppm- Fe, Mg, Al 5ppm- S 2ppm-, Si, 1ppm- Cr, Co, Mn, , Sr, Ti, V, As, B, Cu, Li, Ni, Se, Tl, Zn 0.5ppm- Sn, Ag, Pb, Cd, Ba, Sb 0.2ppm Be, Mo	Room temp.	1 month
ICP/ICSA	100mL Custom Stock ICSA adjusted to 1000mL with10% HNO_3	500ppm – Al, Ca, Mg, 200ppm – Fe	Room temp.	1 month
ICP/ICSAB	100mL Custom Stock ICSA, 10mL Stock ICSAB adjusted to 1000mL with 10% HNO_3	500ppm – Al, Ca, Mg, 200ppm – Fe 1ppm – B, Cd, Pb, Ag, Ni, Si, Zn, 0.5ppm – all others except Sr, Li, S, K, Na	Room temp.	1 month
ICP/Yttrium	5mL Stock Yttrium adjusted to 10L with 10% HNO_3	5 ppm	Room temp.	1 month
ICP/Indium	3mL stock Indium adjusted to 1L with 10% HNO_3	30ppm	Room temp.	1 month
ICPMS/ICV	0.5mL Stock ICV A and B, adjusted to 50mL with 2% HNO_3/0.5%HCl	10ppm Ca, Mg, K, Na, Fe, Al 0.1ppm for all other elements	Room temp.	1 month
ICPMS/ Calibration Standard	1mL Stock Cal Std adjusted to 50mL with 2%HNO_3/0.5%HCl. Serial Dilutions are done each calibration from 0.2ppm Std.	Cal 6 – 20ppm, 2ppm, 0.2ppm Cal 5 – 10ppm, 1ppm, 0.1ppm Cal 4 – 5ppm, 0.5ppm, 0.05ppm Cal 3 – 1ppm, 0.1ppm, 0.01ppm Cal 2 – 0.2ppm, 0.02ppm, 0.002ppm Cal 1 – 0.1ppm, 0.01ppm, 0.001ppm	Room temp.	1 month
ICPMS/CCV	0.5mL Stock CCV adjusted to 50mL with 2% HNO_3/0.5%HCl.	10ppm- Ca, Mg, Na, K 1ppm-Fe, Al 0.1ppm- all other elements	Room temp.	1 month
ICPMS/ICSA	5mL Stock ICSA adjusted to 50mL with 2% HNO_3/0.5%HCl.	1000ppm – Cl 200ppm – C 100ppm – Al, Ca, Fe, Mg, P, K, Na, S 2ppm – Mo, Ti	Room temp.	1 month
ICPMS/ICSAB	5mL Stock ICSA, .5mL StockA and B ICSAB adjusted to 50mL with 2% HNO_3/0.5%HCl	1000ppm – Cl 200ppm – C 100ppm – Al, Ca, Fe, Mg, P, K, Na, S 2ppm – Mo, Ti 0.02ppm – all other elements	Room temp.	1Month
Hg/ICV	90µL of 1ppm Intermediate	0.003ppm – Hg	Room temp.	1Month

Table 8.3B: Working standard concentration, storage and preparation information.
(subject to revision as needed)

WORKING STANDARD PREPARATION
****ICP metals used – Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, K, Li, Mg, Mn, Mo, Na, Ni, Pb, Sb, Se, Si, Sn, Sr, Ti, Tl, V, Zn, S***
****ICP/MS metals used – Ag, As, Ba, Be, Cd, Co, Cr, Cu, Fe, Mn, Mo, Ni, Pb, Sb, Se, Sn, Tl, V, Zn, B, U, Th, Na, Ca, Mg, K, Al, Ti, Sr***

Instrument Group/Standard	***How Prepared***	***Final Concentration***	***Source/ Storage***	***Expiration***
Hg/Calibration Standard	Soils and waters: Std 6 - 300µL of 1ppm Intermediate Std 5 - 150µL of 1ppmIntermediate Std 4 - 60µL of 1ppm Intermediate Std 3 -30µL of 1ppm Intermediate Std 2 - 12µL of 1ppm Intermediate Std 1 - 6µL of 1ppmIntermediate	Std 6 – 0.01ppm Std 5 – 0.005ppm Std 4 – 0.002ppm Std 3 – 0.001ppm Std 2 – 0.0004ppm Std 1 – 0.0002ppm	Room temp.	4 days
Hg/CCV	2.5ppb CCV - 75µL of 1ppm Intermediate	0.0025ppm	Room temp.	1 Month
Hg/LCS Waters	90µL of 1ppm Intermediate	0.003ppm – Hg	Room temp.	1 Month
Hg/LCS Soils	90uL of 1ppm Intermediate	0.003ppm- Hg	Room temp.	1 Month

8.4 INSTRUMENT CALIBRATION

Mercury Analyzer - SOP Numbers 340384A & 340384B

Calibration of the mercury analyzer is achieved using 5 standards. Acceptable calibration is achieved when the correlation coefficient ≥0.995. All results are calculated using software based on the peak area of the sample. A second source ICV is analyzed initially and must recover within ±10% for Methods 7470A/7471A/7471B and within ±5% for method 245.1. A primary source CCV is analyzed after every tenth sample and at the conclusion of the analytical sequence. The CCV must recovery within ±10% for all analyses. Spike analyses are performed on 5% of the samples analyzed using EPA Method 7470A/7471A/7471B and on 10% of the samples analyzed using EPA Method 245.1.

Inductively Coupled Plasma (ICP and ICPMS) - SOP Numbers 340386 & 340390

, Thermo 7400 ICP and Agilent ICPMS 7700, 7900 and calibrated using at least 3 standards. A new calibration curve is analyzed daily. All calculations are performed by software using computerized linear regression. The linear regression correlation coefficient for the each analyte in the calibration curve lines must be 0.995 or better for all methods, except for EPA 6010C and 6020A which must have a correlation coefficient of 0.998 or better, A second source ICV is run initially and a primary source CCV is run after every tenth sample. For method 200.7, the ICV must recover within 5% of the true value and for all other methods, the ICV must recover within 10% for methods 6010B/C/D, 6020, 6020A/B, and 200.8. The CCV for all methods must recover within 10% of the true value. Duplicate and spike analyses are performed on 5% of the samples for EPA Methods 6010B, 6010C, 6010D, 6020, 6020A, 6020B and on 10% of the samples analyzed using EPA Methods 200.7 & 200.8.

TABLE 8.4: CALIBRATION STANDARD CONCENTRATIONS

This table is subject to revision without notice

Analyte	**ICP (mg/L)**	**ICP/MS (mg/L)**	**CVAA (ug/L)**
Aluminum	0.20 - 500	0.01 - 2.0	
Antimony	0.01 – 5.0	0.001 - 0.2	
Arsenic	0.01 – 5.0	0.001 - 0.2	
Barium	0.005 - 10	0.001 - 0.2	
Beryllium	0.002 – 2.0	0.001 - 0.2	
Boron	0.05 – 5.0	0.001 - 0.2	
Cadmium	0.002 – 2.0	0.001 - 0.2	
Calcium	0.5 - 500	1.0 - 20.0	
Chromium	0.01 – 2.5	0.001 - 0.2	
Cobalt	0.01 – 2.5	0.001 - 0.2	
Copper	0.01 – 5.0	0.001 - 0.2	
Iron	0.10- 200	0.01 - 2.0	
Lead	0.005 – 2.0	0.001 - 0.2	
Lithium	0.015 – 3.75	----------------	
Magnesium	0.5 - 500	1.0 - 20.0	
Manganese	0.010 – 2.5	0.001 - 0.2	
Molybdenum	0.005 – 2.0	0.001 - 0.2	
Nickel	0.01 – 5.0	0.001 - 0.2	
Potassium	0.50 - 100	1.0 - 20.0	
Selenium	0.01 – 5.0	0.001 - 0.2	
Silicon	0.05 – 5.0	----------------	
Silver	0.005 – 2.5	0.001 - 0.2	
Sodium	0.50 - 500	1.0 - 20.0	
Strontium	0.01 – 2.5	0.001 - 0.2	
Sulfur	0.5 - 100	----------------	
Thallium	0.01 – 5.0	0.001 - 0.2	
Thorium	----------------	0.001 - 0.2	
Tin	0.05 – 5.0	0.001 - 0.2	
Titanium	0.05 – 2.5	0.001 - 0.2	
Uranium	----------------	0.001 - 0.2	
Vanadium	0.02 – 2.5	0.001 - 0.2	
Zinc	0.05 – 7.5	0.001 - 0.2	
Mercury			Blank, 0.0002 - 0.010

8.5 ACCEPTANCE/REJECTION OF CALIBRATION

The initial calibration curve is compared with previous curves for the same analyte. All new standard curves are immediately checked with a secondary source or laboratory control standard prepared from a separate source than those used for calibration. All curves are visually reviewed to ensure that acceptable correlation represents linearity. Calibration curves may be rejected for nonlinearity, abnormal sensitivity, or poor response of the laboratory control standard. Specific criteria for each instrument are outlined in Table 8.5.

Continuing calibration verification is performed after every tenth sample. If a check standard does not perform within established criteria then the instrument is evaluated to determine the problem. Once the problem is corrected, all samples between the last in control sample and the first out of control check are re-analyzed.

TABLE 8.5 INSTRUMENT CALIBRATION & QC

Instrument (Analysis)	**Calibration Type**	**Number of Standards**	**Acceptance/ Rejection Criteria**	**Frequency**
ICP & ICPMS	Linear/ Initial	3 - 5	6010B, 6020, 200.7 200.8: Must have a correlation coefficient of at least 0.995. 6010C/D, 6020A/B: Must have a correlation coefficient of at least 0.998	Daily
ICP & ICPMS	Initial	Secondary source (ICV)	6010B, 6010C/D, 6020, 6020A/B, 200.8: ICV must be within +/-10%; 200.7: ICV must be within +/-5%	After initial calibration
ICP & ICPMS	Initial	1 Initial Calibration Blank	< ½ RL, concentrations of common laboratory contaminants shall not exceed the RL	After initial calibration
ICP, ICPMS, Mercury	Continuing	1 mid-level ref. std. (CCV)	Must be within ±10%	Every 10th sample
ICP & ICPMS, Mercury	Continuing	1 Continuing Calibration Blank	< RL, concentrations of common laboratory contaminants must not exceed the RL	Every 10th sample
ICP & ICPMS	Continuing	1 ICSA 1 ICSAB	Must be within ±20% for ICP and ICPMS	After initial calibration, at end and every 8 hours of run time.
ICP, ICPMS, Mercury	Continuing	1 Method Blank	< RL (<1/2 RL for DOD).	1 per batch
ICP, ICPMS, Mercury	Continuing	1 Laboratory Control Standard	200.8, 200.7, 245.1: LCS must be within 15%. 6010B, 6010C/D,6020, 6020A/B,7470A, 7471A/B must be within 20%	1 per batch
ICP & ICPMS	Continuing	1 Matrix Spike (MS), 1 Matrix Spike Duplicate (MSD)	6010B, 6010C/D, 6020, 6020A/B: Spike must be within ±25%, 200.8, 200.7 must be within 30%. MS and MSD must have an RPD ≤20%	1 of each per batch

TABLE 8.5 INSTRUMENT CALIBRATION & QC

Instrument (Analysis)	Calibration Type	Number of Standards	Acceptance/ Rejection Criteria	Frequency
Mercury	Linear/ Initial	3 - 5	Must have a correlation coefficient of at least 0.995	Daily
Mercury	Initial	Secondary source (ICV)	7470A, 7471: ICV must be within ±10% 245.1: ICV must be within ±5%	After initial calibration
Mercury	Continuing	1 Matrix Spike (MS), 1 Matrix Spike Duplicate (MSD)	7470A, 7471A/B: Spike must be within ±25%, 245.1 must be within 30%. MS and MSD must have an RPD ≤20%	1 of each per batch

9.0 LABORATORY PRACTICES

9.1 REAGENT GRADE WATER

Reagent grade water is obtained from an ELGA Purelab Ultra system.

9.2 GLASSWARE WASHING AND STERILIZATION PROCEDURES

Much of the glassware used in metals preparation is disposable; however non-disposable glassware involved in metals preparation is washed with soap and water, rinsed in 1+1 nitric acid, and rinsed in DI water. Through digestion blanks, it has been determined that chromic acid washing is unnecessary. Glassware with visible gummy deposits remaining after washing is disposed of properly. All metals glassware is given another DI water rinse immediately prior to use. Metals glassware is segregated from all other glassware.

10.0 ANALYTICAL PROCEDURES

10.1 A list of laboratory SOPs associated with the metals laboratory can be found in the following table.

TABLE 10.1: METALS DEPARTMENT SOPS

This table is subject to revision without notice

SOP #	Title
TCLP SOPs	
340358	TCLP
340704	SPLP
340363	EP TOX
340364	MEP
340705	California Waste Extraction Test
Mercury SOPs	
340384A	Mercury in Liquid Waste (Cold-Vapor Technique) 7470A/245.1
340384B	Mercury in Solid Waste (Cold-Vapor Technique) 7471A
Metals Prep SOPs	
340389	Acid Digestion of Aqueous Samples and Extracts Method 3005A/3010A/3015/3030C
340380	Digestion of Metals and Trace Elements in DW and Wastes Method 200.2
340388	Acid Digestion of Sediments, Sludge, Soils and Oils Method 3050B/3051

SOP #	Title
340354A	Turbidity-Metals Drinking Water Screen Only (EPA Method 180.1)
340392	Sodium Absorption Ratio
Metals Analysis SOPs	
340386	Metals by ICP Method 6010, 200.7
340390	Metals by ICP-MS Method 6020, 200.8

11.0 QUALITY CONTROL CHECKS

NOTE: For specific guidance on each determinative method, including required quality control and specific state requirements/modifications, refer to the relevant laboratory standard operating procedure(s).

11.1 ESC participates in proficiency testing (PTs) in support of various laboratory accreditations/recognitions. Environmental samples are purchased from Phenova. The WS, WP and solid matrix studies are completed every 6 months. All proficiency testing samples are received and analyzed by method according to the vendor's instructions and according to the applicable analytical SOP.

11.2 Initial Demonstrations of Capability (IDOCs) are performed during new analyst training and/or prior to acceptance and use of any new method/instrumentation. Continuing Demonstration of Capability (CDOCs) must be updated at least annually. The associated data is filed within the department and available for review.

11.3 Matrix Spike and Matrix Spike Duplicates are performed on 5–10% of samples analyzed depending on analytical method requested. For methods 6010, 6020, 7470A and 7471A duplicates, matrix spikes and matrix spike duplicates are performed on 5% of samples. For methods 200.7, 200.8 and 245.1, the same QC is performed on 10% of samples. The RPD must not exceed 20%.

11.4 A laboratory control sample (LCS) is analyzed one per batch of samples. The acceptance criteria for all water samples is ±15% for 245.1, 200.7, and 200.8. All other methods have an acceptance criteria of ±20%.

11.5 A method preparation blank is performed per batch of samples processed. If the reporting limit [RL] is exceeded, the laboratory evaluates whether reprocessing of the samples is necessary, based on the following criteria:

- The blank contamination exceeds a concentration greater than 1/10 of the measured concentration of any sample in the associated preparation batch or
- The blank contamination is greater than 1/10 of the specified regulatory limit.

The concentrations of common laboratory contaminants must not exceed the reporting limit. Any samples associated with a blank that fail these criteria are re-processed in a subsequent preparation batch, except when the sample analysis resulted in non-detected results for the failing analytes.

12.0 DATA REDUCTION, VALIDATION, AND REPORTING

12.1 DATA REDUCTION

The analyst performs the data calculation and is responsible for the initial examination of the finished data. Data reduction steps applied to the raw data are outlined in ESC SOP #030201, *Data Handling and Reporting.* A secondary review of the data package is performed according to ESC SOP #030227, *Data Review*. The reviewer verifies that the analysis has been performed as required and meets method criteria, all associate data is present and complete, and also ensures that any additional documentation is completed as required (i.e. Ohio VAP checklists, required flags on test reports, etc.)

12.2 VALIDATION

The validation process consists of data generation, reduction review, and reporting results. Once data reduction is complete, validation is conducted by verification that the QC samples are within acceptable QC limits and that all documentation is complete, including the analytical report and associated QC. See Table 12.1 for current QC targets and controls and current reporting limits.

12.3 REPORTING

Reporting procedures are documented in SOP #030201, *Data Handling and Reporting.*

Table 12.3: QC Targets for Environmental Metals Accuracy (LCS), Precision and RLs

(subject to revision without notice)

Class	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Precision (RPD)	RL (ppm)
(ICP-AES)	Aluminum	200.2 NPDES	200.7	Liquid/Aqueous	85 - 115	<20	0.20
(ICP-AES)	Aluminum	3015/3010	6010B/C/D	Liquid/Aqueous	80 - 120	<20	0.20
(ICP-AES)	Aluminum	3050B/3051A	6010B/C/D	Solid	80 - 120	<20	10
(ICP-MS)	Aluminum	200.2 NPDES	200.8	Liquid/Aqueous	85 - 115	<20	0.10
(ICP-MS)	Aluminum	3015/3010	6020/A/B	Liquid/Aqueous	80 - 120	<20	0.1
(ICP-MS)	Aluminum	3050B/3051A	6020/A/B	Solid	80 - 120	<20	10
(ICP-AES)	Antimony	200.2 NPDES	200.7	Liquid/Aqueous	85 - 115	<20	0.01
(ICP-AES)	Antimony	3015/3010	6010B/C/D	Liquid/Aqueous	80 - 120	<20	0.01
(ICP-AES)	Antimony	3050B/3051A	6010B/C/D	Solid	80 - 120	<20	2.0
(ICP-MS)	Antimony	200.2 NPDES	200.8	Liquid/Aqueous	85 - 115	<20	0.001
(ICP-MS)	Antimony	3015/3010	6020/A/B	Liquid/Aqueous	80 - 120	<20	0.002
(ICP-MS)	Antimony	3050B/3051A	6020/A/B	Solid	80 - 120	<20	0.10
(ICP-AES)	Arsenic	200.2 NPDES	200.7	Liquid/Aqueous	85 - 115	<20	0.01
(ICP-AES)	Arsenic	3015/3010	6010B/C/D	Liquid/Aqueous	80 - 120	<20	0.01
(ICP-AES)	Arsenic	3050B/3051A	6010B/C/D	Solid	80 - 120	<20	2.0
(ICP-MS)	Arsenic	200.2 NPDES	200.8	Liquid/Aqueous	85 - 115	<20	0.001

Table 12.3: QC Targets for Environmental Metals Accuracy (LCS), Precision and RLs

(subject to revision without notice)

Class	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Precision (RPD)	RL (ppm)
(ICP-MS)	Arsenic	3015/3010	6020/A/B	Liquid/Aqueous	80 - 120	<20	0.002
(ICP-MS)	Arsenic	3050B/3051A	6020/A/B	Solid	80 - 120	<20	0.10
(ICP-AES)	Barium	200.2 NPDES	200.7	Liquid/Aqueous	85 - 115	<20	0.005
(ICP-AES)	Barium	3015/3010	6010B/C/D	Liquid/Aqueous	80 - 120	<20	0.005
(ICP-AES)	Barium	3050B/3051A	6010B/C/D	Solid	80 - 120	<20	0.50
(ICP-MS)	Barium	200.2 NPDES	200.8	Liquid/Aqueous	85 - 115	<20	0.002
(ICP-MS)	Barium	3015/3010	6020/A/B	Liquid/Aqueous	80 - 120	<20	0.005
(ICP-MS)	Barium	3050B/3051A	6020/A/B	Solid	80 - 120	<20	0.20
(ICP-AES)	Beryllium	200.2 NPDES	200.7	Liquid/Aqueous	85 - 115	<20	0.002
(ICP-AES)	Beryllium	3015/3010	6010B/C/D	Liquid/Aqueous	80 - 120	<20	0.002
(ICP-AES)	Beryllium	3050B/3051A	6010B/C/D	Solid	80 - 120	<20	0.20
(ICP-MS)	Beryllium	200.2 NPDES	200.8	Liquid/Aqueous	85 - 115	<20	0.001
(ICP-MS)	Beryllium	3015/3010	6020/A/B	Liquid/Aqueous	80 - 120	<20	0.002
(ICP-MS)	Beryllium	3050B/3051A	6020/A/B	Solid	80 - 120	<20	0.10
(ICP-AES)	Boron	200.2 NPDES	200.7	Liquid/Aqueous	85 - 115	<20	0.20
(ICP-AES)	Boron	3015/3010	6010B/C/D	Liquid/Aqueous	80 - 120	<20	0.20
(ICP-AES)	Boron	3050B/3051A	6010B/C/D	Solid	80 - 120	<20	10
(ICP-MS)	Boron	200.2 NPDES	200.8	Liquid/Aqueous	85 - 115	<20	0.02
(ICP-MS)	Boron	3015/3010	6020/A/B	Liquid/Aqueous	80 - 120	<20	0.02
(ICP-MS)	Boron	3050B/3051A	6020/A/B	Solid	80 - 120	<20	1.0
(ICP-AES)	Cadmium	200.2 NPDES	200.7	Liquid/Aqueous	85 - 115	<20	0.002
(ICP-AES)	Cadmium	3015/3010	6010B/C/D	Liquid/Aqueous	80 - 120	<20	0.002
(ICP-AES)	Cadmium	3050B/3051A	6010B/C/D	Solid	80 - 120	<20	0.50
(ICP-MS)	Cadmium	200.2 NPDES	200.8	Liquid/Aqueous	85 - 115	<20	0.001
(ICP-MS)	Cadmium	3015/3010	6020/A/B	Liquid/Aqueous	80 - 120	<20	0.001
(ICP-MS)	Cadmium	3050B/3051A	6020/A/B	Solid	80 - 120	<20	0.10
(ICP-AES)	Calcium	200.2 NPDES	200.7	Liquid/Aqueous	85 - 115	<20	1.0
(ICP-AES)	Calcium	3015/3010	6010B/C/D	Liquid/Aqueous	80 - 120	<20	1.0
(ICP-AES)	Calcium	3050B/3051A	6010B/C/D	Solid	80 - 120	<20	100
(ICP-MS)	Calcium	200.2 NPDES	200.8	Liquid/Aqueous	85 - 115	<20	1.0
(ICP-MS)	Calcium	3015/3010	6020/A/B	Liquid/Aqueous	80 - 120	<20	1.0
(ICP-MS)	Calcium	3050B/3051A	6020/A/B	Solid	80 - 120	<20	50
(ICP-AES)	Chromium	200.2 NPDES	200.7	Liquid/Aqueous	85 - 115	<20	0.01
(ICP-AES)	Chromium	3015/3010	6010B/C/D	Liquid/Aqueous	80 - 120	<20	0.01
(ICP-AES)	Chromium	3050B/3051A	6010B/C/D	Solid	80 - 120	<20	1.0
(ICP-MS)	Chromium	200.2 NPDES	200.8	Liquid/Aqueous	85 - 115	<20	0.001
(ICP-MS)	Chromium	3015/3010	6020/A/B	Liquid/Aqueous	80 - 120	<20	0.002
(ICP-MS)	Chromium	3050B/3051A	6020/A/B	Solid	80 - 120	<20	0.10

Table 12.3: QC Targets for Environmental Metals Accuracy (LCS), Precision and RLs

(subject to revision without notice)

Class	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Precision (RPD)	RL (ppm)
(ICP-AES)	Cobalt	200.2 NPDES	200.7	Liquid/Aqueous	85 - 115	<20	0.01
(ICP-AES)	Cobalt	3015/3010	6010B/C/D	Liquid/Aqueous	80 - 120	<20	0.01
(ICP-AES)	Cobalt	3050B/3051A	6010B/C/D	Solid	80 - 120	<20	1.0
(ICP-MS)	Cobalt	200.2 NPDES	200.8	Liquid/Aqueous	85 - 115	<20	0.001
(ICP-MS)	Cobalt	3015/3010	6020/A/B	Liquid/Aqueous	80 - 120	<20	0.002
(ICP-MS)	Cobalt	3050B/3051A	6020/A/B	Solid	80 - 120	<20	0.10
(ICP-AES)	Copper	200.2 NPDES	200.7	Liquid/Aqueous	85 - 115	<20	0.01
(ICP-AES)	Copper	3015/3010	6010B/C/D	Liquid/Aqueous	80 - 120	<20	0.01
(ICP-AES)	Copper	3050B/3051A	6010B/C/D	Solid	80 - 120	<20	2.0
(ICP-MS)	Copper	200.2 NPDES	200.8	Liquid/Aqueous	85 - 115	<20	0.002
(ICP-MS)	Copper	3015/3010	6020/A/B	Liquid/Aqueous	80 - 120	<20	0.005
(ICP-MS)	Copper	3050B/3051A	6020/A/B	Solid	80 - 120	<20	0.20
(ICP-AES)	Iron	200.2 NPDES	200.7	Liquid/Aqueous	85 - 115	<20	0.10
(ICP-AES)	Iron	3015/3010	6010B/C/D	Liquid/Aqueous	80 - 120	<20	0.10
(ICP-AES)	Iron	3050B/3051A	6010B/C/D	Solid	80 - 120	<20	10
(ICP-MS)	Iron	200.2 NPDES	200.8	Liquid/Aqueous	85 - 115	<20	0.10
(ICP-MS)	Iron	3015/3010	6020/A/B	Liquid/Aqueous	80 - 120	<20	0.10
(ICP-MS)	Iron	3050B/3051A	6020/A/B	Solid	80 - 120	<20	250
(ICP-AES)	Lead	200.2 NPDES	200.7	Liquid/Aqueous	85 - 115	<20	0.005
(ICP-AES)	Lead	3015/3010	6010B/C/D	Liquid/Aqueous	80 - 120	<20	0.005
(ICP-AES)	Lead	3050B/3051A	6010B/C/D	Solid	80 - 120	<20	0.50
(ICP-MS)	Lead	200.2 NPDES	200.8	Liquid/Aqueous	85 - 115	<20	0.001
(ICP-MS)	Lead	3015/3010	6020/A/B	Liquid/Aqueous	80 - 120	<20	0.002
(ICP-MS)	Lead	3050B/3051A	6020/A/B	Solid	80 - 120	<20	0.10
(ICP-AES)	Lithium	200.2 NPDES	200.7	Liquid/Aqueous	85 - 115	<20	0.015
(ICP-AES)	Lithium	3015/3010	6010B/C/D	Liquid/Aqueous	80 - 120	<20	0.015
(ICP-AES)	Lithium	3050B/3051A	6010B/C/D	Solid	80 - 120	<20	5.0
(ICP-AES)	Magnesium	200.2 NPDES	200.7	Liquid/Aqueous	85 - 115	<20	1.0
(ICP-AES)	Magnesium	3015/3010	6010B/C/D	Liquid/Aqueous	80 - 120	<20	1.0
(ICP-AES)	Magnesium	3050B/3051A	6010B/C/D	Solid	80 - 120	<20	100
(ICP-MS)	Magnesium	200.2 NPDES	200.8	Liquid/Aqueous	85 - 115	<20	1.0
(ICP-MS)	Magnesium	3015/3010	6020/A/B	Liquid/Aqueous	80 - 120	<20	1.0
(ICP-MS)	Magnesium	3050B/3051A	6020/A/B	Solid	80 - 120	<20	50
(ICP-AES)	Manganese	200.2 NPDES	200.7	Liquid/Aqueous	85 - 115	<20	0.01
(ICP-AES)	Manganese	3015/3010	6010B/C/D	Liquid/Aqueous	80 - 120	<20	0.01
(ICP-AES)	Manganese	3050B/3051A	6010B/C/D	Solid	80 - 120	<20	1.0
(ICP-MS)	Manganese	200.2 NPDES	200.8	Liquid/Aqueous	85 - 115	<20	0.002
(ICP-MS)	Manganese	3015/3010	6020/A/B	Liquid/Aqueous	80 - 120	<20	0.005

Table 12.3: QC Targets for Environmental Metals Accuracy (LCS), Precision and RLs

(subject to revision without notice)

Class	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Precision (RPD)	RL (ppm)
(ICP-MS)	Manganese	3050B/3051A	6020/A/B	Solid	80 - 120	<20	0.20
(CVAA)	Mercury	7471A/B	7471A/B	Solid	80 - 120	<20	0.02
(CVAA)	Mercury	7470A	7470A	Liquid/Aqueous	80 - 120	<20	0.0002
(CVAA)	Mercury	245.1 /7470A	245.1	Liquid/Aqueous	85 - 115	<20	0.0002
(ICP-AES)	Molybdenum	200.2 NPDES	200.7	Liquid/Aqueous	85 - 115	<20	0.005
(ICP-AES)	Molybdenum	3015/3010	6010B/C/D	Liquid/Aqueous	80 - 120	<20	0.005
(ICP-AES)	Molybdenum	3050B/3051A	6010B/C/D	Solid	80 - 120	<20	0.50
(ICP-MS)	Molybdenum	200.2 NPDES	200.8	Liquid/Aqueous	85 - 115	<20	0.002
(ICP-MS)	Molybdenum	3015/3010	6020/A/B	Liquid/Aqueous	80 - 120	<20	0.005
(ICP-MS)	Molybdenum	3050B/3051A	6020/A/B	Solid	80 - 120	<20	0.20
(ICP-AES)	Nickel	200.2 NPDES	200.7	Liquid/Aqueous	85 - 115	<20	0.01
(ICP-AES)	Nickel	3015/3010	6010B/C/D	Liquid/Aqueous	80 - 120	<20	0.01
(ICP-AES)	Nickel	3050B/3051A	6010B/C/D	Solid	80 - 120	<20	2.0
(ICP-MS)	Nickel	200.2 NPDES	200.8	Liquid/Aqueous	85 - 115	<20	0.001
(ICP-MS)	Nickel	3015/3010	6020/A/B	Liquid/Aqueous	80 - 120	<20	0.002
(ICP-MS)	Nickel	3050B/3051A	6020/A/B	Solid	80 - 120	<20	0.10
(ICP-AES)	Potassium	200.2 NPDES	200.7	Liquid/Aqueous	85 - 115	<20	1.0
(ICP-AES)	Potassium	3015/3010	6010B/C/D	Liquid/Aqueous	80 - 120	<20	1.0
(ICP-AES)	Potassium	3050B/3051A	6010B/C/D	Solid	80 - 120	<20	100
(ICP-MS)	Potassium	200.2 NPDES	200.8	Liquid/Aqueous	85 - 115	<20	1.0
(ICP-MS)	Potassium	3015/3010	6020/A/B	Liquid/Aqueous	80 - 120	<20	1.0
(ICP-MS)	Potassium	3050B/3051A	6020/A/B	Solid	80 - 120	<20	50
(ICP-AES)	Selenium	200.2 NPDES	200.7	Liquid/Aqueous	85 - 115	<20	0.01
(ICP-AES)	Selenium	3015/3010	6010B/C/D	Liquid/Aqueous	80 - 120	<20	0.01
(ICP-AES)	Selenium	3050B/3051A	6010B/C/D	Solid	80 - 120	<20	2.0
(ICP-MS)	Selenium	200.2 NPDES	200.8	Liquid/Aqueous	85 - 115	<20	0.001
(ICP-MS)	Selenium	3015/3010	6020/A/B	Liquid/Aqueous	80 - 120	<20	0.002
(ICP-MS)	Selenium	3050B/3051A	6020/A/B	Solid	80 - 120	<20	0.10
(ICP-AES)	Silicon	200.2 NPDES	200.7	Liquid/Aqueous	85 - 115	<20	0.20
(ICP-AES)	Silicon	3015/3010	6010B/C/D	Liquid/Aqueous	80 - 120	<20	0.20
(ICP-AES)	Silicon	3050B/3051A	6010B/C/D	Solid	80 - 120	<20	20
(ICP-AES)	Silver	200.2 NPDES	200.7	Liquid/Aqueous	85 - 115	<20	0.005
(ICP-AES)	Silver	3015/3010	6010B/C/D	Liquid/Aqueous	80 - 120	<20	0.005
(ICP-AES)	Silver	3050B/3051A	6010B/C/D	Solid	80 - 120	<20	1.0
(ICP-MS)	Silver	200.2 NPDES	200.8	Liquid/Aqueous	85 - 115	<20	0.001
(ICP-MS)	Silver	3015/3010	6020/A/B	Liquid/Aqueous	80 - 120	<20	0.002
(ICP-MS)	Silver	3050B/3051A	6020/A/B	Solid	80 - 120	<20	0.20
(ICP-AES)	Sodium	200.2 NPDES	200.7	Liquid/Aqueous	85 - 115	<20	1.0

Table 12.3: QC Targets for Environmental Metals Accuracy (LCS), Precision and RLs

(subject to revision without notice)

Class	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Precision (RPD)	RL (ppm)
(ICP-AES)	Sodium	3015/3010	6010B/C/D	Liquid/Aqueous	80 - 120	<20	1.0
(ICP-AES)	Sodium	3050B/3051A	6010B/C/D	Solid	80 - 120	<20	100
(ICP-MS)	Sodium	200.2 NPDES	200.8	Liquid/Aqueous	85 - 115	<20	1.0
(ICP-MS)	Sodium	3015/3010	6020/A/B	Liquid/Aqueous	80 - 120	<20	1.0
(ICP-MS)	Sodium	3050B/3051A	6020/A/B	Solid	80 - 120	<20	50
(ICP-AES)	Strontium	200.2 NPDES	200.7	Liquid/Aqueous	85 - 115	<20	0.01
(ICP-AES)	Strontium	3015/3010	6010B/C/D	Liquid/Aqueous	80 - 120	<20	0.01
(ICP-AES)	Strontium	3050B/3051A	6010B/C/D	Solid	80 - 120	<20	1.0
(ICP-MS)	Strontium	200.2 NPDES	200.8	Liquid/Aqueous	85 - 115	<20	0.01
(ICP-MS)	Strontium	3015/3010	6020/A/B	Liquid/Aqueous	80 - 120	<20	0.01
(ICP-MS)	Strontium	3050B/3051A	6020/A/B	Solid	80 - 120	<20	0.50
(ICP-AES)	Sulfur	200.2 NPDES	200.7	Liquid/Aqueous	85 - 115	<20	1.0
(ICP-AES)	Sulfur	3015/3010	6010B/C/D	Liquid/Aqueous	80 - 120	<20	1.0
(ICP-AES)	Sulfur	3050B/3051A	6010B/C/D	Solid	80 - 120	<20	100
(ICP-AES)	Thallium	200.2 NPDES	200.7	Liquid/Aqueous	85 - 115	<20	0.01
(ICP-AES)	Thallium	3015/3010	6010B/C/D	Liquid/Aqueous	80 - 120	<20	0.01
(ICP-AES)	Thallium	3050B/3051A	6010B/C/D	Solid	80 - 120	<20	2.0
(ICP-MS)	Thallium	200.2 NPDES	200.8	Liquid/Aqueous	85 - 115	<20	0.001
(ICP-MS)	Thallium	3015/3010	6020/A/B	Liquid/Aqueous	80 - 120	<20	0.002
(ICP-MS)	Thallium	3050B/3051A	6020/A/B	Solid	80 - 120	<20	0.10
(ICP-MS)	Thorium	200.2 NPDES	200.8	Liquid/Aqueous	85 - 115	<20	0.01
(ICP-MS)	Thorium	3015/3010	6020/A/B	Liquid/Aqueous	80 - 120	<20	0.01
(ICP-MS)	Thorium	3050B/3051A	6020/A/B	Solid	80 - 120	<20	1
(ICP-AES)	Tin	200.2 NPDES	200.7	Liquid/Aqueous	85 - 115	<20	0.05
(ICP-AES)	Tin	3015/3010	6010B/C/D	Liquid/Aqueous	80 - 120	<20	0.05
(ICP-AES)	Tin	3050B/3051A	6010B/C/D	Solid	80 - 120	<20	5.0
(ICP-MS)	Tin	200.2 NPDES	200.8	Liquid/Aqueous	85 - 115	<20	0.001
(ICP-MS)	Tin	3015/3010	6020/A/B	Liquid/Aqueous	80 - 120	<20	0.002
(ICP-MS)	Tin	3050B/3051A	6020/A/B	Solid	80 - 120	<20	0.10
(ICP-AES)	Titanium	200.2 NPDES	200.7	Liquid/Aqueous	85 - 115	<20	0.05
(ICP-AES)	Titanium	3015/3010	6010B/C/D	Liquid/Aqueous	80 - 120	<20	0.05
(ICP-AES)	Titanium	3050B/3051A	6010B/C/D	Solid	80 - 120	<20	5.0
(ICP-MS)	Titanium	200.2 NPDES	200.8	Liquid/Aqueous	85 - 115	<20	0.01
(ICP-MS)	Titanium	3015/3010	6020/A/B	Liquid/Aqueous	80 - 120	<20	0.01
(ICP-MS)	Titanium	3050B/3051A	6020/A/B	Solid	80 - 120	<20	0.50
(ICP-AES)	Vanadium	200.2 NPDES	200.7	Liquid/Aqueous	85 - 115	<20	0.02
(ICP-AES)	Vanadium	3015/3010	6010B/C/D	Liquid/Aqueous	80 - 120	<20	0.02
(ICP-AES)	Vanadium	3050B/3051A	6010B/C/D	Solid	80 - 120	<20	2.0

Table 12.3: QC Targets for Environmental Metals Accuracy (LCS), Precision and RLs
(subject to revision without notice)

Class	Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range (%)	Precision (RPD)	RL (ppm)
(ICP-MS)	Vanadium	200.2 NPDES	200.8	Liquid/Aqueous	85 - 115	<20	0.002
(ICP-MS)	Vanadium	3015/3010	6020/A/B	Liquid/Aqueous	80 - 120	<20	0.005
(ICP-MS)	Vanadium	3050B/3051A	6020/A/B	Solid	80 - 120	<20	0.20
(ICP-MS)	Uranium	200.2 NPDES	200.8	Liquid/Aqueous	85 - 115	<20	0.01
(ICP-MS)	Uranium	3015/3010	6020/A/B	Liquid/Aqueous	80 - 120	<20	0.01
(ICP-MS)	Uranium	3050B/3051A	6020/A/B	Solid	80 - 120	<20	1
(ICP-AES)	Zinc	200.2 NPDES	200.7	Liquid/Aqueous	85 - 115	<20	0.05
(ICP-AES)	Zinc	3015/3010	6010B/C/D	Liquid/Aqueous	80 - 120	<20	0.05
(ICP-AES)	Zinc	3050B/3051A	6010B/C/D	Solid	80 - 120	<20	5.0
(ICP-MS)	Zinc	200.2 NPDES	200.8	Liquid/Aqueous	85 - 115	<20	0.01
(ICP-MS)	Zinc	3015/3010	6020/A/B	Liquid/Aqueous	80 - 120	<20	0.025
(ICP-MS)	Zinc	3050B/3051A	6020/A/B	Solid	80 - 120	<20	1.0

13.0 CORRECTIVE ACTIONS

13.1 In the event that a nonconformance occurs in conjunction with the analytical batch, a corrective action response (CAR) form must be completed. The cause of the event is stated on the form and the measures taken to correct the nonconformance clearly defined. The effectiveness of the corrective action must be assessed and noted. The CARs are kept on file by the Regulatory Affairs Department. Corrective action procedures are documented in SOP #030208, *Corrective and Preventive Action*

13.2 Required Corrective Action

Control limits have been established for each type of analysis. When these control limits are exceeded, corrective action must be taken. Calculated sample spike control limits are also used.

All samples and procedures are governed by ESC's quality assurance program. General corrective actions are as follows; however additional and more specific direction is provided in the specific determinative procedure. For more information, see the appropriate determinative SOP

13.2.1 Laboratory QC Criteria and Appropriate Corrective Actions

If the analytical method contains acceptance/rejection criteria and it is more stringent than those controls generated by the laboratory, the method criteria takes precedence.

13.2.2 Calibration Verification Criteria Are Not Met: Inorganic Analysis

Rejection Criteria - See Table 8.5.

Corrective Action - If a standard curve linearity is not acceptable and/or the absorbance for specific standard(s) is not analogous to historic data, the instrument settings, nebulizer, etc. are examined to ensure that nothing has been altered, clogged, etc. The working standards are made fresh, intermediate dilutions are re-checked and the instrument is re-calibrated. If a problem persists, the Department Supervisor is notified for further action.

If the initial reference check sample is out of control, the instrument is re-calibrated and the check sample is rerun. If the problem continues the check sample is re-prepared. If the problem still exists then the standards and reagent blank are re-prepared. If the problem persists, the Department Supervisor is notified for further action.

13.2.3 Out Of Control Blanks: Applies to Method, Trip, Rinsate & Instrument Blanks

Rejection Criteria - Blank reading is more than the RL for Method Blanks and/or Instrument Blanks. (½ the RL for Method Blanks and/or instrument blanks for DoD work and also may be required for some customers and programs.)

Corrective Action - Standard curves and samples are evaluated for any obvious contamination that may be isolated or uniform throughout the sequence. If necessary, reagents, QC samples and field samples are re-prepared and re-analyzed. Re-analyses are not initiated until the cause of the contamination is identified and resolved. If samples have already been partially prepared or analyzed, the Department Supervisor is consulted to determine if data needs to be rejected or if samples need to be re-prepped.

13.2.4 Out Of Control Laboratory Control Standards (LCS)

Rejection Criteria - If the performance is outside of lab-generated control (Listed in Table 12.3).

Corrective Action - Instrument settings are checked. The LCS standard is re-analyzed. If the LCS is still out of control, re-calibration is performed, and samples affected since the last in control reference standard are re-analyzed. If the LCS fails again after re-calibration, the entire workgroup must be re-prepped. The Department Supervisor is consulted for further action.

13.2.5 Out Of Control Matrix Spike Samples

Rejection Criteria - If either the MS or MSD sample is outside the established control limits.

Corrective Action - Any compound that is outside of these limits is considered to be ‘out of control’ and must be qualified appropriately. Batch acceptance, however, is based on method blank and LCS performance, not on MS/MSD recoveries. Specific methods, customers, and programs may require further corrective action in some cases.

13.2.8 Out Of Control Calibration Standards: ICV, CCV, SSCV

Rejection Criteria - If the performance is outside of method requirements.

Corrective Action - Instrument settings are checked, calibration verification standard is rerun. If the standard is still out of control, re-calibration is performed, and samples affected since the last in control reference standard are rerun. The Department Supervisor is consulted for further action.

13.3 Responsibility - It is the Department Supervisor's responsibility to evaluate the validity of the corrective action response and submit it to the QA department for processing. In addition, the Supervisor is responsible for appointing the appropriate person within the department to be responsible for correcting the nonconformance. When a corrective action warrants a cessation of analysis, the following personnel are responsible for executing the "stop work" order:

- Laboratory Manager
- QA Department
- Department Supervisor
- Technical Service Representative

14.0 RECORD KEEPING

Record keeping is outlined in SOP #030230, *Standards Logger, SOP #030227, Data Review* and SOP #030201, *Data Handling and Reporting*

15.0 QUALITY AUDITS

System and data quality audits are outlined in the ESC Quality Assurance Manual Version 12.0 and *SOP #010104, Internal Audits.*

16.0 REVISIONS

The Regulatory Affairs Department has an electronic version of this Quality Assurance Manual with tracked changes detailing all revisions made to the previous version. This version is available upon request. Revisions to the previous version of this appendix are summarized in the table below.

Document	**Revision**
Quality Assurance Manual Version 15.0 (Appendix V)	General – Replaced the term “client” with the term “customer” Section 7.1 – Revised to state all soils are stored <6°C not just soils for Hg Section 8.0 – Updated Software Table 8.1 – Updated Equipment List Tables 8.3A and 8.3B – Updated Standards Table 8.4 – Updated range of calibration standards Table 10.1 – Updated SOP List Section 11.1 – Removed AIHA PTs Section 11.4 – Removed AIHA LCS Section 12.3 – Removed AIHA QC Table Table 12.3 – Updated RLs and added Thorium by ICP/MS

1.0 SIGNATORY APPROVALS

VOLATILES
QUALITY ASSURANCE MANUAL

APPENDIX VI TO THE ESC QUALITY ASSURANCE MANUAL

for

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Prepared by

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NOTE: The QAM has been approved by the following people.

7/13
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2.0 *APPENDIX TABLE OF CONTENTS*

3.0 SCOPE AND APPLICATION

This appendix discusses specific QA requirements for general analytical protocols to ensure analytical data generated from the Volatiles (VOC) laboratory are scientifically valid and are of acceptable quality. Any deviations from these requirements and any deviations that result in nonconforming work must be immediately evaluated and their corrective actions documented.

4.0 LABORATORY ORGANIZATION AND RESPONSIBILITIES

ESC Lab Sciences offers diverse environmental capabilities that enable the laboratory to provide the customer with both routine and specialized services, field sampling guidance and broad laboratory expertise. A brief outline of the organization and responsibilities as they apply to the ESC Quality Assurance Program is presented in *Section 4.0 in the ESC Quality Assurance Manual.*

5.0 PERSONNEL AND TRAINING

5.1 PERSONNEL

Heidi Ferrell, with a B.S. degree in Chemistry, is the Department Supervisor and is responsible for the overall production of the department; including the management of the staff and scheduling. Ms. Ferrell has 10 years of environmental laboratory experience. In her absence, Brett Andersen assumes responsibility for departmental decisions in the Volatiles Lab.

Brett Andersen, with a B.S in Microbiology and M.S. in Plant Microbiology and Pathology, is the Primary Analyst for the Volatiles Lab. He is proficient in volatile organic analytical methods and has 10 years of environmental laboratory experience.

5.2 TRAINING

5.2.1 All new analysts to the laboratory are trained by a Primary Analyst or Supervisor according to ESC protocol. ESC's training program is outlined in *SOP 030205 Technical Training and Personnel Qualifications.* Performance is documented using an initial demonstration of capability (IDOCs) and continuing demonstration of capability (CDOC). On-going acceptable capability in VOC Laboratory is also demonstrated by acceptable participation in the Phenova proficiency testing program (PTs) and using daily Quality Control sample analyses. Documentation of analyst training is maintained on file within the department.

6.0 FACILITIES AND LABORATORY SAFETY

6.1 FACILITIES

The main area of the instrumentation laboratory in Building #2 has approximately 7000 square feet with 700 square feet of bench area and 300 square feet of preparatory area. The lighting standard is fluorescence. The air handling systems are (1) 60-ton units with gas heating and (1) 25-ton unit. The physical and air-handling separations, between this laboratory and other ESC sections, prevent potential cross-contamination between solvent vapor generation and incompatible analytical processes. Waste disposal containers are located in the laboratory and Clean Harbors serves as ESC's waste disposal carrier. Waste handling is discussed in detail in Section 6.0 of the ESC Quality Assurance Manual. ESC's building information guides and site plan are shown in Appendix I.

6.2 LABORATORY SAFETY

- Laboratory access is limited when work is being performed.
- All procedures where chemicals are prepared or splashes may occur are conducted in laboratory exhaust hoods.

ESC's laboratory safety guidelines are detailed in the *ESC Chemical Hygiene Plan.*

7.0 SAMPLING PROCEDURES

7.1 FIELD SAMPLING PROCEDURES, SAMPLE STORAGE, AND HANDLING

- Field Sampling procedures are described in Appendix III of this ESC Quality Assurance Manual. Sample information is recorded and kept on the ESC chain of custody and field logbooks.
- Matrices for VOC environmental analyses include groundwater, wastewater, drinking water, soil, and sludge.
- Sample containers, preservation methods and holding times vary depending on analyses requested. Please see determinative procedures for specific directions.
- Plastic containers or lids may NOT be used for the storage of samples due to sample contamination from the phthalate esters and other hydrocarbons in the plastic.
- Environmental sample containers should be filled carefully to prevent any portion of the sample from coming into contact with the sampler's gloves causing possible contamination.
- Containers for VOC samples should be selected carefully to minimize headspace that could lead to a low bias in the analytical results. Headspace is monitored during sample login and is documented on the Sample Receipt Corrective Action form when observed.

8.0 EQUIPMENT

8.1 EQUIPMENT LIST

TABLE 8.1 – LABORATORY EQUIPMENT LIST: MAJOR ITEMS - Volatiles Analysis
This table is subject to revision without notice

Item	*Manufacturer*	*Model*	*Instrument Name*	*#*	*Serial #*	*Location*
Gas Chromatograph	Hewlett Packard	5890 Series II	VOCGC	1	3333A31215	Volatiles
Gas Chromatograph	Agilent	6890	VOCGC	2	CN10609095	Volatiles
Gas Chromatograph	Hewlett Packard	5890 Series II	VOCGC	3	2950A26786	Volatiles
Gas Chromatograph	Hewlett Packard	5890 Series II	VOCGC	4	3336A50614	Volatiles
Gas Chromatograph	Hewlett Packard	5890 Series II	VOCGC	5	3027A29678	Volatiles
Gas Chromatograph	Hewlett Packard	5890 Series II	VOCGC	6	2950A27895	Volatiles
Gas Chromatograph	Hewlett Packard	5890 Series II	VOCGC	7	3313A37610	Volatiles
Gas Chromatograph	Hewlett Packard	5890 Series II	VOCGC	13	2921A23548	Volatiles
Gas Chromatograph	Agilent	6890	VOCGC	10	US00022519	Volatiles
Gas Chromatograph	Agilent	6890	VOCGC	12	US00000410	Volatiles
Gas Chromatograph	Agilent	6890	VOCGC	14	CN10408054	Volatiles
Gas Chromatograph	Agilent	6890	VOCGC	15	US10232130	Volatiles
Gas Chromatograph/ Mass Spectrometer	Agilent	6890 GC/ 5975 MSD	VOCMS	2	GCCN10641044 MSUS63234371	Volatiles
Gas Chromatograph/ Mass Spectrometer	Agilent	6890 GC/ 5973 MSD	VOCMS	6	GCCN10343037 MSUS44647141	Volatiles
Gas Chromatograph/ Mass Spectrometer	Agilent	6890 GC/ 5973MSD	VOCMS	4	GCUS00003465 MSUS82311257	Volatiles
Gas Chromatograph/ Mass Spectrometer	Agilent	6890 GC/ 5973MSD	VOCMS	7	GCUS00040221 MS05040022	Volatiles
Gas Chromatograph/ Mass Spectrometer	Agilent	6890 GC/ 5973MSD	VOCMS	8	GCUS00040221 MS03940725	Volatiles
Gas Chromatograph/ Mass Spectrometer	Agilent	6890 GC/ 5973MSD	VOCMS	13	GCCN103390006 MSUS91911078	Volatiles
Gas Chromatograph/ Mass Spectrometer	Agilent	6890 GC/ 5973MSD	VOCMS	14	GCUS00009794 MSUS63810153	Volatiles
Gas Chromatograph/ Mass Spectrometer	Agilent	6890 GC/ 5973MSD	VOCMS	16	GCUS00006479 MSUS82321899	Volatiles
Gas Chromatograph/ Mass Spectrometer	Agilent	6890 GC/ 5973MSD	VOCMS	18	GC CN10517046 MSUS03340424	Volatiles
Gas Chromatograph/ Mass Spectrometer	Agilent	6890 GC/ 5973MSD	VOCMS	19	GCCN10611062 MSUS60542638	Volatiles
Gas Chromatograph/ Mass Spectrometer	Agilent	6890 GC/ 5975MSD	VOCMS	20	GCCN621S4367 MSUS469A4832	Volatiles
Gas Chromatograph/ Mass Spectrometer	Agilent	6890 GC/ 5975MSD	VOCMS	21	GCCN621S4368 MSUS469A4833	Volatiles
Gas Chromatograph/ Mass Spectrometer	Agilent	7890 GC/ 5975MSD	VOCMS	22	GCCN10728074 MSUS71236615	Volatiles
Gas Chromatograph/ Mass Spectrometer	Agilent	6890 GC/ 5975MSD	VOCMS	23	GCCN10728068 MSUS71236616	Volatiles

TABLE 8.1 – LABORATORY EQUIPMENT LIST: MAJOR ITEMS - Volatiles Analysis

This table is subject to revision without notice

Item	*Manufacturer*	*Model*	*Instrument Name*	*#*	*Serial #*	*Location*
Gas Chromatograph/ Mass Spectrometer	Agilent	7890 GC/ 5975MSD	VOCMS	24	GCCN10151020 MSUS10223406	Volatiles
Gas Chromatograph/ Mass Spectrometer	Agilent	7890 GC/ 5975MSD	VOCMS	25	GCCN99205324 MSUS98003634	Volatiles
Gas Chromatograph/ Mass Spectrometer	Agilent	7890 GC/ 5975MSD	VOCMS	26	GCCN10301152 MSUS10313616	Volatiles
Gas Chromatograph/ Mass Spectrometer	Agilent	7890 GC/ 5975MSD	VOCMS	27	GCCN10301155 MSUS10313619	Volatiles
Gas Chromatograph/ Mass Spectrometer	Agilent	6890 GC/ 5973MSD	VOCMS	28	GCUS000034135 MSUS94240103	Volatiles
Gas Chromatograph/ Mass Spectrometer	Agilent	6890 GC/ 5973MSD	VOCMS	29	GCUS00033898 MSUS94240096	Volatiles
Gas Chromatograph/ Mass Spectrometer	Agilent	6890 GC/ 5973MSD	VOCMS	30	GCUS10208101 MSUS10442360	Volatiles
Gas Chromatograph/ Mass Spectrometer	Agilent	7890 GC/ 5975MSD	VOCMS	31	GCUS14453011 MSUS54441572	Volatiles
Gas Chromatograph/ Mass Spectrometer	Agilent	7890 GC/ 5975MSD	VOCMS	32	GCCN13113015 MSUS92013978	Volatiles
Gas Chromatograph/ Mass Spectrometer	Agilent	7890 GC/ 5975MSD	VOCMS	33	GCCN11351165 MSUS52440724	Volatiles
Gas Chromatograph/ Mass Spectrometer	Agilent	7890 GC/ 5975MSD	VOCMS	34	GCCN13231014 MSUS50680012	Volatiles
Gas Chromatograph/ Mass Spectrometer	Agilent	7890 GC/ 5975MSD	VOCMS	35	GCCN10849077 MSUS83131017	Volatiles
Gas Chromatograph/ Mass Spectrometer	Agilent	7890 GC/ 5975 MSD	VOCMS	36	GCCN11281031 MSUS50680017	Volatiles
Gas Chromatograph/ Mass Spectrometer	Agilent	7890 GC/ 5977MSD	VOCMS	37	GCCN15333012 MSUS1534M407	Volatiles
Gas Chromatograph/ Mass Spectrometer	Agilent	7890 GC/ 5975MSD	VOCMS	38	GCCN11281031 MSUS83141150	Volatiles
Gas Chromatograph/ Mass Spectrometer	Agilent	7890 GC/ 5975MSD	VOCMS	39	GCCN10940090 MSUS92043681	Volatiles
Centurion Autosampler	(14) PTS/EST	Centurion				Volatiles
Autosampler	(24) Varian	Archon				Volatiles
Autosampler	(2) CDS	7400				Volatiles
Autosampler	(1) OI Analytical	4100				Volatiles
Purge and Trap	(18) OI Analytical	Eclipse				Volatiles
Purge and Trap	(15) PTS/EST	Encon				Volatiles
Purge and Trap	(7)PTS/EST	Evolution				Volatiles

8.2 EQUIPMENT PREVENTIVE MAINTENANCE, EQUIPMENT CALIBRATION

INSTRUMENT	P. M. DESCRIPTION	FREQUENCY
Analytical Balances	•Check with Class "I" weights	Daily; tolerance ±0.1%
Analytical Balances	•Service/Calibration (semiannual contract maintenance and calibration check)	Semiannually

8.2 EQUIPMENT PREVENTIVE MAINTENANCE, EQUIPMENT CALIBRATION

INSTRUMENT	P. M. DESCRIPTION	FREQUENCY
Refrigerators & Incubators	•Maintenance service	As needed - determined by daily temperature performance checks
Gas Chromatograph Detectors: FID	Change Quartz jet; clean; replace flame tip	As needed - when deterioration is noticeable
Gas Chromatograph Detectors: PID	Change or clean lamp	As needed - when deterioration is noticeable
Gas Chromatograph/Mass Spectrometer	•Autotune Report	Inspected daily
Gas Chromatograph/Mass Spectrometer	•Clean ion source	As needed to maintain high mass resolution
Gas Chromatograph/Mass Spectrometer & Gas Chromatographs	•Replace septum and liner	As needed to maintain injection port inert
Gas Chromatograph/Mass Spectrometer	•Replace vacuum pump oil	Every 6 months
Gas Chromatograph/Mass Spectrometer & Gas Chromatographs	•Replace column	When separation begins to degrade
Archon/ Centurion Autosampler	•Monitor the Daily QC, including internal standards for changes or failure.	Daily with use

8.3 STANDARDS AND REAGENTS

Table 8.3A: Standard stock sources, description and calibration information.

This table is subject to revision without notice

Method	Vendor*	Description	Calibration	Storage Req.	Expiration
8260	Ultra	Gases Mix	Primary	-30°C to 4°C	1 week
	Ultra	Custom Standard	Primary	2°C to 8°C	6 months
	NSI	Mix 2	Primary	2°C to 8°C	6 months
	Restek	Acrolein	Primary	<0°C	3 months
	SPEX	Custom (AZ analytes)	Primary	<0°C	6 months
	Restek	TX TPH Mix (GRO)	Primary	<10°C	6 months
	SPEX	Custom (AZ analytes)	Secondary	<0°C	6 months
	NSI	Custom VOC Mix 2	Secondary	2°C to 8°C	6 months
	Restek	Custom VOC Standard #1	Secondary	<0°C	6 months
	Restek	Custom VOCStandard #2	Secondary	<0°C	6 months
	Restek	Custom VOC Standard #3	Secondary	<0°C	6 months
	Restek	Custom VOC Standard #4	Secondary	<0°C	6 months
	Restek	Acrolein	Secondary	<0°C	3 months
	Ultra	Petroleum Products Solution (GRO)	Secondary	15°C to 30°C	6 months
8015 (GRO)	Restek	Certified BTEX in Unleaded Gas Composite Standard	Secondary	<0°C	6 months
	NSI	Gas Composite	Primary	2°C to 8°C	6 months
8021	Restek	WISC PVOC/GRO Mix	Secondary	<0°C	6 months
	NSI	PVOC/GRO Mix WI	Primary	4° ± 2°C	6 months
VPH	NSI	Primary VPH Dilution Std	Primary	15°C to 30°C	6 months
	NSI	Custom VPH LCS MIX	Secondary	4° ± 2°C	6 months

**Equivalent Providers may be utilized.*

TABLE 8.3B: Working Standard Concentrations

This table is subject to revision without notice

ORGANIC COMPOUNDS	Method #	GC/MS	GC
VOCs by GC/MS	524.2, 624, SM6200B 20th, 8260B	GW/WW , 0.5, 1, 2, 5, 10, 25, 40, 75, 100, 200µg/L DW 0.25, 0.5, 1, 2, 5, 10, 25, 50, 100, 150µg/L GRO 0.4, 1, 2, 4, 5, 7, 10, 20ug/mL	
BTEX/GRO, 8015MOD, WI GRO, LA TPH G, OHIO GRO, WI PVOC, BTEX/OA1	BTEX 8021 GRO 8015, BTEX OA1 or state specific GRO		BTEX 0.5, 1, 5,10, 25,50,100,150,200, 250ug/L (m,p-Xylene is doubled) GRO 0.055, 0.11, 0.55, 1.1. 2.75, 5.5, 11mg/L
MADEP VPH	MADEP VPH		Aromatic C9-C10: 0.001, 0.002, 0.01, 0.02, 0.05, 0.1, 0.2, 0.4, 1.0, 2.0mg/L Aliphatic C5-C8: 0.006, 0.012, 0.06, 0.12, 0.3, 0.6, 1.2, 2.4, 6.0, 12.0mg/L Aliphatic C9-C12: 0.007, 0.014, 0.07, 0.14, 0.36, 0.7, 1.4, 2.8, 7.0, 14.0mg/L

8.4 INSTRUMENT CALIBRATION

602 - BTEX - SOP Number 330351

The gas chromatograph is calibrated using the internal standard procedure. A standard curve is prepared using a minimum of three concentration levels for each compound of interest. The calibration standards are tabulated according to peak height or area responses against concentration for each compound and response factors are calculated. If the response factors are <10 % RSD over the working range, the average RF can be used for calculations. Alternatively, when the response factor criteria is exceeded, the analyst may utilize a linear calibration model of response ratios (i.e. Area/Ref. Area or Amt./Ref Amt.) for quantitation providing that the correlation coefficient is at least 0.990 (0.995 for USACE Projects). An independent, or second source, calibration verification standard (SSCV) is analyzed after each initial calibration and should recover within ±20% of the expected concentration for each analyte.

During the analytical sequence, the stability of the initial calibration is verified, following every 10th sample and at the end of the sequence, by the analysis of continuing calibration verification (CCV) standards. The CCV must recovery within 15% of the expected concentration for each analyte.

At daily instrument startup and in lieu of performing an entire initial calibration, the working calibration curve or response factors are verified on each working day by the analysis of a Quality Control Check Standard. The responses must meet the criteria found in Table 2 of the 602 Method. If the responses do not meet these criteria, the analysis must be repeated. If the standard still does not meet the criteria, a new calibration curve is prepared.

8021B - BTEX - SOP Number 330351

The gas chromatograph is calibrated using the internal standard procedure. A standard curve is prepared using a minimum of five concentration levels for each compound of interest.

The calibration standards are tabulated according to peak height or area responses against concentration for each compound and response factors are calculated. If the response factors are <20 % RSD over the working range, the average RF can be used for calculations. Alternatively, the results can be used to plot a calibration curve of response ratios (Area/Ref. Area) vs (Amt./Ref Amt). If the response factors of the initial calibration are <20 % RSD over the calibration range, the average RF can be used for calculations. Alternatively, when the response factor criteria is exceeded, the analyst may utilize a linear calibration model of response ratios (i.e. Area/Ref. Area or Amt./Ref Amt.) for quantitation providing that the correlation coefficient is at least 0.990 (0.995 for USACE Projects). An independent, or second source, calibration verification standard (SSCV) is analyzed after each initial calibration and should recover within ±20% of the expected concentration for each analyte.

At daily instrument startup and in lieu of performing an entire initial calibration, the most recent calibration curve may be verified by the analysis of check calibration verification standard (CCV). If the response for any analyte in this check varies from the predicted response by more than ±20%, the analysis must be repeated using fresh standard. If the standard still does not meet the acceptance criteria, a new initial calibration curve must be generated.

8015B/C/D & State Methods - Gasoline Range Organics - SOP Number 330351

Certain state accreditation/registration programs may have specific requirements for calibration and analysis that must be met. Those requirements supersede the general guidance provided in this section and are addressed in the relevant determinative SOP. For EPA Method 8015 for routine GRO analyses, the gas chromatograph is calibrated using the internal standard procedure. A standard curve is prepared using a minimum of five concentration levels for each analyte of interest. The calibration range must represent the typical environmental sample concentration and include the RL as the lowest calibration point. The linear range of the instrument must also be monitored to ensure that the maximum calibration point is within detection range. The calibration standards are tabulated according to peak height or area responses against concentration for each compound and response factors are calculated. If the response factors of the initial calibration are <20 % RSD over the calibration range, the average RF can be used for calculations. Alternatively, when the response factor criteria is exceeded, the analyst may utilize a linear calibration model of response ratios (i.e. Area/Ref. Area or Amt./Ref Amt.)

for quantitation providing that the correlation coefficient is at least 0.990 (0.995 for USACE DOD Projects). An independent, or second source, calibration verification standard (SSCV) is analyzed after each initial calibration and should meet criteria of ±20% of the expected concentration for each analyte.
The working calibration curve or response factors are verified on each working day by the analysis of one or more calibration standards. If the response of any analyte varies from the predicted response by more than 20% RSD, the analysis must be repeated using a new calibration standard. If the standard still does not meet the criteria, a new calibration curve is prepared.

8260B/C, 624, SM6200B, 524.2 - Gas Chromatography/Mass Spectrometry (GC/MS): Volatile Organics - SOP Numbers 330363 & 330364

Detector mass calibration is performed daily using the autotune function of the GC/MS analytical system and BFB (Bromofluorobenzene). Following verification of the appropriate masses, the instrument sensitivity is verified by injecting a tuning solution containing bromofluorobenzene (BFB). The BFB spectra must meet the following ion abundance criteria:

Mass	Ion Abundance Criteria
50	15 to 40% of mass 95
75	30 to 60% of mass 95
95	base peak, 100% relative abundance
96	5 to 9% of mass 95
173	Less than 2% of mass 174
174	greater than 50% of mass 95
175	5 to 9% of mass 174
176	greater than 95% but less than 101% of mass 174
177	5 to 9% of mass 176

Successful tuning must occur every 12 hours for method 524.2, 8260B/C & SM6200B and every 24 hours for method 624.

Following successful tuning, the GC/MS is calibrated using the internal standard procedure. A standard curve is prepared using a minimum of three standards for method 624, 524.2 and five standards for method 8260B/C and SM6200B. The calibration standards are tabulated according to peak height or area against concentration and the concentrations and responses of the internal standard analytes. The results are used to determine a response factor for each analyte in each standard injected. A calibration curve is constructed and is determined to be acceptable if each target analyte is found to be constant over the working range as defined as:

≤15% RSD for methods 8260B
≤20% RSD for method 524.2, 8260C, SM6200B
≤35% RSD for method 624

Per the analytical method, specific target analytes are defined as calibration check compounds (CCCs) or system performance check compounds (SPCCs). The calibration checks compounds (CCCs) for method 8260B must be ≤30% RSD. When these conditions are met, linearity through the origin can be assumed and the average RF can be used in place of a calibration curve.

Linear regression can be used for any target compound exceeding the RSD criteria but less than 40% (poor performers <50%), if the correlation coefficient is 0.990 or better. For USACE/DOD projects the correlation coefficient must meet 0.995 or better. The same is true for the CCCs in EPA 8260B as long as the RSD does not exceed 30%.

8260B SPCCs:

Analyte	Minimum Average Response Factor
Chloromethane	0.10
1,1-Dichloroethane	0.10
Bromoform	0.10
Chlorobenzene	0.30
1,1,2,2-Tetrachloroethane	0.30

8260B CCCs:

1,1-Dicholoethene	Toluene
Chloroform	Ethylbenzene
1,2-Dichloropropane	Vinyl Chloride

The initial calibration range must represent the typical environmental sample and include the RL as the lowest calibration point. The linear range of the instrument must be monitored to ensure that the maximum calibration point is within the range.

A second source calibration verification standard is analyzed after each calibration. The second source should recover within 30% for all CCC compounds and within 40% for other analytes of interest, with the exception of analytes known to perform poorly (i.e. low purging efficiency, etc.) that will meet historical LCS accuracy limits. For 524.2 the second source calibration verification standard must be within ± 30%. Following successful calibration, the analysis of field and QC samples may begin. Sample analysis may be performed only during the timeframe of a valid tuning cycle (12 hours for 8260B, 524.2 & SM6200B and 24 hours for 624). Following the expiration of the tuning clock, the instrument must be re-tuned and either recalibrated or the existing calibration must be re-verified.

For 8260B/C, 524.2 & SM6200B analyses, daily calibration verification includes successful demonstration of BFB sensitivity and the injection of a mid-level CCV standard containing all the target analytes of interest and all required system monitoring compounds, where applicable. The BFB tune must meet the ion abundance criteria (see table above). For 8260B, each SPCC in the calibration verification standard must meet the minimum response factors listed above. The CCC must achieve the criteria of +/- 20% RSD. For 524.2 & SM6200B, each target analyte must achieve a drift or difference

of +/-30% of the expected concentration. For V8260C each target analyte must achieve a drift or difference of +/-20% of the expected concentration.
Each internal standard in the CCV must recover between -50% to + 100%, when compared to the same internal standard compound in the mid-point standard of the initial calibration curve. Additionally, if the retention time of an internal standard changes by more than 30 seconds from the retention time of the same internal standard in the mid-level standard of the most recent initial calibration, the system must be evaluated, corrected, and possibly re-calibrated.

Daily calibration is accomplished for method 624 by a BFB tuning and analysis of a QC check standard. The BFB tune must meet EPA ion abundance criteria. The QC check standard must meet the criteria found in table 5 of the method.

Poor performing compounds for 8260B/524.2/SM6200B/624:

Propene	2-Chloroethylvinyl Ether
Dichlorodifluoromethane	Acrolein
Carbon Disulfide	Vinyl acetate
Bromomethane	trans-1,4-dichloro-2-butene
Chloroethane	Alcohols (Ethanol, TBA, TAA, ETBA, Butanol)
1,3-Butadiene	Iodomethane.
2,2-Dibromo-3-chloropropane	Naphthalene
1- Methylnaphthalene	2-Butanone
2- Methylnaphthalene	2-Hexanone
Acetone	4-Methyl-2-pentanone
Pentachloroethane	Cyclohexanone
Tert-butyl Formate	

8.5 ACCEPTANCE/REJECTION OF CALIBRATION

Organic Chemistry

The initial calibration curve is compared with previous curves for the same analyte. All new standard curves are immediately checked with a secondary source or laboratory control standard prepared from a separate source than those used for calibration. All curves are visually reviewed to ensure that acceptable correlation represents linearity. Calibration curves may be rejected for nonlinearity, abnormal sensitivity, or poor response of the laboratory control standard.

Continuing calibration verification is performed on each day that initial calibration is not performed and following every tenth sample for GC analyses and once per 12 hour shift for GCMS analyses. If a check standard does not perform within established criteria, the instrument is evaluated to determine the cause. Once the issue is corrected, all samples between the last in control sample and the first out of control check is re-analyzed.

TABLE 8.5: INSTRUMENT CALIBRATION

Instrument (Analysis)	**Calibration Type**	**Minimum Number of Standards**	**Calibration Model**	**Acceptance/ Rejection Criteria**	**Frequency**
GC (VOC)	Initial	3 –600 series	Avg. RF	Must be ≤10% RSD for 601/602,	As needed
		5 –All others	Avg. RF	≤20%RSD for 8021B, and ≤20% difference for 8015B	
	Second Source	1 Second Source	External	+/- 20% of true value	With each calibration
	Daily / Cont.	1/10	External	Must be within 20% of the initial calibration curve	Beginning, every 20
			Internal	Must be within 20% of the initial calibration curve	Every 12 hours
GC/MS VOC 8260/SM 6200B	Initial	5 –8000 series & SM 6200B	Avg. RF	8260B - Must be ≤15 %RSD for all target analytes and ≤30% for CCCs. 8260C - Must be ≤20 %RSD for all target analytes and ≤30% for CCCs. 6200B - Must be ≤20 %RSD for all target analytes. If Linear regression is used, an MRL check must pass +/-30%.	As needed
	Second Source	1 Second Source		8260B - Should recover within 20% for all CCC compounds and within 40% for other analytes of interest, with the exception of analytes known to perform poorly. 6200B – Should recover within 30% for all compounds, with the exception of analytes known to perform poorly	With each calibration
	Daily / Cont.	Tune & CCV every 12 hours		8260B/C - Must pass established method tuning criteria; 8260B - CCV must be ≤20% difference for CCC compounds, RF criteria for SPCC compounds must meet method criteria. Targets must meet ESC %drift criteria. 8260C/6200B – All targets meet designated minimum response factor, and all compounds ≤20% difference and 30% difference respectively, however for EPA 8260C, 20% of target compounds can fail. If any failures, an MRL check is analyzed.	Every 12 hours

Instrument (Analysis)	Calibration Type	Minimum Number of Standards	Calibration Model	Acceptance/ Rejection Criteria	Frequency
GC/MS VOC 624	Initial	3 –600 series	Avg. RF	624 - Must be ≤35 %RSD for all target analytes and ≤30% for CCCs	As needed
	Second Source	1 Second Source		Should recover within 20% for all CCC compounds and within 40% for other analytes of interest, with the exception of analytes known to perform poorly	With each calibration
	Daily / Cont.	Tune & CCV every 12 hours		Must pass established method tuning criteria; 624 - CCV must be ≤20% difference for CCC, RF for SPCC compounds must meet method criteria. Targets must meet ESC %drift criteria.	Every 12 hours

9.0 LABORATORY PRACTICES

9.1 REAGENT GRADE WATER

Reagent grade water is obtained from an ELGA Purelab Ultra system.

9.2 GLASSWARE WASHING PROCEDURE

All VOA sampling vials are purchased specifically for volatiles analysis and only used once. They are stored in a contaminant-free environment in the original carton with screw cap lids tightly fastened. All glassware used for volatiles analysis (volumetric flasks, syringes, etc.) is segregated from other laboratory glassware. Standard cleaning procedures involve rinsing three times with methanol. When a highly contaminated sample is purged, a blank is analyzed before another sample can be purged to ensure cleanliness of the analytical system. If the blank proves to be contaminant free, the system is then ready for further field sample analyses.

10.0 ANALYTICAL PROCEDURES

10.1 A list of laboratory SOPs associated with the volatiles laboratory can be found in the following table:

TABLE 10.1: VOLATILE DEPARTMENT SOPS

This table is subject to revision without notice

SOP #	Title/Description
330351	BTEX and Gasoline Range Organics by Gas Chromatography (8015B)
330354	MA Volatile Petroleum Hydrocarbons
330357	Volatile Organic Compounds (GRO by GCMS)
330363OH	Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry 8260A/B (Ohio VAP)
330363	Volatile Organic Compounds by Gas Chromatography/Mass

SOP #	Title/Description
	Spectrometry
330364	DW Volatile Organic Compounds by GC/MS (524.2)
330365	VOC Screen using RAE Systems PID ppbRAE
330375	GRO Analysis in Air (based on EPA 8015)
330751	5035 Closed System Purge and Trap and Extraction for VOC's in Soil and Waste
330751OH	5035 Closed System Purge and Trap and Extraction for VOC's in Soil for Ohio VAP
330752OH	5030B Purge and Trap for OH VAP Samples
330752	5030B Purge and Trap for Aqueous Samples
330753	Waste Dilution

11.0 QUALITY CONTROL CHECKS

NOTE: For specific guidance on each determinative method, including required quality control and specific state requirements/modifications, refer to the relevant laboratory standard operating procedure(s).

11.1 ESC participates in proficiency testing (PTs) in support of various laboratory accreditations/recognitions. Environmental samples are purchased from Phenova. The WS, WP and solid matrix studies are completed every 6 months. PT samples are received and analyzed by method according to the vendor's instructions and according to ESC SOP.

11.2 Initial Demonstrations of Capability (IDOCs) are performed during new analyst training and/or prior to acceptance and use of any new method/instrumentation. Continuing Demonstration of Capability (CDOCs) must be updated at least annually. The associated data is filed within the department and available for review.

11.3 Matrix Spike and Matrix Spike Duplicates are performed on each batch of samples analyzed depending on analytical method requested.

11.4 A Laboratory Control Sample (LCS) and LCS Duplicate (LCSD) are analyzed one per batch of samples.

11.5 A method preparation blank is performed per batch of samples processed. If the acceptance criteria as listed in the determinative SOP is exceeded, the laboratory shall evaluate whether reprocessing of the samples is necessary, based on the following criteria:

- The blank contamination exceeds a concentration greater than 1/10 of the measured concentration of any sample in the associated preparation batch or
- The blank contamination is greater than 1/10 of the specified regulatory limit. The concentrations of common laboratory contaminants shall not exceed the reporting limit.

Any samples associated with a blank that fail these criteria shall be reprocessed in a subsequent preparation batch, except where the sample analysis resulted in non-detected results for the failing analytes.

12.0 *DATA REDUCTION, VALIDATION AND REPORTING*

12.1 DATA REDUCTION

The analyst performs the data calculation functions and is responsible for the initial examination of the finished data. Data reduction steps applied to the raw data are outlined in SOP #030201, *Data Handling and Reporting.* A secondary review of the data package is performed according to ESC SOP #030227, *Data Review*. The reviewer verifies that the analysis has been performed as required and meets method criteria, all associate data is present and complete, and also ensures that any additional documentation is completed as required (i.e. Ohio VAP checklists, required flags on test reports, etc.)

TABLE 12.1 Data Reduction Formulas

PARAMETER	FORMULA
GC	$\frac{\text{response of sample analyte } \{\textit{area}\} \text{ x final extract volume } \{\textit{mL}\} \text{ x dilution}}{\text{response factor } \{\textit{area/(mg/L)}\} \text{ x initial extract volume-mass } \{\textit{mL or g}\}}$ *Calculations performed by HP Enviroquant Software*
GC/MS	$\frac{\text{response of analyte } \{\textit{area}\} \text{ x extract volume } \{\textit{mL}\} \text{ x dilution x int. std amt. } \{\textit{area}\}}{\text{response factor } \{\textit{area/(mg/mL)}\} \text{ x initial volume-mass } \{\textit{mL or g}\} \text{ x int. std cal. } \{\text{area}\}}$ *Calculations performed by HP Enviroquant Software*

12.2 VALIDATION

The validation process consists of data generation, reduction review, and reporting results. Once data reduction is complete, validation is conducted by verification that the QC samples are within acceptable QC limits and that all documentation is complete, including the analytical report and associated QC. See Table 12.3 by method for current QC targets and controls and current reporting limits.

Marginal Exceedance – When a large number of analytes exist in the LCS, it is statistically possible for a few analytes to be outside established control limits while the analytical system remains in control. These excursions must be random in nature and, if not, a review of the control limits or analytical process is necessary.

Upper and lower marginal exceedance (ME) limits are established as the mean of at least 20 data points ± four times their standard deviations. The number of allowable marginal exceedances per event is based on the number of analytes spiked in the LCS.

Allowable Marginal Exceedance per Event	
Analytes in LCS:	**ME Allowable**
>90	5
71-90	4
51-70	3
31-50	2
11-30	1
<11	0

Organic Control Limits - The organic QC targets are statutory in nature; warning and control limits for organic analyses are initially established for groups of compounds based on preliminary method validation data. When additional data becomes available, the QC targets are reviewed. All QC targets are routinely re-evaluated at least annually (and updated, if necessary) against laboratory historical data to insure that the limits continue to reflect realistic, method achievable goals.

