Quality Assurance Project Plan

Former Franklen Auto Garage
2586 Coney Island Avenue, Brooklyn, New York
NYSDEC Class P Site No. 224164

Prepared for:

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April 26, 2021

Addendum to Quality Assurance Project Plan

Former Franklen Auto Garage Site No. 224164

Dated April 26, 2021

The following changes have been made to the above referenced document at the request of NYS DEC on July 21, 2021:

1). Page 11 – Table 4.2 – Reporting Limits – Groundwater Analysis – the reporting limits in PFAS should be ng/L

2). Page 14 – Table 4.2 – Reporting Limits – Soil Analysis – the reporting limits for PFAS should be ng/Kg

3). Page 16 – Sampling Procedures –at the end of the first sentence, in parenthesis, the acronym should be SCWP.

4). Page 32 – Sample QA/QC – It states that 'Samples will be collected in the following order:' the emerging contaminant, PFOS, will be collected first, followed by 1,4-dioxane, Volatile Organic Compounds, Semi Volatile Organic Compounds and TAL Metals.

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APPENDICES

1 INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been prepared as a supplement to the Site Characterization Work Plan for investigation of the site known as the former Frankly Auto Garage (the Site) and is a NYSDEC Class P Site No. 224164. Also an Order on Consent has been issued for this project. This document and the Site Characterization Work Plan is being prepared in response to the Order on Consent.

This site specific QAPP describes the measures to be taken in the field and in the laboratory to ensure that samples collected during the investigation are collected, handled, and analyzed in an appropriate manner. This QAPP was developed to assure that all environmental data generated for the New York State Department of Environmental Conservation (NYSDEC), Division of Environmental Remediation are scientifically valid, representative, and of known and acceptable precision and accuracy.

This QAPP builds upon prior work and earlier submissions. Familiarity with the Site and these prior submissions is assumed.

2 PROJECT DESCRIPTION

The subject property consists of one commercial building and a parking lot located at 2586 - 2590 Coney Island Avenue, Brooklyn, New York. The property is described as Block 7184 Lots 25 and 26. It is bounded by Avenue W to the north, Coney Island Avenue to the East, Lancaster Avenue to the south and residential properties to the west.

The site is owned by Eugene Flatteron and is currently leased to Realty Income Corporation. The current characterization activity on the site is accomplished at the behest of Realty Income Corporation. The site formally included a Lumber Yard and Auto Repair Shop. It currently contains one commercial building that is a Walgreens Pharmacy and the associated parking lot.

3 PROJECT ORGANIZATION AND RESPONSIBILITY

This section of the QAPP details the specific roles, activities, and responsibilities of key project participants, as well as the lines of responsibility and communication within and between organizations. Galli Engineering has been contracted by Realty Income Corporation to provide services pertaining to the planning and implementation of remedial measures at the site, as required under the Order on Consent

Galli Engineering's technical program management responsibility resides with Mr. Richard Galli, President and Project Director. The Project Director will assign senior technical personnel to provide their expertise for the required technical activities and will assure consistency in technical approach and product deliverables.

The Galli Engineering project manager, a senior scientist or engineer, will supervise technical activities and will draw from Galli Engineering's staff of qualified specialists, which includes hydrogeologists, engineers, and environmental scientists, to perform the specific project activities associated with this site characterization program. The organizational structure provided below assures that the Galli Engineering team is responsive and that there is a direct line of communication to senior management, the client and the NYSDEC. The project organization chart is presented in Figure 1. The project personnel and their responsibilities are indicated below.

- Project Manager Frank Gehrling, PG, Senior Geologist) – The Project Manager will ensure that the overall project objectives are met and that the Site Characterization Work Plan, Quality Assurance Project Plan, and Health and Safety Plan (HASP) are followed throughout all phases of this project. He will be responsible for the development and implementation of the sampling work plan, as well as the assignment of field sampling personnel and the coordination of all project activities and subcontractors. He will be responsible for the submission of samples to the analytical laboratory, and will be the recipient of analytical and field reports. He is responsible for the compilation of data and technical report preparation. He will convey data to the Quality Assurance Coordinator for review.

