Brownfields Cleanup Program
Highland Plaza Site (#C915293)
215 Highland Parkway
Tonawanda, New York

Supplemental Phase II Investigation

QUALITY ASSURANCE PROJECT PLAN

Prepared For:

Highland Plaza
215 Highland Parkway
Tonawanda, New York

Prepared By:

Environmental & Geologic Management Services, LLC

EGMS

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1.1 Introduction

This Quality Assurance Project Plan (QAPP) was prepared for the Highland Plaza site located in Tonawanda, New York. The project work will be performed by Environmental & Geologic Management Services, LLC (EGMS), or conducted under their discretion by NYSDEC-approved contractors. Project-specific descriptions can be found in the Supplemental Phase II Investigation Work Plan.

This QAPP presents the policies, organization, objectives, functional activities, and specific quality assurance (QA) and quality control (QC) activities that will be implemented by EGMS for this project. This QAPP is designed to ensure that all technical data generated by EGMS is accurate and representative.

All QA/QC procedures are implemented in accordance with applicable professional technical standards, NYSDEC and the United States Environmental Protection Agency (USEPA) requirements, government regulations and guidelines, and specific project goals and requirements. This QAPP is prepared in accordance with all NYSDEC and USEPA QAPP guidance documents.

This QAPP incorporates the following activities:

- Sample Management and Chain of Custody;
- Document Control;
- Laboratory Quality Control; and
- Review of Project Deliverables.

Analytical samples will be collected in the field utilizing standard operating procedures (SOPs) and sent to the contracted New York State Department of Health (NYSDOH) Environmental Laboratory Accreditation Program (ELAP) Contract Laboratory Protocol (CLP)-certified laboratory for analysis. Field data compilation, tabulation, and analysis will be checked for accuracy. Calculations and other post-field tasks will be reviewed by field personnel and the project manager.

Equipment used to take field measurements will be maintained and calibrated in accordance with established procedures. Records of calibration and maintenance will be kept by assigned personnel. Field testing and data acquisition will be performed in standard fashion following strict guidelines.

Document control procedures will be used to coordinate the distribution, coding, storage, retrieval, and review of all data collected during all sampling tasks. These include, but are not limited to, the sampling of soil/sediment, groundwater, and wastes.

In addition, the laboratory has developed SOPs for individual analytical methods and internal QC procedures. These documents are an important aspect of their QA program and are available for review upon request.

2.0 Project Objectives

The intent of the Supplemental Phase II Investigation is to further delineate the nature and extent of contamination at the Site. Sampling of soil and groundwater will be used to identify potential exposure pathways and evaluate the Site for future use. The identification of significant Site characteristics, extent of contamination, and exposure pathways (if completed exposure pathways are indicated) will provide the basis for developing remedial alternatives. The Scope of Work is described in the Supplemental Phase II Investigation Work Plan.

A complete project description, including Site history and background information, is given in the Preliminary Phase II Investigation that was completed at the Site in 2014.

3.0 Project Organization and Responsibility

Experienced senior technical staff will be assigned to the project QA/QC functions. The management structure provides for direct and constant operational responsibility, clear lines of authority, and the integration of QA activities. The various QA functions are explained below.

QA contacts include the EGMS Project Manager and LTP Services as Quality Assurance Officer. Qualifications of key personnel are included in Appendix A.

Paradigm Environmental Services, Inc., a NYSDOH ELAP-CLP certified laboratory, will provide analytical services for the project.

Project Director

The project director for this project will be Norman K. Wohlabaugh, PG, CPG. As project director, he will have overall responsibility for ensuring that the project meets client objectives. In addition, the project director will be responsible for technical quality control and project oversight.

Project Manager

Mr. Wohlabaugh will also function as the Project Manager. As project manager, he will be responsible for implementing the project and will have the authority to commit the resources necessary to meet project objectives and requirements. The project manager's primary function is to ensure that technical, financial, and scheduling objectives are achieved. The project manager will provide the major point of contact and control for matters concerning the project. The project manager will:

- Work directly with the Highland Plaza and the NYSDEC Regional Office to complete and implement the work plan for the project;
- Define project objectives and schedule;
- Establish project policy and procedures to address the specific needs of the project as a whole, as well as the objectives of each task;
- Acquire and apply technical managerial resources as needed to ensure performance within budget and schedule constraints;
- Develop and meet ongoing project and/or task staffing requirements, including mechanisms to review and evaluate each task product;
- Review the work performed on each task to ensure its quality, responsiveness, and timeliness;
- Review and analyze overall task performance with respect to planned requirements and authorizations;
- Approve all external reports (deliverables) before their submission to the client;
- Ultimately be responsible for the preparation and quality of interim and final reports; and
- Represent the project team at meetings.

Quality Assurance Officer (QAO)

The QAO is Peter Tarnawskyj, QEP. He will be responsible for maintaining QA for a specific program and the projects within that program. Specific functions and duties include:

- Providing an external and, thereby, independent QA function for the project;
- Responsibility for field and sampling audits conducted by qualified QA personnel;
- Coordinating with client personnel, the EGMS project manager, laboratory management, and staff to ensure that QA objectives appropriate to the project are set and that personnel are aware of these objectives;
- Coordinating with project management and personnel to ensure that QC procedures appropriate to demonstrating data validity sufficient to meet QA objectives are developed and in place;
- Interfacing with the data validator (if necessary) and development of a project specific data usability report;
- Coordinating with QA personnel to ensure that QC procedures are followed and documented;
- Requiring and/or reviewing corrective actions taken in the event of QC failures;

- Reporting non-conformance with QC criteria or QA objectives, including an assessment of the impact on data quality or project objectives, to the project manager.

Technical Staff

Mr. Wohlabaugh will provide field oversight, sample collection, data analysis and prepare various task reports and support materials. He is an experienced environmental professional who possesses the degree of specialization; training and technical competences required to effectively and efficiently perform the required work.