12.3 REPORTING

Reporting procedures are documented in SOP #030201, *Data Handling and Reporting.*

Table 12.3: QC Targets for Volatiles Accuracy (LCS), Precision and RLs
This table is subject to revision without notice

Class	Analyte	Method	Matrix	Accuracy (%)**	Prec.** (RPD)	RL	Unit
Volatiles	1,1,1,2-TETRACHLOROETHANE	8260B/C, 624, 6200B	GW, WW	78.5-125	20.0	0.001	mg/L
Volatiles	1,1,1-TRICHLOROETHANE	8260B/C, 624, 6200B	GW, WW	71.1-129	20.0	0.001	mg/L
Volatiles	1,1,2,2-TETRACHLOROETHANE	8260B/C, 624, 6200B	GW, WW	79.3-123	20.0	0.001	mg/L
Volatiles	1,1,2-TRICHLOROETHANE	8260B/C, 624, 6200B	GW, WW	81.6-120	20.0	0.001	mg/L
Volatiles	1,1,2-TRICHLORO-TRIFLUOROETHANE	8260B/C, 624, 6200B	GW, WW	62.0-141	20.0	0.001	mg/L
Volatiles	1,1-DICHLOROETHANE	8260B/C, 624, 6200B	GW, WW	71.7-127	20.0	0.001	mg/L
Volatiles	1,1-DICHLOROETHENE	8260B/C, 624, 6200B	GW, WW	59.9-137	20.0	0.001	mg/L
Volatiles	1,1-DICHLOROPROPENE	8260B/C, 624, 6200B	GW, WW	72.5-127	20.0	0.001	mg/L
Volatiles	1,2,3-TRICHLOROBENZENE	8260B/C, 624, 6200B	GW, WW	75.7-134	20.0	0.001	mg/L
Volatiles	1,2,3-TRICHLOROPROPANE	8260B/C, 624, 6200B	GW, WW	74.9-124	20.0	0.0025	mg/L
Volatiles	1,2,3-TRIMETHYLBENZENE	8260B/C, 624, 6200B	GW, WW	79.9-118	20.0	0.001	mg/L
Volatiles	1,2,4-TRICHLOROBENZENE	8260B/C, 624, 6200B	GW, WW	76.1-136	20.0	0.001	mg/L
Volatiles	1,2,4-TRIMETHYLBENZENE	8260B/C, 624, 6200B	GW, WW	79.0-122	20.0	0.001	mg/L
Volatiles	1,2-DIBROMO-3-CHLOROPROPANE	8260B/C, 624, 6200B	GW, WW	64.8-131	20.0	0.005	mg/L
Volatiles	1,2-DIBROMOETHANE	8260B/C, 624, 6200B	GW, WW	79.8-122	20.0	0.001	mg/L
Volatiles	1,2-DICHLOROBENZENE	8260B/C, 624, 6200B	GW, WW	84.7-118	20.0	0.001	mg/L
Volatiles	1,2-DICHLOROETHANE	8260B/C, 624, 6200B	GW, WW	65.3.-126	20.0	0.001	mg/L

Table 12.3: QC Targets for Volatiles Accuracy (LCS), Precision and RLs
This table is subject to revision without notice

Class	Analyte	Method	Matrix	Accuracy (%)**	Prec.** (RPD)	RL	Unit
Volatiles	1,2-DICHLOROPROPANE	8260B/C, 624, 6200B	GW, WW	77.4-125	20.0	0.001	mg/L
Volatiles	1,3,5-TRIMETHYLBENZENE	8260B/C, 624, 6200B	GW, WW	81.0-123	20.0	0.001	mg/L
Volatiles	1,3-BUTADIENE	8260B/C, 624, 6200B	GW, WW	36.2-142	20.0	0.002	mg/L
Volatiles	1,3-DICHLOROBENZENE	8260B/C, 624, 6200B	GW, WW	77.6-127	20.0	0.001	mg/L
Volatiles	1,3-DICHLOROPROPANE	8260B/C, 624, 6200B	GW, WW	80.6-115	20.0	0.001	mg/L
Volatiles	1,4-DICHLOROBENZENE	8260B/C, 624, 6200B	GW, WW	82.2-114	20.0	0.001	mg/L
Volatiles	1-METHYLNAPHTHALENE	8260B/C, 624, 6200B	GW, WW	48.8-157	20.0	0.01	mg/L
Volatiles	2,2-DICHLOROPROPANE	8260B/C, 624, 6200B	GW, WW	61.3-134	20.0	0.001	mg/L
Volatiles	2-BUTANONE (MEK)	8260B/C, 624, 6200B	GW, WW	46.4-155	20.0	0.01	mg/L
Volatiles	2-CHLOROETHYL VINYL ETHER	8260B/C, 624, 6200B	GW, WW	23.4-162	23.5	0.05	mg/L
Volatiles	2-CHLOROTOLUENE	8260B/C, 624, 6200B	GW, WW	76.4-125	20.0	0.001	mg/L
Volatiles	2-HEXANONE	8260B/C, 624, 6200B	GW, WW	59.4-151	20.0	0.01	mg/L
Volatiles	2-METHYLNAPHTHALENE	8260B/C, 624, 6200B	GW, WW	55.6-154	20.0	0.01	mg/L
Volatiles	4-CHLOROTOLUENE	8260B/C, 624, 6200B	GW, WW	81.5-121	20.0	0.001	mg/L
Volatiles	4-ETHYLTOLUENE	8260B/C, 624, 6200B	GW, WW	69.5-137	20.0	0.001	mg/L
Volatiles	4-METHYL-2-PENTANONE (MIBK)	8260B/C, 624, 6200B	GW, WW	63.3-138	20.0	0.01	mg/L
Volatiles	ACETONE	8260B/C, 624, 6200B	GW, WW	28.7-175	20.9	0.01	mg/L
Volatiles	ACROLEIN	8260B/C, 624, 6200B	GW, WW	40.4-172	20.0	0.05	mg/L
Volatiles	ACRYLONITRILE	8260B/C, 624, 6200B	GW, WW	58.2-145	20.0	0.01	mg/L
Volatiles	BENZENE	8260B/C, 624, 6200B	GW, WW	73.0-122	20.0	0.001	mg/L
Volatiles	BROMOBENZENE	8260B/C, 624, 6200B	GW, WW	81.5-115	20.0	0.001	mg/L
Volatiles	BROMOCHLOROMETHANE	8260B/C, 624, 6200B	GW, WW	78.9-123	20.0	0.001	mg/L
Volatiles	BROMODICHLOROMETHANE	8260B/C, 624, 6200B	GW, WW	75.5-121	20.0	0.001	mg/L
Volatiles	BROMOFORM	8260B/C, 624, 6200B	GW, WW	71.5-131	20.0	0.001	mg/L
Volatiles	BROMOMETHANE	8260B/C, 624, 6200B	GW, WW	22.4-187	20.0	0.005	mg/L
Volatiles	CARBON DISULFIDE	8260B/C, 624, 6200B	GW, WW	53.0-134	20.0	0.001	mg/L
Volatiles	CARBON TETRACHLORIDE	8260B/C, 624, 6200B	GW, WW	70.9-129	20.0	0.001	mg/L
Volatiles	CHLOROBENZENE	8260B/C, 624, 6200B	GW, WW	79.7-122	20.0	0.001	mg/L
Volatiles	CHLORODIBROMOMETHANE	8260B/C, 624, 6200B	GW, WW	78.2-124	20.0	0.001	mg/L
Volatiles	CHLOROETHANE	8260B/C, 624, 6200B	GW, WW	41.2-153	20.0	0.005	mg/L
Volatiles	CHLOROFORM	8260B/C, 624, 6200B	GW, WW	73.2-125	20.0	0.005	mg/L
Volatiles	CHLOROMETHANE	8260B/C, 624, 6200B	GW, WW	55.8-134	20.0	0.025	mg/L
Volatiles	CIS-1,2-DICHLOROETHENE	8260B/C, 624, 6200B	GW, WW	77.3-122	20.0	0.001	mg/L
Volatiles	CIS-1,3-DICHLOROPROPENE	8260B/C, 624, 6200B	GW, WW	77.7-124	20.0	0.001	mg/L
Volatiles	DIBROMOMETHANE	8260B/C, 624, 6200B	GW, WW	78.8-119	20.0	0.001	mg/L

Table 12.3: QC Targets for Volatiles Accuracy (LCS), Precision and RLs
This table is subject to revision without notice

Class	Analyte	Method	Matrix	Accuracy (%)**	Prec.** (RPD)	RL	Unit
Volatiles	DICHLORODIFLUOROMETHANE	8260B/C, 624, 6200B	GW, WW	56.0-134	20.0	0.005	mg/L
Volatiles	DICHLOROFLUOROMETHANE	8260B/C, 624, 6200B	GW, WW	53.5-145	20.0	0.005	mg/L
Volatiles	DICYCLOPENTADIENE	8260B/C, 624, 6200B	GW, WW	73.4-126	20.0	0.001	mg/L
Volatiles	DI-ISOPROPYL ETHER	8260B/C, 624, 6200B	GW, WW	65.1-135	20.0	0.001	mg/L
Volatiles	ETHYL ETHER	8260B/C, 624, 6200B	GW, WW	56.6-136	20.0	0.001	mg/L
Volatiles	ETHYLBENZENE	8260B/C, 624, 6200B	GW, WW	80.9-121	20.0	0.001	mg/L
Volatiles	HEXACHLORO-1,3-BUTADIENE	8260B/C, 624, 6200B	GW, WW	73.7-133	20.0	0.001	mg/L
Volatiles	IODOMETHANE	8260B/C, 624, 6200B	GW, WW	64.6-137	20.0	0.01	mg/L
Volatiles	ISOPROPYLBENZENE	8260B/C, 624, 6200B	GW, WW	81.6-124	20.0	0.001	mg/L
Volatiles	M&P-XYLENE	8260B/C, 624, 6200B	GW, WW	78.5-122	20.0	0.002	mg/L
Volatiles	METHYL TERT-BUTYL ETHER	8260B/C, 624, 6200B	GW, WW	70.1-125	20.0	0.001	mg/L
Volatiles	METHYLENE CHLORIDE	8260B/C, 624, 6200B	GW, WW	69.5-120	20.0	0.005	mg/L
Volatiles	NAPHTHALENE	8260B/C, 624, 6200B	GW, WW	69.7-134	20.0	0.005	mg/L
Volatiles	N-BUTYLBENZENE	8260B/C, 624, 6200B	GW, WW	75.9-134	20.0	0.001	mg/L
Volatiles	N-HEXANE	8260B/C, 624, 6200B	GW, WW	59.5-132	20.0	0.01	mg/L
Volatiles	N-PROPYLBENZENE	8260B/C, 624, 6200B	GW, WW	81.9-122	20.0	0.001	mg/L
Volatiles	O-XYLENE	8260B/C, 624, 6200B	GW, WW	79.1-123	20.0	0.001	mg/L
Volatiles	P-ISOPROPYLTOLUENE	8260B/C, 624, 6200B	GW, WW	77.6-129	20.0	0.001	mg/L
Volatiles	PROPENE	8260B/C, 624, 6200B	GW, WW	10.0-200	20.0	0.0025	mg/L
Volatiles	SEC-BUTYLBENZENE	8260B/C, 624, 6200B	GW, WW	80.6-126	20.0	0.001	mg/L
Volatiles	STYRENE	8260B/C, 624, 6200B	GW, WW	79.9-124	20.0	0.001	mg/L
Volatiles	TERT-BUTYLBENZENE	8260B/C, 624, 6200B	GW, WW	79.3-127	20.0	0.001	mg/L
Volatiles	TETRACHLOROETHENE	8260B/C, 624, 6200B	GW, WW	73.5-130	20.0	0.001	mg/L
Volatiles	TETRAHYDROFURAN	8260B/C, 624, 6200B	GW, WW	54.0-134	20.0	0.005	mg/L
Volatiles	TOLUENE	8260B/C, 624, 6200B	GW, WW	77.9-116	20.0	0.005	mg/L
Volatiles	TPH (GC/MS) LOW FRACTION	8260B/C, 624, 6200B	GW, WW	62.3-131	20.0	0.50	mg/L
Volatiles	TRANS-1,2-DICHLOROETHENE	8260B/C, 624, 6200B	GW, WW	72.6-125	20.0	0.001	mg/L
Volatiles	TRANS-1,3-DICHLOROPROPENE	8260B/C, 624, 6200B	GW, WW	73.5-127	20.0	0.001	mg/L
Volatiles	TRANS-1,4-DICHLORO-2-BUTENE	8260B/C, 624, 6200B	GW, WW	58.3-129	20.0	0.0025	mg/L
Volatiles	TRICHLOROETHENE	8260B/C, 624, 6200B	GW, WW	79.5-121	20.0	0.001	mg/L
Volatiles	TRICHLOROFLUOROMETHANE	8260B/C, 624, 6200B	GW, WW	49.1-157	20.0	0.005	mg/L
Volatiles	VINYL ACETATE	8260B/C, 624, 6200B	GW, WW	41.7-159	20.0	0.01	mg/L

Table 12.3: QC Targets for Volatiles Accuracy (LCS), Precision and RLs
This table is subject to revision without notice

Class	Analyte	Method	Matrix	Accuracy (%)**	Prec.** (RPD)	RL	Unit
Volatiles	VINYL CHLORIDE	8260B/C, 624, 6200B	GW, WW	61.5-134	20.0	0.001	mg/L
Volatiles	XYLENES, TOTAL	8260B/C, 624, 6200B	GW,WW	79.2-122	20.0	0.002	mg/L
Volatiles	1,1,1,2-TETRACHLOROETHANE	8260B/C	Solid	76.7-127	20.0	0.001	mg/kg
Volatiles	1,1,1-TRICHLOROETHANE	8260B/C	Solid	69.9-127	20.0	0.001	mg/kg
Volatiles	1,1,2,2-TETRACHLOROETHANE	8260B/C	Solid	78.8-124	20.0	0.001	mg/kg
Volatiles	1,1,2-TRICHLOROETHANE	8260B/C	Solid	81.9-119	20.0	0.001	mg/kg
Volatiles	1,1,2-RICHLOROTRIFLUOROETHANE	8260B/C	Solid	62.6-138	20.0	0.001	mg/kg
Volatiles	1,1-DICHLOROETHANE	8260B/C	Solid	71.7-125	20.0	0.001	mg/kg
Volatiles	1,1-DICHLOROETHENE	8260B/C	Solid	60.6-133	20.0	0.001	mg/kg
Volatiles	1,1-DICHLOROPROPENE	8260B/C	Solid	71.2-126	20.0	0.001	mg/kg
Volatiles	1,2,3-TRICHLOROBENZENE	8260B/C	Solid	72.5-137	20.0	0.001	mg/kg
Volatiles	1,2,3-TRICHLOROPROPANE	8260B/C	Solid	74.0-124	20.0	0.0025	mg/kg
Volatiles	1,2,3-TRIMETHYLBENZENE	8260B/C	Solid	79.4-118	20.0	0.001	mg/kg
Volatiles	1,2,4-TRICHLOROBENZENE	8260B/C	Solid	74.0-137	20.0	0.001	mg/kg
Volatiles	1,2,4-TRIMETHYLBENZENE	8260B/C	Solid	77.1-124	20.0	0.001	mg/kg
Volatiles	1,2-DIBROMO-3-CHLOROPROPANE	8260B/C	Solid	64.9-131	20.0	0.005	mg/kg
Volatiles	1,2-DIBROMOETHANE	8260B/C	Solid	78.7-123	20.0	0.001	mg/kg
Volatiles	1,2-DICHLOROBENZENE	8260B/C	Solid	83.6-119	20.0	0.001	mg/kg
Volatiles	1,2-DICHLOROETHANE	8260B/C	Solid	67.2-121	20.0	0.001	mg/kg
Volatiles	1,2-DICHLOROPROPANE	8260B/C	Solid	76.9-123	20.0	0.001	mg/kg
Volatiles	1,3,5-TRIMETHYLBENZENE	8260B/C	Solid	79.0-125	20.0	0.001	mg/kg
Volatiles	1,3-BUTADIENE	8260B/C	Solid	35.1-134	20.0	0.002	mg/kg
Volatiles	1,3-DICHLOROBENZENE	8260B/C	Solid	75.9-129	20.0	0.001	mg/kg
Volatiles	1,3-DICHLOROPROPANE	8260B/C	Solid	80.3-114	20.0	0.001	mg/kg
Volatiles	1,4-DICHLOROBENZENE	8260B/C	Solid	81.0-115	20.0	0.001	mg/kg
Volatiles	1-METHYLNAPHTHALENE	8260B/C	Solid	60.4-138	24.7	0.01	mg/kg
Volatiles	2,2-DICHLOROPROPANE	8260B/C	Solid	61.9-132	20.0	0.001	mg/kg
Volatiles	2-BUTANONE (MEK)	8260B/C	Solid	44.5-154	21.3	0.01	mg/kg
Volatiles	2-CHLOROETHYL VINYL ETHER	8260B/C	Solid	16.7-162	23.7	0.05	mg/kg
Volatiles	2-CHLOROTOLUENE	8260B/C	Solid	74.6-127	20.0	0.001	mg/kg
Volatiles	2-HEXANONE	8260B/C	Solid	62.7-150	20.0	0.01	mg/kg
Volatiles	2-METHYLNAPHTHALENE	8260B/C	Solid	63.3-137	21.5	0.01	mg/kg
Volatiles	4-CHLOROTOLUENE	8260B/C	Solid	79.5-123	20.0	0.001	mg/kg
Volatiles	4-ETHYLTOLUENE	8260B/C	Solid	78.0-127	20.0	0.001	mg/kg

Table 12.3: QC Targets for Volatiles Accuracy (LCS), Precision and RLs
This table is subject to revision without notice

Class	Analyte	Method	Matrix	Accuracy (%)**	Prec.** (RPD)	RL	Unit
Volatiles	4-METHYL-2-PENTANONE (MIBK)	8260B/C	Solid	61.1-138	20.0	0.01	mg/kg
Volatiles	ACETONE	8260B/C	Solid	25.3-178	22.9	0.01	mg/kg
Volatiles	ACROLEIN	8260B/C	Solid	41.0-182	20.0	0.05	mg/kg
Volatiles	ACRYLONITRILE	8260B/C	Solid	57.8-143	20.0	0.01	mg/kg
Volatiles	BENZENE	8260B/C	Solid	72.6-120	20.0	0.001	mg/kg
Volatiles	BROMOBENZENE	8260B/C	Solid	80.3-115	20.0	0.001	mg/kg
Volatiles	BROMOCHLOROMETHANE	8260B/C	Solid	79..7-123	20.0	0.001	mg/kg
Volatiles	BROMODICHLOROMETHANE	8260B/C	Solid	75.3-119	20.0	0.001	mg/kg
Volatiles	BROMOFORM	8260B/C	Solid	69.1-135	20.0	0.001	mg/kg
Volatiles	BROMOMETHANE	8260B/C	Solid	23.0-191	20.0	0.005	mg/kg
Volatiles	CARBON DISULFIDE	8260B/C	Solid	49.9-136	20.0	0.001	mg/kg
Volatiles	CARBON TETRACHLORIDE	8260B/C	Solid	69.4-129	20.0	0.001	mg/kg
Volatiles	CHLOROBENZENE	8260B/C	Solid	78.9-122	20.0	0.001	mg/kg
Volatiles	CHLORODIBROMOMETHANE	8260B/C	Solid	76.4-126	20.0	0.005	mg/kg
Volatiles	CHLOROETHANE	8260B/C	Solid	47.2-147	20.0	0.005	mg/kg
Volatiles	CHLOROFORM	8260B/C	Solid	73.3-122	20.0	0.025	mg/kg
Volatiles	CHLOROMETHANE	8260B/C	Solid	53.1-135	20.0	0.001	mg/kg
Volatiles	CIS-1,2-DICHLOROETHENE	8260B/C	Solid	76.1-121	20.0	0.001	mg/kg
Volatiles	CIS-1,3-DICHLOROPROPENE	8260B/C	Solid	77.3-123	20.0	0.001	mg/kg
Volatiles	DIBROMOMETHANE	8260B/C	Solid	78.5-117	20.0	0.005	mg/kg
Volatiles	DICHLORODIFLUORO-METHANE	8260B/C	Solid	50.9-139	20.0	0.005	mg/kg
Volatiles	DICHLOROFLUORO-METHANE	8260B/C	Solid	61.8-140	20.0	0.001	mg/kg
Volatiles	DICYCLOPENTADIENE	8260B/C	Solid	73.1-126	20.0	0.001	mg/kg
Volatiles	DI-ISOPROPYL ETHER	8260B/C	Solid	67.2-131	20.0	0.001	mg/kg
Volatiles	ETHYL ETHER	8260B/C	Solid	57.5-136	20.0	0.001	mg/kg
Volatiles	ETHYLBENZENE	8260B/C	Solid	78.6-124	20.0	0.001	mg/kg
Volatiles	HEXACHLORO-1,3-BUTADIENE	8260B/C	Solid	69.2-136	20.0	0.01	mg/kg
Volatiles	IODOMETHANE	8260B/C	Solid	63.3-136	20.0	0.001	mg/kg
Volatiles	ISOPROPYLBENZENE	8260B/C	Solid	79.4-126	20.0	0.002	mg/kg
Volatiles	M&P-XYLENE	8260B/C	Solid	77.3-124	20.0	0.001	mg/kg
Volatiles	METHYL TERT-BUTYL ETHER	8260B/C	Solid	70.2-122	20.0	0.005	mg/kg
Volatiles	METHYLENE CHLORIDE	8260B/C	Solid	68.2-119	20.0	0.005	mg/kg
Volatiles	NAPHTHALENE	8260B/C	Solid	69.9-132	20.0	0.001	mg/kg
Volatiles	N-BUTYLBENZENE	8260B/C	Solid	74.2-134	20.0	0.01	mg/kg
Volatiles	N-HEXANE	8260B/C	Solid	59.9-125	20.0	0.001	mg/kg

Table 12.3: QC Targets for Volatiles Accuracy (LCS), Precision and RLs
This table is subject to revision without notice

Class	Analyte	Method	Matrix	Accuracy (%)**	Prec.** (RPD)	RL	Unit
Volatiles	N-PROPYLBENZENE	8260B/C	Solid	80.2-124	20.0	0.001	mg/kg
Volatiles	O-XYLENE	8260B/C	Solid	78.5-124	20.0	0.001	mg/kg
Volatiles	P-ISOPROPYLTOLUENE	8260B/C	Solid	75.4-132	20.0	0.0025	mg/kg
Volatiles	PROPENE	8260B/C	Solid	10.0-192	26.1	0.001	mg/kg
Volatiles	SEC-BUTYLBENZENE	8260B/C	Solid	77.8-129	20.0	0.001	mg/kg
Volatiles	STYRENE	8260B/C	Solid	79.4-124	20.0	0.001	mg/kg
Volatiles	TERT-BUTYLBENZENE	8260B/C	Solid	77.2-129	20.0	0.001	mg/kg
Volatiles	TETRACHLOROETHENE	8260B/C	Solid	71.1-133	20.0	0.005	mg/kg
Volatiles	TETRAHYDROFURAN	8260B/C	Solid	63.4-122	20.0	0.005	mg/kg
Volatiles	TOLUENE	8260B/C	Solid	76.7-116	20.0	0.50	mg/kg
Volatiles	TPH (GC/MS) LOW FRACTION	8260B/C	Solid	61.5-138	20.0	0.001	mg/kg
Volatiles	TRANS-1,2-DICHLOROETHENE	8260B/C	Solid	70.7-124	20.0	0.001	mg/kg
Volatiles	TRANS-1,3-DICHLOROPROPENE	8260B/C	Solid	73.0-127	20.0	0.0025	mg/kg
Volatiles	TRANS-1,4-DICHLORO-2-BUTENE	8260B/C	Solid	58.4-125	20.0	0.001	mg/kg
Volatiles	TRICHLOROETHENE	8260B/C	Solid	77.2-122	20.0	0.001	mg/kg
Volatiles	TRICHLOROFLUORO-METHANE	8260B/C	Solid	51.5-151	20.0	0.005	mg/kg
Volatiles	VINYL ACETATE	8260B/C	Solid	39.8-156	20.0	0.01	mg/kg
Volatiles	VINYL CHLORIDE	8260B/C	Solid	58.4-134	20.0	0.001	mg/kg
Volatiles	XYLENES, TOTAL	8260B/C	Solid	78.1-123	20.0	0.002	mg/kg
Volatiles	DI-ISOPROPYL ETHER	8260B/C	Solid	70.4-133	20.0	0.001	mg/kg
Volatiles	ETHYL TERT-BUTYL ETHER	8260B/C	Solid	81.4-110	25.0	0.001	mg/kg
Volatiles	METHYL-TERT-BUTYL ETHER	8260B/C	Solid	73.0-129	20.0	0.001	mg/kg
Volatiles	TERT-BUTYL ALCOHOL	8260B/C	Solid	59.5-170	25.0	0.050	mg/kg
Volatiles	TERT-AMYL METHYL ETHER	8260B/C	Solid	82-115	25.0	0.001	mg/kg
Volatiles	2-PROPANOL	8260B/C	Solid	70.0-130	25.0	0.05	mg/kg
Volatiles	GRO	8015B/C/D	GW, WW	66.3-133	20.0	0.100	mg/L
Volatiles	BENZENE	8021B, 602, 6200C	GW, WW	70.0-130	20.0	0.0005	mg/L
Volatiles	TOLUENE	8021B, 602, 6200C	GW, WW	70.0-130	20.0	0.005	mg/L
Volatiles	ETHYLBENZENE	8021B, 602, 6200C	GW, WW	70.0-130	20.0	0.0005	mg/L
Volatiles	M&P-XYLENE	8021B, 602, 6200C	GW, WW	70.0-130	20.0	0.001	mg/L
Volatiles	O-XYLENE	8021B, 602, 6200C	GW, WW	70.0-130	20.0	0.0005	mg/L
Volatiles	MTBE	8021B, 602, 6200C	GW, WW	70.0-130	20.0	0.001	mg/L
Volatiles	GRO	8015B/C/D	Solid	63.6-136	20.0	0.10	mg/kg
Volatiles	BENZENE	8021B	Solid	70.0 - 130	20.0	0.0005	mg/kg

Table 12.3: QC Targets for Volatiles Accuracy (LCS), Precision and RLs
This table is subject to revision without notice

Class	Analyte	Method	Matrix	Accuracy (%)**	Prec.** (RPD)	RL	Unit
Volatiles	TOLUENE	8021B	Solid	70.0 - 130	20.0	0.005	mg/kg
Volatiles	ETHYLBENZENE	8021B	Solid	70.0 - 130	20.0	0.001	mg/kg
Volatiles	M&P-XYLENE	8021B	Solid	70.0 - 130	20.0	0.001	mg/kg
Volatiles	O-XYLENE	8021B	Solid	70.0 - 130	20.0	0.0005	mg/kg
Volatiles	MTBE	8021B	Solid	70.0 - 130	20.0	0.001	mg/kg
Volatiles	1,1,1,2-TETRACHLOROETHANE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	1,1,1-TRICHLOROETHANE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	1,1,2,2-TETRACHLOROETHANE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	1,1,2-TRICHLOROETHANE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	1,1-DICHLOROETHANE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	1,1-DICHLOROETHENE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	1,1-DICHLOROPROPENE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	1,2,3-TRICHLOROBENZENE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	1,2,3-TRICHLOROPROPANE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	1,2,4-TRICHLOROBENZENE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	1,2,4-TRIMETHYLBENZENE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	1,2-DIBROMO-3-CHLOROPROPANE	524.2	DW	70.0-130	25.0	0.0010	mg/L
Volatiles	1,2-DIBROMOETHANE	524.2	DW	70.0-130	25.0	0.0010	mg/L
Volatiles	1,2-DICHLOROBENZENE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	1,2-DICHLOROETHANE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	1,2-DICHLOROPROPANE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	1,3,5-TRIMETHYLBENZENE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	1,3-DICHLOROBENZENE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	1,3-DICHLOROPROPANE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	1,4-DICHLOROBENZENE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	2,2-DICHLOROPROPANE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	2-CHLOROTOLUENE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	4-CHLOROTOLUENE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	4-ISOPROPYLTOLUENE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	ACETONE	524.2	DW	70.0-130	25.0	0.01	mg/L
Volatiles	BENZENE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	BROMOBENZENE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	BROMOCHLOROMETHANE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	BROMODICHLOROMETHANE	524.2	DW	70.0-130	25.0	0.0005	mg/L

Table 12.3: QC Targets for Volatiles Accuracy (LCS), Precision and RLs
This table is subject to revision without notice

Class	Analyte	Method	Matrix	Accuracy (%)**	Prec.** (RPD)	RL	Unit
Volatiles	BROMOFORM	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	BROMOMETHANE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	CARBON TETRACHLORIDE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	CHLOROBENZENE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	CHLOROETHANE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	CHLOROFORM	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	CHLOROMETHANE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	CIS-1,2-DICHLOROETHENE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	CIS-1,3-DICHLOROPROPENE	524.2	DW	70.0-130	25.0	0.0010	mg/L
Volatiles	DIBROMOMETHANE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	DICHLORODIFLUORO-METHANE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	ETHYLBENZENE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	HEXACHLOROBUTADIENE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	ISOPROPYLBENZENE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	METHYLENE CHLORIDE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	METHYL-T-BUTYL ETHER	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	NAPHTHALENE	524.2	DW	70.0-130	25.0	0.0050	mg/L
Volatiles	N-BUTYLBENZENE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	N-PROPYLBENZENE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	SEC-BUTYLBENZENE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	STYRENE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	TERT-BUTYLBENZENE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	TETRACHLOROETHENE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	TOLUENE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	TRANS-1,2-DICHLOROETHENE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	TRANS-1,3-DICHLOROPROPENE	524.2	DW	70.0-130	25.0	0.0010	mg/L
Volatiles	TRICHLOROETHENE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	TRICHLOROFLUORO-METHANE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	VINYL CHLORIDE	524.2	DW	70.0-130	25.0	0.0005	mg/L
Volatiles	XYLENES – TOTAL	524.2	DW	70.0-130	25.0	0.0015	mg/L

*** Specific organizations may require limits that supersede the values listed.*

13.0 CORRECTIVE ACTION

13.1 In the event that a nonconformance occurs in conjunction with the analytical batch, a corrective action response (CAR) form must be completed. The cause of the event is stated on the form and the measures taken to correct the nonconformance clearly defined. The effectiveness of the corrective action must be assessed and noted. The CARs are kept on file by the Regulatory Affairs Department. Corrective action procedures are documented in SOP #030208, *Corrective and Preventive Action*

13.2 Required Corrective Action

Control limits have been established for each type of analysis. When these limits are exceeded, corrective action must be taken. Calculated sample spike control limits are also used.

All samples and procedures are governed by ESC's quality assurance program. General corrective actions are as follows; however additional and more specific direction is provided in the specific determinative procedure. For more information, see the appropriate determinative SOP.

13.2.1 Laboratory QC Criteria and Appropriate Corrective Actions

If the analytical method contains acceptance/rejection criteria and it is more stringent than those controls generated by the laboratory, the method criteria takes precedence.

13.2.2 Out Of Control Blanks: Applies to Method, Trip, Rinsate & Instrument Blanks

Rejection Criteria - Blank reading is more than twice the background absorbance or more than ½RL.

Corrective Action - Blanks are re-analyzed and the response is assessed. Standard curves and samples are evaluated for any obvious contamination that is isolated or uniform throughout the run. If necessary, reagents are re-prepared. Analyses are not initiated until the problem is identified and solved. If samples have already been prepared or analyzed, the Department Supervisor is consulted to determine if data needs to be rejected or if samples need to be re-prepared.

13.2.3 Out Of Control Laboratory Control Standards (LCS & LCSD)

Rejection Criteria - If the performance is outside of lab-generated control limits which are calculated as the mean of at least 20 data points +/- 3 times the standard deviation of those points (Listed in Section 12) and the marginal excedence allowance is surpassed (see section 12.2).

Corrective Action - Instrument settings are checked and the LCS standard is re-analyzed. If the LCS is still out of control, instrumentation is checked for systemic problems and repaired (if necessary). Re-calibration is performed and the samples affected since the last in control reference standard are reanalyzed. The group leader or Department Supervisor is consulted for further action.

13.2.4 Out Of Control Matrix Spike Samples

Rejection Criteria - If either the MS or MSD sample is outside the established control limits.

Corrective Action - Any compound that is outside of these limits is considered to be ‘out of control’ and must be qualified appropriately. Batch acceptance, however, is based on method blank and LCS performance, not on MS/MSD recoveries. Specific methods, customers, and programs may require further corrective action in some cases.

13.2.5 Out Of Control Duplicate Samples

Rejection Criteria - Lab-generated maximum RPD limit (as listed under precision in Section 12)

Corrective Action - Any compound that is outside of these limits is considered to be ‘out of control’ and must be qualified appropriately. Batch acceptance, however, is based on method blank and LCS performance. Specific methods, customers, and programs may require further corrective action in some cases.

13.2.7 Out Of Control Calibration Standards: ICV, CCV, SSCV

Rejection Criteria - If the performance is outside of method requirements.

Corrective Action - Instrument settings are checked, calibration verification standard is re-analyzed. If the standard is still out of control, re-calibration is performed, and samples affected since the last in control reference standard are rerun. The group leader or Department Supervisor is consulted for further action.

14.0 RECORD KEEPING

Record keeping is outlined in SOP #030230, *Standards Logger, SOP #030227, Data Review* and SOP #030201, *Data Handling and Reporting*

Volatile organics calibration data are recorded and integrated using HP Enviroquant software. Calibration data from the volatile analyses, in addition to the initial and daily calibration, includes GC/MS autotunes, BFB reports and surrogate recovery reports. PDF records of initial calibration and daily calibration are stored with chromatograms and integrated with sample data by date analyzed.

15.0 QUALITY AUDITS

System and data quality audits are outlined in the ESC Quality Assurance Manual Version 13.0 and *SOP #010104, Internal Audits*.

16.0 REVISIONS

The Regulatory Affairs Department has an electronic version of this Quality Assurance Manual with tracked changes detailing all revisions made to the previous version. This version is available upon request. Revisions to the previous version of this appendix are summarized in the table below.

Document	**Revision**
Quality Assurance Manual Version 15.0 (Appendix VI)	General – Replaced the term “client” with the term “customer” Table 8.1 – Updated Equipment List Table 8.3A – Updated Standards Table 10.1 – Updated SOP List

1.0 *SIGNATORY APPROVALS*

Semi-Volatile
QUALITY ASSURANCE MANUAL

APPENDIX VII TO THE ESC QUALITY ASSURANCE MANUAL

for

ESC LAB SCIENCES
12065 LEBANON ROAD
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Prepared by

ESC LAB SCIENCES
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NOTE: The QAM has been approved by the following people.

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Jim
Jim Brownfield, B.S., Compliance Director 615-773-9681

Steve Miller
Steve Miller, B.S., Quality Assurance Manager, 615-773-9684

2.0 APPENDIX TABLE OF CONTENTS

3.0 SCOPE AND APPLICATION

This appendix discusses specific QA requirements for general analytical protocols to ensure that analytical data generated from the Semi-Volatile (SVOC) laboratory are scientifically valid and are of acceptable quality. Any deviations from these requirements and any deviations that result in non-conforming work must be immediately evaluated and their corrective actions documented.

4.0 LABORATORY ORGANIZATION AND RESPONSIBILITIES

ESC Lab Sciences offers diverse environmental capabilities that enable the laboratory to provide the customer with both routine and specialized services, field sampling guidance and broad laboratory expertise. A brief outline of the organization and responsibilities as they apply to the ESC Quality Assurance Program is presented in *Section 4.0 in the ESC Quality Assurance Manual.*

5.0 PERSONNEL AND TRAINING

5.1 PERSONNEL

Chris Johnson, with a B.S. degree in Biology, is the Organics Manager and is responsible for the overall production of these laboratories; including the management of the staff and scheduling. Mr. Johnson has over 15 years of environmental laboratory experience.

In his absence, Blake Judge assumes responsibility for SVOC departmental decisions. Mr. Judge has a B.S. degree in Chemistry and is a Senior Chemist in the SVOC Department. He is proficient in semi-volatile organic analytical methods and has over 10 years of environmental laboratory experience.

5.2 TRAINING

5.2.1 All new analysts to the laboratory are trained by a Chemist or Department Lead according to ESC protocol. ESC's training program is outlined in *SOP 030205 Technical Training and Personnel Qualifications.* Performance is documented using an initial demonstration of capability (IDOCs) and continuing demonstration of capability (CDOC). On-going acceptable capability in SVOC analyses and preparation is also demonstrated by acceptable participation in multiple proficiency testing programs (PTs) and daily Quality Control sample analyses. Documentation of analyst training is maintained on file within the department.

6.0 FACILITIES AND LABORATORY SAFETY

6.1 FACILITIES

The main area of the instrumentation laboratory in Building #5 has nearly 1500 square feet with approximately 500 square feet of bench area. The 4000 square feet of area in the extraction laboratory includes roughly 330 square feet of bench area with 245 square feet of hood space. There is an additional 2000 square feet of storage for this laboratory. The air system is a 15-ton make-up unit plus 15-ton HVAC with electric heat. The physical and air-handling separations, between this laboratory and other ESC sections, prevent potential cross-contamination between solvent vapor generation and incompatible analytical processes. The laboratory reagent water is provided through the US Filter deionizer system. Waste disposal containers are located in the laboratory and Clean Harbors serves as ESC's waste disposal carrier as discussed in detail in Section 6.0 of the ESC Quality Assurance Manual. ESC's building information guides and site plan are shown in Appendix I.

6.2 LABORATORY SAFETY

- Laboratory access is limited when work is being performed.
- All procedures where chemicals are prepared or splashes may occur are conducted in laboratory exhaust hoods.
- ESC's laboratory safety guidelines are detailed in the *ESC Chemical Hygiene Plan.*

7.0 SAMPLING PROCEDURES

7.1 FIELD SAMPLING PROCEDURES, SAMPLE STORAGE, AND HANDLING

- Field Sampling procedure is described in Appendix III of this ESC Quality Assurance Manual. Sample information is recorded and kept on the ESC chain of custody and field logbooks.
- Matrices for SVOC environmental analyses include groundwater, wastewater, drinking water, soil, and sludge.
- Sample containers, preservation methods and holding times vary depending on analyses requested. Please see determinative procedures for specific directions.
- Plastic containers or lids may NOT be used for the storage of samples due to possible contamination from the phthalate esters and other hydrocarbons.
- Environmental sample containers should be filled carefully to prevent any portion of the sample from coming into contact with the sampler's gloves causing possible phthalate contamination.

8.0 EQUIPMENT

8.1 EQUIPMENT LIST

LABORATORY EQUIPMENT LIST: MAJOR ITEMS - Semi-Volatiles Analysis
This table is subject to revision without notice

Item	*Manufacturer*	*Model*	*Instrument Name*	*#*	*Serial #*	*Location*
Gas Chromatograph 2	HP	6890	svcompa	2	US00004397	SVOC
Gas Chromatograph 7	Agilent	6890	svcompe	7	US10350064	SVOC
Gas Chromatograph 8	Agilent	6890	svcompp	8	DE00022534	SVOC
Gas Chromatograph 9	HP	6890	svcompj	9	US00029095	SVOC
Gas Chromatograph 10	Agilent	6890	svcompk	10	US00039655	SVOC
Gas Chromatograph 11	Agilent	6890	svcompn	11	US00040550	SVOC
Gas Chromatograph 12	Agilent	6890	svcompo	12	US00034155	SVOC
Gas Chromatograph 13	HP	6890	svcomps	13	US00010364	SVOC
Gas Chromatograph 14	HP	6890	svcompt	14	US00020581	SVOC
Gas Chromatograph 16	Agilent	6890	svcompv	16	US10212071	SVOC
Gas Chromatograph 17	Agilent	6890	svcompw	17	US10344078	SVOC
Gas Chromatograph 18	Agilent	6890	svcompd	18	US10351038	SVOC
Gas Chromatograph 19	Agilent	6890	svcompaa	19	CN10516070	SVOC
Gas Chromatograph 20	Agilent	6890	svcompab	20	CN10543031	SVOC
Gas Chromatograph 21	Agilent	7890	svcompae	21	CN 10730070	SVOC
Gas Chromatograph 22	Agilent	7890	svcompaf	22	CN 10730081	SVOC
Gas Chromatograph 23	Agilent	6890	svcompag	23	CN 92174366	SVOC
Gas Chromatograph 24	Agilent	6890	svcompah	24	CN 92174369	SVOC
Gas Chromatograph 25	Agilent	7890	svcompaj	25	CN 10091009	SVOC
Gas Chromatograph 26	Agilent	7890	Svcompar	26	CN11501138	SVOC
Gas Chromatograph 27	Agilent	7890	Svcompas	27	CN11501139	SVOC
Gas Chromatograph 28	Agilent	7890	Svcompat	28	US11521018	SVOC
Gas Chromatograph 29	Agilent	7890	Svcompau	29	CN11521077	SVOC
Gas Chromatograph 30	Agilent	7890	svcompav	30	US11521020	SVOC
Gas Chromatograph 31	Agilent	7890	svcompba	31	CN13503096	SVOC
Gas Chromatograph 32	Agilent	7890	svcompbc	32	CN14423060	SVOC
Gas Chromatograph 33	Agilent	7890	svcompbd	33	CN15033026	SVOC
Gas Chromatograph 34	Agilent	7890	svcompbe	34	CN15033027	SVOC
Gas Chromatograph Detectors 3	Detectors	NPD/NPD	svcompo	3	N/A	SVOC
Gas Chromatograph Detectors 7	Detectors	FID	svcompe	7	N/A	SVOC
Gas Chromatograph Detectors 8	Detectors	FID	svcompp	8	N/A	SVOC
Gas Chromatograph Detectors 9	Detectors	FID	svcompj	9	N/A	SVOC
Gas Chromatograph Detectors 10	Detectors	FID	svcompk	10	N/A	SVOC

LABORATORY EQUIPMENT LIST: MAJOR ITEMS - Semi-Volatiles Analysis

This table is subject to revision without notice

Item	*Manufacturer*	*Model*	*Instrument Name*	*#*	*Serial #*	*Location*
Gas Chromatograph Detectors 11	Detectors	ECD/ECD	svcompn	11	F) U11750 B) U12481	SVOC
Gas Chromatograph Detectors 12	Detectors	FPD/FPD	svcompo	12	N/A	SVOC
Gas Chromatograph Detectors 13	Detectors	FID	svcomps	13	N/A	SVOC
Gas Chromatograph Detectors 14	Detectors	ECD/ECD	svcompt	14	F) U3113 B) U2620	SVOC
Gas Chromatograph Detectors 16	Detectors	FID	svcompu	16	N/A	SVOC
Gas Chromatograph Detectors 17	Detectors	FID	svcompv	17	N/A	SVOC
Gas Chromatograph Detectors 18	Detectors	ECD/ECD	svcompd	18	F) U11613 B) U13988	SVOC
Gas Chromatograph Detectors 19	Detectors	ECD/ECD	svcompaa	19	F) U6632 B) U8422	SVOC
Gas Chromatograph Detectors 20	Detectors	ECD/ECD	svcompab	20	F) U13989 B) U0418	SVOC
Gas Chromatograph Detectors 21	Detectors	FID	svcompae	21	N/A	SVOC
Gas Chromatograph Detectors 22	Detectors	ECD/ECD	svcompaf	22	F)U12039 B) 12038	SVOC
Gas Chromatograph Detectors 23	Detectors	ECD/ECD	svcompag	23	F) U2621 B) U8104	SVOC
Gas Chromatograph Detectors 24	Detectors	ECD/ECD	svcompah	24	F) U8423 B) U12482	SVOC
Gas Chromatograph Detectors 26	Detectors	FID	svcompar	26	N/A	SVOC
Gas Chromatograph Detectors 27	Detectors	FID	svcompas	27	N/A	SVOC
Gas Chromatograph Detectors 28	Detectors	ECD/ECD	Svcompat	28	F) U26768 B) U26237	SVOC
Gas Chromatograph Detectors 29	Detectors	ECD/ECD	svcompau	29	F) U20277 B) U20299	SVOC
Gas Chromatograph Detectors 30	Detectors	ECD/ECD	svcompav	30	F) U20425 B) U20424	SVOC
Gas Chromatograph Detectors 31	Detectors	FID	svcompba	31	N/A	SVOC
Gas Chromatograph Detectors 32	Detectors	FID	svcompbc	32	N/A	SVOC
Gas Chromatograph Detectors 33	Detectors	FID	svcompbd	33	N/A	SVOC
Gas Chromatograph Detectors 34	Detectors	FID	svcompbe	34	N/A	SVOC
Gas Chromatograph/Mass Spectrometer 1	Agilent	6890 GC/5973MSD	svcompf	1	GC CN10335001 MS US33220022	SVOC
Gas Chromatograph/Mass Spectrometer 2	Agilent	6890 GC/5973MSD	svcompc	2	GC US10409048 MS US35120400	SVOC
Gas Chromatograph/Mass Spectrometer 4	Agilent	6890 GC/5973MSD	svcomph	4	GC CN10403067 MS US35120308	SVOC
Gas Chromatograph/Mass Spectrometer 7	Agilent	6890 GC/5973MSD	svcompm	7	GC --------------- MS US03940745	SVOC

LABORATORY EQUIPMENT LIST: MAJOR ITEMS - Semi-Volatiles Analysis
This table is subject to revision without notice

Item	*Manufacturer*	*Model*	*Instrument Name*	*#*	*Serial #*	*Location*
Gas Chromatograph/Mass Spectrometer 9	Agilent	6890 GC/5973MSD	svcompx	9	GC CN10344042 MS US33220158	SVOC
Gas Chromatograph/Mass Spectrometer 10	Agilent	6890 GC/5973MSD	svcompy	10	GC CN10340045 MS US33220183	SVOC
Gas Chromatograph/Mass Spectrometer 11	Agilent	6890 GC/5975MSD		11	GC CN10509031 MS US60532657	SVOC
Gas Chromatograph/Mass Spectrometer 12	Agilent	7890 GC/5975MSD	svcompai	12	GC CN10728074/ MS 12-0706-1325	SVOC
Gas Chromatograph/Mass Spectrometer 13	Agilent	7890 GC/5975MSD	svcompak	13	GC CN10301081/ MS US10313621	SVOC
Gas Chromatograph/Mass Spectrometer 14	Agilent	7890 GC/5975MSD	Svcompal	14	GC: CN11031022 MS: US11093726	SVOC
Gas Chromatograph/Mass Spectrometer 15	Agilent	7890 GC/5975MSD	Svcompam	15	GC: CN10301081 MS: US10313621	SVOC
Gas Chromatograph/Mass Spectrometer 16	Agilent	7890 GC/5975MSD	Svcompan	16	GC: CN10301152 MS: US10313616	SVOC
Gas Chromatograph/Mass Spectrometer 17	Agilent	7890 GC/5975MSD	Svcompao	17	GC: CN11191064 MS: US11363807	SVOC
Gas Chromatograph/Mass Spectrometer 18	Agilent	7890 GC/5975MSD	Svcompap	18	GC: CN11401093 MS: US11403903	SVOC
Gas Chromatograph/Mass Spectrometer 19	Agilent	7890 GC/5975MSD	Svcompaq	19	GC: CN11391051 MS: US11383838	SVOC
Gas Chromatograph/Mass Spectrometer 20	Agilent	7890 GC/5975MSD	Svcompaw	20	GC: CN12031161 MS: US11503941	SVOC
Gas Chromatograph/Mass Spectrometer 21	Agilent	7890 GC/5975MSD	Svcompax	21	GC: CN12031160 MS: US11513903	SVOC
Gas Chromatograph/Mass Spectrometer 22	Agilent	7890 GC/5975MSD	Svcompay	22	GC: CN11521157 MS: US12023909	SVOC
Gas Chromatograph/Mass Spectrometer 23	Agilent	7890 GC/5975MSD	Svcompaz	23	GC: CN12031114 MS: US11433926	SVOC
Gas Chromatograph/Mass Spectrometer 24	Agilent	7890 GC/5977MSD	Svcompbb	24	GC:CN10906031 MS: US11343905	SVOC
High Performance Liquid Chromatography	Agilent	1100 Series DAD/FLD	hplc1	1	DAD de01608402 FLD de23904489	SVOC
High Performance Liquid Chromatography	Agilent	1100 Series DAD/FLD	hplc2	2	DAD de30518420 FLD	SVOC
High Performance Liquid Chromatography (HPLC3)	Agilent	1100 Series DAD	hplc3	3	DAD us64400711	SVOC
High Performance Liquid Chromatography (HPLC4)	Agilent	1100 Series DAD/FLD	hplc4	4	DAD de43623013	SVOC
Analytical Balance	Mettler Toledo	PB1502-S		1	1126193668	Ext. Lab
Analytical Balance	Mettler Toledo	MS1602S		2	B243464732	Ext.Lab
Analytical Balance	Mettler Toledo	MS1602S		3	B115130112	Ext.Lab
Analytical Balance	Ohaus	ARA520		3	1202120618	Ext. Lab
Analytical Balance	Ohaus	ARA520		4	1202120814	Ext. Lab
Analytical Balance	Ohaus	Scout Pro			7132101108	Ext. Lab
Automatic Concentrators	Buchi	Syncore	Buchi	1	2302	Ext. Lab
Automatic Concentrators	Buchi	Syncore	Buchi	2	2304	Ext. Lab

LABORATORY EQUIPMENT LIST: MAJOR ITEMS - Semi-Volatiles Analysis

This table is subject to revision without notice

Item	*Manufacturer*	*Model*	*Instrument Name*	*#*	*Serial #*	*Location*
Automatic Concentrators	Buchi	Syncore	Buchi	3	2303	Ext. Lab
Automatic Concentrators	Buchi	Syncore	Buchi	4	0400000940	Ext. Lab
Automatic Concentrators	Buchi	Syncore	Buchi	5	406583020005	Ext. Lab
Automatic Concentrators	Buchi	Syncore	Buchi	6	1469	Ext. Lab
Automatic Concentrators	Buchi	Syncore	Buchi	7	1461	Ext. Lab
Automatic Concentrators	Buchi	Syncore	Buchi	8	417004020002	Ext. Lab
Automatic Concentrators	Buchi	Syncore	Buchi	9	416870050003	Ext. Lab
Automatic Concentrators	Buchi	Syncore	Buchi	10	1466	Ext. Lab
Automatic Concentrators	Buchi	Syncore	Buchi	11	1463	Ext. Lab
Automatic Concentrators	Buchi	Syncore	Buchi	12	1462	Ext. Lab
Automatic Concentrators	Buchi	Syncore	Buchi	13	1468	Ext. Lab
Capping station	Horizon	MARS X			snxc2225	Ext. Lab
Capping station	Horizon	MARS X			snxc2215	Ext. Lab
Centrifuge	Sorvall	ST-40		2	2224	Ext. Lab
Centrifuge	Sorvall	ST-40		3	2225	Ext. Lab
Centrifuge	Sorvall	ST-40		5	2227	Ext. Lab
Concentration Chiller	Lauda	UC0300			64593	Ext. Lab
Concentration Chiller	Lauda	WKL 3200			2039	Ext. Lab
Furnace	Thermo Scientific				1882	Ext. Lab
Oven	Fisher	6556			166	Ext. Lab
Oven	VWR	1305U			0520	Ext. Lab
HAA Shaker	Eberbach				2159	Ext. Lab
RV shaker	Eberbach	F6010.00			041242	Ext. Lab
RV shaker	Eberbach	F6010.00			041250	Ext. Lab
LVI Shaker	Eberbach	6010-04			1834	Ext. Lab
HAA water Bath	Thermo Scientific	280 series			2033602-102	Ext. Lab
High Intensity Ultrasonic Processor	Misonix			1	2193	Ext. Lab
High Intensity Ultrasonic Processor	Misonix			2	1382	Ext. Lab
High Intensity Ultrasonic Processor	Misonix			3	1888	Ext. Lab
High Intensity Ultrasonic Processor	Misonix			4	1381	Ext. Lab
Microwave	CEM	MARS 6		3	2296	Ext. Lab
Microwave	CEM	MARS 6		2	MJ2518	Ext. Lab
Microwave	CEM	MARS 6		4	MJ6367	Ext. Lab
OG concentrator	Horizon	SpeedVap III		1	1534	Ext. Lab
OG concentrator	Horizon	SpeedVap III		2	SN04-2020	Ext. Lab
OG concentrator	Horizon	SpeedVap III		3	2186	Ext. Lab
OG concentrator	Horizon	SpeedVap IV		1	15-0055	Wet Lab
OG concentrator	Horizon	SpeedVap IV		2	15-0056	Wet Lab

LABORATORY EQUIPMENT LIST: MAJOR ITEMS - Semi-Volatiles Analysis
This table is subject to revision without notice

Item	*Manufacturer*	*Model*	*Instrument Name*	*#*	*Serial #*	*Location*
OG SPE extractor	Horizon	SPE-DEX 3000		1	2222	Ext. Lab
OG SPE extractor	Horizon	SPE-DEX 3000		2	2223	Ext. Lab
OG SPE extractor	Horizon	SPE-DEX 3000		3	2221	Ext. Lab
OG SPE extractor	Horizon	SPE-DEX 3000		4	2220	Ext. Lab
OG SPE extractor	Horizon	SPE-DEX3100		1	15-0113	Wet Lab
OG SPE extractor	Horizon	SPE-DEX3100		2	15-0116	Wet Lab
OG SPE extractor	Horizon	SPE-DEX3100		3	15-0117	Wet Lab
OG SPE extractor	Horizon	SPE-DEX3100		4	15-0118	Wet Lab
OG SPE Controllers	Horizon	1000/3000XL		1	2125	Ext. Lab
OG SPE Controllers	Horizon	1000/3000XL		2	2659	Ext. Lab
OG SPE Controllers	Horizon	1000/3000XL		3	2127	Ext. Lab
OG SPE Controllers	Horizon	1000/3000XL		4	2128	Ext. Lab
Separatory funnel rotators	ATR				1514	Ext. Lab
Separatory funnel rotators	ATR				1515	Ext. Lab
Separatory funnel rotators	ATR				1516	Ext. Lab
Separatory funnel rotators	ATR				2055	Ext. Lab
Separatory funnel rotators	ATR				2056	Ext. Lab
Separatory funnel rotators	ATR				2057	Ext. Lab
Speed Vap	FMS				2471	Ext. Lab
Water Bath Sonicator	Branson	8510			RPA040384175E	Ext. Lab
Vacuum Pump	Gast				0908605639	Ext. Lab
Vacuum Pump	Gast				0913008139	Ext. Lab
Vacuum Pump	Gast			3	0311000841	Ext. Lab
Puck Mill/Shatterbox	SPEX	8530		1	10191	Ext. Lab

8.2 EQUIPMENT PREVENTIVE MAINTENANCE, EQUIPMENT CALIBRATION

INSTRUMENT	**P. M. DESCRIPTION**	**FREQUENCY**
Analytical Balances	•Check with Class "I" weights	Daily-tolerance ±0.1%
Analytical Balances	•Service/Calibration (semi-annual contract maintenance and calibration check)	Semi-annually
Refrigerators & Incubators	•Maintenance service	As needed determined by daily temperature performance checks
Gas Chromatograph Detectors: ECD	•Bake off or Replace •Perform wipe leakage test	GC/detector maintenance is routinely completed as needed for each instrument. Analysts are responsible for performing and documenting maintenance on each component of the instrumentation based on daily performance of the instrument and its
Gas Chromatograph Detectors: FID	•Change Quartz jet; clean; replace flame tip	
Gas Chromatograph/Mass Spectrometer	•Autotune Report	
Gas Chromatograph/Mass Spectrometer	•Clean ion source	

INSTRUMENT	P. M. DESCRIPTION	FREQUENCY
Gas Chromatograph/Mass Spectrometer	•Replace vacuum pump oil	ability to meet certain method requirements. Senior analyst team is available to help with major maintenance issues.
Gas Chromatographs/Mass Spectrometer & Gas Chromatographs	•Replace septa and liner	
Gas Chromatographs/Mass Spectrometer & Gas Chromatographs	•Replace column	
High Intensity Ultrasonic Processor - Misonix	•Check tuning criteria	Daily with use
Infrared Spectrophotometer - Foxboro Miran 1A	•Optics alignment or replacement	As needed when response begins to deteriorate

8.3 STANDARDS AND REAGENTS

Table 8.3A: Standard stock sources, description and calibration information.

This table is subject to revision without notice

Method	Vendor*	Description	Calibration	Storage Req.	Expiration
8310	Ultra	Aromatic Hydrocarbon	Primary	4° ± 2°C	6 months
	NSI	8310/610 Spike	Second Source	4° ± 2°C	6 months
DRO	NSI	DRO #2 Cal Mix	Primary	-10°C to –20°C	6 months
	NSI	DRO #2 Spike	Second Source	-10°C to –20°C	6 months
EPH TN DRO	NSI	TN-EPH Calibration Mix	Primary	-10°C to –20°C	6 months
	NSI	EPH-TN Spike	Second Source	-10°C to –20°C	6 months
RRO	NSI	30W Oil	Primary	-10°C to –20°C	6 months
PCB	Accustd	Aroclor PCB Kit	Primary	4° ± 2°C	6 months
	NSI	1260 Spike	Second Source	4° ± 2°C	6 months
Chlordane	Restek	Chlordane Mix	Primary	4° ± 2°C	6 months
Toxaphene	Restek	Toxaphene	Primary	4° ± 2°C	6 months
Pesticides	Ultra	Pest Mix	Primary	4° ± 2°C	6 months
	NSI	Pest Spike Mix	Second Source	4° ± 2°C	6 months
Herbicides	NSI	Custom Herbicide Mis	Primary	4° ± 2°C	6 months
	NSI	Herb Spike Mix	Second Source	4° ± 2°C	6 months
8141 OP Pest	Ultra/NSI	OP Cal Mix A, B	Primary	4° ± 2°C	6 months
	NSI	OP Spike Mix A, B	Second Source	4° ± 2°C	6 months
507 NP Pest	Ultra/NSI	507 Cal Mix	Primary	4° ± 2°C	2 months
	NSI	NP Pest Spike	Second Source	4° ± 2°C	2 months
THAA	Ultra/Accustd	HAA Cal Mix	Primary	-10°C to –20°C	6 months
	Accustd/NSI	HAA Spike	Second Source	-10°C to –20°C	6 months
8270	Ultra	Custom Std Mega Mix	Primary	4° ± 2°C	6 months
	Restek	Spike Mix	Second Source	4° ± 2°C	6 months
8330	Restek	Mix1, Mix2, PETN	Primary	4° ± 2°C	6 months
	Ultra, Chemservice	Mix1, Mix2, PETN	Second Source	4° ± 2°C	6 months
8011, 504.1	Accustd	504.1 Cal Mix	Primary	4° ± 2°C	1 month
	NSI	Spike Mix	Second Source	4° ± 2°C	1 month

Table 8.3A: Standard stock sources, description and calibration information.

This table is subject to revision without notice

Method	Vendor*	Description	Calibration	Storage Req.	Expiration
Sulfolane, 8270C	Sigma Aldrich	Calibration Mix	Primary	4° ± 2°C	6 months
	Restek	Spike Mix	Second source	4° ± 2°C	6 months
Glycol, 8015	Chemservice	Calibration Mix	Primary	4° ± 2°C	6 months
	Chemservice	Spike Mix	Second source	4° ± 2°C	6 months

**Equivalent Providers may be utilized.*

TABLE 8.3B: Working Standard Concentrations

This table is subject to revision without notice

Organic Compounds	Method #	Standard Concentrations	Storage Requirements	Expiration
Semi-Volatiles	625, SM6410B 20th, 8270C/D	1,2,4,8,12,16,20,30,40,50,80 (low level and regular)	4° ± 2°C	6 months
Semi-Volatiles: RV/LVI/NC SS	625, SM6410B 20th, 8270C/D	10,20,50,100,200,500,1000,2000 ug/L	4° ± 2°C	6 months
PCBs: 1L/RV SS	608, SM6431B 20th, 8082	2.0,4.0,5.0,10,20,50 µg/L	4° ± 2°C	6 months
Pesticides: 1L/RV/SS	608, SM 6630C, 8081A,	0.5,1.0,2.0,5.0,10,15,20 µg/L	4° ± 2°C	6 months
Chlordane and/or Toxaphene 1L/RV/SS	608, SM 6630C, 8081A,	10,20,50,100,150,200 µg/L	4° ± 2°C	6 months
Sulfolane	8270C/D	4,8,10,20,50,100,200,500 ug/L	4° ± 2°C	6 months
PCB Arochlors 1221, 1232, 1242, 1248, 1254	8082	10 ug/L	4° ± 2°C	6 months
Herbicides	8151A, SM6640C 20th	0.02, 0.05, 0.1, 0.2, 0.5, 1.0 mg/L	4° ± 2°C	6 months
OP and NP Pesticides	507 by dual-NPD, 1657A, 8141A by dual-FPD	0.2,1.0, 2.0, 5.0, 10.0, 15.0, 20.0 ug/L	4° ± 2°C	6 months
PAHs	8310, 610, SM6440B	0.04, 0.20,1.0,5.0,8.0,20.0,30.0, 40.0 ug/L	4° ± 2°C	6 months
PAHs: 1L/RV/LVI/ SS	8270C/D SIM	4.0,20,40,100,160,400,600,800 ug/L 1.0,5.0,10,20,40,80,200 ug/L	4° ± 2°C	6 months
Nitroaromatics & Nitramines	8330	.05, 0.1, 0.25, 0.5, 2.0, 5.0, 10.0, 25.0 mg/L	NA*	NA*
EPHTN	EPH TN	10000, 6000, 4000, 2000, 1000, 400, 200, 100 mg/L	NA*	NA*
DRO	OA2 , 8015Mod, LA TPH D, LA TPH O, OHIO DRO	10000, 5000, 3000, 2000, 1000, 400, 200, 100 mg/L	NA*	NA*
Diesel/M.O: RV/LVI	EPH TN OA2 ,	2.0,4.0,8.0,20,40,80,100,200	NA*	NA*

TABLE 8.3B: Working Standard Concentrations
This table is subject to revision without notice

Organic Compounds	Method #	Standard Concentrations	Storage Requirements	Expiration
	8015Mod, LA TPH D, LA TPH O, OHIO DRO	mg/L		
DRO	DRO/CA LUFT/CO	2.0,4.0,10,20,40,60,100,200 mg/L	NA*	NA*
DROMO: LVI PAHMO: LVI	MO DRO/PAH by 8270	5.0,10,20,40,80,120,160,200 mg/L 4.0,20,40,100,160,400,600,800 ug/L	4° ± 2°C	6 months
MADEP EPH	MADEP EPH	Aromatics C11-C22: 17, 85, 425, 850, 1700, 3400, 6800 mg/L Aliphatic C9 - C18: 6, 30, 150, 300, 600, 1200, 2400 mg/L Aliphatic C19 - C36: 8, 40, 200, 800, 1600, 3200 mg/L	NA*	NA*
EDB, DBCP, TCP	8011, 504.1	0.01, 0.02, 0.05, 0.10, 0.25, 0.5	NA*	NA*
THAAs	552.2	1, 2, 4, 10, 20, 30, 40, 50 ug/L	NA*	NA*
FL PRO	FL PRO	85, 850, 2550, 4250, 5950, 8500 mg/l	NA*	NA*
FL PRO RV	FL PRO	1.7, 3.4, 6.8, 13.6, 34, 85, 170 mg/L	NA*	NA-
Glycols	8015B/C/D - Modified	1.5,7.5,15,30,45,60 ppm	NA*	NA*
TX TPH	TX1005	Individual Ranges- 4.5, 10, 25, 50, 125, 250, 500, 1250, 2500 ppm. Total Range- 9.0, 20, 50, 100, 250, 500, 1000, 2500, 5000 ppm.	NA*	NA*

* indicates solutions are prepared fresh daily as needed.

8.4 INSTRUMENT CALIBRATION

608/8081A or B/SM6630C - Chlorinated Pesticides – SOP Number 330344

The gas chromatograph is calibrated using either the internal or external standard calibration model. A standard curve is prepared using a minimum of three concentration levels for each compound of interest for method 608. A minimum of five concentration levels is necessary for methods 8081A/B and SM6630C. The calibration range must represent the typical environmental sample concentration and include the RL as the lowest calibration point. The linear range of the instrument must also be monitored to ensure that the maximum calibration point is within detection range. The calibration standards are tabulated according to peak height or area responses against concentration or ISTD response for each compound and calibration/response factors are calculated. If performing analysis by method 608 and the response factors of the initial calibration are

< 10 % RSD for method 608 and 20% RSD for methods 8081A/B and 6630C over the calibration range, the average RF can be used for calculations. Alternatively, when the response factor criteria is exceeded, the analyst may utilize a linear calibration model of response ratios (i.e. Area/Ref. Area or Amt./Ref Amt.) for quantitation providing that the correlation coefficient is at least 0.990.

During the analytical sequence, the stability of the initial calibration curve is verified, following every 20th sample for external calibration and every 12 hours if monitoring ISTD, by the analysis of a continuing calibration verification (CCV) standard. The CCV must recover within 15% of the expected concentration for each analyte.
At daily instrument startup and in lieu of performing an entire initial calibration, the most recent calibration curve may be verified by the analysis of initial calibration verification standard (ICV). If the response for any analyte in this check varies from the predicted response by more than ±15%, the analysis must be repeated using fresh standard. If the standard still does not meet the acceptance criteria, a new initial calibration curve must be generated.

An independent, or second source, calibration verification standard (SSCV) is analyzed after each initial calibration and should recover within ±20% of the expected concentration for each analyte. When analyte responses in field samples exceed the calibration range, the sample is diluted and re-analyzed.

Degradation if DDT and Endrin are also verified at least every 12hr window. Breakdown should recover less 20% of the total injection.

507 - Nitrogen/Phosphorus Pesticides - SOP Number 330348

The gas chromatograph is calibrated using the external standard procedure. A standard curve is prepared using a minimum of three concentration levels for each compound of interest for method 507. The calibration range must represent the typical environmental sample concentration and include the RL as the lowest calibration point. The linear range of the instrument must also be monitored to ensure that the maximum calibration point is within detection range. The calibration standards are tabulated according to peak height or area responses against concentration for each compound and response factors are calculated. If the response factors of the initial calibration are ≤20 % RSD over the calibration range, the average RF can be used for calculations. Alternatively, when the response factor criteria is exceeded, the analyst may utilize a linear calibration model of response ratios (i.e. Area/Ref. Area or Amt./Ref Amt.) for quantitation providing that the correlation coefficient is at least 0.990.

During the analytical sequence the stability of the initial calibration is verified, following every 10th sample and at the end of the sequence, by the analysis of a continuing calibration verification (CCV) standard. The CCV must recovery within 20% of the expected concentration for each analyte.

At daily instrument startup and in lieu of performing an entire initial calibration, the most recent calibration curve may be verified by the analysis of check calibration verification standard (CCV). If the response for any analyte in this check varies by more than ±20% from the initial calibration, the analysis must be repeated using fresh standard. If the standard still does not meet the criteria, a new initial calibration curve must be generated.

A Quality Control Sample (QCS) is analyzed at a minimum quarterly to verify calibration standards.

552.2 - HAA - SOP Number 330319

The gas chromatograph is calibrated using the internal standard procedure. A standard curve is prepared using a minimum of five concentration levels for each compound of interest. The calibration range must represent the typical environmental sample concentration and include the RL as the lowest calibration point. The linear range of the instrument must also be monitored to ensure that the maximum calibration point is within detection range. The calibration standards are tabulated according to peak height or area responses against concentration for each compound and response factors are calculated. If the response factors of the initial calibration are ≤20 % RSD over the calibration range, the average RF can be used for calculations. Alternatively, when the response factor criteria is exceeded, the analyst may utilize a linear calibration model of response ratios (i.e. Area/Ref. Area or Amt./Ref Amt.) for quantitation providing that the correlation coefficient is at least 0.990.

During the analytical sequence the stability of the initial calibration is verified, following every 10th sample and at the end of the sequence, by the analysis of a continuing calibration verification (CCV) standard. The response of the analytes in the CCV must not vary more than 30% from the initial calibration.

At daily instrument startup and in lieu of performing an entire initial calibration, the most recent calibration curve may be verified by the analysis of check calibration verification standard (CCV). If the response for any analyte in this check varies by more than ±30% from the initial calibration, the analysis must be repeated using fresh standard. If the standard still does not meet the criteria, a new initial calibration curve must be analyzed.

A Quality Control Sample (QCS) is analyzed at a minimum quarterly to verify calibration standards.

8151A, SM6640B – Herbicides - SOP Number 330320

The gas chromatograph is calibrated using the external standard procedure. A standard curve is prepared using a minimum of five concentration levels for each analyte of interest. The calibration range must represent the typical environmental sample concentration and include the RL as the lowest calibration point. The linear range of the instrument must also be monitored to ensure that the maximum calibration point is within detection range. The calibration standards are tabulated according to peak height or area responses against concentration for each compound and response factors are calculated. If the response factors of the initial calibration are $\leq$20 % RSD over the calibration range, the average RF can be used for calculations. Alternatively, when the response factor criteria is exceeded, the analyst may utilize a linear calibration model of response ratios (i.e. Area/Ref. Area or Amt./Ref Amt.) for quantitation providing that the correlation coefficient is at least 0.990.

During the analytical sequence, the stability of the initial calibration is verified following every 10th sample and at the end of the sequence by the analysis of a continuing calibration verification (CCV) standard. The CCV must recovery within 15% of the expected concentration for each analyte for method 8151A and within 20% for method 6640C. The value of the CCV can exceed the criteria for a single compound provided that all samples in the analytical batch are BDL (below detection limit). The concentration of the continuing check standard must be routinely varied to verify the entire calibration range.

At daily instrument startup and in lieu of performing an entire initial calibration, the most recent calibration curve may be verified by the analysis of check calibration verification standard (CCV). If the response for any analyte in this check varies from the predicted response by more than ±15%, the analysis must be repeated using fresh standard. If the standard still does not meet the criteria, a new initial calibration curve must be generated.

An independent, or second source, calibration verification standard (SSCV) is analyzed after each initial calibration and should recover within ±20% of the expected concentration for each analyte. When sample responses exceed the calibration range, the sample is diluted and re-analyzed.

8141A, 1657A – Organophosphorus Pesticides - SOP Number 330318

The gas chromatograph is calibrated using either the internal or external standard calibration model. A minimum of five concentration levels is necessary for methods 8141A and 1657A. The calibration range must represent the typical environmental sample concentration and include the RL as the lowest calibration point. The linear range of the instrument must also be monitored to ensure that the maximum calibration point is within detection range. The calibration standards are tabulated according to peak height or area responses against concentration or ISTD response for each compound and calibration/response factors are calculated. If the response factors of the initial calibration are $\leq$20 % RSD over the calibration range, the average RF can be used for calculations. Alternatively, when the response factor criteria is exceeded, the analyst may utilize a linear calibration model of response ratios (i.e. Area/Ref. Area or Amt./Ref Amt.) for quantitation providing that the correlation coefficient is at least 0.990.

During the analytical sequence, the stability of the initial calibration is verified following every 20th sample by the analysis of a continuing calibration verification (CCV) standard for external calibration or at the beginning of every 12hrs for ISTD calibration. The CCV must recovery within 15% of the expected concentration for each analyte. The concentration of the continuing check standard must be routinely varied to verify the entire calibration range.

At daily instrument startup and in lieu of performing an entire initial calibration, the most recent calibration curve may be verified by the analysis of check calibration verification standard (CCV). If the response for any analyte in this check varies from the predicted response by more than ±15%, the analysis must be repeated using fresh standard. If the standard still does not meet the criteria, a new initial calibration curve must be generated. An independent, or second source, calibration verification standard (SSCV) is analyzed after each initial calibration and should recover within ±20% of the expected concentration for each analyte. When sample responses exceed the calibration range, the sample is diluted and re-analyzed.

625, 8270C or D, SM6410B - Base/Neutrals/Acids by GC/MS: Semivolatile Organics – SOP Number 330345

Detector mass calibration is performed using the autotune function of the GC/MS analytical system and PFTBA (Perfluorotributylamine). Following verification of the appropriate masses, the instrument sensitivity is verified by injecting a tuning solution containing decafluorotriphenylphosphine (DFTPP), benzidine, pentachlorophenol and DDT. The DFTPP must meet the ion abundance criteria specified by the EPA published method. Benzidine and pentachlorophenol are reviewed for tailing and DDT is reviewed for breakdown to DDE and DDD. Successful tuning must occur every 12 hours for method 8270C/D and every 24 hours for method 625, except where noted in the determinative SOP.

Following successful tuning, the GC/MS is calibrated using the internal standard procedure. A standard curve is prepared using a minimum of three standards for method 625 and five standards for method 8270C/D and SM6410B. The calibration standards are tabulated according to peak height or area against concentration and the concentrations and responses of the internal standard analytes. The results are used to determine a response factor for each analyte in each standard injected. A calibration curve is the constructed and is determined to be acceptable if each analyte meets the criteria specified in the determinative method. When this condition is met, linearity through the origin can be assumed and the average RF can be used in place of a calibration curve. Initial calibration that does not meet these requirements will not be accepted and recalibration must be performed. Linear regression can be used for target compounds exceeding the 15% criteria, providing that the correlation coefficient is 0.990 or better. USACE projects must meet a correlation coefficient of 0.995 or better. The initial calibration range must represent the typical environmental sample and include the RL as the lowest calibration point. The linear range of the instrument must be monitored to ensure that the maximum calibration point is within the range.

A second source calibration verification standard is analyzed after each calibration and should recover within 20% for all CCC compounds and within 50% for other analytes of interest for 8270C. All analytes must recover +/- 30% for 8270D. Following successful calibration, the analysis of field and QC samples may begin. Analysis may be performed only during the timeframe of a valid tuning cycle (12 hours for 8270C/D and 24 hours for 625). Following the expiration of the tuning clock, the instrument must be retuned and either re-calibrated or existing calibration may be re-verified.

For 8270C/D analyses, daily calibration verification includes successful demonstration of DFTPP sensitivity and the injection of a mid-level CCV standard containing all the target analytes of interest. The DFTPP tune must meet the ion abundance criteria specified within the published method. Each internal standard in the CCV must recover between -50% to + 100%, when compared to the same internal standard compound in the mid-point standard of the initial calibration curve. Additionally, if the retention time of an internal standard changes by more than 30 seconds from the retention time of the same internal standard in the mid-level standard of the most recent initial calibration, the system must be evaluated, corrected, and possibly re-calibrated.

For 625 analyses, daily calibration verification is accomplished by a successful demonstration of DFTPP sensitivity and the injection of a mid-level CCV standard containing all the target analytes of interest. The DFTPP tune must meet the same ion abundance criteria as the 8270C analysis and the CCV standard must recover within 20 % of predicted response for all analytes of interest.

8310, 610, SM6640B - PAHs by HPLC - SOP Number 330322

610: A standard curve is prepared using a minimum of three concentration levels for each compound of interest. If the response factors are < 10 % RSD over the working range, the average RF can be used for calculations

8310 & SM6640B: Perform calibration using a minimum of 5 points. If the response factors are < 20 % RSD over the working range, the average RF can be used for calculations or linear regression may be used providing that the correlation coefficient for each analyte of interest is 0.990 or better. USACE projects must meet a correlation coefficient of 0.995 or better. The regression line must never be forced through the origin.

The initial calibration standards are tabulated according to peak height or area responses against concentration for each compound and response factors are calculated. Alternatively, the results can be used to plot a calibration curve of response ratios (Area/Ref. Area) vs (Amt./Ref Amt.). The calibration range must represent the typical environmental sample and include the RL as the lowest calibration point. The linear range of the instrument must be monitored to ensure that the maximum calibration point is within the range. A second source calibration verification standard is analyzed after each calibration and should meet criteria of ±20%.

A continuing calibration verification (CCV) must be run at the beginning of each run and every 10 samples thereafter. The continuing calibration standard is prepared from the same source as the calibration curve and must perform within ±15% of the actual value. The CCV must represent the midpoint of the calibration range.

8330A/B/C – Nitroaromatics/Nitrosamines - SOP Number 330323

A standard curve is prepared using a minimum of five concentration levels for each compound of interest. Experience indicates that a linear calibration curve with zero intercept is appropriate for each analyte. Therefore, a response factor for each analyte can be taken as the slope of the best-fit regression line. The correlation coefficient for each analyte of interest is 0.990 or better. The calibration range must represent the typical environmental sample and include the RL as the lowest calibration point. The linear range of the instrument must be monitored to ensure that the maximum calibration point is within the range. A second source calibration verification standard is analyzed after each calibration and should meet the criteria of ±20%.

Daily calibration is accomplished through the analysis of midpoint calibration standards, at a minimum, at the beginning of the day, and singly after the last sample of the day (assuming a sample group of 10 samples or less). Obtain the response factor for each analyte from the mean peak heights or peak areas and compare it with the response factor obtained for the initial calibration. The mean response factor for the daily calibration must agree within ±20% of the response factor of the initial calibration. If this requirement is not met, a new initial calibration must be obtained.

8015B/C/D or State Specific Method - DRO/RRO - Various SOPs

Certain state accreditation/registration programs may have specific requirements for calibration and analysis that must be met. Those requirements supersede the general guidance provided in this section and are addressed in the determinative SOP. Generally, for 8015B/C/D analysis, the gas chromatograph is calibrated using the external standard procedure. A standard curve is prepared using a minimum of five concentration levels for each analyte of interest. The calibration range must represent the typical environmental sample concentration and include the RL as the lowest calibration point. The linear range of the instrument must also be monitored to ensure that the maximum calibration point is within detection range. The calibration standards are tabulated according to peak height or area responses against concentration for each compound and response factors are calculated. If the response factors of the initial calibration are ≤20 % RSD over the calibration range, or per state method, the average RF can be used for calculations. Alternatively, when the response factor criteria is exceeded, the analyst may utilize a linear calibration model of response ratios (i.e. Area/Ref. Area or Amt./Ref Amt.) for quantitation providing that the correlation coefficient is at least 0.990. USACE projects must meet a correlation coefficient of 0.995 or better.

During the analytical sequence, the stability of the initial calibration is verified following every 10th or 20th sample depending on method and at the end of the sequence by the analysis of a continuing calibration verification (CCV) standard. Typically, the CCV must recovery within 15% of the expected concentration for each analyte for method 8015B/C/D; however state specific limits for the CCV may vary. See the specific SOP or published method for more guidance. The concentration of the continuing check standard must be routinely varied to verify the entire calibration range.

At daily instrument startup and in lieu of performing an entire initial calibration, the most recent calibration curve may be verified by the analysis of check calibration verification standard (CCV). If the response for any analyte in this check varies from the predicted response by more than ±15% of the expected concentration for each analyte for method 8015B/C/D or more than state specified limits, the analysis must be repeated using fresh standard. If the standard still does not meet the criteria, a new initial calibration curve must be generated.

An independent, or second source, calibration verification standard (SSCV) is analyzed after each initial calibration and should meet criteria of ±20% of the expected concentration for each analyte. When sample responses exceed the range of the standard curve, the sample is diluted to a concentration suspected to be within the calibration range and re-analyzed.

8.5 ACCEPTANCE/REJECTION OF CALIBRATION

Organic Chemistry

The initial calibration curve is compared with previous curves for the same analyte. All new standard curves are immediately checked with a secondary source or laboratory control standard prepared from a separate source than those used for calibration. All curves are visually reviewed to ensure that acceptable correlation represents linearity. Calibration curves may be rejected for nonlinearity, abnormal sensitivity, or poor response of the laboratory control standard.

Continuing calibration verification is performed on each day that initial calibration is not performed and following every 10th or 20th sample. If a check standard does not perform within established criteria then the instrument undergoes an evaluation to determine the cause. Once the issue is corrected, all samples between the last in control standard and the first out of control check are re-analyzed.