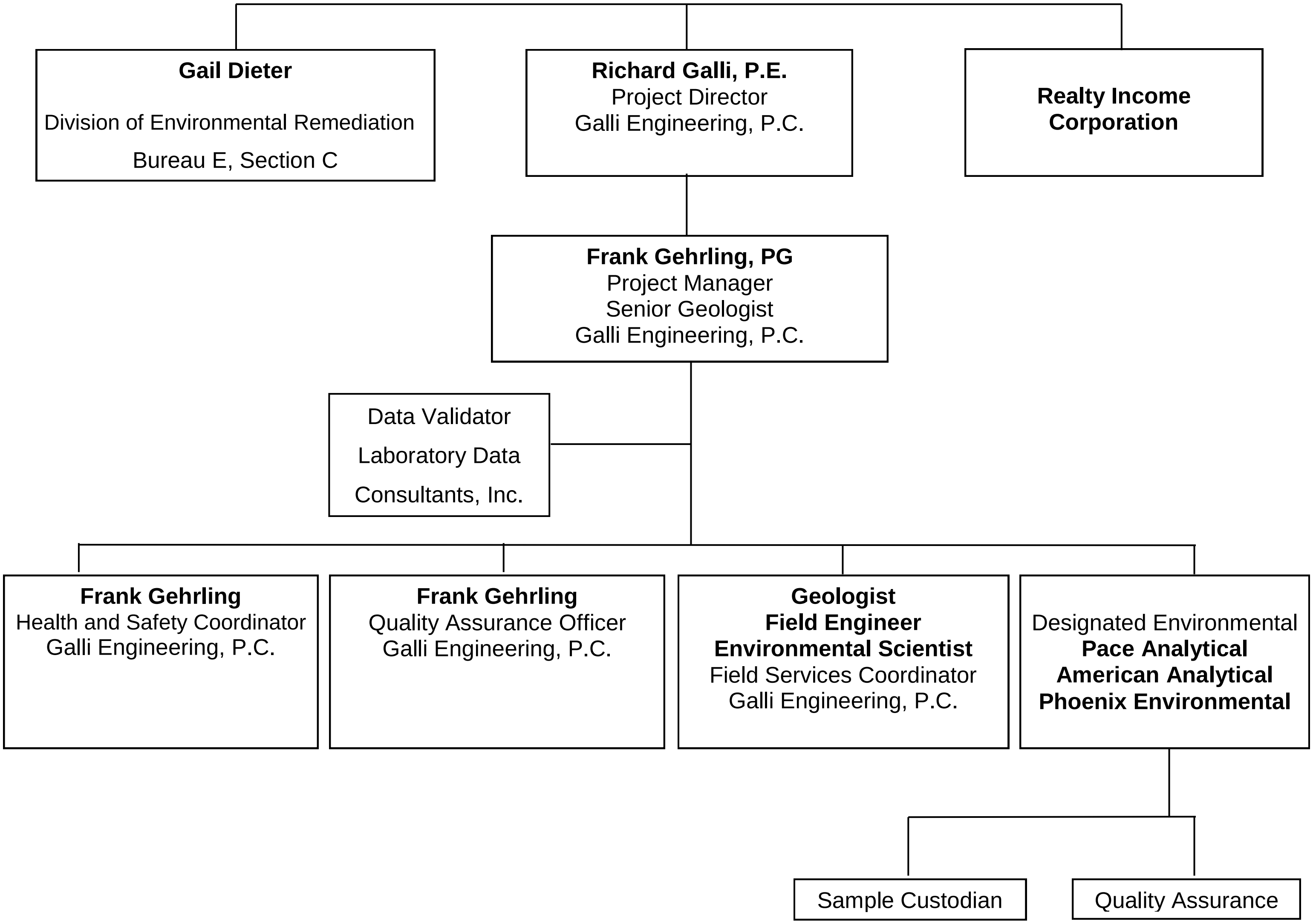
- Quality Assurance Officer (Frank Gehrling, Senior Geologist) – The Quality Assurance Officer (QAO) will be responsible for ensuring that the quality of the data and the reports are suitable for the project objectives. His primary QA responsibilities will be to provide review and guidance on all quality aspects of the project. He will be responsible for having all sample data validated by an independent third-party data validator, who will prepare a Data Usability Summary Report (DUSR). As the QAO, he will have authority to approve or disapprove project work plans, specific analyses and final reports. The QAO will work closely with the laboratory, the project manager and field personnel to ensure that the QAPP is being implemented. The QAO will report to the Project Manager.

- Health and Safety Coordinator (Frank Gehrling, Senior Geologist) – The Health and Safety Coordinator (HSC) will be responsible for implementation of the Site Health and Safety Plan (HASP) that conforms to applicable health and safety requirements to ensure that health and safety is not compromised during on-site environmental activities. The HASP provides site task specific health and safety requirements that are to be followed during fieldwork to ensure that workers are properly protected while meeting the objectives of the QAPP.

- Field Services Coordinator – The Field Service Coordinator (FSC) will be responsible for sample collection and monitoring activities at the site. The FSC will ensure that sample collection is performed according to methods detailed in Section 5 of this report, entitled Sampling Procedures, and will ensure that the requirements and objectives of the QAPP for the collection are met.

- Laboratory Sample Custodian – The laboratory sample custodian will be responsible for receiving, logging and storing samples as they are submitted to the analytical laboratory from Galli Engineering. The sample custodian will ensure the completeness of the chain of custody form, which contains specific information such as sample collection data, analytical parameters, and analysis priority. The sample custodian will also ensure that holding times are within requirements and that sample custody is maintained.

Figure 1 - Project Organization Chart



4 MEASUREMENT PERFORMANCE CRITERIA

4.1 Data Quality Objectives

The overall objective of the sampling and analysis activities addressed herein is to achieve an acceptable level of confidence in the analytical data generated in order to evaluate the quality of soil and groundwater at the subject property. These data will be used to confirm the level of contamination on-site pursuant to the Order on Consent; to characterize the soil for possible removal from the site; to determine the origin of the known groundwater impacts; determine if soil vapor has impacted the commercial building and risk to residential properties to the west, and to confirm that program-required cleanup objectives have been met. The methods and the procedures used to implement and achieve the data quality objectives (DQOs) are described throughout this QAPP.

Data Quality Objectives are qualitative and quantitative statements that specify the purpose, quality, and/or quantity of the environmental data required to support management and remedial decisions at the site. DQOs are predicated in accordance with the anticipated end uses of the data that is to be collected. Data collected typically will be used to meet the following DQOs:

- Determine if there is an immediate threat to public health or the environment.
- Locate and identify potential sources of contamination.
- Characterize the extent of impact from contamination.
- Determine if there is a long-term risk from exposure to the site.
- Determine potential remediation and long-term stewardship strategies (if necessary).

Data quality indicators (DQI) are qualitative and quantitative descriptors used to interpret the degree of acceptability or usability of data. The five principal DQIs are (1) precision, (2) accuracy, (3) representativeness, (4) comparability, and (5) completeness. Representativeness and comparability are qualitative parameters incorporated into the design and rationale of the sampling plan. Representativeness is achieved by selecting sampling locations that typify the survey areas. Comparability of data is accomplished by using only New York State Department of Environmental Conservation (NYSDEC) or United States Environmental Protection Agency (U.S. EPA) approved sampling and analytical methods. The three quantitative measurements, precision, accuracy, and completeness, are defined below.