Data Validation and QA Staff

If necessary, data validation and QA staff will include data validation chemists, QA auditors, and other technical specialists who remain independent of the laboratory and project management. The staff will independently validate analytical data to assess and summarize their accuracy, precision, and reliability and determine their usability. The staff will also perform audits and document the historical record of project activities, including any factors affecting data usability, such as data discrepancies and deviations from standard practices. The staff will act under the direction of the QA officer and project manager in accordance with specific project requirements. Vali – Data will act as the third party for data validation purposes.

4.0 Sampling Procedures

4.1 Sampling Design

Sampling procedures for this project are designed to further delineate the nature and extent of contamination at the Site. Soil, groundwater and soil vapor will be used to further evaluate Site conditions.

Approximately 12 soil borings; five, one-inch micro-well installations, and one sub-slab soil vapor location will be completed as part of the Supplemental Phase II Investigation.

Soil and groundwater samples will be analyzed for:

- Target Compound List (TCL) volatile organic compounds (VOCs) (USEPA Method 8260).

In addition, two soil samples will also be analyzed for:

- Semi-volatile organic compounds (SVOCs) (USEPA Method 8270);
- Target Analyte List Metals (USEPA Method 6020);
- Pesticides (USEPA Method 8081); and
- Polychlorinated Biphenyls (PCBS) (USEPA Method 8082).

Groundwater waste associated with well development activities will be filtered through activated carbon and discharged to the ground surface.

Continuous perimeter and work zone air monitoring for VOCs will also be conducted during all intrusive activities in accordance with the actions outlined in the project CAMP.

A Site map showing sample locations is provided as Figure 5 of the Supplemental Phase II Work Plan.

4.2 QC Samples

Various types of field QC samples are used to check the cleanliness and effectiveness of field handling methods. They are analyzed in the laboratory as samples, and their purpose is to assess the sampling and transport procedures as possible sources of sample contamination and document overall sampling and analytical precision. Rigorous documentation of all field QC samples in the site logbooks is mandatory.

- **Trip Blanks** are similar to field blanks with the exception that they are not exposed to field conditions. Their analytical results give the overall level of contamination from everything except ambient field conditions. Trip blanks are prepared at the lab prior to the sampling event and shipped with the sample bottles. Trip blanks are prepared by adding organic-free water to a 40-ml volatile organic analysis (VOA) vial. One trip blank will be used with every batch of water samples shipped for volatile organic analysis. Each trip blank will be transported to the sampling location, handled like a sample, and returned to the laboratory for analysis without being opened in the field.
- **Field Equipment/Rinsate Blanks** are blank samples designed to demonstrate that sampling equipment has been properly prepared and cleaned before field use and that cleaning procedures between samples are sufficient to minimize cross-contamination. Rinsate blanks are prepared by passing analyte-free water over sampling equipment and analyzing the samples for all applicable parameters. If a sampling team is familiar with a particular site, its members may be able to predict which areas or samples are likely to have the highest concentration of contaminants. Unless other constraints apply, these samples should be taken last to avoid excessive contamination of sampling equipment. Rinsate blanks are not required if dedicated sampling equipment is used for sample collection.
- **Field Duplicates** consist of a set of two samples collected independently at a sampling location during a single sampling event. Field duplicates can be sent to the laboratory so that they are indistinguishable from other analytical samples and personnel performing the analysis are not able to determine which of the samples field duplicates are. Field duplicates are designed to assess the consistency of the overall sampling and analytical system.

Field QC samples and the frequency of analysis for this project are summarized in Table 1.

4.3 Decontamination Procedures

All decontamination will be performed in accordance with NYSDEC-approved procedures. Sampling methods and equipment have been chosen to minimize decontamination

requirements and prevent the possibility of cross-contamination. All drilling equipment will be decontaminated prior to drilling, after drilling each boring/monitoring well, and after the completion of all drilling. Special attention will be given to the drilling assembly, augers, split-spoons, and polyvinyl chloride (PVC) casing. Soil samples will be collected using clean disposable acetate liners in the Geoprobe macro-sampler. Groundwater wells will be developed and sampled using clean disposable bailers.

Non-disposable sampling equipment and stainless steel spoons will be decontaminated using the following procedure:

- Disassembling the split spoon or other sampling equipment if necessary;
- Cleaning equipment of all foreign matter;
- Scrubbing equipment with brushes in alconox solution;
- Rinsing equipment with distilled water; and
- Rinsing equipment with 10% nitric acid (when sampling for metals only);
- Triple-rinsing equipment with distilled water; and
- Allowing equipment to air dry.

All drill cuttings and water generated during drilling boring and monitoring well installation will remain on-Site. All waters generated by decontamination or by developing, purging, or pumping the monitoring wells will be filtered through activated carbon and discharged to the ground surface.

A temporary decontamination pool will be established in a secure area on Site using 6-mil polyethylene sheeting. The drill rig and associated tooling will be decontaminated using steam-cleaning methods at the designated location. Fluids generated during decontamination will be collected in the plastic-lined pool. All decontamination wastes will be transferred into drums or an on-Site holding tank for appropriate staging and disposal. It is not anticipated that investigative derived waste needing off-Site disposal will be generated as part of this investigation.

4.4 Sampling Methods

This section describes the sampling procedures to be utilized for each environmental medium that will be collected and analyzed in accordance with the Supplemental Phase II Investigation Work Plan. All sampling procedures described are consistent with USEPA sampling procedures as described in SW-846, third edition and the NYSDEC Analytical Services Protocols (ASP), or equivalent.

4.41 Subsurface Soil Samples

Soil borings will be advanced using a direct push Geoprobe drill rig or equivalent. A four-foot long macro-core sample barrel lined with a new acetate sleeve will be used for all subsurface soil sampling in this area. At soil sampling locations, borings will be advanced to depth 15 feet below ground surface (BGS); at groundwater monitoring well locations, borings will be

advanced to 25 feet BGS or 10 feet into the groundwater table, whichever condition is met first. Non-disposable sampling equipment will be decontaminated between sampling locations as detailed in Section 4.3.