TABLE 8.5: INSTRUMENT CALIBRATION

Instrument (Analysis)	Calibration Type	Minimum Number of Standards	Type of Curve	Acceptance/ Rejection Criteria	Frequency
Gas Chromatography	Initial	3 (600 series methods) - 5 (other) cal.stds	Avg. RF or Linear	8081A, 8151A, 6640C, 8141A, 657A: Must be ≤20% RSD 608 - ≤10% RSD	As needed
	Second Source	1 Second Source		+/- 20% of true value	With each calibration

TABLE 8.5: INSTRUMENT CALIBRATION

Instrument (Analysis)	**Calibration Type**	**Minimum Number of Standards**	**Type of Curve**	**Acceptance/ Rejection Criteria**	**Frequency**
(Pest/PCB, Herbicides, Organophos/ Organonitrogen Pesticides)	Daily / Continuing	OPPEST/HERB1/10 P/PCB 1/20		Must be within 15% of the initial calibration curve, 20% for 6640C.	Beginning, every 20 samples and ending for external cal.
	Daily / Continuing	OPPEST/HERB1/10 P/PCB 1/20		Must be within 15% of the initial calibration curve, 20% for 6640C.	Every 12hrs samples for internal cal
HPLC (PAH and Explosive)	Initial	3 (600 series methods) 5 (other) cal.stds	Avg. RF or Linear	8310, 8330: Must be ≤20% RSD 610 - ≤10% RSD	As needed
	Second Source	1 Second Source		+/- 20% of true value	With each calibration
	Daily / Continuing	1/10		Must be within 15% of the initial calibration curve.	Beginning, every 10 and ending.
GC/MS Semi-volatiles 8270C/D	Initial	At least 5 cal. stds	Avg. RF or Linear	8270C - Must be ≤15% RSD, CCCs must be ≤ 30% RSD, Linear regression: 0.990 per method or 0.995 for USACE	As needed
		1 Second Source		8270D - Must be ≤20% RSD for target analytes, Linear regression: 0.990 per method or 0.995 for USACE	
	Second Source	1 Second Source		8270C: Should recover within 20% for all CCC compounds and within 50% for other analytes of interest, with the exception of analytes known to perform poorly 8270D: Should recover w/in 30% for all	With each calibration
	Daily / Continuing	Tune & CCV		Must pass established method criteria. See SOP.	Every 12 hours per method
GC/MS Semi-volatiles 625	Initial	3 cal.stds	Avg. RF or Linear	625 - ≤35% RSD all compounds	As needed
	Second Source	1 Second Source		Should recover within 20% for all CCC compounds and within 50% for other analytes of interest, with the exception of analytes known to perform poorly	With each calibration
	Daily / Continuing	Tune & CCV every 24 hours		Must pass established method tuning criteria; 625: CCV must be ≤20% difference for all compounds,	Every 24 hours
HAA 552.2	Initial	5 cal.stds	Avg. RF or Linear	≤30% RSD all compounds	As needed
	Second Source(QCS)	1 Second Source		±30% of true value	Extracted with each batch
	Daily / Continuing	1/10		CCV must be ≤30% difference for all compounds,	Beginning, every 10 and ending

TABLE 8.5: INSTRUMENT CALIBRATION

Instrument (Analysis)	Calibration Type	Minimum Number of Standards	Type of Curve	Acceptance/ Rejection Criteria	Frequency
Pesticides 507	Initial	5 cal.stds	Avg. RF or Linear	≤20% RSD all compounds	As needed
	Second Source(QCS)	1 Second Source		+20% of true value	Extracted with each batch
	Daily / Continuing	1/10		CCV must be ≤20% difference for all compounds,	Beginning, every 10 and ending
DRO –8015, State Programs* * Or per state requirement	Initial	5 cal.stds	Avg. RF or Linear	8015B/C/D - ≤20% RSD all compounds	As needed
	Second Source	1 Second Source		+20% of true value	With each calibration
	Daily / Continuing	1/10		CCV must be ≤15% difference for all compounds,	Beginning, every 10/20 and ending

9.0 LABORATORY PRACTICES

9.1 REAGENT GRADE WATER

Reagent grade water is obtained from an Evoqua resin with Aquafine UV system.

9.2 GLASSWARE WASHING AND STERILIZATION PROCEDURES

Organic laboratory glassware is washed in a non-phosphate detergent and warm tap water. Before washing, all writing and large deposits of grease are removed with acetone. Glassware is then rinsed with: tap water, "No Chromix" solution, tap water, and deionized (DI) water. It is then solvent rinsed in the following order: acetone, and then methylene chloride. Glassware is stored in designated drawers or on shelves, inverted if possible. All glassware is rinsed with the required solvent for the particular extraction protocol prior to use.

10.0 ANALYTICAL PROCEDURES

10.1 A list of laboratory SOPs associated with the semi-volatile laboratory can be found in the following table:

TABLE 10.1: SEMI-VOLATILE DEPARTMENT SOPS

This table is subject to revision without notice

SOP #	Title
	Preparatory SOPs
330702B	RV Separatory Funnel Liquid-Liquid Extraction 3510C
330702A	Separatory Funnel Liquid-Liquid Extraction 3510C MN
330702	Separatory Funnel Liquid-Liquid Extraction 3510C
330707	Microwave Extraction (3546)

SOP #	**Title**
330708	Buchi Syncore Concentration System
330709	Microextraction Procedure (3511)
330754	3580A Waste Dilution for SVOC's
330755	PCB in Oil Waste Dilution
Extract Cleanup SOPs	
330739	3630C Silica Gel Cleanup
330740	3665A Acid Clean up
330741	3660C Sulfur Clean up
330742	3620B Florisil Clean up
Semi-Volatiles Analysis SOPs	
330770A	TPH/O&G- Soxhlet extraction using Hexane
330771A	n-Hexane Oil and Grease Extraction by SPE for South Carolina
330771	n-Hexane Oil and Grease Extraction by SPE
330317	Sulfolane (Modified EPA Method 8270C/D)
330318	8141 Organophosphorus Pesticides
330319	THAA's
330320	Chlorinated Herbicides by Gas Chromatography (Method 8151A)
330322	8310 PAH's by HPLC
330323	8330 Explosives by HPLC
330343	8082 PCB's
330344	Pesticides and PCBS by Gas Chromatography (608 and 8081A)
330345	Semi-volatile Organics by GC/MS using Capillary Column
330346	8011/504.1 EDB in Drinking Water by GC ECD
330346OH	8011 EDB in Drinking Water by GC ECD
330348	507 NP Pesticides in Drinking Water by GC NPD
330350A	Diesel Range Organics/Total Petroleum Hydrocarbons (Diesel) By Gas Chromatography
330352	TN - Extractable Petroleum Hydrocarbons / KY- Diesel Range Organics
330353	MA Extractable Petroleum Hydrocarbons
330355	Florida Pro and CT ETPH
330356	TXTPH 1005/1006
330358	OA2 & NWTPHDx
330359	AK102/AK103
330360	DROWM
330361	Glycols by GC/FID (8015)

11.0 QUALITY CONTROL CHECKS

NOTE: For specific guidance on each determinative method, including required quality control and specific state requirements/modifications, refer to the relevant laboratory standard operating procedure(s).

11.1 ESC participates in proficiency testing (PT's) in support of various laboratory accreditations/recognitions. Environmental samples are purchased from Environmental Resource Associates (ERA). The WS, WP and solid matrix studies are completed every 6 months. Proficiency testing samples are received and analyzed by method according to the vendor's instructions and according to the applicable analytical SOP.

11.2 Initial Demonstrations of Capability (IDOCs) are performed during new analyst training and/or prior to acceptance and use of any new method/instrumentation. Continuing

Demonstration of Capability (CDOCs) must be updated at least annually. The associated data is filed within the department and available for review.

11.3 Matrix Spike and Matrix Spike Duplicates are performed on each batch of samples analyzed depending on analytical method requested provided that sufficient volume is provided by the customer.

11.4 A Laboratory Control Sample (LCS) and LCS Duplicate are analyzed one per batch of samples.

11.5 A method preparation blank is performed per batch of samples processed. If the acceptance criteria as listed in the determinative SOP is exceeded, the laboratory shall evaluate whether re-processing of the samples is necessary, based on the following criteria:

- The blank contamination exceeds a concentration greater than 1/10 of the measured concentration of any sample in the associated preparation batch or
- The blank contamination is greater than 1/10 of the specified regulatory limit. The concentrations of common laboratory contaminants shall not exceed the reporting limit.

Any samples associated with a blank that fail these criteria shall be reprocessed in a subsequent preparation batch, except when the sample analysis resulted in non-detected results for the failing analytes.

12.0 *DATA REDUCTION, VALIDATION AND REPORTING*

12.1 DATA REDUCTION

The analyst performs the data calculation functions and is responsible for the initial examination of the finished data. Data reduction steps applied to the raw data are outlined in SOP #030201, *Data Handling and Reporting.* A secondary review of the data package is performed according to ESC SOP #030227, *Data Review*. The reviewer verifies that the analysis has been performed as required and meets method criteria, all associate data is present and complete, and also ensures that any additional documentation is completed as required (i.e. Ohio VAP checklists, required flags on test reports, etc.)

TABLE 12.1 Data Reduction Formulas

PARAMETER	FORMULA
GC and HPLC	$\frac{\text{response of sample analyte } \{\textit{area}\} \text{ x final extract volume } \{\textit{mL}\} \text{ x dilution}}{\text{response factor } \{\textit{area/(mg/mL)}\} \text{ x initial extract volume-mass } \{\textit{mL or g}\}}$ *Calculations performed by HP Enviroquant Software*
GC/MS	$\frac{\text{response of analyte } \{\textit{area}\} \text{ x extract volume } \{\textit{mL}\} \text{ x dilution x int. std amt. } \{\textit{area}\}}{\text{response factor } \{\textit{area/(mg/mL)}\} \text{ x initial volume-mass } \{\textit{mL or g}\} \text{ x int. std cal. } \{\text{area}\}}$ *Calculations performed by HP Enviroquant Software*

12.2 VALIDATION

The validation process consists of data generation, reduction review, and reporting results. Once data reduction is complete, validation is conducted by verification that the QC samples are within acceptable QC limits and that all documentation is complete, including the analytical report and associated QC. See Table 12.3 by method for current QC targets and controls and current reporting limits.

Marginal Excedence – When a large number of analytes exist in the LCS, it is statistically possible for a few analytes to be outside established control limits while the analytical system remains in control. These excursions must be random in nature and, if not, a review of the control limits or analytical process is necessary.

Upper and lower marginal excedence (ME) limits are established as the mean of at least 20 data points ± four times their standard deviations. The number of allowable marginal excedences per event is based on the number of analytes spiked in the LCS.

Allowable Marginal Exceedance per Event	
Analytes in LCS:	**ME Allowable**
>90	5
71-90	4
51-70	3
31-50	2
11-30	1
<11	0

Organic Control Limits - The organic QC targets are statutory in nature; warning and control limits for organic analyses are initially established for groups of compounds based on preliminary method validation data. When additional data becomes available, the QC targets are reviewed. All QC targets are routinely re-evaluated at least annually (and updated, if necessary) against laboratory historical data to insure that the limits continue to reflect realistic, method achievable goals.

12.3 REPORTING

Reporting procedures are documented in *SOP 030201 Data Handling and Reporting.*

Table 12.3: QC Targets for Semi-Volatiles Accuracy (LCS), Precision and RLs
This table is subject to revision without notice

Class	**Analyte**	**Method**	**Matrix**	**Accuracy (%)**	**Prec. (RPD)**	**RL**	**Unit**
Pesticides	AZINPHOS-METHYL	8141A, 1657A	GW	64.9-120	20.0	0.001	mg/L
Pesticides	BOLSTAR (SULPROFOS)	8141A, 1657A	GW	65.4-119	20.0	0.001	mg/L
Pesticides	CHLORPYRIFOS	8141A, 1657A	GW	65.3-113	20.0	0.001	mg/L
Pesticides	COUMAPHOS	8141A, 1657A	GW	62.2-121	20.0	0.001	mg/L
Pesticides	DEMETON,-O AND -S	8141A, 1657A	GW	65.9-110	20.0	0.002	mg/L

Table 12.3: QC Targets for Semi-Volatiles Accuracy (LCS), Precision and RLs

This table is subject to revision without notice

Class	Analyte	Method	Matrix	Accuracy (%)	Prec. (RPD)	RL	Unit
Pesticides	DIAZINON	8141A, 1657A	GW	62.4-116	20.0	0.001	mg/L
Pesticides	DICHLORVOS	8141A, 1657A	GW	51.0-117	20.0	0.002	mg/L
Pesticides	DIMETHOATE	8141A, 1657A	GW	19.9-109	35.6	0.001	mg/L
Pesticides	DISULFOTON	8141A, 1657A	GW	63.3-113	20.0	0.001	mg/L
Pesticides	EPN	8141A, 1657A	GW	635-119	20.0	0.001	mg/L
Pesticides	ETHOPROP	8141A, 1657A	GW	63.7-113	20.0	0.001	mg/L
Pesticides	ETHYL PARATHION	8141A, 1657A	GW	71.8-112	20.0	0.001	mg/L
Pesticides	FENSULFOTHION	8141A, 1657A	GW	63.4-112	20.0	0.001	mg/L
Pesticides	FENTHION	8141A, 1657A	GW	61.5-114	20.0	0.001	mg/L
Pesticides	MALATHION	8141A, 1657A	GW	68.5-112	20.0	0.001	mg/L
Pesticides	MERPHOS	8141A, 1657A	GW	52.0-115	20.0	0.001	mg/L
Pesticides	METHYL PARATHION	8141A, 1657A	GW	70.6-114	20.0	0.001	mg/L
Pesticides	MEVINPHOS	8141A, 1657A	GW	58.8-111	20.0	0.001	mg/L
Pesticides	NALED	8141A, 1657A	GW	60.7-112	20.0	0.001	mg/L
Pesticides	PHORATE	8141A, 1657A	GW	64.1-113	20.0	0.001	mg/L
Pesticides	RONNEL	8141A, 1657A	GW	63.0-112	20.0	0.001	mg/L
Pesticides	STIROPHOS	8141A, 1657A	GW	65.3-118	20.0	0.001	mg/L
Pesticides	SULFOTEP	8141A, 1657A	GW	64.7-110	20.0	0.001	mg/L
Pesticides	TEPP	8141A, 1657A	GW	34.3-107	31.3	0.020	mg/L
Pesticides	TOKUTHION (PROTHIOFOS)	8141A, 1657A	GW	62.9-118	20.0	0.001	mg/L
Pesticides	TRICHLORONATE	8141A, 1657A	GW	67.1-112	20.0	0.001	mg/L
Pesticides	AZINPHOS-METHYL	8141A	SS	63.3-118	20.0	0.1	mg/Kg
Pesticides	BOLSTAR (SULPROFOS)	8141A	SS	67.3-119	20.0	0.1	mg/Kg
Pesticides	CHLORPYRIFOS	8141A	SS	67.1-117	20.0	0.1	mg/Kg
Pesticides	COUMAPHOS	8141A	SS	64.4-122	20.0	0.1	mg/Kg
Pesticides	DEMETON,-O AND -S	8141A	SS	60.9-111	20.0	0.1	mg/Kg
Pesticides	DIAZINON	8141A	SS	27.8-141	21.7	0.1	mg/Kg
Pesticides	DICHLORVOS	8141A	SS	43.8-117	20.0	0.1	mg/Kg
Pesticides	DIMETHOATE	8141A	SS	43.7-115	23.2	0.1	mg/Kg
Pesticides	DISULFOTON	8141A	SS	67.7-114	20.0	0.1	mg/Kg
Pesticides	EPN	8141A	SS	58.0-120	20.0	0.1	mg/Kg
Pesticides	ETHOPROP	8141A	SS	70.9-114	20.0	0.1	mg/Kg
Pesticides	ETHYL PARATHION	8141A	SS	66.0-115	20.0	0.1	mg/Kg
Pesticides	FENSULFOTHION	8141A	SS	41.1-121	24.9	0.1	mg/Kg
Pesticides	FENTHION	8141A	SS	63.8-119	20.0	0.1	mg/Kg
Pesticides	MALATHION	8141A	SS	66.9-117	20.0	0.1	mg/Kg
Pesticides	MERPHOS	8141A	SS	63.8-117	20.0	0.1	mg/Kg

Table 12.3: QC Targets for Semi-Volatiles Accuracy (LCS), Precision and RLs
This table is subject to revision without notice

Class	Analyte	Method	Matrix	Accuracy (%)	Prec. (RPD)	RL	Unit
Pesticides	METHYL PARATHION	8141A	SS	67.6-113	20.0	0.1	mg/Kg
Pesticides	MEVINPHOS	8141A	SS	49.7-120	20.0	0.1	mg/Kg
Pesticides	NALED	8141A	SS	17.4-116	25.9	0.1	mg/Kg
Pesticides	PHORATE	8141A	SS	67.03-114	20.0	0.1	mg/Kg
Pesticides	RONNEL	8141A	SS	66.3-113	20.0	0.1	mg/Kg
Pesticides	STIROPHOS	8141A	SS	66.1-113	20.0	0.1	mg/Kg
Pesticides	SULFOTEP	8141A	SS	67.8-117	20.0	0.1	mg/Kg
Pesticides	TEPP	8141A	SS	0-79	40.0	1.0	mg/Kg
Pesticides	TOKUTHION (PROTHIOFOS)	8141A	SS	67.2-118	20.0	0.1	mg/Kg
Pesticides	TRICHLORONATE	8141A	SS	65.4-121	20.0	0.1	mg/Kg
Pesticides	ALACHLOR	507	DW	70.0-130	25.0	0.0002	mg/L
Pesticides	ATRAZINE	507	DW	70.0-130	25.0	0.0001	mg/L
Pesticides	BUTACHLOR	507	DW	70.0-130	25.0	0.0001	mg/L
Pesticides	METOLACHLOR	507	DW	70.0-130	25.0	0.0002	mg/L
Pesticides	METRIBUZIN	507	DW	70.0-130	25.0	0.0002	mg/L
Pesticides	SIMAZINE	507	DW	70.0-130	25.0	7.00E-05	mg/L
Pesticides	4,4-DDD	608/8081A/B, 6630C	GW, WW	63.0-130	20.0	0.00005	mg/L
Pesticides	4,4-DDE	608/8081A/B, 6630C	GW, WW	59.3-125	20.0	0.00005	mg/L
Pesticides	4,4-DDT	608/8081A/B, 6630C	GW, WW	61.3-130	20.0	0.00005	mg/L
Pesticides	ALDRIN	608/8081A/B, 6630C	GW, WW	39.0-123	20.0	0.00005	mg/L
Pesticides	ALPHA BHC	608/8081A/B, 6630C	GW, WW	60.1-128	20.0	0.00005	mg/L
Pesticides	BETA BHC	608/8081A/B, 6630C	GW, WW	59.2-135	20.0	0.00005	mg/L
Pesticides	ALPHA CHLORDANE	608/8081A/B, 6630C	GW, WW	63.7-132	20.0	0.005	mg/L
Pesticides	DELTA BHC	608/8081A/B, 6630C	GW, WW	61.8-131	20.0	0.00005	mg/L
Pesticides	DIELDRIN	608/8081A/B, 6630C	GW, WW	61.4-130	20.0	0.00005	mg/L
Pesticides	ENDOSULFAN I	608/8081A/B, 6630C	GW, WW	61.8-131	20.0	0.00005	mg/L
Pesticides	ENDOSULFAN II	608/8081A/B, 6630C	GW, WW	54.8-138	20.0	0.00005	mg/L
Pesticides	ENDOSULFAN SULFATE	608/8081A/B, 6630C	GW, WW	61.9-139	20.0	0.00005	mg/L
Pesticides	ENDRIN	608/8081A/B, 6630C	GW, WW	53.8-125	20.0	0.00005	mg/L

Table 12.3: QC Targets for Semi-Volatiles Accuracy (LCS), Precision and RLs
This table is subject to revision without notice

Class	Analyte	Method	Matrix	Accuracy (%)	Prec. (RPD)	RL	Unit
Pesticides	ENDRIN ALDEHYDE	608/8081A/B, 6630C	GW, WW	63.0-129	20.0	0.00005	mg/L
Pesticides	ENDRIN KETONE	608/8081A/B, 6630C	GW, WW	61.3-129	20.0	0.00005	mg/L
Pesticides	GAMMA BHC	608/8081A/B, 6630C	GW, WW	43.3-123	20.0	0.00005	mg/L
Pesticides	HEPTACHLOR	608/8081A/B, 6630C	GW, WW	61.8-130	20.0	0.00005	mg/L
Pesticides	HEPTACHLOR EPOXIDE	608/8081A/B, 6630C	GW, WW	48.3-110	20.0	0.00005	mg/L
Pesticides	HEXACHLOROBENZENE	608/8081A/B, 6630C	GW, WW	48.3-110	20.0	0.00005	mg/L
Pesticides	METHOXYCHLOR	608/8081A/B, 6630C	GW, WW	62.1-135	20.0	0.00005	mg/L
PCBs	PCB 1016	608, 6431B, 8082/A	GW, WW	55.5-103	20.0	0.0005	mg/L
PCBs	PCB 1260	608, 6431B, 8082/A	GW, WW	51.2-111	22.0	0.0005	mg/L
PCBs	PCB 1016	8082/A	SS	46.3-117	27.5	0.017	mg/Kg
PCBs	PCB 1260	8082/A	SS	46.5-120	27.0	0.017	mg/Kg
Pesticides	4,4-DDD	8081A/B	SS	70.8-120	20.0	0.02	mg/Kg
Pesticides	4,4-DDE	8081A/B	SS	70.9-121	20.0	0.02	mg/Kg
Pesticides	4,4-DDT	8081A/B	SS	68.1-124	20.0	0.02	mg/Kg
Pesticides	ALDRIN	8081A/B	SS	71.1-120	20.0	0.02	mg/Kg
Pesticides	ALPHA BHC	8081A/B	SS	69.9-121	20.0	0.02	mg/Kg
Pesticides	BETA BHC	8081A/B	SS	69.6-121	20.0	0.02	mg/Kg
Pesticides	DELTA BHC	8081A/B	SS	68.1-127	20.0	0.02	mg/Kg
Pesticides	DIELDRIN	8081A/B	SS	71.3-122	20.0	0.02	mg/Kg
Pesticides	ENDOSULFAN I	8081A/B	SS	71.6-122	20.0	0.02	mg/Kg
Pesticides	ENDOSULFAN II	8081A/B	SS	71.1-120	20.0	0.02	mg/Kg
Pesticides	ENDOSULFAN SULFATE	8081A/B	SS	67.4-125	20.0	0.02	mg/Kg
Pesticides	ENDRIN	8081A/B	SS	69.6-126	20.0	0.02	mg/Kg
Pesticides	ENDRIN ALDEHYDE	8081A/B	SS	59.9-114	20.0	0.02	mg/Kg
Pesticides	ENDRIN KETONE	8081A/B	SS	70.8-122	20.0	0.02	mg/Kg
Pesticides	GAMMA BHC	8081A/B	SS	70.1-121	20.0	0.02	mg/Kg
Pesticides	HEPTACHLOR	8081A/B	SS	63.3-126	20.0	0.02	mg/Kg
Pesticides	HEPTACHLOR EPOXIDE	8081A/B	SS	71.9-121	20.0	0.02	mg/Kg
Pesticides	HEXACHLOROBENZENE	8081A/B	SS	62.7-117	20.0	0.02	mg/Kg
Pesticides	METHOXYCHLOR	8081A/B	SS	69.3-122	20.0	0.02	mg/Kg

Table 12.3: QC Targets for Semi-Volatiles Accuracy (LCS), Precision and RLs
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Class	Analyte	Method	Matrix	Accuracy (%)	Prec. (RPD)	RL	Unit
Herbicides	2,4,5-T	1658, 8151A, 6640C	GW, WW	50.0-121	26.5	0.002	mg/L
Herbicides	2,4,5-TP (SILVEX)	1658, 8151A, 6640C	GW, WW	46.3-127	29.5	0.002	mg/L
Herbicides	2,4-D	1658, 8151A, 6640C	GW, WW	31.1-136	28.6	0.002	mg/L
Herbicides	2,4-DB	1658, 8151A, 6640C	GW, WW	39.5-128	31.9	0.002	mg/L
Herbicides	DALAPON	1658, 8151A, 6640C	GW, WW	36.6-132	29.2	0.002	mg/L
Herbicides	DICAMBA	1658, 8151A, 6640C	GW, WW	53.7-134	20.0	0.002	mg/L
Herbicides	DICHLOROPROP	1658, 8151A, 6640C	GW, WW	42.5-109	26.8	0.002	mg/L
Herbicides	DINOSEB	1658, 8151A, 6640C	GW, WW	42.5-112	21.3	0.002	mg/L
Herbicides	MCPA	1658, 8151A, 6640C	GW, WW	30.5-137	31.4	0.1	mg/L
Herbicides	MCPP	1658, 8151A, 6640C	GW, WW	33.2-148	25.2	0.1	mg/L
Herbicides	PENTACHLOROPHENOL	1658, 8151A, 6640C	GW	60-140	20	.001	mg/L
Herbicides	2,4,5-T	8151A	SS	44.9-111	21.5	0.07	mg/Kg
Herbicides	2,4,5-TP (SILVEX)	8151A	SS	48.4-110	25.9	0.07	mg/Kg
Herbicides	2,4-D	8151A	SS	40.0-112	24.8	0.07	mg/Kg
Herbicides	2,4-DB	8151A	SS	33.8-126	27.8	0.07	mg/Kg
Herbicides	DALAPON	8151A	SS	36.7-119	28.0	0.07	mg/Kg
Herbicides	DICAMBA	8151A	SS	50.2-125	20.0	0.07	mg/Kg
Herbicides	DICHLOROPROP	8151A	SS	39.9-99.0	20.1	0.07	mg/Kg
Herbicides	DINOSEB	8151A	SS	15.6-109	40.0	0.07	mg/Kg
Herbicides	MCPA	8151A	SS	34.7-110	31.7	6.5	mg/Kg
Herbicides	MCPP	8151A	SS	41.0-121	24.9	6.5	mg/Kg
PAH	PYRENE	8310, 610, 6440B	GW, WW	69.2-96.9	20.0	0.00001	mg/L
PAH	PHENANTHRENE	8310, 610, 6440B	GW, WW	66.5-95.7	20.0	0.00001	mg/L
PAH	NAPHTHALENE	8310, 610, 6440B	GW, WW	47.5-86.6	20.2	0.001	mg/L
PAH	INDENO(1,2,3-CD)PYRENE	8310, 610, 6440B	GW, WW	52.4-104	20.0	0.00001	mg/L
PAH	FLUORENE	8310, 610, 6440B	GW, WW	55.3-98.8	20.0	0.00001	mg/L
PAH	FLUORANTHENE	8310, 610,	GW, WW	70.4-102	20.0	0.00001	mg/L

Table 12.3: QC Targets for Semi-Volatiles Accuracy (LCS), Precision and RLs
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Class	Analyte	Method	Matrix	Accuracy (%)	Prec. (RPD)	RL	Unit
		6440B					
PAH	DIBENZ(A,H)ANTHRACENE	8310, 610, 6440B	GW, WW	38.6-111	22.2	0.000005	mg/L
PAH	CHRYSENE	8310, 610, 6440B	GW, WW	72.9-107	20.0	0.00001	mg/L
PAH	BENZO(K)FLUORANTHENE	8310, 610, 6440B	GW, WW	67.3-102	20.0	0.00001	mg/L
PAH	BENZO(G,H,I)PERYLENE	8310, 610, 6440B	GW, WW	41.9-115	20.0	0.00001	mg/L
PAH	BENZO(B)FLUORANTHENE	8310, 610, 6440B	GW, WW	68.5-102	20.0	0.00001	mg/L
PAH	BENZO(A)PYRENE	8310, 610, 6440B	GW, WW	58..8-106	20.0	0.00001	mg/L
PAH	BENZO(A)ANTHRACENE	8310, 610, 6440B	GW, WW	72.4-102	20.0	0.00001	mg/L
PAH	ANTHRACENE	8310, 610, 6440B	GW, WW	68.8-99.3	20.0	0.00001	mg/L
PAH	ACENAPHTHYLENE	8310, 610, 6440B	GW, WW	59.4-91.9	20.0	0.00001	mg/L
PAH	ACENAPHTHENE	8310, 610, 6440B	GW, WW	57.0-89.5	20.0	0.00001	mg/L
PAH	2-METHYLNAPHTHALENE	8310, 610, 6440B	GW, WW	45.7-92.1	20.0	0.001	mg/L
PAH	1-METHYLNAPHTHALENE	8310, 610, 6440B	GW, WW	54.6-104	20.0	0.001	mg/L
PAH	PYRENE	8310	SS	71.9-100	20.0	0.02	mg/Kg
PAH	PHENANTHRENE	8310	SS	66.9-97.1	20.0	0.02	mg/Kg
PAH	NAPHTHALENE	8310	SS	52..0-94.2	20.0	0.02	mg/Kg
PAH	INDENO(1,2,3-CD)PYRENE	8310	SS	64.6-101	20.0	0.02	mg/Kg
PAH	FLUORENE	8310	SS	58.6-100	20.0	0.02	mg/Kg
PAH	FLUORANTHENE	8310	SS	73.4-103	20.0	0.02	mg/Kg
PAH	DIBENZ(A,H)ANTHRACENE	8310	SS	72.1-100	20.0	0.02	mg/Kg
PAH	CHRYSENE	8310	SS	77.3-107	20.0	0.02	mg/Kg
PAH	BENZO(K)FLUORANTHENE	8310	SS	73.3-102	20.0	0.02	mg/Kg
PAH	BENZO(G,H,I)PERYLENE	8310	SS	67.1-110	20.0	0.02	mg/Kg
PAH	BENZO(B)FLUORANTHENE	8310	SS	73.9-103	20.0	0.02	mg/Kg
PAH	BENZO(A)PYRENE	8310	SS	66.5-104	20.0	0.02	mg/Kg
PAH	BENZO(A)ANTHRACENE	8310	SS	77.7-102	20.0	0.02	mg/Kg
PAH	ANTHRACENE	8310	SS	71.9-101	20.0	0.02	mg/Kg
PAH	ACENAPHTHYLENE	8310	SS	59.5-98.4	20.0	0.02	mg/Kg
PAH	ACENAPHTHENE	8310	SS	58.6-95.5	20.0	0.02	mg/Kg

Table 12.3: QC Targets for Semi-Volatiles Accuracy (LCS), Precision and RLs

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Class	Analyte	Method	Matrix	Accuracy (%)	Prec. (RPD)	RL	Unit
PAH	2-METHYLNAPHTHALENE	8310	SS	54.9-95.3	20.0	0.02	mg/Kg
PAH	1-METHYLNAPHTHALENE	8310	SS	62.3-110	20.0	0.02	mg/Kg
BNA	PYRIDINE	8270C/D 625	GW,WW	13.0-54.0	32.8	0.01	mg/L
BNA	PYRENE	8270C/D 625	GW,WW	40.2-135	20.0	0.0002	mg/L
BNA	PHENOL	8270C/D 625	GW,WW	10.0-77.3	24.6	0.01	mg/L
BNA	PHENANTHRENE	8270C/D 625	GW,WW	41.4-134	20.0	0.0002	mg/L
BNA	PENTACHLOROPHENOL	8270C/D 625	GW,WW	17.0-117	34.3	0.001	mg/L
BNA	N-OCTADECANE	8270C/D 625	GW,WW	28.3-151	20.0	0.01	mg/L
BNA	N-NITROSODIPHENYLAMINE	8270C/D 625	GW,WW	41.1-134	20.0	0.01	mg/L
BNA	N-NITRODIPHENYLAMINE	8270C/D 625	GW,WW	40.1-157	20.0	0.01	mg/L
BNA	N-NITROSODI-N-PROPYLAMINE	8270C/D 625	GW,WW	35.6-125	20.0	0.01	mg/L
BNA	N-NITROSODIMETHYLAMINE	8270C/D 625	GW,WW	12.3-70.5	33.0	.01	mg/L
BNA	NITROBENZENE	8270C/D 625	GW,WW	34.4-121	21.2	.01	mg/L
BNA	N-DECANE	8270C/D 625	GW,WW	10.0-118	32.3	0.01	mg/L
BNA	NAPHTHALENE	8270C/D 625	GW,WW	33.0-117	20.0	0.001	mg/L
BNA	ISOPHORONE	8270C/D 625	GW,WW	30.5-109	20.0	0.01	mg/L
BNA	INDENO(1,2,3-CD)PYRENE	8270C/D 625	GW,WW	41.0-140	20.0	0.0002	mg/L
BNA	HEXACHLOROETHANE	8270C/D 625	GW,WW	22.2-109	25.8	0.01	mg/L
BNA	HEXACHLOROCYCLOPENTADIENE	8270C/D 625	GW,WW	13.5-122	21.6	0.01	mg/L
BNA	HEXACHLOROBENZENE	8270C/D 625	GW,WW	34.1-125	20.0	0.001	mg/L
BNA	HEXACHLORO-1,3-BUTADIENE	8270C/D 625	GW,WW	24.9-121	22.0	0.01	mg/L
BNA	FLUORENE	8270C/D 625	GW,WW	39.9-132	20.0	0.0002	mg/L
BNA	FLUORANTHENE	8270C/D 625	GW,WW	41.4-141	20.0	0.0002	mg/L
BNA	DI-N-OCTYL PHTHALATE	8270C/D 625	GW,WW	39.8-146	20.0	0.003	mg/L
BNA	DI-N-BUTYL PHTHALATE	8270C/D 625	GW,WW	33.0-151	20.0	0.003	mg/L
BNA	DIMETHYL PHTHALATE	8270C/D 625	GW,WW	23.4-138	20.2	0.003	mg/L
BNA	DIETHYL PHTHALATE	8270C/D 625	GW,WW	36.0-140	20.0	0.003	mg/L
BNA	DIBENZOFURAN	8270C/D 625	GW,WW	37.9-128	20.0	0.01	mg/L
BNA	DIBENZ(A,H)ANTHRACENE	8270C/D 625	GW,WW	39.9-141	20.0	0.0002	mg/L
BNA	CHRYSENE	8270C/D 625	GW,WW	40.5-140	20.0	0.0002	mg/L
BNA	CARBAZOLE	8270C/D 625	GW,WW	41.0-137	20.0	0.01	mg/L
BNA	CAPROLACTAM	8270C/D 625	GW,WW	10.0-45.6	25.2	0.01	mg/L
BNA	BIS(2-ETHYLHEXYL)PHTHALATE	8270C/D 625	GW,WW	41.4-150	20.0	0.003	mg/L
BNA	BIS(2-CHLOROISOPROPYL)ETHER	8270C/D 625	GW,WW	33.6-115	21.3	0.01	mg/L
BNA	BIS(2-CHLOROETHYL)ETHER	8270C/D 625	GW,WW	29.8-114	25.3	0.01	mg/L

Table 12.3: QC Targets for Semi-Volatiles Accuracy (LCS), Precision and RLs

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Class	Analyte	Method	Matrix	Accuracy (%)	Prec. (RPD)	RL	Unit
BNA	BIS(2-CHLORETHOXY)METHANE	8270C/D 625	GW,WW	36.7-123	20.0	0.01	mg/L
BNA	BIPHENYL	8270C/D 625	GW,WW	36.9-126	20.0	0.01	mg/L
BNA	BENZYLBUTYL PHTHALATE	8270C/D 625	GW,WW	29.2-146	20.7	0.003	mg/L
BNA	BENZYL ALCOHOL	8270C/D 625	GW,WW	26.0-104	21.0	0.01	mg/L
BNA	BENZOIC ACID	8270C/D 625	GW,WW	10.0-54.3	40.0	0.05	mg/L
BNA	BENZO(K)FLUORANTHENE	8270C/D 625	GW,WW	41.5-140	20.0	0.0002	mg/L
BNA	BENZO(G,H,I)PERYLENE	8270C/D 625	GW,WW	38.8-137	20.0	0.0002	mg/L
BNA	BENZO(B)FLUORANTHENE	8270C/D 625	GW,WW	40.5-137	20.0	0.0002	mg/L
BNA	BENZO(A)PYRENE	8270C/D 625	GW,WW	41.7-138	20.0	0.0002	mg/L
BNA	BENZO(A)ANTHRACENE	8270C/D 625	GW,WW	42.3-137	20.0	0.0002	mg/L
BNA	BENZIDINE	8270C/D 625	GW,WW	10.0-75.5	40.0	0.05	mg/L
BNA	BENZALDEHYDE	8270C/D 625	GW,WW	10.0-93.4	27.8	0.01	mg/L
BNA	AZOBENZENE	8270C/D 625	GW,WW	37.2-129	20.0	0.01	mg/L
BNA	ATRAZINE	8270C/D 625	GW,WW	40.6-154	20.0	0.01	mg/L
BNA	ANTHRACENE	8270C/D 625	GW,WW	42.9-138	20.0	0.001	mg/L
BNA	ANILINE	8270C/D 625	GW,WW	22.5-99.1	28.3	0.01	mg/L
BNA	ACETOPHENONE	8270C/D 625	GW,WW	35.6-122	20.0	0.01	mg/L
BNA	ACENAPHTHYLENE	8270C/D 625	GW,WW	41.0-135	20.0	0.0002	mg/L
BNA	ACENAPHTHENE	8270C/D 625	GW,WW	39.0-128	20.0	0.0002	mg/L
BNA	4-NITROPHENOL	8270C/D 625	GW,WW	10.0-65.4	33.6	0.01	mg/L
BNA	4-NITROANILINE	8270C/D 625	GW,WW	37.3-159	20.0	0.01	mg/L
BNA	4-CHLOROPHENYL-PHENYLETHER	8270C/D 625	GW,WW	37.3-130	20.0	0.01	mg/L
BNA	4-CHLOROANILINE	8270C/D 625	GW,WW	29.8-128	20.9	0.01	mg/L
BNA	4-CHLORO-3-METHYLPHENOL	8270C/D 625	GW,WW	34.6-130	20.0	0.01	mg/L
BNA	4-BROMOPHENYL-PHENYLETHER	8270C/D 625	GW,WW	39.0-137	20.0	0.01	mg/L
BNA	4,6-DINITRO-2-METHYLPHENOL	8270C/D 625	GW,WW	28.2-134	29.2	0.01	mg/L
BNA	3-NITROANILINE	8270C/D 625	GW,WW	34.8-132	20.0	0.01	mg/L
BNA	3,3-DICHLOROBENZIDINE	8270C/D 625	GW,WW	33.1-134	20.0	0.01	mg/L
BNA	3&4-METHYLPHENOL	8270C/D 625	GW,WW	23.1-107	20.7	0.01	mg/L
BNA	2-NITROPHENOL	8270C/D 625	GW,WW	38.3-125	20.0	0.01	mg/L
BNA	2-NITROANILINE	8270C/D 625	GW,WW	41.9-143	20.0	0.01	mg/L
BNA	2-METHYLPHENOL	8270C/D 625	GW,WW	23.9-97	20.0	0.01	mg/L
BNA	2-METHYLNAPHTHALENE	8270C/D 625	GW,WW	35.6-124	20.0	0.001	mg/L
BNA	2-CHLOROPHENOL	8270C/D 625	GW,WW	31.2-103	20.0	0.01	mg/L
BNA	2-CHLORONAPHTHALENE	8270C/D 625	GW,WW	35.1-123	20.0	0.001	mg/L
BNA	2,6-DINITROTOLUENE	8270C/D 625	GW,WW	41.0-139	20.0	0.01	mg/L

Table 12.3: QC Targets for Semi-Volatiles Accuracy (LCS), Precision and RLs

This table is subject to revision without notice

Class	Analyte	Method	Matrix	Accuracy (%)	Prec. (RPD)	RL	Unit
BNA	2,4-DINITROTOLUENE	8270C/D 625	GW,WW	42.3-143	20.0	0.01	mg/L
BNA	2,4-DINITROPHENOL	8270C/D 625	GW,WW	10.0-108	40.0	0.01	mg/L
BNA	2,4-DIMETHYLPHENOL	8270C/D 625	GW,WW	33.8-126	20.0	0.01	mg/L
BNA	2,4-DICHLOROPHENOL	8270C/D 625	GW,WW	39.6-121	20.0	0.01	mg/L
BNA	2,4,6-TRICHLOROPHENOL	8270C/D 625	GW,WW	35.9-129	22.4	0.01	mg/L
BNA	2,4,5-TRICHLOROPHENOL	8270C/D 625	GW,WW	35.4-136	20.0	0.01	mg/L
BNA	1-METHYLNAPHTHALENE	8270C/D 625	GW,WW	34.3-123	20.0	0.001	mg/L
BNA	1,4-DICHLOROBENZENE	8270C/D 625	GW,WW	24.8-105	25.2	0.01	mg/L
BNA	1,3-DICHLOROBENZENE	8270C/D 625	GW,WW	23.9-103	25.2	0.01	mg/L
BNA	1,2-DICHLOROBENZENE	8270C/D 625	GW,WW	26.1-107	25.4	0.01	mg/L
BNA	1,2,4-TRICHLOROBENZENE	8270C/D 625	GW,WW	26.6-109	20.0	0.01	mg/L
BNA	1,2,4,5-TETRACHLOROBENZENE	8270C/D 625	GW,WW	30.8-124	20.7	0.01	mg/L
BNA	PYRIDINE	8270C/D	SS	10.0-90.0	38.3	0.33	mg/Kg
BNA	PYRENE	8270C/D	SS	47.1-108	20.0	0.33	mg/Kg
BNA	PHENOL	8270C/D	SS	41.5-106	20.0	0.33	mg/Kg
BNA	PHENANTHRENE	8270C/D	SS	51.6-107	20.0	0.33	mg/Kg
BNA	PENTACHLOROPHENOL	8270C/D	SS	16.2-102	22.9	0.33	mg/Kg
BNA	N-OCTADECANE	8270C/D	SS	40.7-122	20.0	0.33	mg/Kg
BNA	N-NITROSODIPHENYLAMINE	8270C/D	SS	48.8-107	20.0	0.33	mg/Kg
BNA	N-NITROSODI-N-PROPYLAMINE	8270C/D	SS	43.3-109	20.0	0.33	mg/Kg
BNA	N-NITROSODIMETHYLAMINE	8270C/D	SS	18.1-1422	23.5	0.33	mg/Kg
BNA	NITROBENZENE	8270C/D	SS	40.7-109	21.0	0.33	mg/Kg
BNA	N-DECANE	8270C/D	SS	38.1-116	20.0	0.33	mg/Kg
BNA	NAPHTHALENE	8270C/D	SS	43.4-103	20.0	0.33	mg/Kg
BNA	ISOPHORONE	8270C/D	SS	28.8-104	20.0	0.033	mg/Kg
BNA	INDENO(1,2,3-CD)PYRENE	8270C/D	SS	47.5-109	20.0	0.33	mg/Kg
BNA	HEXACHLOROETHANE	8270C/D	SS	36.2-103	22.7	0.033	mg/Kg
BNA	HEXACHLOROCYCLOPENTADIENE	8270C/D	SS	13.5-123	20.7	0.33	mg/Kg
BNA	HEXACHLOROBENZENE	8270C/D	SS	43.2-104	20.1	0.33	mg/Kg
BNA	HEXACHLORO-1,3-BUTADIENE	8270C/D	SS	41.5-112	20.0	0.33	mg/Kg
BNA	FLUORENE	8270C/D	SS	51.1-109	20.0	0.33	mg/Kg
BNA	FLUORANTHENE	8270C/D	SS	53.7-110	20.0	0.33	mg/Kg
BNA	DI-N-OCTYL PHTHALATE	8270C/D	SS	49.6-112	20.0	0.33	mg/Kg
BNA	DI-N-BUTYL PHTHALATE	8270C/D	SS	49.7-113	20.0	0.33	mg/Kg
BNA	DIMETHYL PHTHALATE	8270C/D	SS	51.4-108	20.0	0.33	mg/Kg
BNA	DIETHYL PHTHALATE	8270C/D	SS	52.0-112	20.0	0.33	mg/Kg

Table 12.3: QC Targets for Semi-Volatiles Accuracy (LCS), Precision and RLs
This table is subject to revision without notice

Class	Analyte	Method	Matrix	Accuracy (%)	Prec. (RPD)	RL	Unit
BNA	DIBENZOFURAN	8270C/D	SS	48.6-104	20.0	0.33	mg/Kg
BNA	DIBENZ(A,H)ANTHRACENE	8270C/D	SS	45.7-111	20.0	0.33	mg/Kg
BNA	CHRYSENE	8270C/D	SS	54.4-110	20.0	0.33	mg/Kg
BNA	CARBAZOLE	8270C/D	SS	52.4-102	21.1	0.33	mg/Kg
BNA	CAPROLACTAM	8270C/D	SS	42.2-107	21.9	0.33	mg/Kg
BNA	BIS(2-ETHYLHEXYL)PHTHALATE	8270C/D	SS	48.1-116	20.5	0.33	mg/Kg
BNA	BIS(2-CHLOROISOPROPYL)ETHER	8270C/D	SS	40.4-99.0	20.7	0.33	mg/Kg
BNA	BIS(2-CHLOROETHYL)ETHER	8270C/D	SS	32.5-112	26.0	0.33	mg/Kg
BNA	BIS(2-CHLORETHOXY)METHANE	8270C/D	SS	44.9-108	20.0	0.33	mg/Kg
BNA	BIPHENYL	8270C/D	SS	45.6-103	20.0	0.33	mg/Kg
BNA	BENZYLBUTYL PHTHALATE	8270C/D	SS	47.5-115	20.0	0.33	mg/Kg
BNA	BENZYL ALCOHOL	8270C/D	SS	49.1-105	20.0	0.033	mg/Kg
BNA	BENZOIC ACID	8270C/D	SS	0.00-82.0	32.5	0.033	mg/Kg
BNA	BENZO(K)FLUORANTHENE	8270C/D	SS	52.9-107	20.0	0.33	mg/Kg
BNA	BENZO(G,H,I)PERYLENE	8270C/D	SS	45.8-108	20.0	0.33	mg/Kg
BNA	BENZO(B)FLUORANTHENE	8270C/D	SS	51.3-106	20.0	0.33	mg/Kg
BNA	BENZO(A)PYRENE	8270C/D	SS	51.9-106	20.0	0.33	mg/Kg
BNA	BENZO(A)ANTHRACENE	8270C/D	SS	52.3-106	20.0	0.33	mg/Kg
BNA	BENZIDINE	8270C/D	SS	0.00-48.0	40.0	0.033	mg/Kg
BNA	BENZALDEHYDE	8270C/D	SS	46.4-109	24.8	0.33	mg/Kg
BNA	AZOBENZENE	8270C/D	SS	45.0-131	20.0	0.33	mg/Kg
BNA	ATRAZINE	8270C/D	SS	45.0-131	20.0	0.33	mg/Kg
BNA	ANTHRACENE	8270C/D	SS	52.0-112	20.0	0.33	mg/Kg
BNA	ANILINE	8270C/D	SS	10.0-94.0	24.2	0.33	mg/Kg
BNA	ACETOPHENONE	8270C/D	SS	47.1-99.0	22.1	0.33	mg/Kg
BNA	ACENAPHTHYLENE	8270C/D	SS	49.2-111	20.0	0.033	mg/Kg
BNA	ACENAPHTHENE	8270C/D	SS	48.9-107	20.0	0.033	mg/Kg
BNA	4-NITROPHENOL	8270C/D	SS	34.8-109	20.0	0.033	mg/Kg
BNA	4-NITROANILINE	8270C/D	SS	38.6-133	21.7	0.033	mg/Kg
BNA	4-CHLOROPHENYL-PHENYLETHER	8270C/D	SS	48.1-108	20.0	0.033	mg/Kg
BNA	4-CHLOROANILINE	8270C/D	SS	24.5-101	24.5	0.33	mg/Kg
BNA	4-CHLORO-3-METHYLPHENOL	8270C/D	SS	51.1-113	20.0	0.33	mg/Kg
BNA	4-BROMOPHENYL-PHENYLETHER	8270C/D	SS	51.4-110	20.0	0.33	mg/Kg

Table 12.3: QC Targets for Semi-Volatiles Accuracy (LCS), Precision and RLs

This table is subject to revision without notice

Class	Analyte	Method	Matrix	Accuracy (%)	Prec. (RPD)	RL	Unit
BNA	4,6-DINITRO-2-METHYLPHENOL	8270C/D	SS	23.1-119	23.7	0.33	mg/Kg
BNA	3-NITROANILINE	8270C/D	SS	34.7-103	20.7	0.33	mg/Kg
BNA	3,3-DICHLOROBENZIDINE	8270C/D	SS	21.0-101	22.0	0.33	mg/Kg
BNA	3&4-METHYLPHENOL	8270C/D	SS	50.5-115	20.0	0.33	mg/Kg
BNA	2-NITROPHENOL	8270C/D	SS	44.2-113	20.9	0.33	mg/Kg
BNA	2-NITROANILINE	8270C/D	SS	56.2-117	20.0	0.33	mg/Kg
BNA	2-METHYLPHENOL	8270C/D	SS	53.8-107	20.0	0.33	mg/Kg
BNA	2-METHYLNAPHTHALENE	8270C/D	SS	42.4-100	20.0	0.033	mg/Kg
BNA	2-CHLOROPHENOL	8270C/D	SS	48.0-101	20.0	0.33	mg/Kg
BNA	2-CHLORONAPHTHALENE	8270C/D	SS	40.8-103	20.0	0.33	mg/Kg
BNA	2,6-DINITROTOLUENE	8270C/D	SS	47.1-105	20.0	0.33	mg/Kg
BNA	2,4-DINITROTOLUENE	8270C/D	SS	51.6-110	20.0	0.033	mg/Kg
BNA	2,4-DINITROPHENOL	8270C/D	SS	53.0-112	36.5	0.33	mg/Kg
BNA	2,4-DIMETHYLPHENOL	8270C/D	SS	10.0-105	20.0	0.33	mg/Kg
BNA	2,4-DICHLOROPHENOL	8270C/D	SS	42.2-109	20.0	0.33	mg/Kg
BNA	2,4,6-TRICHLOROPHENOL	8270C/D	SS	44.4-108	20.0	0.33	mg/Kg
BNA	2,4,5-TRICHLOROPHENOL	8270C/D	SS	43.3-110	20.0	0.33	mg/Kg
BNA	1-METHYLNAPHTHALENE	8270C/D	SS	49.8-104	20.0	0.33	mg/Kg
BNA	1,4-DICHLOROBENZENE	8270C/D	SS	36.5-97.0	20.0	0.33	mg/Kg
BNA	1,3-DICHLOROBENZENE	8270C/D	SS	35.0-94.0	20.0	0.33	mg/Kg
BNA	1,2-DICHLOROBENZENE	8270C/D	SS	37.2-98.0	20.0	0.33	mg/Kg
BNA	1,2,4-TRICHLOROBENZENE	8270C/D	SS	39.8-100	20.0	0.33	mg/Kg
BNA	1,2,4,5-TETRACHLOROBENZENE	8270C/D	SS	47.6-107	20.0	0.33	mg/Kg
BNA	PYRIDINE	8270C/D RV	GW,WW	13.5-58.9	32.5	0.01	mg/L
BNA	PYRENE	8270C/D RV	GW,WW	463-117	20.0	0.0002	mg/L
BNA	PHENOL	8270C/D RV	GW,WW	10.0-57.9	35.0	0.01	mg/L
BNA	PHENANTHRENE	8270C/D RV	GW,WW	46.4-113	20.0	0.0002	mg/L
BNA	PENTACHLOROPHENOL	8270C/D RV	GW,WW	10.9-97.4	35.1	0.01	mg/L
BNA	N-OCTADECANE	8270C/D RV	GW,WW	15.8-132	21.1	0.01	mg/L
BNA	N-NITROSODIMETHYLAMINE	8270C/D RV ISOTOPE DIL	GW,WW	60-140	20.0	0.01/ .05ug/L SIM	mg/L
BNA	1,4-DIOXANE	8270C/D RV ISOTOPE DIL	GW,WW	60-140	20.0	.4ug/L SIM	mg/L
BNA	N-NITROSODI-N-PROPYLAMINE	8270C/D RV	GW,WW	33.2-106	23.7	0.01	mg/L
BNA	N-NITROSODIMETHYLAMINE	8270C/D RV	GW,WW	33.2-106	37.5	0.01	mg/L
BNA	NITROBENZENE	8270C/D RV	GW,WW	31.4-106	25.7	0.01	mg/L

Table 12.3: QC Targets for Semi-Volatiles Accuracy (LCS), Precision and RLs

This table is subject to revision without notice

Class	Analyte	Method	Matrix	Accuracy (%)	Prec. (RPD)	RL	Unit
BNA	N-DECANE	8270C/D RV	GW,WW	10.0-95.2	40.0	0.01	mg/L
BNA	NAPHTHALENE	8270C/D RV	GW,WW	32.2-101	23.8	0.001	mg/L
BNA	ISOPHORONE	8270C/D RV	GW,WW	35.4-112	21.5	0.01	mg/L
BNA	INDENO(1,2,3-CD)PYRENE	8270C/D RV	GW,WW	45.0-116	20.0	0.0002	mg/L
BNA	HEXACHLOROETHANE	8270C/D RV	GW,WW	16.5-89.8	30.7	0.01	mg/L
BNA	HEXACHLOROCYCLOPENTADIENE	8270C/D RV	GW,WW	10.0-121	27.9	0.01	mg/L
BNA	HEXACHLOROBENZENE	8270C/D RV	GW,WW	38.5-116	20.1	0.001	mg/L
BNA	HEXACHLORO-1,3-BUTADIENE	8270C/D RV	GW,WW	16.1-104	31.2	0.01	mg/L
BNA	FLUORENE	8270C/D RV	GW,WW	41.0-112	20.2	0.0002	mg/L
BNA	FLUORANTHENE	8270C/D RV	GW,WW	45.9-115	20.0	0.0002	mg/L
BNA	DI-N-OCTYL PHTHALATE	8270C/D RV	GW,WW	39.7-112	21.1	0.003	mg/L
BNA	DI-N-BUTYL PHTHALATE	8270C/D RV	GW,WW	41.8-120	20.2	0.003	mg/L
BNA	DIMETHYL PHTHALATE	8270C/D RV	GW,WW	35.3-128	20.8	0.003	mg/L
BNA	DIETHYL PHTHALATE	8270C/D RV	GW,WW	36.5-129	20.0	0.003	mg/L
BNA	DIBENZOFURAN	8270C/D RV	GW,WW	42.4-105	20.0	0.01	mg/L
BNA	DIBENZ(A,H)ANTHRACENE	8270C/D RV	GW,WW	42.8-118	20.0	0.0002	mg/L
BNA	CHRYSENE	8270C/D RV	GW,WW	54.6-120	20.0	0.0002	mg/L
BNA	CARBAZOLE	8270C/D RV	GW,WW	49.0-110	20.0	0.01	mg/L
BNA	CAPROLACTAM	8270C/D RV	GW,WW	10.0-40.4	40.0	0.01	mg/L
BNA	BIS(2-ETHYLHEXYL)PHTHALATE	8270C/D RV	GW,WW	36.9-134	23.6	0.003	mg/L
BNA	BIS(2-CHLOROISOPROPYL)ETHER	8270C/D RV	GW,WW	32.9-100	25.1	0.01	mg/L
BNA	BIS(2-CHLOROETHYL)ETHER	8270C/D RV	GW,WW	22.6-108	27.9	0.01	mg/L
BNA	BIS(2-CHLORETHOXY)METHANE	8270C/D RV	GW,WW	37.2-111	24.1	0.01	mg/L
BNA	BIPHENYL	8270C/D RV	GW,WW	38.0-103	20.1	0.01	mg/L
BNA	BENZYLBUTYL PHTHALATE	8270C/D RV	GW,WW	31.8-123	20.7	0.003	mg/L
BNA	BENZYL ALCOHOL	8270C/D RV	GW,WW	30.1-89.2	24.8	0.01	mg/L
BNA	BENZOIC ACID	8270C/D RV	GW,WW	0.00-79.4	31.1	0.05	mg/L
BNA	BENZO(K)FLUORANTHENE	8270C/D RV	GW,WW	49.4-114	20.0	0.0002	mg/L
BNA	BENZO(G,H,I)PERYLENE	8270C/D RV	GW,WW	45.2-117	20.0	0.0002	mg/L
BNA	BENZO(B)FLUORANTHENE	8270C/D RV	GW,WW	47.6-110	20.0	0.0002	mg/L
BNA	BENZO(A)PYRENE	8270C/D RV	GW,WW	45.6-106	20.0	0.0002	mg/L
BNA	BENZO(A)ANTHRACENE	8270C/D RV	GW,WW	51.2-112	20.0	0.0002	mg/L
BNA	BENZIDINE	8270C/D RV	GW,WW	10.0-165	40.0	0.05	mg/L
BNA	BENZALDEHYDE	8270C/D RV	GW,WW	11.7-132	25.2	0.01	mg/L
BNA	AZOBENZENE	8270C/D RV	GW,WW	37.6-111	21.1	0.01	mg/L
BNA	ATRAZINE	8270C/D RV	GW,WW	50.0-123	21.5	0.01	mg/L

Table 12.3: QC Targets for Semi-Volatiles Accuracy (LCS), Precision and RLs
This table is subject to revision without notice

Class	Analyte	Method	Matrix	Accuracy (%)	Prec. (RPD)	RL	Unit
BNA	ANTHRACENE	8270C/D RV	GW,WW	43.6-113	18.7	0.0002	mg/L
BNA	ANILINE	8270C/D RV	GW,WW	25.8-88.1	26.3	0.01	mg/L
BNA	ACETOPHENONE	8270C/D RV	GW,WW	41.6-104	24.8	0.01	mg/L
BNA	ACENAPHTHYLENE	8270C/D RV	GW,WW	36.0-106	21.0	0.0002	mg/L
BNA	ACENAPHTHENE	8270C/D RV	GW,WW	38.7-109	21.5	0.0002	mg/L
BNA	4-NITROPHENOL	8270C/D RV	GW,WW	10.0-52.7	40.0	0.01	mg/L
BNA	4-NITROANILINE	8270C/D RV	GW,WW	35.4-124	23.1	0.01	mg/L
BNA	4-CHLOROPHENYL-PHENYLETHER	8270C/D RV	GW,WW	39.0-113	20.9	0.01	mg/L
BNA	4-CHLOROANILINE	8270C/D RV	GW,WW	32.0-104	26.4	0.01	mg/L
BNA	4-CHLORO-3-METHYLPHENOL	8270C/D RV	GW,WW	35.7-100	22.9	0.01	mg/L
BNA	4-BROMOPHENYL-PHENYLETHER	8270C/D RV	GW,WW	40.7-116	21.0	0.01	mg/L
BNA	4,6-DINITRO-2-METHYLPHENOL	8270C/D RV	GW,WW	18.4-148	24.4	0.01	mg/L
BNA	3-NITROANILINE	8270C/D RV	GW,WW	33.6-103	21.8	0.01	mg/L
BNA	3,3-DICHLOROBENZIDINE	8270C/D RV	GW,WW	27.2-142	22.3	0.01	mg/L
BNA	3&4-METHYLPHENOL	8270C/D RV	GW,WW	27.9-92	27.0	0.01	mg/L
BNA	2-NITROPHENOL	8270C/D RV	GW,WW	25.9-106	26.9	0.01	mg/L
BNA	2-NITROANILINE	8270C/D RV	GW,WW	56.4-173	20.0	0.01	mg/L
BNA	2-METHYLPHENOL	8270C/D RV	GW,WW	35.6-113	20.9	0.01	mg/L
BNA	2-METHYLNAPHTHALENE	8270C/D RV	GW,WW	26.4-86.9	26.5	0.001	mg/L
BNA	2-CHLOROPHENOL	8270C/D RV	GW,WW	33.8-98.6	24.2	0.01	mg/L
BNA	2-CHLORONAPHTHALENE	8270C/D RV	GW,WW	26.2-91.5	26.5	0.001	mg/L
BNA	2,6-DINITROTOLUENE	8270C/D RV	GW,WW	33.6-105	23.0	0.01	mg/L
BNA	2,4-DINITROTOLUENE	8270C/D RV	GW,WW	30.6-106	23.1	0.01	mg/L
BNA	2,4-DINITROPHENOL	8270C/D RV	GW,WW	31.2-105	22.0	0.01	mg/L
BNA	2,4-DIMETHYLPHENOL	8270C/D RV	GW,WW	24.2-128	20.5	0.01	mg/L
BNA	2,4-DICHLOROPHENOL	8270C/D RV	GW,WW	31.9-107	25.7	0.01	mg/L
BNA	2,4,6-TRICHLOROPHENOL	8270C/D RV	GW,WW	31.4-103	24.9	0.01	mg/L
BNA	2,4,5-TRICHLOROPHENOL	8270C/D RV	GW,WW	29.8-107	24.1	0.01	mg/L
BNA	2,3,4,6-TETRACHLOROPHENOL	8270C/D RV	GW,WW	34.9-112	23.9	0.01	mg/L
BNA	1-METHYLNAPHTHALENE	8270C/D RV	GW,WW	34.7-102	24.9	0.01	mg/L
BNA	1,4-DICHLOROBENZENE	8270C/D RV	GW,WW	21.0-89.4	32.6	0.01	mg/L
BNA	1,3-DICHLOROBENZENE	8270C/D RV	GW,WW	20.9-86.7	32.4	0.01	mg/L
BNA	1,2-DICHLOROBENZENE	8270C/D RV	GW,WW	23.7-91.9	31.9	0.01	mg/L
BNA	1,2,4-TRICHLOROBENZENE	8270C/D RV	GW,WW	22.9-96.1	27.5	0.01	mg/L
BNA	1,2,4,5-TETRACHLOROBENZENE	8270C/D RV	GW,WW	30.7-102	27.7	0.01	mg/L
BNA	SULFOLANE	8270C/D	GW, WW	70.0-130	20.0	0.2	ug/L

Table 12.3: QC Targets for Semi-Volatiles Accuracy (LCS), Precision and RLs
This table is subject to revision without notice

Class	Analyte	Method	Matrix	Accuracy (%)	Prec. (RPD)	RL	Unit
BNA	SULFOLANE	8270C/D	SS	70.0-130	20.0	0.33	ug/kg
Glycols	ETHYLENE GLYCOL	8015	SS	70.0-130	20.0	5.0	mg/L
Glycols	PROPYLENE GLYCOL	8015	SS	70.0-130	20.0	5.0	mg/L
Glycols	ETHYLENE GLYCOL	8015	GW,WW	70.0-130	20.0	5.0	mg/L
Glycols	PROPYLENE GLYCOL	8015	GW,WW	70.0-130	20.0	5.0	mg/L
Explosives	1,3,5-TRINITROBENZENE	8330A/B	SS	70.0-130	20.0	0.5	mg/Kg
Explosives	1,3-DINITROBENZENE	8330A/B	SS	70.0-130	20.0	0.5	mg/Kg
Explosives	2,4,6-TRINITROTOLUENE	8330A/B	SS	70.0-130	20.0	0.5	mg/Kg
Explosives	2,4-DINITROTOLUENE	8330A/B	SS	70.0-130	20.0	0.5	mg/Kg
Explosives	2,6-DINITROTOLUENE	8330A/B	SS	70.0-130	20.0	0.5	mg/Kg
Explosives	2-NITROTOLUENE	8330A/B	SS	70.0-130	20.0	0.5	mg/Kg
Explosives	3-NITROTOLUENE	8330A/B	SS	70.0-130	20.0	0.5	mg/Kg
Explosives	4-NITROTOLUENE (4-NT)	8330A/B	SS	70.0-130	20.0	0.5	mg/Kg
Explosives	HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE	8330A/B	SS	70.0-130	20.0	0.5	mg/Kg
Explosives	METHYL-2,4,6-TRINITROPHENYLNITRAMINE	8330A/B	SS	70.0-130	20.0	0.5	mg/Kg
Explosives	NITROBENZENE	8330A/B	SS	70.0-130	20.0	0.5	mg/Kg
Explosives	OCTAHYDRO - 1,3,5,7 - TETRANITRO-1,3,5,7-TETRAZOCINE (HMX)	8330A/B	SS	70.0-130	20.0	0.0005	mg/Kg
Explosives	PENTAERYTHRITOL TETRANITRATE (PETN)	8330A/B	SS	70.0-130	20.0	2	mg/Kg
Explosives	NITROGLYCERINE	8330A/B	SS	70.0-130	20.0	2	mg/Kg
Explosives	NITROGUANIDINE	8330A/B	SS	70.0-130	20.0	8	mg/Kg
Explosives	1,3,5-TRINITROBENZENE	8330A/B	GW	70.1-98.5	20.0	0.0005	mg/L
Explosives	1,3-DINITROBENZENE	8330A/B	GW	50.8-88.7	24.2	0.0005	mg/L
Explosives	2,4,6-TRINITROTOLUENE	8330A/B	GW	61.4-102	20.0	0.0005	mg/L
Explosives	2,4-DINITROTOLUENE	8330A/B	GW	40.2-91.7	36.2	0.0005	mg/L
Explosives	2,6-DINITROTOLUENE	8330A/B	GW	47.0-94.4	29.4	0.0005	mg/L
Explosives	2-NITROTOLUENE	8330A/B	GW	43.3-93.9	30.4	0.0005	mg/L
Explosives	3-NITROTOLUENE	8330A/B	GW	36.8-89.5	37.3	0.0005	mg/L
Explosives	4-NITROTOLUENE (4-NT)	8330A/B	GW	41.1-93.1	34.4	0.0005	mg/L
Explosives	HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE	8330A/B	GW	63.1-94.2	20.0	0.0005	mg/L
Explosives	METHYL-2,4,6-TRINITROPHENYLNITRAMINE	8330A/B	GW	57.6-104	20.0	0.0005	mg/L
Explosives	NITROBENZENE	8330A/B	GW	56.0-99.0	20.4	0.0005	mg/L

Table 12.3: QC Targets for Semi-Volatiles Accuracy (LCS), Precision and RLs
This table is subject to revision without notice

Class	Analyte	Method	Matrix	Accuracy (%)	Prec. (RPD)	RL	Unit
Explosives	OCTAHYDRO - 1,3,5,7 - TETRANITRO-1,3,5,7-TETRAZOCINE (HMX)	8330A/B	GW	58.1-100	20.0	0.0005	mg/L
Explosives	PENTAERYTHRITOL TETRANITRATE (PETN)	8330A/B	GW	67.1-110	20.0	0.0005	mg/L
Explosives	NITROGLYCERINE	8330A/B	GW	65.0-126	20.0	0.0005	mg/L
GC	1, 2 DIBROMOETHANE (EDB)	504/8011	DW,GW, WW	70.0-130	30	0.00002	mg/L
GC	1, 2 DIBROMO-3-CHLOROPROPANE	504/8011	DW,GW, WW	70.0-130	30	0.00002	mg/L
GC	1,2,3-TRICHLOROPROPANE	504/8011	DW,GW, WW	70.0-130	30	0.0005	mg/L
THAA	BROMOACETIC ACID	552.2	DW	70.0-130	30	0.001	mg/L
THAA	CHLOROACETIC ACID	552.2	DW	70.0-130	30	0.002	mg/L
THAA	DIBROMOACETIC ACID	552.2	DW	70.0-130	30	0.001	mg/L
THAA	DICHLOROACETIC ACID	552.2	DW	70.0-130	30	0.001	mg/L
THAA	TRICHLOROACETIC ACID	552.2	DW	70.0-130	30	0.001	mg/L
TPH	PETROLEUM RANGE ORGANICS (TRPH)	FL-PRO RV	GW,	50.0-150	20.0	0.1	mg/L
TPH	PETROLEUM RANGE ORGANICS (TRPH)	FL-PRO	SS	50.0-150	20.0	4.0	mg/Kg
TPH	PETROLEUM RANGE ORGANICS (TRPH)	EPH TN	GW	50.0-150	20.0	0.1	mg/L
TPH	PETROLEUM RANGE ORGANICS (TRPH)	EPH TN	SS	50.0-150	20.0	4.0	mg/Kg
TPH	PETROLEUM RANGE ORGANICS (TRPH) - C9-C18, C19-C36, C11-C22	MADEP EPH	GW, WW	50.0-150	20.0	0.1	mg/L
TPH	PETROLEUM RANGE ORGANICS (TRPH) - C9-C18, C19-C36, C11-C22	MADEP EPH	SS	50.0-150	20.0	5.5	mg/Kg
TPH	PETROLEUM RANGE ORGANICS (TRPH) - C10-C28	DRO, 8015Mod	GW, WW	50.0-150	20.0	0.1	mg/L
TPH	PETROLEUM RANGE ORGANICS (TRPH) - C10-C28	DRO, 8015Mod	SS	50.0-150	20.0	4.0	mg/Kg
TPH	PETROLEUM RANGE ORGANICS (TRPH) – C10-C20, C20-C34	OHIO DRO	GW, WW	50.0-150	20.0	0.1	mg/L
TPH	PETROLEUM RANGE ORGANICS (TRPH) – C10-C20, C20-C34	OHIO DRO	SS	50.0-150	20.0	4.0	mg/Kg
TPH	PETROLEUM RANGE ORGANICS (TRPH) – GAS, DIESEL, MOTOR OIL, ETC.	OA2	GW, WW	50.0-150	20.0	0.1	mg/L
TPH	PETROLEUM RANGE ORGANICS (TRPH) – GAS, DIESEL, MOTOR OIL, ETC.	OA2	SS	50.0-150	20.0	4.0	mg/Kg

Table 12.3: QC Targets for Semi-Volatiles Accuracy (LCS), Precision and RLs
This table is subject to revision without notice

Class	Analyte	Method	Matrix	Accuracy (%)	Prec. (RPD)	RL	Unit
TPH	PETROLEUM RANGE ORGANICS - C10-C28, C28-C40	DRORLA	GW, WW	50.0-150	20.0	0.1	mg/L
TPH	PETROLEUM RANGE ORGANICS - C10-C28, C28-C40	DRORLA	SS	50.0-150	20.0	4.0	mg/Kg
TPH	PETROLEUM RANGE ORGANICS – C10-C32	DROWY	GW, WW	50.0-150	20.0	0.1	mg/L
TPH	PETROLEUM RANGE ORGANICS – C10-C32	DROWY	SS	50.0-150	20.0	4.0	mg/Kg
TPH	PETROLEUM RANGE ORGANICS – GAS, DIESEL, MOTOR OIL, ETC.	NWTPH-Dx	GW, WW	50.0-150	20.0	0.25	mg/L
TPH	PETROLEUM RANGE ORGANICS – GAS, DIESEL, MOTOR OIL, ETC.	NWTPH-Dx	SS	50.0-150	20.0	25	mg/Kg
TPH	PETROLEUM RANGE ORGANICS – C10-C28	DROWM	GW, WW	75.0-115	20.0	0.1	mg/L
TPH	PETROLEUM RANGE ORGANICS – C10-C28	DROWM	SS	70.0-120	20.0	10	mg/Kg
TPH	PETROLEUM RANGE ORGANICS – C10-C22	TPHAZ	SS	70.0-130	20.0	30	mg/Kg
TPH	PETROLEUM RANGE ORGANICS – C22-C32	TPHAZ	SS	70.0-130	20.0	100.	mg/Kg
TPH	PETROLEUM RANGE ORGANICS – C10-C32	TPHAZ	SS	70.0-130	20.0	130.	mg/Kg
TPH	PETROLEUM RANGE ORGANICS - C6-C12, C12-C28, C28-C35, C6-C35	TX TPH	SS	75.0-125	20.0	50	mg/Kg
TPH	PETROLEUM RANGE ORGANICS - C10-C21, C21-C35	DROMO	GW, WW	75.0-125	20.0	1.0	mg/L
TPH	PETROLEUM RANGE ORGANICS - C10-C21, C21-C35	DROMO	SS	75.0-125	20.0	20	mg/Kg

13.0 CORRECTIVE ACTION

13.1 In the event that a nonconformance occurs in conjunction with the analytical batch, a corrective action response (CAR) form must be completed. The cause of the event is stated on the form and the measures taken to correct the nonconformance clearly defined. The effectiveness of the corrective action must be assessed and noted. The CAR is kept on file by the Regulatory Affairs Department. Corrective action procedures are documented in SOP #030208, *Corrective and Preventive Action*

13.2 Required Corrective Action

Control limits have been established for each type of analysis. When these limits are exceeded, corrective action must be taken. Calculated sample spike control limits are also used.

All samples and procedures are governed by ESCs quality assurance program. General corrective actions are as follows; however additional and more specific direction is provided in the specific determinative procedure. For more information, see the appropriate determinative SOP.

13.2.1 Laboratory QC Criteria and Appropriate Corrective Actions

If the analytical method contains acceptance/rejection criteria and it is more stringent than those controls generated by the laboratory the method criteria takes precedence.

13.2.2 Out Of Control Blanks: Applies to Method, Trip, Rinsate & Instrument Blanks

Rejection Criteria - Blank reading is more than twice the background absorbance or more than RL.

Corrective Action - Blanks are re-analyzed and the response is assessed. Standard curves and samples are evaluated for any obvious contamination that is isolated or uniform throughout the run. If necessary, reagents are re-prepared. Analyses are not initiated until the problem is identified and solved. If samples have already been prepared or analyzed, the Senior Chemist and/or Department Supervisor are consulted to determine if data needs to be rejected or if samples need to be re-prepared.

13.2.3 Out Of Control Laboratory Control Standards (LCS & LCSD)

Rejection Criteria - If the performance is outside of lab-generated control limits which are calculated as the mean of at least 20 data points ±3 times the standard deviation of those points (Listed in Section 12) and the marginal excedence allowance is surpassed (see section 12.2).

Corrective Action - Instrument settings are checked and the LCS standard is reanalyzed. If the LCS is still out of control, instrumentation is checked for systemic problems and repaired (if necessary). Re-calibration is performed and the samples affected since the last in control reference standard are rerun. The Senior Chemist and/or Department Supervisor are consulted for further action.

13.2.4 Out Of Control Matrix Spike Samples

Rejection Criteria - If either the MS or MSD sample is outside the established control limits.

Corrective Action - Any compound that is outside of these limits is considered to be ‘out of control’ and must be qualified appropriately. Batch acceptance, however, is based on method blank and LCS performance, not on MS/MSD recoveries. Specific methods, customers, and programs may require further corrective action in some cases.

13.2.5 Out Of Control Duplicate Samples

Rejection Criteria - Lab-generated maximum RPD limit (as listed under precision in Section 12)

Corrective Action - Any compound that is outside of these limits is considered to be ‘out of control’ and must be qualified appropriately. Batch acceptance, however, is based on method blank and LCS performance. Specific methods, customers, and programs may require further corrective action in some cases.

13.2.7 Out Of Control Calibration Standards: ICV, CCV, SSCV

Rejection Criteria - If the performance is outside of method requirements.

Corrective Action - Instrument settings are checked, calibration verification standard is reanalyzed. If the standard is still out of control, recalibration is performed, and samples affected since the last in control reference standard are rerun. The the Senior Chemist and/or Department Supervisor are consulted for further action.

14.0 RECORD KEEPING

Record keeping is outlined in SOP #030230, *Standards Logger, SOP #030227, Data Review* and SOP #030201, *Data Handling and Reporting.* Semi-Volatile organics calibration data are recorded and integrated using HP Enviroquant software. Calibration data from the semi-volatile analyses, in addition to the initial and daily calibration, includes GC/MS autotunes, DFTPP reports and surrogate recovery reports. Hard copy records of initial calibration and daily calibration are stored with chromatograms and integrated with sample data by date analyzed.

15.0 QUALITY AUDITS

System and data quality audits are outlined in the ESC Quality Assurance Manual Version 12.0 and *SOP #010104, Internal Audits*.

16.0 REVISIONS

The Regulatory Affairs Department has an electronic version of this Quality Assurance Manual with tracked changes detailing all revisions made to the previous version. This version is available upon request. Revisions to the previous version of this appendix are summarized in the table below.

Document	**Revision**
Quality Assurance Manual Version 15.0 (Appendix VII)	General – Replaced the term “client” with the term “customer” Table 8.1 – Updated Equipment List Table 10.1 – Updated SOP List Table 12.3 – Updated some RLs and added 1,4-Dioxane by Isotope Dilution

1.0 SIGNATORY APPROVALS

Air Laboratory
QUALITY ASSURANCE MANUAL

APPENDIX VIII TO THE ESC QUALITY ASSURANCE MANUAL

for

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NOTE: The QAM has been approved by the following people.

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2.0 *APPENDIX TABLE OF CONTENTS*

3.0 SCOPE AND APPLICATION

This appendix discusses specific QA requirements for general analytical protocols to ensure that analytical data generated from the Air Laboratory are scientifically valid and are of acceptable quality. Any deviations from these requirements and any deviations that result in nonconforming work must be immediately evaluated and their corrective actions documented.

4.0 LABORATORY ORGANIZATION AND RESPONSIBILITIES

ESC Lab Sciences offers diverse environmental capabilities that enable the laboratory to provide the customer with both routine and specialized services, field sampling guidance and equipment, and broad laboratory expertise. A brief outline of the organization and responsibilities as they apply to the ESC Quality Assurance Program is presented in *Section 4.0 in the ESC Quality Assurance Manual.*

5.0 PERSONNEL AND TRAINING

5.1 PERSONNEL

Heidi Ferrell, with a B.S. degree in Chemistry, is the Department Supervisor and is responsible for the overall production of the Air Laboratory; including the management of the staff and scheduling. Ms. Ferrell has 10 years of environmental laboratory experience.

In her absence, Matt Ferrell, with an A.S. of Applied Science, assumes responsibility for the Air Department decisions. Mr. Ferrell is the Primary Analyst for the Air Laboratory and is proficient in air analytical methods. He has 6 years of environmental laboratory experience.

5.2 TRAINING

The Supervisor trains new laboratory analysts according to ESC protocol. ESC's training program is outlined in *SOP 030205 Technical Training and Personnel Qualifications.* Performance is documented using an initial demonstration of capability (IDOCs) and continuing demonstration of capability (CDOC). On-going acceptable capability in Air Laboratory is also demonstrated by acceptable participation in the Phenova proficiency testing program (PTs). Documentation of analyst training is maintained on file within the department.

6.0 FACILITIES AND LABORATORY SAFETY

6.1 FACILITIES

The main area of the laboratory has approximately 670 square feet of area with roughly 150 square feet of bench area. There are 670 square feet of additional storage and the lighting is fluorescence. The air system is a ten-ton Trane split unit with natural gas for heating. The laboratory reagent water is provided through the US Filter deionizer system. Waste disposal containers are located in the laboratory and Clean Harbors serves as ESC's hazardous waste disposal company. ESC's building information guides and site plan are shown in Appendix I.

6.2 LABORATORY SAFETY

- Laboratory access is limited when work is being performed.
- All procedures where chemicals are prepared or splashes may occur are conducted in laboratory exhaust hoods.