When analyzing environmental samples, all measurements will be made so that results are reflective of the medium and conditions being measured. The level of detail and data quality needed will vary with the intended use of the data. DQOs typically are assessed by evaluating the precision, accuracy, representativeness, completeness, and comparability of all aspects of the data collection process, defined as follows:

4.1.1 Data Precision

Precision is a measure of agreement among replicate measurements of the same property under similar conditions. Precision is achieved by using consistent sampling procedures and measurement techniques established for a parameter or an analyte ("prescribed similar conditions"). Precision is assessed through calculation of relative percent difference (RPD) or relative standard deviation (RSD). Precision is calculated for laboratory duplicates, field duplicate samples, and matrix spike/matrix spike duplicates (MS/MSD). Field duplicate samples will be collected at a frequency of one per every 20 samples collected.

Laboratory duplicate samples, separate from field duplicate samples, will be analyzed to gauge analytical precision. The designated laboratory will analyze duplicate samples for each matrix under investigation at the frequency specified in Section 10 of this QAPP. Representative samples will be selected and analyzed in duplicate, and two portions of a representative sample will be spiked with matrix compounds and analyzed in duplicate. The results of these two analyses will be compared to assess the precision of the analytical system. Table 4.1 lists acceptance criteria for accuracy, precision, and completeness for each of the analytical methods specified. The criteria (predetermined acceptance limits) are expressed as numerical values.

4.1.2 Accuracy

Accuracy is the measure of the propinquity of an individual measurement or average number of measurements to the true value (known concentration). Accuracy includes a combination of random error (precision) and systematic error (bias) components that are due to sampling and analytical operations. Accuracy is expressed as the percent difference between a measurement and an accepted or true value.

4.1.3 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount expected under ideal conditions. Completeness (percent) is calculated by dividing the number of valid measurements by the number of planned measurements and multiplying by one hundred. Valid measurements include unqualified and estimated results that are usable for data interpretation. Estimated results cannot be verified as precise and accurate, but may be usable as long as associated limitations are considered by the data users and project DQOs can be met. Rejected results or results not reported due to sample loss or error negatively impact completeness. Completeness goals for groundwater samples are more stringent due to the small number of groundwater samples scheduled for collection.

Completeness will be evaluated by carefully comparing project objectives with the proposed data acquisition scheme and the resulting potential data gaps in the required information. The goal for completeness for this project is greater than 95 percent.

4.1.4 Representativeness

Representativeness is the degree to which sampling data accurately and precisely depicts selected characteristics such as parameter variations at a sampling point or an environmental condition.

4.1.5 Comparability

Comparability is the degree of confidence with which one data set can be compared to another. To assess if environmental measurements are of an appropriate quality, the general requirements above will be examined and compared to agency-recommended parameters when available. Calculation of precision and accuracy should be specified in the site-specific work plan and/or SSQA. Samples should be collected in a manner so they are representative of both the chemical composition and physical state of the sample at the time of sampling. To ensure comparability, all data will be reported as ^{o} Celsius (flash point), pH units, µg/l or mg/l for water and liquids, µg/kg or mg/kg for soil, sediment or other solids, and mg/m^3 for air. Comparability is further addressed by using appropriate field and laboratory methods that are consistent with current standards of practice as approved by EPA.

Table 4.1 Reporting Limits and Analytical Data Quality Objectives for Groundwater Analysis

Analysis	Reference Method	Units	Target Reporting Limits	Precision Objectives		Accuracy Objectives		Completeness (%)
				Field Duplicate Analysis (RPD)	MS/MSD Duplicate Analysis (RPD)	Matrix Spike Analyses (%Recovery)	Laboratory Control Sample Analyses (%Recovery)	
Cyanide	(SW846) 9010C	ug/l	10	< 50	< 20	80-120	80-120	95
Hexavalent Chromium	(SW846) 7196A	ug/l	10	< 50	< 20	85-120	85-120	95
Aluminum	(SW-846) 6010C	ug/l	200	< 50	< 20	80-120	80-120	95
Antimony	(SW-846) 6010C	ug/l	60	< 50	< 20	85-120	85-120	95
Arsenic	(SW-846) 6010C	ug/l	10	< 50	< 20	85-120	85-120	95
Barium	(SW-846) 6010C	ug/l	200	< 50	< 20	80-120	80-120	95
Beryllium	(SW-846) 6010C	ug/l	5	< 50	< 20	85-120	85-120	95
Cadmium	(SW-846) 6010C	ug/l	5	< 50	< 20	85-120	85-120	95
Calcium	(SW-846) 6010C	ug/l	5000	< 50	< 20	80-120	80-120	95
Chromium	(SW-846) 6010C	ug/l	10	< 50	< 20	85-120	85-120	95
Cobalt	(SW-846) 6010C	ug/l	50	< 50	< 20	80-120	80-120	95
Copper	(SW-846) 6010C	ug/l	25	< 50	< 20	85-120	85-120	95