Each soil sample will be described at the time it is retrieved, and a subsurface log will be produced by an on-Site geologist based upon visual examination and other field observations. Soil descriptions will be based the Burmister Soil Classification System.

All soil samples will be screened at two foot intervals for the presence of VOCs with a PID. Screening will be performed by placing a representative soil sample into a Ziploc™ (or equivalent) plastic bag, sealing the bag, and then allowing the sample to volatilize for at least 15-minutes. The concentration of VOCs will then be measured by inserting the tip of the PID or equivalent device into the sample's headspace and taking a reading. VOC measurements will be entered on the boring log. At five locations, the soil borings will be constructed into micro-monitoring wells.

The field geologist will also evaluate soil samples for the presence of staining or other unusual observations. Samples noted to have these characteristics may require analysis, for parameters described in Section 4.1.

4.42 Groundwater Investigation

The groundwater sampling plan outlined in this subsection has been prepared in general accordance with DER 10.

Well Installation

Prior to initiating drilling activities, the drilling rig, augers, rods, split spoons, and pertinent equipment will be steam cleaned. These activities will be performed prior to the arrival of this equipment on site by the drilling subcontractor; or, on site in a designated decontamination area. Throughout and after the cleaning processes, direct contact between the equipment and the ground surface will be avoided. Plastic sheeting and/or clean support structures (i.e., pallets, sawhorses) will be used as needed. The drilling rig and all equipment will be steam cleaned upon completion of the investigation and prior to leaving the Site.

Monitoring wells will be installed using a direct push Geoprobe drill rig. During the drilling, a hand held VOC monitor (i.e., PID) will be used to monitor the gases exiting the hole.

A four-foot long macro-core sample barrel lined with a new (clean) acetate sleeve will be used for all subsurface soil sampling to collect continuous soil cores for this project. Soil samples will be screened at two-foot intervals with a PID as described in Section 4.4.1. The boring will be advanced to approximately 25 feet BGS, or 10 feet into the water table, depending on which condition is met first.

The sampler will be decontaminated between sampling locations as described in Section 4.3.

Well Casing (Riser)

The well riser shall consist of 1-inch diameter, threaded flush-joint PVC pipe which will extend from the well screen to the ground surface. All well risers will conform to the requirements of American Society of Testing and Materials (ASTM)-D 1785 Schedule 40 pipe, and shall bear markings that will identify the material as that which is specified. All materials used to construct the wells will be National Science Foundation (NSF)/ASTM approved.

Well Screen

Groundwater monitoring wells will be constructed with 1-inc diameter, 10-foot 0.01-inch slot machine-slotted screens, unless dictated otherwise by field conditions (i.e., screens of less than 10-feet in length may be used, depending on the characteristics of the well). Screen and riser sections shall be joined by flush-threaded coupling to form watertight unions that retain 100% of the strength of the casing. Solvent PVC glues will not be used at any time in the construction of the wells. The bottom of the screen shall be sealed with a treated cap or plug. All wells will be completed in accordance with applicable industry standards and NYSDEC requirements.

Artificial Sand Pack

Granular backfill will be chemically and texturally clean inert, siliceous, and of appropriate grain size for the screen slot size and the host environment. The well screen and riser casing will be installed, and the sand pack placed around the screen and casing to a depth approximately 2-feet above the top of the well screen.

Bentonite Seal

A minimum 2-foot thick seal of bentonite pellets/chips and water slurry will be placed directly on top of the sand pack, and care will be taken to avoid bridging. The seal will be measured immediately after placement, without allowance for swelling.

Grout Mixture

Upon completion of the bentonite seal, the well will be grouted with a non-shrinking cement grout mix to be placed from the top of the bentonite seal to the ground surface. The cement grout shall consist of a mixture of Portland cement (ASTM-C 150) and water, in the proportion of not more than 7-gallons of clean water per bag of cement (1 cubic foot or 94 pounds). Additionally, 5% by weight of bentonite powder shall be added, if permitted.

Surface Protection

At all times during the progress of the work, precautions shall be used to prevent tampering with or the entrance of foreign material into the well. Upon completion of the well, a suitable vented cap shall be installed to prevent material from entering the well. The PVC well riser will be protected at the surface with a flush mount steel surface casing box with a cap and lock. The box will encased in a concrete pad at ground level.

Surveying

Upon completion of field activities, coordinates and elevations will be established by a New York State (NYS) licensed land surveyor for each boring, monitoring well, sampling location, and other key contour points. A map of each site will be prepared for inclusion into the final report.

Elevations (0.01-foot) will be established for the ground surface at each boring, monitoring well, sampling location, the top of each monitoring well casing (T.C), and at least one other permanent object (i.e., property corner markers, corners of buildings, bridges, etc.) in the vicinity of the borings and wells. Elevations will be relative to a regional, local, or project specific datum.

United States Geological Survey (USGS) benchmarks will be used if within ½ mile of the Site being surveyed and will take precedence over the use of a project specific datum. Unsurveyed data, (i.e., approximate Site and property boundaries), developed through the use of current tax maps and initial Site visits, also will be shown on the survey map. The location and extent of filled areas, buried tanks and drums, other items pertinent to Site usage will be indicated on the survey maps based on the best available data.

Well Development

After completion of the well, but not sooner than 48-hours after grouting is completed, development will be accomplished using well specific, disposable bailers. No dispersing agents, acids, disinfectants, or other additives will be used during development nor be introduced into the well at any other time. Well development will include washing the entire well cap and the interior of the well casing above the water table, using only water from the well itself. As a result of the operation, the well casing will be free of extraneous materials (grout, bentonite, and sand) inside the riser, well cap, and blank casing between top of the well casing and water table. This washing will be conducted before and/or during development; not after development. Groundwater waste associated with well development activities will be filtered through activated carbon and discharged to the ground surface. The spent activated carbon will be stored on-site until it can be delivered to the carbon vendor for re-use.