ESC's laboratory safety guidelines are detailed in the *ESC Chemical Hygiene Plan.*

7.0 SAMPLING PROCEDURES

7.1 FIELD SAMPLING PROCEDURES, SAMPLE STORAGE, AND HANDLING

- Field Sampling procedures are described in Appendix III of this ESC Quality Assurance Manual. Sample information is recorded and kept on the ESC chain of custody and field logbooks.
- Samples for air analysis are collected in four ways:
  - ➢ Samples may be collected directly in evacuated Summa canisters fit with the appropriately adjusted regulators that control sampling flow to fill the canister over a given time period.
  - ➢ Summa canisters may also be collected as "grab" samples by simply opening the evacuated canister without the aid of a flow regulator and allowing the canister to fill quickly by virtue of the canister vacuum.
  - ➢ The third method entails collection of field samples using various sized bags specifically designed for air sampling (i.e. Tedlar). This type of sampling allows a pump connected via tubing to the bag's intake valve to sample the air at a controlled flow and over the appropriate timeframe needed by the customer.
  - ➢ The headspace of containers housing water samples may also be analyzed for specific volatile components.

- Air samples taken in summa canisters should be shipped in bubble wrapped boxes. Tedlar bags and water samples can be shipped in a container or cooler that is sufficiently rigid and protects the samples from damage that may be incurred in transport. The chain of custody is also placed in the container. The shipping label containing the name and address of the shipper is affixed to the outside of the shipment container.
- Samples are received in the laboratory login area and are tracked using LIMS (Laboratory Information Management System). A Chain of Custody Form accompanies all samples received by the lab. This is necessary to prove the traceability of the samples and to document the change in possession from sampling to delivery to receipt by the laboratory. Prior to analysis samples are checked for integrity. Sample handling, tracking and acceptance procedures are outlined in *SOP #060105, Sample Receiving.*

8.0 EQUIPMENT

8.1 EQUIPMENT LIST

TABLE 8.1 – LABORATORY EQUIPMENT LIST: MAJOR ITEMS - Air Analysis
This table is subject to revision without notice

Item	*Manufacturer*	*Model*	*Instrument Name*	*#*	*Serial #*	*Location*
Gas Chromatograph	HP	6890N TCD	AIRGC3	1	US10726007	Air Lab
Gas Chromatograph/Mass Spectrometer	HP	6890 GC/5973MSD	AIRMS1	1	GCUS00024616 MSUS63810244	Air Lab
Gas Chromatograph/Mass Spectrometer	Agilent	6890N/5975	AIRMS2	2	CN10551083	Air Lab
Gas Chromatograph/Mass Spectrometer	Agilent	6890/5973	AIRMS3	3	US000011333 US91911078	Air Lab
Gas Chromatograph/Mass Spectrometer	Agilent	6890/5973	AIRMS4	4	US00024695 US82311265	Air Lab
Gas Chromatograph/Mass Spectrometer	Agilent	6890/5973	AIRMS5	5	GCUS0003961 MSUS0340681	Air Lab
Gas Chomatograph/Mass Spectrometer	Agilent	7890A/5975C	AIRMS6	6	GCUS10831022 MSU91732329	Air Lab
Canister Autosampler	Entech	7016C			0203	Air Lab
Preconcentrator	Entech	7100A			1089	Air Lab
Preconcentrator	Entech	7200			1005	Air Lab
Canister Autosampler	Entech	7016CA			1039	Air Lab
Tedlar Autosampler	Entech	(3) 7032A-L			1019	Air Lab
Dynamic Diluter	Entech	Model 4600A			1086	Air Lab
Canister Cleaner	Entech	Model 3100A			1045	Air Lab
Canister Cleaner	Entech	Model 3100A			1178	Air Lab
Canister cleaner	Entech	Model 3100A			B33-02663	Air Lab
Preconcentrator	Entech	7100A			1137	Air Lab
Canister Autosampler	(2) Entech	7016D				Air Lab
Preconcentrator	(2) Entech	7200				Air Lab
Tedlar Autosampler	Entech	7032A			1044	Air Lab

TABLE 8.1 – LABORATORY EQUIPMENT LIST: MAJOR ITEMS - Air Analysis
This table is subject to revision without notice

Item	***Manufacturer***	***Model***	***Instrument Name***	***#***	***Serial #***	***Location***
Canister Autosampler	Entech	7016CA			1137	Air Lab
GC/FID	Agilent	6890N	AIRGC2	2	US10137006	Air Lab
Headspace Autosampler	(2) EST/PTS	LGX50				Air Lab
TO Canister	Restek/Entech	TO-Can/ SiloniteCan	2200 cans owned		N/A	Air Lab
Passive Sampling Kit	Restek		1500 owned		N/A	Air Lab
Field hand held PID	RAE Systems	MiniRae2000			110-012980	Air Lab
Field hand held PID	RAE Systems	MiniRAE2000				Air Lab

8.2 EQUIPMENT PREVENTIVE MAINTENANCE, EQUIPMENT CALIBRATION

INSTRUMENT	***P. M. DESCRIPTION***	***FREQUENCY***
Gas Chromatograph Detectors: FID	Change Quartz jet; clean; replace flame tip	As needed - when deterioration is noticeable
Gas Chromatograph/Mass Spectrometer	•Autotune Report	Inspected daily
Gas Chromatograph/Mass Spectrometer	•Clean ion source	As needed to maintain high mass resolution
Gas Chromatograph/Mass Spectrometer	•Replace vacuum pump oil	Every 6 months
Gas Chromatographs	•Replace column	When separation begins to degrade

8.3 STANDARDS AND REAGENTS

Table 8.3A: Standard stock sources, description and calibration information.
This table is subject to revision without notice

Method	**Vendor**	**Description**	**Conc.**	**Storage Req.**	**Expiration**
TO-15/SIM/8260B (VAP)/Method 8-mod. ISTD Stock Standard	Spectra Gases	ISTD and Tuning Mixture	1 ppmv	3395 L (2A) cylinder	1 year
TO-15/SIM/8260B (VAP)/Method 18-mod. Stock Standard*	Spectra Gases	Target Analytes	100 ppbv	3395 L (2A) cylinder	1 year
Landfill Gases Stock (CO_2, CO, CH_6, O_2, He)	Spectra Gases	Target Analytes	3 Levels	3395 L (2A) cylinder	1 year
Landfill Gases Laboratory Control Stock Standard	Spectra Gases	Target Analytes – Second Source	20%	3395 L (2A) cylinder	1 year
RSK-175 (Methane, Ethane, Ethene, Propane, Acetylene) Stock Standard	Scotty Gases	Target Analytes	1000 ppmv	3395 L (2A) cylinder	1 year
RSK-175 Laboratory Control Stock Standard	Scotty Gases	Target Analytes – Second Source	1000 ppmv	3395 L (2A) cylinder	1 year

TABLE 8.3B: Intermediate/Working Standard Concentrations
This table is subject to revision without notice

Organic Compounds	Method #	Working Standard Concentrations	Volume of Stock Used	Final Volume	Expiration
ISTD and Tuning Intermediate Standard	TO-15/8260B (VAP)/Method 18.	20 ppbv	1800 cc	15L in 15L Canister	1 year
Target Analytes* Intermediate Standard	TO-15/8260B (VAP)/Method 18	5 ppbv except Bromoform at 5ppbv, m&p Xylene at 10 ppbv and GRO at 200 ppbv	225 cc	15L in 15L Canister	1 year
TO-15/ 8260B(VAP)/ Method 18-mod. Laboratory Control* Intermediate Standard	TO-15/8260B (VAP)/Method 18	Second Source: 5 ppbv except Bromoform at 15ppbv, m&p Xylene at 10 ppbv and GRO at 200	225 cc	15L in 15L Canister	1 year
ISTD and Tuning Intermediate Standard	TO-15SIM	0.2ppbv	300 cc	15L in 15L Canister	1 year
Target Analytes	TO-15SIM	0.5ppbv	22.5 cc	15L in 15L Canister	1 year
TO-15SIM Laboratory Control* Intermediate Standard	TO-15SIM	0.5ppbv	22.5 cc	15L in 15L Canister	1 year

** see analytes listed in Table 12.3.*

8.4 INSTRUMENT CALIBRATION

TO-15, 8260B (Ohio VAP Air), Gasoline Range Components (Method 18) – Volatiles in Air by GC/MS – SOP Numbers 330367, 330368, & 330369

Detector mass calibration is performed daily using the autotune function of the GC/MS analytical system and BFB (Bromofluorobenzene). Following verification of the appropriate masses, the instrument sensitivity is verified by injecting a tuning solution containing Bromofluorobenzene (BFB). The BFB must meet the following ion abundance criteria:

Mass	Ion Abundance Criteria
50	8.0-40.0% of mass 95
75	30.0-66.0% of mass 95
95	base peak, 100% relative abundance
96	5.0-9.0% of mass 95
173	< 2.0% of mass 174
174	50.0-120% of mass 95
175	4.0-9.0% of mass 174
176	> 93.0%, but less than 101% of mass 174

Mass	Ion Abundance Criteria
177	5.0-9.0% of mass 176

Successful tuning must occur every 24 hours for method TO-15, TO-15SIM and Method 18 and every 12 hours for method 8260B (OH VAP only).

Following successful tuning, the GC/MS is calibrated using the internal standard procedure. A standard curve is prepared using a minimum of five standards. The calibration standards are tabulated according to peak height or area against concentrations of the target analytes and the concentrations and responses of the internal standard analytes. The results are used to determine a response factor for each analyte in each standard injected.
A TO-15, TO-15SIM or Method 18 calibration curve is constructed and determined to be acceptable if each analyte is found to be constant over the working range (<30 % RSD with no more than 2 compounds being between 30 and 40 % RSD). When this condition is met, linearity through the origin can be assumed and the average RF can be used in place of a calibration curve.

When analyzing air by method 8260B, specific target analytes in the calibration standards are defined as calibration check compounds (CCCs) or system performance check compounds (SPCCs).

SPCCs:

Analyte	Minimum Relative Response Factor
Chloromethane	0.10
1,1-Dichloroethane	0.10
Bromoform	0.10
Chlorobenzene	0.30
1,1,2,2-Tetrachloroethane	0.30

CCCs:

1,1-Dichloroethene	Toluene
Chloroform	Ethylbenzene
1,2-Dichloropropane	Vinyl Chloride

Analytes identified by the method as SPCCs must meet the minimum average response factors listed above for successful initial calibration. Compounds identified as CCCs must have a %RSD of less than 30% in the initial calibration curve. The remaining target analytes in the calibration standards must be <15% RSD. Linear regression can be used for any target compound exceeding the 15% RSD criteria providing that the correlation coefficient is 0.990 or better. Initial 8260B calibration for the target analytes of interest for the customer project that do not meet these requirements are not accepted and re-calibration must be performed.

For all methods, the initial calibration range must represent the typical air sample and include the lowest standard at or below the RL. The linear range of the instrument must be monitored to ensure that the maximum calibration point is within the range. Following successful calibration, the analysis of field and QC samples may begin. Analysis may be performed only during the timeframe of a valid tuning cycle (12 hours for 8260B and 24 hours for TO-15, TO-15SIM and Method 18). Following the expiration of the tuning clock, the instrument must be re-tuned and either recalibrated or the existing calibration may be verified prior to further sample analysis.

For 8260B analyses, daily continuing calibration verification (CCV) includes successful demonstration of BFB sensitivity and the injection of a mid-level CCV standard containing all the target analytes of interest, the CCC, and SPCC compounds. The BFB tune must meet the ion abundance criteria (see table above). Each SPCC in the calibration verification standard must meet a minimum response factors listed above. The CCCs must achieve the criteria of +/- 20% RSD. Each internal standard in the CCV must recover between -50% to + 100%, when compared to the same internal standard compound in the mid-point standard of the initial calibration curve. Additionally, if the retention time of an internal standard changes by more than 30 seconds from the retention time of the same internal standard in the mid-level standard of the most recent initial calibration, the system must be evaluated, corrected, and possibly re-calibrated.

For TO-15,TO-15SIM and Method 18 analyses, daily calibration verification is accomplished by a successful demonstration of BFB sensitivity and the injection of a mid-level CCV standard containing all the target analytes of interest. The BFB tune must meet the same ion abundance criteria as previously listed and the CCV standard must recover within 30% of predicted response for all analytes of interest.

Fixed Gases (Carbon Dioxide, Carbon Monoxide, Methane, Oxygen) based on ASTM D1946 – SOP Number 330372

Optimize the conditions of the Gas Chromatograph with Thermal Conductivity Detection according to the manufacturer’s specification to provide good resolution and sensitivity. Verify that the gas flows and column and detector temperatures are at optimum levels for analysis, based on peak resolution and chromatograph performance. Allow sufficient time between each temperature adjustment to attain a stable reading (typically one hour). Standards are injected at a minimum of five concentration levels from purchased certified standards. Generation of the initial calibration is performed using PC-based D.01 ChemStation software and a calibration factor or linear regression model. The calibration must meet 15% RSD for calibration factors or a correlation coefficient of at least 0.990. Instrument calibration must be verified initially on days when a full calibration curve is not analyzed, following every 10 injections during the analytical sequence, and at the end of each sequence by the analysis of a check standard. These standards must recover within 15% of the expected concentration.

Methane, Ethane, Ethene, Propane, Acetylene based on RSK-175 – SOP Number 330370

Optimize the conditions of the Gas Chromatograph with Thermal Conductivity Detection according to the manufacturer's specification to provide good resolution and sensitivity. Verify that the gas flows and column and detector temperatures are at optimum levels for analysis, based on peak resolution and chromatograph performance. Allow sufficient time between each temperature adjustment to attain a stable reading (typically one hour). Standards are injected at a minimum of five concentration levels. The target analytes in the calibration standards must be $\leq$15% RSD. Linear regression can be used for any target compound exceeding the 15% RSD criteria providing that the correlation coefficient is 0.990 or better. Headspace is created in each field sample by forcing 20cc of helium into each sample vial. Following sufficient time for the sample and headspace to reach equilibrium, 100uL of air is removed from each vial and injected into the GC. Instrument calibration must be verified initially on days when a full calibration curve is not analyzed, following every 10 injections during the analytical sequence, and at the end of each sequence by the analysis of a check standard. These standards must recover within 15% of the expected concentration.

Methanol and Ethanol (MEETAC) in soil and water samples based on EPA 8260B/C – SOP Number 330373

Detector mass calibration is performed daily using the autotune function of the GC/MS analytical system and BFB (Bromofluorobenzene). Following verification of the appropriate masses, the instrument sensitivity is verified by injecting a tuning solution containing Bromofluorobenzene (BFB). The BFB must meet the following ion abundance criteria:

Mass	Ion Abundance Criteria
50	15.0-40.0% of mass 95
75	30.0-60.0% of mass 95
95	base peak, 100% relative abundance
96	5.0-9.0% of mass 95
173	< 2.0% of mass 174
174	> 50.0% of mass 95
175	5.0-9.0% of mass 174
176	> 95.0%, but less than 101% of mass 174
177	5.0-9.0% of mass 176

Successful tuning must occur every 12 hours.

Following successful tuning, the GC/MS is calibrated using the external standard procedure. A standard curve is prepared using a minimum of five standards. The calibration standards are tabulated according to peak height or area against concentrations of the target analytes. The results are used to determine a response factor for each analyte in each standard injected. A calibration curve is constructed and determined to be acceptable if each analyte is found to be constant over the working range (<15 % RSD). When this condition is met, linearity through the origin can be assumed and the average CF can be used in place of a calibration curve. Linear regression can be used for any target compound exceeding the 15% RSD criteria providing that the correlation coefficient is 0.990 or better.

The initial calibration range must represent the typical field sample and include the lowest standard at or below the RL. The linear range of the instrument must be monitored to ensure that the maximum calibration point is within the range. Following successful calibration, the analysis of field and QC samples may begin. Analysis may be performed only during the timeframe of a valid tuning cycle (12 hours). Following the expiration of the tuning clock, the instrument must be re-tuned and either recalibrated or the existing calibration may be verified prior to further sample analysis.

Daily calibration verification is accomplished by a successful demonstration of BFB sensitivity and the injection of a mid-level CCV standard containing all the target analytes of interest. The BFB tune must meet the same ion abundance criteria as previously listed and the CCV standard must recover within 15% of predicted response for all analytes of interest.

8.5 ACCEPTANCE/REJECTION OF CALIBRATION

The initial calibration curve is compared with previous curves for the same analyte. All new standard curves are immediately checked with a secondary source or laboratory control standard prepared from a separate source than those used for calibration. All curves are visually reviewed to ensure that acceptable correlation represents linearity. Calibration curves may be rejected for nonlinearity, abnormal sensitivity, or poor response of the laboratory control standard.

Continuing calibration verification is performed on each day that initial calibration is not performed and following every tenth sample. If a check standard does not perform within established criteria then the instrument will undergo evaluation to determine the problem. Once the problem is corrected, all samples between the last in control sample and the first out of control check will be re-analyzed.

TABLE 8.5: INSTRUMENT CALIBRATION & QC

Analysis/ Instrument	**Calibration Type**	**Number of Standards**	**Acceptance/ Rejection Criteria**	**Frequency**
TO-15/SIM & Method 18/ GC/MS	Initial/ Continuing	1 - Tuning Solution	Mass m/z Abundance Criteria 50 8-40% of mass 95 75 30-66% of mass 95 95 Base peak, 100% 96 5-9% of mass 95 173 <2% of mass 174 174 50-120% of mass 95 175 4-9% of mass 174 176 >93% but <101% of mass 174 177 5-9% of mass 176	TO-15/SIM/ M-18: Every 24 hours 8260 VAP: Every 12 hours
TO-15/SIM & Method 18/ GC/MS	Initial	5 minimum	Average Response Factor: <30 % RSD with no more than 2 compounds being between 30 and 40 % RSD	As needed
8260B VAP/ GC/MS	Initial	5 minimum	Average Response Factor: Target analytes in the calibration standards must be <15% RSD, CCCs must have a %RSD of less than 30% & SPCCs must meet the minimum average response factors. Linear regression can be used for any target compound exceeding the 15% RSD	As needed
TO-15/SIM & Method 18/ GC/MS	Continuing	1 cal. check verification (CCV)	Percent Difference for all compounds <30%	Daily, when init. calibration is not required.
TO-15 VAP/ GC/MS	Continuing	1 cal. check verification (CCV)	Average Response Factor: Target analytes in the calibration standards must be <15% RSD, CCCs must have a %RSD of less than 20% & SPCCs must meet the minimum average response factors.	Daily, when init. calibration is not required.
TO-15/SIM & Method 18	Initial/ Continuing	1 - Blank	< RL, concentrations of common laboratory contaminants shall not exceed the reporting limit	Following init. calibration or daily cal. verification
TO-15/SIM & Method 18	Initial/ Continuing	2 – (LCS/LCSD)	Must be within +/-30% with an RPD of <25.	Following initial calibration or daily cal. Verification
Landfill Gas/Helium	Initial	3	Average Response Factor: Target analytes in the calibration standards must be <15% RSD. Linear regression can be used for any target compound exceeding the 15% RSD	As needed
Landfill Gas/Helium	Continuing	1 - cal. check verification (CCV)	Target analytes in the calibration standards must be <15% RSD.	Daily, when init. calibration is not required, following every 10th injection, and the end of the sequence.

TABLE 8.5: INSTRUMENT CALIBRATION & QC

Analysis/ Instrument	**Calibration Type**	**Number of Standards**	**Acceptance/ Rejection Criteria**	**Frequency**
Landfill Gas/Helium	Initial/ Continuing	1 - Blank	< RL, concentrations of common laboratory contaminants shall not exceed the reporting limit	Following init. calibration or daily cal. verification
Landfill Gas/Helium	Initial/ Continuing	2 – Second source (LCS/LCSD)	Must be within +/-30% with an RPD of <25.	Following initial calibration or daily cal. verification
RSK-175	Initial	3	Average Response Factor: Target analytes in the calibration standards must be <15% RSD. Linear regression can be used for any target compound exceeding the 15% RSD	As needed
RSK-175	Continuing	1 - cal. check verification (CCV)	Target analytes in the calibration standards must be <15% RSD.	Daily, when init. calibration is not required, following every 10th injection, and the end of the sequence.
RSK-175	Initial/ Continuing	1 - Blank	< RL, concentrations of common laboratory contaminants shall not exceed the reporting limit	Following init. calibration or daily cal. verification
RSK-175	Initial/ Continuing	2 – Second source (LCS/LCSD)	Must be within +/-30% with an RPD of <25.	Following initial calibration or daily cal. verification
MEETAC	Initial/ Continuing	1 - Tuning Solution	Mass m/z Abundance Criteria 50 15.0-40.0% of mass 95 75 30.0-60.0% of mass 95 95 base peak, 100% relative abundance 96 5.0-9.0% of mass 95 173 < 2.0% of mass 174 174 > 50.0% of mass 95 175 5.0-9.0% of mass 174 176 > 95.0%, but less than 101% of mass 174 177 5.0-9.0% of mass 176	Every 12 hours
MEETAC	Initial	5 minimum	Average Response Factor: Target analytes in the calibration standards must be <15% RSD,	As needed
MEETAC	Continuing	1 cal. check verification (CCV)	Average Response Factor: Target analytes in the calibration standards must be <15% RSD,	Daily, when init. calibration is not required.
MEETAC	Initial/ Continuing	1 - Blank	< RL, concentrations of common laboratory contaminants shall not exceed the reporting limit	Following init. calibration or daily cal. verification

9.0 LABORATORY PRACTICES

9.1 REAGENT GRADE WATER

Reagent Grade water –Type II used in the Air Laboratory is generated in the Microbiology Laboratory and is periodically checked for contamination. Type II water is checked annually for single and total heavy metals. Monthly checks for total organic carbon, ammonia and organic nitrogen, total residual chlorine and a heterotrophic plate count are also conducted. Conductivity and pH are checked continuously or with each use.

9.2 SAMPLER CLEANING AND CERTIFICATION PROCEDURE

Canisters are cleaned in the laboratory using the Entech 3100 4-Position Canister Cleaner. Canisters are cleaned in batches of 4 to 8 per cleaning cycle. Prior to cleaning, canisters are inspected for integrity, damage and visible contamination. Acceptable canisters are connected to the manifold on the Entech cleaner and the cleaning cycle is controlled using Entech SmartLab software. Programmable cleaning cycles include: light, medium and heavy-duty and the cycle selected depends on the previous use of the dirtiest canister being cleaned. The cleaner automatically performs a leak check for the canisters and the manifold prior to the initial evacuation cycle. Heating bands are placed on each canister to elevate the temperature of the metallic canister to a level that provides for efficient cleaning. The typical cleaning cycle parameters are:

	Operating temperature = 120°C
1	Initial evacuation of canister to 1000 mtorr
2	Refill canister to 20psi
3	Evacuate the canister to 1000 mtorr
4	Repeat items 2 & 3 for a minimum of 8 cycles
5	Final zero air pressure in clean canister is 50 mtorr.

Following cleaning, a single canister is selected as a QC sample for the entire batch and the sample is filled with zero air or nitrogen and analyzed to verify that successful cleaning has occurred. If the analysis indicates that the batch is clean (i.e. <0.2 ppbv for target analytes and free of additional contamination), the QC sample is returned to the cleaner manifold. The entire batch is evacuated to less than 50 mtorr and clearly labeled as clean and ready for sample collection. If the QC sample indicates that canister contamination is still present, the batch is recycled through the cleaning process until residual contamination is no longer present. If following repeated cleaning cycles, residual contamination is still observed, canisters may be permanently removed from service and clearly identified as unusable.

Tedlar bags and vials, as used for headspace analyses, are purchased as certified pre-cleaned from approved providers and disposed of following the sample retention period.

9.3 TYPICAL ENTECH AUTOSAMPLER OPERATING PARAMETERS

These parameters are provided as an example and may be modified to improve analytical system performance or better address project needs.

Line Temp = 100°C	Module 2 Desorb = 180°C
Bulk Head 1 = 30°C	Module 2 Bake = 190°C
Bulk Head 2 = 30°C	Module 2 Desorb Time = 3.5 min
Module 1 Trap = -150°C	Module 3 Trap = -180°C
Module 1 Preheat = 20°C	Module 3 Inject = 2 min
Module 1 Desorb = 20°C	Module 3 Bake Time = 2 min
Module 1 Bake = 130°C	Module 3 Event = 3
Module 1 Bake Time = 5 min	Module 3 Wait Time = 25 min.
Module 2 Trap = -30°C	Pressure Comp Factor = 14
Module 2 Preheat = off	Loop Flush = 30 seconds

10.0 ANALYTICAL PROCEDURES

10.1 A list of laboratory SOPs associated with the air laboratory can be found in the following table:

TABLE 10.1: AIR DEPARTMENT SOPs

This Table is subject to revision without notice

SOP #	Title/Description
330367	Measurement of Volatile Organic Compound in Ambient Air by GC/MS (EPA TO-15)
330367OH	Measurement of Volatile Organic Compound in Ambient Air by GC/MS (EPA TO-15) (Ohio VAP only)
330368	Gasoline Range Organics in Ambient Air by GC/MS – Method 18 Modified
330370	Method for Determination of Methane, Ethane, and Ethene (Based on RSK-175)
330371	Canister Cleaning, Certification and Storage
330371OH	Canister Cleaning (Ohio Vap Only)
330372	The Analysis of Fixed Gases using GC/TCD
330373	Meetac – Methanol and Ethanol Based on EPA 8260B/C

10.2 Sample Dilutions:

Dilutions for air samples from summa canisters and Tedlar bags may take three forms depending on the level of dilution required. These dilution techniques are demonstrated below:

Autosampler Dilution:

- First, a smaller sample volume can be analyzed using the capabilities of the Entech autosampler. For example, for a standard sample volume of 400cc, if 40cc were analyzed, that would be equivalent to a 10-fold dilution.
- The smallest sample volume that can be accurately analyzed using the autosampler method is l0cc (or a 40x).

Pressurized Manual Dilution:

- Sometimes, a 40X dilution is not sufficient to bring the concentration of a target analyte within the calibration range. In those cases, the sample canister is pressurized resulting in a dilution of the target analytes present.
- The act of introducing more pure air into the canister performs a dilution.
- The canister can then be analyzed at 400cc or diluted using a lesser autosampler volume, if necessary.

Secondary Manual Dilution:

- In extreme cases, the canister may need to be diluted into a second evacuated canister.
- This is accomplished by using a gas tight syringe to remove an aliquot of sample (1-l0mL) from the initial canister then injecting it into a clean evacuated second canister.
- The second canister is then analyzed and quantified taking into account the dilution based on the amount of sample injected and the total volume of the canister utilized.

Tedlar Bag Dilutions:

- Dilutions on Tedlar bags can be performed in much the same manner as summa canisters using either the autosampler dilution or the secondary manual dilution using a second Tedlar bag and filling it with pure air then adding an aliquot of field sample using a gas tight syringe.

11.0 QUALITY CONTROL CHECKS

NOTE: For specific guidance on each determinative method, including required quality control and specific state requirements/modifications, refer to the relevant laboratory standard operating procedure(s).

11.1 Initial Demonstrations of Capability (IDOCs) are performed during new analyst training and/or prior to acceptance and use of any new method/instrumentation. Continuing Demonstration of Capability (CDOCs) must be updated at least annually for each analyst performing testing on field samples. The associated data is filed within the department and available for review.

11.2 A Laboratory Control Sample (LCS) and LCS Duplicate are analyzed per batch of samples and must yield recoveries within 70-130% of the expected concentration for all analytes and this pair must not exceed and RPD of 25%. Analytes specifically listed in each SOP as poor performers must yield recoveries as listed in each determinative SOP. LCS stock standards are prepared from sources independent of the calibration standards and also serve to verify the original calibration curve.

11.3 A method preparation blank is performed per batch of samples processed. If the acceptance criteria as listed in the determinative SOP is exceeded, the laboratory shall evaluate whether reprocessing of the samples is necessary, based on the following criteria:

- The blank contamination exceeds a concentration greater than 1/10 of the measured concentration of any sample in the associated preparation batch or
- The blank contamination is greater than 1/10 of the specified regulatory limit. The concentrations of common laboratory contaminants shall not exceed the reporting limit.

Any samples associated with a blank that fail these criteria shall be reprocessed in a subsequent preparation batch, except when the sample analysis resulted in non-detected results for the failing analytes.

12.0 DATA REDUCTION, VALIDATION AND REPORTING

12.1 DATA REDUCTION

The analyst performs the data calculation functions and is responsible for the initial examination of the finished data. Data reduction steps applied to the raw data are outlined in SOP #030201, *Data Handling and Reporting.* A secondary review of the data package is performed according to ESC SOP #030227, *Data Review*. The reviewer verifies that the analysis has been performed as required and meets method criteria, all associate data is present and complete, and also ensures that any additional documentation is completed as required (i.e. Ohio VAP checklists, required qualifiers on test reports, etc.)

TABLE 12.1 Data Reduction Formulas

PARAMETER	**FORMULA**
GC/MS – Analyte Response Factor	$\frac{\text{response of analyte primary ion } \{\textit{area}\} \text{ x concentration of analyte (ug/L)}}{\text{response of ISTD primary ion } \{\textit{area}\} \text{ x concentration of ISTD (ug/L)}}$ *Calculations performed by HP Enviroquant Software*
GC/MS – Sample Analyte Concentration	$\frac{\text{response of primary ion in analyte x int. std concentration. } \{\textit{ppbv}\} \text{ x dilution factor}}{\text{response factor } \{\textit{area/(mg/ml)}\} \text{ x initial volume-mass } \{\textit{ml or g}\} \text{ x int. std cal. } \{\text{area}\}}$ *Calculations performed by HP Enviroquant Software*

12.2 VALIDATION

The validation process consists of data generation, reduction review, and reporting results. Once data reduction is complete, validation is conducted by verification that the QC samples are within acceptable QC limits and that all documentation is complete, including the analytical report and associated QC. See Table 12.3 by method for current QC targets and controls and current reporting limits.

Organic Control Limits **-** The organic QC targets are statutory in nature; warning and control limits for organic analyses are initially established for groups of compounds based on preliminary method validation data. When additional data becomes available, the QC targets are reviewed. All QC targets are routinely re-evaluated at least annually (and updated, if necessary) against laboratory historical data to insure that the limits continue to reflect realistic, method achievable goals.

12.3 REPORTING

Reporting procedures are documented in SOP #030201, *Data Handling and Reporting.*

Table 12.3: QC Targets for Air Accuracy (LCS), Precision and RLs
This table is subject to revision without notice

Analyte	**Method**	**Matrix**	**Accuracy (%)**	**Prec. (% RPD)**	**RL**	**Unit**
1,1,1-Trichloroethane	TO-15	Air	70.0-130	25.0	0.2	ppbv
1,1,2,2-Tetrachloroethane	TO-15	Air	70.0-130	25.0	0.2	ppbv
1,1,2-Trichloroethane	TO-15	Air	70.0-130	25.0	0.2	ppbv
1,1-Dichloroethane	TO-15	Air	70.0-130	25.0	0.2	ppbv
1,1-Dichloroethene	TO-15	Air	70.0-130	25.0	0.2	ppbv
1,2,4-Trichlorobenzene	TO-15	Air	53.6-154	25.0	0.63	ppbv
1,2,4-Trimethylbenzene	TO-15	Air	70.0-130	25.0	0.2	ppbv
1,2-Dibromoethane	TO-15	Air	70.0-130	25.0	0.2	ppbv
1,2-Dichlorobenzene	TO-15	Air	70.0-130	25.0	0.2	ppbv
1,2-Dichloroethane	TO-15	Air	70.0-130	25.0	0.2	ppbv
1,2-Dichloropropane	TO-15	Air	70.0-130	25.0	0.2	ppbv
1,3,5-Trimethylbenzene	TO-15	Air	70.0-130	25.0	0.2	ppbv
1,3-Butadiene	TO-15	Air	70.0-130	25.0	0.2	ppbv
1,3-Dichlorobenzene	TO-15	Air	70.0-130	25.0	0.2	ppbv
1,4-Dichlorobenzene	TO-15	Air	70.0-130	25.0	0.2	ppbv
1,4-Dioxane	TO-15	Air	48.0-156	25.0	0.2	ppbv
1,1,1-Trichloroethane	TO-15	Air	70.0-130	25.0	0.2	ppbv
2,2,4-Trimethylpentane	TO-15	Air	70.0-130	25.0	0.2	ppbv
2-Chlorotoluene	TO-15	Air	70.0-130	25.0	0.2	ppbv

Table 12.3: QC Targets for Air Accuracy (LCS), Precision and RLs
This table is subject to revision without notice

Analyte	Method	Matrix	Accuracy (%)	Prec. (% RPD)	RL	Unit
2-Propanol	TO-15	Air	50.4-152	25.0	0.2	ppbv
4-Ethyltoluene	TO-15	Air	70.0-130	25.0	0.2	ppbv
Acetone	TO-15	Air	70.0-130	25.0	1.25	ppbv
Allyl Chloride	TO-15	Air	70.0-130	25.0	0.2	ppbv
Benzene	TO-15	Air	70.0-130	25.0	0.2	ppbv
Benzyl Chloride	TO-15	Air	55.6-160	25.0	0.2	ppbv
Bromomethane	TO-15	Air	70.0-130	25.0	0.2	ppbv
Bromodichloromethane	TO-15	Air	70.0-130	25.0	0.2	ppbv
Bromoform	TO-15	Air	70.0-130	25.0	0.6	ppbv
Carbon Disulfide	TO-15	Air	70.0-130	25.0	0.2	ppbv
Carbon Tetrachloride	TO-15	Air	70.0-130	25.0	0.2	ppbv
Chlorobenzene	TO-15	Air	70.0-130	25.0	0.2	ppbv
Chloroethane	TO-15	Air	70.0-130	25.0	0.2	ppbv
Chloroform	TO-15	Air	70.0-130	25.0	0.2	ppbv
Chloromethane	TO-15	Air	70.0-130	25.0	0.2	ppbv
Cis-1,2-Dichloroethene	TO-15	Air	70.0-130	25.0	0.2	ppbv
Cis-1,3-Dichloropropene	TO-15	Air	70.0-130	25.0	0.2	ppbv
Cyclohexane	TO-15	Air	70.0-130	25.0	0.2	ppbv
Dibromochloromethane	TO-15	Air	70.0-130	25.0	0.2	ppbv
Dichlorodifluoromethane	TO-15	Air	56.7-140	25.0	0.2	ppbv
Ethanol	TO-15	Air	34.3-167	25.0	0.63	ppbv
Ethyl Acetate	TO-15	Air	70.0-130	25.0	0.2	ppbv
Ethylbenzene	TO-15	Air	70.0-130	25.0	0.2	ppbv
Freon-11	TO-15	Air	70.0-130	25.0	0.2	ppbv
Freon-12	TO-15	Air	70.0-130	25.0	0.2	ppbv
Freon-113	TO-15	Air	70.0-130	25.0	0.2	ppbv
Freon-114	TO-15	Air	70.0-130	25.0	0.2	ppbv
Gasoline Range Organics	TO-15	Air	70.0-130	25.0	50	ppbv
Heptane	TO-15	Air	70.0-130	25.0	0.2	ppbv
Hexachloro-1,3-Butadiene	TO-15	Air	62.1-143	25.0	0.63	ppbv
Hexane	TO-15	Air	70.0-130	25.0	0.2	ppbv
Isopropylbenzene	TO-15	Air	70.0-130	25.0	0.2	ppbv
M&P-Xylene	TO-15	Air	70.0-130	25.0	0.4	ppbv
Methyl Butyl Ketone	TO-15	Air	47.9-165	25.0	1.25	ppbv
Methyl Ethyl Ketone	TO-15	Air	70.0-130	25.0	1.25	ppbv

Table 12.3: QC Targets for Air Accuracy (LCS), Precision and RLs
This table is subject to revision without notice

Analyte	Method	Matrix	Accuracy (%)	Prec. (% RPD)	RL	Unit
Methyl Isobutyl Ketone	TO-15	Air	55.3-154	25.0	1.25	ppbv
Methyl Methacrylate	TO-15	Air	70.0-130	25.0	0.2	ppbv
Methyl tert Butyl Ether	TO-15	Air	70.0-130	25.0	0.31	ppbv
Methylene Chloride	TO-15	Air	70.0-130	25.0	0.63	ppbv
Naphthalene	TO-15	Air	52.0-158	25.0	0.63	ppbv
N-butyl benzene	TO-15	Air	70.0-130	25.0	0.2	ppbv
N-propyl benzene	TO-15	Air	70.0-130	25.0	0.2	ppbv
o-Xylene	TO-15	Air	70.0-130	25.0	0.2	ppbv
Propene	TO-15	Air	53.9-143	25.0	0.4	ppbv
Sec-butyl benzene	TO-15	Air	70.0-130	25.0	0.2	ppbv
Styrene	TO-15	Air	70.0-130	25.0	0.2	ppbv
t-Butyl Alcohol	TO-15	Air	70.0-130	25.0	0.2	ppbv
Tert-butyl benzene	TO-15	Air	70.0-130	25.0	0.2	ppbv
Tetrachloroethylene	TO-15	Air	70.0-130	25.0	0.2	ppbv
Tetrahydrofuran	TO-15	Air	65.0-140	25.0	0.2	ppbv
Toluene	TO-15	Air	70.0-130	25.0	0.2	ppbv
Trans-1,3-Dichloropropene	TO-15	Air	70.0-130	25.0	0.2	ppbv
Trans-1,2-Dichloroethene	TO-15	Air	70.0-130	25.0	0.2	ppbv
Trichloroethylene	TO-15	Air	70.0-130	25.0	0.2	ppbv
Vinyl Acetate	TO-15	Air	70.0-130	25.0	0.2	ppbv
Vinyl Bromide	TO-15	Air	70.0-130	25.0	0.2	ppbv
Vinyl Chloride	TO-15	Air	70.0-130	25.0	0.2	ppbv
1,1,1-Trichloroethane	TO-15SIM	Air	70.0-130	25.0	0.02	ppbv
1,1,2,2-Tetrachloroethane	TO-15SIM	Air	70.0-130	25.0	0.02	ppbv
1,1,2-Trichloroethane	TO-15SIM	Air	70.0-130	25.0	0.03	ppbv
1,1-Dichloroethane	TO-15SIM	Air	70.0-130	25.0	0.02	ppbv
1,1-Dichloroethene	TO-15SIM	Air	70.0-130	25.0	0.02	ppbv
1,2-Dibromoethane	TO-15SIM	Air	70.0-130	25.0	0.02	ppbv
1,2-Dichloropropane	TO-15SIM	Air	70.0-130	25.0	0.03	ppbv
1,4-Dichlorobenzene	TO-15SIM	Air	70.0-130	25.0	0.02	ppbv
Benzene	TO-15SIM	Air	70.0-130	25.0	0.02	ppbv
Carbon Tetrachloride	TO-15SIM	Air	70.0-130	25.0	0.02	ppbv
Chloroethane	TO-15SIM	Air	70.0-130	25.0	0.04	ppbv
Chloroform	TO-15SIM	Air	70.0-130	25.0	0.02	ppbv
Chloromethane	TO-15SIM	Air	70.0-130	25.0	0.03	ppbv

Table 12.3: QC Targets for Air Accuracy (LCS), Precision and RLs
This table is subject to revision without notice

Analyte	Method	Matrix	Accuracy (%)	Prec. (% RPD)	RL	Unit
Cis-1,2-Dichloroethene	TO-15SIM	Air	70.0-130	25.0	0.02	ppbv
Cis-1,3-Dichloropropene	TO-15SIM	Air	70.0-130	25.0	0.03	ppbv
Ethylbenzene	TO-15SIM	Air	70.0-130	25.0	0.03	ppbv
Tetrachloroethylene	TO-15SIM	Air	70.0-130	25.0	0.02	ppbv
Trans-1,3-Dichloropropene	TO-15SIM	Air	70.0-130	25.0	0.03	ppbv
Trans-1,2-Dichloroethene	TO-15SIM	Air	70.0-130	25.0	0.02	ppbv
Trichloroethylene	TO-15SIM	Air	70.0-130	25.0	0.02	ppbv
Vinyl Acetate	TO-15SIM	Air	70.0-130	25.0	0.02	ppbv
Vinyl Chloride	TO-15SIM	Air	70.0-130	25.0	0.02	ppbv
Methane	RSK-175	Air/ Headspace	85.0-115	20.0	0.01	ppmv
Ethane	RSK-175	Air/ Headspace	85.0-115	20.0	0.0129	ppbmv
Ethene	RSK-175	Air/ Headspace	85.0-115	20.0	0.0127	ppmv
Propane	RSK-175	Air/ Headspace	85.0-115	20.0	0.0186	ppmv
Acetylene	RSK-175	Air/ Headspace	85.0-115	20.0	0.0208	ppmv
Carbon Dioxide	ASTM D1946	Air	70.0-130	20.0	0.50 / 200	% / ppmv
Carbon Monoxide	ASTM D1946	Air	70.0-130	20.0	0.50 / 200	% / ppmv
Methane	ASTM D1946	Air	70.0-130	20.0	0.50 / 200	% / ppmv
Nitrogen	ASTM D1946	Air	70.0-130	20.0	0.50 / 200	% / ppmv
Oxygen	ASTM D1946	Air	70.0-130	20.0	0.50 / 200	% / ppmv
Helium	ASTM D1946	Air	70.0-130	25.0	100	ppmv
Methanol	MEETAC	Water/Soil	70.0-130	20.0	20.0/100	ppb / ppm
Ethanol	MEETAC	Water/Soil	70.0-130	20.0	20.0/100	ppb / ppm

13.0 CORRECTIVE ACTION

13.1 In the event that a nonconformance occurs in conjunction with the analytical batch, a corrective action response (CAR) form must be completed. The cause of the event is stated on the form and the measures taken to correct the nonconformance clearly defined. The effectiveness of the corrective action must be assessed and noted. The CARs are kept on file by the Regulatory Affairs Department. Corrective action procedures are documented in SOP #030208, *Corrective and Preventive Action*

13.2 Required Corrective Action

Control limits have been established for each type of analysis. When these limits are exceeded, corrective action must be taken. Calculated sample spike control limits are also used.

All samples and procedures are governed by ESC's quality assurance program. General corrective actions are as follows; however additional and more specific direction is provided in the specific determinative procedure. For more information, see the appropriate determinative SOP

13.2.1 Laboratory QC Criteria and Appropriate Corrective Actions

If the analytical method contains acceptance/rejection criteria and it is more stringent than those controls generated by the laboratory, the method criteria takes precedence.

13.2.2 Calibration Verification Criteria Are Not Met.

<u>Rejection Criteria</u> – See Table 8.5.

Corrective Action – Instrument settings are checked. The standard is reviewed for obvious cause. The standard may require re-analysis or the instrument may require recalibration.

13.2.3 Out Of Control Blanks:

<u>Rejection Criteria</u> - Blank reading is more than ½ the RL.

<u>Corrective Action</u> - Instrument settings are checked. The Blank is re-analyzed. If the blank is still out of control, bakeout of the system is performed and the blank is re-analyzed.

13.2.4 Out Of Control Laboratory Control Standards (LCS)

<u>Rejection Criteria</u> - If the performance is outside of lab-generated control (Listed in Table 12.3).

<u>Corrective Action</u> - Instrument settings are checked. The LCS standard is re-analyzed. If the LCS is still out of control, re-calibration is performed, and samples affected since the last in control reference standard are re-analyzed.

14.0 RECORD KEEPING

Record keeping is outlined in SOP #030230, *Standards Logger, SOP #030227, Data Review* and SOP #030201, *Data Handling and Reporting*

15.0 QUALITY AUDITS

System and data quality audits are outlined in the ESC Quality Assurance Manual Version 13.0 and in *SOP #010104, Internal Audits*.

16.0 REVISIONS

The Regulatory Affairs Department has an electronic version of this Quality Assurance Manual with tracked changes detailing all revisions made to the previous version. This version is available upon request. Revisions to the previous version of this appendix are summarized in the table below.

Document	**Revision**
Quality Assurance Manual Version 15.0 (Appendix VIII)	General – Replaced the term “client” with the term “customer” and added TO-15SIM Table 8.1 – Updated Equipment List Tables 8.3A and 8.3B – Updated standards Table 10.1 – Updated SOP List

1.0 SIGNATORY APPROVALS

Aquatic Toxicity Laboratory
QUALITY ASSURANCE MANUAL

APPENDIX IX TO THE ESC QUALITY ASSURANCE MANUAL

for

ESC LAB SCIENCES
12065 LEBANON ROAD
MT. JULIET, TENNESSEE 37122
(615) 758-5858

Prepared by

ESC LAB SCIENCES
12065 LEBANON ROAD
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NOTE: The QAM has been approved by the following people.

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C Fernandes Monteiro

Christabel Fernandes-Monteiro, PhD., Biology Department Manager, 615-773-9683

2.0 *APPENDIX TABLE OF CONTENTS*

3.0 SCOPE AND APPLICATION

This appendix discusses specific QA requirements for general analytical protocols to ensure that analytical data generated from the Aquatic Toxicity laboratory are scientifically valid and are of acceptable quality. Any deviations from these requirements and any deviations that result in non-conforming work must be immediately evaluated and their corrective actions documented.

4.0 LABORATORY ORGANIZATION AND RESPONSIBILITIES

ESC Lab Sciences offers diverse environmental capabilities that enable the laboratory to provide the customer with both routine and specialized services, field sampling guidance and materials and broad laboratory expertise. A brief outline of the organization and responsibilities as they apply to the ESC Quality Assurance Program is presented in *Section 4.0 in the ESC Quality Assurance Manual.*

5.0 PERSONNEL AND TRAINING

5.1 PERSONNEL

Dr. Christabel Fernandes-Monteiro, with a Ph.D. in Applied Biology, is the Department Manager of Biology. She oversees supervision of laboratory operations in the Mold, Aquatic Toxicity, Microbiology, Protozoan and BOD laboratories. Her responsibilities include assurance of reliable data through monitoring of quality control, corroborating the analysis performed, protocol development, coordination with customers regarding sample analysis, scheduling of tests and overall production in all sections within the Biology Laboratory, including management of staff. In her absence, Shain Schmitt assumes her responsibilities in the Aquatic Toxicity laboratory.

Shain Schmitt with a B.S. degree in Conservation Biology, is the Primary Analyst for the Aquatic Toxicity laboratory. Mr. Schmitt is proficient in aquatic toxicity analytical methods and is responsible for sample analysis, review and approval of data associated with toxicity analyses. His responsibilities also include the coordination with customers regarding sample analysis, scheduling, data reductions, interpretation and validation of toxicity testing. In his absence, Brandon Etheridge assumes his responsibilities.

5.2 TRAINING

All new analysts to the laboratory are trained by the Primary Analyst or Manager according to ESC protocol. ESC's training program is outlined in *SOP 350355 Technical Training and Personnel Qualification for Biology–Aquatic Toxicity.* Performance is documented using an initial demonstration of capability (IDOCs) and continuing demonstration of capability (CDOC). On-going acceptable capability in toxicity analysis is also demonstrated by acceptable participation in the Phenova proficiency testing program (PTs) as well as by performing routine reference toxicant testing at the same concentrations and in the same dilution water as is used for field sample testing. Documentation of analyst training is maintained on file within the department.

6.0 FACILITIES AND LABORATORY SAFETY

6.1 FACILITIES

The main area of the laboratory has approximately 1440 square feet of area with roughly 280 square feet of bench area. There are 300 square feet of additional storage and the lighting is fluorescence. The air system is a five-ton Trane split unit with natural gas for heating. The laboratory reagent water is provided through the Siemans Elga UltraPure deionizer system. Biohazard containers are located in the laboratory and Stericycle Waste Removal serves as ESC's biological waste disposal contractor. ESC's building information guides and site plan are shown in Appendix I.

6.2 LABORATORY SAFETY

- Laboratory access is limited when work is being performed.
- The following Biosafety Level 2 (BSL2) guidelines are adhered to:
  - Closed-toe shoes are worn in the laboratory
  - Floors and work surfaces are cleaned on a regular basis
  - Emergency numbers are posted in the laboratory
  - Laboratory personnel are trained in the use of the biological spill kit and emergency safety equipment
- ESC's laboratory safety guidelines are detailed in the ESC *Chemical Hygiene Plan*.

7.0 SAMPLING PROCEDURES

7.1 FIELD SAMPLING PROCEDURES, SAMPLE STORAGE, AND HANDLING

- Field Sampling procedures are described in Appendix III of this ESC Quality Assurance Manual. Sample information is recorded and kept on the ESC chain of custody and field logbooks.
- Samples are received in the laboratory login area and are tracked using LIMS (Laboratory Information Management System). A Chain of Custody Form accompanies all samples and can be viewed in LIMS. This is necessary to prove the traceability of the samples and to document the change in possession from sampling to delivery to receipt by the laboratory. Prior to analysis samples are checked for integrity. Once samples are checked to confirm integrity, the samples are logged with unique sample identification information and a label is affixed to each container. Chronic Toxicity samples are uniquely identified with "sample 1, sample 2 and sample 3". A sample custodian then transports samples to the laboratory. Sample handling and tracking procedures are outlined in *SOP 060105, Sample Receiving.*

- Samples for Chronic and Acute toxicity testing are collected in either 1 Gal HDPE or glass containers with no preservative and 125 ml HDPE without preservative for Alkalinity and with preservative for Hardness. Holding time is 36 hours between collection and first use of sample and last use of sample for renewal shall not exceed 72 hours without permission from permitting authority.
- Requirements for sample acceptance are located in *SOP 060105, Sample Receiving.* At a minimum, the following physical and chemical parameters are analyzed for each sample received:

    - Temperature
    - pH - initial and final measurements recorded
    - D.O. - initial and final measurements recorded
    - Specific Conductance
    - Alkalinity
    - Hardness
    - Total Residual Chlorine
- Samples must be immediately cooled and maintained at 0-6°C following sampling, during shipment and prior to testing.

Residual Chlorine Treatment

- Residual chlorine in biomonitoring samples is monitored using a pocket colorimeter and these checks are documented. Chlorine removal is not performed on submitted field samples.

Dissolved Oxygen

For acute tests, samples that are $\leq$ 4.0mg/L are aerated until the sample reaches 90% saturation. For chronic tests, samples that are $\leq$ 5.0 mg/L are aerated until the sample reaches 90% saturation.

8.0 EQUIPMENT

8.1 EQUIPMENT LIST

TABLE 8.1 – LABORATORY EQUIPMENT LIST: MAJOR ITEMS – Aquatic Toxicity Lab
This table is subject to revision without notice.

Item	*Manufacturer*	*Model*	*Location*
Analytical Balance	Mettler	AT261 Delta Range	Aquatic Tox Lab
Class “I” weights (2)	Troemner		Aquatic Tox Lab
Conductivity Meter	Orion	150 A+	Aquatic Tox Lab
Dissolved Oxygen Meter	YSI	Model 50	Aquatic Tox Lab
Stereoscope	Olympus	SZX-IllK100	Aquatic Tox Lab
Oven (1)	Fisher	655F	Aquatic Tox Lab
Incubator	Thermo-Kool	Environmental chamber	Aquatic Tox Lab

TABLE 8.1 – LABORATORY EQUIPMENT LIST: MAJOR ITEMS – Aquatic Toxicity Lab
This table is subject to revision without notice.

Item	*Manufacturer*	*Model*	*Location*
Incubator	Percival Scientific	1-37 VL	Aquatic Tox Lab
Incubator	Precision Sci.	818	Aquatic Tox Lab
Incubator (2)	Precision Sci.	818	Aquatic Tox Lab
Incubator (3)	VWR	2030-ZZMFG	Aquatic Tox Lab
Microscope	Olympus	CHT	Aquatic Tox Lab
pH Meter	Orion	VersaStar	Aquatic Tox Lab
Refrigerator (2)	Beverage Air	E Series	Aquatic Tox Lab
Stereoscope	Olympus	SZH-ILLD	Aquatic Tox Lab
Stereoscope	Olympus	SZH-ILLD	Aquatic Tox Lab
Refrigerator	Frigidaire	FRC445GB	Aquatic Tox Lab
Refrigerator	True	T-49	Aquatic Tox Lab
Water Purifier	Siemans	Elga LabPure S4	Aquatic Tox Lab
Refrigerator	Fridgidaire	FRC 445GB	Aquatic Tox Lab
pH/Conductivity Benchtop meter	Thermo Scientific Orion	VSTAR 52	Aquatic Tox Lab
RDO Probe	Thermo Scientific Orion	VSTAR-RD	Aquatic Tox Lab
Oven (2)	Thermoscientific	Heratherm OGS400	Aquatic Tox Lab
Stereoscope	Olympus	SZH-STS	Aquatic Tox Lab
Freezer	Kenmore	198.813.582	Aquatic Tox Lab

8.2 EQUIPMENT PREVENTIVE MAINTENANCE, EQUIPMENT CALIBRATION

PREVENTATIVE MAINTENANCE FOR LABORATORY EQUIPMENT

INSTRUMENT	*P. M. DESCRIPTION*	*FREQUENCY*
Analytical Balances	•Check with Class "I" weights	Daily-tolerance 1 gm - ±0.0001 gm
Analytical Balances	•Service/Calibration (semiannual contract maintenance and calibration check)	10 gm - ±0.01 gm
Analytical Balances	•Service/Calibration (semiannual contract maintenance and calibration check)	Semi-annually
Refrigerators & Incubators	•Maintenance service	As needed - determined by twice daily temperature performance checks @ least 4 hours apart
Dissolved oxygen meter	•Calibrate with each use	Daily
Dissolved oxygen meter	•Change probe membrane	Every two to four weeks when in use
Conductivity Meter	•Check probe cables	As needed
Conductivity Meter	•Clean probe	As needed
Conductivity Meter	•Replace or replatinize probe	Poor response not corrected by above
Conductivity Meter	•Calibrate with each use	Daily (or prior to each use)
Microscope/Stereoscope	•Service/calibration of each ocular micrometer	Annually

PREVENTATIVE MAINTENANCE FOR LABORATORY EQUIPMENT		
INSTRUMENT	***P. M. DESCRIPTION***	***FREQUENCY***
Microscope/Stereoscope	• Clean optics and stage	As needed
pH Meters	•Reference junction & electrode replacement	As needed
pH Meters	•Probe stored in pH standard 4	At all times when not in use
pH Meters	•Other	As described in the manufacturer's manual
pH Meters	•Calibrate with each use	Daily (or prior to each use)
pH meter	•ATC checks	Quarterly
Bottle top dispenser/repipettor	•Calibrate	Quarterly
Bottle top dispenser/repipettor	•Clean to prevent residue buildup	As needed
Water Purifier	Tank Exchange, UV bulb and sleeve replacement (service contract maintenance and check	As needed and annually
Water Purifier	•Replace cartridge and filter	As needed and semi-annual
RDO probe	•Replace sensor cap	Annually
RDO probe	•Clean sensor cap	As needed
RDO probe	•Other	As described in manufacturer’s manual
pH/Conductivity/DO meter	•Calibrate with each use	Daily
Light Meter	•Calibrate	Annually

8.3 STANDARDS , REAGENTS AND ORGANISM CULTURES

All reagents and standards must meet the requirements listed in the analytical methods.

Table 8.3A: Stock solution sources, description and related information.
(subject to revision as needed)

Description	Vendor	Storage Req.	Expiration
Conductivity standard 1413	NSI	Ambient	1 yr
pH buffer 4	-VWR	Ambient	1 yr
pH buffer 7	-VWR	Ambient	1 yr
pH buffer 10	-VWR	Ambient	1 yr
Bromothymol blue solution	-VWR	Ambient	1 yr
Potassium phosphate monobasic	-VWR	Ambient	1 yr
Magnesium chloride	-VWR	Ambient in dessicator	1 yr
Potassium Chloride	-VWR	Ambient in dessicator	1 yr
Brine shrimp eggs	Brine Shrimp Direct (BSD)	Ambient, tightly sealed.	1 yr
Calcium sulfate	-VWR	Ambient in dessicator	1 yr
EDTA	-VWR	Ambient in dessicator	1 yr
Sodium thiosulfate	-VWR	Ambient in dessicator	1 yr
pH buffer 4	-VWR	Ambient.	1 yr
YCT	Made in-house	-10 to -20^{o}C	14 days after thawing
Raphidocelis subcapitata	Aq. Biosystems	1-6^{o}C	One month from concentration date

Table 8.3A: Stock solution sources, description and related information.
(subject to revision as needed)

Description	Vendor	Storage Req.	Expiration
Vitamin B12	ICN	1-6°C	NA

TABLE 8.3B: Working Solution Descriptions and Related Information.
(subject to change)

Solution	Concentrations	Storage Requirements	Expiration
KCl stock solution	31.237g KCl to 2L of mod. Hard SDW	1-4°C	14 days
B12 Solution	0.01125g to 1L of DI Water	1-4°C	NA

Source and Maintenance of in-house cultures:

Source of Biological Organisms (*subject to change*):
The primary source for all fathead minnows is:

Aquatic Biosystems Inc.
2821 Remington Street
Fort Collins, CO 80525

The source for their organisms is documented on each packing slip received. ESC accepts the packing slip as documentation and verification by the supplier with regard to the taxonomic identification of the bioassay species. The packing slips for bioassay test organisms are kept on file.

The amount of food added to culture vessels depends upon the number of organisms within a given culture. As standard procedure, *Ceriodaphnia dubia* batch cultures are fed 4.5mL of Yeast Cereal leaves, Tout chow (YCT) and *Raphidocelis subcapitata* algal suspension on the day of initiation. Batches are fed as needed. The date, time and the amount the organisms are fed is documented. All yeast purchased is at least food grade and has passed FDA standards. All (YCT) Yeast Trout Chow is made in-house. New lots are tested for pesticides, metals, and PCBs.

Ceriodaphnia dubia, fresh batch cultures are set up on Monday, Wednesday and Friday using newly hatched neonates less than 24 hours old. In addition, a minimum of 4 brood trays are set up daily in order to guarantee organisms of the right age to use in bioassay tests. The *C. dubia* brood trays are fed daily. The *C. dubia* are transferred into fresh water daily after their first brood of neonates is born. Third generation neonates, less than 24 hours old, are used for batch cultures and brood trays. Third generation neonates, less than 24 hours old and hatched within 8 hours of each other, are used for chronic tests. Adults are used as sources for neonates until 14 days of age.

C. dubia are taxonomically identified to species on a quarterly basis. All taxonomy information is documented and kept on file for a year.

Pimephales promelas batch cultures are cleaned as needed by siphoning off the excess food and waste from the bottom of the culture vessel and renewing the water. Cultures are aerated as needed to maintain adequate dissolved oxygen.

Pimephales promelas are taxonomically identified to species on a quarterly basis. All taxonomy information is documented and kept on file for a year.

The water used for culturing is moderately hard synthetic dilution water (SDW) and is prepared by diluting 1L synthetic freshwater concentrate to 20 L ultra-pure deionized water, and vigorously aerating for a minimum of 1 hour. The physical and chemical parameters for each new tank of water prepared are recorded and should fall within the following acceptable range:

1. pH – 7.5- 8.5 units
2. D.O. - greater than 80% saturation in mg/L
3. Specific Conductance - ~250 micromhos/cm
4. Alkalinity - 57-64 mg $CaCO_3$/L
5. Hardness - 80 to 100 mg $CaCO_3$/L
6. Total Residual Chlorine - <0.1 mg/L

8.4 INSTRUMENT CALIBRATION

Lighting

All testing and culturing is maintained in incubators in which temperature is constant and the photoperiod is on a 16-hour light/8-hour dark cycle. The photoperiod is verified and documented quarterly. The light intensity must be within 50 – 100 foot candles (approximately 10-20*u*E/m_2/s) and is verified and documented quarterly. All incubators are monitored at least weekly for proper light intensity.

pH Meter

The pH meters are calibrated with each use according to manufacturer's instructions. The slope is documented on a daily basis. Ensure the acceptable pH slope range is within the manufacturer's acceptable range prior to use. Perform automatic temperature compensation (ATC) checks quarterly on the pH probe. All calibration information is documented.

Volumetric Equipment

Equipment such as filter funnels, bottles, pipettes, non-Class A and other containers with graduations are calibrated once per lot prior to first use. The error of calibration must not exceed 3.0%.

Analytical Balance

Analytical balances are checked and calibrated semi-annually by a certified technician. Calibration is checked before each use with Class I weights. Class I weights are calibrated annually.

Stereoscope

Maintenance is performed by a trained technician on an annual basis.

Conductivity Meter

The conductivity meter is calibrated with each use according to manufacturer's instructions.

Dissolved Oxygen Meter

The DO meter is calibrated according to manufacturer's instructions with each use. The electrochemical probe membrane is changed every two to four weeks to maintain accurate readings when in use. The RDO probe sensor cap is cleaned regularly, and replaced once per year. The RDO probe sensor cap must be stored in a moist environment.

Test Chambers

Each test chamber is rinsed with DI water prior to introducing the test organisms.

Bottle Top Dispenser/Repipettor

Repipettors are calibrated quarterly to ensure the instrument is dispensing the correct amount. Periodic cleaning is performed to maintain the accuracy and to prevent buildup of residue.

Colorimeter Chlorine tester

The colorimeter is calibrated before each use using standards to verify accuracy.

Light Meter

Calibrate the light meter annually to ensure it meets original performance specifications or purchase new calibrated meter as needed.

9.0 LABORATORY PRACTICES

9.1 REAGENT GRADE WATER

Deionized water or reverse-osmosis produces water free from bactericidal and inhibitory substances and is used in the preparation of media, solutions and buffers. The quality of the water is monitored for chlorine residual, specific conductance, and heterotrophic bacteria plate count monthly (when in use), when maintenance is performed on the water treatment system, or at startup after a period of disuse longer than one month.

Analysis for metals and organic contaminants is performed quarterly and the Bacteriological Water Quality Test (to determine presence of toxic agents or growth promoting substances) is performed annually. Results of these analyses meet the specifications of the required method and records of analyses are maintained for five years. (An exception to performing the Bacteriological Water Quality Test can be given to laboratories that can supply documentation to show that their water source meets the criteria, as specified by the method, for Type I or Type II reagent water.)

9.2 PH BUFFERS/CONDUCTIVITY STANDARDS

pH buffer and conductivity standard aliquots are used only once. Reagents containers are dated upon receipt and the date opened.

9.3 SECONDARY STANDARDS

Standards are used for retrieval and verification of the factory calibrated colorimeter and are used to verify consistent instrument calibration.

9.4 LABORATORY CONTROL WATER

Control water (moderately hard synthetic dilution water- SDW) is prepared by diluting 1L of synthetic freshwater concentrate to 20L deionized water and aerating for a minimum of 1 hour. The physical and chemical parameters for each new tank of water prepared are recorded and should fall within the following acceptable range:

1. pH – 7.5-8.5 units
2. D.O. - greater than 80% saturation in mg/L
3. Specific Conductance - ~250 micromhos/cm
4. Alkalinity - 57 to 64 mg $CaCO_3$/L
5. Hardness - 80 to 100 mg $CaCO_3$/L
6. Total Residual Chlorine - <0.1 mg/L

Control water (10% dilute mineral water-DMW) is prepared by diluting approximately 2 Liters of Perrier to the 20 Liters mark of a 20 L NALGENE® carboy with ultra-pure deionized water and aerating for a minimum of 1 hour. The physical and chemical parameters for each new tank of water prepared are recorded and should fall within the following acceptable range:

1. pH – 6.5 to 8.5 units
2. D.O. - greater than 80% saturation in mg/L
3. Specific Conductance - ~95 micromhos/cm
4. Alkalinity - 60 to 70mg $CaCO_3$/L
5. Hardness - 30 to 50mg $CaCO_3$/L
6. Total Residual Chlorine - <0.1mg/L

A given batch of control water is not used for more than 14 days following preparation.

9.5 BRINE SHRIMP

Artemia cysts are certified brine shrimp eggs from Brine Shrimp Direct To determine the quality of the new lots of Brine shrimp, a side-by-side comparison test is performed using the new food and the food of known acceptable quality.

9.6 YCT

YCT-Yeast Cereal leaves and Trout chow is prepared in the laboratory. To determine the quality of the new lots of YCT a side-by-side comparison test is performed using the new food and the food of known acceptable quality.

9.7 ALGAE

Algae- *Raphidocelis subcapitata* are commercially prepared. Upon arrival, each batch received has an accompanying Certificate of Algae Preparation History. The certificate provides the following quality control data: date prepared, species name, inoculation date, harvest date, concentration date and cell count.

9.8 GLASSWARE WASHING, STERILIZATION PROCEDURES AND EQUIPMENT STERILITY CHECKS

Glassware washing and preparation/sterilization procedures are performed according to EPA guidelines and are outlined in *SOP 030701 Glassware Cleaning* and *SOP 350335, Quality Control and Quality Assurance of Microbiological Equipment and Testing Materials.* Before use, examine and discard items with chipped edges or etched inner surfaces. Reusable glassware is cleaned using the following protocol:

- Soak for 15 minutes in hot tap water with detergent and scrub. Rinse thoroughly with tap water. Rinse thoroughly with dilute nitric acid (10%). Rinse thoroughly with deionized water. Rinse thoroughly with pesticide grade acetone. Rinse well with deionized water.

- New glassware is cleaned according to the same procedure as listed above except the first step is preceded by soaking overnight in 10 % HNO_3.

Inspect glassware after washing for excessive water beading and rewash, if necessary. Perform checks on pH and test for inhibitory residues on glassware and plastic ware. Use utensils and containers of borosilicate glass, stainless steel, aluminum, or other corrosion resistant material for media preparation. All biological glassware is purchased pre-sterilized. In-house sterilization of any auxiliary equipment is performed via autoclave.

Pipettes of all sizes are checked for sterility by drawing up non-selective media into the pipette and re-dispensing the volume back into original tube that contained the media. The tube is then incubated and monitored for growth. All results are recorded and maintained within the laboratory.

10.0 ANALYTICAL PROCEDURES

10.1 A list of laboratory SOPs associated with the Aquatic Toxicity laboratory can be found in the following table:

TABLE 10.1: AQUATIC TOXICITY DEPARTMENT SOPs

This Table is subject to revision without notice

SOP #	Title/Description
340312	Dissolved Oxygen Membrane Electrode Method
350301	Fathead Minnow, *Pimephales promelas*, Larval Survival and Growth Test, EPA Method 1000.0
350302	Cladoceran, *Ceriodaphnia dubia*, Chronic Survival and Reproduction Test, EPA Method 1002.0
350303	*Pimephales promelas* Acute Toxicity Testing, EPA Method 2000.0
350303NC	North Carolina *Pimephales promelas* Acute Toxicity Testing
350304	*Ceriodaphnia dubia* Acute Toxicity Testing EPA Method 2002.0
350304NC	North Carolina *Ceriodaphnia dubia* Acute Toxicity Testing
350317	WET Reference toxicant testing
350318	Mini Chronic *C. dubia* NC
350320	Acceptability Test for New Food Batches for WET Testing
350321	Pocket Colorimeter Chlorine Tester Maintenance and Calibration
350322	DO Meter Maintenance and Calibration
350323	Fluke Thermometer Operation and Maintenance
350324	Digital Light Meter Maintenance and Method of Operation
350325	pH Meter Maintenance and Calibration
350326	Thermometer Operation, Maintenance and Calibration Procedure
350327	Bottle Top Dispenser Maintenance and Method of Operation
350328	Conductivity Meter Maintenance and Calibration
350329	Taxonomic Verification/Identification of *Pimephales promelas* - Fathead Minnow
350330	Taxonomic Verification/Identification of *Ceriodaphnia dubia*
350345	Receipt and Maintenance of *Pimephalas Promelas* (Fathead Minnow)
350346	Ceriodaphnia Dubia Culture Maintenance, Food Preparation, and Food Maintenance
350355	Technical Training and Personnel Qualifications for Biomonitoring-Aquatic

SOP #	Title/Description
	Toxicity, Mold and Microbiology
350356	Water Bath and Incubator Temperature Stability and Load Testing
350362	Analytical Balance Operation and Verification in the Aquatic Toxicity Microbiology Lab
350364	North Carolina Phase II Chronic Whole Effluent Toxicity Test Procedure for Ceriodaphnia dubia

10.2 Additional information regarding Aquatic Toxicity testing can be found in:

Method Resources: EPA/821/R-02/013, EPA/821/R-02/012

- 7-Day Fathead Minnow (*Pimephales promelas*) Larval Survival and Growth Test; Test Method 1000.0 from "Short Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms" (EPA 821-R-02-013).
- 3-Brood *Ceriodaphnia dubia* Survival and Reproduction Test; Test Method 1002.0 from "Short Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms" (EPA 821-R-02-013).
- Fathead Minnow (*Pimephales promelas*) Acute Toxicity Test (24, 48 or 96 hour duration); referenced in "Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms" (EPA 821-R-02-012, 10-02).
- *Ceriodaphnia dubia* Acute Toxicity Test (24, 48 or 96 hour duration); referenced in “Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms” (EPA 821-R-02-012, 10-02)

11.0 QUALITY CONTROL CHECKS

11.1 At a minimum, the following physical and chemical parameters are analyzed for each biomonitoring sample received:

- Temperature - recorded up to twice daily.
- pH - initial and final measurements recorded
- D.O. - initial and final measurements recorded
- Specific Conductance
- Alkalinity
- Hardness
- Total Residual Chlorine

11.2 FEEDING REGIME

- 7-Day Fathead Minnow Larval Survival and Growth Test - Test organisms are fed 0.15mL, per container of 10 organisms. Newly hatched brine shrimp (*Artemia*) are fed to minnow batches 2-3 times daily. Batch cultures are fed depending on organism density.

- 3-Brood *Ceriodaphnia dubia* Survival and Reproduction Test - test organisms are fed 0.15mL of Yeast, Cereal leaves, Trout chow (YCT) and 0.15mL *Raphidocelis subcapitata* algal suspension once daily.
- 24 and 48 Hour Acute Toxicity Tests - organisms are fed 2-5 hours prior to introduction into sample but are not fed for the duration of the test.
- 96-Hour Acute Toxicity Tests – organisms are fed at the 48 hour renewal period.
- 3-Brood *Ceriodaphnia dubia* Survival and Reproduction Test for North Carolina - test organisms are fed .05mL of YCT/15mL test solution and .05 Raphidocelis subcapitata algal concentrate once daily (1.7x10 to the 7th power cells/mL).

11.3 BATCH CULTURES

Batch cultures are identified by date set up or date received. The set-up date is recorded for each batch.

Ceriodaphnia dubia, fresh batch cultures are set up on Monday, Wednesday and Friday using newly hatched neonates less than 24 hours old. In addition, a minimum of 4 brood trays are set up daily in order to guarantee organisms of the right age to use in bioassays. Condition of cultures is monitored daily and documented in the daily log. The *C. dubia* brood trays are fed daily. The *C. dubia* are transferred into fresh water daily after their first brood of neonates is born. Third generation neonates, less than 24 hours old, are used for batch cultures and brood trays. Third generation neonates, less than 24 hours old and hatched within 8 hours of each other, are used for chronic tests. Adults are used as sources for neonates until 14 days of age.

Pimephales promelas, organisms less than 36 hours old are obtained from a commercial supplier and are used immediately for chronic bioassays. Upon receipt, temperature, conductivity, pH, alkalinity and hardness are recorded and the organisms are slowly acclimated to a temperature of 25°C. If more than 10% mortality has occurred in the batch shipment, the batch is rejected and supplier is contacted. The date of the batch culture is recorded and batches are maintained for 14 days after receipt to use in acute tests. Batch cultures are monitored and fed daily. The number of organisms used is recorded in the daily log. Lots are cleaned as needed by siphoning off the excess food and waste from the bottom of the vessel and renewing the water. Minnow lots are aerated to maintain adequate dissolved oxygen. *Pimephales promelas* lots are fed 2.5 mL of newly-hatched brine shrimp per batch, 2-3 times daily. The date, time and the amount the organisms are fed are documented.

11.4 REFERENCE TOXICANT

The reference toxicant used at ESC is potassium chloride. Acute and chronic reference toxicant tests are performed at a minimum of once monthly and upper and lower control limits have been established.

12.0 DATA REDUCTION, VALIDATION AND REPORTING

12.1 DATA REDUCTION

The analyst performs the data calculation functions and is responsible for the initial examination of the finished data. Data reduction steps applied to the raw data are outlined in *SOP 030201 Data Handling and Reporting.* The primary analyst reviews the quality of data based on the following guidelines:

- The appropriate SOP has been followed
- Sample preparation is correct and complete
- Analytical results are correct and complete
- QC is within criteria and complete

All calculations are performed according to the EPA methods manual. When applicable, software is used to perform statistical analysis. All formulae are chosen appropriately depending on the conditions and outcome of each individual test. Due to the complexity of each formula please see EPA/821/R-02/013 for formulae pertaining to Chronic Toxicity tests and EPA/821/R-02/012 for formulae pertaining to Acute Toxicity tests.

TABLE 12.1 Data Reduction Formulas

PARAMETER	FORMULA
IC25, NOEC, LC50, AEC	Toxcalc 5.0 Software

For chronic tests the PMSD and the % CV is calculated and reported.

12.2 VALIDATION

The validation process consists of data generation, reduction review, and reporting results. Once data reduction is complete, validation is conducted by reviewing all data entries and calculations for errors, reviewing all documentation to assure that sample information is correct, and that the tests have been performed appropriately and within the appropriate holding times. The secondary analyst reviews the quality of data based on the following guidelines:

- The appropriate SOP has been followed
- Sample preparation is correct and complete
- Analytical results are correct and complete

12.3 REPORTING

Reporting procedures are documented in *SOP 030201 Data Handling and Reporting* and *SOP 030227, Data Review.*

13.0 CORRECTIVE ACTION

13.1 In the event that a nonconformance occurs in conjunction with the analytical batch, a corrective action response (CAR) form must be completed. The cause of the event is stated on the form and the measures taken to correct the nonconformance clearly defined. The effectiveness of the corrective action must be assessed and noted. The CARs are kept on file by the Regulatory Affairs Department. Corrective action procedures are documented in SOP #030208, *Corrective and Preventive Action*

13.2 Required Corrective Action

All samples and procedures are governed by ESC's quality assurance program. Designated corrective actions are as follows:

13.2.1 Laboratory QC Criteria and Appropriate Corrective Actions

If the analytical method contains acceptance/rejection criteria and it is more stringent than those controls generated by the laboratory the method criteria takes precedence.

13.2.2 Out of control acute toxicity tests.

Rejection Criteria –More than 10% mortality occurs in the control organisms within the specified time frame of the test.

Corrective Action – The test is considered invalid and must be repeated using fresh control water and fresh sample.

13.2.3 Out of control 3-Brood *Ceriodaphnia dubia* Survival and Reproduction Test.

Rejection Criteria – If more than 10% mortality occurs in the control organisms within 96 hours or more than 20% mortality occurs in the test organisms in the 3-brood period (approx. 7 days)

Corrective Action – The test is considered invalid and must be repeated using fresh control water and fresh sample.

13.2.4 Out of control 3-Brood *Ceriodaphnia dubia* Survival and Reproduction Test.

Rejection Criteria – If the average number of young produced in the control is less than 15 per organism

Corrective Action – The test is considered invalid and must be repeated using fresh control water and fresh sample.

13.2.5 Out of control 3-Brood *Ceriodaphnia dubia* Survival and Reproduction Test.

<u>Rejection Criteria</u> – A test is considered invalid if less than 60% (80% for NC tests) of the original number of adult daphnia loaded do not produce three broods within an eight day maximum (7 day maximum for NC tests).

<u>Corrective Action</u> – The test is considered invalid and must be repeated using fresh control water and fresh sample.

13.2.6 Out of control 7-Day *Pimephales promelas* Larval Survival and Growth Test.

<u>Rejection Criteria</u> – If more than 10% mortality occurs in the control organisms within 96 hours or more than 20% mortality occurs in the test organisms in 7 day period.

<u>Corrective Action</u> – The test is considered invalid and must be repeated using fresh control water and fresh sample.

13.2.7 Out of control 7-Day *Pimephales promelas* Larval Survival and Growth Test.

<u>Rejection Criteria</u> – The average weight of the control minnows is less than 0.2500 mg.

<u>Corrective Action</u> – The test is considered invalid and must be repeated using fresh control water and fresh sample.

13.2.8 Out of control Monthly Reference Toxicant:

<u>Rejection Criteria</u> – KCl is the reference toxicant used for acute and chronic testing for the following methods: 1000.0, 1002.0, 2000.0, and 2002.0. If reference toxicant test results fail to meet ESC in-house established criteria (± 2 standard deviations from the mean & median).

<u>Corrective Action</u> – The test is deemed invalid and must be repeated twice. No test will be performed using organisms that fail to meet reference toxicant criteria.

13.2.9 Out of control PMSD 7-Day *Pimephales promelas* Larval Survival and Growth Test.

<u>Rejection Criteria</u> – The PMSD value is greater than the upper value of 30.

<u>Corrective Action</u> - The test may be deemed invalid and should be repeated.

13.2.10 Out of control PMSD 3-Brood *Ceriodaphnia dubia* Survival and Reproduction Test.

<u>Rejection Criteria</u> – The PMSD value is greater than the upper value of 47.

<u>Corrective Action</u> - The test may be deemed invalid and should be repeated.

13.2.11 Out of control %CV 3-Brood *Ceriodaphnia dubia* Survival and Reproduction Test and 7-Day *Pimephales promelas* Larval Survival and Growth Test.

Rejection Criteria – The %CV value is greater than the upper value of 40%.

Corrective Action - The test is deemed invalid and must be repeated.

14.0 RECORD KEEPING

Record keeping is outlined in SOP #030230, *Standards Logger*, *SOP #030227, Data Review* and SOP #030201, *Data Handling and Reporting*

15.0 QUALITY AUDITS

System and data quality audits are outlined in the ESC Quality Assurance Manual Version 13.0 and *SOP #010104, Internal Audits*.

16.0 REVISIONS

The Regulatory Affairs Department has an electronic version of this Quality Assurance Manual with tracked changes detailing all revisions made to the previous version. This version is available upon request. Revisions to the previous version of this appendix are summarized in the table below.

Document	**Revision**
Quality Assurance Manual Version 15.0 (Appendix IX)	General – Replaced the term “client” with the term “customer” Section 7.1 – Added third bullet point about containers used for collection and holding time of Acute and Chronic tests Table 8.1 – Updated equipment list Table 8.2 – Revised ATC check for pH meter to quarterly Table 8.3A – Added pH=4 buffer Section 8.3 – Minor clarifications about maintenance of in-house cultures Section 8.4 – Revised ATC check for pH meter to quarterly and added language about purchasing a new light meter rather than recalibrating an old one. Section 11.2 – Changed algal species used for 3-Brood Ceriodaphnia dubia Survival and Reproduction Test from Selanastrum capricornutum to Raphidocelis subcapitata

1.0 SIGNATORY APPROVALS

Microbiology Laboratory
QUALITY ASSURANCE MANUAL

APPENDIX X TO THE ESC QUALITY ASSURANCE MANUAL

for

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2.0 APPENDIX TABLE OF CONTENTS

3.0 SCOPE AND APPLICATION

This appendix discusses specific QA requirements for general analytical protocols to ensure that analytical data generated from the Microbiology laboratory are scientifically valid and are of acceptable quality. Any deviations from these requirements and any deviations that result in non-conforming work must be immediately evaluated and their corrective actions documented.