Analysis	Reference Method	Units	Target Reporting Limits	Precision Objectives		Accuracy Objectives		Completeness (%)
				Field Duplicate Analysis (RPD)	MS/MSD Duplicate Analysis (RPD)	Matrix Spike Analyses (%Recovery)	Laboratory Control Sample Analyses (%Recovery)	
Iron	(SW-846) 6010C	ug/l	100	< 50	< 20	80-120	80-120	95
Lead	(SW-846) 6010C	ug/l	10	< 50	< 20	85-120	85-120	95
Magnesium	(SW-846) 6010C	ug/l	5000	< 50	< 20	80-120	80-120	95
Manganese	(SW-846) 6010C	ug/l	15	< 50	< 20	80-120	80-120	95
Mercury	(SW-846) 6010C	ug/l	0.2	< 50	< 20	85-120	85-120	95
Nickel	(SW-846) 6010C	ug/l	40	< 50	< 20	85-120	85-120	95
Potassium	(SW-846) 6010C	ug/l	5000	< 50	< 20	80-120	80-120	95
Selenium	(SW-846) 6010C	ug/l	35	< 50	< 20	85-120	85-120	95
Silver	(SW-846) 6010C	ug/l	10	< 50	< 20	85-120	85-120	95
Sodium	(SW-846) 6010C	ug/l	5000	< 50	< 20	80-120	80-120	95
Thallium	(SW-846) 6010C	ug/l	25	< 50	< 20	85-120	85-120	95
Vanadium	(SW-846) 6010C	ug/l	50	< 50	< 20	80-120	80-120	95
Zinc	(SW-846) 6010C		60	< 50	< 20	85-120	85-120	95
TCL VOC	(SW-846) 8260C	ug/l		< 50	< 20	85-120	85-120	95

Analysis	Reference Method	Units	Target Reporting Limits	Precision Objectives		Accuracy Objectives		Completeness (%)
				Field Duplicate Analysis (RPD)	MS/MSD Duplicate Analysis (RPD)	Matrix Spike Analyses (%Recovery)	Laboratory Control Sample Analyses (%Recovery)	
TCL SVOC	(SW-846) 8270D	ug/l		< 50	< 20	85-120	85-120	95
PCBs	(SW-846) 8082A	ug/l		< 50	< 20	85-120	85-120	95
Pesticides	(SW-846) 8081B	ug/l		< 50	< 20	85-120	85-120	95
PFAS	EPA Method 537.1	ug/l		< 30%	< 30%	70% - 130%	50% - 150%	

ug/l – microgram per liter

MS/MSD – matrix spike, matrix spike duplicate

RPD – Relative Percent Difference

SW – Solid Waste

Table 4.2 Reporting Limits and Analytical Data Quality Objectives for Soil Analysis

Analysis	Reference Method	Units	Target Reporting Limits	Precision Objectives		Accuracy Objectives		Completeness (%)
				Field Duplicate Analysis (RPD)	MS/MSD Duplicate Analysis (RPD)	Matrix Spike Analyses (%Recovery)	Laboratory Control Sample Analyses (%Recovery)	
Cyanide	(SW846) 9010C	ug/Kg	10	< 50	< 20	80-120	80-120	95
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Aluminum	(SW-846) 6010C	ug/Kg	200	< 50	< 20	80-120	80-120	95
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Cadmium	(SW-846) 6010C	ug/Kg	5	< 50	< 20	85-120	85-120	95
Calcium	(SW-846) 6010C	ug/Kg	5000	< 50	< 20	80-120	80-120	95
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Analysis	Reference Method	Units	Target Reporting Limits	Precision Objectives		Accuracy Objectives		Completeness (%)
				Field Duplicate Analysis (RPD)	MS/MSD Duplicate Analysis (RPD)	Matrix Spike Analyses (%Recovery)	Laboratory Control Sample Analyses (%Recovery)	
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Analysis	Reference Method	Units	Target Reporting Limits	Precision Objectives		Accuracy Objectives		Completeness (%)
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PCBs	(SW-846) 8082A	ug/Kg		< 50	< 20	85-120	85-120	95
Pesticides	(SW-846) 8081B	ug/Kg		< 50	< 20	85-120	85-120	95
PFAS	EPA Method 537.1	ng/l		< 30%	< 30%	70% - 130%	50% - 150%	

ug/Kg – microgram per kilogram

ng/Kg – nanogram per kilogram

MS/MSD – matrix spike, matrix spike duplicate

RPD – Relative Percent Difference

SW – Sold Waste

TABLE 4.3 DUPLICATE FREQUENCIES

ACTIVITY	FREQUENCY	BENEFIT
Field Duplicate	one in 20	Data shows precision of analytical scheme from sampling through analysis when compared with results of sample. This represents a blind QC sample to the laboratory. Collect an additional amount of sample.
Laboratory Duplicate	one in 20	Data shows precision of the analytical scheme within the laboratory. The difference between this precision and that of the field duplicate represents the precision of the analytical method.
Laboratory Spike	one in 20	Data shows how well the analysis of interest can be performed, and recovered from the sample matrix. Such information is useful when reported value is near an action level, but the sample exhibits poor recovery.
Matrix Spike Matrix Duplicate (inorganic)	one in 20	Data shows precision of laboratory analysis when compared with results of sample. Collect an additional amount of sample for each analysis. Analyzed as unspiked sample.
Matrix Spike (inorganic)	one in 20	Data shows matrix effects from recovery of spiked analysis. Collect an additional amount for each analysis. Analyzed as a spike sample.
Matrix Spike/Matrix Spike Duplicate	one in 20	Data shows precision of analysis when compared with matrix spike duplicate and matrix effects from recovery of spiked analysis. Collect an additional amount for each analysis. Analyzed as a spike.
Field Blank	one per day	Data demonstrates that sample was not contaminated with volatile organics by outside site influences that would be present during filling of sample jars for VOC analysis.
Equipment Blank	As required by the DQOs	Data demonstrates that sampling equipment was clean prior to use. Pass a sample of reagent water through collection device. Submit for analysis of analytes of concern.
Trip Blank	One per sample cooler	Data demonstrates that sample was not contaminated with volatile organics by other samples in shipping container, laboratory or outside influences.
Background or Reference Sample	As required by the DQOs	Data provides baseline information to evaluate environmental impact.
Split Samples/Inter-laboratory Split Sample	When required to meet DQOs	Compare the quality of laboratory procedures of the permittee with State contracted laboratory procedures. Collect an additional amount of sample for each analysis.