The development process will continue until a stabilization of pH, specific conductance, temperature, and clarity (goal of <50 Nephelometric Turbidity Unit NTUs) of the discharge is achieved and/or five well volumes are extracted from the respective well.

Geologic Logging and Sampling

At each well location, the boring will be advanced into overburden using a direct push drill rig and a macro-core sampler. Soils will be visually inspected for stains and monitored with a PID. Soil samples will be collected continuously over the entire depth of the well as detailed in Section 4.4.1. The sampling device will be decontaminated according to procedures outlined in Section 4.3.

Soil samples will be screened in the field for VOCs using a hand held PID, and will be classified in accordance with the Burmister Soil Classification System, and logged. Samples will be stored in glass jars until they are needed for testing or the project is complete. Information regarding analytical requirements for soil borings is found in Section 4.1.

Monitoring well borings will be installed to a depths outlined in the Supplemental Phase II Investigation Work Plan, or determined through the examination of boring logs and water levels encountered. Discrepancies between the prepared Work Plan and actual Site conditions will be noted and countersigned by both parties in the project's on-Site logbook.

If hydrogeologic conditions are favorable for well installation at a depth less than design, the well will be installed at the boring or coring termination depth. In the even that maximum design depth is reached and hydrogeologic conditions are not suitable for well installation, the maximum drilling depth will be revised. Hydrogeologic suitability for well emplacement will be determined by the supervising geologist in consultation with NYSDEC, based on thickness and estimated hydraulic conductivity to the saturated zone encountered. If necessary, the borehole will be advanced to water or abandoned.

Drilling logs will be prepared by an experienced geologist who will be present during all drilling operations. One copy of each field boring log, well construction log and groundwater data will be submitted as part of the report. Information provided in the logs shall include, but not be limited to, the following:

- Date, test hole identification, and project identification;
- Name of individual developing the log;
- Name of driller and assistant(s);
- Drill, make and model, auger size;
- Identification of alternative drilling methods used and justification thereof (i.e., rotary drilling with a specific bit type to remove material from within the hollow stem augers);
- Field diagram of each monitoring well installed with the depth to bottom of screen, top of screen, and pack, bentonite seal, etc.;
- Reference elevation for all depth measurements;
- Depth of each change of stratum;
- Thickness of each stratum;
- Identification of the material of which each stratum is composed, according to the Burmister Soil Classification system;
- Depth interval from which each sample was taken;
- Depth at which groundwater is encountered;
- Depth to static water level;
- Total depth of completed well;
- Depth or location of any loss of tools or equipment;
- Location of any fractures, joints, faults, cavities, or weathered zones;
- Depth of any grouting or sealing;
- Nominal hole diameters;
- Amount of cement used for grouting or sealing;

- Depth and type of well casing;
- Description of well screen (to include depth, length, location, diameter, slot sizes, material, and manufacturer);
- Any sealing-off of water-bearing strata;
- Static water level upon completion of the well and after development;
- Drilling date or dates;
- Construction details of well; and
- An explanation of any variations from the Work Plan.

Groundwater Sampling Procedures

Static water levels will be measured to within 0.01-foot prior to purging and sampling. Purging and sampling of each well will be accomplished using pre-cleaned disposable PVC bailers on new polypropylene line. All wells will be purged a minimum of three volumes of water standing in the casing or to dryness. Temperature, pH and conductivity will be measured and recorded during purging. Sample volumes will be collected immediately following purging. Groundwater samples will be collected according to the following procedures.

- When transferring water from the bailer or pump line to sample containers, care will be taken to avoid agitating the sample, since agitation promotes the loss of VOCs;
- Any observable physical characteristics of the groundwater (i.e., color, sheen, odor, turbidity) at the time of sampling will be recorded; and
- Weather conditions (i.e., air temperature, sky condition, recent heavy rainfall, drought conditions) at the time of sampling will be recorded.

All groundwater samples and their accompanying QA/QC samples will be analyzed as specified in the Supplemental Phase II Investigation Work Plan.

4.6 Sample Documentation

4.5.1 Logbooks

All field activities will be documented in a field logbook. This logbook will provide a record of activities conducted at the Site. All entries will be signed and dated at the end of each day of fieldwork. The field logbook will include the following: date and time of all entries; names of all personnel on Site; weather conditions (temperature, precipitation, etc.); location of activity; and description of activity. In addition, EGMS will complete the following standard field forms as necessary:

- Test boring/probing logs;
- Groundwater elevations, development, sampling and conductivity logs;
- Field sampling records; and
- Chain of custody for all analytical laboratory sampling.

As with any data logbooks, no pages will be removed for any reason. If corrections are necessary, these must be made by drawing a single line through the original entry (so that the original entry can still be read) and writing the corrected entry alongside it. The correction must be initialed and dated. Most corrected errors will require a footnote explaining the correction.

4.5.2 Sample Identification

All containers of samples collected by EGMS from the project will be identified using a format identified in the field on a label affixed to the sample container. Generally, the format will include two letters identifying the Site (HP –Highland Plaza), two additional letters identifying the type of sample (GW – Groundwater), two numbers identifying a sample location, two to four additional numbers identifying a sample depth if appropriate, and additional letters identifying special parameters (MS/MSD – Matrix Spike, Matrix Spike Duplicate) if applicable.

Each sample will be labeled and sealed immediately after collection. To minimize handling of sample containers, labels will be filled out prior to sample collection. The sample label will be filled out using waterproof ink and will be firmly affixed to the sample containers. The sample label will give the sample number, the date of the collection and analysis required. The laboratory sample number will appear on a barcode label affixed to each sample, extract, or digestate.