4.0 LABORATORY ORGANIZATION AND RESPONSIBILITIES

ESC Lab Sciences offers diverse environmental capabilities that enable the laboratory to provide the customer with both routine and specialized services, field sampling guidance and materials and broad laboratory expertise. A brief outline of the organization and responsibilities as they apply to the ESC Quality Assurance Program is presented in *Section 4.0 in the ESC Quality Assurance Manual.*

5.0 PERSONNEL AND TRAINING

5.1 PERSONNEL

Dr. Christabel Fernandes-Monteiro, with a Ph.D. in Applied Biology, is the Department Manager of Biology. She oversees supervision of laboratory operations in the Mold, Aquatic Toxicity, Microbiology, Protozoan and BOD laboratories. Her responsibilities include assurance of reliable data through monitoring of quality control, corroborating the analysis performed, protocol development, coordination with customers regarding sample analysis, scheduling of tests and overall production in all sections within the Biology Laboratory, including management of staff. In her absence, Shain Schmitt assumes her responsibilities in the Microbiology laboratory.

Shain Schmitt with a B.S. degree in Conservation Biology, is the Primary Analyst for the Microbiology laboratory. Mr. Schmitt is proficient in microbiological analytical methods and is responsible for sample analysis, review and approval of data associated with microbiological analyses. In his absence, Brandon Etheridge assumes his responsibilities.

5.2 TRAINING

The Primary Analyst or Manager trains new laboratory analysts according to ESC protocol. ESC's training program is outlined in SOP #350355, *Technical Training and Personnel Qualification for Biomonitoring-Microbiology.* Performance is documented using an initial demonstration of capability (IDOCs) and continuing demonstration of capability (CDOC). On-going acceptable capability in microbiological analysis is also demonstrated by acceptable participation in the Phenova proficiency testing program (PTs) and routine laboratory quality control practices. Documentation of analyst training is maintained on file within the department.

6.0 FACILITIES AND LABORATORY SAFETY

6.1 FACILITIES

The main area of the laboratory has approximately 1440 square feet of area with roughly 280 square feet of bench area. There are 300 square feet of additional storage and the lighting is fluorescence. The air system is a five-ton Trane split unit with natural gas for heating. The laboratory reagent water is provided through the Siemans Elga Lab Pure deionizer system. Biohazard containers are located in the laboratory and Stericycle Waste Removal serves as ESC's biological waste disposal contractor. ESC's building information guides and site plan are shown in Appendix I.

6.2 LABORATORY SAFETY

- Laboratory access is limited when work is being performed.
- The following Biosafety Level 2 (BSL2) guidelines are adhered to:
    - ➢ Closed-toe shoes are worn in the laboratory
    - ➢ Floors and work surfaces are cleaned on a regular basis
    - ➢ Emergency numbers are posted in the laboratory
    - ➢ Laboratory personnel are trained in the use of the biological spill kit and emergency safety equipment
- ESC's laboratory safety guidelines are detailed in the ESC *Chemical Hygiene Plan*.

7.0 SAMPLING PROCEDURES

7.1 FIELD SAMPLING PROCEDURES, SAMPLE STORAGE, AND HANDLING

- Field Sampling procedures are described in Appendix III of this ESC Quality Assurance Manual. Sample information is recorded and kept on the ESC chain of custody and field logbooks.
- Samples for bacterial analysis are collected directly into pre-sterilized high-density polyethylene (HDPE) sample containers preserved with sodium thiosulfate. The container should be kept closed until sample collection. Once the container is open, do not wash, rinse or contaminate the cap or the inside of the container. For microbiological samples, the container is filled allowing at least 1 inch of headspace per container.
- Sources for microbiological samples are surface waters, waste and drinking water, ground water and soil/sludge.
- Holding times for microbiological drinking water samples is generally 30 hours (except HPC which has a 8 hour holding time). Soil and sludge samples have a holding time of 24 hour and 8 hours depending on the method used. All other water samples have a 8-hour hold time.

- Microbiological samples are shipped in a cooler lined with a heavy-duty plastic bag. Once the sample container lids are secure, the samples are placed in appropriately sized polyethylene bags. The chain of custody is also placed in a plastic bag. The cooler liner is completely filled with ice and the plastic bag sealed tightly with a cable tie. The shipping label contains the name and address of the shipper and is affixed to the outside of the cooler.
- Samples are received in the laboratory login area and are tracked using LIMS (Laboratory Information Management System). A Chain of Custody Form accompanies all samples received by the lab. This is necessary to prove the traceability of the samples and to document the change in possession from sampling to delivery to receipt by the laboratory. Prior to analysis samples are checked for integrity. Sample handling, tracking and acceptance procedures are outlined in *SOP 060105, Sample Receiving.*

8.0 EQUIPMENT

8.1 EQUIPMENT LIST

TABLE 8.1 – LABORATORY EQUIPMENT LIST: MAJOR ITEMS - Microbiological Analysis
This table is subject to revision without notice

Item	***Manufacturer***	***Model***	***Location***
Analytical Balance	Mettler	AT261 Delta Range	Microbiology Lab
Class “I” weights	(2 sets) Troemner		Microbiology Lab
Conductivity Meter	Orion	150 A+	Microbiology Lab
Autoclave	Pelton and Crane	Validator 8	Microbiology Lab
Water Bath	Lindberg Blue	WB1130A	Microbiology Lab
Water Bath	Blue M	MW-1110A-1	Microbiology Lab
Oven	Fisher	655F	Microbiology Lab
Incubator	VWR	2030 22MFG	Microbiology Lab
Quantitray Sealer	IDEXX	2X	Microbiology Lab
Incubator	Precision Sci.	818	Microbiology Lab
Colony Counter	Quebecor		Microbiology Lab
pH Meter	Beckman	pH/Temp/mV/ISE	Microbiology Lab
Refrigerator			Microbiology Lab
Stereoscope (2)	Olympus	SZH-ILLD	Microbiology Lab
UV light; short and long wave	UVP		Microbiology Lab
Autoclave	SterileMax	Harvey	Microbiology Lab
Stereoscope	Olympus	SZX-ILLK100	Microbiology Lab
Water Purifier	Siemans	Elga Lab Pure S4	Microbiology Lab
Oven	VWR	13054	Microbiology Lab
pH meter/Conductivity meter	Thermo Scientific Orion	VStar 52	Aquatic Tox Lab

8.2 EQUIPMENT PREVENTIVE MAINTENANCE, EQUIPMENT CALIBRATION

PREVENTATIVE MAINTENANCE FOR LABORATORY EQUIPMENT		
INSTRUMENT	***P. M. DESCRIPTION***	***FREQUENCY***
Analytical Balances	•Check with Class "I" weights	Daily-tolerance 1 gm - ±0.0001 gm
Analytical Balances	•Service/Calibration (semiannual contract maintenance and calibration check)	10 gm - ±0.01 gm
Analytical Balances	•Service/Calibration (semiannual contract maintenance and calibration check)	Semi-annually
Refrigerators, Incubators, and Water Baths	•Maintenance service	Determined by twice daily temperature performance checks @ least 4 hours apart, when in use.
Water Bath	•Check thermometer vs. NIST traceable	Annually
Water Bath	•Remove from service when not maintaining temperature and send off for repair or replace	As needed
Autoclave	•Check sterilization efficiency	Monthly – Geobacillus stearothermophilus ampoule
Autoclave	•Check sterilization efficiency	With each use– Chemical Indicator Strip
Conductivity Meter	•Calibrate and clean probe	As needed
Conductivity Meter	•Replace or replatinize probe	When poor response not corrected by above
pH	Automatic Temperature Compensation of pH probe	Quarterly
Stereoscope	• Clean optics and stage	Each Use
pH Meters	•Reference junction & electrode replacement	As needed
pH Meters	•Probe stored in pH 4.0 Buffer	At all times when not in use.
pH Meters	•Other	As described in the manufacturer's O & M manual
Autoclave	•Check timing device	Quarterly
pH meter	•Calibrate and check slope (per manufacturer)	Daily
Quanti-Tray Sealer	•Check sealer for leaks	Monthly
Water Purifier	•Conductivity check using a calibrated conductivity meter	Monthly
Water Purifier	•Check for TOCs, ammonia, nitrogen, TRC and heterotrophic bacteria	Monthly
Water Purifier	•Check for single and heavy total metals	Annually
Incubators and Water Baths	Perform temperature stability and load testing	Annually
Autoclave	•Check pressure (annual contract maintenance)	Annually
Autoclave	Check mechanical timing device	Quarterly
Stereoscope	• Clean optics and stage; microscope alignment (annual maintenance contract)	Annually

8.3 STANDARDS AND REAGENTS

All reagents and standards must meet the requirements listed in the analytical methods.

Table 8.3A: Commercially prepared agar/broth, reagent sources, and storage information. ***(subject to revision as needed)***

Agar Type	***Source***	***Storage***
M-FC Broth w/ Rosolic acid	Millipore	4 ± 2°C
A-1 Media (broth)	Hach	4 ± 2°C
mEndo Broth	Hach	4 ± 2°C
Lauryl Tryptose Broth	Hach	4 ± 2°C
Brilliant Green Lactose Broth	Hach	4 ± 2°C
EC media w/ mug broth	Hach	4 ± 2°C
HPC	Hach	4 ± 2°C
Colilert reagent powder	IDEXX	Room temp
Enterolert reagent powder	IDEXX	Room temp
Phosphate Buffer Solution	Weber Scientific	Room temp

All stock agar expirations are per manufacturer specification.

Table 8.3B: In-house prepared agar/broth, reagent sources, and storage information.
(subject to revision as needed)

Agar Type-Stock	***Source***	***Stock Storage***	***Stock Expiration***	***Preparation Components Media***	***Prepared Storage***	***Prepared Expiration***
Plate Count Agar	VWRDifco	Room Temp	As specified by Manufacturer	PCA + Water	4 ± 2°C	3 months
Tryptic Soy Agar	VWRDifco	Room Temp	As specified by Manufacturer	TSA + Water	4 ± 2°C	3 months
Tryptic Soy Broth (TSB)	VWRDifco	Room Temp	As specified by Manufacturer	TSB + Water	4 ± 2°C	3 months
Lauryl Tryptose Broth (LTB)	VWRDifco	Room Temp	As specified by Manufacturer	LTB + Water	4 ± 2°C	3 months
Buffered Rinse Water	VWRDifco	4 ± 2°C	As specified by Manufacturer	KH_2PO_4 + $MgCl_2$+Water	Room temp.	1 year
Heart Infusion Agar	VWR/BD	Room Temp	As specified by Manufacturer	HIA + Water	4 ± 2°C	2 weeks

Membrane Filters and Pads

Membrane filters and pads are purchased and certified to meet the following specifications:

- Filter diameter - 47 mm, mean pore diameter - 0.45 µm. Alternate filter and pore sizes may be used if the manufacturer provides data verifying performance equal to or better than that of 47mm-diam, 0.45-µm-pore size filter. At least 70% of filter area must be pores.
- When filters are floated on reagent water, the water diffuses uniformly through the filters in 15s with no dry spots on the filters.
- Flow rates are at least 55 $mL/min/cm^2$ at 25°C and a differential pressure of 93kPa.
- Filters are nontoxic, free of bacterial-growth-inhibiting or stimulating substances, and free of materials that directly or indirectly interfere with bacterial indicator systems in the media. Ink grid is nontoxic. The arithmetic mean of five counts on filters must be at least 90% of the arithmetic mean of the counts on five agar spread plates using the same sample volumes and agar media.
- Filters retain the organisms from a 100mL suspension of *Serratia marcescens* containing 1×10^3 cells.
- Water extractables in filters do not exceed 2.5% after the membrane is boiled in 100mL reagent water for 20min, dried, cooled, and brought to constant weight.
- Absorbent pad has diameter 47mm, thickness 0.8mm, and is capable of absorbing 2.0 ± 0.2mL Endo broth.
- Pads release less than 1mg total acidity calculated as $CaCO_3$ when titrated to the phenolphthalein endpoint with 0.02*N* NaOH.
- If the filter and absorbent pad are not sterile, they should not be degraded by sterilization at 121°C for 10min. Confirm sterility by absence of growth when a membrane filter is placed on a pad saturated with tryptic soy broth and incubated at 35 ± 0.5°C for 24h.

8.4 INSTRUMENT CALIBRATION

Autoclave

Prior to first use, autoclaves must be initially evaluated for performance. All initial checks must be recorded and records must be retained on file. With each use, a record of items sterilized, temperature, pressure, and time is kept for each batch processed. Operating temperature is checked and recorded at least weekly with a minimum/maximum thermometer. Performance is tested monthly with *Bacillus stearothermophilus* ampoules. Chemical strips are used with each use to verify that supplies and materials in each cycle have been sterilized. The autoclave mechanical timing device is checked quarterly against a stop watch and actual time elapsed documented. Records of autoclave operations are maintained for every cycle. Records include: date, contents, maximum temperature reached, pressure, time in sterilization mode, total run time (may be recorded as time in and time out) and analyst's initials.

Quebecor Colony counter

A dark field colony counter is used to count Heterotrophic Plate Count colonies. Maintenance is performed per manufacturer's instructions.

Quanti-tray Sealer

The Quanti-tray sealer is checked monthly using 100mL of bromocresol purple, or equivalent dye. The solution is poured into a test tray, sealed, and tested for leaks.

pH Meter/Conductivity Meter

With each use, calibrate the instrument according to the manufacturer's instructions. Verify that the slope of the calibration is within the manufacturer's acceptable range prior to use. Automatic temperature compensation (ATC) verifications are performed quarterly on the pH probe.

Incubators & Waterbaths

Records of temperature checks are documented twice daily at least 4 hours apart when in use. Thermometers used for temperature checks are verified at least annually. Temperature stability and load testing is performed on an annual basis.

Analytical Balances

Analytical balances are checked at least daily prior to each use with class "I" weights. Records of these verifications are maintained within the laboratory. Balances are also serviced and verified and/or calibrated by an external calibration service at least semi-annually.

Volumetric Equipment, IDEXX and Commercially Prepared Phosphate Buffer Bottles

Equipment such as filter funnels, bottles, pipettes, non-Class A glassware and other containers with graduation must be calibrated once per lot prior to the first use. Mechanical hand pipettes, automatic dispensers and diluters are verified for accuracy quarterly. The error of calibration must not exceed 3%.

IDEXX Bottles and Quanti-trays

Prior to first use, IDEXX bottles and Quanti-trays must be checked for fluorescence using a long wave UV light.

Ultraviolet Lamp

The output of the UV lamp used to measure fluorescence for the identification of *E. coli* is tested quarterly with a UV light meter. The UV bulbs are replaced if the output is less than 70% of the original.

9.0 LABORATORY PRACTICES

9.1 REAGENT GRADE WATER

Reagent Grade water –Type II used in the Microbiology Laboratory is periodically checked for contamination. Type II water is checked annually for single and total heavy metals and organic chemicals. Monthly checks for total organic carbon, ammonia and organic nitrogen, total residual chlorine and a heterotrophic plate count are also conducted. Resistivity and pH are checked continuously or with each use. Conductivity is also checked monthly using a calibrated conductivity meter. The Use test is performed quarterly and the Water Suitability test is performed annually.

9.2 GLASSWARE WASHING , STERILIZATION PROCEDURES AND EQUIPMENT STERILITY CHECKS

Glassware washing and preparation/sterilization procedures are performed according to EPA guidelines and are outlined in *SOP 030701 Glassware Cleaning and SOP 350335, Quality Control and Quality Assurance of Microbiological Equipment and Testing Materials.* Before use, examine and discard items with chipped edges or etched inner surfaces. Reusable glassware is cleaned using the protocol established by the EPA:

- Soak for 15 minutes in hot tap water with detergent and scrub. Rinse thoroughly with tap water. Rinse thoroughly with dilute nitric acid (10%). Rinse thoroughly with deionized water. Rinse thoroughly with pesticide grade acetone. Rinse well with deionized water.
- New glassware are cleaned according to the same procedure as listed above except the first step is preceded by soaking overnight in 10 % $HNO_{3.}$

Inspect glassware after washing for excessive water beading and rewash, if necessary. Perform checks on pH and test for inhibitory residues on glassware and plastic ware. Use utensils and containers of borosilicate glass, stainless steel, aluminum, or other corrosion resistant material for media preparation. All biological glassware is purchased pre-sterilized. In-house sterilization of any auxiliary equipment is performed via autoclave.

Pipettes of all sizes are checked for sterility by drawing up non-selective media into the pipette and re-dispensing the volume back into original tube that contained the media. The tube is then incubated and monitored for growth. All results are recorded and maintained within the laboratory.

Inoculating loops are cultured by aseptically transferring the entire tip of the loop into a tube containing non-selective media. The tube is incubated and monitored for growth. Results are maintained within the laboratory.

A sterility check is performed on one container for each lot of purchased, pre-sterilized sample containers, and IDEXX containers. Results are maintained within the laboratory.

A check is performed on one container from each new lot of microbiological sample containers to ensure efficacy of sodium thiosulfate to 15 mg/L chlorine, and documented. A sterility check is performed on each batch of dilution and rinse water prepared in the laboratory and on each batch of commercially prepared water with non-selective growth media prior to first use.

In addition, stock solutions used for preparing rinse water are checked for turbidity prior to each use. If turbid, the stock buffer is discarded or re-sterilized.

9.3 MEDIA STERILITY VERIFICATION PROCEDURES

A sterility check must be analyzed for each lot of pre-prepared media and for each lot of media prepared in the laboratory. This is done prior to the first use of the media used for membrane filtration, MPN, pour plate and chromofluorogenic methods. For media used in the pour plate analytical technique, sterility blanks of the media must be made by pouring an uninoculated plate for each run in addition to sterility and lot comparison tests being performed on each lot prior to first use. Reagents and containers used in chromofluorogenic method tests are checked for fluorescence prior to first use.
All results of the sterility and lot comparison tests are documented.

9.4 POSITIVE AND NEGATIVE CONTROLS USING PURE CULTURES

ATCC Pure Cultures

Positive culture controls demonstrate that the media can support the growth of the target organism(s), and that the media produces the specified or expected reaction to the target organism(s). All media must be tested with at least one pure culture of a known positive reaction. This must be done prior to first use of the media.

Negative culture controls demonstrate that the media does not support the growth of non-target organisms or does not demonstrate the typical positive reaction of the target organism(s). All batches of selective media in the laboratory must be analyzed with one or more known negative culture controls. This must be done prior to first use of the media.

10.0 ANALYTICAL PROCEDURES

10.1 A list of laboratory SOPs associated with the microbiology laboratory can be found in the following table:

TABLE 10.1: MICROBIOLOGICAL DEPARTMENT SOPs

This Table is subject to revision without notice

SOP #	Title/Description
350305	Fecal Coliform: Membrane Filter Technique (SM 9222D)
350315	Fecal Coliform Determination in Biosolids: Membrane Filter Technique (SM 9222D)
350315A	Fecal Coliforms in Sewage Sludge (Biosolids) by MPN Fermentation using A-1 medium (EPA Method 1681)
350316	Total Coliform (SM 9222B)
350321	Pocket Colorimeter Chlorine Tester Maintenance and Calibration
350325	PH Meter Maintenance and Calibration
350326	Thermometer Operation, Maintenance and Calibration Procedure
350328	Conductivity Meter Maintenance and Calibration
350332	Laboratory Maintenance of Bacteria Reference Cultures
350333	QA/QC of Microbiological Equipment and Testing Materials
350343	Colilert (SM 9223B)
350348	Enterolert (ASTM 6503-99)
350354	HPC (SM 9215 B)
350355	Technical Training and Personnel Qualification for Biomonitoring-Microbiology
350356	Water bath and Incubator Temperature Stability and Load Testing
350359	Calibration and Maintenance of Autoclaves
350369	Sterilization, Sanitization and Residue Testing of Microbiological Glassware and Equipment
350380	Class “A” MPN Fecal Coliform Analysis (SM 9221E/C)

10.2 Additional information regarding microbiological testing can be found in:

- Standard Methods for the Examination of Water and Wastewater, Sections 9020 through 9050.
- Heterotrophic Plate Count, SM 9215B
- Fecal Coliform Direct Test (A-1 Media), SM 9221E
- Standard Total Coliform Membrane Filter Procedure, SM 9222B.
- Fecal Coliform Membrane Filter Procedure, SM 9222D.
- Enzyme Substrate Test, SM 9223B.
- Environmental Regulations and Technology, Control of Pathogens and Vector Attraction in Sewage Sludge, Appendix F.
- Fecal Coliforms in Sewage Sludge, EPA 821-R-06-013

11.0 QUALITY CONTROL CHECKS

11.1 ESC participates in microbiological proficiency testing (PTs) in various matrices by analyzing samples provided by Phenova. Blind samples are received and analyzed according to instructions from Phenova and the standard operating procedure.

11.2 Plate count comparison between two analysts is conducted monthly. Acceptable plate count comparisons must be within 10%. Analyst deviations that are outside the 10% range are repeated. If the repeat inter-analyst count is unacceptable, additional procedural training and method reviews are conducted.

11.3 Duplicate analyses are performed on 10% of samples or at least one sample per month for total and fecal coliform and *E. coli* tests. Due to the infrequent laboratory receipt of some samples, duplicate analyses are conducted per sample. If the RPD exceeds 20%, the data is qualified.

11.4 For membrane filtration analyses, sterility control checks are conducted on the filter assembly at the beginning and end of each sequence and following every 10 samples analyzed. If QC blanks fails, the run is rejected or qualified.

11.5 Verification of total coliform and fecal coliform colonies must be conducted monthly (10 colonies/month for wastewater). Colonies found in drinking water samples must have at least five typical sheen colonies and five atypical colonies verified.

11.6 For HPC analysis, duplicate plates are run for each dilution. A positive control and an uninoculated plate performed for each run. If the QC fails, the run is rejected and qualified, and sample re-collected.

11.7 Duplicate counts are performed monthly for colony counts from membrane filtration or pour plated media on one positive sample for each month the test is performed. Each analyst counts typical colonies on the same plate and counts must be within 10% difference to be acceptable, if the laboratory has two or more analysts. The same plate is counted twice by the analyst and difference between counts must be no more than 5% in laboratories with only one analyst.

11.8 For biosolids testing, an Initial Precision and Recovery test (IPR) is performed prior to the first time the method is used and at any time the method or instrumentation is modified. The IPR consists of four Milorganite® samples spiked with *E. coli* (ATCC #25922), and must be accompanied by an acceptable method blank and appropriate sterility checks. Mean percent recoveries from the IPR must fall within the EPA approved QC limits of 1-312%, and Relative Standard Deviation of the recovery should be less than or equal to 96%.

11.9 For biosolids testing, an Ongoing Precision and Recovery sample (OPR) is analyzed after every 20 field and matrix spike samples, or one per week that samples are analyzed, whichever occurs more frequently. The OPR consists of one Milorganite® sample spiked with *E. coli* (ATCC #25922), and must be accompanied by an acceptable method blank and appropriate sterility checks. Recoveries from the OPR must fall within the EPA approved QC limits of 1- 371%.

11.10 For biosolids testing, a Method blank is analyzed everyday samples are processed. The Method Blank must be free of contamination from the target organism, and serve as a sterility control to verify the sterility of equipment, materials, and supplies.

11.11 For biosolids testing, a Matrix Spike (MS) is analyzed when samples are first received from a source from which the laboratory has not previously analyzed samples and subsequently, 5% of field samples to determine the effect of a particular matrix on fecal coliform recoveries. MS samples must be accompanied by the analysis of an unspiked field sample sequentially collected from the same sampling site, an acceptable method blank, media sterility checks, and an OPR sample if possible. MS percent recoveries must fall within the EPA approved QC limits: Class A Biosolid= 2-541%; Class B Biosolid= >0-6172%, and RSD less than or equal to 182% and 184% for Class A and Class B biosolids, respectively.

11.12 For biosolids testing, control charts for OPR, IPR, and MS are charted and maintained in the laboratory. The control charts graphically display the results of continuing performance when using Method 1681.

12.0 DATA REDUCTION, VALIDATION AND REPORTING

12.1 DATA REDUCTION

The analyst performs the data calculation functions and is responsible for the initial examination of the finished data. Data reduction steps applied to the raw data are outlined in *SOP 030201 Data Handling and Reporting.* The primary analyst reviews the quality of data based on the following guidelines:

- The appropriate SOP has been followed
- Sample preparation is correct and complete
- Analytical results are correct and complete
- QC is within criteria and complete

12.2 VALIDATION

The validation process consists of data generation, reduction review, and reporting results. Once data reduction is complete, validation is conducted by reviewing all data entries and calculations for errors, reviewing all documentation to assure that sample information is correct, and that the tests have been performed appropriately and within the appropriate holding times. The secondary analyst reviews the quality of data based on the following guidelines:

- The appropriate SOP has been followed
- Sample preparation is correct and complete
- Analytical results are correct and complete

12.3 REPORTING

Reporting procedures are documented in *SOP 030201 Data Handling and Reporting.* Microbiological data is reported as Colony Forming Units (CFU) per unit volume, Presence/Absence, or Most Probable Number (MPN)/100mL.

13.0 CORRECTIVE ACTION

13.1 In the event that a nonconformance occurs in conjunction with the analytical batch, a corrective action response (CAR) form must be completed. The cause of the event is stated on the form and the measures taken to correct the nonconformance clearly defined. The effectiveness of the corrective action must be assessed and noted. The CARs are kept on file by the Regulatory Affairs Department. Corrective action procedures are documented in SOP #030208, *Corrective and Preventive Action*

13.2 Required Corrective Action

All samples and procedures are governed by ESC's quality assurance program. Designated corrective actions are as follows:

13.2.1 Laboratory QC Criteria and Appropriate Corrective Actions

If the analytical method contains acceptance/rejection criteria and it is more stringent than those controls generated by the laboratory the method criteria takes precedence.

13.2.2 Out of control plate count comparisons between analysts.

<u>Rejection Criteria</u> – Comparisons must be within ±10% for monthly plate count comparisons.

<u>Corrective Action</u> – Duplicate counts are repeated. If repeat counts are still beyond acceptance range, procedural training and method reviews are conducted.

13.2.3 Out of control duplicate analyses for total and/or fecal coliform or *E. coli*.

<u>Rejection Criteria</u> – Duplicate RPDs must not exceed 20% for total and/or fecal coliform or *E. coli*.

<u>Corrective Action</u> – Data is qualified or the analysis is repeated. If repeat analysis is still beyond acceptance range, procedural training and method reviews are conducted.

13.2.4 Out of control QC blank for membrane filtration analysis.

<u>Rejection Criteria</u> – Blank analyses performed either at the beginning or end of the analytical sequence is positive.

<u>Corrective Action</u> – The analytical sequence may be rejected and reprocessed or qualified based on the nature of the contamination.

13.2.5 Out of Control QC Blank for HPC analysis

<u>Rejection Criteria</u> - Blank analysis performed during each run is positive for growth.

<u>Corrective Action</u> - The analytical run is rejected, and data qualified with an “R” for rejected data, and sample re-collected.

13.2.6 Out of control IPR analyses

Rejection Criteria - Recoveries from IPR fall outside of the required range for recovery: 1 - 312%, and RSD of 96%.

Corrective Action - Identify the problem by evaluating each step in the analytical process, media, reagents, and controls, correct the problem and repeat the IPR.

13.2.7 Out of Control OPR analyses

Rejection Criteria - Recoveries from OPR fall outside of the required range for recoveries: 1-371%.

Corrective Action - Identify the problem by evaluating each step in the analytical process, media, reagents, and controls, correct the problem and repeat the OPR.

13.3.8 Out of Control MS analyses

Rejection Criteria - Recoveries from MS fall outside of the required range for recoveries: Class A Biosolid= 2-541%; Class B Biosolid= >0-6172%, and RSD less than or equal to 182% and 184% for Class A and Class B biosolids, respectively.

Corrective Action - Flag all associated filed data.

14.0 RECORD KEEPING

Record keeping is outlined in SOP #030230, *Standards Logger*, *SOP #030227, Data Review* and SOP #030201, *Data Handling and Reporting*

15.0 QUALITY AUDITS

System and data quality audits are outlined in the ESC Quality Assurance Manual Version 13.0 and *SOP #010104, Internal Audits*.

16.0 REVISIONS

The Regulatory Affairs Department has an electronic version of this Quality Assurance Manual with tracked changes detailing all revisions made to the previous version. This version is available upon request. Revisions to the previous version of this appendix are summarized in the table below.

Document	**Revision**
Quality Assurance Manual Version 15.0 (Appendix X)	General – Replaced the term "client" with the term "customer" Table 8.1 – Updated Equipment List Table 8.2 – Revised ATC check for pH meter to quarterly Section 8.4 – Revised ATC check for pH meter to quarterly Table 10.1 – Updated SOP List

1.0 SIGNATORY APPROVALS

Mold/BOD Laboratory QUALITY ASSURANCE MANUAL

APPENDIX XI TO THE ESC QUALITY ASSURANCE MANUAL

for

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Prepared by

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2.0 APPENDIX TABLE OF CONTENTS

3.0 SCOPE AND APPLICATION

This appendix discusses specific QA requirements for general analytical protocols to ensure that analytical data generated from the Mold laboratory are scientifically valid and are of acceptable quality. Any deviations from these requirements and any deviations that result in nonconforming work must be immediately evaluated and their corrective actions documented.

4.0 LABORATORY ORGANIZATION AND RESPONSIBILITIES

ESC Lab Sciences offers diverse environmental capabilities that enable the laboratory to provide the customer with both routine and specialized services, field sampling guidance and materials and broad laboratory expertise. A brief outline of the organization and responsibilities as they apply to the ESC Quality Assurance Program is presented in Section 4.0 in the *ESC Quality Assurance Manual.*

5.0 PERSONNEL AND TRAINING

5.1 PERSONNEL

Dr. Christabel Fernandes-Monteiro, with a Ph.D. in Applied Biology, is the Department Manager for Biology. She oversees supervision of laboratory operations in the Mold, Aquatic Toxicity, Microbiology, BOD and Protozoan laboratories. Her responsibilities include assurance of reliable data through monitoring of quality control, corroborating the analysis performed, protocol development, coordination with customers regarding sample analysis, scheduling of tests and overall production in all sections within the Biology Laboratory, including management of staff. Dr. Fernandes-Monteiro oversees the review and approval processes of all data associated with all Biological laboratory sections. She gained experience in Mold analytical techniques at ESC, an AIHA-LAP accredited laboratory, and obtained additional training in microscopic techniques at the McCrone Research Institute. She also reviews AIHA-LAP and EPA online training modules related to the methods being performed in the Mold and BOD Laboratory. In her absence, Bridget Miller assumes responsibility for Mold/BOD departmental decisions.

Bridget Miller, with a BS degree in Biology, is the Primary Analyst in the Mold and BOD laboratory. She is proficient in Mold analytical methods as per AIHA-LAP guidelines. Bridget has gained analytical experience at ESC, an AIHA-LAP accredited laboratory, and obtained additional training in Mold analysis at the McCrone Research Institute. She reviews AIHA-LAP and EPA online training modules related to the methods being performed in the Mold and BOD Laboratory.

5.2 TRAINING

All new analysts to the laboratory are trained by the Primary Analyst or Manager according to ESC protocol. ESC's training program is outlined in SOP #350355, *Technical Training and Personnel Qualification for Biomonitoring-Mold.* Analyst performance in the Mold/BOD Laboratory is documented using an initial demonstration of capability (IDOCs) and continuing demonstration of capability (CDOC). On-going acceptable capability in mold analysis is demonstrated by acceptable participation in the AIHA-PAT proficiency testing programs (EMPAT-Direct Exam and EMPAT-Bacterial/Fungal), Round Robin analysis and daily Quality Control sample analysis. On-going acceptable capability in BOD analysis is demonstrated by acceptable participation in the Phenova proficiency testing program and daily Quality Control sample analyses. Documentation of analyst training, including a copy of college transcripts or degree, is maintained on file within the department.

6.0 FACILITIES AND LABORATORY SAFETY

6.1 FACILITIES

MOLD LAB

The main area of the Mold laboratory has approximately 532 square feet with 167 square feet of bench space. The lighting throughout the laboratory is fluorescence. The air system is a five-ton Trane split unit with natural gas for heating. The laboratory reagent water is provided through the ELGA PureLab Ultra deionizer system. Biohazard containers are located in the laboratory and Stericycle Waste Removal serves as ESC'S biological waste disposal contractor. ESC's building information guides and site plan are shown in Appendix I.

BOD LAB

The main area of the BOD laboratory has approximately 532 square feet of area with 151 square feet of bench space. The lighting standard throughout the laboratory is fluorescence. The air system is a five-ton Trane split unit with natural gas for heating. The laboratory reagent water is provided through the ELGA PureLab Ultra deionizer system. Biohazard containers are located in the laboratory and Stericycle Waste Removal serves as ESC'S biological waste disposal contractor. ESC's building information guides and site plan are shown in Appendix I.

6.2 LABORATORY SAFETY

- Laboratory access is limited when work is being performed.
- All procedures where infectious aerosols or splashes may occur are conducted in biological safety II cabinets.
- The following Biosafety Level 2 (BSL2) guidelines are adhered to:
  - ➢ Closed-toe shoes are worn in the laboratory
  - ➢ Floors and work surfaces are cleaned on a regular basis
  - ➢ Emergency numbers are posted in the laboratory

  - ➢ Biological safety hoods are tested and certified annually
  - ➢ Laboratory personnel are trained in the use of the biological spill kit and emergency safety equipment
- ESC's laboratory safety guidelines are detailed in the ESC *Chemical Hygiene Plan*.

7.0 SAMPLING PROCEDURES

7.1 FIELD SAMPLING PROCEDURES, SAMPLE STORAGE, AND HANDLING

- Field Sampling procedure is described in Appendix III of this ESC Quality Assurance Manual. Sample information is recorded and kept on the ESC chain of custody and field logbooks.
- Samples are received in the laboratory login area and are tracked using LIMS (Laboratory Information Management System). A Chain of Custody Form accompanies all samples received by the lab. This is necessary to prove the traceability of the samples and to document the change in possession from sampling to delivery to receipt by the laboratory. Prior to analysis samples are checked for integrity. Sample handling, tracking and acceptance procedures are outlined in SOP #060105, *Sample Receiving.*
- Sample storage procedures are followed using guidance from each approved method and associated department SOP.

8.0 EQUIPMENT

8.1 EQUIPMENT LIST

TABLE 8.1 – LABORATORY EQUIPMENT LIST: MAJOR ITEMS – Mold/ BOD Analysis
This table is subject to revision without notice

Item	**Manufacturer**	***Model***	***Serial #***	***Location***
Analytical Balance	Mettler	PL602-S	1125081657	Bacteriology Lab
Autoclave	Tuttnauer	2540EK	2906170	Bacteriology Lab
Class I BSC	AirFiltronix	AirFiltronix HS 4500	41031	Mold Lab
Class II BSC	Labconco	Labconco 36213	60554894	Mold Lab
Class II BSC	Labconco	Labconco 36209	03076555	Bacteriology Lab
COD Reactor	HACH	45600	900903221	BOD
Microscope	NIKON	LABOPHOT	242008	Mold Lab
Microscope	NIKON	LABOPHOT	235267	Mold Lab
Microscope	Olympus	CH2	900216	Mold Lab
Microscope	Olympus	BH-2	708821	Mold Lab
Microscope	Leitz	Laborlux	512663	Mold Lab
Microscope	VWR Scientific	VWRC1	V167173	Mold Lab
Refrigerator	Whirlpool			Bacteriology Lab
Refrigerator	Whirlpool	El05PPXMQ	EEP3524864	Mold Lab
Refrigerator	Whirlpool	EL7ATRRMQ07	EWR4973976	Mold Lab

TABLE 8.1 – LABORATORY EQUIPMENT LIST: MAJOR ITEMS – Mold/ BOD Analysis
This table is subject to revision without notice

Item	Manufacturer	*Model*	*Serial #*	*Location*
Refrigerator	Frigidaire	FRT17G4BW9	BA703306	Mold Lab
Stereoscope	VWR Scientific	VWRS1	V168430	Mold Lab
Incubator	Labtronix	BOD2100D	21000010213	Mold Lab
Incubator	Quincy Lab	10-100	I11-2454	Mold Lab
Incubator	Precision Scientific	30M	9303590	Bacteriology Lab
Incubator	Precision Scientific	30M		Bacteriology Lab
Incubator	VWR	2030	802202	BOD
Incubator	Fisher	Not Visible	100212	BOD
Incubator	Thermo Scientific Precision	3271	317217-1241	BOD
Incubator	Precision	818	35AK-10	BOD
Waterbath	Blue M-MagniWhirlpool	MW-1110A	14991	Bacteriology Lab
Waterbath	Precision	Circulating 260	21-AJ11	BOD
Biolog MicroStation	Biolog, Inc.	Microlog 3	342689	Bacteriology Lab
Turbidimeter	Biolog, Inc.	21907	6093898	Bacteriology Lab
Plate Reader	Biotek	ELX808BLG	203222	Bacteriology Lab
Vortex Genie2 Mixer	VWR	G-560	2-223236	Mold Lab
Vortex Genie2 Mixer	VWR	G-560	2-223236	Bacteriology Lab
Stir Plate	Corning	PC-420D	023507102961	Bacteriology Lab
Stir Plate	Fisher	118	102	Bacteriology Lab
Stir Plate	VWR	205	7852	BOD
Stir Plate	VWR	220	5031	BOD
BOD SP Robotic Analyzer	Skalar	SP50	08124	BOD
BOD SP Robotic Analyzer	Skalar	SP50	08123	BOD
DO meter	YSI	5000	081C101451	BOD
DO meter	YSI	5000	081C101450	BOD
pH meter	VWR	Symphony B10P	12284S0009	BOD
Spectrophotometer	Hach	DR 2700	1388224	BOD

8.2 EQUIPMENT PREVENTIVE MAINTENANCE

INSTRUMENT	*P. M. DESCRIPTION*	*FREQUENCY*
Analytical Balances	•Check with Class "I" weights	Daily-tolerance 1 gm - ±0.0001gm
Analytical Balances	•Service/Calibration (semiannual contract maintenance and calibration check)	10 gm - ±0.01 gm
Analytical Balances	•Service/Calibration (semiannual contract maintenance and calibration check)	Semiannually
Refrigerators, Waterbaths, & Incubators	•Maintenance service	As needed - determined by daily temperature performance checks twice daily and at least 4 hours apart
Water Bath	•Check thermometer vs. NIST	Annually

INSTRUMENT	***P. M. DESCRIPTION***	***FREQUENCY***
Water Bath	•Remove from service when not maintaining temperature and send off for repair or replace	As needed
Incubators and Waterbaths	Perform Temperature stability and load testing	Annually
Autoclave	•Check sterilization efficiency	Weekly – *G. stearothermophilus*
Autoclave	•Check sterilization efficiency	Per Use – Chemical Indicator
Autoclave	Check timing devices	Quarterly
Autoclave	Check pressure (annual Maintenance contract)	Annually
Class II Biosafety Cabinet	•Monitor air and UV lamps	Monthly
Class II Biosafety Cabinet	•Inspect for air flow	Quarterly
Class II Biosafety Cabinet	•Recertification according to NSF standard 49	Annually
Turbidimeter	•Maintenance Service	Annually
Turbidimeter	•Check for accuracy using NIST traceable stds	Per Use
Biolog MicroStation	•Maintenance Service	Annually
Microscope	•Service/calibration of each ocular micrometer	Annually
Microscope	•Clean optics and stage, Kohler Alignment	Each Use
pH meters	Calibrate and check slope (acceptablerange)95-	Daily
pH meters	Reference junction & electrode replacement	As needed
pH meters	Probe stored in KCl	At all times when not in use
pH meters	ATC checks	Quarterly
pH meters	Other	As described in manufacturer’s O &
BOD SP Robotic Analyzer	Calibrate DO probe	Daily
BOD SP Robotic Analyzer	Clean and Change DO probe membrane	Weekly
BOD SP Robotic Analyzer	Rinse ATU (seed) dispenser using rinse pump option	As needed
BOD SP Robotic Analyzer	Clean rinsing vessel	Every three months or as needed
BOD SP Robotic Analyzer	Replace tubing for dispenser, diluent pump, and rinsing vessel	Annually or as needed

.

8.3 STANDARDS AND REAGENTS

Table 8.3A lists commercially prepared agar sources. Table 8.3 B lists in-house prepared agar sources and storage information. Table 8.3C lists standard sources, receipt, and preparation information for BOD Analysis. Table 8.3D is designed to provide general calibration range information for BOD analysis. These tables may change depending on regulatory requirements, procedural changes, or project needs.

Table 8.3A: Commercially prepared agar sources and storage information.
(subject to revision as needed)

Agar Type	***Source***	***Storage***
Malt Extract Agar w/chloramphenicol (MEA)	HealthLink	4 ± 2°C
DG18 Agar	HealthLink	4 ± 2°C
Modified Cellulose Agar	HealthLink	4 ± 2°C
Tryptic Soy Agar w/Sheep Blood	HealthLink	4 ± 2°C
2 % Malt Extract	Biolog	4 ± 2°C
BUG w/BL	Biolog	4 ± 2°C
BUA w/BL	Biolog	4 ± 2°C

Table 8.3A: Commercially prepared agar sources and storage information.

(subject to revision as needed)

Agar Type	***Source***	***Storage***
Biolog Universal Yeast Agar (BUY)	Biolog	4 ± 2°C
TSA w/SB contact	HealthLink	4 ± 2°C
Malt Extract Agar w/chloramphenicol contact	HealthLink	4 ± 2°C
Chocolate Agar	Biolog	4 ± 2°C
Czapek Yeast Extract Agar	HealthLink	4 ± 2°C
CNA w/5 % SB	HealthLink	4 ± 2°C
Saboraud's Dextrose Agar	HealthLink	4 ± 2°C

All stock agar expirations are per manufacturer specification.

Table 8.3B: In-house prepared agar sources and storage information.

(subject to revision as needed)

Agar Type-Stock	***Source***	***Stock Storage***	***Stock Expiration***	***Preparation Components Media***	***Prepared Storage***	***Prepared Expiration***
Malt Extract Agar (MEA) slants	VWR/Difco	Room Temp	As specified by Manufacturer	MEA + Water	4 ± 2°C	3 months
Anaerobic Agar (ANA)	VWR	Room Temp	As specified by Manufacturer	ANA + water	4 ± 2°C	2 weeks
Tryptic Soy Agar (TSA) slants	VWR/Difco	Room Temp	As specified by Manufacturer	TSA + Water	4 ± 2°C	3 months
Tryptic Soy Broth (TSB)	VWR/Difco	Room Temp	As specified by Manufacturer	TSB + Water	4 ± 2°C	3 months

Table 8.3C: Standard sources, description and calibration information.

(This table is subject to revision without notice)

Instrument Group	***Standard Source***	***How Received***	***Source/Storage***	***Preparation from Source***	***Lab Stock Storage***	***Preparation Frequency***
BOD	Lab preparation	As dry glucose and glutamic acid	Dessicator	150mg each/L	Ambient	Made fresh daily
pH meter	Commercial source	pH 4.0 buffer	Ambient	No prep required	NA	Annual/Expiration Date
pH meter	Commercial source	pH 7.0 buffer	Ambient	No prep required	NA	Annual/Expiration Date
pH meter	Commercial source	pH 10.0 buffer	Ambient	No prep required	NA	Annual/Expiration Date
Turbidity meter	Commercial source	Turbidity standard	Ambient	No prep required	NA	Annual/Expiration Date

Table 8.3D: Working Standard Calibration

Analysis	***Calibration Standard***
BOD	D.O.- Barometric pressure/temp, Glucose and glutamic acid reference standard

Source of Fungi

A collection of fungi is maintained in the laboratory as training and reference material. The fungi are isolated from proficiency testing samples, laboratory contaminants and customer samples, and stored as Malt Extract Agar slants for 3 months at 4 ± 2ºC. Cultures are sub-cultured every 3 months. Each culture is assigned an accession number, genus, specific epithet, authority, source, and name of collector. Records are maintained in the laboratory in the accession list database.

Source of Bacteria

A collection of bacteria is maintained in the laboratory as training and reference material. The bacterial strains are purchased from an accredited microbiological supply company and are used as positive and negative reference controls. Alternatively, bacterial strains are collected from proficiency testing samples and laboratory contaminants, and stored as Tryptic Soy Agar slants for 3 months at 4 ± 2ºC.

8.4 INSTRUMENT CALIBRATION

Autoclave

Operating temperature is checked and recorded with each use with a minimum/maximum thermometer. Performance is tested weekly with *Bacillus stearothermophilus* ampoules. Chemical strips are used with each batch processed to verify that supplies and materials have been sterilized. Records of autoclave operations are maintained for every cycle. Records include: date, contents, maximum temperature reached, pressure, time in sterilization mode, total run time (may be recorded as time in and time out) and analyst initials.

Incubators & Waterbaths

The record of temperature checks is documented twice daily at least 4 hours apart when in use. Thermometers used for temperature checks are verified at least annually. In addition temperature chart recorders are being used to continuously monitor the temperature in the incubators used for BOD analysis and the BOD Lab.

Analytical Balances

Analytical balances are checked at least daily prior to each use with class “I” weights. Records of these verifications are maintained within the laboratory. Balances are also serviced and verified and/or calibrated by an external calibration service at least semi-annually.

Microscope

A record of cleaning and alignment for each microscope is maintained in the laboratory. Each microscope has an ocular micrometer that is verified annually with a stage micrometer. All microscopes are serviced annually by an external microscope service.

Biochemical Oxygen Demand Robotic Analyzer – SOP Number 340303A

The Dissolved oxygen meter is calibrated according to manufacturer's instructions with each use. Air calibration is performed on the DO meter probes to correct DO for the ambient temperature and given local barometric pressure. The local barometric pressure is determined from information provided by the National Weather Service for the Nashville International Airport (BNA) by accessing http://w1.weather.gov/obhistory/KBNA.html.The air calibration is confirmed daily using the Winkler Test. During the analytical sequence, the calibration stability of the DO probes is verified after every ten samples and at the end of sequence, by the analysis of continuing calibration verification (CCV). If either of the readings differs from the initial readings by more than 0.2 mg DO/L., the instrument automatically re-calibrates the DO meters and re-reads everything after the last passing CCVs.

A laboratory control sample (LCS) is prepared from glucose and glutamic acid, and is analyzed in triplicate exactly like a field sample at the beginning of the workgroup, after every twenty samples throughout the run and at the end of the workgroup, to verify that the analytical process is performing accurately.

pH meter

With each use of pH meters, calibrate the instrument according to manufacturer's instructions. The slope is documented on a daily basis. Acceptable pH slope range is per the manufacturer's operating manual. Automatic temperature compensation (ATC) verifications are performed quarterlyon the pH probe.

Turbidimeter

With each use, calibrate the instrument according to manufacturer's instructions. Adjust transmittance to a 100% using a blank reference test tube. Establish appropriate turbidity range on turbidimeter by adding or subtracting 2% T to the percent transmittance measured with the appropriate turbidity standard.

Volumetric equipment

Equipment such as pipettes, non-Class A and other containers with graduations are calibrated once per lot prior to first use. Volumetric equipment that is not disposed of after use is calibrated on an annual basis. The error of calibration must not exceed 3%.

Air Sampler

The air sampling pump used for laboratory environmental monitoring is verified monthly prior to use with a calibrator that is calibrated annually by an ISO 17025 accredited laboratory to ensure its measurement integrity.

9.0 LABORATORY PRACTICES

9.1 REAGENT GRADE WATER

Reagent Grade water –Type II used in the Mold Laboratory is periodically checked for contamination. Type II water is checked annually for single and total heavy metals, and organic contaminants. Monthly checks for total organic carbon, ammonia and organic nitrogen, total residual chlorine and a heterotrophic plate count are also conducted. Conductivity and pH are checked continuously or with each use. The water suitability test is performed annually and the USE test is performed quarterly.

Prior to first use, a sterility check with non-selective growth media is performed on each batch of reagent water prepared in the laboratory.

9.2 GLASSWARE WASHING AND STERILIZATION PROCEDURES

Glassware washing and preparation/sterilization procedures are performed according to EPA guidelines and are outlined in SOP #030701, *Glassware Cleaning*. The glassware used in the mold laboratory is restricted to microscopic slides, cover slips, and screw capped bottles, vials or flasks for preparation of media. Before use, examine microscope slides, and discard items with chipped edges or etched inner surfaces. Prior to use, clean microscopic slides with 70 % isopropyl alcohol. Examine screw-capped bottles, vials or flasks for chipped inner edges that could leak. Screw-capped bottles, vials or flasks are cleaned using the following protocol:

- Prewash with hot tap water. Wash with hot tap water. Wash with non-foaming powder detergent. Rinse with tap water. Rinse with DI water. Dry and cool.
- New glassware is cleaned according to the same procedure as listed above.

Inspect glassware after washing for excessive water beading and re-wash, if necessary. Perform checks on pH and test for inhibitory residues on glassware and plastic ware. Use utensils and containers of borosilicate glass, stainless steel, aluminum, or other corrosion resistant material for media preparation. Sterilization of any auxiliary equipment is performed via autoclave.

Pipettes of all sizes are checked for sterility by drawing up non-selective media into the pipette and re-dispensing the volume back into original tube that contained the media. The tube is then incubated and monitored for growth. All results are recorded and maintained within the laboratory.

Inoculating loops are cultured by aseptically transferring the entire tip of the loop into a tube containing non-selective media. The tube is incubated and monitored for growth. Results are maintained within the laboratory.

BOD analysis is performed in disposable, pre-sterilized bottles. In the event that glass bottles must be used, the BOD glassware is washed in a commercial laboratory dishwasher using a phosphate free detergent, followed by a nitric acid rinse, with a final rinse of laboratory DI water.

9.3 MEDIA STERILITY VERIFICATION PROCEDURES

A sterility check must be analyzed for each lot of pre-prepared media and for each lot of media prepared in the laboratory. This is done prior to the first use of the media used for membrane filtration, or MPN, or pour plate, and chromofluorogenic methods. For media used in the pour plate testing technique, sterility blanks of the media must be made by pouring an uninoculated plate for each run. All results are documented.

9.4 POSITIVE AND NEGATIVE CONTROLS USING PURE CULTURES

Positive culture controls demonstrate that the media can support the growth of the target organism(s), and that the media produces the specified or expected reaction to the target organism(s). All prepared media must be tested with at least one pure culture of a known positive reaction. This must be done prior to first use of the media.

Negative culture controls demonstrate that the media does not support the growth of non-target organisms or does not demonstrate the typical positive reaction of the target organism(s). All batches of prepared selective media in the laboratory must be analyzed with one or more known negative culture controls. This must be done prior to first use of the media.

New lots of commercially-prepared media are evaluated for suitability using a known positive and negative culture prior to use.

10.0 ANALYTICAL PROCEDURES

A list of laboratory SOPs associated with the Mold and BOD laboratory can be found in the following table:

TABLE 10.1: MOLD DEPARTMENT SOPs

This Table is subject to revision without notice

SOP #	Title
340303	Biochemical Oxygen Demand
350306	Spore Traps
350307	Fungal Andersen
350308	Fungal Quantification
350309	Fungal RODAC
350310	Direct Exam Prep Procedure

SOP #	Title
350311	Fungal Identification
350312	Mold QA/QC
350313	Mold Lab Safety
350314	MUG – E. coli/Coliforms/Enterococcus
350319	Processing of Bacterial Andersen Samples for Quantification
350334	Microscope Usage
350335	Fungal Spore Identification
350342	BART Testing
350347	Processing of Bacterial Swabs, Bulk, Dust and Water Samples for Quantification
350349	Bacterial Identification Using Biolog
350352	Anaerobic Plate Count
350367	Labconco Flaskscrubber Operation and Maintenance
350370	Preparation of Culture Media
350371	Mold lab Autoclave Maintenance and Operation
350379	Mold Lab Reference Culture Maintenance

11.0 QUALITY CONTROL CHECKS

11.1 ESC participates in proficiency testing (PTs) in support of various laboratory accreditations/recognitions. For Mold analyses, PTs are administered quarterly by AIHA-PAT. ESC participates in both the EMPAT Fungal Direct Examination and Bacterial/Fungal Culturable proficiency testing. The samples are received and analyzed by method according to the vendor’s instructions and according to the applicable analytical SOP.

For BOD analysis, environmental PTs are purchased from Phenova. The WP studies are completed every 6 months.

11.2 As part of the total spore analysis QC, the laboratory maintains a slide collection with various count levels and genera/groups of spores. Acceptance criteria for the slide collection include counts that are statistically determined (e.g. ±3STD). Each analyst reviews one slide from this collection on each day of analysis. The slides are reviewed on a rotational basis such that a different slide is reviewed each day until the entire slide collection has been examined. The total spore count and acceptance criteria for each slide are calculated and compared with the statistically determined acceptance criteria.

11.3 Each week, a different pure culture is chosen from the culture collection and is identified by an analyst as part of training and continuing QC program.

11.4 Inter- and intra-analyst precision is determined by the re-analysis of samples by the same and different analysts (where possible). The rate of re-analysis by the same analyst (intra-analyst) and by a second qualified analyst (inter-analyst) is 5%, or at least one each month samples are received, for each field of testing. The laboratory uses control charts to compare the intra- and inter-analyst performance to an established control limit.

11.5 Media blanks for viable count analysis are used to monitor media and laboratory procedures for contamination. These blanks are utilized in two ways:

- Laboratory media blanks are unexposed fresh media (either recently received from the manufacturer or newly laboratory prepared) that is incubated under the same conditions as those used for analysis.
- Field blanks are unopened media that is handled identically to field samples. These samplers are returned to the laboratory with sampled media to demonstrate that media utilized was not originally contaminated and did not become contaminated during transport.

11.6 Environmental monitoring of the laboratory air and the surfaces in the Mold laboratory is performed monthly. BSLII hoods are also monitored in the Mold laboratory.

11.7 Round Robin studies are performed for direct examination of fungal air samples in accordance with AIHA-LAP policy requirements. Results for these studies include raw counts and final concentrations for each fungal structure. Acceptance criteria include organism identification, ranking and quantification.

11.8 Analysts also participate in other continuing education activities, including attending seminars and conferences, in-house training meetings, reviews of journal publications and self-taught training on CD.

11.9 For BOD analysis, Initial Demonstrations of Capabilility (IDOCs) are performed during new analyst training and/or prior to acceptance and use of any new or modified method/instrumentation. Continuing Demonstration of Capability must be updated at least annually. The associated data is filed within the department and available for review.

11.10 For BOD analysis, samples are analyzed in batches of 1-20 samples. Each batch must include the following: method blank, seed blank, seed control, seed check, a laboratory control sample run in triplicate, 1 sample duplicate/ 10 samples. A calibration check (CCV) is performed every 10 samples and an additional LCS every twenty samples including the end of the sequence.

11.10.1 A method blank is analyzed for each probe at the beginning and end of the sequence. The method blank is used to define the level of laboratory background and reagent contamination. All blanks must meet method acceptance criteria. If method blanks fail, data is qualified. The depletion of the method blank must be < 0.20mg DO/L but no lower than -0.20 mg DO/L. Multiple dilution water blanks in the same batch using the same dilution water are treated as replicates and averaged. The average of the dilution water blanks in a batch must not be more than 0.20 mg DO/ L.

11.10.2 The Seed Blank/Seed Control/Seed Check must deplete to show that the microorganism population is viable. The seed correction factor should be 0.6-1 mg/L and seed check and seed control should show depletions within 30% between dilutions.

11.10.3 The CCV should not vary more than 0.2mg DO/L within a run.

11.10.4 The BOD value for the LCS must be within 167.5 and 228.5 mg/L.

11.10.5 The RPD for the sample duplicate must be ≤30% for high and low values.

12.0 DATA REDUCTION, VALIDATION AND REPORTING

12.1 DATA REDUCTION

The analyst performs the data calculation functions and is responsible for the initial examination of the finished data. Data reduction steps applied to the raw data are outlined in SOP #030201, *Data Handling and Reporting* and ESC SOP# 030227, *Data Review* The primary analyst reviews the quality of data based on the following guidelines:

- The appropriate SOP is followed
- Sample preparation is correct and complete
- Analytical results are correct and complete
- QC is within criteria and complete

For BOD analysis, the Laboratory Manager or Senior Analyst performs the secondary review of the data package using the ESC SOP# 030227, *Data Review*. The reviewer verifies that the analysis is performed as required and meets method criteria, All associated data is present and complete, and also ensures that any additional documentation is completed as required (i.e. required qualifiers on test reports, case narratives, etc.)

TABLE 12.1 Data Reduction Formulas

PARAMETER	**FORMULA**
Non-viable (Spore Traps) Mold	$\frac{SporeCount}{m^3} = \frac{\text{number on trace} \times 1000}{\text{Volume of air sampled in liters}}$
Andersen Fungal Viable (Culturable) Mold Spore Andersen Bacterial Viable (Culturable) Bacteria	$\frac{CFU}{m^3} = \frac{\text{raw counts} \times 1000}{\text{Volume of air sampled in liters}}$ P_c= N [1/N+ 1/N-1+1/N-2+……1/N-r+1]
Quantitative Fungal/Bacterial	$\frac{\text{CFU}}{\text{gm}} \text{ or } \frac{\text{CFU}}{\text{Swab}} = \frac{\text{\# of Colonies} \times \text{Dilution Factor}}{\text{Sample Amount}}$
BOD, 5-DAY	$\frac{\text{Initial D.O.} - \text{Final D.O.} - \text{CF}}{\text{\% Dilution Sample}}$ *Calculations are performed by computer software* *CF= (Depletion of Seed Control or Seed Check) X (Vol of Seed in Samples)/Volume of Seed in Seed Control or Seed Check*

PARAMETER	FORMULA
Percent Recovery (%R)	%R = (Observed Value)X(100%) True Value
Relative Percent Difference (RPD)	RPD = [ABS(Result1-Result2)]X(100%) RPD = [ABS(Result1-Result2)]X(100%)Mean Result
Reporting Limit (RL)	RL (1 ppm) X Final Volume (300 ml)/Initial volume X Dilution Factor

12.2 VALIDATION

The validation process consists of data generation, reduction review, and reporting results. Once data reduction is complete, validation is conducted by reviewing all data entries and calculations for errors, reviewing all documentation to assure that sample information is correct, and that the tests have been performed appropriately and within the appropriate holding times. The secondary analyst reviews the quality of data based on the following guidelines:

- The appropriate SOP is followed
- Sample preparation is correct and complete
- Analytical results are correct and complete

For BOD analysis, once data reduction is complete, validation is conducted by verification that the QC samples are within acceptable QC limits and that all documentation is complete, including the analytical report and associated QC. See Table 12.3 for current QC targets, controls and current reporting limits for BOD analysis.

12.3 REPORTING

Reporting procedures are documented in SOP #030201, *Data Handling and Reporting.*

BOD Control Limits: BOD QC targets are statutory. The laboratory calculated limits verify the validity of the regulatory limits. The BOD QC targets are within the range of 5 to 15% for accuracy, depending on determinative method requirements, and, where applicable, <30% RPD for precision, unless laboratory-generated data indicate that tighter control limits can be routinely achieved. When using a certified reference material for QC sample analysis, the acceptance limits used in the laboratory conform to the provider’s certified ranges for accuracy and precision.

Table 12.3: QC Targets for BOD Lab Accuracy (LCS), Precision and RLs
This table is subject to revision without notice

Analyte	Analysis Method	Matrix	Accuracy Range (%)	Precision (RPD)	RL (ppm)
Biochemical Oxygen Demand	SM5210B	W	85-115	≤30	1
Biochemical Oxygen Demand - Carbonaceous	SM5210B	W	85-115	≤30	1

13.0 CORRECTIVE ACTION

13.1 In the event that a nonconformance occurs in conjunction with the analytical batch, a corrective action response (CAR) form must be completed. The cause of the event is stated on the form and the measures taken to correct the nonconformance clearly defined. The effectiveness of the corrective action must be assessed and noted. The CARs are kept on file by the Regulatory Affairs Department. Corrective action procedures are documented in SOP #030208, *Corrective and Preventive Action*

13.2 Required Corrective Action

Control limits are established for each type of analysis. When these control limits are exceeded, corrective action must be taken.

All samples and procedures are governed by ESC's quality assurance program. General corrective actions are followed; however additional and more specific direction is provided in the specific determinative procedure. For more information, see the appropriate SOP.

13.2.1 Laboratory QC Criteria and Appropriate Corrective Actions

If the analytical method contains acceptance/rejection criteria and it is more stringent than those controls generated by the laboratory the method criteria takes precedence.

13.2.2 Out of Control RPD for inter- and/or intra-analyst reanalysis.

Rejection Criteria - RPD value of the original analysis is calculated and must be below the current control limit.

Corrective Action - Both first and second analysts re-analyze the sample until a consensus is reached and the RPD value falls within control limits.

13.2.3 Out of Control RPD for inter-analyst analysis.

Rejection Criteria – All organisms must be accurately identified.

Corrective Action - Both first and second analysts review the sample. The second analyst results are reported to the customer.

13.2.4 Calibration Verification criteria are not met: BOD Analysis

Rejection Criteria see section 8.4

Corrective Action- If the CCV fails, the data may still be used. If the failure persists, check cleanliness of the equipment and stability of the DO probe for subsequent runs. If a problem persists, the group supervisor or Regulatory Affairs Department is notified for further action.

13.2.5 Out of Control Blanks: Applies to Method Blank

Rejection Criteria- Blank depletion is greater than established limit of -0.2 mg DO/L and + 0.2 mg DO/L.

Corrective Action - If the average of the blanks fail, all data must be reported with a qualifier

13.2.6 Out of Control Laboratory Control Standards (LCS)

Rejection Criteria - If the performance of associated laboratory control sample(s) is outside of acceptance limits as listed in Section 12.

Corrective Action - All samples bracketed by the failed LCS must be reported with a qualifier.

13.2.7 Out of Control Duplicate Samples

Rejection Criteria - Lab-generated maximum RPD limit (as listed under precision in Section12)

Corrective Action - The sample and duplicate are reported with a qualifier.

14.0 RECORD KEEPING

Record keeping is outlined in SOP #030230, *Standards Logger, SOP #030227, Data Review* and SOP #030201, *Data Handling and Reporting*

15.0 QUALITY AUDITS

System and data quality audits are outlined in the ESC Quality Assurance Manual Version 13.0 and *SOP #010104, Internal Audits*.

16.0 REVISIONS

The Regulatory Affairs Department has an electronic version of this Quality Assurance Manual with tracked changes detailing all revisions made to the previous version. This version is available upon request. Revisions to the previous version of this appendix are summarized in the table below.

Document	**Revision**
Quality Assurance Manual Version 15.0 (Appendix XI)	General - Replaced the term “client” with the term “customer”. Also changed references to AIHA to AIHA-LAP or AIHA-PAT as appropriate. Table 8.1 – Updated Equipment List Table 8.2 – Revised ATC check frequency for pH meters to quarterly Tables 8.3A and 8.3B – Updated Agars Table 8.3C – Added pH=4 buffer Section 8.4 – Revised ATC check frequency for pH meters to quarterly Table 10.1 – Updated SOP list

1.0 SIGNATORY APPROVALS

Protozoa Laboratory
QUALITY ASSURANCE MANUAL

APPENDIX XII TO THE ESC
QUALITY ASSURANCE MANUAL

for

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2.0 *APPENDIX TABLE OF CONTENTS*

3.0 SCOPE AND APPLICATION

This manual discusses specific QA requirements for EPA Methods 1622 and 1623 to ensure that analytical data generated from the protozoan laboratory are scientifically valid and are of acceptable quality. Any deviations from these requirements and any deviations that result in nonconforming work must be immediately evaluated and their corrective actions documented.

4.0 LABORATORY ORGANIZATION AND RESPONSIBILITIES

ESC Lab Sciences offers diverse environmental capabilities that enable the laboratory to provide the customer with both routine and specialized services, field sampling guidance and materials and broad laboratory expertise. A brief outline of the organization and responsibilities as they apply to the ESC Quality Assurance Program is presented in Section 4.0 in the *ESC Quality Assurance Manual.*

5.0 PERSONNEL AND TRAINING

5.1 PERSONNEL

Dr. Christabel Fernandes-Monteiro, with a Ph.D. in Applied Biology, is the Department Manager of Biology. She oversees supervision of laboratory operations in the Mold, Aquatic Toxicity, Microbiology, Protozoan and BOD laboratories. Her responsibilities include assurance of reliable data through monitoring of quality control, corroborating the analysis performed, protocol development, coordination with customers regarding sample analysis, scheduling of tests and overall production in all sections within the Biology Laboratory, including management of staff. In her absence, Stacy Kennedy assumes her responsibilities in the Protozoan laboratory.

Stacy Kennedy, with a M.S. degree in Biotechnology, is the Principal Analyst for the Protozoan laboratory. Ms. Kennedy is proficient in performing EPA Methods 1622 and 1623. She gained analytical experience from a certified EPA Protozoan Principal Analyst and obtained additional training on microscopic techniques. Also, she frequently reviews EPA online training modules related to the methods being performed.

5.2 TRAINING

The Principal Analyst trains all new analysts in the Protozoan laboratory according to ESC protocol and EPA guidelines. ESC’s training program is outlined in SOP #350405, *Training Protocol for Method 1622/1623* and is in accordance with *Supplement 2 to the 5th Edition of the Manual for the Certification of Laboratories Analyzing Drinking Water.* Documentation of training received and authorizations to perform these analyses are maintained within the department.

6.0 FACILITIES AND LABORATORY SAFETY

6.1 FACILITIES

The main area of the laboratory is approximately 420 square feet and has roughly 67.5 square feet of bench area. The microscope dark room is located in the back of the laboratory is 36 square feet with 18 square feet of bench area. Additionally, there is 40 square feet of storage and fluorescent lighting throughout all areas. The air handling system is a five-ton Trane split unit with natural gas for heating. The laboratory reagent water is provided through the Siemans Elga UltraPure deionizer system. Biohazard containers are located in the protozoan laboratory and Stericycle serves as ESC's biological waste disposal contractor. ESC's building information guides and site plan are shown in Appendix I.

6.2 LABORATORY SAFETY

- Laboratory access is limited when work is being performed.
- All procedures where infectious aerosols or splashes may occur are conducted in Biological Safety II cabinets.
- The following Biosafety Level 2 (BSL2) guidelines are adhered to:
    - Closed-toe shoes are worn in the laboratory
    - Floors and work surfaces are cleaned on a regular basis
    - Emergency numbers are posted in the laboratory
    - Biological safety hoods are tested and certified annually
    - Laboratory personnel are trained in the use of the biological spill kit and emergency safety equipment
- ESC's laboratory safety guidelines are detailed in SOP #350408, *Biosafety Guidelines for the Cryptosporidium Laboratory*.

7.0 SAMPLING PROCEDURES

7.1 FIELD SAMPLING PROCEDURES, SAMPLE STORAGE, AND HANDLING

- A description of field sample collection, containers, storage, temperature, and transport times are located in SOP #350402, *Method 1622/1623 Field-Filtering Sample Collection and Laboratory Delivery* and SOP #350403, *Method 1622/1623 Bulk Sample Collection and Laboratory Delivery*.
- Laboratory sample identification, handling, tracking and the information recording system are found in the following procedures: SOP #350404, *Method 1622/1623 Sample Receiving* and SOP #060105, *Sample Receiving*.

- A Chain of Custody and LT2 Sample Collection Form accompanies all compliance samples received by the lab. This is necessary to prove the traceability of the samples and to document the change in possession from sampling through receipt by the laboratory. Prior to analysis, all samples are checked for integrity.
- Following analysis, the slides are maintained for a minimum of 2 months and disposed of following all State and Federal regulations governing disposal.
- Requirements for sample acceptance are located in SOP #350404, Section 7.0, *Method 1622/1623 Sample Receiving*.

8.0 EQUIPMENT

Laboratory equipment specifications are outlined in SOP #350407, *Microscope Analyst Verification*, SOP #350410, *IEC CRU-500 Centrifuge Operation and Maintenance*, SOP #350411, *Lab-Line Multi-Wrist Shaker Operation and Maintenance* and SOP #350413, *Olympus BX40 Microscope Operation and Maintenance.*

8.1 EQUIPMENT LIST

TABLE 8.1 – LABORATORY EQUIPMENT LIST: MAJOR ITEMS - Protozoan

Item	***Manufacturer***	***Model***
Flow control valve	Plast-o-matic	FC050B
Centrifugal pump	Jabsco	18610-0271
Graduated container	Nalgene	20 Liter Carboy
Laboratory shaker	Lab-Line	3587-4
Laboratory shaker side arms	Lab-Line	3589
1500 XG swinging bucket centrifuge	Damon/IEC Division	CRU-5000
Sample mixer/rotator	DYNAL	Cat#: 947.01
Magnetic Particle Concentrator	DYNAL	MPC-1
Magnetic Particle Concentrator	DYNAL	MPC-S
Magnetic Particle Concentrator	DYNAL	MPC-6
Flat-sided sample tubes	DYNAL	Cat#: 740.03
Epifluorescence/differential interference contrast microscope	Olympus	BX-40
Excitation/band pass microscope for fluorescein isothiocyanate (FTIC)	C-Squared	UN3100
Excitation/band pass filters for 4’,6-diamidino-2-phenylindole (DAPI)	C-Squared	UN41001

8.2 EQUIPMENT PREVENTIVE MAINTENANCE, EQUIPMENT CALIBRATION

Calibration of equipment is conducted on an annual and/or semi-annual basis and is documented. Maintenance and cleaning is conducted on an as needed basis or per manufacturer’s instructions. Equipment cleaning is specified in SOP #350412, *Cryptosporidium Laboratory Equipment Cleaning.*

TABLE 8.2 – PREVENTATIVE MAINTENANCE AND CALIBRATION FOR LABORATORY EQUIPMENT

INSTRUMENT	*P. M. DESCRIPTION*	*FREQUENCY*
Balances (Top Loader or Pan)- capability of detection of 0.1 g for a load of 150 g, and 1 mg for a load of 10 g or less.	Service/Calibration (maintenance and calibration check) Verified using ASTM Class 1,2, or 3 weights Non-reference weights should be calibrated	Annually by a qualified independent service tech Monthly Every six months
pH meter	Electrodes should be maintained Slope determination Meter standardized with pH 7.0, and either 4.0 or 10.0 pH buffers	Per manufacturer's instructions Monthly (Acceptable slope= 95-105%) Each use period
Thermometer- Glass and Electronic Continuous recording devices Reference Thermometer	Calibration checked with NIST certified traceable reference thermometer or one traceable to a NIST reference thermometer Re-calibrated Re-calibrated	Annually Annually Annually by a certified service technician
Autoclave	Maintenance Check Sterilization efficiency Maximum temperature registering Automatic timing mechanism Clean door seals, drain screen, remove debris	Annually by a qualified independent technician Monthly- Geobacillus stearothermophilus ampoule With each use–Chemical Indicator Strip With each use Quarterly As needed
Conductivity Meter	Calibrated using a low level certified traceable standard or determine cell constant	Monthly per manufacturer instructions
Refrigerator	Record temperature	Daily when in use
Micropipettes	Calibrated	Annually
Hand Tally or Digital/Electronic Counter	Checked to confirm accuracy and operational status	Periodically as needed
Centrifuge	Clean and disinfect after spills/leakage Service/Calibration	Periodically as needed Annually by a qualified service technician
Microscope	Service Alignment and adjustment of optics Stage Micrometer calibration Kohler illumination procedure	Annually With each use Annually With each use
DI unit	Manufacturer's instructions	As needed

8.3 STANDARDS AND REAGENTS

Table 8.3A: Stock solution sources, description and related information.
(subject to revision as needed)

Description	Vendor	Concentration	Storage Req.	Expiration
Sodium Hydroxide (NaOH)	VWR	Concentrated	ambient	1 year
Hydrochloric Acid (HCl)	VWR	Concentrated	ambient	1 year
Laureth-12	VWR	--	ambient	1 year
Tris Stock	VWR	--	ambient	NA
EDTA	Sigma-Aldrich	0.5 M, pH 8.0	2 - 8°C	1 year
Antifoam A	Sigma-Alrich	--	ambient	NA
Dynabeads® GC-Combo/Crypto	Idexx	--	2 - 8°C	2 years
Direct labeling kit for det. of oocysts and cysts, Merifluor Cryptosporidium/Giardia	VWR	--	2 - 8°C	1 year
Phosphate Buffered Saline (PBS) Solution, pH 7.4	Sigma-Aldrich	--	ambient	1 year
4’, 6-diamidino-2-phenylindole (DAPI) stain	Waterborne, Inc	2mg/mL	2 - 8°C /Darkness	18 months/When positive control fails
Purified, live *Cryptosporidium* oocysts stock suspension	WSLH	--	2 - 8°C	1 month
Purified, live *Giardia* cysts stock suspension	WSLH	--	2 - 8°C	1 month

Table 8.3B: Working Solution Descriptions and Related Information.
(subject to change)

Solution	Concentrations	Storage Requirements	Expiration
Sodium Hydroxide (NaOH)	6.0 N	ambient	1 year
Sodium Hydroxide (NaOH)	1.0 N	ambient	1 year
Hydrochloric Acid (HCl)	6.0 N	ambient	1 year
Hydrochloric Acid (HCl)	1.0 N	ambient	1 year
Hydrochloric Acid (HCl)	0.1 N	ambient	1 year
Laureth-12 stock vials	10g/100mL	0°C to –20°C	1 year
Tris Working Solution	1 M, pH 7.4	ambient	3 months
Elution Buffer	--	ambient	1 week
1X SL Buffer A Solution	--	2 - 8°C	Prepared Daily
Staining 1X wash buffer	--	ambient	3 months
Phosphate Buffered Saline (PBS) Solution, pH 7.4	--	ambient	1 week
Working DAPI stain	10µL Stock/25ml Phosphate Buffer	Ambient/Dark container	1 day

9.0 LABORATORY PRACTICES

9.1 REAGENT GRADE WATER

ASTM Type II grade water: Reagent water is analyzed for total chlorine, heterotrophic bacteria, specific conductance, pH, total organic carbon, ammonia and organic nitrogen on a monthly basis. Reagent water is tested for metals: Lead, Cadmium, Chromium, Copper, Nickel, and Zinc on an annual basis. A Use Test is performed on a quarterly basis. Reagent water used for preparing reagents must meet the following acceptance criteria:

Parameter	Limits	Frequency
Conductivity	>0.5 megaohms or <2 µmhos/cm (µseimens/cm) at 25 deg C	Monthly
Pb, Cd, Cr, Cu, Ni, Zn	Not greater than 0.05mg/L per contaminant. Collectively not greater than 0.1mg/L	Annually
Total Residual Chlorine	< 0.1 mg/L	Monthly
Heterotrophic Plate Count	<500 CFU/mL or MPN <500/mL	Monthly

9.2 GLASSWARE WASHING AND STERILIZATION PROCEDURES

Glassware washing and preparation/sterilization procedures are outlined in SOP #350414, *Steamscrubber Operation and Maintenance*, SOP #350408, *Biosafety Guidelines for Cryptosporidium Laboratory* and SOP #350412, *Cryptosporidium Laboratory Equipment Cleaning*.

Laboratory glassware and plasticware are checked for acceptability prior to use. Glassware acceptance criteria are documented in SOP #350412, *Cryptosporidium Laboratory Equipment Cleaning*.

10.0 ANALYTICAL PROCEDURES

10.1 A list of laboratory SOPs associated with the protozoan laboratory can be found in the following table:

TABLE 10.1: PROTOZOAN DEPARTMENT SOPs

This Table is subject to revision without notice

SOP #	Title
350401	Isolation & Identification of *Giardia* and/or *Cryptosporidium* in Water
350402	Method 1622/1623 Field-Filtering Sample Collection and Laboratory
350403	Method 1622/1623 Bulk Sample Collection and Laboratory Delivery
350404	Method 1622/1623 Sample Receiving
350405	Training Protocol for Method 1622/1623
350406	Data Collection and Verification for Method 1622/1623

SOP #	Title
350407	Microscope Analyst Verification
350408	Biosafety Guidelines for *Cryptosporidium* Laboratory
350409	IPR, OPR and MS Spiking Procedures and Corrective Actions
350410	IEC CRU-5000 Centrifuge Operation and Maintenance
350411	Lab-Line Multi-Wrist Shaker Operation and Maintenance
350412	*Cryptosporidium* Laboratory Equipment Cleaning
350413	Olympus BX40 Microscope Operation and Maintenance
350414	Steamscrubber Dishwasher Operation and Maintenance

10.2 The following references are used for analytical procedures conducted in the laboratory:

- EPA. Method 1623: *Cryptosporidium* and *Giardia* in Water by Filtration/IMS/FA, December 2005.
- EPA. Method 1622: *Cryptosporidium* in Water by Filtration/IMS/FA, December 2005.
- EPA. Microbial Laboratory Guidance Manual for the Final Long Term 2 Enhanced Surface Water Treatment Rule. February 2006.
- Supplement 2 to the Fifth Edition of the Manual for the Certification of Laboratories Analyzing Drinking Water, EPA 815-F-12-006, November 2012

11.0 QUALITY CONTROL CHECKS

11.1 ESC participates in proficiency testing (PT) through the analysis of spiked vials received from Wisconsin State Laboratory of Hygiene (WSLH) and analyzed according to study instructions and the ESC SOP. When the analysis is completed, the results are reported to the PT sample provider who issues the testing results as either a “pass” or “fail” to all regulatory agencies, as requested by ESC. If the laboratory fails a PT round, a follow-up test is performed in an attempt to meet the necessary requirements for proficiency. If the follow-up test results in a second failure, the laboratory takes part in re-training .

11.2 An Initial Precision and Recovery test (IPR) is performed prior to the first time the method is used and at any time the method or instrumentation is modified. The IPR consists of four reagent water samples spiked with 100-500 oocysts from a spiking vial received from Wisconsin State Laboratory. Recoveries from the IPR must fall within the EPA approved QC limits: Oocysts= 24- 100% and Cysts= 24-100%, and the Relative Standard Deviation (RSD) of the four recoveries should be less than or equal to 55% for Cryptosporidium, and less than or equal to 49% for Giardia.

11.2 An Ongoing Precision and Recovery sample (OPR) is analyzed once weekly or per 20 samples, and before any field samples are processed. The OPR is spiked with 100-500 cysts and/or oocysts from a spiking vial received from the WSLH. Recoveries from the OPR must fall within EPA approved QC limits: Oocysts = 33-100% and Cysts = 14-100%.

11.3 A Method Blank is also analyzed at least once weekly or per every 20 samples processed, and before any field samples are processed. The Method Blank must be free of test organisms and serves as a sterility control on the analytical system.

11.4 If either sample falls outside acceptance parameters, corrective action must be taken and the samples re-analyzed until the QC criteria are met. Customer samples may only be analyzed following acceptable QC sample results. Quality control information is located in SOP #350409, *IPR (Initial Precision and Recovery), OPR (Ongoing Precision and Recovery) and MS (Matrix Spike sample), Spiking Procedures and Corrective Actions.*

11.5 Customers are required to send a duplicate sample early in their sampling schedule and then again after every 20 field samples collected. This duplicate is utilized in the laboratory as a Matrix Spike (MS). The MS is spiked in the same manner and with the same number of organisms as the OPR to determine the effects of the matrix on the analytical process. The recoveries from matrix spike /matrix spike duplicates must fall within the EPA approved QC limits for oocysts= 13-111% and cysts= 15-118%.