NOTE: This table is provided to serve as a guide only; AQA/AQC sample requirements should be developed on a site-specific basis. Laboratory blanks and surrogate spikes are method specific and are not included in this table (see NYSDEC ASP).

5 SAMPLING PROCEDURES

In order to achieve the Data Quality Objectives, soil and groundwater samples will be collected from areas of concern described in the Site Characterization Work Plan (RIWP).

The following sections describe the sampling procedures for the collection of soil and groundwater samples at the subject site, as well as the quality control requirements.

5.1 Soil Samples

5.1.1 Soil Sample Collection

Soil sampling will be via a Geoprobe Macro-Core sampler utilizing single use, clear acetate liners. A new liner will be utilized each time the sampler is placed in the Geoprobe. The liner will be removed from the sampling tool and split by the driller. The soil in the split tube will be quickly screened with the PID to detect volatile organic compounds. Soil samples will be taken from the split tube either by gloved hand, stainless steel trowel or utilizing single use scoops. Samples will be of two types: grab and composite. A grab sample for Volatile Organic Compounds will be taken from the soil that generates the highest PID reading from the split sample tubes for that sample zone. A grab sample of the area along the split acetate liner with the elevated PID reading will be sampled and placed in a new 2-oz laboratory glass jar. The rest of the split tube sample soil will be placed in a new 1-gallon plastic freezer bag. This will be repeated with new sample tubes and sampling until the push probe reaches the planned depth or through the designated sampling zone. The VOC sample with the highest PID reading or other indicator of possible contamination will be submitted to the laboratory for analysis. The material in the new plastic bag will be mixed in the bag and placed in laboratory supplied glassware for all other laboratory analysis. The VOC sample sent to the laboratory will be from the grab sample previously retained and not from the composite sample in order to minimize the loss of volatiles due to handling.

A minimum of two samples will be collected for lab analysis from each boring, including one at 0-2’ below grade and one form above the top of groundwater. If contamination is observed by high PID readings, one additional sample will be collected from that interval. The planned depth is approximately 20 feet.

The above sampling method for VOCs in soil is meant to minimize the disturbance of the sample; and thereby maximize the amount of VOC retained in the sample. As stated previously, if contamination is noted, the grab sample with the highest PID reading would be analyzed for VOC. This sampling method would bias the sampling for VOC in soil toward the sample with the highest VOC reading. The PID readings collected will be recorded, but will not be compared to any external standard.

5.1.2 Soil Sampling Handling and Analysis

Each soil sample collected for laboratory analysis will be placed in new 40 ml with septum capped vials and 8 oz glass jars for laboratory analysis. These sample jars will be placed in a cooler on ice, with proper chain of custody, and transported or shipped to a NYS DOH ELAP approved laboratory. These samples will be analyzed for:

Volatile Organic Compounds Method 8260B
Semi-Volatile Organic Compounds Method 8270D
TAL Metals Method 6010B/7471B
Hexavalent Chromium Method 3060A/7196A
Total Cyanide Method 9014
PCBs Method 8082A ,
Pesticides Method 8081A,
Diesel Range Organics Method 8015D,

A few soil samples will be further analyzed for full hazardous waste characteristics and for emerging contaminants. New borings, for the additional monitoring wells, SB-12, SB-13 and SB-14. In addition, soil samples from SB-10 will be analyzed for full hazardous waste characteristics and for emerging contaminants.

Full TCLP Method SW1311,
Hazardous Waste Characteristics (Reactivity, Ignitability, and Corrosivity)
PFAS EPA Method 537.1
1,4-Dioxane EPA Method 8270 (soil)

Galli Engineering field sampling personnel will wear clean nitrile gloves during all sample collection procedures and equipment decontamination. To prevent cross contamination, gloves will be changed if they become soiled and when starting at a new sample location. The contaminants present at this site will likely pose no significant risk due to the low level of contaminants; therefore, only modified Level D personnel protection is required.

5.2 GROUNDWATER SAMPLES

5.2.1 Prior To Sampling

One set of groundwater samples will be collected from all existing and new monitoring wells. The monitoring well locations are identified on the Addition Sample Locations , which is figure 12 in the Site Characterization Work Plan and is provided in Appendix A of the QAPP. All samples will be collected using methods consistent with Test Methods For Evaluating Solid Waste; SW-846, U.S. Environmental Protection Agency (EPA) Office of Solids Waste and Emergency Response, Washington, D.C. 3rd Edition 1986; and the U.S. EPA RCRA Ground Water Monitoring Technical Enforcement Guidance Document, Washington, D.C., 1986.

Galli Engineering field sampling personnel will wear clean nitrile gloves during all sample collection procedures and equipment decontamination. Gloves will be changed if they become soiled, and when starting at a new sample location, to prevent cross contamination. The groundwater contaminants present at this site will likely pose no significant risk due to the low level of contaminants; therefore, modified Level D personnel protection is required. Monitoring wells will be purged and sampled using low-flow procedures in accordance with the EPA Region 1 Low-Stress (Low-Flow) SOP (EQASOP-GW4 Revision 4 dated September 19, 2017, and is included as Appendix B of the QAPP. Purging will be done at a minimal flow rate until field parameters stabilize. One round of groundwater sampling will be conducted at the site to assess groundwater contamination.