4.6 Field Instrumentation

All instruments and equipment used during sampling and analysis will be operated, calibrated and maintained according to manufacture's guidelines and recommendations. Operation, calibration, and maintenance will be performed by personnel properly trained in these procedures. Documentation of calibration information will be maintained in the appropriate log book or reference file and will be available upon request.

EGMS will provide continuous perimeter and work zone air monitoring during drilling activities using a MiniRAE 2000 PID to ensure that workers and the public are not exposed to elevated concentrations of VOCs. A Site specific CAMP is included in with the Supplemental Phase II Investigation Work Plan to address potential fugitive dust, odors, and vapors.

5.0 Sample Handling and Custody

This section describes procedures for sample handling and chain-of-custody to be followed by EGMS sampling personnel and the analytical laboratory. The purpose of these procedures is to ensure that the integrity of the samples is maintained during their collection, transportation, storage, and analysis. All chain-of-custody requirements comply with SOPs indicated in USEPA sample-handling protocol.

All samples will be obtained, handled and characterized in accordance with NYSDEC ASP methods. Samples will be relinquished to EGMS's contract accredited NYSDEC ELAP CLP and certified analytical laboratory. All chain of custody requirements will be strictly adhered to for designated analyses.

Sample identification documents will be carefully prepared so that sample identification and chain-of-custody can be maintained and sample disposition controlled. Sample identification documents include field notebooks, sample labels, custody seals, chain-of-custody records, and laboratory sample log-in and tracking forms.

The primary objective of the chain-of-custody procedures is to provide an accurate written record that can be used to trace the possession and handling of a sample from the moment of its collection through it analyses. A sample is in custody if it is:

- In someone's physical possession;
- In someone's view;
- Locked up; or
- Kept in a secured area that is restricted to authorized personnel.

5.1 Sample Containers and Preservation

For sampling performed by EGMS, prewashed sample containers obtained from a reliable supplier will be provided by the analytical laboratory. All containers provided by the laboratory are pre-cleaned (Level 1), with certificates of analysis available for each bottle type. Certifications of Analysis provided by the vendor are kept on file by the laboratory.

All samples will be stored on ice pending delivery to the laboratory. In addition, all water samples for volatile analysis will be preserved with HCl to a pH of less than 2. A list of preservatives and holding times for each type of analysis is included on the attached Table 2.

Sample preservation will be verified at the lab just prior to extraction, digestion, and/or analysis and the pH will be recorded in the extraction/digestion logbook. The pH may be checked upon arrival, if desired. If the samples are improperly preserved, a QA/QC discrepancy form will be submitted to the lab manager and QA coordinator for appropriate follow-up action (i.e., evaluation of the data during the data validation process and, if necessary, additional instruction of personnel regarding proper procedures).

5.2 Field Custody Procedures

- Sample bottles must be obtained pre-cleaned from the laboratory or directly from an approved retail source. All containers will be prepared in a manner consistent with the NYSDEC ASP 1991 bottle-washing procedures. 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.
- All containers will have assigned lot numbers to ensure traceability through the supplier.
- As few persons as possible should handle samples.
- The sample collector is personally responsible for the care and custody of samples collected until the samples are transferred to another person or dispatched properly under chain-of-custody rules.

- The sample collector will record sample data in the field notebook.
- The project manager will determine whether proper custody procedures were followed during the fieldwork and decide if additional samples are required.

5.2.1 Custody Seals

Custody seals are preprinted adhesive-backed seals with security slots designed to break if the seals are disturbed. A custody seal is placed over the cap of individual sample bottles by the sampling technician. Sample shipping containers (coolers, cardboard boxed, etc., as appropriate) are sealed in as many places as necessary to ensure security. Seals must be signed and dated before use. Strapping tape should be placed around the lid to ensure that seals are not accidentally broken during shipment and in a manner that allows easy removal by laboratory personnel. On receipt at the laboratory, the custodian must check (and certify, by completing logbook entries) that seals on boxes and bottles are intact.

5.2.2 Chain-of-Custody Record

The chain-of-custody record must be fully completed in duplicate, using carbon paper where possible, by the field technician who has been designated by the project manager as responsible for sample shipment to the appropriate laboratory for analysis. In addition, if samples are known to require rapid turnaround in the laboratory because of project time constraints or analytical concerns (i.e., extraction time or sample retention period limitations, etc.), the person completing the chain-of-custody record should note these constraints in the "Remarks" section of the custody record.

5.3 Sample Handling, Packaging and Shipping

The 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. Regulations for packaging, marking, labeling, and shipping hazardous materials are promulgated by the United States Department of Transportation (DOT) in the Code of Federal Regulations, 49 CFR 171 through 177.

5.3.1 Sample Packaging

Samples must be packaged carefully to avoid breakage or contamination and must be shipped to the laboratory at proper temperatures. The following sample packaging requirements will be followed:

- Sample bottle lids must never be mixed.
- The sample bottle should never be completely filled except for VOA bottles. At a minimum, a 10% void space should be left in the bottle to allow for expansion. The sample volume level should be marked with a grease pencil or by placing the top of the label at the appropriate sample height.
- Foam inserts should be used as inert packing material when shipping low hazard water

samples via a common carrier to the laboratory.

- Low-hazard environmental samples are to be cooled. “Blue ice” or some other artificial icing material, or ice placed in plastic bags, may be used. Ice will not be used as a substitute for packing material.
- A duplicate custody record must be placed in a plastic bag and taped to the inside of the cooler lid. Custody seals are affixed to the sample cooler.
- The cooler will be labeled as containing a hazardous material if it contains medium or high-hazard samples. Labeling requirements differ depending on the type of material being shipped; the majority of soil samples may be shipped as a class “9” hazardous material with the proper shipping name “OTHER REGULATED SUBSTANCES (ENVIRONMENTAL SAMPLES).”
- A hazardous material shipping manifest will be completed for each cooler of medium to high-hazard samples and affixed to the lid of the cooler.
- Low-hazard environmental samples do not require a hazardous material shipping manifest. The words “LABORATORY SAMPLES” should be printed on the top of the cooler for low-hazard samples.
- Samples packaged and shipped as limited-quantity radioactive material must comply with NYSDOT and shipper regulations for package contamination limits, surface exposure rate, and airbill completion.