11.6 Inter/intra-analyst precision is determined, at least monthly for verification of analyst performance to assess and maintain consistency in slide examination among analysts. Quality Control information is located in SOP #350407, *Microscope Analyst Verification*.

11.7 Control charts of OPR and MS recoveries are maintained in the laboratory. The control charts graphically display the results of continuing performance when using Methods 1623 and 1622. If recoveries fall outside the control limits, or declining trends are observed, corrective action must be taken to investigate the potential causes of the outlying result.

11.8 Positive staining controls are used to verify that the FITC and DAPI stains are fluorescing at the appropriate intensity and uniformity. Negative staining controls are examined to verify that no oocysts or interfering particles are present. Both staining controls are examined using protocols as stated in ESC SOP # 350401 and meet criteria for EPA 1623 or EPA 1622.

11.9 IMS controls are used in the event of low recoveries to rule out any IMS steps as the cause. The IMS controls are processed beginning with the IMS procedure using protocols as stated in ESC SOP #350401, and meet criteria for EPA 1622 or EPA 1623.

12.0 DATA REDUCTION, VALIDATION AND REPORTING

12.1 DATA REDUCTION

- The analyst performs the data calculation functions and is responsible for the initial examination of the finished data. Data reduction steps applied to the raw data are outlined in SOP #350401, *Isolation and Identification of*

Cryptosporidium and/or Giardia in Water and SOP #350406, *Data Collection and Verification for Method 1622/1623.*

12.2 VALIDATION

Guidelines for data validation are found in SOP #350406, *Data Collection and Verification for Method 1622/1623.* In general, data integrity involves reviewing all data entries and calculations for errors, reviewing all documentation to assure that sample information is correct and complete, and that the tests have been performed appropriately and within the appropriate sample holding times. The secondary analyst reviews the quality of data based on the following guidelines:

- The appropriate SOP is followed
- Sample preparation is correct and complete
- Analytical results are correct and complete

12.3 REPORTING

Reporting procedures are documented in SOP #350406*, Data Collection and Verification for Method 1622/1623.* Depending on the needs of the customer, one or more of the following may be included: Case narrative, Chain of Custody, Internal Chain of Custody, Final Report, Raw Data, etc. When the package involves more than just QC forms, it must contain a Table of Contents and Pagination. When the package is complete, it must be reviewed first by the Primary Analyst followed by the Department Manager or second qualified analyst. The final reviewer signs that the information is complete and the package is ready for submission to the customer. A copy of the final package must be kept on file.

13.0 CORRECTIVE ACTION

13.1 In the event that a nonconformance occurs in conjunction with the analytical batch, a corrective action response (CAR) form must be completed. The cause of the event is stated on the form and the measures taken to correct the nonconformance clearly defined. The effectiveness of the corrective action must be assessed and noted. The CARs are kept on file by the Regulatory Affairs Department. Corrective action procedures are documented in SOP #030208, *Corrective and Preventive Action*

Corrective action procedures that are specific to Cryptosporidium and Giardia analyses are documented in the SOP #350409, *IPR (Initial Precision and Recovery), OPR (Ongoing Precision and Recovery) and MS (Matrix Spike sample), Spiking Procedures.*

13.2 Required Corrective Action

Control limits have been established for each type of analysis. When these limits are exceeded, corrective action must be taken. Calculated sample spike control limits are also used.

All samples and procedures are governed by ESC's quality assurance program. General corrective actions are as follows; however additional and more specific direction is provided in the specific determinative procedure. For more information, see the appropriate determinative SOP.

13.2.1 If a spiked sample or set of samples fails to meet quality control limits

Rejection Criteria - Recoveries from the OPR fall beyond the approved QC limits.

Corrective Action - Examine the spiking suspension organisms directly. To determine if the failure of the spike is due to changes in the microscope or problem with the antibody stain, re-examine the positive staining control, check Köhler illumination, and check the fluorescence and DAPI. To determine if the failure of the spike is attributable to the separation system, check the system performance by spiking a 10mL volume of reagent water with 100-500 cysts and/or oocysts and processing the sample through the IMS, staining and examination procedures. Recoveries should be greater than 70% of the expected concentration. If the failure of the spike is attributable to the filtration/elution/concentration system, check the system performance by processing spiked reagent water according to the method and filter, stain and examine the sample concentrate. This process is performed until the cause of the failure is isolated and corrected. The sample then must be re-analyzed until acceptable results are achieved.

13.2.2 Method Blank contains positive organism when analyzed.

Rejection Criteria – The Method Blank must be free of test organisms and serves as a sterility control on the analytical system.

Corrective Action - Equipment used to process the sample may be cleaned and/or replaced. Reagents used to process the sample may be disposed of and new reagents purchased or prepared. A new method blank is prepared and analyzed. This process is repeated until the method blank passes the acceptance criteria.

13.2.3 Inter/intra-analyst precision analyses are beyond ±10%.

Rejection Criteria – Results for inter and/or intra-analyst precision must be within 10% of original results.

Corrective Action - The differences are discussed between analysts until a consensus is found.

13.2.4 Holding time on sample exceeded or not received at appropriate temperature.

Rejection Criteria - The sample not received on day of collection must be received at the laboratory at ≤ 20.0°C and not frozen, and within 96 hours holding time.

Corrective Action - The samples must be re-collected.

13.2.5 Positive and Negative staining controls fail.

Rejection Criteria - If a positive and negative staining control fails all slides that were stained in that batch have failed and samples must be re-collected.

Corrective Action - If positive staining control fails due to faintness, fading or diffusion of the DAPI stain, the holding time may be reduced, or the concentration of the DAPI staining solution may be adjusted so that fading or diffusion does not occur. This process is performed until the cause of the failure is isolated and corrected. The sample then must be re-analyzed until acceptable results are achieved.

14.0 RECORD KEEPING

Record keeping is outlined in SOP #030230, *Standards Logger, SOP #030227, Data Review* and SOP #030201, *Data Handling and Reporting*

Hard copy data of benchsheets and slide examination forms for all compliance monitoring samples, including both field and MS samples, and OPR samples and MB are archived. Benchsheets and slide examination forms for all ongoing PT samples are stored in the laboratory. Documentation for IPR and initial PT data for each method variation used for compliance samples is also archived in the laboratory.

15.0 QUALITY AUDITS

System and data quality audits are outlined in the ESC Quality Assurance Manual Version 13.0 and *SOP #010104, Internal Audits*.

16.0 REVISIONS

The Regulatory Affairs Department has an electronic version of this Quality Assurance Manual with tracked changes detailing all revisions made to the previous version. This version is available upon request. Revisions to the previous version of this appendix are summarized in the table below.

Document	**Revision**
Quality Assurance Manual Version 15.0 (Appendix XII)	General - Replaced the term “client” with the term “customer” Table 8.3A – Updated vendors Section 11.5 – Added MS/MSD criteria

1.0 SIGNATORY APPROVALS

RADIOCHEMISTRY LAB QUALITY ASSURANCE MANUAL

APPENDIX XIII TO THE ESC QUALITY ASSURANCE MANUAL

for

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Prepared by

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NOTE: The QAM has been approved by the following people.

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Jim Brn

Jim Brownfield, Compliance Director 615-773-9681

Steve Miller

Steve Miller, Quality Assurance Director, 615-773-9684

2.0 APPENDIX TABLE OF CONTENTS

3.0 SCOPE AND APPLICATION

This manual discusses specific QA requirements for general analytical protocols to ensure analytical data generated from the Radiochemistry Laboratory are scientifically valid and are of acceptable quality. Any deviations from these requirements and any deviations that result in nonconforming work must be immediately evaluated and their corrective actions documented.

4.0 LABORATORY ORGANIZATION AND RESPONSIBILITIES

ESC Lab Sciences offers diverse environmental capabilities that enable the laboratory to provide the customer with both routine and specialized services, field sampling guidance and materials, and broad laboratory expertise. A brief outline of the organization and responsibilities as they apply to the ESC Quality Assurance Program is presented in *Section 4.0 in the ESC Quality Assurance Manual.*

5.0 PERSONNEL AND TRAINING

5.1 PERSONNEL

Ron Eidson, with a BS degree in Chemistry, is the Director of Radiochemistry and is responsible for the overall production of the Radiochemistry Laboratory; including the management of the staff and scheduling. Mr. Eidson has 28 years of hands-on experience in radiochemical analyses and 25 years in Laboratory Management. He developed an expertise in uranium, radium and thorium while managing a lab at a uranium processing facility. He later launched his own radiochemical testing lab and served as Lab Director and Radiation Safety Officer for 20 years. Ron has provided radiological consultation on projects for the NRC, DoD, DOE, EPA, USACE and for many decommissioning and industrial sites. He is often called on to use his exceptional knowledge and understanding of radiochemical processes to solve complicated matrix issues. In his absence, Raymond Thomas assumes responsibility for departmental decisions in the Radiochemistry Laboratory.

Raymond Thomas , with a BS Chemistry and BA Physics, is the QA Officer for the Radiochemistry Laboratory. Mr. Thomas has 28 years of experience in radiochemical analyses. He develops, updates, and maintains Standard Operating Procedures; calibrates and maintains instrumentation for radiochemical analysis; provides an independent review and approval of analytical data and reports; and conducts internal audits.

5.2 TRAINING

5.2.1 All new analysts to the laboratory are trained according to ESC protocol. ESC's training program is outlined in *SOP 030205 Technical Training and Personnel Qualifications.* Training is intended to provide personnel with the information and guidance needed to help maintain a safe work environment for the production of quality results. The following training is provided for all employees and contract personnel:

- Radiation Safety training upon hire and annually thereafter.
- Written training through the use of laboratory Standard Operating Procedures (SOP's). Technicians must read and sign a certificate of understanding of the latest version of the SOP before they are released to perform that job.
- On the job training is used to train personnel in hands-on use of the method and instrumentation.
- Initial Demonstrations of Capability (IDOCs) and Continuing Demonstrations of Capability (CDOCs) are used to demonstrate the ability to perform a method satisfactorily.
- Analyst training records are maintained on file within the department.
- Training courses or workshops on specific equipment, analytical techniques or laboratory procedures are conducted from time to time. The documentation is retained along with other training records.
- Safety training is conducted monthly.
- Data integrity and computer security training is conducted upon hire and annually thereafter.

6.0 FACILITIES, LABORATORY SAFETY, AND LABORATORY WASTE

6.1 FACILITIES

ESC's radiochemical lab currently occupies 7500 square feet in Broken Arrow, OK.

- 24 hour monitored access for the security of samples and data
- Controlled and separated sample storage areas
- Unencumbered work spaces in each lab
- Fully integrated hood system to remove any toxic or hazardous fumes that might be evolved when using organic solvents or that may be formed during an acid digestion. The laboratory fume hood face velocity is checked monthly for optimum face velocity.
- Laboratory Information Management System (LIMS) for sample tracking
- On-site and secure data archive area
- File backup to prevent loss of data

6.2 LABORATORY SAFETY

It is management's responsibility ensure that the work environment is safe for all employees and that conditions facilitate correct performance of the environmental tests. The following are just a few measures taken at ESC:

- Sign In Log – all employees and visitors are required to sign in and out of the laboratory. The last employee present is not permitted to perform analyses alone.
- Protective Eyewear, Gloves and Lab Coats – these are provided and are to be worn at all times in the sample preparation section of laboratory.
- TLD (Thermoluminescent Dosimeter) – badges are provided for all employees and visitors to detect possible beta and gamma radiation sources and are to be worn at all times in the laboratory.
- Training – All employees receive training relevant to their particular job prior to beginning the job. Standard Operating Procedures must be read and are available to reference at all times. Monthly Health & Safety training is provided to reiterate the need for attention to detail and Radiation Safety Training is conducted upon hire and annually.
- Safety Equipment – safety showers, eyewashes and fire extinguishers are checked monthly to ensure proper functionality.
- Adequate space and equipment – are provided as available to ensure optimum safety of our employees.
- Internal Audits – are conducted at least annually to ensure laboratory procedures are conducted not only in accordance with quality standards but in a safe manner.
- Constant monitoring – Airflow, temperature and barometric pressure are monitored to ensure a comfortable environment safe from fumes.
- Radiation Surveys – All solid samples are surveyed upon receipt and segregated if radiation is found. Laboratory countertops, floors and instrumentation are frequently surveyed to prevent contamination.
- Segregation – Incompatible areas are separated; standards and samples are segregated as is glassware used for elevated samples.
- Good Housekeeping – daily, monthly and quarterly checklists are followed to ensure cleanliness.

6.3 LABORATORY WASTE

As an active member of the environmental industry, ESC is aggressively interested in the preservation and cleanup of our environment. Any waste generated in the laboratory is disposed in a responsible manner. It is a policy at ESC that all hazardous or radioactive samples and any waste corresponding to these samples are returned to the client for disposal. In this way, ESC minimizes the amount of radioactive material on site to primarily sources and standards.

Prior to disposal solid wastes and chemicals are properly labeled and packaged. They are then transported to a disposal facility. ESC's main disposal methods are:

- Non-hazardous/non rad soil samples - dumped into waste bin.
- Non-hazardous/non rad water samples - neutralized with lime or Sodium Hydroxide and flushed down sink with sufficient water to thoroughly wash out the sink and pipes.
- Lead Waste - Disposed by a licensed facility or recycled.
- Acid Waste - Neutralized with lime or Sodium Hydroxide and flushed down the acid drain with copious amounts of water.
- Organic Waste From Extractions - Disposed of by a licensed facility or recycled.
- Mercury Waste - Disposed by a licensed facility.
- Oil Waste - If toxic, the oil waste will be disposed of by returning to the client or it is transported to a disposal facility.
- Bioassay Samples – flushed down drain or stool.
- Empty chemical or acid containers are thoroughly rinsed before placing in the general trash. Empty sample containers are disposed of in the general trash after the customer's name has been made unreadable.

7.0 SAMPLING PROCEDURES AND HANDLING OF SAMPLES

7.1 SAMPLING PROCEDURES

SOP GEN-18 outlines the instructions that ESC personnel use to collect specific liquid samples from a customer. The laboratory does not currently provide services for solid samples or development of site specific, customized sampling plans. The sampling and testing directives of the customer are followed with the customer assuming responsibility for the suitability of the sampling plan and satisfaction of permit requirements.

7.2 HANDLING OF SAMPLES

The complete procedure for sample control is outlined in GEN_01. A sample is tracked at ESC from the moment it is received to a point in time that the sample can be disposed of properly. It is logged in as described below and all paper work involved is distributed to parties of interest in a timely fashion. Any special information is clearly stated to avoid delays or the possibility of missed holding times.

Sample Acceptance Policy

When a sample arrives, the sample acceptance policy is implemented by sample custodial personnel. Each sample must meet the following sample acceptance criteria or it is flagged to clearly indicate the nature and substance of the variation:

- A Chain of Custody including a unique sample identification, the date and time of collection, collector's name, preservation type, sample matrix and any special remarks concerning the sample or project;
- Proper and durable sample labeling including a unique sample identification;
- Use of appropriate sample containers and preservation;
- Adherence to specified holding times;
- Adequate sample volume to perform the necessary tests; and
- No signs of damage, contamination or leakage.

When the sample does not meet the sample acceptance criteria, ESC will:

- Retain correspondence and/or records of conversations concerning the final disposition of rejected samples; or
- Fully document any decision to proceed with the analysis of samples not meeting acceptance criteria.
- The condition of these samples will be noted on the COC and lab receipt documents.
- The analysis data will be appropriately "qualified" on the final report.

In the event holding times are exceeded or improper preservations or containers are used, the client is notified immediately. If the client approves continuation of analyses, any non-conformances are clearly stated on the final report.

Sample Survey and Inspection

Upon arrival at the laboratory, a sample container's exterior is inspected and surveyed for damage or contamination. All shipping containers should be opened in a well-ventilated area. If hazardous materials are suspected, the container will be opened under a hood.

Prior to the removal of samples, absorbent pads should be laid out to receive sample bottles. The SC will note on the Sample Log-in Sheet the following:

- Condition of container, noting any damage, etc.
- Presence/absence of COC seals and their condition
- Sample condition (intact, broken, leaking, cold or ambient, headspace, surface contamination, etc.).
- Presence/absence of sample labels.
- Compare for agreement between sample labels and COC record.
- Samples that are not listed on the COC record will be noted and the client contacted.
- Odors noticed after opening the shipping container are noted.

Sample Log-in and Labeling

All sample information from the Chain of Custody is entered into the Laboratory Information Management System (LIMS). The SC will assign a unique eight digit laboratory log number to each sample. Laboratory sample numbering is comprised of a log number followed by -01 for the first sample, -02 for the second sample, etc. If there is more than one sample container per sample (i.e. one container preserved with nitric acid for metals and three VOA vials for volatiles), the individual containers will be labeled with the proper eight digit log number plus the two digit sample ID plus the a unique letter (A,B,C etc.) for each container. A durable label containing this laboratory ID number along with the proper preservative and analyses requested is placed on the sample container for identification throughout the entire analytical process. A file folder with the log number printed on it will be created to contain all the analytical information relevant to the project including: signed airbill, signed chain-of-custody, work sheets, raw data, QC reports, analytical report, etc.

Sample Splitting and Preservation

When clients supply their own containers or when bulk samples are received, the SC will split samples and preserve according to EPA requirements giving sufficient aliquots for each analytical procedure that is to be performed. SOP GEN_01 describes sample splitting procedures in greater detail.

- Water Samples – When samples arrive that require non-rad analyses, the SC will split and label the sample into appropriate containers.
- Sediment/Soil Samples – The sample will be made homogeneous after any portion has been removed by one or all the following procedures:
    - Stirring
    - Air drying and grinding
    - Particle separation
    - Quartering

Sample Storage, Custody and Security

Sample control is primarily the responsibility of the Sample Custodian and is maintained at ESC through the use of several tracking systems designed to protect sample integrity from login to disposal or return. Samples are placed in designated storage areas except during laboratory analysis. All laboratory personnel who receive samples are responsible for the care and custody of samples from the time each sample is received until samples are returned to storage. Any subset of the sample will be kept in a designated storage area which is controlled by the sample custodian. At the beginning of every work day all the sample storage areas are unlocked by laboratory personnel. At the end of every day the sample storage areas are locked, and the laboratory is locked with a continuously monitored alarm.

Complete details are outlined in SOP GEN_01.

Sample Disposal

Upon completion of the analysis, the samples are placed on an archive list. Once a month, the SC is responsible for collecting all samples on the archive list that have been completed 30 days or more unless other arrangements have been made. Completed samples and all remains are properly disposed of or returned to the client as necessary. Any sample considered hazardous or radioactive is returned to the client for disposal.

This procedure is fully described in SOP GEN_20.

8.0 EQUIPMENT

8.1 EQUIPMENT LIST

LABORATORY EQUIPMENT LIST: MAJOR ITEMS – Rad Lab
This table is subject to revision without notice

Title	QTY	Make	Model	Serial
Chemchek KPA-11 Kinetic Phosphorescence Analyzer w/ Gilson Sample Changer and Gilson Dilutor 401 Syringe Pump	2	Chemchek	KPA-11	1418986; 649025031; 91-5050024
Canberra 2404 Alpha/Beta Counter	5	Canberra	2404	1090352; 988600/787196;488584
Packard Tri-Carb 2550TR Liquid Scintillation Counter	1	Packard	2550TR	103332
Packard Tri-Carb 2200CA Liquid Scintillation Counter	1	Packard	2200CA	102180
Canberra LB4100 Alpha/Beta Counter	3	Canberra	LB4100U2	13000001; 13000002; 13000000; 117
Canberra Genie 2000 Alpha Spectrometer System	2	Canberra	Genie 2000	see description
Canberra Genie 2000 Gamma Spectrometer System	2	Canberra	Genie 2000	see description
IRIS Intreped II Dual-View ICP	1	Therm	Intreped II	12351
Mercury Analyzer	1	Perkin Elmer	3030B	

8.2 EQUIPMENT MAINTENANCE

All equipment is properly maintained, inspected, and cleaned as an ongoing process according to SOP GEN_17.

Preventative Maintenance

ESC regularly performs preventative maintenance, such as checking fluid levels, to ensure that our equipment runs properly and smoothly with limited down time in accordance with SOP GEN_17.

Troubleshooting and Routine Maintenance

Troubleshooting begins with routine maintenance. It may be performed by ESC personnel or trained personnel from the manufacturer. A controlled log for maintenance is assigned to each instrument as well as for electrode(s). Each log is maintained by the analyst responsible for analytical performance with the particular instrumentation.

Equipment subjected to overloading or mishandling, which gives suspect results, or is proven to be defective will be placed out of service by the Laboratory Tag-Out System (GEN_05). When this occurs, previous calibrations and/or analyses are examined for any effect this may have had.

ESC has back up instrumentation to lessen down-time and ensure timely data delivery.

Equipment Checks

Equipment Check	***Frequency***
Analytical balances	Daily
Oven Temp	Daily
Frig Temp	Daily
Balance Calibration	Daily
DI Water Conductivity	Daily
Pipettes Calibrated	Quarterly
Electronic Pipets	Daily
Fire Extinguisher	Monthly/annual
Hood Velocity	Monthly
Survey Meters	Upon use/annual
Thermometers-liquid	Initial & annually
Thermometer gun	quarterly
Weights	Every 5 years
Air filters replaced	Monthly
Vacuum pump oil	Qtrly or as needed
Hood motors	Qtrly or as needed
Volumetric glassware	Initial/ as needed

8.3 INSTRUMENT CALIBRATION FOR RADIOCHEMISTRY

These and other points such as calibration and verification of reference standards can be found in the GEN_25 and method specific SOP's.

Initial Calibration

Sources used to determine detector efficiency are NIST traceable, prepared from NIST traceable or from a recognized entity such as EPA, DOE or IAEA.

Alpha Spectrometry prepared standards are to be checked by a material mass balance remaining from neodymium fluoride precipitation and rinses. Propagated uncertainties are to be determined.

Check sources are only to be used to verify calibrations and not used for efficiency determinations.

Instrument Calibration Verification

Daily source checks traceable to NIST or equivalent are used to monitor calibration. These sources are separate from the Initial calibration source. These sources are used to monitor counting efficiency, FWHM and energy calibration. Energy calibration is the only adjustment that can be made. Control charts are used to determine whether results are with control limits. Limits are 3σ outlier and 2σ warning.

Background Checks

Background count rates will be determined for each radiation detector system on a routine basis, for systems in regular use. A 1000 minute background count is performed monthly to determine the background subtraction count (BSC). Shorter background counts are performed on a daily basis to monitor contamination on detectors. Alpha Spectroscopy backgrounds are performed weekly. Where applicable, the results of these measurements will be recorded in a log and plotted on a control chart. Appropriate investigative and corrective action will be taken when the measurement value falls outside the pre-determined range of control values. For liquid scintillation counters the background sample is counted prior to samples and for the same count time.

Sample Introduction

For systems in which samples are changed manually, check sources are measured daily. For systems with automatic sample changers, it may be more convenient to include the check source within each batch of samples and thus obtain a measurement of this source within each counting cycle.

For proportional counting systems, the plateau will be checked annually at a minimum. Response to the check source will be checked daily or before each use and after each gas change. Background measurements will be daily or before each use, to ensure that background radiation levels are within the expected range. For systems with automatic sample changers, background or reagent blank measurements will be included within each measurement cycle.

Alpha & Gamma Spectrometers

For alpha and gamma-ray spectrometry systems, energy calibration sources will be counted to determine the relationship between channel number and alpha or gamma-ray energy. The frequency of energy calibration checks depends on the stability of the system, but usually is performed daily for gamma spec. and alpha spec. The results of these measurements will be recorded and compared to predetermined limits to determine whether or not system gain and zero level need adjustment. Adjustments will be made as necessary.

Additional checks needed for spectrometry systems are the energy resolution of the system and the count rate of a check source. These will be performed daily or before each use and after system changes, such as power failures or repairs. This is to determine if there has been any significant change in the system. The results of these measurements will be recorded when the system is in use.

8.4 INSTRUMENT CALIBRATION FOR INORGANICS

Initial Calibration – Inductively Coupled Plasma

Prior to use, the Inductively Coupled Argon Plasma (ICP) is calibrated for every element and every line to be used. A daily calibration with a minimum of five points. The lowest point on the curve must be at or less than the LOQ. The r2 (linear regression) must be greater than or equal to 0.995 to ensure that the instrument has been calibrated accurately.

Continuing Instrument Calibration – Inductively Coupled Plasma

Initial Calibration Verification (ICV) is analyzed immediately following the standards. The ICV is from a different source as the standards and the result of the ICV must fall within 10% of the true value. The Continuing Calibration Verification (CCV) is from the same source as the standards and is analyzed after every ten samples and also must fall within 10% of the true value.

Mercury Analysis

All samples and standards are prepared and analyzed under E.P.A. Method 245.1 or 7470A/7471A. A five point standard curve is used with the sixth point going through zero. The r2 (linear regression) must be greater than or equal to 0.995 to ensure that the instrument has been calibrated accurately. Initial Calibration Verification (ICV) is analyzed immediately following the standards. The ICV is from a different source as the standards and the result of the ICV must fall within 10% of the true value. The Continuing Calibration Verification (CCV) is from the same source as the standards and is analyzed after every ten samples and also must fall within 20% of the true value.

9.0 LABORATORY PRACTICES

9.1 REAGENT GRADE WATER

ASTM Type II (DI) water is used in the laboratory for dilution, preparation of reagent solutions, and the final rinsing of glassware. It is free from interferences and other contaminants. After passing through two ion exchange canisters and one carbon filter canister, water purity is monitored by an indicator light at each outlet and at the filtration apparatus, and checked daily for conductivity.

9.2 GLASSWARE

Class A volumetric glassware is used by the laboratory for measuring trace constituents in organic and inorganic analysis. Laboratory contamination is minimized by using disposable beakers for digestion purposes when applicable. The Standard Operating Procedure GEN_15 for glassware and labware cleaning is followed to ensure the removal of all traces of parameters of interest and contaminants that could interfere with analysis.

10.0 ANALYTICAL PROCEDURES

10.1 A list of laboratory SOPs associated in the Radiochemistry Laboratory.

11.0 QUALITY CONTROL

NOTE: For specific guidance on each determinative method, including required quality control and specific state requirements/modifications, refer to the relevant laboratory standard operating procedure(s).

Method Blanks

A method blank is analyzed for each batch of 20 samples or less (5%) for each test method. ASTM Type II (DI) water is used in preparation of method blanks.

Standards

Reference standards will be used to determine counting efficiencies for specific radionuclides and calibration check standards for ICP, CV.Calibration Standards have to be certified by the National Institute of Standards and Technology (NIST), Environmental Protection Agency (EPA) or suppliers who participate in measurement assurance activities with NIST.

Chemical Standards will be prepared using methods reflecting a state of the analytical art and materials of known purity. Commercial chemical standards used will be traceable to NIST or certified by the EPA. Physical Standards and measuring devices will have currently valid calibrations traceable to national standards, primarily NIST.

Calibration certificates, when available, will indicate the traceability to national standards of measurement and will provide the measurement results and associated uncertainty of measurement and/or a statement of compliance with an identified metrological specification. These records can be found in the Quality Assurance Department.

Where traceability to national standards of measurement is not applicable, ESC Lab will provide satisfactory evidence of correlation of results, for example by participation in a suitable program of inter-laboratory comparisons, proficiency testing, or independent analysis.

Determination of QC Limits

Control Charts are generated annually and reestablished after major changes for all analyses routinely performed and are used for trend analysis. Control limits are based on E.P.A. and DoD method recommendations and are +/- 3 times the standard deviation and the warning limits are +/- 2 times the standard deviation. If the control limits exceed the EPA/DoD control limits then the EPA/DoD control limits are used.

Method for Handling Outliers

The method for handling outliers is based on Quality Control, split, and Performance Evaluation Study Program samples. If a LCS sample fails to fall within control limits it will be reanalyzed. If the LCSsample proves to be within specifications, the group of samples the LCS represents will be reanalyzed. If the LCS remains outside control limits, the samples will be re-prepared along with a known standard to identify the problem and where in the process the problem may be occurring.

12.0 DATA COLLECTION, REDUCTION, VALIDATION, AND REPORTING

12.1 DATA COLLECTION

All bench chemists document sample preparation activities in laboratory notebooks. These serve as the primary record for subsequent data reduction. The Alpha/Beta counters generate printouts that are used for calculations generated by a computer or worksheets. The data for alpha and gamma spectrometry, ICP and CV analyses are generated by stand-alone computers. Results of each analysis are transcribed onto Excel spreadsheets specific to the particular analysis. Concentrations of the analytes found in the analysis are expressed according to the required units, depending on the sample matrix.

Any manual integrations for ICP are documented in the raw data records to show a complete audit trail before and after the manual integration to permit reconstruction of the results. This requirement applies to all analytical runs including calibration standards and QC samples. The person performing the manual integration signs and dates each chromatogram and documents the rationale for performing manual integration (electronic signature is acceptable).

12.2 DATA REDUCTION

Gross Alpha/Beta Results – Calculations are performed on a spreadsheet which calculates the counting efficiency of each sample according to the amount of solids present on the counting planchet. Count times are determined according to the MDA required by the client.

Alpha Spectrometry Results – Calculations are based on the specific area of a target peak along with the addition of a tracer. The target isotope is determined by energy and tracer recovery. In some instances the tracer has to be determined using a gamma spectrometer instead of the alpha spectrometer.

Gamma Spectrometry Results – Calculations are performed for each isotope after its identification is determined. The activity of each isotope is determined using a calibration curve and the peak area of each isotope.

Uranium Analyzer Results – Calculations are performed on each sample by entering the sample aliquot and final volume into the KPA computer prior to analysis. The final results will be rounded to the nearest 0.1 ug/L or three (3) significant figures if the results are larger than 10.

Inductively Coupled Plasma (ICP) – Calculations are based upon the emission intensity given off at a certain wavelength. The final calculations are done by the computer system by comparing intensity of sample against the intensity of known standards.

Atomic Absorption Spectrometry (CV) – Calculations are based on the amount of photometric absorbance at a particular wavelength by a specific metal. The final calculation is done by a computer system by comparing absorbance of sample against the absorbance of known standards.

12.2 VALIDATION

All analytical data must undergo a multi-tiered review process prior to being reported to the customer. Data review is the process of examining data and accepting or rejecting it based on pre-defined criteria. These review steps are designed to ensure that reported data is free from errors and any non-conformances are properly documented. Standard Operating Procedure GEN_3 addresses data review in detail.

12.3 REPORTING

The final report is generated when all sample analyses are completed, reviewed and approved. The procedure for analytical reporting is GEN_03.

Any discrepancies encountered during the analysis of the samples are to be stated in the Case Narrative. The Case Narrative will discuss any problems encountered during the routine analysis of the samples. The Case Narrative will be printed on lab letterhead as page one of the final report and will be paginated.

After issuance of the report, the lab report will remain unchanged. Material amendments to an analytical report after issue will be made only in the form of a further document, or data transfer including the statement ”Supplement to Analytical Report”, or equivalent wording. Such amendments will meet all the relevant requirements of the TNI and DoD Standard.

13.0 RECORD KEEPING

SOP GEN_3 outlines the complete procedure.

All records, certificates and reports are stored safely and securely and are held in strict confidence. Records which are stored on electronic media are supported by the hardware and software necessary for their retrieval and have hard copy or write-protected backup copies. Access to archived information relating to project files on the LIMS is protected against unauthorized access or amendment. Access to other archived information is documented with an access log. Records are protected against fire, theft, loss, environmental deterioration, vermin and, in the case of electronic records, electronic or magnetic sources. Records are maintained or transferred according to the client’s instructions in the event the laboratory transfers ownership.

All documents (data and records pertaining to the laboratory and its’ quality system, customers, personnel or business transactions) are maintained for a minimum of 7 years. Drinking water is held for 10 years. Prior to destruction, ODEQ drinking water compliance and bioassay customers are notified.

14.0 REVISIONS

The Regulatory Affairs Department has an electronic version of this Quality Assurance Manual with tracked changes detailing all revisions made to the previous version. This version is available upon request. Revisions to the previous version of this appendix are summarized in the table below.

Document	Revision
Quality Assurance Manual Version 15.0 (Appendix XIII)	Appendix origination – Incorporated necessary elements in previous stand-alone quality manual with effective date of 1/18/16 to produce this appendix.

End of Document

APPENDIX 7

SITE MANAGEMENT FORMS

Annual Maintenance Inspection Form

Name(s) of Inspectors: ____________________
Date of Inspection: ____________________
Location of the permeable pavement facility: ____________________
Surface/wearing course type: ____________________
Address or Intersection: ____________________
Age of permeable pavement facility: ____________________
Permeable pavement facility area : ____________________

Site Sketch (include curbs, islands, trees, north arrow, etc.)
or insert Photographs from inspection date.

Based on visual assessment of the site, answer the following questions and take photographs of the site:

Surface/Wearing Course

1. Are there indications of any of the following on the surface of the permeable pavement facility? (If yes, mark on site sketch)

☐ Excessive sediment
☐ Moss growth
☐ Cracks, trip hazards, or concrete spalling
☐ Trash and debris
☐ Leaf accumulation
☐ Settlement of surface
☐ Other: ____________________
☐ None

2. Is there ponding on the surface of the permeable pavement? ☐ Yes ☐ No

If yes, describe the potential reasons for ponded water below (leaf or debris build up, non-functional underdrain, groundwater input, illicit connection, inadequate capacity in facility, etc.)

Notes and or Photographs from inspection date.

Inlets/Outlets/Pipes

3. How many inlet pipes are present? ☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ > 5

4. Are any of the inlet pipes clogged? (If yes, mark the location on your site sketch and fill in the boxes below with the cause of the clogging (e.g., debris, sediment, vegetation, etc.) ☐ No ☐ Partially ☐ Completely ☐ NA

5. Are any of the inlet pipes altered from the original design or otherwise in need of maintenance? (If yes, write in reason: frost heave, vandalism, unknown, etc.)

	Inlet No.	Inlet No.	Inlet No.
Partly clogged			
Completely Clogged			
Reason for Maintenance			

6. Are any overflow, underdrains, raised subsurface overflow pipes, or outlet structures clogged?

☐ No ☐ Partially ☐ Completely ☐ NA

a. If yes, mark the location on your site sketch and fill in the boxes below with the cause of the clogging (e.g., debris, sediment, vegetation, moss, etc.)

b. Are any of the overflow structures altered from the original design or otherwise in need of maintenance? (If yes, write in reason: frost heave, vandalism, unknown)

	Inlet No.	Inlet No.	Inlet No.
Partly clogged			
Completely Clogged			
Reason for Maintenance			

Observation Port (if present)

7. Is water remaining in the storage aggregate longer than anticipated by design after the end of a storm?

☐ Yes ☐ No ☐ Unknown

a. If yes, identify potential cause of extended ponding and mark the location of observed extended ponding on your site sketch.

Summary

8. Inspector's Recommendations. When is maintenance needed?

☐ Immediately
☐ Within a month or two
☐ Within a year
☐ No sign that any maintenance is required

9. Summarize the results of this inspection and write any other observations in the box below
Summary and other observations or Photographs from
inspection date.

GROUNDWATER SAMPLING WORKSHEET

Bergmann
associates
architects // engineers // planners

PROJECT NAME: ____________________
Project Number: ______________
Site Location: ________________________________
Sample Date: ____________________
Weather: ____________________
Personnel: ______________

GROUNDWATER SAMPLE POINT

Well Number: ______________
Location: ____
Casing Diameter: ______________

Well Dia.	Volume/Foot
1" =	0.041 gal/foot
2" =	0.163 gal/foot
4" =	0.653 gal/foot
6" =	1.469 gal/foot
8" =	2.611 gal/foot

Depth to water, below top of casing: ______________
Depth to bottom of the well: ______________
Length of water column in well: ______________

Volume of water in well casing, gallons: ______________
3 Well volumes (= length water column X gal/foot X 3): ______________
Actual volume purged prior to sampling: ____________________
Sampling Methodology: ____
Sampling Equipment: ____
____
Well Recharged? ____
Required Analysis: ____

FIELD PARAMETER MEASUREMENTS

	Accumulated Volume Purged in Gallons									
Parameter:										
Turbidity										
Temperature										
pH										
Conductivity										
Oxygen										
Salinity										

Time sample was collected: ______________

COMMENTS ____
____
____
____

Figure 2. **Ground Water Sampling Log**

Project ____________ **Site** ____________ **Well No.** ____________ **Date** ____________

Well Depth ____________ **Screen Length** ____________ **Well Diameter** ____________ **Casing Type** ____________

Sampling Device ____________ **Tubing type** ____________ **Water Level** ____________

Measuring Point ____________ **Other Infor** ____________

Sampling Personnel ____________

Time	pH	Temp	Cond.	Dis.O_2	Turb.	[ ]Conc			Notes

Type of Samples Collected

____

Information: 2 in = 617 ml/ft, 4 in = 2470 ml/ft: $Vol_{cyl} = \pi r^2 h$, $Vol_{sphere} = 4/3\pi\ r^3$

Figure 3. **Ground Water Sampling Log** (with automatic data logging for most water quality parameters)

Project ______________ **Site** ______________ **Well No.** ______________ **Date** ______________
Well Depth ______________ **Screen Length** ______________ **Well Diameter** ______________ **Casing Type** ______________
Sampling Device ______________ **Tubing type** ______________ **Water Level** ______________
Measuring Point ______________ **Other Infor** ______________
____
Sampling Personnel ____

Time	Pump Rate	Turbidity	Alkalinity	[ ] Conc	Notes

Type of Samples Collected

____

Information: 2 in = 617 ml/ft, 4 in = 2470 ml/ft: $\mathrm{Vol}_{cyl} = \pi r^2 h$, $\mathrm{Vol}_{sphere} = 4/3\pi\, r^3$

INSPECTOR'S DAILY REPORT

Date: ____________________

Day of Week: | S | M | T | W | T | F | S |

Project: ____________________

Sheet No. ________ of ________

JOB:

Construction Activities:

If pertinent to the Construction Operation		
	AM	PM
Weather		
Temperature		

DESCRIPTION OF WORK PERFORMED AND INSPECTED

Specify for Each Operation: Item No., Subcontractor (if any), Location and Nature of Work

Contractor Activities:

ITEM NO.	FS	ES	INTERIM QUANT.	FINAL QUANT.	QUANT. CHK.	DESCRIPTION OF WORK	COMPUTER	
							ENT	CHK

The work described was incorporated
into this project and was inspected by:

____
Inspector's Signature

Reviewed by: ____________________ ________
☐ Engineer-in-Charge
☐ Resident Engineer
Date

☐ Reverse side used for additional remarks and sketches.

Fax or
E-Mail cc's: ________ File
____
____

Remarks, Extra Work, Visitors, Comments, Work Stoppages, etc.

MANPOWER						EQUIPMENT					
Type	Prime	Sub	Sub	Sub	Sub	Type	Prime	Sub	Sub	Sub	Sub
Foreman -											
Operators -											
Laborers -											
Mechanical -											
Electrical -											
Drillers -											
Inspector-											

Fax or
E-Mail cc's: ________ File
____
____

Community Air Monitoring Daily Log

Date: ____________

Time

Site Representative: ____________ **On-Site:** ________ **Off-Site:** ________

Appr. Wind Direction: ____________ **Appr. Wind Speed:** __ **On-Site:** ________ **Off-Site:** ________

Weather Conditions: ____________ **On-Site:** ________ **Off-Site:** ________

Description of Daily Work Tasks:

Action Level Exceedance:	**None**	**Yes:** (description)

Notes:
Readings to be taken at 15 minute intervals.

	Particulates (ug/m$^{3)}$				**Volatile Organic Compounds (VOCs) (ppm)**			
	Perimeter Monitoring		Work Zone Monitoring		Perimeter Monitoring		Work Zone Monitoring	
Time								

Action Level: Downwind particulate level that exceeds the upwind particulate level by 100 ug/m3.
If the action level is exceeded, the Site Representative will imediately notify the Site Safety Officer.

Meter ID:
Daily Background:

Action Level: Downwind VOC levels exceed upwind VOC levels. If action level exceeded, the Site Representative will immediately notify the Site Safety Officer implement minor or major emission monitoring.

Meter ID:
Calibration Time:
Background Reading

United States
Environmental Protection
Agency

Office of
Research and
Development

Office of Solid Waste
and Emergency
Response

EPA/540/S-95/504
April 1996

Ground Water Issue

LOW-FLOW (MINIMAL DRAWDOWN) GROUND-WATER SAMPLING PROCEDURES

by Robert W. Puls[1] and Michael J. Barcelona[2]

Background

The Regional Superfund Ground Water Forum is a group of ground-water scientists, representing EPA's Regional Superfund Offices, organized to exchange information related to ground-water remediation at Superfund sites. One of the major concerns of the Forum is the sampling of ground water to support site assessment and remedial performance monitoring objectives. This paper is intended to provide background information on the development of low-flow sampling procedures and its application under a variety of hydrogeologic settings. It is hoped that the paper will support the production of standard operating procedures for use by EPA Regional personnel and other environmental professionals engaged in ground-water sampling.

For further information contact: Robert Puls, 405-436-8543, Subsurface Remediation and Protection Division, NRMRL, Ada, Oklahoma.

I. Introduction

The methods and objectives of ground-water sampling to assess water quality have evolved over time. Initially the emphasis was on the assessment of water quality of aquifers as sources of drinking water. Large water-bearing units were identified and sampled in keeping with that objective. These were highly productive aquifers that supplied drinking water via private wells or through public water supply systems. Gradually, with the increasing awareness of subsurface pollution of these water resources, the understanding of complex hydrogeochemical processes which govern the fate and transport of contaminants in the subsurface increased. This increase in understanding was also due to advances in a number of scientific disciplines and improvements in tools used for site characterization and ground-water sampling. Ground-water quality investigations where pollution was detected initially borrowed ideas, methods, and materials for site characterization from the water supply field and water analysis from public health practices. This included the materials and manner in which monitoring wells were installed and the way in which water was brought to the surface, treated, preserved and analyzed. The prevailing conceptual ideas included convenient generalizations of ground-water resources in terms of large and relatively homogeneous hydrologic *units*. With time it became apparent that conventional water supply generalizations of *homogeneity* did not adequately represent field data regarding pollution of these subsurface resources. The important role of *heterogeneity* became increasingly clear not only in geologic terms, but also in terms of complex physical,

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[2] ***University of Michigan***

Superfund Technology Support Center for Ground Water

National Risk Management Research Laboratory
Subsurface Protection and Remediation Division
Robert S. Kerr Environmental Research Center
Ada, Oklahoma

Technology Innovation Office
Office of Solid Waste and Emergency
Response, US EPA, Washington, DC

Walter W. Kovalick, Jr., Ph.D.
Director

chemical and biological subsurface processes. With greater appreciation of the role of heterogeneity, it became evident that subsurface pollution was ubiquitous and encompassed the unsaturated zone to the deep subsurface and included unconsolidated sediments, fractured rock, and *aquitards* or low-yielding or impermeable formations. Small-scale processes and heterogeneities were shown to be important in identifying contaminant distributions and in controlling water and contaminant flow paths.

It is beyond the scope of this paper to summarize all the advances in the field of ground-water quality investigations and remediation, but two particular issues have bearing on ground-water sampling today: aquifer heterogeneity and colloidal transport. Aquifer heterogeneities affect contaminant flow paths and include variations In geology, geochemistry, hydrology and microbiology. As methods and the tools available for subsurface investigations have become increasingly sophisticated and understanding of the subsurface environment has advanced, there is an awareness that in most cases a primary concern for site investigations is characterization of contaminant flow paths rather than entire aquifers. In fact, in many cases, plume thickness can be less than well screen lengths (e.g., 3-6 m) typically installed at hazardous waste sites to detect and monitor plume movement over time. Small-scale differences have increasingly been shown to be important and there is a general trend toward smaller diameter wells and shorter screens.

The hydrogeochemical significance of colloidal-size particles in subsurface systems has been realized during the past several years (Gschwend and Reynolds, 1987; McCarthy and Zachara, 1989; Puls, 1990; Ryan and Gschwend, 1990). This realization resulted from both field and laboratory studies that showed faster contaminant migration over greater distances and at higher concentrations than flow and transport model predictions would suggest (Buddemeier and Hunt, 1988; Enfield and Bengtsson, 1988; Penrose et al., 1990). Such models typically account for interaction between the mobile aqueous and immobile solid phases, but do not allow for a mobile, reactive solid phase. It is recognition of this third *phase* as a possible means of contaminant transport that has brought increasing attention to the manner in which samples are collected and processed for analysis (Puts et al., 1990; McCarthy and Degueldre, 1993; Backhus et al., 1993; U. S. EPA, 1995). If such a phase is present In sufficient mass, possesses high sorption reactivity, large surface area, and remains stable In suspension, it can serve as an important mechanism to facilitate contaminant transport in many types of subsurface systems.

Colloids are particles that are sufficiently small so that the surface free energy of the particle dominates the bulk free energy. Typically, in ground water, this includes particles with diameters between 1 and 1000 nm. The most commonly observed mobile particles include: secondary clay minerals; hydrous iron, aluminum, and manganese oxides; dissolved and particulate organic materials, and viruses and bacteria. These reactive particles have been shown to be mobile under a variety of conditions in both field studies and laboratory column experiments, and as such need to be included in monitoring programs where identification of the *total* mobile contaminant loading (dissolved + naturally suspended particles) at a site is an objective. To that end, sampling methodologies must be used which do not artificially bias *naturally* suspended particle concentrations.

Currently the most common ground-water purging and sampling methodology is to purge a well using bailers or high speed pumps to remove 3 to 5 casing volumes followed by sample collection. This method can cause adverse impacts on sample quality through collection of samples with high levels of turbidity. This results in the inclusion of otherwise immobile artifactual particles which produce an overestimation of certain analytes of interest (e.g., metals or hydrophobic organic compounds). Numerous documented problems associated with filtration (Danielsson, 1982; Laxen and Chandler, 1982; Horowitz et al., 1992) make this an undesirable method of rectifying the turbidity problem, and include the removal of potentially mobile (contaminant-associated) particles during filtration, thus artificially biasing contaminant concentrations low. Sampling-induced turbidity problems can often be mitigated by using low-flow purging and sampling techniques.

Current subsurface conceptual models have undergone considerable refinement due to the recent development and increased use of field screening tools. So-called hydraulic *push* technologies (e.g., cone penetrometer, Geoprobe®, QED Hydro Punch®) enable relatively fast screening site characterization which can then be used to design and install a monitoring well network. Indeed, alternatives to conventional monitoring wells are now being considered for some hydrogeologic settings. The ultimate design of any monitoring system should however be based upon adequate site characterization and be consistent with established monitoring objectives.

If the sampling program objectives include accurate assessment of the magnitude and extent of subsurface contamination over time and/or accurate assessment of subsequent remedial performance, then some information regarding plume delineation in three-dimensional space is necessary prior to monitoring well network design and installation. This can be accomplished with a variety of different tools and equipment ranging from hand-operated augers to screening tools mentioned above and large drilling rigs. Detailed information on ground-water flow velocity, direction, and horizontal and vertical variability are essential baseline data requirements. Detailed soil and geologic data are required prior to and during the installation of sampling points. This includes historical as well as detailed soil and geologic logs which accumulate during the site investigation. The use of borehole geophysical techniques is also recommended. With this information (together with other site characterization data) and a clear understanding of sampling objectives, then appropriate location, screen length, well diameter, slot size, etc. for the monitoring well network can be decided. This is especially critical for new in situ remedial approaches or natural attenuation assessments at hazardous waste sites.

In general, the overall goal of any ground-water sampling program is to collect water samples with no alteration in water chemistry; analytical data thus obtained may be used for a variety of specific monitoring programs depending on the regulatory requirements. The sampling methodology described in this paper assumes that the monitoring goal is to sample monitoring wells for the presence of contaminants and it is applicable whether mobile colloids are a concern or not and whether the analytes of concern are metals (and metalloids) or organic compounds.

II. Monitoring Objectives and Design Considerations

The following issues are important to consider prior to the design and implementation of any ground-water monitoring program, including those which anticipate using low-flow purging and sampling procedures.

A. Data Quality Objectives (DQOs)

Monitoring objectives include four main types: detection, assessment, corrective-action evaluation and resource evaluation, along with *hybrid* variations such as site assessments for property transfers and water availability investigations. Monitoring objectives may change as contamination or water quality problems are discovered. However, there are a number of common components of monitoring programs which should be recognized as important regardless of initial objectives. These components include:

1) Development of a conceptual model that incorporates elements of the regional geology to the local geologic framework. The conceptual model development also includes initial site characterization efforts to identify hydrostratigraphic units and likely flow-paths using a minimum number of borings and well completions;

2) Cost-effective and well documented collection of high quality data utilizing simple, accurate, and reproducible techniques; and

3) Refinement of the conceptual model based on supplementary data collection and analysis.

These fundamental components serve many types of monitoring programs and provide a basis for future efforts that evolve in complexity and level of spatial detail as purposes and objectives expand. High quality, reproducible data collection is a common goal regardless of program objectives.

High quality data collection implies data of sufficient accuracy, precision, and completeness (i.e., ratio of valid analytical results to the minimum sample number called for by the program design) to meet the program objectives. Accuracy depends on the correct choice of monitoring tools and procedures to minimize sample and subsurface disturbance from collection to analysis. Precision depends on the repeatability of sampling and analytical protocols. It can be assured or improved by replication of sample analyses including blanks, field/lab standards and reference standards.

B. Sample Representativeness

An important goal of any monitoring program is collection of data that is truly representative of conditions at the site. The term *representativeness* applies to chemical and hydrogeologic data collected via wells, borings, piezometers, geophysical and soil gas measurements, lysimeters, and temporary sampling points. It involves a recognition of the statistical variability of individual subsurface physical properties, and contaminant or major ion concentration levels, while explaining extreme values. Subsurface temporal and spatial variability are facts. Good professional practice seeks to maximize representativeness by using proven accurate and reproducible techniques to define limits on the distribution of measurements collected at a site. However, measures of representativeness are dynamic and are controlled by evolving site characterization and monitoring objectives. An evolutionary site characterization model, as shown in Figure 1, provides a systematic approach to the goal of consistent data collection.

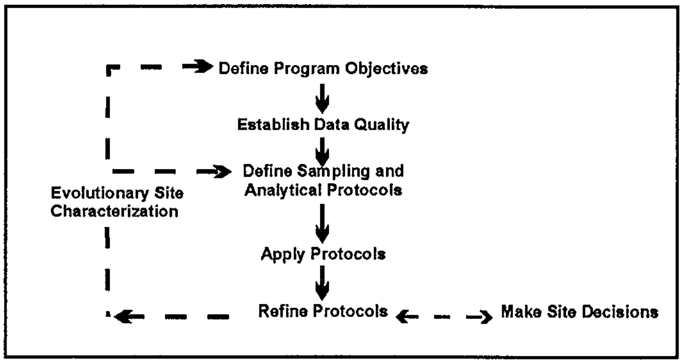

Figure 1. Evolutionary Site Characterization Model

The model emphasizes a recognition of the causes of the variability (e.g., use of inappropriate technology such as using bailers to purge wells; imprecise or operator-dependent methods) and the need to control avoidable errors.

1) Questions of Scale

A sampling plan designed to collect representative samples must take into account the potential scale of changes in site conditions through space and time as well as the chemical associations and behavior of the parameters that are targeted for investigation. In subsurface systems, physical (i.e., aquifer) and chemical properties over time or space are not statistically independent. In fact, samples taken in close proximity (i.e., within distances of a few meters) or within short time periods (i.e., more frequently than monthly) are highly auto-correlated. This means that designs employing high-sampling frequency (e.g., monthly) or dense spatial monitoring designs run the risk of redundant data collection and misleading inferences regarding trends in values that aren't statistically valid. In practice, contaminant detection and assessment monitoring programs rarely suffer these *over-sampling* concerns. In corrective-action evaluation programs, it is also possible that too little data may be collected over space or time. In these cases, false interpretation of the spatial extent of contamination or underestimation of temporal concentration variability may result.

2) Target Parameters

Parameter selection in monitoring program design is most often dictated by the regulatory status of the site. However, background water quality constituents, purging indicator parameters, and contaminants, all represent targets for data collection programs. The tools and procedures used in these programs should be equally rigorous and applicable to all categories of data, since all may be needed to determine or support regulatory action.

C. Sampling Point Design and Construction

Detailed site characterization is central to all decision-making purposes and the basis for this characterization resides in identification of the geologic framework and major hydro-stratigraphic units. Fundamental data for sample point location include: subsurface lithology, head-differences and background geochemical conditions. Each sampling point has a proper use or uses which should be documented at a level which is appropriate for the program's data quality objectives. Individual sampling points may not always be able to fulfill multiple monitoring objectives (e.g., detection, assessment, corrective action).

1) Compatibility with Monitoring Program and Data Quality Objectives

Specifics of sampling point location and design will be dictated by the complexity of subsurface lithology and variability in contaminant and/or geochemical conditions. It should be noted that, regardless of the ground-water sampling approach, few sampling points (e.g., wells, drive-points, screened augers) have zones of influence in excess of a few feet. Therefore, the spatial frequency of sampling points should be carefully selected and designed.

2) Flexibility of Sampling Point Design

In most cases *well-point* diameters in excess of 1 7/8 inches will permit the use of most types of submersible pumping devices for low-flow (minimal drawdown) sampling. It is suggested that *short* (e.g., less than 1.6 m) screens be incorporated into the monitoring design where possible so that comparable results from one device to another might be expected. *Short*, of course, is relative to the degree of vertical water quality variability expected at a site.

3) Equilibration of Sampling Point

Time should be allowed for equilibration of the well or sampling point with the formation after installation. Placement of well or sampling points in the subsurface produces some disturbance of ambient conditions. Drilling techniques (e.g., auger, rotary, etc.) are generally considered to cause more disturbance than *direct push* technologies. In either case, there may be a period (i.e., days to months) during which water quality near the point may be distinctly different from that in the formation. Proper development of the sampling point and adjacent formation to remove fines created during emplacement will shorten this water quality *recovery* period.

III. Definition of Low-Flow Purging and Sampling

It is generally accepted that water in the well casing is non-representative of the formation water and needs to be purged prior to collection of ground-water samples. However, the water in the screened interval may indeed be representative of the formation, depending upon well construction and site hydrogeology. Wells are purged to some extent for the following reasons: the presence of the air interface at the top of the water column resulting in an oxygen concentration gradient with depth, loss of volatiles up the water column, leaching from or sorption to the casing or filter pack, chemical changes due to clay seals or backfill, and surface infiltration.

Low-flow purging, whether using portable or dedicated systems, should be done using pump-intake located In the middle or slightly above the middle of the screened interval. Placement of the pump too close to the bottom of the well will cause increased entrainment of solids which have collected in the well over time. These particles are present as a result of well development, prior purging and sampling events, and natural colloidal transport and deposition. Therefore, placement of the pump in the middle or toward the top of the screened interval is suggested. Placement of the pump at the top of the water column for sampling is only recommended in unconfined aquifers, screened across the water table, where this is the desired sampling point. Low-flow purging has the advantage of minimizing mixing between the overlying stagnant casing water and water within the screened interval.

A. Low-Flow Purging and Sampling

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. It does not necessarily refer to the flow rate of water discharged at the surface which can be affected by flow regulators or restrictions. Water level drawdown provides the best indication of the stress imparted by a given flow-rate for a given hydrological situation. The objective is to pump in a manner that minimizes stress (drawdown) to the system to the extent practical taking into account established site sampling objectives. Typically, flow rates on the order of 0.1 - 0.5 L/min are used, however this is dependent on site-specific hydrogeology. Some extremely coarse-textured formations have been successfully sampled in this manner at flow rates to 1 L/min. The effectiveness of using low-flow purging is intimately linked with proper screen location, screen length, and well construction and development techniques. The reestablishment of natural flow paths in both the vertical and horizontal directions is important for correct interpretation of the data. For high resolution sampling needs, screens less than 1 m should be used. Most of the need for purging has been found to be due to passing the sampling device through the overlying casing water which causes mixing of these stagnant waters and the dynamic waters within the screened interval. Additionally, there is disturbance to suspended sediment collected in the bottom of the casing and the displacement of water out into the formation immediately adjacent to the well screen. These disturbances and impacts can be avoided using dedicated sampling equipment, which precludes the need to insert the sampling device prior to purging and sampling.

Isolation of the screened interval water from the overlying stagnant casing water may be accomplished using low-flow minimal drawdown techniques. If the pump intake is located within the screened interval, most of the water pumped will be drawn in directly from the formation with little mixing of casing water or disturbance to the sampling zone. However, if the wells are not constructed and developed properly, zones other than those intended may be sampled. At some sites where geologic heterogeneities are sufficiently different within the screened interval, higher conductivity zones may be preferentially sampled. This is another reason to use shorter screened intervals, especially where high spatial resolution is a sampling objective.

B. Water Quality Indicator Parameters

It is recommended that water quality indicator parameters be used to determine purging needs prior to sample collection in each well. Stabilization of parameters such as pH, specific conductance, dissolved oxygen, oxidation-reduction potential, temperature and turbidity should be used to determine when formation water is accessed during purging. In general, the order of stabilization is pH, temperature, and specific conductance, followed by oxidation reduction potential, dissolved oxygen and turbidity. Temperature and pH, while commonly used as purging indicators, are actually quite insensitive in distinguishing between formation water and stagnant casing water; nevertheless, these are important parameters for data interpretation purposes and should also be measured. Performance criteria for determination of stabilization should be based on water-level drawdown, pumping rate and equipment specifications for measuring indicator parameters. Instruments are available which utilize in-line flow cells to continuously measure the above parameters.

It is important to establish specific well stabilization criteria and then consistently follow the same methods thereafter, particularly with respect to drawdown, flow rate and sampling device. Generally, the time or purge volume required for parameter stabilization is independent of well depth or well volumes. Dependent variables are well diameter, sampling device, hydrogeochemistry, pump flow rate, and whether the devices are used in a portable or dedicated manner. If the sampling device is already in place (i.e., dedicated sampling systems), then the time and purge volume needed for stabilization is much shorter. Other advantages of dedicated equipment include less purge water for waste disposal, much less decontamination of equipment, less time spent in preparation of sampling as well as time in the field, and more consistency in the sampling approach which probably will translate into less variability in sampling results. The use of dedicated equipment is strongly recommended at wells which will undergo routine sampling over time.

If parameter stabilization criteria are too stringent, then minor oscillations in indicator parameters may cause purging operations to become unnecessarily protracted. It should also be noted that turbidity is a very conservative parameter in terms of stabilization. Turbidity is always the last parameter to stabilize. Excessive purge times are invariably related to the establishment of too stringent turbidity stabilization criteria. It should be noted that natural turbidity levels in ground water may exceed 10 nephelometric turbidity units (NTU).

C. Advantages and Disadvantages of Low-Flow (Minimum Drawdown) Purging

In general, the advantages of low-flow purging include:

- samples which are representative of the *mobile* load of contaminants present (dissolved and colloid-associated);
- minimal disturbance of the sampling point thereby minimizing sampling artifacts;
- less operator variability, greater operator control;

- reduced stress on the formation (minimal drawdown);
- less mixing of stagnant casing water with formation water;
- reduced need for filtration and, therefore, less time required for sampling;
- smaller purging volume which decreases waste disposal costs and sampling time;
- better sample consistency; reduced artificial sample variability.

Some disadvantages of low-flow purging are:

- higher initial capital costs,
- greater set-up time in the field,
- need to transport additional equipment to and from the site,
- increased training needs,
- resistance to change on the part of sampling practitioners,
- concern that new data will indicate a *change in conditions* and trigger an *action*.

IV. Low-Flow (Minimal Drawdown) Sampling Protocols

The following ground-water sampling procedure has evolved over many years of experience in ground-water sampling for organic and inorganic compound determinations and as such summarizes the authors' (and others) experiences to date (Barcelona et al., 1984, 1994; Barcelona and Helfrich, 1986; Puls and Barcelona, 1989; Puls et. al. 1990, 1992; Puls and Powell, 1992; Puls and Paul, 1995). High-quality chemical data collection is essential in ground-water monitoring and site characterization. The primary limitations to the collection of *representative* ground-water samples include: mixing of the stagnant casing and *fresh* screen waters during insertion of the sampling device or ground-water level measurement device; disturbance and resuspension of settled solids at the bottom of the well when using high pumping rates or raising and lowering a pump or bailer; introduction of atmospheric gases or degassing from the water during sample handling and transfer, or inappropriate use of vacuum sampling device, etc.

A. Sampling Recommendations

Water samples should not be taken immediately following well development. Sufficient time should be allowed for the ground-water flow regime in the vicinity of the monitoring well to stabilize and to approach chemical equilibrium with the well construction materials. This lag time will depend on site conditions and methods of installation but often exceeds one week.

Well purging is nearly always necessary to obtain samples of water flowing through the geologic formations in the screened interval. Rather than using a general but arbitrary guideline of purging three casing volumes prior to sampling, it is recommended that an in-line water quality measurement device (e.g., flow-through cell) be used to establish the stabilization time for several parameters (e.g., pH, specific conductance, redox, dissolved oxygen, turbidity) 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.

The following are recommendations to be considered before, during and after sampling:

- use low-flow rates (<0.5 L/min), during both purging and sampling to maintain minimal drawdown in the well;
- maximize tubing wall thickness, minimize tubing length;
- place the sampling device Intake at the desired sampling point;
- minimize disturbances of the stagnant water column above the screened interval during water level measurement and sampling device insertion;
- make proper adjustments to stabilize the flow rate as soon as possible;
- monitor water quality indicators during purging;
- collect unfiltered samples to estimate contaminant loading and transport potential in the subsurface system.

B. Equipment Calibration

Prior to sampling, all sampling device and monitoring equipment should be calibrated according to manufacturer's recommendations and the site Quality Assurance Project Plan (QAPP) and Field Sampling Plan (FSP). Calibration of pH should be performed with at least two buffers which bracket the expected range. Dissolved oxygen calibration must be corrected for local barometric pressure readings and elevation.

C. Water Level Measurement and Monitoring

It is recommended that a device be used which will least disturb the water surface in the casing. Well depth should be obtained from the well logs. Measuring to the bottom of the well casing will only cause resuspension of settled solids from the formation and require longer purging times for turbidity equilibration. Measure well depth after sampling is completed. The water level measurement should be taken from a permanent reference point which is surveyed relative to ground elevation.

D. Pump Type

The use of low-flow (e.g., 0.1-0.5 L/min) pumps is suggested for purging and sampling all types of analytes. All pumps have some limitation and these should be investigated with respect to application at a particular site. Bailers are inappropriate devices for low-flow sampling.

1) General Considerations

There are no unusual requirements for ground-water sampling devices when using low-flow, minimal drawdown techniques. The major concern is that the device give consistent results and minimal disturbance of the sample across a range of *low* flow rates (i.e., < 0.5 L/min). Clearly, pumping rates that cause minimal to no drawdown in one well could easily cause *significant* drawdown in another well finished in a less transmissive formation. In this sense, the pump should not cause undue pressure or temperature changes or physical disturbance on the water sample over a reasonable sampling range. Consistency in operation is critical to meet accuracy and precision goals.

2) Advantages and Disadvantages of Sampling Devices

A variety of sampling devices are available for low-flow (minimal drawdown) purging and sampling and include peristaltic pumps, bladder pumps, electrical submersible pumps, and gas-driven pumps. Devices which lend themselves to both dedication and consistent operation at definable low-flow rates are preferred. It is desirable that the pump be easily adjustable and operate reliably at these lower flow rates. The peristaltic pump is limited to shallow applications and can cause degassing resulting in alteration of pH, alkalinity, and some volatiles loss. Gas-driven pumps should be of a type that does not allow the gas to be in direct contact with the sampled fluid.

Clearly, bailers and other *grab* type samplers are ill-suited for low-flow sampling since they will cause repeated disturbance and mixing of *stagnant* water in the casing and the *dynamic* water in the screened interval. Similarly, the use of inertial lift foot-valve type samplers may cause too much disturbance at the point of sampling. Use of these devices also tends to introduce uncontrolled and unacceptable operator variability.

Summaries of advantages and disadvantages of various sampling devices are listed in Herzog et al. (1991), U. S. EPA (1992), Parker (1994) and Thurnblad (1994).

E. Pump Installation

Dedicated sampling devices (left in the well) capable of pumping and sampling are preferred over any other type of device. Any portable sampling device should be slowly and carefully lowered to the middle of the screened interval or slightly above the middle (e.g., 1-1.5 m below the top of a 3 m screen). This is to minimize excessive mixing of the stagnant water in the casing above the screen with the screened interval zone water, and to minimize resuspension of solids which will have collected at the bottom of the well. These two disturbance effects have been shown to directly affect the time required for purging. There also appears to be a direct correlation between size of portable sampling devices relative to the well bore and resulting purge volumes and times. The key is to minimize disturbance of water and solids in the well casing.

F. Filtration

Decisions to filter samples should be dictated by sampling objectives rather than as a *fix* for poor sampling practices, and field-filtering of certain constituents should not be the default. Consideration should be given as to what the application of field-filtration is trying to accomplish. For assessment of truly dissolved (as opposed to operationally *dissolved* [i.e., samples filtered with 0.45 µm filters]) concentrations of major ions and trace metals, 0.1 µm filters are recommended although 0.45 µm filters are normally used for most regulatory programs. Alkalinity samples must also be filtered if significant particulate calcium carbonate is suspected, since this material is likely to impact alkalinity titration results (although filtration itself may alter the CO_2 composition of the sample and, therefore, affect the results).

Although filtration may be appropriate, filtration of a sample may cause a number of unintended changes to occur (e.g. oxidation, aeration) possibly leading to filtration-induced artifacts during sample analysis and uncertainty in the results. Some of these unintended changes may be unavoidable but the factors leading to them must be recognized. Deleterious effects can be minimized by consistent application of certain filtration guidelines. Guidelines should address selection of filter type, media, pore size, etc. in order to identify and minimize potential sources of uncertainty when filtering samples.

In-line filtration is recommended because it provides better consistency through less sample handling, and minimizes sample exposure to the atmosphere. In-line filters are available in both disposable (barrel filters) and non-disposable (in-line filter holder, flat membrane filters) formats and various filter pore sizes (0.1-5.0 Fm). Disposable filter cartridges have the advantage of greater sediment handling capacity when compared to traditional membrane filters. Filters must be pre-rinsed following manufacturer's recommendations. If there are no recommendations for rinsing, pass through a minimum of 1 L of ground water following purging and prior to sampling. Once filtration has begun, a filter cake may develop as particles larger than the pore size accumulate on the filter membrane. The result is that the effective pore diameter of the membrane is reduced and particles smaller than the stated pore size are excluded from the filtrate. Possible corrective measures include prefiltering (with larger pore size filters), minimizing particle loads to begin with, and reducing sample volume.

G. Monitoring of Water Level and Water Quality Indicator Parameters

Check water level periodically to monitor drawdown in the well as a guide to flow rate adjustment. The goal is minimal drawdown (<0.1 m) during purging. This goal may be difficult to achieve under some circumstances due to geologic heterogeneities within the screened interval, and may require adjustment based on site-specific conditions and personal experience. In-line water quality indicator parameters should be continuously monitored during purging. The water quality indicator parameters monitored can include pH, redox potential, conductivity, dissolved oxygen (DO) and turbidity. The last three parameters are often most sensitive. Pumping rate, drawdown, and the time or volume required to obtain stabilization of parameter readings can be used as a future guide to purge the well. Measurements should be taken every three to five minutes if the above suggested rates are used. Stabilization is achieved after all parameters have stabilized for three successive readings. In lieu of measuring all five parameters, a minimum subset would include pH, conductivity, and turbidity or DO. Three successive readings should be within ± 0.1 for pH, ± 3% for conductivity, ± 10 mv for redox potential, and ± 10% for turbidity and DO. Stabilized purge indicator parameter trends are generally obvious and follow either an exponential or asymptotic change to stable values during purging. Dissolved oxygen and turbidity usually require the longest time for stabilization. The above stabilization guidelines are provided for rough estimates based on experience.

H. Sampling, Sample Containers, Preservation and Decontamination

Upon parameter stabilization, sampling can be initiated. If an in-line device is used to monitor water quality parameters, it should be disconnected or bypassed during sample collection. Sampling flow rate may remain at established purge rate or may be adjusted slightly to minimize aeration, bubble formation, turbulent filling of sample bottles, or loss of volatiles due to extended residence time in tubing. Typically, flow rates less than 0.5 L/min are appropriate. The same device should be used for sampling as was used for purging. Sampling should occur in a progression from least to most contaminated well, if this is known. Generally, volatile (e.g., solvents and fuel constituents) and gas sensitive (e.g., Fe^{2+}, CH_4, H_2S/HS^-, alkalinity) parameters should be sampled first. The sequence in which samples for most inorganic parameters are collected is immaterial unless filtered (dissolved) samples are desired. Filtering should be done last and in-line filters should be used as discussed above. During both well purging and sampling, proper protective clothing and equipment must be used based upon the type and level of contaminants present.

The appropriate sample container will be prepared in advance of actual sample collection for the analytes of interest and include sample preservative where necessary. Water samples should be collected directly into this container from the pump tubing.

Immediately after a sample bottle has been filled, it must be preserved as specified in the site (QAPP). Sample preservation requirements are based on the analyses being performed (use site QAPP, FSP, RCRA guidance document [U. S. EPA, 1992] or EPA SW-846 [U. S. EPA, 1982]). It may be advisable to add preservatives to sample bottles in a controlled setting prior to entering the field in order to reduce the chances of improperly preserving sample bottles or introducing field contaminants into a sample bottle while adding the preservatives.

The preservatives should be transferred from the chemical bottle to the sample container using a disposable polyethylene pipet and the disposable pipet should be used only once and then discarded.

After a sample container has been filled with ground water, a Teflon^{TM} (or tin)-lined cap is screwed on tightly to prevent the container from leaking. A sample label Is filled out as specified in the FSP. The samples should be stored inverted at 4EC.

Specific decontamination protocols for sampling devices are dependent to some extent on the type of device used and the type of contaminants encountered. Refer to the site QAPP and FSP for specific requirements.

I. Blanks

The following blanks should be collected:

(1) field blank: one field blank should be collected from each source water (distilled/deionized water) used for sampling equipment decontamination or for assisting well development procedures.

(2) equipment blank: one equipment blank should be taken prior to the commencement of field work, from each set of sampling equipment to be used for that day. Refer to site QAPP or FSP for specific requirements.

(3) trip blank: a trip blank is required to accompany each volatile sample shipment. These blanks are prepared in the laboratory by filling a 40-mL volatile organic analysis (VOA) bottle with distilled/deionized water.

V. Low-Permeability Formations and Fractured Rock

The overall sampling program goals or sampling objectives will drive how the sampling points are located, installed, and choice of sampling device. Likewise, site-specific hydrogeologic factors will affect these decisions. Sites with very low permeability formations or fractures causing discrete flow channels may require a unique monitoring approach. Unlike water supply wells, wells installed for ground-water quality assessment and restoration programs are often installed in low water-yielding settings (e.g., clays, silts). Alternative types of sampling points and sampling methods are often needed in these types of environments, because low-permeability settings may require extremely low-flow purging (<0.1 L/min) and may be technology-limited. Where devices are not readily available to pump at such low flow rates, the primary consideration is to avoid dewatering of the well screen. This may require repeated recovery of the water during purging while leaving the pump in place within the well screen.

Use of low-flow techniques may be impractical in these settings, depending upon the water recharge rates. The sampler and the end-user of data collected from such wells need to understand the limitations of the data collected; i.e., a strong potential for underestimation of actual contaminant concentrations for volatile organics, potential false negatives for filtered metals and potential false positives for unfiltered metals. It is suggested that comparisons be made between samples recovered using low-flow purging techniques and samples recovered using passive sampling techniques (i.e., two sets of samples). Passive sample collection would essentially entail acquisition of the sample with no or very little purging using a dedicated sampling system installed within the screened interval or a passive sample collection device.

A. Low-Permeability Formations (<0.1 L/min recharge)

1. Low-Flow Purging and Sampling with Pumps

a. "portable or non-dedicated mode" - Lower the pump (one capable of pumping at <0.1 L/min) to mid-screen or slightly above and set in place for minimum of 48 hours (to lessen purge volume requirements). After 48 hours, use procedures listed in Part IV above regarding monitoring water quality parameters for stabilization, etc., but do not dewater the screen. If excessive drawdown and slow recovery is a problem, then alternate approaches such as those listed below may be better.

b. "dedicated mode" - Set the pump as above at least a week prior to sampling; that is, operate in a dedicated pump mode. With this approach significant reductions in purge volume should be realized. Water quality parameters should stabilize quite rapidly due to less disturbance of the sampling zone.

2. Passive Sample Collection

Passive sampling collection requires insertion of the device into the screened interval for a sufficient time period to allow flow and sample equilibration before extraction for analysis. Conceptually, the extraction of water from low yielding formations seems more akin to the collection of water from the unsaturated zone and passive sampling techniques may be more appropriate in terms of obtaining "representative" samples. Satisfying usual sample volume requirements is typically a problem with this approach and some latitude will be needed on the part of regulatory entities to achieve sampling objectives.

B. Fractured Rock

In fractured rock formations, a low-flow to zero purging approach using pumps in conjunction with packers to isolate the sampling zone in the borehole is suggested. Passive multi-layer sampling devices may also provide the most "representative" samples. It is imperative in these settings to identify flow paths or water-producing fractures prior to sampling using tools such as borehole flowmeters and/or other geophysical tools.

After identification of water-bearing fractures, install packer(s) and pump assembly for sample collection using low-flow sampling in "dedicated mode" or use a passive sampling device which can isolate the identified water-bearing fractures.

VI. Documentation

The usual practices for documenting the sampling event should be used for low-flow purging and sampling techniques. This should include, at a minimum: information on the conduct of purging operations (flow-rate, drawdown, water-quality parameter values, volumes extracted and times for measurements), field instrument calibration data, water sampling forms and chain of custody forms. See Figures 2 and 3 and "Ground Water Sampling Workshop -- A Workshop Summary" (U. S. EPA, 1995) for example forms and other documentation suggestions and information. This information coupled with laboratory analytical data and validation data are needed to judge the "useability" of the sampling data.

VII. Notice

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Figure 2. **Ground Water Sampling Log**

Project ________________ **Site** ________________ **Well No.** ______________ **Date** ____________________

Well Depth _____________ **Screen Length** ___________ **Well Diameter** __________ **Casing Type** ____________

Sampling Device ________________ **Tubing type** ______________________ **Water Level** __________________

Measuring Point ____________________ **Other Infor** ____

Sampling Personnel ____

Time	pH	Temp	Cond.	Dis.O_2	Turb.	[ ]Conc			Notes

Type of Samples Collected

____

Information: 2 in = 617 ml/ft, 4 in = 2470 ml/ft: $Vol_{cyl} = \pi r^2 h$, $Vol_{sphere} = 4/3\pi\ r^3$

Figure 3. **Ground Water Sampling Log** (with automatic data logging for most water quality parameters)

Project ______________ **Site** ______________ **Well No.** ____________ **Date** ____________________

Well Depth ____________ **Screen Length** __________ **Well Diameter** _________ **Casing Type** ___________

Sampling Device ______________ **Tubing type** ___________________ **Water Level** ________________

Measuring Point __________________ **Other Infor** ____

____

Sampling Personnel ____

Time	Pump Rate	Turbidity	Alkalinity	[ ] Conc	Notes

Type of Samples Collected

____

Information: 2 in = 617 ml/ft, 4 in = 2470 ml/ft: $Vol_{cyl} = \pi r^2 h$, $Vol_{sphere} = 4/3\pi r^3$

APPENDIX 8
HEALTH AND SAFETY PLAN

SITE SPECIFIC HEALTH AND SAFETY PLAN
VOLUNTEERS OF AMERICA
214 LAKE AVENUE BACK LOT SITE
NYSDEC SITE NO. C828126
ROCHESTER, NEW YORK

Submitted to:
Volunteers of America Upstate New York
214 Lake Avenue
Rochester, New York

Prepared by:
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July 2004
(Revised July 2017)
Bergmann Job No. 8726.05

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FIGURES

1.1 INTRODUCTION

Bergmann Associates (Bergmann) has revised this Site Specific Health and Safety Plan (HASP) for work tasks to be performed under the Site Management Plan dated August 1, 2017. The on-site cleanup work tasks include cleanup construction activities, environmental monitoring, and environmental sample collection. Volatile organic compounds (VOCs), semi-volatile organic compound (SVOC), and heavy metals have been detected in soil and groundwater on site. The completed remedial investigation (RI) evaluated the nature and extent of VOCs, SVOCs, heavy metals, PCBs, and cyanide that resulted from historical uses and previous operations at the Site. The proposed cleanup will be conducted at 214 Lake Avenue, Rochester, New York, on the eastern portion of Parcel A and Parcel B of the property (back lot) and the east and west side of Haidt Place. The laboratory analytical results from previous soil and groundwater samples indicate the detection of SVOCs and heavy metals that are the primary contaminants of concern (COC) on the Site. Volatile organic compounds that include: Acetone, 2- Butanone, Methylene Chloride, and Toluene were also detected in soil and groundwater samples.

This plan outlines the health and safety procedures, personal protective equipment (PPE), and field monitoring equipment required for monitoring the performance of health & safety requirements during proposed cleanup activities. Following the details outlined in the HASP is intended to minimize the potential for injury or exposure to contaminants of concern to Bergmann employees conducting work on this site.

1.2 Health & Safety Plan Overview

This HASP has been prepared for Bergmann personnel for activities conducted during the proposed cleanup project work. The procedures and personal protective equipment described in this plan were developed after reviewing the site environmental data that was presented in the RI report and our environmental data collected from subsurface explorations during the completed supplemental investigation (SI). Bergmann has evaluated the potential hazards that may be encountered during the above noted cleanup (remediation) work. The purpose of this HASP is to:

- Establish personnel safety/protection standards that meet or exceed the Occupational Safety and Health Administration (OSHA) Regulations;
- Define responsibilities of different organizations and personnel with contact information;
- Provide a map route to the nearest hospital;
- Establish safe operating procedures relative to the conditions encountered at the project work area;
- Define the project work area;
- Provide for anticipated contingencies that may arise during the course of remediation work; and
- Modify the HASP in response to new environmental data or conditions encountered during implementation of the remedial action.

2.1 SITE ACCESS & PERSONNEL

Bergmann personnel entering the project work area at the Site must follow this HASP.

2.2 Site Access

Site access will be given to Bergmann personnel and the remediation contractor. The remediation contractor is responsible for providing a health and safety plan that meet's their construction work task, safe work area and securing the project work area during work hours and during non-work hours.

Site Specific Health & Safety Personnel

Bergmann is responsible for the health and safety of Bergmann personnel. This responsibility includes:

- Provide overall health and safety oversight for the project;
- Prepare and/or review potential changes to this HASP and edit a task-specific addendum to the HASP, if required; and
- Monitor health and safety performance.
- One person may be designated as having the responsibilities of the key personnel listed below for this project. A description of the responsibilities of the key personnel involved in the HASP program is presented below.