The monitoring well casings will be surveyed with reference to the nearest U.S. Geological Survey benchmark. The vertical and horizontal location of each well will be established to within 0.01 feet and 1-foot, respectively. This will be performed shortly after monitoring well installation.

Water levels will be measured in the three new monitoring wells prior to sampling using a commercial electronic water level meter. The measurements are made by lowering a sensor slowly to the surface of water in the well. When the audible alarm sounds, the depth is recorded to the nearest 0.01 foot. This information will be used for well volume calculations and for determination of groundwater flow direction.

As an alternative to pumping, if it becomes necessary due to circumstances, purging may be done by bailing, although this is not preferable. In this case, once water level measurements have been recorded, the total volume of water in the well will be calculated (i.e., for a 2 inch well the volume is 0.16 gallons per foot of well casing which would be multiplied by the depth of water present in the well). This volume will be multiplied by the purging factor to determine the extraction volume. Galli Engineering's standard purging factor is three casing volumes; the exception to this standard is in the case of low yield wells. When purging low yield wells, the well is pumped to dryness once, and samples will be collected once sufficient sample volume is available. When full sample volumes cannot be collected due to time constraints or recharge rates, any samples will be collected within 24 hours of the end of the purge.

5.2.2 Groundwater Sample Collection

Groundwater samples will be collected a minimum of one week after the development of each monitoring well is completed. Monitoring wells will be purged and sampled using low-flow procedures in accordance with the EPA Region 1 Low-Stress (Low-Flow) SOP (EQASOP-GW4 Revision 4 dated September 19, 2017), included here as Appendix B. Purging will be done at a minimal flow rate until field parameters stabilize. One round of groundwater sampling will be conducted at the site to assess groundwater contamination.

- Groundwater samples will be collected in order; first from monitoring wells considered least impacted, followed by those considered most impacted. The order of sample collection will be PFAS, VOC, SVOC, metals, PCBs, pesticides/herbicides.

- Measurements of total organic vapor concentrations, using a Photoionization Detector (PID), will be performed by removing the well cap slightly and placing the instrument probe beneath the cap. After the reading has been obtained, the well cap will be completely removed and the well will be allowed to ventilate for a period of three to five minutes. After the well has been ventilated, a measurement in the breathing zone will be made.

- Depth to water will be measured from the chisel or other mark at the top of the PVC well casing to the top of the water surface to the nearest 0.01 ft. prior to sampling. Depth to the bottom of the well will be obtained from the well construction diagrams.

- Ground surface and top of casing elevations will be surveyed by a NYS Licensed Surveyor to within 0.01 ft. so that groundwater elevations can be calculated. The survey shall provide x,y,z coordinate data for each monitoring well. Elevation data shall be referenced to the NAVD 88 datum.

- The low-flow pump intake will be positioned in the middle or slightly above the middle of the saturated screen interval in order to minimize stress to the system as measured by minimal drawdown (<0.1m) during purging. Flow rates on the order of 0.1 to 0.5 liters/min are typically used to achieve minimal drawdown.

- Stabilization is achieved when there is no drawdown and three successive readings taken every three to five minutes are within ± 0.1 units for pH; ± 3% for conductivity; ± 10 mv for ORP; and ± 10% for turbidity, DO, and temperature. Or, as otherwise stated in EQASOP-GW4 Region I Low-Stress (Low Flow) SOP Rev 4.

- The same device will be used for sampling as was used for purging at the same stabilized flow rate.

- The procedures for collection of groundwater samples using low-flow sampling methods are presented in Appendix B – Sampling Procedures.

- The elevation of groundwater in feet will be calculated and recorded with the reference elevation of the top of the PVC well casing and depth to water measurement.

- The purge water generated during sampling activities will be collected in DOT-approved 55-gallon drums for characterization and disposal at the conclusion of the field investigation program.

The volume of purged water will be measured by discharging the pumped water to a volumetric container or measuring the time it takes to pump one container full and determining the time necessary to purge five well volumes. The pump rate will be checked periodically, because it may decrease if the height of the water column changes. At no time during the purging will the pumping rate be high enough to cause the groundwater to cascade back into the well. This can cause excessive aeration.

In-situ field measurements for pH, specific conductivity, turbidity and temperature will be performed on ground-water samples from each monitoring well being sampled. These measurements will be taken at initiation of the well purge, throughout the purge, and at the end of the purge prior to the collection of samples for laboratory analysis. The parameters will be stabilized before measurements are recorded. The measurements for pH, specific conductivity, turbidity and temperature will be performed using a Horiba U-50 Water Quality Checker multi-parameter instrument or equivalent. All the reference parameters are automatically measured at once and the accuracy of the measurements for each parameter is provided in the following table.

TABLE 5.1

ACCURACY OF PH, SPECIFIC CONDUCTIVITY, TURBIDITY AND TEMPERATURE

Parameter	Range Of Measurement	Accuracy
pH	0-14 pH	0.1 pH
Conductivity	0-1 mS/cm 1-10 mS/cm 10-100 mS/cm	0.01 mS/cm 0.1 mS/cm 1.0 mS/cm
Turbidity	0-800 NTU	10 NTU
Temperature	0-50 ºC	1.0 ºC

The Horiba U-50 Water Quality Checker multi-parameter instrument will be manually calibrated prior to the initial measurement of groundwater for the day, and will be automatically calibrated thereafter (instrument has auto-calibration procedure). The pH, specific conductivity, turbidity and temperature measurements will be recorded on the field data sheet designated for each monitoring well.

Since historical analytical data is available from previous soil borings performed at the Site, it has been determined that the purge water will require proper disposal. All purge water will be placed in 55-gallon drums and will be properly disposed in accordance with regulations based upon analytical results.