5.3.2 Shipping Containers

Environmental samples will be properly packaged and labeled for transport and dispatched for analysis to the appropriate subcontracted laboratory for geotechnical analyses. A separate chain-of-custody record must be prepared for each container. The following requirements for marking and labeling of shipping containers will be observed:

- Use abbreviations only where specified;
- The words “This End Up” or “This Side Up” must be clearly printed on the top of the outer package. Upward-pointing arrows should be placed on the sides of the package. The words “Laboratory Samples” should also be printed on the top of the package; and
- After a container has been closed, two custody seals are placed on the container—one on the front and one on the back. The seals are protected from accidental damage by placing strapping tape over them.
- Field personnel will make timely arrangements for transportation of samples to the laboratory. When custody is relinquished to a shipper, field personnel will telephone the laboratory custodian to inform him of the expected time of arrival of the sample shipment and to advise him of any time constraints on sample analysis.

5.3.3 Shipping Procedures

- The coolers in which the samples are packed must be accompanied by a chain- of-custody record. When transferring samples, the individuals relinquishing and receiving them must sign, date, and note the time on the record. This record documents sample custody transfer.

- Samples must be dispatched to the laboratory for analysis with a separate chain- of-custody record accompanying each shipment. Shipping containers must be sealed with custody seals for shipment to the laboratory. The method of shipment, name of courier, and other pertinent information are entered in the "Remarks" section of the chain-of-custody record.
- All shipments must be accompanied by the chain-of-custody record identifying their contents. The original record accompanies the shipment, and the yellow copy is retained by EGMS' Project Manager.
- If sent by mail, the package is registered with return receipt requested. If sent by common carrier, a bill of lading is used. Freight bills, Postal Service receipts, and bills of lading are retained as part of the permanent documentation.
- Samples must be shipped to the analytical laboratory within 24 to 48-hours from the time of collection.

5.4 Laboratory Custody Procedures

The designated sample custodian at the laboratory will be responsible for maintaining the chain-of-custody for samples received at the lab. Among other things, the custodian must adhere to the following basic requirements:

- When the sample arrives at the lab, the custodian will complete a Cooler Receipt & Preservation Form for each cooler/package container.
- Upon receipt, the coolers are examined for the presence and condition of custody seals, locks, shipping papers, etc. Shipping labels are removed and placed on scrap paper and added to the receiving paper work. The custodian then completes the chain-of-custody record by signing and recording the date and time the package is opened.
- Acceptance criteria for cooler temperature is 0-6^{o}C. If a cooler exhibits a temperature outside this range, the anomalies are noted on the Cooler Receipt & Preservation Form.
- The custodian will then unload the samples from the cooler(s)/container(s), assign an identification number to each sample container, and affix a barcode label to each sample container for logging in and out of the Laboratory Information Management System (LIMS) system.

Adherence to this procedure will ensure that all samples can be referenced in the computer tracking system. All sample control and chain-of-custody procedures applicable to the analytical laboratory are presented in laboratory SOPs available for review.

6.0 Analytical Methods

All laboratory analyses will be performed by Paradigm Environmental Services, Inc., an accredited and appropriately (NYSDEC ELAP CLP) certified analytical laboratory. Inorganic, general analytical and organic methods to be performed by the laboratory for this project are listed in Table 1 of this QAPP.

6.1 Analytical Capabilities

The analytical laboratory is fully equipped for analysis of all types of water, air, and soil samples for chemical contaminants, bacteriological quality, and general characterization. Proven and approved analytical techniques are used, backed up by a rigorous system of QC and QA checks to ensure reliable and defensible data. All laboratory work is performed in accordance with guidelines established by USEPA, the NYSDOH, and the National Institute of Occupational Safety and Health (NIOSH).

Organic analysis is accomplished by gas chromatography (GC), high performance liquid chromatography (HPLC), and or GC/mass spectrometry (MS). Liquid, soil, and air samples are analyzed routinely for pesticides, polychlorinated biphenyls (PCBs), volatile organics, extractable organics, and other groups of compounds, as necessary. The laboratory uses two types of instruments for analysis of metals in various matrices: Atomic Absorption Spectrometry (AAS) and Inductively Coupled Plasma (ICP).

Laboratory procedures to be utilized for sample preparation and analysis are referenced in the NYSDEC ASP.

Method Detection Limits

Method detection limits are determined according to procedures outlined in 40 CFR Part 136, Appendix B or USEPA CLP. General analytical detection limits are usually determined by the lowest point on the curve. Detection limits are determined at least annually for all appropriate analytical methods. A listing of the laboratory's method detection limits is available upon request.

6.2 Quality Control Samples

Laboratory QC consists of analysis of laboratory blanks, duplicates, spikes, standards, and QC check samples as appropriate to the methodology. These laboratory QC samples are described below.

6.2.1 Laboratory Blanks

Three types of laboratory blanks, one or more of which will be utilized depending on the analysis are described below:

- Method blanks consist of analyte-free water and are subjected to every step of the analytical procedure to determine possible contamination.
- Reagent blanks are similar to method blanks but incorporate only one of the preparation reagents in the analysis. When a method blank indicates significant contamination, one or more reagent blanks are analyzed to determine the source.
- Calibration blanks consist of pure reagent matrix and are used to zero an instrument's response, thus establishing the baseline.