Project Manager

The Project Manager (PM) will assist with management of on-site work tasks. The PM is responsible for:

- Managing the planned work requirements so that work performed adheres to the outlined health and safety procedures;
- Provide guidance so that personnel follow health and safety procedures; and
- Review daily work activities and field conditions encountered that may result in potential injury or exposure to contaminants of concern (COCs) as identified during project work. Provide notification of unsafe conditions noted during fieldwork to Site owner and contractor.

Site Health and Safety Officer

The Site Health and Safety Officer's (SHSO) responsibilities will be implemented by the on-site representative who will be present during the majority of the field phases of the project. The SHSO will be responsible for the following tasks:

- Implementing the HASP;
- Maintaining a daily record (if relevant to health and safety at the project site) of personnel activities, monitoring activities and results, exposure incidents, and personnel protection equipment usage;

- Monitoring anticipated hazards and propose modifications (if necessary) for the level of personnel protection and/or work procedures;
- Advising the PM on work activities completed and proposed work tasks or conditions which may impact health and safety requirements;
- Having copies of this HASP available on-site for review and provide copies of 40-Hour HAZWOPER certificates to NYSDEC by request; and
- Record daily weather conditions (e.g., temperature, wind speed/direction, etc.) if these conditions are relevant to health and safety at the project site.

The SHSO has the authority to suspend work activities if it is felt that the Site or weather conditions may adversely affect personnel health and safety. The SHSO will notify the PM, remediation contractor, and site owner of such actions.

On-Site Workers

Bergmann project personnel involved in the proposed remediation activities are responsible for:

- Reading, understanding, and complying with the requirements of the HASP;
- Taking reasonable precautions to prevent incidents and to report accidents;
- Implement procedures specified in this HASP, and report deviations to the SHSO;
- Perform tasks that they are trained to do; and
- For this project, hard hats, work boots, safety glasses, and gloves are required for field project work tasks (Level D PPE).

Visitors

Non-Site workers and Site visitors are responsible for:

- Reading, understanding, and complying with the requirements of the HASP;
- Having the required personnel protecting equipment (e.g., hard hats, safety glass, and work boots); and
- Taking reasonable precautions to prevent incidents that may result in injury.
- Limit visit time to less than an hour.
- Visitors must request and receive permission for a date and time to visit the site from the Bergmann project manager and the remediation contactor supervisor. This does not apply to NYSDEC, NYSDOH, and the Monroe County Health Department.

3.1 HEALTH & SAFETY RISK ANALYSES

3.2 Site Overview

The Site is located at:

Eastern Portion of Parcel A and Parcel B
(Back Lot)
East and West side of Haidt Place
(ROW)
214 Lake Avenue
Rochester, New York

Bergmann will monitor the construction activities completed by the remediation contactor that include:

- Site grading;
- Excavation of impacted soils from the source area (hot spot) and backfilling
- Placement and compaction of re-used on-site soils and imported granular fill materials to construct the cover system or backfill excavations;
- Loading impacted soils into trucks for off-site disposal; and
- Placement and compaction of asphalt surface as part of the cover system.

Bergmann will also monitor a drilling contractor during test boring installations to allow for collection of confirmatory soil samples from the soil excavation removal area. Bergmann will monitor these subsurface explorations and collect soil samples. Bergmann will also collect groundwater samples for laboratory testing during post-remediation groundwater monitoring events.

3.3 Hazard Analyses

Physical Hazards

- Physical hazards associated with injury from vehicles, excavator or drilling equipment;
- Physical hazards associated with investigation activities (i.e., slip or trip into excavations);
- Underground utilities injury from damage to these utilities (i.e. electric shock, fire, and explosion); and
- Heat and/or cold stress.

Chemical Hazards

Chemical hazards associated with volatile organic compounds (VOCs) overexposure are presented below:

Toluene

General Description: A chemical compound in liquid form that resembles benzene but is less volatile, less flammable, and less toxic. Toluene is often used as a solvent, a starting material for various industrial chemicals, and as an anti-knock agent for gasoline. This compound is also found in coal-tar light oil and petroleum.

Safety and Health: An eye and skin irritant. Acute systemic effects by inhalation and ingestion may be but are not limited to central nervous system depression, headache, dizziness, and upset stomach. Chronic effects are possible liver damage, cancer, and blindness. The OSHA PEL – 100 ppm during an 8 hour exposure period.

Chemical hazards associated with semi-volatile organic compounds (SVOCs) overexposure are presented below:

Naphthalene

General Description: A chemical compounds (hydrocarbon) usually obtained by distillation of coal tar and used especially in organic synthesis. Current use is mainly as a raw material for the production of phthalic anhydride. Former uses as a moth repellant, wood preservative, soil fumigant, veterinary product, and pharmaceutical.

Safety and Health: An eye and skin irritant. Acute systemic effects by inhalation and ingestion may be but are not limited to headaches, confusion, excitement, malaise, nausea, vomiting, abdominal pain, jaundice, and dermatitis. Chronic effects are possible liver damage, kidney damage, and cancer. The OSHA PEL – 10 ppm during an 8 hour exposure period.

Phenanthrene

General Description: A chemical compound usually used to make dyes, explosives, and drugs as well as in biological research. Phenanthrene is also found in coal, coal tar, and asphalt and is associated with the incomplete combustion of fossil fuels and wood.

Safety and Health: An eye and skin irritant. Acute systemic effects by inhalation and ingestion may be but are not limited to photosensitivity. The OSHA PEL – 5 ppm during an 8 hour exposure period.

Fluoranthene

General Description: A white crystalline hydrocarbon of a complex structure, found as one ingredient of the higher boiling portion of coal tar.

Safety and Health: Limited evidence that this may act as a carcinogen. Skin, eye and respiratory irritant. The OSHA PEL – 0.2 ppm during an 8 hour exposure period.

Acenaphthene

General Description: A chemical compound used in the production of dyes, plastics, and pharmaceuticals. It is also used as an insecticides and fungicide and is present in coal tar.

Safety and Health: A skin, eye, and respiratory irritant. Chronic effects are possible liver and kidney damage.

Pyrene

General Description: One of the less volatile hydrocarbons of coal tar, obtained as a white crystalline substance.

Safety and Health: A skin, eye, and respiratory irritant. The OSHA PEL – 0.2 ppm during an 8 hour exposure period.

Benzo(a) Pyrene

General Description: A by-product of the incomplete combustion and thermal decomposition of fossil fuels and organic matter. It is present in tobacco smoke, automobile and diesel exhaust, coal tar, crude oils, and used lubricating oils.

Safety and Health: May cause cancer. An eye and skin irritant. Acute systemic and chronic effects by inhalation and ingestion may be but are not limited to reproductive system damage including reduction of fertility, possible genetic mutations, and photosensitivity. The OSHA PEL – 0.2 ppm during an 8 hour exposure period.

Chemical hazards associated with heavy metals overexposure are presented below:

Arsenic

General Description: A naturally occurring element widely distributed in the earth's crust. Mining activities, smelters, coal and coal combustion by-products, withdrawal sludges, pesticides enhance the natural levels of arsenic. Inorganic arsenic compounds are mainly used to preserve wood. Organic arsenic compounds are used as pesticides, primarily on cotton plants. Arsenic salts are used as pesticides, wood preservative, for glass manufacturing, in alloys, electronics, paint pigment and in the manufacture of dyes.

Safety and Health: An eye and skin irritant. After absorption, arsenic may cause multi-organ failure. The primary target organs initially are gastrointestinal tract, the heart, brain and kidneys. The skin, bone marrow and peripheral nervous system may also be affected. The OSHA PEL – 10 ppm during an 8 hour exposure period.

Chromium

General Description: A naturally occurring element found in rocks, animals, plants, soil, and in volcanic dust and gases. The metal chromium, which is the Chromium(0) form, is used for making steel. Chromium(VI) and Chromium(III) are used for chrome plating, dyes and pigments, leather tanning, and wood preserving.

Safety and Health: A confirmed carcinogen. An eye and skin irritant. Acute systemic effects by inhalation and ingestion may be but are not limited to nosebleeds, and ulcers and holes in the nasal septum, stomach upsets and ulcers, convulsions, kidney and liver damage. The Occupational Safety and Health Administration (OSHA) has set limits of 500 µg water soluble Chromium(III) compounds per cubic meter of workplace air (500 $\mu g/m^3$), 1,000 $\mu g/m^3$ for metallic chromium(0) and insoluble chromium compounds, and 52 $\mu g/m^3$ for chromium(VI) compounds for 8-hour work shifts and 40-hour work weeks.

Mercury

General Description: A naturally occurring metal that has several forms. The metallic mercury is a shiny, silver-white, odorless liquid. If heated, it is a colorless, odorless gas. Metallic mercury is used to produce chlorine gas and caustic soda, and is also used in thermometers, dental fillings, and batteries. Mercury salts are sometimes used in skin lightening creams and as antiseptic creams and ointments.

Safety and Health: Possible human carcinogen. An eye and skin irritant. Acute systemic effects by inhalation and ingestion may be but are not limited to lung damage, nausea, vomiting, diarrhea, and increases in blood pressure or heart rate. Chronic effects are possible damage to the brain, kidneys, and developing fetus. Effects on brain functioning may result in irritability, shyness, tremors, changes in vision or hearing, and memory problems. The OSHA PEL – 0.1 ppm during an 8 hour exposure period.

Lead

General Description: Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust and is produced as a by-product of the burning of fossil fuels, mining, and manufacturing. Lead has many different uses. It is used in the production of batteries, ammunition, metal products (solder and pipes), and devices to shield X-rays. Because of health concerns, lead from gasoline, paints and ceramic products, caulking, and pipe solder has been dramatically reduced in recent years.

Safety and Health: Lead can affect almost every organ and system in your body. The most sensitive is the central nervous system, particularly in children. Lead also damages kidneys and the reproductive system. The effects are the same whether it is breathed or swallowed. Acute systemic effects by inhalation and ingestion may be but are not limited to decreased reaction time, weakness in fingers, wrists, or ankles. Lead may cause anemia, a disorder of the blood. It can also damage the male reproductive system.

Selenium

General Description: Selenium is a naturally occurring mineral element that is distributed widely in nature in most rocks and soils. Most processed selenium is used in the electronics industry, but it is also used as a nutritional supplement; in the glass industry; as a component of pigments in plastics, paints, enamels, inks, and rubber; in the preparation of pharmaceuticals; as a nutritional feed additive for poultry and livestock; in pesticide formulations; in rubber production; as an ingredient in antidandruff shampoos; and as a constituent of fungicides. Radioactive selenium is used in diagnostic medicine.

Safety and Health: Short-term oral exposure to high concentrations of selenium may cause nausea, vomiting, and diarrhea. Chronic oral exposure to high concentrations of selenium compounds can produce a disease called selenosis. The major signs of selenosis are hair loss, nail brittleness, and neurological abnormalities (such as numbness and other odd sensations in the extremities).

4.1 SITE CONTROL MEASURES

4.2 Site Control

Site control will minimize potential injury and exposure of COCs to workers and visitors. Site control measures also enhance response in emergency situations.

It is anticipated that project work under this program will be conducted following Level D health and safety protocol. In the event that an upgrade to Level C health and safety protocol is necessary, a meeting will be held to prepare for level C health and safety issues and this HASP will be modified. Project work areas and locations to support level C field operations will be defined and divided into distinct areas. The actual extent of the areas is considered task and location specific and will be determined in the field.

4.1.1 Work Zone

The Work Zone is the area in which the potential for chemical contact/exposure may occur. Workers entering this zone will be required to be protected as defined in Section 7.0 of this HASP. The work zone is intended for 40 hour HAZWOPER OSHA-trained workers. Within this zone, the levels of protection may be changed in accordance with Section 7.4 of this HASP.

4.1.2 Decontamination Zone

A decontamination zone will be required in the event that Level C health and safety protocol is necessary. The decontamination zone is the area that is established to facilitate the removal of potential contamination from equipment and personnel protective equipment. A decontamination zone will be set up adjacent to the project work area (work zone) to facilitate decontaminating equipment that is used throughout the remediation project work. The location of the decontamination zone will depend on prevailing wind direction and physical site features.

4.1.3 Support Zone

A support zone may be set up outside the decontamination zone. The support zone will be used to store equipment and first aid supplies. Administrative and other support functions may occur within the support zone such as communication systems. Protective clothing (personnel protection equipment) that is used in the work zone may not be used in the support zone except in emergencies.

4.2 Site Security

The SHSO or designated alternate is responsible for coordinating access to the active work zone with the remediation contactor. The remediation contractor is responsible for site security and securing the excavations during working hours and non-working hours. When necessary to establish a work zone as defined above, the same will be identified by barricades or a barrier tape which will be placed a minimum of 10 feet from the edge of the excavation operation. Unauthorized entry should be noted in the daily field report.

4.3 Buddy System

Field activities in contaminated or otherwise potential hazardous work areas should be conducted with a buddy who is able to:

- Provide partner with assistance;
- Observe partner for signs of chemical or heat/cold exposure;
- Periodically check the integrity of partner's protective clothing; and
- Notify the SHSO or others if emergency help is needed.

4.4 Site Communications

Communications will be conducted through verbal communications. When out of audible range, verbal communications will be communicated using cellular phones or a 2-way radio.

Communications between workers in various zones shall consist of the standard hand signals, voice, or radios. A cellular phone will be used to contact appropriate agencies in the event of an emergency.

4.5 Safe Work Practices

Operating procedures consistent with general safety rules should be followed by all workers. Workers will be conscientious of others working around them and check that they are safe, and working in a safe manner.

General safety rules that will be enforced at the project work areas include the following:

- Monitor the excavation from the upwind location and periodically from the downwind location;
- Smoking will be prohibited at the Site;
- Eating and chewing gum will be prohibited at the Site;
- Field work will be conducted during daylight hours unless adequate light is provided;
- Authorized visitors that enter the Site will sign the daily field log and will also be required to read this HASP;
- Workers must thoroughly wash their hands prior to leaving the work area and decontamination zones and before eating or drinking; and
- Excessive facial hair should be minimized in the event that respiratory equipment is required for Level C project work.

4.6 Visitors

Visitors may be permitted in the immediate area of active operations with the approval from the SHSO. Visitors will not be allowed to enter in to the work zone and decontamination zones. Site visitors will be briefed on appropriate sections of the HASP that apply to their visit time on-site. The presence of visitors will be documented on the daily log maintained by the SHSO or designated alternate during site activities. Visitor vehicles will be restricted to Support Zones. Visitors will not be allowed in work areas, support zone, and decontamination areas during level C project work.

4.7 Nearest Medical Assistance

First Aid supplies will be located near the area of work activity, support zone, or in a field vehicle. Additional medical assistance can be summoned by dialing “911.”

The nearest medical assistance is Highland Hospital, located at 1000 South Avenue, Rochester, New York, (585- 473-2200), and is approximately 2.4 miles from the Site. The emergency route with directions to the hospital from the Site is shown on Figure 1 – Hospital Emergency Route. Additional information regarding medical assistance, evacuation routes, and emergency procedures is contained in Section 9.0 of this HASP.

4.8 Safety Equipment

In addition to the PPE necessary to conduct work activities, the following inventory of safety equipment will be available:

- First aid kit;
- Scissors for emergency equipment removal;
- Emergency eye wash;
- Electrolyte replacement drink – stored in clean area; and
- Fire extinguisher for Class ABC fires.

5.1 EMPLOYEE TRAINING

5.2 Pre-assignment & Annual Refresher Training

Bergmann employees and remediation contractor personnel working on this site will be trained in accordance with OSHA 29 CFR Part 1910.120.

6.0 MEDICAL SURVEILLANCE

Bergmann employees and contractors will follow their respective individual in-house medical surveillance procedures.

7.1 PERSONAL PROTECTIVE EQUIPMENT

The SHSO has reviewed the environmental and historical sampling data that is relevant to this proposed soil excavation and cleanup construction work to determine potential exposure to COCs and physical hazards. This review resulted in designating the work area as a construction zone. Level D PPE has been designated as the primary level of personnel protection that should be used during project work where contact with soil and groundwater is possible. Upgrading to Level C will be executed as required in the monitoring guidelines outlined.

7.2 Personal Protective Equipment Selection Criteria

PPE requirements selected for each project work task are specified in Section 7.3 of this HASP. Equipment selection was based upon the mechanics of the task and the nature of the hazards that are anticipated. The following criteria were used in the selection of PPE equipment:

- Chemical hazards known or suspected to be present;
- Routes of entry through which the chemicals could enter the body, e.g., inhalation, ingestion, skin contact; and
- Potential for contaminant/worker contact while performing the specific task or activity.

Based on available data, we anticipate that most on-Site or near-site work activities will be performed at Level D protection. However, Level C protection will be available in the event an upgrade is required.

7.3 Selected Personal Protective Equipment Ensembles

The following components of Level D PPE will be available and used as appropriate in accordance with the specifications of this HASP:

- Work boots;
- Rubber overboots (when necessary);
- Gloves during sample collection (Nitrile and/or rubber);
- Safety glasses;
- Insert-type hearing protection (when necessary);
- Hard hats;
- Long sleeve shirts and pants (no shorts);
- Leather gloves when using hand held tools; and
- Latex or nitrile gloves when sampling soil, water or debris.

It is possible that an upgrade to Level C may be required during the tasks identified during this project work. If an inhalation hazard is present or per the guidelines presented in the PPE reassessment program, the following must be added to the protective equipment:

- Full-face respirator equipped with NIOSH/OSHA-approved cartridges suitable for protection against organic vapors, acid gases, and particulates; and
- Tyvek disposable coveralls.

7.2.1 Levels of Protection

The following levels of protection will be used for specific work activities. Adjustments to these levels may be required given the site conditions encountered.

- Monitoring Soil borings, environmental monitoring and collection of soil samples - This work may be conducted in Level D.
- Groundwater Sampling - This work conducted in Level D.
- Monitoring remediation construction - This work conducted in Level D.

7.4 Personal Protective Equipment Reassessment Program

Air monitoring will be conducted during the remediation project work when excavation of COC impacted soils is performed. Such monitoring will be conducted within the work zone utilizing photoionization detection (PID) with a 10.2 eV lamp, or equivalent. Monitoring will consist of determining breathing zone concentrations of total volatile organic vapors. The air monitoring equipment utilized will be calibrated and maintained, in accordance with the manufacturer’s instructions. The calibrations and checks will be provided by the vendor of the equipment.

Background readings will be obtained in the work zone, upwind, downwind, and support zone prior to excavation of COC impacted soil. Following the establishment of background PID measurement, air monitoring will be conducted in the work zone during the soil excavation activities. Periodic PID measurements will be obtained at downwind locations. The PID measurements will be utilized for evaluating potential upgrade to Level C, if necessary. This may be accomplished by comparing PID measurements to health and safety action levels. The action levels for the PID air-monitoring measurements in the worker’s breathing zone are provided below:

- Upgrade from Level D to Level C if either of the following conditions exist:
- Total Organic Vapor (TOV) – greater or equal to 5 and less than 50 PID units (part per million) with compensation made for background readings sustained for a period of at least 5 minutes.
- Downgrade from Level C to Level D if both of the following conditions exist:
- Total Organic Vapor (TOV) – less than 5 PID units, above background sustained for a period of at least 5 minutes, with subsequent approval to downgrade provided by the Project Manager.

Immediate Evacuation of Area:

- Total Organic Vapor (TOV) – greater or equal to 50 PID units in the workers' breathing zone.
- Excavation of unknown soil type or containers.

If continued evacuation of the area becomes necessary, a meeting will be held to address the air monitoring results and air monitoring may be continued until levels are below evacuation criteria so the area can be reentered.

8.0 DECONTAMINATION PROCEDURES

Field decontamination of PPE (e.g. Boots) will consist of washing contaminated PPE with a mixture of Alconox soap and water or disposal of the boots. Modification to the decontamination protocol for PPE will be made on-Site as needed.

9.1 EMERGENCY RESPONSE

In the event of an emergency the following procedures will apply:

- Fire – the work area will be evacuated and the fire department will be notified. Telephone 911.

- Injury – Contact emergency medical services (Telephone 911). A qualified person will administer first aid. If injury is not a life or death situation, then self-transport to the hospital is acceptable. Directions to the hospital are attached.

- Chemical overexposure – If possible, move the victim to a safe location and contact 911 for emergency services. Have a qualified person administer first aid. If the person is conscious self-transport to the hospital is acceptable. If the person is unconscious, notify the appropriate emergency medical services at telephone number 911.

9.2 Available Equipment and Emergency Authorities

Bergmann and the remediation contractor will have a cellular telephone. If additional emergency equipment is required, the following local agencies can be called upon for advice, supplies, or additional manpower:

AGENCY	TELEPHONE NUMBER
City of Rochester Fire Department	911
Highland Hospital	911
NYSDEC – Region 8 Project Manager	(585) 226-5354

SIGNATURE PAGE

By signing below, I acknowledge that I have been informed of the items covered by this plan.

PRINTED NAME	SIGNATURE

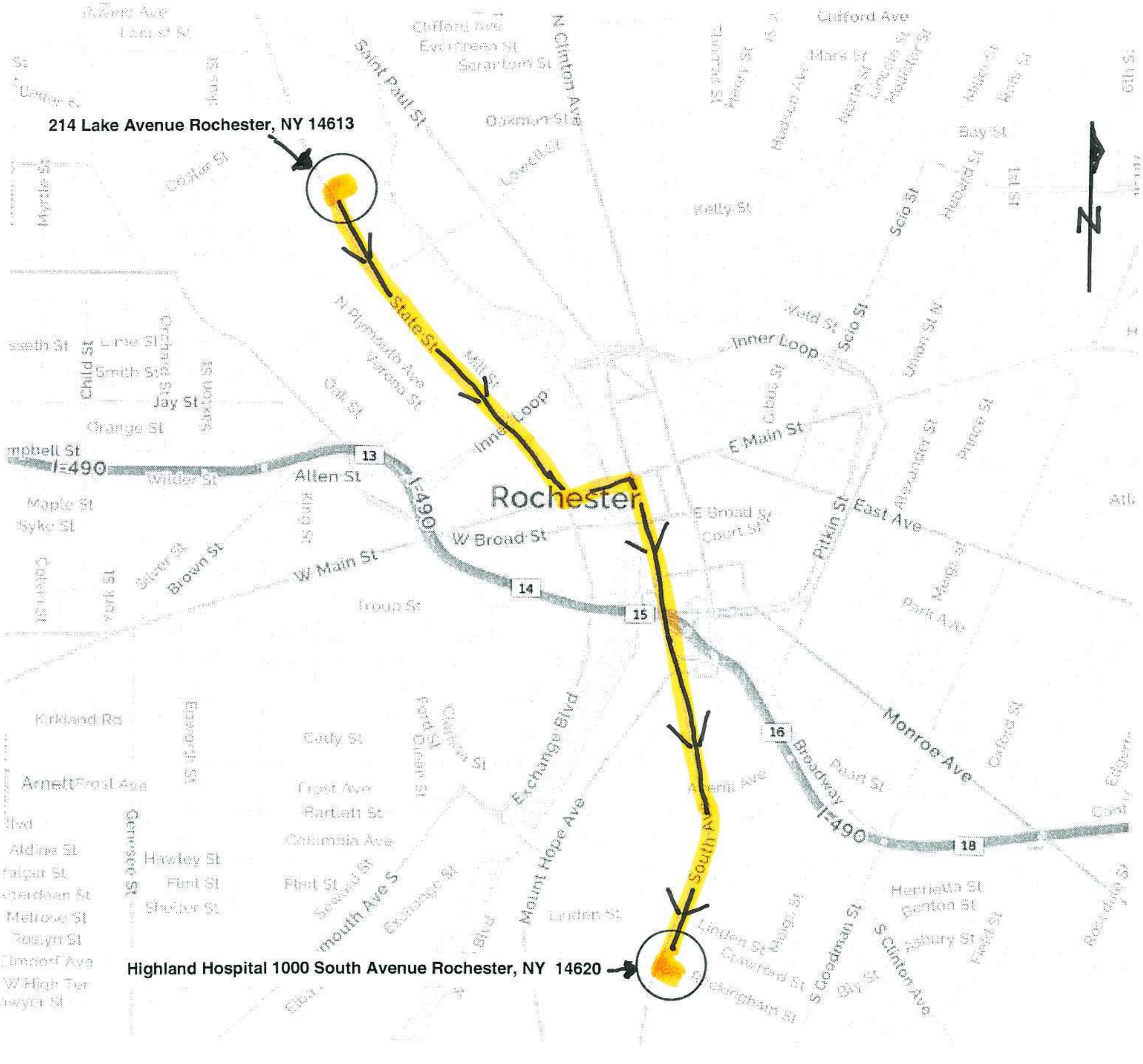

Figure 1 - Hospital Emergency Route

Attachment 1 – Driving Directions

Hospital Emergency Route

(1) Turn left onto Lake Avenue (southeast) - 0.3 miles.

(2) Lake Avenue becomes State Street - 0.2 miles

(3) Turn right onto Brown Street - 0.3 miles

(4) Turn left onto NY-31/West Broad Street - 0.1 miles

(5) Merge onto I-490 East via the ramp on the left - 0.9 miles

(6) Take the South Avenue exit (exit number 15) toward Route 15 (South Avenue) - 0.1 miles

(7) Stay straight to go onto South Avenue - 1.0 miles

(8) Highland Hospital is located at 1000 South Avenue, Rochester, New York.

APPENDIX 9
COMMUNITY AIR MONITORING PLAN

COMMUNITY AIR MONITORING PLAN
NEW YORK STATE TITLE 14 BROWNFIELD CLEANUP PROGRAM
SITE #C828126
214 LAKE AVENUE AND 18 AMBROSE STREET
ROCHESTER, NEW YORK

Submitted To:
Volunteers of America of Western New York
214 Lake Avenue
Rochester, New York 14608

Prepared By:
Bergmann Associates
280 East Broad Street, Suite 200
Rochester, New York 14604

December 2017

Bergmann Associates Job No. 041802

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FIGURES

1.0 INTRODUCTION

This Community Air Monitoring Plan (CAMP) has been prepared by Bergmann Associates on behalf of volunteers of America of Western New York. This CAMP addresses potential volatile organic compounds (VOCs) and particulate air quality issues that may arise during field activities associated with ground intrusive at 214 Lake Avenue and 18 Ambrose Street (Site), City of Rochester, Monroe County, New York (Figure 1 and Figure 2).

The field activities planned during this project that are subject to implementation of this CAMP primarily include field remedial investigation activities that include: excavation of test pits, test borings, and monitoring well installations. These subsurface explorations are required for volatile organic compounds (VOCs), semi-volatile organic compound (SVOC), and heavy metal contaminated soil and groundwater assessment. The remedial investigation is proposed to further evaluate the nature and extent of VOCs, SVOCs, heavy metals, and evaluate for PCBs and cyanide that may be present from historical uses and previous operations at the Site. Petroleum related volatile organic compounds VOCs, SVOCs, and heavy metals are the compounds that are present in the soil and groundwater at the Site. Volatilization of the volatile chemical compounds through disturbance of soils and/or groundwater may result in releases to the ambient air creating possible nuisance odors or fugitive emissions to the neighborhood. In addition, particulate matter (dust) may be entrained into the air from disturbances from field subsurface investigation activities. This CAMP details real-time monitoring activities to be carried out during field remedial investigations to minimize potential impact to neighborhood (off-site) exposure to airborne hazards resulting from fugitive air emissions during the field work.

Pursuant to New York State Department of Environmental Conservation (NYSDEC) DER – 10 Technical Guidance for Site Investigation and Remediation (2010), this CAMP addresses the methods that will be implemented to monitor particulate (dust) and volatile organic compounds (VOCs) levels at the perimeter of, and within, the work area. In the event that elevated particulate levels are encountered, this CAMP identifies the steps that will be taken to reduce and control the elevated particulate levels. This CAMP also identifies a work schedule to be implemented when subsurface explorations are conducted near the children's playground that is located off-site at the Volunteers of America's daycare facility.

Air monitoring and response actions for VOCs / dust levels are also included in this CAMP. VOC monitoring of the work sites will also be conducted as part of the Health and Safety Plan (HASP) that will be implemented during fieldwork by Bergmann Associates or Bergmann Associates' subcontractors.

2.0 METHODOLOGY

Depending on the nature or known or potential contaminants at the site, real-time air monitoring for VOCs and particulates will be conducted at the perimeter of the site. Continuous monitoring will be conducted for all ground intrusive activities that included but not limited to soil/waste excavation and handling, test pitting or trenching, installation of soil boring and monitoring wells. Periodic monitoring will be conducted for non-intrusive activities such as but not limited to collection of soil and sediment samples, collection of groundwater samples from existing monitoring well.

2.1 Perimeter Monitoring for Volatile Organic Compounds and Particulates

For each day of intrusive fieldwork, a windsock or flag will be used to monitor wind direction in the area of the work zone. Based upon the daily wind direction, two temporary VOC and particulate monitoring points will be identified at locations that are upwind and downwind of the work area and at the perimeter of the Site or fieldwork location. Wind direction will be checked periodically throughout the day to determine if wind direction has shifted and the monitoring locations will be adjusted accordingly.

Real-time particulate monitoring will be carried out using an MIE PDM-3 MiniRae aerosol monitor equipped with an audible alarm, or equivalent, capable of providing the measurement of airborne particulate matter less than 10 micrometers in size (PM-10). The equipment will be capable of integrating over a period of 15 minutes for comparison to airborne particulate action levels. VOC monitoring will be accomplished with a Photoionization Detector (PID) fitted with a sufficient lamp to detect VOC of concern. . Rainy, snowy, or damp conditions may eliminate the need for particulate monitoring, as well as reduce the usefulness of the PID for air monitoring purposes.

Prior to the commencement of fieldwork each day, background measurements of particulate and VOC concentrations will be logged at both up-wind and downwind locations with the equipment engines and other gas/diesel engines operating on Site.

Thereafter, measurements will be recorded at 15-minute running averages at the temporary upwind and downwind locations. The measurements will be used to observe the difference between upwind (background) levels and downwind particulate and VOC levels.

*VOC Response Levels and Action*s

If the ambient air concentration of total organic vapors at the downwind perimeter of the work zone exceeds 5 ppm above the background for the 15-miniute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor levels readily decrease (per instantaneous measurements) below 5 ppm over the background, work activities can resume with continued monitoring. The upwind location will be monitored to check the background levels.

If the total organic vapor levels at the downwind perimeter of the work area or work zone persist at levels in excess of 5 ppm over the background but less than 25 ppm, work activities must be halted, the sources of vapors identified, corrective actions implemented to abate emissions, and monitoring continued. After these tasks are completed, work activities can resume provided that the total organic vapor level 200 feet downwind of the work zone or half the distance to the nearest potential receptor or residential / commercial structure, which ever is less – but in one case less than 20 feet, is below 5 ppm over background for 15-minite measurements. If levels are sustained above the background levels then the contractor will then be required to implement suppression techniques or other means necessary to control or reduce VOCs. The initial measurements of the day will be obtained prior to the commencement of work to obtain daily background readings. Readings will be logged along with the perimeter downwind measurements. Specific monitoring procedures to be used in the work zone can be found in the HASP prepared for the activities at this Site.

If the organic vapor level is above 25 ppm at the perimeter of the work area activities must be shut down.

Particulate Response levels and Actions

If the downwind PM-10 particulate level is 100 micrograms per cubic meter 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 micro grams per cubic meter above the upwind level and provided that visible dust is not observed migrating from the work area.

In the event that downwind PM-10 particulate levels are greater than 150 micrograms per cubic meter after implementation of dust suppression techniques, work must stop and a re-evaluation of activities initiated. Work may resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 micrograms of the upwind level and preventing visible dust migration.

2.2 Work Zone Monitoring

In addition to perimeter monitoring, monitoring for VOCs, and particulates will be carried out continuously (continuous monitoring) within and around the work zone (work area) to monitor potential personal exposures and to compare work zone measurements with downwind and upwind measurements. The initial measurements of the day will be obtained prior to the commencement of work to obtain daily background readings. Upwind measurements will be logged along with the perimeter downwind measurements. Specific monitoring procedures to be used in the work zone can be found in the HASP prepared for the activities at this Site.

2.3 Fugitive Dust Control

If the monitoring described in Sections 2.1 or 2.2 indicate that fugitive particulate levels exceed the monitoring levels above background, then the contractor will implement fugitive dust control measures which may include one or more of the following:

- Using water spray or other dust suppression methods;
- Establishing wind shielding;
- Slowing down the fieldwork speed; and/or
- Stopping the fieldwork activities.

2.4 Minor Vapor Emission Response Plan

If the ambient air concentration of total organic vapors (VOCs) exceeds 5 ppm above background at the perimeter of the work zone, for a sustained 15 minute average, activities will be halted and monitoring continued. If the total organic vapor level decreases below 5 ppm above background, work activities can resume, with emphasis given to observing spikes in levels. If the total organic vapor levels are greater than 5 ppm over background but less than 25 ppm over background at the perimeter of the work area, activities can resume provided:

- The organic vapor level 200 ft. downwind of the work zone (work area) or <u>half the distance to the nearest residential or commercial structure</u>, whichever is less, is below 5 ppm over background. (The locations of structures in the subject neighborhood may not allow the 200 ft. buffer zone to be used).

If the organic vapor level is above 25 ppm at the perimeter of the work zone, for a sustained period of 15 minutes, activities must be shutdown. When work shutdown occurs, downwind air monitoring as directed by the Safety Officer will be implemented to evaluate if the vapor emission levels exceed those specified in Section 2.5, Major Vapor Emission Response Plan.

2.5 Major Vapor Emission Response Plan

If total organic vapor levels greater than 5 ppm over background are sustained for a15 minute period, at the 200 foot downwind location from the work zone (work area) or half the distance to the nearest residential or commercial structure, whichever is less, all work activities must be halted.

If, following the cessation of the work activities, or as the result of an emergency, total organic vapor levels greater than 5 ppm above background persist, during a 15 minute period, at 200 feet downwind or half the distance to the nearest residential or commercial structure, then the air quality must be monitored within 20 feet of the perimeter of the nearest residential or commercial structure (20 foot zone).

If efforts to abate the emission source area are unsuccessful and if the organic vapor levels continue to persist at or near 5 ppm above background for more than 30 minutes in the 20 foot zone, then the Major Vapor Emission Response Plan shall automatically be placed into effect.

The Major Vapor Emission Response Plan shall also be immediately placed into effect if organic vapor levels are greater than 10 ppm above background at the 20 foot zone.

Upon activation, the following activities will be undertaken:

1. All Emergency Response Contacts, as listed in the Health and Safety Plan, will be contacted.
2. The local fire department will immediately be contacted by the Safety Officer and advised of the situation. Evacuation or neighborhood notification plans can be discussed at that time.
3. Air monitoring will be conducted at 15 minute intervals within the 20 foot zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the Safety Officer.

2.6 Additional Measures for Work Near Daycare Playground

Two test pit explorations and one surface soil sample are planed subsurface explorations located close (greater than 20 feet) to the day care children’s playground. These subsurface explorations will be conducted when the daycare is closed and children are not on the playground (before or after operation hours or on weekends). Following this work schedule will significantly reduce potential human receptor issues associated with the approved project work.

Monitoring levels will be followed in accordance with DER-10 Community Air Monitoring Plan during implementation of subsurface explorations near the daycare playground.

3.0 RECORD KEEPING AND QUALITY CONTROL

For the duration of the field activities, a monitoring logbook will be kept to record calibration, operational notes, and summary of monitoring readings. The results of the Community Air Monitoring Program will be incorporated by Bergmann, or Bergmann subcontractors, into the required reports. The 15 – minute measurements will be recorded and will be available to NYSDEC and NYSDOH as well as County Health personnel to review.

Instrumentation will be calibrated and/or operationally checked, either daily or at intervals recommended by the manufacturer. Only approved calibration gases will be used. Operators for air monitoring will have been trained in the proper use, maintenance, limitation, and interpretation of results of the monitoring equipment.

BERGMANN
ASSOCIATES

Figure 1
Site Vicinity Map

Volunteers of America- NYDEC site NO. C828126

🟥 Site Boundary

BERGMANN
ASSOCIATES
Bergmann Associates, Architects, Engineers,
Landscape Architects & Surveyors, D.P.C.

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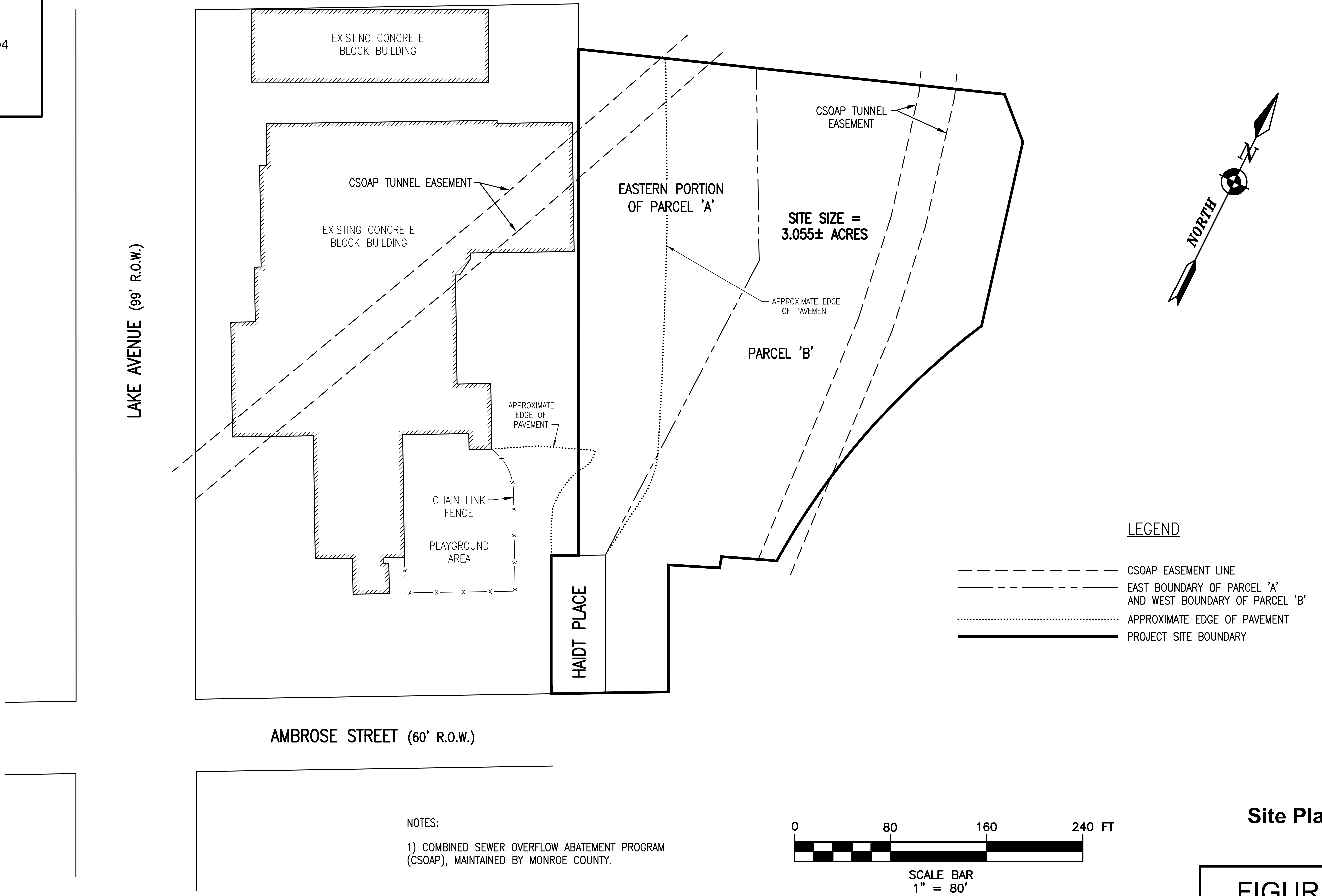

NOTES:

1) COMBINED SEWER OVERFLOW ABATEMENT PROGRAM (CSOAP), MAINTAINED BY MONROE COUNTY.

Site Plan

FIGURE 2

I:\VOA\008726.05 VOA-214 LAKE AVE NYS TITLE 14 BROWNFIELD\3.0 Design\3.8 Reports\Site Management Plan\Final SMP\Figures\Figure 2.dwg

BERGMANN
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Bergmann Associates, Architects, Engineers,
Landscape Architects & Surveyors, D.P.C.

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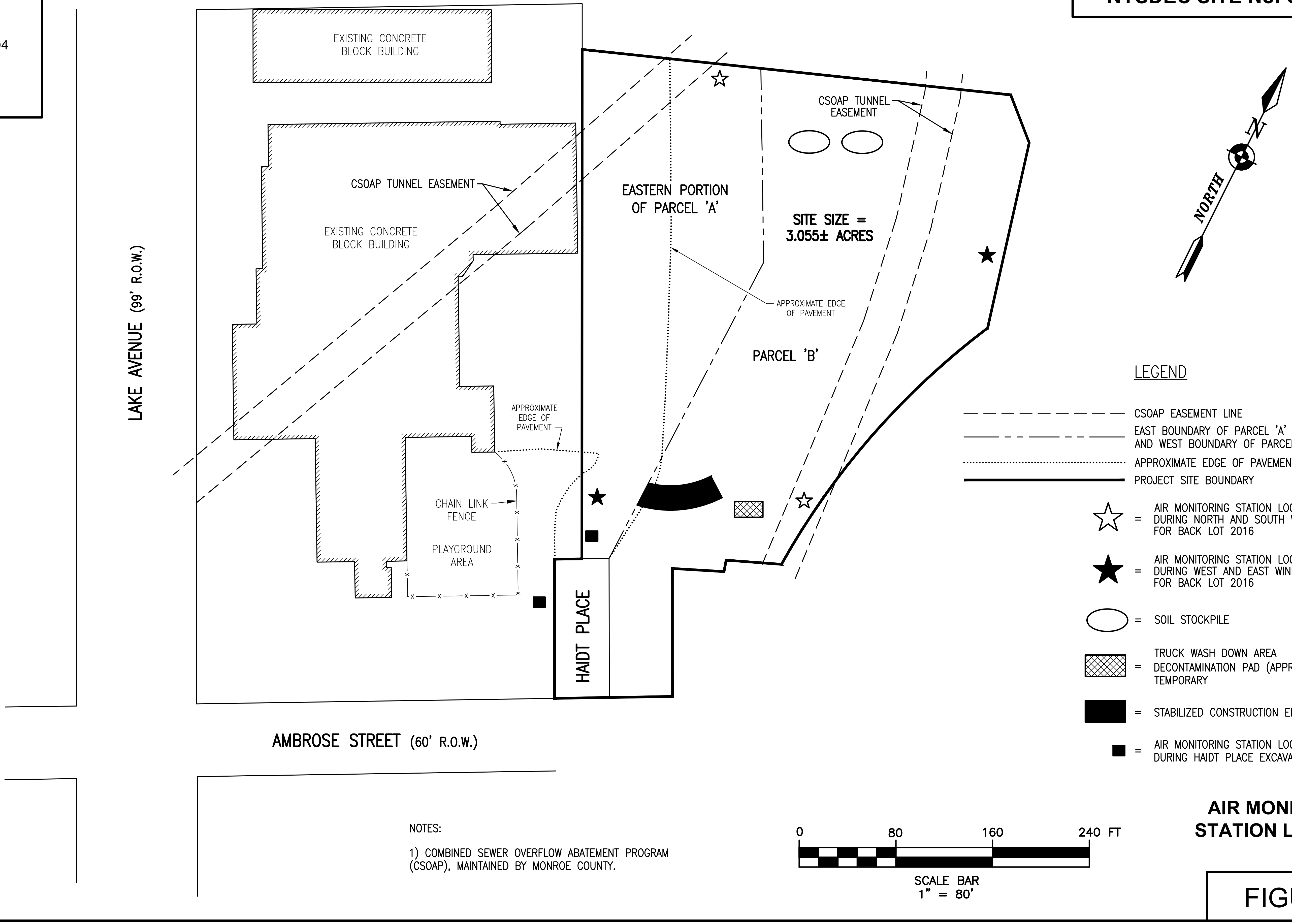
fax: 585.232.4652
www.bergmannpc.com

FINAL ENGINEERING REPORT
VOLUNTEERS OF AMERICA
BACK LOT SITE
NYSDEC SITE No. C828126



LEGEND

— — — — —	CSOAP EASEMENT LINE
—— - ——	EAST BOUNDARY OF PARCEL 'A' AND WEST BOUNDARY OF PARCEL 'B'
········	APPROXIMATE EDGE OF PAVEMENT
━━━━	PROJECT SITE BOUNDARY
☆ =	AIR MONITORING STATION LOCATION USED DURING NORTH AND SOUTH WIND DIRECTION FOR BACK LOT 2016
★ =	AIR MONITORING STATION LOCATION USED DURING WEST AND EAST WIND DIRECTION FOR BACK LOT 2016
○ =	SOIL STOCKPILE
▨ =	TRUCK WASH DOWN AREA DECONTAMINATION PAD (APPROXIMATE) TEMPORARY
▬ =	STABILIZED CONSTRUCTION ENTRANCE
■ =	AIR MONITORING STATION LOCATION USED DURING HAIDT PLACE EXCAVATION 2017

NOTES:

1) COMBINED SEWER OVERFLOW ABATEMENT PROGRAM (CSOAP), MAINTAINED BY MONROE COUNTY.

AIR MONITORING STATION LOCATION

FIGURE 3

I:\VOA\008726.05 VOA-214 LAKE AVE NYS TITLE 14 BROWNFIELD\3.0 Design\3.8 Reports\Final Engineering Report\Final FER December\Final FER\Figures\Figure 7.dwg

APPENDIX 10

BORING LOGS & WELL CONSTRUCTION LOGS

GeoQuest Environmental, Inc.

Test Boring Report

MW - 101

Project:	Volunteers of America, 214 Lake Avenue, BCA Index #B 8-0688-05-04, Site C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 2
Contractor	SJB Services, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Drilling Equipment and Procedures	
Type:	Auger	SS	NX	Rig Type:	CME 85 Truck mounted
Inside Diameter (IN):	NA	1.8	NA	Bit Type:	Rorary Augers
Hemmer Weight (LB):	140	NA	NA	Drill Mud:	water
Hammer Fall (IN):	30	NA	NA	Other:	
Other:	NA	NA	NA		

Elevation:	482.3
Datum:	NGVD
Start:	7/1/2008
Finish	7/2/2008
Driller:	R. Brown
GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0	0				0.5	PAVEMENT
		25,3,4,15		S1		Loose gray GRAVEL, with coal fragments, damp.
	2			20"/24"		Dense black to gray GRAVEL, with brick and coal fragments, damp. -UPPER FILL-
2	2					
			ND	S2		
				22"/24"		
		30,18,15,12				
4	4					
	4			S3		Medium dense black to gray CINDERS and SLAG, damp.
6	6	10,11,8,7	ND	21"/24"		
				S4		
	6					Loose black to gray CINDERS and SLAG, with ash damp. -UPPER FILL-
	8	4,2,3,4	ND	22"/24"		
8	8					
						Same.
				S5		
						- UPPER FILL -
	10		ND	20"/24"		
10						
		7,2,2,2				Same.
				S6		
	10					
12	12	1,2,2,1	ND	0"/24"		
	12					
				S7		
				20"/24"		Same. - UPPER FILL-
	14	1,1,1,1				
14			ND	S8		
	14					Same.
				20"/24"		
						- UPPER FILL -
16	16	1,1,2,2				
	16					Same.
			ND	S9		
				24"/24"		
18	18	1,1,2,2	ND	S10		
	18					
				17"/24"		Same.
20	20					
		1,2,2,2	ND			- UPPER FILL -

Ground Water Data

Date	Time	Elapsed Time (HR)	Depth: Bottom Of Casing	Depth: Bottom Of Hole	Depth: Groundwater Encountered
7/2/2008	NA	NA	NA	34.0 Ft.	Yes

Summary

Overburden (Lin FT)	34.0
Rock Cored (Lin FT)	NA
Samples:	S16

GeoQuest Environmental, Inc.

GeoQuest Environmental, Inc.

Test Boring Report

MW - 101

Project:	Volunteers of America, 214 Lake Avenue, BCA Index #B 8-0688-05-04, Site C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	2 of 2
Contractor	SJB Sevices, Inc.		

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
20	20					Medium dense CINDERS and SLAG with ash, moist.
		WOH,2,2,7	ND	S11		
	22			24"/24"		
						Same.
22	22					
			ND	S12		
						-UPPER FILL-
				24"/24"		
24	24	3,3,3,2,			24.0	
	24			S13		
			ND			Medium dense gray to white CINDERS and ASH with glass, shell, and leather fragments, damp.
26	26	1,1,1,2		21"/24"		
	26 28		ND	S14		Loose gray to white CINDERS and ASH, damp. -LOWER FILL-
		3,3,5,7		23"/24"		
28	28			S15		Same, except with shell fragments
			ND	24"/24"		
30	30	1,3,4,5				
	30			S16		Same.
			ND	20"/24"		
32	32	2,2,3,2				
	32			S17		Loose CINDERS and ASH, little silt, wet.
			ND			
34	34	2,4,5,9		24"/24"		-LOWER FILL-
36						Notes: Monitoring well MW-101 installed in completed test boring.
						See Well Completion Log MW-101
38						
40						

Ground Water Data

Date	Time	Elapsed Time (HR)	Depth: Bottom Of Casing	Depth: Bottom Of Hole	Depth: Groundwater Encountered
7/2/2008	NA	NA	NA	34.0 Ft.	Yes

Summary

Overburden (Lin FT)	34.0
Rock Cored (Lin FT)	NA
Samples:	S17

GeoQuest Environmental, Inc.

Test Boring Report

MWR - 101

Project:	Volunteers of America, 214 Lake Avenue, BCA Index #B 8-0688-05-04, Site C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	SJB Services, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Drilling Equipment and Procedures		
Type:	Auger	SS	NX	Rig Type: CME 85 Truck mounted	Elevation:	482.2
Inside Diameter (IN):	NA	1.8	NA	Bit Type: Rorary Augers	Datum:	NGVD
Hemmer Weight (LB):	140	NA	NA	Drill Mud: water	Start:	7/9/2008
Hammer Fall (IN):	30	NA	NA	Other: NX core barrel - rock core	Finish	7/10/2008
Other:	NA	NA	NA		Driller:	R. Brown
					GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
34						Augers without sampling from ground surface to 34.0 ft. see MW-101 for soil descriptions
	34	12,18,14,20				Dense light brown SILT, some coarse to fine sand, little gravel, wet.
	36					same, except very dense.
36	36	35,30,36,40				- GLACIAL TILL-
	38					
38	38	10,22,34,31				Dense light brown to gray GRAVEL, some silt, little coarse to fine sand, tracy clay, wet.
	40					
40	40	8,16,18, 22				same.
	42					
	42	22,28,40,45				Same, except very dense.
42						
	44					
	Augered					-GLACIAL TILL-
44	44 -44.5	100/.5				
						TOP OF BEDROCK AT APPROXIMATELY 44.5 ft.
	44.5					
46		R1				Medium hard gray shaley mudstone ROCHESTER SHALE, with calcarenite lenses,
		57"/60"				occasional horizontal partings and high angle joints.
		52"/60"				
48						
		REC. 95.0%				
	49.5					
		RQD. 86.7%				
						Medium hard gray shaley mudstone ROCHESTER SHALE, with calcarenite
50	49.5					lenses and occasional horizontal partings.
		R2				
52		56"/60'				
		51"/60"				
		REC.93.3%				
54	54.5					
		RQD.85.0%				
						Bottom of boring at 54.5 ft. Installed monitoring well MWR-101 in completed borehole.

Ground Water Data

Date	Time	Elapsed Time (HR)	Depth: Bottom Of Casing	Depth: Bottom Of Hole	Depth: Groundwater Encountered
7/10/2008	NA	NA	NA	54.5	Yes

Summary

Overburden (Lin FT)	44.5
Rock Cored (Lin FT)	10
Samples:	S6

GeoQuest Environmental, Inc.

Test Boring Report

MW - 102

Project:	Volunteers of America, 214 Lake Avenue, BCA Index #B 8-0688-05-04, Site C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 2
Contractor	SJB Services, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Drilling Equipment and Procedures			
Type:	Auger	SS	NX	Rig Type: CME 85 Truck mounted		Elevation:	490.6
Inside Diameter (IN):	NA	1.8	NA	Bit Type: Rorary Augers		Datum:	NGVD
Hemmer Weight (LB):	140	NA	NA	Drill Mud: water		Start:	7/7/2008
Hammer Fall (IN):	30	NA	NA	Other:		Finish	7/7/2008
Other:	NA	NA	NA			Driller:	R. Brown
						GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0	0				0.5	PAVEMENT
		36,8,9,9		S1		Medium dense gray GRAVEL, with coal, cinders, and brick fragments, damp.
	2			22"/24"		Same. -UPPER FILL-
2	2		ND	S2		
				22"/24"		
		9,6,6,6				
4	4					
	4			S3		Loose black to gray CINDERS and SLAG, with ash and coal fragments, damp.
6	6	2,3,2,2	ND	22"/24"		
				S4		
	6					Same.
	8	2,3,1,1	ND	22"/24"		
8	8					
						Same.
				S5		
						- UPPER FILL -
	10		ND	24"/24"		
10						
		1,2,4,2				Same.
				S6		
	10					
12	12	3,3,2,1	ND	0"/24"		
	12					
				S7		
				21"/24"		Same. - UPPER FILL-
	14	3,3,4,1				
14			ND	S8		
	14					Medium dense brown SAND, with cinders, slag and ash, damp.
				23"/24"		
						- UPPER FILL -
16	16	4,4,5,6				
	16					Medium dense gray SILT and SAND, with cinders, slag, and ash, damp.
			ND	S9		
				24"/24"		
18	18	5,5,4,6	ND	S10		
	18					
				24"/24"		Same.
20	20					
		2,6,8,4	ND			- UPPER FILL -

Ground Water Data						Summary	
			Depth			Overburden (Lin FT)	32.0
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Groundwater Encountered	Rock Cored (Lin FT)	NA
7/7/2008	NA	NA	NA	32.0 Ft.	Yes	Samples:	S15

GeoQuest Environmental, Inc.

GeoQuest Environmental, Inc.

Test Boring Report

MW - 102

Project:	Volunteers of America, 214 Lake Avenue, BCA Index #B 8-0688-05-04, Site C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	2 of 2
Contractor	SJB Sevices, Inc.		

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
20	20					Medium dense black to gray CINDERS and SLAG and brick fragments, moist.
		6,5,5,5	ND	S11		
	22			23"/24"		
						Same.
22	22					
			ND			
				S12		
						-LOWER FILL-
				24"/24"		
24	24	9,5,5,5			24.0	
	24			S13		
			ND			Loose gray to white CINDERS and ASH with glass, shell, and leather fragments, damp.
26	26					
		2,1,2,2		22"/24"		
	26 28		ND	S14		Loose gray to white CINDERS and ASH, damp. -LOWER FILL-
		2,9,7,7		23"/24"		Medium dense light brown GRAVEL, some silt, little coarse to fine sand, moist. -GLACIAL TILL-
28						
	28			S15		Same, except moist to wet.
			ND	20"/24"		
30	30	4,5,7,9				
	30			S16		Same, except wet. -GLACIAL TILL-
			ND	23"/24"		
32	32	10,17,20,31				
34						
36						Notes: Monitoring well MW-102 installed in completed test boring.
						See Well Completion Log MW-102
38						
40						

Ground Water Data

			Depth		
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Groundwater Encountered
7/7/2008	NA	NA	NA	32.0 Ft.	Yes

Summary

Overburden (Lin FT)	32.0
Rock Cored (Lin FT)	NA
Samples:	S16

GeoQuest Environmental, Inc.

GeoQuest Environmental, Inc.

Test Boring Report

MWR - 102

Project:	Volunteers of America, 214 Lake Avenue, BCA Index #B 8-0688-05-04, Site C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	SJB Services, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Drilling Equipment and Procedures		
					Elevation:	490.5
Type:	Auger	SS	NX	Rig Type: CME 85 Truck mounted	Datum:	NGVD
Inside Diameter (IN):	NA	1.8	NA	Bit Type: Rorary Augers	Start:	7/7/2008
Hemmer Weight (LB):	140	NA	NA	Drill Mud: water	Finish	7/8/2008
Hammer Fall (IN):	30	NA	NA	Other: NX core barrel - rock core		
Other:	NA	NA	NA		Driller:	R. Brown
					GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
34						Augers without sampling from ground surface to 34.0 ft. see MW-102 for soil descriptions
	34 36	50,47,43,49				Very Dense light brown GRAVEL, some silt, little clay, wet.
36	36 38	54,47,50,43				- GLACIAL TILL-
38	38 38.3	100/0.3				Same.
40	40 40.4	100/0.4				
42	42 42.3	100/0.3				Very Dense light brown coarse to fine SAND, some gravel, little silt, trace clay, wet.
44	42 44	45,44,53,48				-GLACIAL TILL-
46 48	44 49	R1 59"/60" 53"/60" REC. 98.3% RQD. 88.3%				TOP OF BEDROCK AT APPROXIMATELY 44.0 ft. Medium hard gray, shalely mudstone ROCHESTER SHALE with calcarenite lenses, occasional horizontal partings.
50 52 54	49 54	R2 57"/60' 52"/60" REC.95% RQD.86.6%				Medium hard gray, shalely mudstone ROCHESTER SHALE with calcerenite lenses, occasional horizontal partings, and high angle joints.
						Bottom of boring at 54.0 ft. Installed monitoring well MWR-102 in completed borehole.

Ground Water Data

Date	Time	Elapsed Time (HR)	Depth: Bottom Of Casing	Depth: Bottom Of Hole	Depth: Groundwater Encountered
7/7/2008	NA	NA	NA	54.0	Yes

Summary

Overburden (Lin FT)	44.0
Rock Cored (Lin FT)	10
Samples:	S6

GeoQuest Environmental, Inc.

GeoQuest Environmental, Inc.

Test Boring Report

MW - 103

Project:	Volunteers of America, 214 Lake Avenue, BCA Index #B 8-0688-05-04, Site C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 2
Contractor	SJB Services, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Drilling Equipment and Procedures			
						Elevation:	483.8
Type:	Auger	SS	NX	Rig Type:	CME 85 Truck mounted	Datum:	NGVD
Inside Diameter (IN):	NA	1.8	NA	Bit Type:	Rorary Augers	Start:	7/1/2008
Hemmer Weight (LB):	140	NA	NA	Drill Mud:	water	Finish	7/2/2008
Hammer Fall (IN):	30	NA	NA	Other:			
Other:	NA	NA	NA			Driller:	R. Brown
						GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0	0					Medium dense gray GRAVEL, some coarse to fine sand with coal, damp.
		6,12,20,15	ND	S1		
	2			24"/24"		Medium dense black COAL and GRAVEL, with brick fragments, damp. -UPPER FILL-
2	2					
			11.2 ppm	S2		
				23"/24"		
		6,8,12,15				
4	4					
	4			S3		Medium dense black to gray CINDERS and WOOD FIBERS, little fine sand, damp.
6	5.9	23,11,17,100/0.4	ND	20"/23"		
				S4		
	6					Medium dense black to gray GRAVEL, some coarse to fine sand, trace slag,damp.
	8	34,12,8,12	ND	22"/24"		
8	8					
						Same, except with coal fragments.
				S5		
						- UPPER FILL -
	10		ND	24"/24"		
10						
		5,15,12,8				Same.
				S6		
	10					
12	12	7,6,8,10	ND	18"/24"		Same.
	12					- UPPER FILL -
				S7		
				23"/24"		Medium dense black to gray SILT, with brick fragments, damp.
	14	4,7,6,8				
14			ND	S8		
	14					Loose black to gray SILT, with brick fragments, damp.
				20"/24"		
						- UPPER FILL -
16	16	4,4,4,4				
	16					Medium dense black to gray CINDERS and SLAG, damp.
			ND	S9		
				24"/24"		
18	18	11,4,6,10	ND			
	18					
				S10		Medium dense CINDERS, SLAG, with ash and coal, damp.
				24"/24"		Loose black to gray CINDERS and SLAG, damp. -UPPER FILL-
20	20					
		4,3,2,8	ND			

Ground Water Data						Summary	
			Depth			Overburden (Lin FT)	34.0
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Groundwater Encountered	Rock Cored (Lin FT)	NA
6/27/2008	NA	NA	NA	46.0 Ft.	Yes	Samples:	S22

GeoQuest Environmental, Inc.

Test Boring Report

MW - 103

Project:	Volunteers of America, 214 Lake Avenue, BCA Index #B 8-0688-05-04, Site C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	2 of 2
Contractor	SJB Sevices, Inc.		

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
20 22	20 22	11,14,3,4	ND	S11 19"/24"	22	Medium dense black to gray CINDERS and SLAG, trace ash, damp. -UPPER FILL-
24	22 24	3,3,3,4	ND	S12 23"/24"		Loose gray to white CINDERS and ASH, with shell and glass fragments, damp. -LOWER FILL-
26	24 26	4,6,5,3	ND	S13 22"/24"		Same, except medium dense.
28	26 28	4,7,1,3	ND	S14 21"/24"		Same, except Loose.
30	28 30	4,9,13,14	ND	S15 22"/24"		Same, except mendum dense. -LOWER FILL-
32	30 32	3,3,4,4	ND	S16 22"/24"		Same, except loose.
34	32 34	6,7,5,5	ND	S17 24"/24"		Same, except medium dense. -LOWER FILL-
36	34 36	4,5,7,8	ND	S18 23"/24"		Same.
38	36 38	7,6,8,9	ND	S19 24"/24"		Same.
40	38 40	4,3,4,3	ND	S20 24"/24"		Loose gray to white CINDERS and ASH, with glass, shell fragments, moist. - LOWER FILL-
42	40 42	2,3,3,4	ND	S21 22"/24"		Same.
44	42 44	3,3,3,3	ND	S22 21"/24"		Same, except with leather fragments, moist to wet.
46	44 46	1,4,3,2	ND	S23 24"/24"		Same, except wet. -LOWER FILL-
						Notes: Monitoring well MW-103 installed in completed test boring. See Monitroing well log MW-103

Ground Water Data						
			Depth			
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Groundwater Encountered	
6/27/2008	NA	NA	NA	46.0 Ft.	Yes	

Summary	
Overburden (Lin FT)	46.0
Rock Cored (Lin FT)	NA
Samples:	S23

GeoQuest Environmental, Inc.

Test Boring Report

MW - 104

Project:	Volunteers of America, 214 Lake Avenue, BCA Index #B 8-0688-05-04, Site C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 2
Contractor	SJB Services, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Drilling Equipment and Procedures			
Type:	Auger	SS	NX	Rig Type: CME 85 Truck mounted	Elevation:	481.9
Inside Diameter (IN):	NA	1.8	NA	Bit Type: Rorary Augers	Datum:	NGVD
Hemmer Weight (LB):	140	NA	NA	Drill Mud: water	Start:	6/27/2008
Hammer Fall (IN):	30	NA	NA	Other:	Finish	6/27/2008
Other:	NA	NA	NA		Driller:	R. Brown
					GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0	0					Medium dense Brown GRAVEL and COAL, damp.
		16,10,12,4		S1		Medium dense black COAL, damp.
	2			22"/24"		Loose black COAL, damp. -UPPER FILL-
2	2					
			ND	S2		
				22"/24"		
		3,4,3,8				
4	4					
	4			S3		Medium dense black to gray CINDERS and SLAG, little coares to fine sand, damp.
6	6	3,15,17,16	ND	24"/24"		
				S4		
	6					Very dense black CINDERS and SLAG, with brick fragments, damp. -UPPER FILL-
	8	13,10,15,19	ND	22"/24"		
8	8					
						Medium dense CINDERS and SLAG, with ash, damp.
				S5		
						- UPPER FILL -
	10		ND	21"/24"		
10						
		10,11,7,8				
				S6		
	10					
12	12	11,4,5,7	ND	20"/24"		Coarse to fine SAND, little gravel, with wood fragments, damp.
	12					- UPPER FILL -
				S7		
				23"/24"		Medium dense CINDERS and SLAG with COAL, damp. - FILL-
	14	5,7,11,9				
14			ND	S8		
	14					Loose CINDERS and SLAG, with ash, moist to wet.
				24"/24"		
						- UPPER FILL -
16	16	7,4,5,8				
	16					Same, except medium dense.
			ND	S9		
				24"/24"		
18	18	10,8,6,8	ND		18	Medium dense CINDERS, SLAG, with ash and coal, damp. -UPPER FILL-
	18					
				S10		
				23"/24"		Loose brown GRAVEL, with glass and shell fragments, damp. -LOWER FILL-
20	20					
		1,3,5,4	ND			

Ground Water Data						Summary	
			Depth			Overburden (Lin FT)	34.0
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Groundwater Encountered	Rock Cored (Lin FT)	NA
6/27/2008	NA	NA	NA	34.0 Ft.	Yes	Samples:	S17

GeoQuest Environmental, Inc.

GeoQuest Environmental, Inc.

Test Boring Report

MW - 104

Project:	Volunteers of America, 214 Lake Avenue, BCA Index #B 8-0688-05-04, Site C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	2 of 2
Contractor	SJB Sevices, Inc.		

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
20	20					Loose brown GRAVEL, with glass fragments, damp. - LOWER FILL-
		1,1,2,3	ND	S11		
	22			19"/24"		
						Medium dense gray SILT and COAL, trace fine sand, with shell fragments, damp.
22	22					
			ND			
				S12		
				24"/24"		
24	24	8,15,16,10				
	24			S13		
			ND			Medium dense gray to white CINDERS and ASH with shell, and leather fragments, damp.
26	26					
		5,10,7,4		22"/24"		
	26 28		ND	S14		Medium dense gray SILT and COAL, damp. -LOWER FILL-
		10,9,7,9		21"/24"		
28						
	28			S15		Loose brown to gray coarse to fine SAND, little gravel, moist.
			ND	24"/24"		
30	30	WOH,2,3,5				
	30			S16		Loose CINDERS and ASH, with wood fragments, moist.
			ND	22"/24"		
32	32	2,2,3,5				
	32			S17		Loose CINDERS and ASH, with leather and shell fragments, wet.
			ND			
34	34	6,4,5,7		24"/24"		-LOWER FILL-
36						Notes: Monitoring well MW-104 installed in completed test boring.
						See Well Completion Log MW-104
38						
40						

Ground Water Data					
			Depth		
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Groundwater Encountered
6/27/2008	NA	NA	NA	34.0 Ft.	Yes

Summary	
Overburden (Lin FT)	34.0
Rock Cored (Lin FT)	NA
Samples:	S17

GeoQuest Environmental, Inc.

GeoQuest Environmental, Inc.

Test Boring Report

MW - 105

Project:	Volunteers of America, 214 Lake Avenue, BCA Index #B 8-0688-05-04, Site C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 2
Contractor	SJB Services, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Drilling Equipment and Procedures			
Type:	Auger	SS	NX	Rig Type:	CME 85 Truck mounted	Elevation:	481.5
Inside Diameter (IN):	NA	1.8	NA	Bit Type:	Rorary Augers	Datum:	NGVD
Hemmer Weight (LB):	140	NA	NA	Drill Mud:	water	Start:	6/30/2008
Hammer Fall (IN):	30	NA	NA	Other:		Finish	6/30/2008
Other:	NA	NA	NA			Driller:	R. Brown
						GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0	0					Medium dense Black and gray BRICK and COAL, some coarse to fine sand, damp.
		2,4,5,6		S1		
	2			24"/24"		Same. -UPPER FILL-
2	2		ND	S2		
				23"/24"		
		5,6,16,10				
4	4					Loose gray CINDERS and SILT, with brick and ash, damp.
	4			S3		
6	6	1,1,4,6	ND	24"/24"		
				S4		
	6					Loose black and gray WOOD FIBERS, moist.
	8	2,1,1,1	ND	19"/24"		
8	8					Loose black to gray WOOD FIBERS, little coarse to fine sand, damp.
				S5		- UPPER FILL -
10	10	4,4,4,4	ND	20"/24"		
				S6		
	10					
12	12	16,4,5,4	ND	23"/24"		No recovery.
	12			S7		
				21"/24"	14	Loose CINDERS and SLAG with trace ash, moist. - UPPER FILL-
	14	5,4,3,2				
14			ND	S8		
	14			24"/24"		Medium dense light brown SILT, some gravel, little coarse to fine sand, moist.
						- GLACIAL TILL -
16	16	4,8,8,13		S9		
	16		ND	10"/10"		Very dense light brown GRAVEL, some coarse to fine sand, little silt, damp.
	16.8	22, 50/0.3				
	Augered					
18			ND			
	18					
	18.3	50/0.3		S10		Same. -GLACIAL TILL-
	Augered			4"/4"		
20						

Ground Water Data						Summary	
			Depth			Overburden (Lin FT)	26.3
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Groundwater Encountered	Rock Cored (Lin FT)	NA
6/30/2008	NA	NA	NA	26.3 Ft.	Yes	Samples:	S11

GeoQuest Environmental, Inc.

GeoQuest Environmental, Inc.

Test Boring Report

MW - 105

Project: Volunteers of America, 214 Lake Avenue, BCA Index #B 8-0688-05-04, Site C828126

Client: Volunteers of America of Western New York

Contractor SJB Sevices, Inc.

File No: 110204

Sheet No: 2 of 2

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
20	Augered					
22						-GLACIAL TILL
	Augered					
24						
	Augered					Same.
26						
	26-26.3	50/0.3	ND	S11		Very dense light brown GRAVEL, some coarse to fine sand, little silt, moist. -GLACIAL TILL-
28						
30						
32						
34						
36						Notes: Monitoring well MW-105 installed in completed test boring. See Well Completion Log MW-105
38						
40						

Ground Water Data

			Depth		
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Groundwater Encountered
6/30/2008	NA	NA	NA	26.3 Ft.	Yes

Summary

Overburden (Lin FT)	26.3
Rock Cored (Lin FT)	NA
Samples:	S11

GeoQuest Environmental, Inc.

GeoQuest Environmental, Inc.

Test Boring Report

MW - 106

Project:	Volunteers of America, 214 Lake Avenue, BCA Index #B 8-0688-05-04, Site C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 2
Contractor	SJB Services, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Drilling Equipment and Procedures			
Type:	Auger	SS	NX	Rig Type:	CME 85 Truck mounted	Elevation:	480.9
Inside Diameter (IN):	NA	1.8	NA	Bit Type:	Rorary Augers	Datum:	NGVD
Hemmer Weight (LB):	140	NA	NA	Drill Mud:	water	Start:	6/26/2008
Hammer Fall (IN):	30	NA	NA	Other:		Finish	6/27/2008
Other:	NA	NA	NA			Driller:	R. Brown
						GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0	0					Medium dense Brown GRAVEL and COAL, damp.
		10,12,12,16		S1		
	2			20"/24"		Same, except with brick fragments. -UPPER FILL-
2	2		ND	S2		
				22"/24"		
		14,10,8,16				
4	4					
	4			S3		Dense light brown to brown SAND, little silt, with brick fragments, damp.
6	6	9,18,22,35	ND	23"/24"		
				S4		
	6					Very dense black CINDERSand SLAG, with brick fragments, damp. -FILL-
	6.8	50, 50/.3	ND	22"/24"		
8	8					
						Same.
				S5		
						- UPPER FILL -
10	10		ND	24"/24"		
		10,12,8,17				
				S6		
	10					
12	12	2,2,3,1	ND	0"/24"		No recovery.
	12			S7		
				20"/24"		Loose CINDERS and SLAG with COAL, damp. - FILL-
	14	2,3,3,2				
14			ND	S8		
	14					Same.
				20"/24"		
						- UPPER FILL -
16	16	3,3,2,5				
	16					Same, except medium dense.
			ND	S9		
				24"/24"		
18	18	9,11,8,6	ND	S10		
	18					
				23"/24"		Medium dense CINDERS, SLAG, and ASH, damp.
20	20					
		4,10,11,15	ND			- UPPER FILL -

Ground Water Data

Date	Time	Elapsed Time (HR)	Depth: Bottom Of Casing	Depth: Bottom Of Hole	Depth: Groundwater Encountered
6/27/2008	NA	NA	NA	34.0 Ft.	Yes

Summary

Overburden (Lin FT)	34.0
Rock Cored (Lin FT)	NA
Samples:	S16

GeoQuest Environmental, Inc.

GeoQuest Environmental, Inc.

Test Boring Report

MW - 106

Project:	Volunteers of America, 214 Lake Avenue, BCA Index #B 8-0688-05-04, Site C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	2 of 2
Contractor	SJB Sevices, Inc.		

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
20	20					Medium dense CINDERS and SLAG with ash, moist.
		6,6,5,4	ND	S11		
	22			24"/24"		
						Same.
22	22					
			ND			
				S12		
						-UPPER FILL-
				24"/24"		
24	24	4,6,7,7,			24.0	
	24			S13		
			ND			Medium dense gray to white CINDERS and ASH with glass, shell, and leather fragments, damp.
26	26					
		4,6,7,7		21"/24"		
	26 28		ND	S14		Loose gray to white CINDERS and ASH, damp. -LOWER FILL-
		1,2,1,4		23"/24"		
28						
	28			S15		Same, except with shell fragments
			ND	24"/24"		
30	30	1,3,6,3				
	30			S16		Same.
			ND	20"/24"		
32	32	4,7,1,2				
	32			S17		Loose CINDERS and ASH, with leather and shell fragments, damp.
			ND			
34	34	1,2,1,2		24"/24"		-LOWER FILL-
36						Notes: Monitoring well MW-106 installed in completed test boring.
						See Well Completion Log MW-106
38						
40						

Ground Water Data					
			Depth		
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Groundwater Encountered
6/27/2008	NA	NA	NA	34.0 Ft.	Yes

Summary	
Overburden (Lin FT)	34.0
Rock Cored (Lin FT)	NA
Samples:	S16

GeoQuest Environmental, Inc.

Bergmann associates architects // engineers // planners	# Test Boring Report	MW - 107

Project:	Volunteers of America, 214 Lake Avenue, BCA Index #B 8-0688-05-04, Site C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 2
Contractor	SJB Services, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Drilling Equipment and Procedures		
					Elevation:	482
Type:	Auger	SS	NX	Rig Type: CME 65 Track mounted	Datum:	NGVD
Inside Diameter (IN):	NA	1.8	NA	Bit Type: Rorary Augers	Start:	10/27/2010
Hemmer Weight (LB):	140	NA	NA	Drill Mud: None	Finish	10/27/2010
Hammer Fall (IN):	30	NA	NA	Other:		
Other:	NA	NA	NA		Driller:	R. Steiner
					Bergmann Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0	0				1	Medium dense Brown GRAVEL, some coarse to fine sand, with coal fragmants, damp.
		7,14,13,10		S1		Medium dense black COAL, damp.
	2			23"/24"		Loose black COAL, damp. - UPPER FILL-
2	2					
			ND	S2		
				20"/24"		
		4,7,9,11				
4	4					
						Medium dense black COAL, damp.
	4			S3		
6	6	9,9,6,7	ND	22"/24"		
				S4		
	6					No recovery.
	8	4,4,3,3	ND	0"/24"	8	
8	8					
						Dense coarse to fine SAND, little gravel, with brick fragments, damp.
				S5		
						- UPPER FILL -
	10		ND	21"/24"		
10						
		6,16,31,16				Medium dense fine SAND, little silt, with coal fragments, cinders, and slag.
				S6		
	10					
12	12	5,5,3,16	ND	24"/24"		
	12					- UPPER FILL -
				S7		
				22"/24" **107 (12-14 ft.)**	.	Soil sample 107 (12-14 ft.) collected for laboratory analysis
	14	11,7,5,7				
14			ND	S8		
	14					Loose coarse to fine SAND, cinders and slag SILT, with cinders and slag, moist.
				24"/24"		
						- UPPER FILL -
16	16	3,3,5,5				
	16					Medium dense SILT, with cinders and slag.
			ND	S9		
				24"/24"		
18	18	3,5,4,3	ND			
	18					
				S10		Loose brown SILTwith cinders, damp. - UPPER FILL-
				24"/24"		
20	20					
		2,4,2,3	ND			

Ground Water Data						Summary	
			Depth			Overburden (Lin FT)	45.0
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Groundwater Encountered	Rock Cored (Lin FT)	NA
10/27/2010	NA	NA	NA	45.0 Ft.	Yes	Samples:	S21

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Test Boring Report

MW - 107

Project:	Volunteers of America, 214 Lake Avenue, BCA Index #B 8-0688-05-04, Site C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	2 of 2
Contractor	SJB Sevices, Inc.		

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
20	20					Loose brown CINDERS, with brick fragments, damp. - UPPER FILL -
		2,3,2,4	ND	S11	21	
	22			17"/24"		
						Medium dense black CINDERS, with wood, ash, and shell fragments, damp. - LOWER FILL -
22	22					
						SAME.
			ND			
				S12		
				21"/24"		
24	24	8,6,5,7				
						SAME. .
	24			S13		
			ND			Medium dense gray to white CINDERS and ASH with shell, and leather fragments, damp.
26	26					
		3,4,5,3		23"/24"		
	26		ND	S14		Medium dense gray SILT and COAL, damp. - LOWER FILL-
	28					
		6,5,5,5		21"/24"		
28						
	28			S15		Loose brown to gray coarse to fine SAND, little gravel, moist.
			ND	20"/24"		
30	30	WOH,WOH,3,4				
	30			S16		Loose CINDERS and ASH, with wood fragments, moist.
			ND	22"/24"		
32	32	WOH,2,3,4				
	32			S17		Loose CINDERS and ASH, with leather and shell fragments, wet. - LOWER FILL -
			ND			
34	34	2,3,3,3		24"/24"		Loose black CINDERS and ASH, trace slag. - LOWER FILL -
	34					
			ND			
36	36	1,2,4,4		21"/24"		
	36		ND			SAME.
				S18		
38	38	1,2,4,3		24"/24"		
	38					
			ND	S19	.	SAME.
	40					
		2,3,3,2		23"/24"		
40	40					
			ND	S20		SAME.
	42					
		2,3,4,2		19"/24"		
42	42					
			ND	S21		Same. - LOWER FILL -
	44					
		9,3,4,3		17"/24"		
44	44					
		Augered to 45 ft.		no sample		
45						
						Installed monitoring well MW-107 in completed test boring, see monitoring well completion report.

Ground Water Data					
			Depth		
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Groundwater Encountered
10/27/2010	NA	NA	NA	45.0 Ft.	Yes

Summary	
Overburden (Lin FT)	45.0
Rock Cored (Lin FT)	NA
Samples:	S21

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GeoQuest Environmental, Inc.