If for any reason, it becomes necessary to collect groundwater samples with the use of a bailer, Galli Engineering will use a dedicated single-use, bottom filling, environmental grade polypropylene bailer to obtain groundwater samples from each well. No field decontamination of bailers will be necessary. The bailers will be equipped with a new nylon line. A clean plastic surround will be used to cover the area around the well during sample collection. This plastic surround will prevent the nylon line from coming in contact with the ground, and will be disposed of after each use. Prior to sample collection, an aliquot of groundwater for in-situ measurements will be taken.

5.2.3 Groundwater Sample Handling and Analysis

The three newly installed monitoring wells and MW-2 (for a total of 4 monitoring wells) will be analyzed for the full list of TOGS GA. Samples collected from each of the remaining existing monitoring wells will be analyzed for VOCs. This is appropriate as the known contaminants of concern in groundwater are: MTBE, PCE and TCE.

Samples for dissolved metals analysis will not be filtered in the field consistent with guidelines presented in DER-10 at Subdivision 2.1(g). Filtering of water samples will be accomplished in the lab. The samples for filtered total metals will utilize lab supplied, unpreserved bottles.

5.3 Soil Vapor Sampling

Soil vapor point construction and sampling will be conducted in accordance with “Guidance for Evaluating Soil Vapor Intrusion in the State of New York, NYSDOH, October 2006.

5.3.1 Soil Vapor Point Construction

Six soil vapor probes will be installed during the Site Characterization at locations indicated on the Proposed Sampling Location Plan, Figure 12 (Appendix A). A direct-push Geoprobe rig or similar means will be used to create +/- 1.5-inch hole to a depth of 3 to 4 feet below grade and a stainless steel Geoprobe screen implant (5/16-inch diameter, +/- 8-inch length) will be threaded to laboratory- or food-grade Teflon® tubing (0.313-inch diameter) and lowered to the bottom of the hole. The Geoprobe rods will then be removed from the hole and a sand filter pack installed around the screen implant by pouring clean sand into the annulus. The remainder of the borehole will then be filled to grade with clean sand and Bentonite slurry, which will form an air-tight seal.

An interior air sample will also be collected in the basement of the Walgreens store, where sub-slab vapor sampling is performed.

Each set of outdoor and sub-slab soil vapor probes will be constructed in same manner at each sampling location to minimize possible discrepancies. The following procedures will be included in any permanent construction protocol:

a) implants will be installed using an appropriate method based on site conditions (e.g., direct push, manually driven, auger – if necessary to attain the desired depth or if sidewall smearing is a concern, etc.);

b) porous, inert backfill material (e.g., glass beads, washed #1 crushed stone, etc.) shall be used to create a sampling zone 1 to 2 feet in length;

c) implants will be fitted with inert tubing (e.g., polyethylene, stainless steel, nylon, Teflon, etc.) of the appropriate size (typically 1/8 to 1/4 inch diameter) and of laboratory or food grade quality to the surface;

d) soil vapor probes shall be sealed above the sampling zone with a Bentonite slurry for a minimum distance of three feet to prevent outdoor air infiltration and the remainder of the borehole backfilled with clean material;

e) steps shall be taken to minimize infiltration of water or outdoor air and to prevent accidental damage (e.g., setting a protective casing around the top of the probe tubing and grouting in place to the top of the Bentonite, sloping the ground surface to direct water away from the borehole like a groundwater monitoring well, etc.).

To obtain representative samples and to minimize possible discrepancies, soil vapor samples shall be collected in the following manor at all locations:

a) at least 24 hours after the installation of permanent probes and shortly after the installation of temporary probes, one to three implant volumes (i.e., the volume of the sample probe and tube) should be purged prior to collecting the samples;
b) flow rates for both purging and collecting should not exceed 0.02 liters per minute to minimize outdoor air infiltration during sampling;
c) samples will be collected, using conventional sampling methods, in an appropriate container – one which;

    i) meets the objectives of the sampling (e.g., investigation of areas where low or high concentrations of volatile chemicals are expected; to minimize losses of volatile chemicals that are susceptible to photodegradation),
    ii) is consistent with the sampling and analytical methods (e.g., low flow rate; Summa® Canisters if analyzing by EPA Method TO-15), and
    iii) is certified clean by the laboratory;

d) sample size depends upon the volume of that will achieve minimum reporting limits; and
e) a tracer gas (e.g., helium) should be used when collecting soil vapor samples to verify that adequate sampling techniques are being implemented (i.e., to verify infiltration of outdoor air is not occurring)

In some cases, weather conditions may present certain limitations on soil vapor sampling. For example, condensation in the sampling tubing may be encountered during winter sampling due to low outdoor air temperatures. Devices, such as tube warmers, may be used to address these conditions. Anticipated limitations to the sampling should be discussed prior to the sampling event so appropriate measures can be taken to address these difficulties and produce representative and reliable data.

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

a) if sampling near a commercial or industrial building, uses of volatile chemicals during normal operations of the facility should be identified;
b) outdoor plot sketches should be drawn that include the site, area streets, neighboring commercial or industrial facilities (with estimated distance to the Site), outdoor air sampling locations (if applicable), and compass orientation (north);
c) weather conditions (e.g., precipitation and outdoor temperature) shall be noted for the past 24 to 48 hours; and
d) any pertinent observations shall be recorded, such as odors and readings from the field instrumentation.

Additional information that could be gathered to assist in the interpretation of the results includes barometric pressure, wind speed and wind direction.

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

a) sample identification’
b) date and time of sample collection,
c) sampling depth,
d) identity of samplers,
e) sampling methods and devices,

f) purge volumes,
g) volume of soil vapor extracted,
h) if canisters are used, the vacuum before and after samples were collected,
i) apparent moisture content (dry moist , saturated, etc.) of the sampling zone, and
j) chain of custody protocols and records used to track samples from sampling point to analysis.