6.2.2 Calibration Standards

A calibration standard may be prepared in the laboratory by dissolving a known amount of a pure compound in an appropriate matrix. The final concentration calculated from the known quantities is the true value of the standard. The results obtained from these standards are used to generate a standard curve and thereby quantitative the compound in the environmental sample. A minimum of three (3) calibration standards will be used to generate a standard curve for all analyses.

6.2.3 Reference Standard

A reference standard is prepared in the same manner as a calibration standard but from a different source. Reference standards may be obtained from the USEPA. The final concentration calculated from the known quantities is the "true" value of the standard. The important difference in a reference standard is that it is not carried through the same process used for the environmental samples, but is analyzed without digestion or extraction. A reference standard result is used to validate an existing concentration calibration standard file or calibration curve.

6.2.4 Spike Sample

A sample spike is prepared by adding to an environmental sample (before extraction or digestion) a known amount of pure compound of the same type that is to be assayed for in the environmental sample. Spikes are added at 1 to 10 times the expected sample concentration or approximately 10 times the method detection limit. These spikes simulate the background and interferences found in the actual samples, and the calculated percent recovery of the spike is taken as a measure of the accuracy of the total analytical method.

A blank spike is the same as a spike sample except the spike is added to analyte-free water. The blank spike is used to determine whether the sample preparation and analysis are under control.

6.2.5 Surrogate Standard

A surrogate is prepared by adding a known amount of pure compound to the environmental sample; the compound selected is not one expected to be found in the sample, but is similar in nature to the compound of interest. Surrogate compounds are added to the sample prior to extraction or digestion. Surrogate spike concentrations indicate the percent recovery of the analytes and, therefore, the efficiency of the methodology.

6.2.6 Internal Standard

Internal standards are similar to surrogate standards in chemical composition but are used to

quantify the concentration of analytes sampled based on the relative response factor. Internal standards are added to the environmental sample just prior to instrumental analysis.

6.2.7 Laboratory Duplicate or Matrix Spike Duplicate

Laboratory duplicates are aliquots of the same sample that are split prior to analysis and treated exactly the same throughout the analytical method. Spikes and duplicates for the batch are normally aliquots of the same sample. For organics, spikes are added at approximately 10 times the method detection limit. The relative percent difference (RPD) between the values of the matrix spike and matrix spike duplicate for organics or between the original and the duplicate for inorganics is taken as a measure of the precision of the analytical method. In general, the tolerance limit for RPDs between laboratory duplicates should not exceed 20% for validation in homogeneous samples.

6.2.8 Check Standard/Samples

Inorganic and organic check standards or samples are prepared with reference standards or are available from the USEPA. They are used as a means of evaluating analytical techniques of the analyst. Check standards or samples are subjected to the entire sample procedure, including extraction, digestion, etc., as appropriate for the analytical method utilized. The check standard or sample can provide information on the accuracy of the analytical method independent of various sample matrices.

6.3 Laboratory Instrumentation

Laboratory capabilities will be demonstrated initially for instrument and reagent/ standards performance as well as accuracy and precision of analytical methodology. A discussion of reagent/standard procedures and brief descriptions of calibration procedures for major instrument types follow.

All standards are obtained directly from USEPA or through a reliable commercial supplier with a proven record for quality standards. All commercially supplied standards will be traceable to USEPA or National Institute of Standards and Technology (NIST) reference standards and appropriate documentation will be obtained from the supplier. In cases where documentation is not available, the laboratory will analyze the standard and compare the results to a known USEPA-supplied or previous NIST-traceable standard.

All sections of the laboratory will have SOP for standard and reagent procedures to document specific standard receipt, documentation, and preparation activities. In general, the individual SOPs incorporate the following items:

- Documentation and labeling of date received, lot number, date opened, and expiration date;
- Documentation of traceability;
- Preparation, storage, and labeling of stock and working solutions; and
- Establishing and documenting expiration dates and disposal of unusable standards.

Each laboratory instrument will be labeled clearly with a unique identifier that relates to all laboratory calibration documentation. Laboratory SOPs and calibration procedures are detailed in the laboratory's Quality Assurance Manual, available upon request.

7.0 Data Reporting and Validation

7.1 Deliverables

Once the contract laboratory has provided all analytical data and hydrogeologic information has been evaluated, EGMS will develop a report on the findings of the investigation and remedial measures. The report will be prepared as indicated by the following outline:

1.0 INTRODUCTION
2.0 INVESTIGATION ACTIVITIES
3.0 PHYSICAL SITE CHARACTERISTICS
4.0 NATURE AND EXTENT OF CONTAMINATION
5.0 CONTAMINANT FATE AND TRANSPORT
6.0 SUMMARY AND CONCLUSIONS

The report will carefully document all findings of the investigation and will be supplemented with photographic documentation, subsurface soil logs, cross sections, and study area plans indicating groundwater flow direction and subaerial contaminant distribution.

7.1.1 Category B Data Package

All analytical data will be reported by the laboratory with NYSDEC ASP Category B deliverables. The Category B data package includes:

1. A detailed summary of the report contents and any quality control outliers or corrective actions taken.
2. Chain of Custody documentation
3. Sample Information including: date collected, date extracted, date analyzed, and analytical methods.
4. Data (including raw data) for:
   - samples
   - laboratory duplicates
   - method blanks
   - spikes and spike duplicates
   - surrogate recoveries
   - internal standard recoveries
   - calibrations
   - any other applicable QC data
5. Method detection limits and/or instrument detection limits
6. Run logs, standard preparation logs, and sample preparation logs
7. Percent solids (where applicable).

7.1.2 Quality Assurance Reports

For the laboratory, a general QA report summarizing problems encountered throughout the laboratory effort, including sample custody, analyses, and reporting, is provided to Lu Engineers' project QA management by the QA coordinator. This report identifies areas of concern and possible resolutions in an effort to ensure data quality.