Test Boring Report

B - 108

Project:	Volunteers of America, 214 Lake Avenue, BCA Index #B 8-0688-05-04, Site C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 2
Contractor	SJB Services, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Drilling Equipment and Procedures			
Type:	Auger	SS	NX	Rig Type:	CME 85 Truck mounted	Elevation:	484.1
Inside Diameter (IN):	NA	1.8	NA	Bit Type:	Rorary Augers	Datum:	NGVD
Hemmer Weight (LB):	140	NA	NA	Drill Mud:	water	Start:	7/11/2008
Hammer Fall (IN):	30	NA	NA	Other:	Boring drilled at location of test pit TP-28	Finish	7/11/2008
Other:	NA	NA	NA			Driller:	R. Brown
						GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0	0				0.5	PAVEMENT
		33,14,17,20		S1		Medium dense gray GRAVEL, some coal, litle coarse to fine sand, damp.
	2			24"/24"		Medium dense brown GRAVEL, with coal and brick fragments, damp.
2	2		ND	S2		
				22"/24"		
		15,12,12,12				
4	4					
	4			S3		Loose brown coarse to fine SAND, little gravel with brick fragments damp.
6	6	6,4,3,2	ND	21"/24"		
				S4		
	6					Same. -UPPER FILL-
	8	3,4,8,8	ND	23"/24"		
8	8					
						Medium dense black to gray CINDERS and SLAG, damp.
				S5		
	10		ND	21"/24"		
10		5,6,5,11				Same.
				S6		
	10					
12	12	9,4,5,4	ND	0"/24"		
	12			S7		
				19"/24"		Same. - UPPER FILL -
	14	2,2,3,2				
14			ND	S8		
	14					Same.
				20"/24"		
						- UPPER FILL -
16	16	2,2,2,2				
	16		ND	S9		Medium dense black to gray CINDERS and SLAG, damp.
				17"/24"		
18	18	5,8,5,3	ND	S10		
	18					
				20"/24"		Same.
20	20					
		4,2,4,3	ND			- UPPER FILL -

Notes: Test boring B-108 installed at the location for test pit TP-28.

Test boring backfilled with cement grount to ground surface.

Ground Water Data

Date	Time	Elapsed Time (HR)	Depth: Bottom Of Casing	Depth: Bottom Of Hole	Depth: Groundwater Encountered
7/11/2008	NA	NA	NA	20.0 Ft.	No

Summary

Overburden (Lin FT)	20.0
Rock Cored (Lin FT)	NA
Samples:	S10

GeoQuest Environmental, Inc.

GeoQuest Environmental, Inc.

Test Boring Report

B - 109

Project:	Volunteers of America, 214 Lake Avenue, BCA Index #B 8-0688-05-04, Site C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 2
Contractor	SJB Services, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Drilling Equipment and Procedures			
Type:	Auger	SS	NX	Rig Type:	CME 85 Truck mounted	Elevation:	481
Inside Diameter (IN):	NA	1.8	NA	Bit Type:	Rorary Augers	Datum:	NA
Hemmer Weight (LB):	140	NA	NA	Drill Mud:	water	Start:	7/3/2008
Hammer Fall (IN):	30	NA	NA	Other:	Boring drilled at location of test pit TP-27	Finish	7/3/2008
Other:	NA	NA	NA			Driller:	R. Brown
						GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0	0					Very dense brown to gray GRAVEL, with coal and wood fragments, damp.
		11,13,38,17		S1		
	2			24"/24"		Dense black to gray CINDERS and SLAG, with ash and coal fragments, damp.
2	2					
			ND	S2		
				22"/24"		
		12,18,25,27				
4	4					
	4			S3		Medium dense black to gray COAL and GRAVEL, with brick fragments damp.
6	6	19,13,8,8	ND	21"/24"		
				S4		
	6					Same. -UPPER FILL-
	8	7,5,4,2	ND	23"/24"		
8	8					
						Loose black to gray CINDERS and SLAG, damp.
				S5		
						- UPPER FILL -
	10		ND	20"/24"		
10						
		3,3,3,2				Loose black to gray CINDERS and SLAG, with ash, damp.
				S6		
	10					
12	12	2,2,2,2	ND	0"/24"		
	12			S7		
				20"/24"		Same.
	14	2,1,1,2				
14			ND	S8		
	14					Same.
				24"/24"		
						- UPPER FILL -
16	16	1,2,5,3				
	16					Loose black to gray CINDERS and SLAG, damp.
			ND	S9		
				24"/24"		
18	18	2,3,3,3	ND	S10		
	18					
				24"/24"		Same.
20	20					
		3,2,2,3	ND			- UPPER FILL -
						Notes: Test boring B-109 installed at the location for test pit TP-27. Test boring backfilled with cement grount to ground surface.

Ground Water Data						Summary	
			Depth			Overburden (Lin FT)	20.0
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Groundwater Encountered	Rock Cored (Lin FT)	NA
7/2/2008	NA	NA	NA	20.0 Ft.	No	Samples:	S10

GeoQuest Environmental, Inc.

GeoQuest Environmental, Inc.

Environmental Test Pit Log

TP- 101

Project:	Remedial Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	GeoQuest Environmental, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures			
Type:	NA	NA	NA	Excavator:	CAT 280 DL	Elevation:	481
Inside Diameter (IN):	NA	NA	NA	Reach:	22 feet	Datum:	NGVD
Hemmer Weight (LB):	NA	NA	NA	Bucket:	36 inch.	Start:	10/31/2007
Hammer Fall (IN):	NA	NA	NA	Other:	Excavate test pits to approximately	Finish	10/31/2007
Other:	NA	NA	NA		20 ft. and backfill to ground surface	Operator:	D. Connell
						GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0					0.5	Brown SILT, with root fibers, damp. - UPPER FILL-
			ND			Light brown GRAVEL, some coarse to fine sand, damp.
					1.5	- UPPER FILL-
2						
						Black COAL
			ND			
4					4.0	
						Black COAL - UPPER FILL-
6						Orange GRAVEL and SLAG, with cinders and ash, damp. - UPPER FILL-
					7.0	
			ND			
8						
						Gray to green CINDERS and ASH with fused black and brown materials, damp.
10						
						SAME
			ND			
12						
14						
						SAME.
16						
			ND			
18						SAME
			ND			-UPPER FILL-
20						
						Bottom of test pit at approximately 20 ft.
						Backfilled test pit to ground surface.

Groundwater Data						Summary	
			Depth			Overburden (Lin FT)	20.0
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Water	Rock Cored (Lin FT)	NA
10/31/2007	NA	NA	NA	20.0 ft.	NO		

GeoQuest Environmental, Inc.

Environmental Test Pit Log

TP- 102

Project:	Remedial Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	GeoQuest Environmental, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures			
Type:	NA	NA	NA	Excavator: CAT 280 DL		Elevation:	482.5
Inside Diameter (IN):	NA	NA	NA	Reach: 22 feet		Datum:	NGVD
Hemmer Weight (LB):	NA	NA	NA	Bucket: 36 inch.		Start:	10/31/2007
Hammer Fall (IN):	NA	NA	NA	Other: Excavate test pits to approximately		Finish	10/31/2007
Other:	NA	NA	NA	18 ft. and backfill to ground surface		Operator:	D. Connell
						GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0					0.5	Brown SILT, with root fibers, damp. - UPPER FILL-
			ND			Light brown GRAVEL, some coarse to fine sand, damp.
					1.5	- UPPER FILL-
2						
						Black COAL
			ND			
4					4.0	Black COAL - UPPER FILL-
					6	
6						Orange GRAVEL and SLAG, with cinders and ash, damp. - UPPER FILL-
			0.8 ppm			
						purched water seep at 8.0 ft.
8						
						Gray to green CINDERS and ASH with fused black and brown materials, damp.
			2.7 ppm			
10			11.0 ppm	TP-102(10.0-10.5 ft.)	10.0	Slight petroleum odor
						Brown to Green CINDERS and ASH with fused black and brown materals, damp -UPPER FIL
			ND			
12						
14						
						Same.
16						
			ND			
18						Same - UPPER FILL - test pit walls collasped at 18.0 ft.
20						
						Bottom of test pit at approximately 18 ft.
						Backfilled test pit to ground surface.

Groundwater Data

Date	Time	Elapsed Time (HR)	Depth: Bottom Of Casing	Depth: Bottom Of Hole	Depth: Water
10/31/2007	NA	NA	NA	18.0 ft.	NO

Summary

Overburden (Lin FT)	18.0
Rock Cored (Lin FT)	NA

Environmental Test Pit Log

TP- 103

Project:	Remedial Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	GeoQuest Environmental, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures			
Type:	NA	NA	NA	Excavator:	CAT 280 DL	Elevation:	484
Inside Diameter (IN):	NA	NA	NA	Reach:	22 feet	Datum:	NGVD
Hemmer Weight (LB):	NA	NA	NA	Bucket:	36 inch.	Start:	10/31/2007
Hammer Fall (IN):	NA	NA	NA	Other:	Excavate test pits to approximately	Finish	10/31/2007
Other:	NA	NA	NA		20 ft. and backfill to ground surface	Operator:	D. Connell
						GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0					0.5	Brown GRAVEL, little coarse to fine sand, damp. - UPPER FILL-
			ND			Brown to gray GRAVELand COAL, with concrete, wood,and metal fragments, damp. -FILL- -UPPER FILL-
2						
			ND			
4						
6						Same. - UPPER FILL-
			ND		7.0	
8						
						Gray to green CINDERS and ASH with fused black and brown materials, damp.
			ND			Wooden utility poles with glass electric insulators, and carbon rods - UPPER FILL-
10					10.0	
						Brown to Green CINDERS and ASH with fused black and brown materals, damp
			ND			
12						
14						
						Same. -UPPER FILL-
16				TP-103(16.0-16.5 ft.)	16.5	
			ND			Gray to white CINDERS and ASH with old bottles, metal, and shoe soles, damp. -FILL-
18						Same - LOWER FILL -
			ND			
						Same.
20						
						Bottom of test pit at approximately 20 ft.
						Backfilled test pit to ground surface.

Groundwater Data						Summary	
			Depth			Overburden (Lin FT)	20.0
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Water	Rock Cored (Lin FT)	NA
10/31/2007	NA	NA	NA	20.0 ft.	NO		

GeoQuest Environmental, Inc.

Environmental Test Pit Log

TP- 104

Project:	Remedial Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	GeoQuest Environmental, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures			
Type:	NA	NA	NA	Excavator:	CAT 280 DL	Elevation:	482.2
Inside Diameter (IN):	NA	NA	NA	Reach:	22 feet	Datum:	NGVD
Hemmer Weight (LB):	NA	NA	NA	Bucket:	36 inch.	Start:	10/31/2007
Hammer Fall (IN):	NA	NA	NA	Other:	Excavate test pits to approximately	Finish	10/31/2007
Other:	NA	NA	NA		20 ft. and backfill to ground surface	Operator:	D. Connell
						GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0						
			ND			Brown to gray GRAVELand COAL, with concrete, wood,and metal fragments, damp. FILL
					1.0	
						Black COAL - UPPER FILL -
2						
			ND			
4					4.0	
						Black COAL - UPPER FILL -
						Orange to Yellow Coarse to fine SAND, damp -UPPER FILL-
					5	
6						
			ND			Gray to green CINDERS and SLAG with ash, fused black and brown materials, damp.
						Wooden utility poles with glass electric insulators, and carbon rods from 5 to 8 ft.)
8						
						Black CINDERS and SLAG with ash, fused black and brown materials, damp.
			ND			
10						
						Same. -UPPER FILL-
			ND			
12						
14					14	
						Gray to white CINDERS and ASH with old bottles, metal, and shoe soles, damp.
16						
			ND			
				TP-104(17.0-17.5 ft.)		
18						Same. - LOWER FILL -
						Same.
20						
						Bottom of test pit at approximately 20 ft.
						Backfilled test pit to ground surface.

Groundwater Data						Summary	
			Depth			Overburden (Lin FT)	20.0
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Water	Rock Cored (Lin FT)	NA
10/31/2007	NA	NA	NA	20.0 ft.	NO		

GeoQuest Environmental, Inc.

Environmental Test Pit Log

TP- 105

Project:	Remedial Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	GeoQuest Environmental, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures			
Type:	NA	NA	NA	Excavator: CAT 280 DL		Elevation:	481.9
Inside Diameter (IN):	NA	NA	NA	Reach: 22 feet		Datum:	NGVD
Hemmer Weight (LB):	NA	NA	NA	Bucket: 36 inch.		Start:	10/31/2007
Hammer Fall (IN):	NA	NA	NA	Other: Excavate test pits to approximately		Finish	10/31/2007
Other:	NA	NA	NA	20 ft. and backfill to ground surface		Operator:	D. Connell
						GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0						
			ND			Brown GRAVEL, some coarse to fine sand, damp. -UPPER FILL-
					1.0	
						Black COAL - UPPER FILL -
2					2	
						Yellow to orange coarse to fine SAND, damp. -UPPER FILL-
			ND		3.5	
4						Black CINDERS and SLAG, with black and brown fused materals, brick/glass fragments. -UPPER FILL-
6						
			ND			
					8	
8						
			ND			Gray to black CINDERS and SLAG with ash, fused black and brown materials, damp.
10						
						Same. -UPPER FILL-
			ND			
12						
14					14	Same. -UPPER FILL-
						Gray to white CINDERS and ASH with old bottles, metal, and shoe soles, damp.
				TP-105(15.0-15.5 ft.)		
16						
			ND			
						Oyster and Clam shells from 14 to 1
18						Same. - LOWER FILL -
			ND			
						Same.
20						
						Bottom of test pit at approximately 20 ft.
						Backfilled test pit to ground surface.

Groundwater Data						Summary	
			Depth			Overburden (Lin FT)	20.0
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Water	Rock Cored (Lin FT)	NA
10/31/2007	NA	NA	NA	20.0 ft.	NO		

Environmental Test Pit Log

TP- 106

Project:	Remedial Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	GeoQuest Environmental, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures			
Type:	NA	NA	NA	Excavator: CAT 280 DL		Elevation:	482.3
Inside Diameter (IN):	NA	NA	NA	Reach: 22 feet		Datum:	NGVD
Hemmer Weight (LB):	NA	NA	NA	Bucket: 36 inch.		Start:	11/1/2007
Hammer Fall (IN):	NA	NA	NA	Other: Excavate test pits to approximately		Finish	11/1/2007
Other:	NA	NA	NA	20 ft. and backfill to ground surface		Operator:	D. Connell
						GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0						
			ND			Brown GRAVEL, some coarse to fine sand, damp. -UPPER FILL-
					1.0	
						Black COAL - UPPER FILL -
2					2	
						Yellow to orange coarse to fine SAND, damp. -UPPER FILL-
			ND		3.5	
4						
						Black CINDERS and SLAG, with black and brown fused materals, brick/glass fragments. -UPPER FILL-
6						
			ND			
					8	
8						
			ND			Gray to black CINDERS and SLAG with ash, fused black and brown materials, damp.
10						
						Same. -UPPER FILL-
			ND			
12						
14				TP-106 (14.0-14.5 ft.)	14.5	
						Gray to white CINDERS and ASH with old bottles, metal, and shoe soles, damp. -FILL-
16						
			ND			
						Oyster and Clam shells from 14 to 1
18						Same. - LOWER FILL -
			ND			
						Same.
20						
						Bottom of test pit at approximately 20 ft.
						Backfilled test pit to ground surface.

Groundwater Data						Summary	
		Depth				Overburden (Lin FT)	20.0
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Water	Rock Cored (Lin FT)	NA
11/1/2007	NA	NA	NA	20.0 ft.	NO		

GeoQuest Environmental, Inc.

Environmental Test Pit Log

TP- 107

Project:	Remedial Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	GeoQuest Environmental, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures			
Type:	NA	NA	NA	Excavator:	CAT 280 DL	Elevation:	489.8
Inside Diameter (IN):	NA	NA	NA	Reach:	22 feet	Datum:	NGVD
Hemmer Weight (LB):	NA	NA	NA	Bucket:	36 inch.	Start:	11/1/2007
Hammer Fall (IN):	NA	NA	NA	Other:	Excavate test pits to approximately	Finish	11/1/2007
Other:	NA	NA	NA		20 ft. and backfill to ground surface	Operator:	D. Connell
						GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0						Gray Gravel, some coarse to fine sand, damp. -FILL-
			ND			Black COAL - UPPER FILL -
2						
			ND		4	Black COAL -UPPER FILL-
4					4.5	
						Yellow to Orange coarse to fine SAND, damp.
						Blue to gray CINDERS, damp. -UPPER FILL-
					5	
6						Black CINDERS and SLAG, with ash and fused materials, damp. -FILL-
			ND			
					8	
8				TP-107(8.0-8.5 ft.)		
						Blue to gray CINDERS, damp. -UPPER FILL-
			ND		8.5	Gray to black CINDERS and SLAG with ash, fused black and brown materials, damp.
10						
						Same. -UPPER FILL-
			ND			
12						
14						Same.. -UPPER FILL-
16						
			ND			
18					18	Same. -UPPER FILL-
						Gray to white CINDERS and ASH with old bottles,oyster/clam shells,shoe soles,da
			ND			
						- LOWE
20						
						Bottom of test pit at 20.0 ft.
						Backfilled test pit to ground surface

Groundwater Data						Summary	
			Depth			Overburden (Lin FT)	20.0
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Water	Rock Cored (Lin FT)	NA
11/1/2007	NA	NA	NA	20.0 ft.	NO		

GeoQuest Environmental, Inc.

GeoQuest Environmental, Inc.

Environmental Test Pit Log

TP- 108

Project:	Remedial Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	GeoQuest Environmental, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures			
Type:	NA	NA	NA	Excavator:	CAT 280 DL	Elevation:	481.9
Inside Diameter (IN):	NA	NA	NA	Reach:	22 feet	Datum:	NGVD
Hemmer Weight (LB):	NA	NA	NA	Bucket:	36 inch.	Start:	11/1/2007
Hammer Fall (IN):	NA	NA	NA	Other:	Excavate test pits to approximately	Finish	11/1/2007
Other:	NA	NA	NA		20 ft. and backfill to ground surface	Operator:	D. Connell
						GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0						Gray Gravel, some coarse to fine sand, damp. -UPPER FILL-
					1	
			ND			
					2.0	
						Black COAL - UPPER FILL-
2						
			ND		4	Yellow to Orange coarse to fine SAND, damp. -UPPER FILL-
4						
						Black CINDERS and SLAG, with ash, wood, brick fragments, fused black/brown materials.
6						Black CINDERS and SLAG, with ash and fused materials, damp. -UPPER FILL-
			ND			
					8	-UPPER FILL-
8						
			ND			Gray to black CINDERS and SLAG with ash, fused black and brown materials, damp.
10						Black carbon rods from 8.0 to 10.0 ft.
						Same. -UPPER FILL-
			ND			
12						
14						Same. -UPPER FILL-
16						
			ND			
18						Same. -UPPER FILL-
			ND			
						Same.
20						
						Bottom of test pit at 20.0 fr.
						Backfilled test pit to ground surface.

Groundwater Data						Summary	
			Depth			Overburden (Lin FT)	20.0
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Water	Rock Cored (Lin FT)	NA
11/1/2007	NA	NA	NA	20.0 ft.	NO		

GeoQuest Environmental, Inc.

GeoQuest Environmental, Inc.

Environmental Test Pit Log

TP- 109

Project:	Remedial Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	GeoQuest Environmental, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures			
Type:	NA	NA	NA	Excavator: CAT 280 DL		Elevation:	482.9
Inside Diameter (IN):	NA	NA	NA	Reach: 22 feet		Datum:	NGVD
Hemmer Weight (LB):	NA	NA	NA	Bucket: 36 inch.		Start:	11/1/2007
Hammer Fall (IN):	NA	NA	NA	Other: Excavate test pits to approximately		Finish	11/1/2007
Other:	NA	NA	NA	20 ft. and backfill to ground surface		Operator:	D. Connell
						GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0						Gray Gravel, some coarse to fine sand, damp. -UPPER FILL-
					1	
			ND			
						Brown GRAVEL, with bricks and wood, damp. -UPPER FILL-
2						
			ND		4	
4						Black CINDERS and SLAG, with ash, wood, brick fragments, fused black/brown materials.
6						Black CINDERS and SLAG, with ash and fused materials, damp. -UPPER FILL-
			ND			
					8	-UPPER FILL-
8						Gray to white CINDERS and ASH, with clam and oyster shells, old bottles, damp. -LOWER FI
			ND			
10						
						Same. -LOWER FILL-
			ND			
12						
14						Same. -LOWER FILL-
16						
			ND			
18						Same -LOWER FILL-
			ND			
						Same.
20						
						Bottom of test pit at 20.0 ft.
						Backfilled test pit to ground surface.

Groundwater Data			Depth			Summary	
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Water	Overburden (Lin FT)	20.0
11/1/2007	NA	NA	NA	20.0 ft.	NO	Rock Cored (Lin FT)	NA

GeoQuest Environmental, Inc.

Environmental Test Pit Log

TP- 110

Project:	Remedial Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	GeoQuest Environmental, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures			
Type:	NA	NA	NA	Excavator:	CAT 280 DL	Elevation:	482.1
Inside Diameter (IN):	NA	NA	NA	Reach:	22 feet	Datum:	NGVD
Hemmer Weight (LB):	NA	NA	NA	Bucket:	36 inch.	Start:	11/1/2007
Hammer Fall (IN):	NA	NA	NA	Other:	Excavate test pits to approximately	Finish	11/1/2007
Other:	NA	NA	NA		20 ft. and backfill to ground surface	Operator:	D. Connell
						GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0						Gray Gravel, some coarse to fine sand, damp. -UPPER FILL-
					1	
			ND			
						Brown GRAVEL, with bricks and wood, damp. -UPPER FILL-
2						
			ND		4	
4						Black CINDERS and SLAG, with ash, wood, brick fragments, fused black/brown materials.
6						Black CINDERS and SLAG, with ash and fused materials, damp. -UPPER FILL-
			ND			
					8	-UPPER FILL-
8						Gray to white CINDERS and ASH, with clam and oyster shells, old bottles, damp. -FILL-
			ND			
10						
						Same -LOWER FILL-
			ND			
12						
14						Same. -LOWER FILL-
16						
			ND			
18						Same -LOWER FILL-
			ND			
						Same.
20						Bottom of test pit at 20.0 ft.
						Backfilled test pit to ground surface.

Groundwater Data						Summary	
			Depth			Overburden (Lin FT)	20.0
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Water	Rock Cored (Lin FT)	NA
11/1/2007	NA	NA	NA	20.0 ft.	NO		

GeoQuest Environmental, Inc.

Environmental Test Pit Log

TP- 111

Project:	Remedial Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	GeoQuest Environmental, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures			
Type:	NA	NA	NA	Excavator: CAT 280 DL		Elevation:	492.2
Inside Diameter (IN):	NA	NA	NA	Reach: 22 feet		Datum:	NGVD
Hemmer Weight (LB):	NA	NA	NA	Bucket: 36 inch.		Start:	11/1/2007
Hammer Fall (IN):	NA	NA	NA	Other: Excavate test pits to approximately		Finish	11/1/2007
Other:	NA	NA	NA	20 ft. and backfill to ground surface		Operator:	D. Connell
						GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0						
			ND			Brown GRAVEL, some coarse to fine sand, damp. -UPPER FILL-
					1.0	
						Black COAL - UPPER FILL -
2					2	
						Yellow to orange coarse to fine SAND, damp. -UPPER FILL-
			ND		3.5	
4						Black CINDERS and SLAG, with black and brown fused materals, brick/glass fragments. -UPPER FILL-
6						
			ND			
					8	Same. -UPPER FILL-
8						
			ND			Gray to black CINDERS and SLAG with ash, fused black and brown materials, damp.
10						
						Same. -UPPER FILL-
			ND			
12						
14					14	Same.. -UPPER FILL-
						Gray to white CINDERS and ASH with old bottles, metal, and shoe soles, damp.LOWER
16						
			ND			
						Oyster and Clam shells from 14 to 1
18						Same. - LOWER FILL -
			ND			
						Same.
20						
						Bottom of test pit at approximately 20 ft.
						Backfilled test pit to ground surface.

Groundwater Data						Summary	
			Depth			Overburden (Lin FT)	20.0
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Water	Rock Cored (Lin FT)	NA
11/1/2007	NA	NA	NA	20.0 ft.	NO		

GeoQuest Environmental, Inc.

GeoQuest Environmental, Inc.

Environmental Test Pit Log

TP- 112

Project:	Remedial Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	GeoQuest Environmental, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures			
Type:	NA	NA	NA	Excavator: CAT 280 DL		Elevation:	481.2
Inside Diameter (IN):	NA	1.8	NA	Reach: 22 feet		Datum:	NGVD
Hemmer Weight (LB):	NA	NA	NA	Bucket: 36 inch.		Start:	11/1/2007
Hammer Fall (IN):	NA	NA	NA	Other: Excavate test pits to approximately		Finish	11/1/2007
Other:	NA	NA	NA	20 ft. and backfill to ground surface		Operator:	D. Connell
						GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0					0.5	Brown GRAVEL, some coarse to fine sand, damp. -UPPER FILL-
			ND			
					1.5	
						Black COAL - UPPER FILL -
2						
						Brown GRAVEL, some coarse to fine sand, with bricks, damp. -UPPER FILL-
			ND			
4						
						-UPPER FILL-
6						
			ND			Same.
8						
			ND			
10					10.0	Same. -UPPER FILL-
						Gray to white CINDERS and ASH, with very old bottles, damp. -LOWER FILL-
			ND			
12						
14						Same.
16						
			ND			
						Same. -LOWER FILL-
18						
			ND			
20						
						Bottom of test pit at approximately 20 ft.
						Backfilled test pit to ground surface.

Groundwater Data

Date	Time	Elapsed Time (HR)	Depth: Bottom Of Casing	Depth: Bottom Of Hole	Depth: Water
11/1/2007	NA	NA	NA	20.0 ft.	NO

Summary

Overburden (Lin FT)	20.0
Rock Cored (Lin FT)	NA

GeoQuest Environmental, Inc.

GeoQuest Environmental, Inc.

Environmental Test Pit Log

TP- 113

Project:	Remedial Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	GeoQuest Environmental, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures	
Type:	NA	NA	NA	Excavator: CAT 280 DL	
Inside Diameter (IN):	NA	NA	NA	Reach: 22 feet	
Hemmer Weight (LB):	NA	NA	NA	Bucket: 36 inch.	
Hammer Fall (IN):	NA	NA	NA	Other: Excavate test pits to approximately	
Other:	NA	NA	NA	20 ft. and backfill to ground surface	

Elevation:	481.2
Datum:	NGVD
Start:	11/1/2007
Finish	11/1/2007
Operator:	D. Connell
GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0					0.5	Brown GRAVEL, some coarse to fine sand, damp. -FILL-
			ND			
					1.5	
						Black COAL - FILL -
2						
						Brown GRAVEL, some coarse to fine sand, with bricks, damp. -FILL-
			ND			
4						
						-FILL-
6						
			ND			SAME
8						
			ND			
10					10.0	Same. -UPPER FILL-
						Gray to white CINDERS and ASH, with very old bottles, damp. -LOWER FILL-
			ND			
12						
14						Same.
16						
			ND			
						Same. -LOWER F
18						
			ND			
20						
						Bottom of test pit at approximately 20 ft.
						Backfilled test pit to ground surface.

Groundwater Data

Date	Time	Elapsed Time (HR)	Depth: Bottom Of Casing	Depth: Bottom Of Hole	Depth: Water
11/1/2007	NA	NA	NA	20.0 ft.	NO

Summary

Overburden (Lin FT)	20.0
Rock Cored (Lin FT)	NA

GeoQuest Environmental, Inc.

Environmental Test Pit Log

TP- 114

Project:	Remedial Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	GeoQuest Environmental, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures	
Type:	NA	NA	NA	Excavator:	CAT 280 DL
Inside Diameter (IN):	NA	NA	NA	Reach:	22 feet
Hemmer Weight (LB):	NA	NA	NA	Bucket:	36 inch.
Hammer Fall (IN):	NA	NA	NA	Other:	Excavate test pits to approximately
Other:	NA	NA	NA		20 ft. and backfill to ground surface

Elevation:	481.2
Datum:	NGVD
Start:	11/1/2007
Finish	11/1/2007
Operator:	D. Connell
GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0					0.5	Gray Gravel, some coarse to fine sand, damp. -UPPER FILL-
			ND			Black COAL - UPPER FILL -
2						
			ND		4	Black COAL -UPPER FILL-
4					4.5	Yellow to Orange coarse to fine SAND, damp.
						Blue to gray CINDERS, damp. -UPPER FILL-
					5	
6						Black CINDERS and SLAG, with ash and fused materials, damp. -UPPER FILL-
			ND			
					8	
8						Blue to gray CINDERS, damp. -UPPER FILL-
			ND		8.5	Gray to black CINDERS and SLAG with ash, fused black and brown materials, damp.
10						
						Same. -UPPER FILL-
			ND			
12						
14						Same. -UPPER FILL-
16						
			ND			
18					18	Same. -UPPER FILL-
						Gray to white CINDERS and ASH with old bottles,oyster/clam shells,shoe soles,da
			ND			
						-LOWER FILL
20						
						Bottom of test pit at 20.0 ft.
						Backfilled test pit to ground surface.

Groundwater Data

Date	Time	Elapsed Time (HR)	Depth: Bottom Of Casing	Depth: Bottom Of Hole	Depth: Water
11/1/2007	NA	NA	NA	20.0 ft.	NO

Summary

Overburden (Lin FT)	20.0
Rock Cored (Lin FT)	NA

GeoQuest Environmental, Inc.

Environmental Test Pit Log

TP- 115

Project:	Remedial Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	GeoQuest Environmental, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures			
Type:	NA	NA	NA	Excavator:	CAT 280 DL	Elevation:	482.5
Inside Diameter (IN):	NA	NA	NA	Reach:	22 feet	Datum:	NGVD
Hemmer Weight (LB):	NA	NA	NA	Bucket:	36 inch.	Start:	11/2/2007
Hammer Fall (IN):	NA	NA	NA	Other:	Excavate test pits to approximately	Finish	11/2/2007
Other:	NA	NA	NA		20 ft. and backfill to ground surface	Operator:	D. Connell
						GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0						Gray Gravel, some coarse to fine sand, damp. -UPPER FILL-
			ND			
					1.0	
						Black COAL
2						
			ND			Black COAL -UPPER FILL-
4						
6						Black COAL
			ND			
					8	Black COAL -UPPER FILL-
8						
						Black to gray COKE -UPPER FILL-
			ND			
10					10.0	Black to gray COKE -UPPER FILL-
						Black CINDERS and SLAG, with ash and black and brown fused materials, damp. -FILL-
			ND			
12						
14			ND			Same. -UPPER FILL-
16						
			ND			
18					18	Same. -UPPER FILL-
						Gray to white CINDERS and ASH with old bottles,oyster/clam shells,shoe soles,da
			ND			
						-LOWER FILL-
20						
						Bottom of test pit at approxametely 20.0 ft.
						Test pit backfilled to ground surface.

Groundwater Data

Date	Time	Elapsed Time (HR)	Depth: Bottom Of Casing	Depth: Bottom Of Hole	Depth: Water
11/2/2007	NA	NA	NA	20.0 ft.	NO

Summary

Overburden (Lin FT)	20.0
Rock Cored (Lin FT)	NA

GeoQuest Environmental, Inc.

GeoQuest Environmental, Inc.

Environmental Test Pit Log

TP- 116

Project:	Remedial Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	GeoQuest Environmental, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures			
Type:	NA	NA	NA	Excavator:	CAT 280 DL	Elevation:	484.3
Inside Diameter (IN):	NA	1.8	NA	Reach:	22 feet	Datum:	NGVD
Hemmer Weight (LB):	NA	NA	NA	Bucket:	36 inch.	Start:	11/2/2007
Hammer Fall (IN):	NA	NA	NA	Other:	Excavate test pits to approximately	Finish	11/2/2007
Other:	NA	NA	NA		20 ft. and backfill to ground surface	Operator:	D. Connell
						GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0						Gray Gravel, some coarse to fine sand, damp. -UPPER FILL-
			ND			
					1.0	
						Yellow orange coarse to fine SAND, damp. -UPPER FILL-
2					2	
			ND			Black to gray CINDERS and SLAG, with ash black and brown fused materials, damp.
4						
6						Same. -UPPER FILL-
			ND			
8						
			ND			
10						Same -UPPER FILL-
			ND			
12						
14						Same. -UPPER FILL-
16						
			ND			
18					18	Same. -UPPER FILL-
						Gray to white CINDERS and ASH with old bottles,oyster/clam shells,shoe soles,da
			ND			
20						
						Bottom of test pit at approxametely 20.0 ft. Test pit backfilled to ground surface.

Groundwater Data						Summary	
			Depth			Overburden (Lin FT)	20.0
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Water	Rock Cored (Lin FT)	NA
11/2/2007	NA	NA	NA	20.0 ft.	NO		

GeoQuest Environmental, Inc.

Environmental Test Pit Log

TP- 117

Project:	Remedial Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	GeoQuest Environmental, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures			
Type:	NA	NA	NA	Excavator:	CAT 280 DL	Elevation:	482.7
Inside Diameter (IN):	NA	NA	NA	Reach:	22 feet	Datum:	NGVD
Hemmer Weight (LB):	NA	NA	NA	Bucket:	36 inch.	Start:	11/2/2007
Hammer Fall (IN):	NA	NA	NA	Other:	Excavate test pits to approximately	Finish	11/2/2007
Other:	NA	NA	NA		20 ft. and backfill to ground surface	Operator:	D. Connell
						GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0						Gray Gravel, some coarse to fine sand, damp. -UPPER FILL-
			ND			
					1.0	
						Black to gray CONCRETE and BRICK, with metal glass and wood, damp. -UPPER FILL-
2						
			ND			
4						
						Wooden Utitlity poles and cable at approximately 6.0 to 8.0 ft.
					8	
6						SAME -UPPER FILL-
			ND			Black to gray CINDERS and SLAG, with ash and black to brown fused materials, damp.
8						
			ND			
10						SAME -UPPER FILL-
			ND			
12						
14						SAME. -UPPER FILL-
16						
			ND			
18					18	SAME -UPPER FILL-
						Gray to white CINDERS and ASH with old bottles,oyster/clam shells,shoe soles,da
			ND			
						- LOWE
20						
						Bottom of test pit at approxametely 20.0 ft.
						Test pit backfilled to ground surface.

Groundwater Data						Summary	
			Depth			Overburden (Lin FT)	20.0
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Water	Rock Cored (Lin FT)	NA
11/2/2007	NA	NA	NA	20.0 ft.	NO		

Environmental Test Pit Log

TP- 118

Project:	Remedial Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	GeoQuest Environmental, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures			
Type:	NA	NA	NA	Excavator:	CAT 280 DL	Elevation:	482.8
Inside Diameter (IN):	NA	NA	NA	Reach:	22 feet	Datum:	NGVD
Hemmer Weight (LB):	NA	NA	NA	Bucket:	36 inch.	Start:	11/2/2007
Hammer Fall (IN):	NA	NA	NA	Other:	Excavate test pits to approximately	Finish	11/2/2007
Other:	NA	NA	NA		20 ft. and backfill to ground surface	Operator:	D. Connell
						GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0						Gray Gravel, some coarse to fine sand, damp. -UPPER FILL-
			ND			
					1.0	Yellow orange coarse to fine SAND, damp. -UPPER FILL-
2					2	
			ND			Black to gray CINDERS and SLAG, with ash black and brown fused materials, damp.
4						
6						SAME. -UPPER FILL-
			ND			
8				TP-118(8.0-8.5 ft.)		
10			40			SAME -UPPER FILL-
			ND			
12						
14						SAME. -UPPER FILL-
16						
			ND			
18					18	SAME -UPPER FILL-
						Gray to white CINDERS and ASH with old bottles,oyster/clam shells,shoe soles,da
						- LOWE
20						
						Bottom of test pit at approxametely 20.0 ft.
						Test pit backfilled to ground surface.

Groundwater Data						Summary	
			Depth			Overburden (Lin FT)	20.0
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Water	Rock Cored (Lin FT)	NA
11/2/2007	NA	NA	NA	20.0 ft.	NO		

Environmental Test Pit Log

TP- 119

Project:	Remedial Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	GeoQuest Environmental, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures			
Type:	NA	NA	NA	Excavator: CAT 280 DL		Elevation:	485.1
Inside Diameter (IN):	NA	NA	NA	Reach: 22 feet		Datum:	NGVD
Hemmer Weight (LB):	NA	NA	NA	Bucket: 36 inch.		Start:	11/2/2007
Hammer Fall (IN):	NA	NA	NA	Other: Excavate test pits to approximately		Finish	11/2/2007
Other:	NA	NA	NA	20 ft. and backfill to ground surface		Operator:	D. Connell
						GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0						
			ND			Brown GRAVEL, some coarse to fine sand, damp. -UPPER FILL-
					1.0	
						Black COAL - UPPER FILL -
2					2	
						Yellow to orange coarse to fine SAND, damp. -UPPER FILL-
			ND		3.5	
4						
						Black CINDERS and SLAG, with black and brown fused materals, brick/glass fragments. -UPPER FILL-
6						
			ND			
					8	
8						
			ND			Gray to black CINDERS and SLAG with ash, fused black and brown materials, damp.
10						
						SAME -UPPER FILL-
			ND			
12						
14					14	SAME. -UPPER FILL-
						Gray to white CINDERS and ASH with old bottles, metal, and shoe soles, damp.
16						
			ND			- LOWER FILL -
						Oyster and Clam shells from 14 to 1
18						SAME - LOWER FILL -
			ND			
						SAME
20						
						Bottom of test pit at approximately 20 ft.
						Backfilled test pit to ground surface.

Groundwater Data

Date	Time	Elapsed Time (HR)	Depth: Bottom Of Casing	Depth: Bottom Of Hole	Depth: Water
11//2007	NA	NA	NA	20.0 ft.	NO

Summary

Overburden (Lin FT)	20.0
Rock Cored (Lin FT)	NA

GeoQuest Environmental, Inc.

Environmental Test Pit Log

TP- 120

Project:	Remedial Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	GeoQuest Environmental, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures			
Type:	NA	NA	NA	Excavator: CAT 280 DL		Elevation:	482
Inside Diameter (IN):	NA	1.8	NA	Reach: 22 feet		Datum:	NGVD
Hemmer Weight (LB):	NA	NA	NA	Bucket: 36 inch.		Start:	11/2/2007
Hammer Fall (IN):	NA	NA	NA	Other: Excavate test pits to approximately		Finish	11/2/2007
Other:	NA	NA	NA	20 ft. and backfill to ground surface		Operator:	D. Connell
						GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0						Gray Gravel, some coarse to fine sand, damp. -UPPER FILL-
			ND			
					1.0	
						Black to gray CONCRETE and BRICK, with metal glass and wood, damp. -UPPER FILL-
2						
			ND			
4						Wooden Utitlity poles and cable at approximately 6.0 to 8.0 ft.
					8	
6						SAME -UPPER FILL-
			ND			Black to gray CINDERS and SLAG, with ash and black to brown fused materials, damp.
8						
			ND			
10						SAME -UPPER FILL-
			ND			
12						
14						SAME. -UPPER FILL-
16						
			ND			
18					18	SAME -UPPER FILL-
						Gray to white CINDERS and ASH with old bottles,oyster/clam shells,shoe soles,da
						- LOWE
20						Bottom of test pit at approxametely 20.0 ft. Test pit backfilled to ground surface.

Groundwater Data						Summary	
			Depth			Overburden (Lin FT)	20.0
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Water	Rock Cored (Lin FT)	NA
11/2/2007	NA	NA	NA	20.0 ft.	NO		

GeoQuest Environmental, Inc.

Environmental Test Pit Log

TP- 121

Project:	Remedial Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	GeoQuest Environmental, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures		
Type:	NA	NA	NA	Excavator: CAT 280 DL	Elevation:	486.5
Inside Diameter (IN):	NA	NA	NA	Reach: 22 feet	Datum:	NGVD
Hemmer Weight (LB):	NA	NA	NA	Bucket: 36 inch.	Start:	11/2/2007
Hammer Fall (IN):	NA	NA	NA	Other: Excavate test pits through soil pile	Finish	11/2/2007
Other:	NA	NA	NA	to ground surface	Operator:	D. Connell
					GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0						Brown GRAVEL, some coarse to fine sand, damp. -- UPPER FILL - (Top of soil pile)
			ND			
						Brown CONCRETE and BOULDERS, some gravel, little coarse to fine sand, damp
2						
				TP-121 soil pile		
			ND			
4						
						SAME, except with topsoil, damp. -UPPER FILL-
6						
			ND			SAME. -UPPER FILL-
						(Top of ground surface)
8						
						test pit excavated from top of soil pile to ground surface.
10						Test pit backfilled.
12						
14						
16						
18						
20						

Groundwater Data

Date	Time	Elapsed Time (HR)	Bottom Of Casing	Depth: Bottom Of Hole	Depth: Water
11/2/2007	NA	NA	NA	NA	NO

Summary

Overburden (Lin FT)	NA
Rock Cored (Lin FT)	NA

GeoQuest Environmental, Inc.

GeoQuest Environmental, Inc.

Environmental Test Pit Log

TP- 122

Project:	Remedial Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	GeoQuest Environmental, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures			
Type:	NA	NA	NA	Excavator:	CAT 280 DL	Elevation:	488.8
Inside Diameter (IN):	NA	NA	NA	Reach:	22 feet	Datum:	NGVD
Hemmer Weight (LB):	NA	NA	NA	Bucket:	36 inch.	Start:	11/2/2007
Hammer Fall (IN):	NA	NA	NA	Other:	Excavate test pits through soil pile	Finish	11/2/2007
Other:	NA	NA	NA		to ground surface	Operator:	D. Connell
						GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0						Brown GRAVEL, some coarse to fine sand, damp. -- UPPER FILL - (Top of soil pile)
			ND			
						Brown CONCRETE and BOULDERS, some gravel, little coarse to fine sand, damp
2						
			ND			
4				TP-122 soil pile		SAME, except with topsoil, damp. -UPPER FILL-
6						
			ND			SAME. -UPPER FILL-
						(Top of ground surface)
8						
						test pit excavated from top of soil pile to ground surface.
10						Test pit backfilled.
12						
14						
16						
18						
20						

Groundwater Data						Summary	
			Depth			Overburden (Lin FT)	NA
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Water	Rock Cored (Lin FT)	NA
11/2/2007	NA	NA	NA	NA	NO		

GeoQuest Environmental, Inc.

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Environmental Test Pit Log

TP- 123

Project:	Remedial Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	GeoQuest Environmental, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures			
Type:	NA	NA	NA	Excavator:	CAT 280 DL	Elevation:	492.5
Inside Diameter (IN):	NA	NA	NA	Reach:	22 feet	Datum:	NGVD
Hemmer Weight (LB):	NA	NA	NA	Bucket:	36 inch.	Start:	11/2/2007
Hammer Fall (IN):	NA	NA	NA	Other:	Excavate test pits through soil pile	Finish	11/2/2007
Other:	NA	NA	NA		to ground surface	Operator:	D. Connell
						GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0						Brown GRAVEL, some coarse to fine sand, damp. -- UPPER FILL - (Top of soil pile)
			ND			
						Brown CONCRETE and BOULDERS, some gravel, little coarse to fine sand, damp
2						
				TP-123 soil pile		
			ND			
4						SAME, except with topsoil, damp. -UPPER FILL-
6						
			ND			SAME. -UPPER FILL-
						(Top of ground surface)
8						
						test pit excavated from top of soil pile to ground surface.
10						Test pit backfilled.
12						
14						
16						
18						
20						

Groundwater Data						Summary	
			Depth			Overburden (Lin FT)	NA
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Water	Rock Cored (Lin FT)	NA
11/2/2007	NA	NA	NA	NA	NO		

GeoQuest Environmental, Inc.

GeoQuest Environmental, Inc.

Environmental Test Pit Log

TP- 124

Project:	Remedial Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	GeoQuest Environmental, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures			
Type:	NA	NA	NA	Excavator:	CAT 280 DL	Elevation:	483.1
Inside Diameter (IN):	NA	NA	NA	Reach:	22 feet	Datum:	NGVD
Hemmer Weight (LB):	NA	NA	NA	Bucket:	36 inch.	Start:	11/2/2007
Hammer Fall (IN):	NA	NA	NA	Other:	Excavate test pits through soil pile	Finish	11/2/2007
Other:	NA	NA	NA		to ground surface	Operator:	D. Connell
						GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0						Brown GRAVEL, some coarse to fine sand, damp. -- UPPER FILL - (Top of soil pile)
			ND			
						Brown Boulders and GRAVEL, some gravel, little coarse to fine sand, damp
2						
				TP-124 soil pile		
			ND			
4						SAME. -UPPER FILL-
6						
			ND			SAME. -UPPER FILL-
						(Top of ground surface)
8						
						test pit excavated from top of soil pile to ground surface.
10						Test pit backfilled.
12						
14						
16						
18						
20						

Groundwater Data			Depth			Summary	
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Water	Overburden (Lin FT)	NA
11/2/2007	NA	NA	NA	NA	NO	Rock Cored (Lin FT)	NA

GeoQuest Environmental, Inc.

Environmental Test Pit Log

TP- 125

Project:	Remedial Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	GeoQuest Environmental, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures			
Type:	NA	NA	NA	Excavator:	CAT 280 DL	Elevation:	492.5
Inside Diameter (IN):	NA	NA	NA	Reach:	22 feet	Datum:	NGVD
Hemmer Weight (LB):	NA	NA	NA	Bucket:	36 inch.	Start:	11/2/2007
Hammer Fall (IN):	NA	NA	NA	Other:	Excavate test pits through soil pile	Finish	11/2/2007
Other:	NA	NA	NA		to ground surface	Operator:	D. Connell
						GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0						Brown GRAVEL, some coarse to fine sand, damp. -- UPPER FILL - (Top of soil pile)
			ND			
						Brown CONCRETE and BOULDERS, some gravel, little coarse to fine sand, damp
2						
			ND			
4						SAME, except with occasional pavement fragments, damp. -UPPER FILL-
6						
			ND	TP-125 soil pile		Brown BOULDERS, some gravel, little coarse to fine sand, with occasional concrete frag.
8						
						-UPPER FILL-
10			ND			(Top of ground surface)
						Test pit excavated from top of soil pile to ground surface.
12						
14						Test pit Backfilled.
16						
18						
20						

Groundwater Data						Summary	
			Depth			Overburden (Lin FT)	NA
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Water	Rock Cored (Lin FT)	NA
11/2/2007	NA	NA	NA	NA	NO		

Environmental Test Pit Log

TP- 126

Project:	Remedial Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	110204
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	GeoQuest Environmental, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures			
Type:	NA	NA	NA	Excavator:	CAT 280 DL	Elevation:	481.1
Inside Diameter (IN):	NA	NA	NA	Reach:	22 feet	Datum:	NGVD
Hemmer Weight (LB):	NA	NA	NA	Bucket:	36 inch.	Start:	11/2/2007
Hammer Fall (IN):	NA	NA	NA	Other:	Excavate test pits through soil pile	Finish	11/2/2007
Other:	NA	NA	NA		to ground surface	Operator:	D. Connell
						GeoQuest Rep:	S. DeMeo

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0						Brown GRAVEL, some coarse to fine sand, damp. -- UPPER FILL - (Top of soil pile)
			ND			
						Brown CONCRETE and BOULDERS, some gravel, little coarse to fine sand, damp
2						
			ND			
4						
						SAME, except with topsoil, damp. -UPPER FILL-
6						
			ND			Brown BOULDERS, some gravel, little coarse to fine sand, with occasional concrete frag.
8						
						-UPPER FILL-
10			ND			(Top of ground surface)
						Test pit excavated from top of soil pile to ground surface.
12						
14						
16						
18						
20						

Groundwater Data						Summary	
			Depth			Overburden (Lin FT)	NA
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Water	Rock Cored (Lin FT)	NA
11/2/2007	NA	NA	NA	NA	NO		

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Environmental Test Pit Log

TP- 127

Project:	Supplemental Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	8726.02
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	SJB Services, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures	
Type:	NA	NA	NA	Excavator:	CAT 280 DL
Inside Diameter (IN):	NA	NA	NA	Reach:	22 feet
Hemmer Weight (LB):	NA	NA	NA	Bucket:	36 inch.
Hammer Fall (IN):	NA	NA	NA	Other:	Excavate test pits to approximately
Other:	NA	NA	NA		20 ft. and backfill to ground surface

Elevation:	482.2
Datum:	NGVD
Start:	10/25/2010
Finish	10/25/2010
Operator:	A. Koske
Bergmann Rep:	M. Carpenter / SJD

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0						Gray Gravel, some coarse to fine sand, damp. -UPPER FILL-
			ND			Black to gray CINDERS and SLAG, with ash black and brown fused materials, damp.
2					2	
						Black COAL
			ND			- UPPER FILL -
4						Concrete railroad bridge foundation encountered in test pit.
6						Black COAL
			ND			- UPPER FILL -
8				TP-127(8.0-10.0 ft.)	8.0	Yellow orange coarse to fine SAND, damp.
						- UPPER FILL -
10			ND			Gray COKE
						- UPPER FILL -
			ND			Black CINDERS and SLAG, with ash
12						
14						SAME. - UPPER FILL-
16						
			ND			
18						SAME - UPPER FILL-
20						
						Black COAL at northern end of the test pit orange slag and cinders. - UPPER FILL-
						Bottom of test pit at approximately 22 feet. Backfilled to ground surface.

Groundwater Data

Date	Time	Elapsed Time (HR)	Depth: Bottom Of Casing	Depth: Bottom Of Hole	Depth: Water
10/25/2010	NA	NA	NA	22.0 ft.	NO

Summary

Overburden (Lin FT)	22.0
Rock Cored (Lin FT)	NA

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Environmental Test Pit Log

TP- 128

Project:	Supplemental Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	8726.02
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	SJB Services, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures		
Type:	NA	NA	NA	Excavator: CAT 280 DL	Elevation:	482.5
Inside Diameter (IN):	NA	NA	NA	Reach: 22 feet	Datum:	NGVD
Hemmer Weight (LB):	NA	NA	NA	Bucket: 36 inch.	Start:	10/25/2010
Hammer Fall (IN):	NA	NA	NA	Other: Excavate test pits to approximately	Finish	10/25/2010
Other:	NA	NA	NA	20 ft. and backfill to ground surface	Operator:	A. Koske
					Bergmann Rep:	M. Carpenter / SJD

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0						Gray Gravel, some coarse to fine sand, damp. -UPPER FILL-
			ND			
					2.0	
2						
						Black COAL
			ND			- UPPER FILL -
4						
					6	
6						
			ND			Yellow orange coarse to fine SAND, damp.
8						
						Black CINDERS and SLAG, with ash and black, orange and brown fused materials, damp.
				TP-128 (8.0-10.0 ft.)		
						- UPPER FILL-
10			ND			
			ND			
12						
14						SAME. - UPPER FILL-
						Refusal Concrete Railroad bridge at
16						
			ND			
						Bottom of test Pit at approx. 15 feet.
18						
20						

Groundwater Data						Summary	
			Depth			Overburden (Lin FT)	15.0
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Water	Rock Cored (Lin FT)	NA
10/25/2010	NA	NA	NA	15.0 ft.	NO		

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Environmental Test Pit Log

TP- 129

Project:	Supplemental Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	8726.02
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	SJB Services, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures			
Type:	NA	NA	NA	Excavator:	CAT 280 DL	Elevation:	481.5
Inside Diameter (IN):	NA	NA	NA	Reach:	22 feet	Datum:	NGVD
Hemmer Weight (LB):	NA	NA	NA	Bucket:	36 inch.	Start:	10/25/2010
Hammer Fall (IN):	NA	NA	NA	Other:	Excavate test pits to approximately	Finish	10/25/2010
Other:	NA	NA	NA		20 ft. and backfill to ground surface	Operator:	A. Koske
						Bergmann Rep:	M. Carpenter / SJD

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0						Gray Gravel, some coarse to fine sand, damp. -FILL-
			ND			- UPPER FILL -
2					2	
						Black COAL - UPPER FILL -
			ND			Black COAL and gray COKE - UPPER FILL -
4						
6						
			ND			Black COAL and gray COKE - UPPER FILL-
8						
				No sample		
10			ND			
						Black COAL and gray COKE - UPPER FILL-
			ND			
12						
14						SAME.
16						
			ND			
18						SAME - UPPER FILL -
20						
						SAME.
						Bottom of test pit at approximately 22 feet. Backfilled to ground surface.

Groundwater Data					
			Depth		
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Water
10/25/2010	NA	NA	NA	22.0 ft.	NO

Summary	
Overburden (Lin FT)	22.0
Rock Cored (Lin FT)	NA

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Environmental Test Pit Log

TP- 130

Project:	Supplemental Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	8726.02
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	SJB Services, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures		
Type:	NA	NA	NA	Excavator: CAT 280 DL	Elevation:	481.5
Inside Diameter (IN):	NA	NA	NA	Reach: 22 feet	Datum:	NGVD
Hemmer Weight (LB):	NA	NA	NA	Bucket: 36 inch.	Start:	10/25/2010
Hammer Fall (IN):	NA	NA	NA	Other: Excavate test pits to approximately	Finish	10/25/2010
Other:	NA	NA	NA	20 ft. and backfill to ground surface	Operator:	A. Koske
					Bergmann Rep:	M. Carpenter

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0						Gray Gravel, some coarse to fine sand, damp. - UPPER FILL-
					1	
			ND			
						Black COAL
2						
			ND		4	- UPPER FILL -
4						Yellow orange coarse to fine SAND, damp.
6						
			ND			
						- UPPER FILL -
8					8.0	
				TP-130 (8.0-10.0 ft.)		
						Black CINDERS and SLAG, with black and brown fused materals, brick/glass fragments.
10			ND			
						- UPPER FILL -
			ND			Black CINDERS and SLAG, with ash
12						
14						SAME. - UPPER FILL-
						SAME, except with fused materials.
16						
			ND			
18						SAME - UPPER FILL-
20						
						Refusal at approximately 20.0 feet.
						Bottom of test pit at approximately 20 feet. Backfilled to ground surface.

Groundwater Data						Summary	
			Depth			Overburden (Lin FT)	20.0
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Water	Rock Cored (Lin FT)	NA
10/25/2010	NA	NA	NA	20.0 ft.	NO		

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Environmental Test Pit Log

TP- 131

Project:	Supplemental Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	8726.02
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	SJB Services, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures		
Type:	NA	NA	NA	Excavator: CAT 280 DL	Elevation:	482
Inside Diameter (IN):	NA	NA	NA	Reach: 22 feet	Datum:	NGVD
Hemmer Weight (LB):	NA	NA	NA	Bucket: 36 inch.	Start:	10/25/2010
Hammer Fall (IN):	NA	NA	NA	Other: Excavate test pits to approximately	Finish	10/25/2010
Other:	NA	NA	NA	20 ft. and backfill to ground surface	Operator:	A. Koske
					Bergmann Rep:	M. Carpenter / SJD

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0						Gray Gravel, some coarse to fine sand, damp. - UPPER FILL-
					1	
			ND			
						Black COAL
2						- UPPER FILL -
			ND			
4						Yellow orange coarse to fine SAND, damp. - UPPER FILL -
					5	
6			19.8 ppm			Odors from test pit soils noticed beginning at approximately 6 feet below the ground surface.
						Black to gray CINDERS and SLAG, with ash black, orange and brown fused materials, damp.
						- UPPER FILL -
8						
				TP-131 (8.0-10.0 ft.)		
						Black Stained SAND and SILT, with slag and cinders, mosit.
10						
			19.8 ppm			
						SAME.
12						
14			84 ppm			SAME. - UPPER FILL-
						SAME.
16						
18			84 ppm			SAME - UPPER FILL-
20						
						Odors from approximately 6 feet to 20 feet below ground surface
						Bottom of test pit at approximately 20 feet. Backfilled to ground surface.

Groundwater Data

Date	Time	Elapsed Time (HR)	Depth: Bottom Of Casing	Depth: Bottom Of Hole	Depth: Water
10/25/2010	NA	NA	NA	20.0 ft.	NO

Summary

Overburden (Lin FT)	20.0
Rock Cored (Lin FT)	NA

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Environmental Test Pit Log

TP- 132

Project:	Supplemental Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	8726.02
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	SJB Services, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures			
						Elevation:	481.5
Type:	NA	NA	NA	Excavator:	CAT 280 DL	Datum:	NGVD
Inside Diameter (IN):	NA	NA	NA	Reach:	22 feet	Start:	10/26/2010
Hemmer Weight (LB):	NA	NA	NA	Bucket:	36 inch.	Finish	10/26/2010
Hammer Fall (IN):	NA	NA	NA	Other:	Excavate test pits to approximately		
Other:	NA	NA	NA		20 ft. and backfill to ground surface	Operator:	R. Steiner
						Bergmann Rep:	M. Carpenter / SJD

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0						Gray Gravel, some coarse to fine sand, damp. - UPPER FILL-
					1	
			ND			
						Black COAL
2						- UPPER FILL -
			ND		4	
4						Yellow orange coarse to fine SAND, damp. - UPPER FILL -
					6	
6			19.8 ppm			Odors from test pit soils noticed beginning at approximately 6 feet below the ground surface.
						Black stained SAND and SILT with strong odor.
						- UPPER FILL -
8						
						Black stained SAND and SILT with strong odor.
10				TP-132 (8.0-10.0 ft.)		
			59 ppm			Black stained SAND and SILT and moist.
12						
14						SAME. - UPPER FILL-
						SAME.
16						
			440 ppm			
18			300 ppm			SAME - UPPER FILL-
						Black stained SAND and SILT with wooden sticks - UPPER FILL -
20						
						Bottom of test pit at approximately 20 feet. Backfilled to ground surface.

Groundwater Data						Summary	
			Depth			Overburden (Lin FT)	20.0
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Water	Rock Cored (Lin FT)	NA
10/26/2010	NA	NA	NA	20.0 ft.	NO		

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Project:	Supplemental Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	8726.02
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	SJB Services, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures		
					Elevation:	481.5
Type:	NA	NA	NA	Excavator: CAT 280 DL	Datum:	NGVD
Inside Diameter (IN):	NA	NA	NA	Reach: 22 feet	Start:	9/22/2011
Hemmer Weight (LB):	NA	NA	NA	Bucket: 36 inch.	Finish	9/22/2011
Hammer Fall (IN):	NA	NA	NA	Other: Excavate test pits to approximately		
Other:	NA	NA	NA	20 ft. and backfill to ground surface	Operator:	R. Steiner
					Bergmann Rep:	M. Carpenter

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0						Gray Gravel, some coarse to fine sand, damp. - UPPER FILL-
					1	
			ND			
						Black COAL
2						- UPPER FILL -
			ND		3.5	
4						Yellow orange coarse to fine SAND, damp. - UPPER FILL -
					5	
6			ND			
						Black to gray CINDERS and SLAG, with ash black, orange and brown fused materials, damp.
						- UPPER FILL -
8						
10				TP132 (8.0-10.0 ft.0	10.0	
			ND			SAME. - UPPER FILL -
12						
14						Black to gray CINDERS and SLAG, with ash black and brown fused materials, damp.
16						
			ND			
18			ND			SAME. - UPPER FILL-
						Some black staining on soils with no odors noted.
20						
						Bottom of test pit at approximately 20 feet. Backfilled to ground surface.

Groundwater Data						Summary	
			Depth			Overburden (Lin FT)	20.0
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Water	Rock Cored (Lin FT)	NA
9/22/2011	NA	NA	NA	20.0 ft.	NO		

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Environmental Test Pit Log

TP- 133

Project:	Supplemental Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	8726.02
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	SJB Services, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures			
Type:	NA	NA	NA	Excavator: CAT 280 DL	Elevation:	481.5
Inside Diameter (IN):	NA	NA	NA	Reach: 22 feet	Datum:	NGVD
Hemmer Weight (LB):	NA	NA	NA	Bucket: 36 inch.	Start:	10/26/2010
Hammer Fall (IN):	NA	NA	NA	Other: Excavate test pits to approximately	Finish	10/26/2010
Other:	NA	NA	NA	20 ft. and backfill to ground surface	Operator:	R. Steiner
					Bergmann Rep:	M. Carpenter

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0						Gray Gravel, some coarse to fine sand, damp. - UPPER FILL-
			ND		1	
2						Black Coal - UPPER FILL -
			ND		4	
4						Yellow orange coarse to fine SAND, damp. - UPPER FILL -
6			ND			
						Black to gray CINDERS and SLAG, with ash black and brown fused materials, damp. - UPPER FILL -
8						
10				TP- 133 (8.0-10.0 ft.)		
			ND			Same, except with white ceramic insulaters. - UPPER FILL -
12						
14						Black to gray CINDERS and SLAG, with ash black and brown fused materials, damp.
						SAME.
16			ND			
18			ND			SAME - UPPER FILL-
20						Bottom of test pit at approximately 20 feet. Backfilled to ground surface.

Groundwater Data

Date	Time	Elapsed Time (HR)	Depth: Bottom Of Casing	Depth: Bottom Of Hole	Depth: Water
10/26/2010	NA	NA	NA	20.0 ft.	NO

Summary

Overburden (Lin FT)	20.0
Rock Cored (Lin FT)	NA

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Environmental Test Pit Log

TP- 134

Project:	Supplemental Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	8726.02
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	SJB Services, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures			
Type:	NA	NA	NA	Excavator: CAT 280 DL		Elevation:	482
Inside Diameter (IN):	NA	NA	NA	Reach: 22 feet		Datum:	NGVD
Hemmer Weight (LB):	NA	NA	NA	Bucket: 36 inch.		Start:	10/26/2010
Hammer Fall (IN):	NA	NA	NA	Other: Excavate test pits to approximately		Finish	10/26/2010
Other:	NA	NA	NA	20 ft. and backfill to ground surface		Operator:	R. Steiner
						Bergmann Rep:	M. Carpenter

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0						Gray Gravel, some coarse to fine sand, damp. - UPPER FILL-
					1	
			ND			
						Black Coal
2					3	- UPPER FILL -
			ND			
4						Yellow orange coarse to fine SAND, damp. - UPPER FILL -
					6	
6			ND			
						Black to gray CINDERS and SLAG, with ash black and brown fused materials, damp.
						- UPPER FILL -
8						
10				TP-134 (8.0-10.0)		
			ND			Same, except with white ceramic insulaters. - UPPER FILL -
12						
14						Black to gray CINDERS and SLAG, with ash black and brown fused materials, damp.
						SAME.
16						
			ND			
18			9 ppm			Black to green CINDERS and SLAG, with wooden board damp.
						noted odor from approximately 18 feet to approximately 20 feet.
20						
						Bottom of test pit at approximately 20 feet. Backfilled to ground surface.

Groundwater Data

Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Water
			Depth		
10/26/2010	NA	NA	NA	20.0 ft.	NO

Summary

Overburden (Lin FT)	20.0
Rock Cored (Lin FT)	NA

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Project:	Supplemental Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	8726.02
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	SJB Services, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures		
Type:	NA	NA	NA	Excavator: CAT 280 DL	Elevation:	482.5
Inside Diameter (IN):	NA	NA	NA	Reach: 22 feet	Datum:	NGVD
Hemmer Weight (LB):	NA	NA	NA	Bucket: 36 inch.	Start:	10/26/2010
Hammer Fall (IN):	NA	NA	NA	Other: Excavate test pits to approximately	Finish	10/26/2010
Other:	NA	NA	NA	20 ft. and backfill to ground surface	Operator:	R. Steiner
					Bergmann Rep:	M. Carpenter

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0						Gray Gravel, some coarse to fine sand, damp. - UPPER FILL-
					1	
			ND			
						Black COAL
2						- UPPER FILL -
			ND		4	
4						Yellow orange coarse to fine SAND, damp. - UPPER FILL -
					5	
6			ND			
						Black to gray CINDERS and SLAG, with ash black and brown fused materials, damp.
						- UPPER FILL -
8						
10				No sample		
			ND			SAME. - UPPER FILL -
12						
14						Black to gray CINDERS and SLAG, with ash black and brown fused materials, damp.
						SAME, with some black stain colore
16						
			ND			
18			ND			Black to gray CINDERS and SLAG, with wooden board damp. - UPPER FILL-
						noted odor from approximately 18 feet to approximately 20 feet.
20						
						Bottom of test pit at approximately 20 feet. Backfilled to ground surface.

Groundwater Data						Summary	
			Depth			Overburden (Lin FT)	20.0
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Water	Rock Cored (Lin FT)	NA
10/26/2010	NA	NA	NA	20.0 ft.	NO		

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Environmental Test Pit Log

TP- 136

Project:	Supplemental Investigation 214 Lake Avenue Eastern Portion Parcel A and Parcel B - Site #C828126	File No:	8726.02
Client:	Volunteers of America of Western New York	Sheet No:	1 of 1
Contractor	SJB Services, Inc.	Location:	See Plan

Item	Casing	Drive Sampler	Core Barrel	Excavation Equipment and Procedures			
Type:	NA	NA	NA	Excavator:	CAT 280 DL	Elevation:	481.5
Inside Diameter (IN):	NA	NA	NA	Reach:	22 feet	Datum:	NGVD
Hemmer Weight (LB):	NA	NA	NA	Bucket:	36 inch.	Start:	10/26/2010
Hammer Fall (IN):	NA	NA	NA	Other:	Excavate test pits to approximately	Finish	10/26/2010
Other:	NA	NA	NA		20 ft. and backfill to ground surface	Operator:	R. Steiner
						Bergmann Rep:	M. Carpenter

Depth (FT)	Sample Depth (FT)	Sampler Blows Per 6 Inchs	Head Space (PPM)	Sample Number and Recovery	Strata Change (FT)	Visual Classification and Remarks
0						Gray Gravel, some coarse to fine sand, damp. - UPPER FILL-
					1	
			ND			
						Black coal.
2						- UPPER FILL -
			ND		3.5	
4						Yellow orange coarse to fine SAND, damp. - UPPER FILL -
					5	
6			ND			
						Black to gray CINDERS and SLAG, with ash black, orange and brown fused materials, damp.
						- UPPER FILL -
8						
10				No sample	10.0	
			ND			SAME. - UPPER FILL -
12						
14						Black to gray CINDERS and SLAG, with ash black and brown fused materials, damp.
16						
			ND			
18			ND			SAME. - UPPER FILL-
						Some black staining on soils with no odors noted.
20						
						Bottom of test pit at approximately 20 feet. Backfilled to ground surface.

Groundwater Data						Summary	
			Depth			Overburden (Lin FT)	20.0
Date	Time	Elapsed Time (HR)	Bottom Of Casing	Bottom Of Hole	Water	Rock Cored (Lin FT)	NA
10/26/2010	NA	NA	NA	20.0 ft.	NO		

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APPENDIX 11

RESPONSIBILITIES OF OWNER
AND
FUTURE OWNERS / DEVELOPERS

Responsibilities

The responsibilities for implementing the Site Management Plan ("SMP") for the 214 Lake Ave & 18 Ambrose Street (the "site"), number C828126, is with the site owner, as defined below. The owner is currently listed as:

Volunteers of America- NYDEC Site Number C828126, 214 Lake Avenue, Rochester, New York 14614, (the "owner")

There is no Responsible Party identified for this site.

If in the future the site management responsibilities will be carried out by multiple parties then the SMP will be modified to reflect that change and the following section will be populated the necessary information. The revised SMP will be submitted to the Department for review and approval.

Nothing on this page shall supersede the provisions of an Environmental Easement, Consent Order, Consent Decree, agreement, or other legally binding document that affects rights and obligations relating to the site.

Site Owner's Responsibilities:

1) The owner shall follow the provisions of the SMP as they relate to implementing the remaining remedy detailed in the SMP, future construction and excavation at the site.

2) In accordance with a periodic time frame determined by the NYSDEC, the owner shall periodically certify, in writing, that all Institutional Controls set forth in an Environmental Easement remain in place and continue to be complied with. The owner shall provide a written certification Periodic Review Report (PRR) certification to the NYSDEC.

3) In the event the site is delisted, the owner remains bound by the Environmental Easement and shall submit, upon request by the NYSDEC, a written certification that the Environmental Easement, Deed Restriction, Environmental is still in place and has been complied with.

4) The owner shall grant access to the site to NYSDEC and its agents for the purposes of performing activities required under the SMP and assuring compliance with the SMP.

5) The owner is responsible for assuring the security of the remedial components located on its property to the best of its ability. In the event that damage to the remedial components or vandalism is evident, the owner shall notify the NYSDEC in accordance with the timeframes indicated in Section 1.3 - Notifications of the SMP.

6) In the event some action or inaction by the owner adversely impacts the site, the owner must notify the NYSDEC in accordance with the time frame indicated in Section 1.3 of the SMP- Notifications and (ii) coordinate the performance of necessary corrective actions.

7) The owner must notify the NYSDEC of any change in ownership of the site property (identifying the tax map numbers in any correspondence) and provide contact information for the new owner of the site property/ies. 6 NYCRR Part contains notification requirements applicable to any construction or activity changes and changes in ownership. Among the notification requirements is the following: Sixty days prior written notification must be made to the NYSDEC. Notification is to be submitted to the NYSDEC Division of Environmental Remediation's Site Control Section. Notification requirements for a change in use are detailed in Section 2.4 of the SMP. A 60-Day Advance Notification Form and Instructions are found at http://www.dec.ny.gov/chemical/76250.html.

8) The site remedy requires the operation, and maintenance of an on-site oxygen injection system with soil vapor collection trench system (collectively systems) until such time as the NYSDEC deems the systems unnecessary, the owner shall operate the systems, pay for the utilities for the system's operation, and report any maintenance issues to the NYSDEC.

9) In accordance with the tenant notification law, within 15 days of receipt, the owner must supply a copy of any vapor intrusion data, that is produced with respect to structures and that exceeds NYSDOH or OSHA guidelines on the site, whether produced by the NYSDEC, RP, or owner, to the tenants on the property. The owner must otherwise comply with the tenant and occupant notification provisions of Environmental Conservation Law Article 27, Title 24.

Future Owners / Developers Responsibilities

1) The future owners/ developers must follow the SMP provisions regarding any construction and/or excavation it undertakes at the site.

2) The future owners / developers shall report to the NYSDEC all activities required for remediation, operation, maintenance, monitoring, and reporting. Such reporting includes, but is not limited to, periodic review reports and certifications, electronic data deliverables, corrective action work plans and reports, and updated SMPs.

3) Before accessing the site property to undertake a specific activity, the future owners / developers shall provide the owner advance notification that shall include an explanation of the work expected to be completed. The future owner / developers shall provide to (i) the owner, upon the owner's request, (ii) the NYSDEC, and (iii) other entities, if required by the SMP, a copy of any data generated during the site visit and/or any final report produced.

4) If the NYSDEC determines that an update of the SMP is necessary, the future owners shall update the SMP and obtain final approval from the NYSDEC. Within 5 business days after NYSDEC approval, the future owners / developers shall submit a copy of the approved SMP to the owner.

5) The future owners / developers shall notify the NYSDEC and the owner of any changes in control and of any changes in the party/entity responsible for the operation, maintenance, and monitoring of and reporting with respect to any remedial system (Engineering Controls). The future owners shall provide contact information for the new party/entity. Such activity constitutes a Change of Use pursuant to 375-1.11(d) and requires 60-days prior notice to the NYSDEC. A 60-Day Advance Notification Form and Instructions are found at http://www.dec.ny.gov/chemical/76250.html .

6) The future owners / developers shall notify the NYSDEC of any damage to or modification of the systems as required under Section 1.3 - Notifications of the SMP.

7) The future owner(s) / developers is/are responsible for the proper maintenance of any installed systems or future required vapor intrusion mitigation systems associated with the site, as required in Section 5.0 and Appendix 4 (Operation, Monitoring and Maintenance plan) of the SMP.

8) Prior to a change in use that impacts the remedial system or requirements and/or responsibilities for implementing the SMP, the future owners / developers shall submit to the NYSDEC for approval an amended SMP.

10) Any change in use, change in ownership, change in site classification (*e.g.*, delisting), reduction or expansion of remediation, and other significant changes related to the site may result in a change in responsibilities and, therefore, necessitate an update to the SMP and/or updated legal documents. The future owners shall contact the Department to discuss the need to update such documents.

Change in future owner ownership and/or control and/or site ownership does not affect the future owner's obligations with respect to the site unless a legally binding document executed by the NYSDEC releases the future owners of its obligations.

All future site owners and their successors and assigns are required to carry out the activities set forth above.

APPENDIX 12

REMEDIAL SYSTEM OPTIMIZATION

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APPENDIX 13

ALLOWABLE CONSTITUENT LEVELS FOR IMPORTED FILL AND SOIL

DER-10 / Technical Guidance for Site Investigation and Remediation

Allowable Constituent Levels for Imported Fill or Soil
Subdivision 5.4(e)

Source: This table is derived from soil cleanup objective (SCO) tables in 6 NYCRR 375. Table 375-6.8(a) is the source for unrestricted use and Table 375-6.8(b) is the source for restricted use.

Note: For constituents not included in this table, refer to the contaminant for supplemental soil cleanup objectives (SSCOs) in the Commissioner Policy on *Soil Cleanup Guidance*. If an SSCO is not provided for a constituent, contact the DER PM to determine a site-specific level.

Constituent	Unrestricted Use	Residential Use	Restricted Residential Use	Commercial or Industrial Use	If Ecological Resources are Present
Metals					
Arsenic	13	16	16	16	13
Barium	350	350	400	400	433
Beryllium	7.2	14	47	47	10
Cadmium	2.5	2.5	4.3	7.5	4
Chromium, Hexavalent[1]	1[3]	19	19	19	1[3]
Chromium, Trivalent[1]	30	36	180	1500	41
Copper	50	270	270	270	50
Cyanide	27	27	27	27	NS
Lead	63	400	400	450	63
Manganese	1600	2000	2000	2000	1600
Mercury (total)	0.18	0.73	0.73	0.73	0.18
Nickel	30	130	130	130	30
Selenium	3.9	4	4	4	3.9
Silver	2	8.3	8.3	8.3	2
Zinc	109	2200	2480	2480	109
PCBs/Pesticides					
2,4,5-TP Acid (Silvex)	3.8	3.8	3.8	3.8	NS
4,4'-DDE	0.0033[3]	1.8	8.9	17	0.0033[3]
4,4'-DDT	0.0033[3]	1.7	7.9	47	0.0033[3]
4,4'-DDD	0.0033[3]	2.6	13	14	0.0033[3]
Aldrin	0.005	0.019	0.097	0.19	0.14
Alpha-BHC	0.02	0.02	0.02	0.02	0.04[4]
Beta-BHC	0.036	0.072	0.09	0.09	0.6
Chlordane (alpha)	0.094	0.91	2.9	2.9	1.3
Delta-BHC	0.04	0.25	0.25	0.25	0.04[4]
Dibenzofuran	7	14	59	210	NS
Dieldrin	0.005	0.039	0.1	0.1	0.006
Endosulfan I	2.4[2]	4.8	24	102	NS
Endosulfan II	2.4[2]	4.8	24	102	NS
Endosulfan sulfate	2.4[2]	4.8	24	200	NS
Endrin	0.014	0.06	0.06	0.06	0.014
Heptachlor	0.042	0.38	0.38	0.38	0.14
Lindane	0.1	0.1	0.1	0.1	6
Polychlorinated biphenyls	0.1	1	1	1	1

Constituent	Unrestricted Use	Residential Use	Restricted Residential Use	Commercial or Industrial Use	If Ecological Resources are Present
Semi-volatile Organic Compounds					
Acenaphthene	20	98	98	98	20
Acenaphthylene	100	100	100	107	NS
Anthracene	100	100	100	500	NS
Benzo(a)anthracene	1	1	1	1	NS
Benzo(a)pyrene	1	1	1	1	2.6
Benzo(b)fluoranthene	1	1	1	1.7	NS
Benzo(g,h,i)perylene	100	100	100	500	NS
Benzo(k)fluoranthene	0.8	1	1.7	1.7	NS
Chrysene	1	1	1	1	NS
Dibenz(a,h)anthracene	0.33 [3]	0.33 [3]	0.33 [3]	0.56	NS
Fluoranthene	100	100	100	500	NS
Fluorene	30	100	100	386	30
Indeno(1,2,3-cd)pyrene	0.5	0.5	0.5	5.6	NS
m-Cresol(s)	0.33 [3]	0.33 [3]	0.33 [3]	0.33 [3]	NS
Naphthalene	12	12	12	12	NS
o-Cresol(s)	0.33 [3]	0.33 [3]	0.33 [3]	0.33 [3]	NS
p-Cresol(s)	0.33	0.33	0.33	0.33	NS
Pentachlorophenol	0.8 [3]	0.8 [3]	0.8 [3]	0.8 [3]	0.8 [3]
Phenanthrene	100	100	100	500	NS
Phenol	0.33 [3]	0.33 [3]	0.33 [3]	0.33 [3]	30
Pyrene	100	100	100	500	NS
Volatile Organic Compounds					
1,1,1-Trichloroethane	0.68	0.68	0.68	0.68	NS
1,1-Dichloroethane	0.27	0.27	0.27	0.27	NS
1,1-Dichloroethene	0.33	0.33	0.33	0.33	NS
1,2-Dichlorobenzene	1.1	1.1	1.1	1.1	NS
1,2-Dichloroethane	0.02	0.02	0.02	0.02	10
1,2-Dichloroethene(cis)	0.25	0.25	0.25	0.25	NS
1,2-Dichloroethene(trans)	0.19	0.19	0.19	0.19	NS
1,3-Dichlorobenzene	2.4	2.4	2.4	2.4	NS
1,4-Dichlorobenzene	1.8	1.8	1.8	1.8	20
1,4-Dioxane	0.1 [3]	0.1 [3]	0.1 [3]	0.1 [3]	0.1
Acetone	0.05	0.05	0.05	0.05	2.2
Benzene	0.06	0.06	0.06	0.06	70
Butylbenzene	12	12	12	12	NS
Carbon tetrachloride	0.76	0.76	0.76	0.76	NS
Chlorobenzene	1.1	1.1	1.1	1.1	40
Chloroform	0.37	0.37	0.37	0.37	12
Ethylbenzene	1	1	1	1	NS
Hexachlorobenzene	0.33 [3]	0.33 [3]	1.2	3.2	NS
Methyl ethyl ketone	0.12	0.12	0.12	0.12	100
Methyl tert-butyl ether	0.93	0.93	0.93	0.93	NS
Methylene chloride	0.05	0.05	0.05	0.05	12

Volatile Organic Compounds (continued)					
Propylbenzene-n	3.9	3.9	3.9	3.9	NS
Sec-Butylbenzene	11	11	11	11	NS
Tert-Butylbenzene	5.9	5.9	5.9	5.9	NS
Tetrachloroethene	1.3	1.3	1.3	1.3	2
Toluene	0.7	0.7	0.7	0.7	36
Trichloroethene	0.47	0.47	0.47	0.47	2
Trimethylbenzene-1,2,4	3.6	3.6	3.6	3.6	NS
Trimethylbenzene-1,3,5	8.4	8.4	8.4	8.4	NS
Vinyl chloride	0.02	0.02	0.02	0.02	NS
Xylene (mixed)	0.26	1.6	1.6	1.6	0.26

All concentrations are in parts per million (ppm)
NS = Not Specified

Footnotes:

[1] The SCO for Hexavalent or Trivalent Chromium is considered to be met if the analysis for the total species of this contaminant is below the specific SCO for Hexavalent Chromium.

[2] The SCO is the sum of endosulfan I, endosulfan II and endosulfan sulfate.

[3] For constituents where the calculated SCO was lower than the contract required quantitation limit (CRQL), the CRQL is used as the Track 1 SCO value.

[4] This SCO is derived from data on mixed isomers of BHC.