Upon completion of a project sampling effort, analytical and QC data will be included in a comprehensive report that summarizes the work and provides a data evaluation. A discussion of the validity of the results in the context of QA/QC procedures will be made, as well as a summation of all QA/QC activity.

Serious analytical or sampling problems will be reported to NYSDEC. Time and type of corrective action, if needed, will depend on the severity of the problem and relative overall project importance. Corrective actions may include altering procedures in the field, conducting an audit, or modifying laboratory protocol. All corrective actions will be implemented after notification and approval of NYSDEC.

In addition to the laboratory report narrative, QA data validation reports that include any contractual requirements will also be provided to NYSDEC. These QA reports will be submitted with the analytical data, on a monthly basis, or at the conclusion of the project.

7.2 Data Validation and Usability

Prior to the submission of the report to NYSDEC, all data will be evaluated for precision, accuracy, and completeness.

QA/QC requirements from both methodology and company protocols will be strictly adhered to during sampling and analytical work. All data generated will be reviewed by comparing and interpreting results from instrumental responses, retention time, determination of percent recovery of spiked samples or blanks, and reproducibility of duplicate sample results. All calculations and data manipulations are included in the appropriate methodology references. Control charts and calibration curves will be used to review the data and identify outlying results.

7.2.1 Data Validation

If necessary, a third-party validator will be responsible for an independent review of all analytical work performed under the NYSDEC ASP-CLP protocol. The functions will be to assess and summarize the quality and reliability of the data for the purpose of determining its usability and to document for the historical record of each Site any factors affecting data usability, such as discrepancies, poor laboratory practices, and Site locations that are difficult to analyze. The data validator will be responsible for determining completeness and compliance. The Project QAO will be responsible for determining data usability and overseeing the work of the data

validator.

Information available to the data validator and the QAO for performance of these functions include the NYSDEC ASP Category B data package, information from the sampling team regarding field conditions and field QA samples, chain-of-custody and shipping forms. The data package is designed to provide all necessary documentation to verify compliance with NYSDEC ASP CLP protocol and the accuracy and reliability of the reported results.

The laboratory will deliver the data package to the project QA coordinator for processing prior to submission to the data validator. The project QA coordinator will review the report for immediate problems, summarize the data for in-house use, and process the work order for the third-party data-validation subcontract within five working days.

In order to effectively review the data package, the data validator will obtain a general overview of each case. This includes the exact number of samples, their assigned numbers, and their matrix. The data validator will deliver the data validation report within 30 days of receipt of the data package.

If a problem arises between the data validator and the laboratory, the data validator must submit written questions to the laboratory. The laboratory will be required to respond in writing within 10 working days to correct any deficiencies. If the data validator does not receive a written response from the laboratory within the specified time period, the data in question shall be considered noncompliant.

Sampling locations will be obtained from the sampling records, such as the chain-of- custody forms. This information is necessary for preparation of the data summary, evaluation of adherence to sample holding times, discussion of matrix problems, and discussion of contaminants detected in the samples.

The following is a brief outline of the data validation process:

- Compilation of all samples with the dates of sampling, laboratory receipt, and analysis;
- Compilation of all QC samples, such as field blanks, field duplicates, MS/MSD samples, laboratory blanks, and laboratory replicates;
- Review of chain-of-custody documents for completeness and correctness;
- Review of laboratory analytical procedure and instrument performance criteria;
- Qualification of data outside acceptable QC criteria ranges; and
- Preparation of a memorandum summarizing any problems encountered and the potential effects on data usability;
- Preparation of a data summary, including validated results, with sample matrix, location, and identification; and
- Tabulation of field duplicates, laboratory replicate, and blank results.

Copies of all data validation and usability reports, as well as all data summary packages,

will be provided to the NYSDEC project manager. In addition, copies of all analytical raw data will be provided to NYSDEC upon request.

7.2.2 Data Usability

A Data Usability Summary Report (DUSR) will be provided after review and evaluation of the analytical data package. The DUSR will contain required elements listed in Appendix 2B of *Department of Environmental Remediation (DER)-10 Technical Guidance for Site Investigation and Remediation*.

The DUSR will include a description of the samples and analytical procedures used. Any data deficiencies, protocol deviations, or quality control problems will be discussed as to their effect on data results. The report will also include any suggestions for resampling or reanalysis.

Tables

Table 1
Proposed Sampling and Analysis Summary

Analyte	Location	Media	Number	QA/QC	Total
TCL VOCs	Borings	Soil	12	3	15
TCL VOCs	Wells	Groundwater	5	3	8
TCL SVOCs	2 Borings	Soil	2	3	5
TAL Metals	2 Borings	Soil	2	3	5
Pesticides	2 Borings	Soil	2	3	5
PCBs	2 Borings	Soil	2	3	5

Table 2
Sample Preservation and Holding Times

Parameter	Method Number	Container Type and Size	Preservation	Holding Time*
Soil Samples				
VOCs	8260C	2 x 4 oz. wide mouth glass jar with Teflon-lined cap	Cool to 4°C; minimize headspace	14 days
SVOCs	8270C	2 x 4 oz. amber wide mouth glass jar with Teflon-lined cap	Cool to 4°C	12 days to extract; analyze 40 days from extraction
TAL Metals	6010B	2 x 4 oz. glass jar	None required (cool to 4°C preferred)	6 months
PCBs	8082	2 x 4 oz. glass jar	Cool to 4°C	12 days to extract; analyze 40 days from extraction
Pesticides	8081	2 x 4 oz. glass jar	Cool to 4°C	12 days to extract; analyze 40 days from extraction
Groundwater				
VOCs	8260C	3 x 40-ml. glass VOA vial with Teflon-lined cap	Cool to 4°C; minimize headspace; HCl to pH<2	5 days unpreserved / 12 days preserved

* Holding times are based on verified time of sample receipt (VTSR) at the laboratory

Appendix A- Qualifications