5.3.2 Sub-Slab Soil Vapor Sampling

During colder months, heating systems should be operating to maintain normal indoor air temperatures (i.e., 65-75º F) for at least 24 hours prior to and during the scheduled sampling time. Prior to installation of sub-slab vapor probes, the building floor should be installed at locations where the potential for ambient air infiltration via floor penetrations is minimal.

Sub-slab vapor probe installations may be permanent, semi-permanent or temporary. A vacuum should not be used to remove drilling debris from the sampling port. Sub-slab implants or probes shall be constructed in the same manor at all sampling locations to minimize possible discrepancies. The following procedures should be included in any construction protocol:

a) permanent recessed probes shall be constructed with brass or stainless steel tubing and fittings;
b) temporary probes will be constructed with inert tubing (e.g., polyethylene, stainless steel, nylon, Teflon®, Etc
c) tubing should not extend further than 2 inches into the sub-slab material;
d) porous, inert backfill material (e.g., glass beads, washed #1 crushed stone, etc.) should be added to cover about 1 inch of the probe tip for permanent installations; and
e) the implant will be sealed to the surface with non-VOC-containing and non-shrinking products for temporary installations (e.g., permagum grout, melted beeswax, putty, etc.) or cement for permanent installations.

To obtain representative samples that meet the data quality objectives, sub-slab vapor samples shall be collected in the following manner:

a) after the installation of the probes, one to three implant volumes (i.e., the volume of the sample probe and tube) will be purged prior to collecting the samples;
b) flow rates for both purging and collecting shall not exceed 0.02 liters per minute to

minimize outdoor air infiltration during sampling;

c) samples will be collected, using conventional sampling methods, in an appropriate container – one which;
    i) meets the objectives of the sampling (e.g., investigation of areas where low or high concentrations of volatile chemicals are expected; to minimize losses of volatile chemicals that are susceptible to photodegradation),
    ii) is consistent with the sampling and analytical methods (e.g., low flow rate; Summa® Canisters if analyzing by EPA Method TO-15), and
    iii) is certified clean by the laboratory;
d) sample size will depend upon the volume of that will achieve minimum reporting limits, the flow rate and the sampling duration; and
e) ideally, samples should be collected over the same time as concurrent indoor and outdoor air samples.

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

a) historic and current storage and uses of volatile chemicals should be identified, especially if sampling within a commercial or industrial building (i.e., use of volatile chemicals in commercial processes and/or during building maintenance);
b) the use of heating or air-conditioning systems during sampling should be noted;
c) floor plan sketches should be drawn that include the floor layout with sampling locations, chemical storage areas, garages, doorways, stairways, location of basement sumps or subsurface drains and utility perforations through building foundations, HVAC system air supply and return registers, compass orientation (north), footings that create separate foundation sections, and any other pertinent information should be completed;
d) outdoor plot sketches will be drawn that include the building site, area streets, outdoor air sampling locations (if applicable), compass orientation (north) and paved areas;
e) weather conditions (e.g., precipitation and indoor outdoor temperature) and ventilation conditions (e.g., heating system active and windows closed) should be reported; and
f) any pertinent observations, such as spills, floor stains, smoke tube results, odors and readings from field instrumentation (e.g., vapors via PID) shall be recorded.

Additional documentation that could be gathered to assist in the interpretation of the results includes information about air flow patterns and pressure relationships obtained by using smoke tubes or other devices (especially between floor levels and between suspected contaminant sources and other areas), the barometric pressure and photographs to accompany floor plan sketches.

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

a) sample identification’
b) date and time of sample collection,
c) sampling depth,
d) identity of samplers,
e) sampling methods and devices,
f) soil vapor purge volumes,
g) volume of soil vapor extracted,
h) if canisters are used, the vacuum before and after samples were collected,
i) apparent moisture content (dry moist , saturated, etc.) of the sampling zone, and
j) chain of custody protocols and records used to track samples from sampling point to analysis.

5.3.3 Indoor Air Sampling

During colder months, heating systems (when operational) will be operating to maintain normal indoor air temperatures (i.e., 65-75º F) for at least 24 hours prior to and during the scheduled sampling time. Prior to collecting indoor samples, a pre-sampling inspection will be performed to evaluate the physical layout and conditions of the building being investigated, to identify conditions that may interfere with the proposed sampling.

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

a) sampling duration will reflect the exposure scenario being evaluated without compromising the detection limit or sample collection flow rate (e.g., an 8-hour sample from a workplace with a single shift verses a 24 hour sample from a workplace with multiple shifts). To insure that the sample collected is representative of the locations sampled, and to avoid undue influence from sampling personnel, samples should be collected for at least one hour. If the goal of the sampling is to represent average concentrations over longer periods then longer duration sampling periods may be appropriate.

b) personnel will avoid lingering in the immediate area of the sampling device while samples are being collected;

c) sample flow rates will conform to the specifications in the sample collection method and, if possible shall be consistent with the flow rates for concurrent outdoor air and sub-slab samples; and

d) samples will be collected, using conventional sampling methods, in an appropriate container – one which

    i) meets the objectives of the sampling (e.g., investigation of areas where low or high concentrations of volatile chemicals are expected; to minimize losses of volatile chemicals that are susceptible to photodegradation),
    ii) is consistent with the sampling and analytical methods (e.g., low flow rate; Summa® Canisters if analyzing by EPA Method TO-15), and
    iii) is certified clean by the laboratory.

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

a) historic and current storage and uses of volatile chemicals will be identified, especially if sampling within a commercial or industrial building (i.e., use of volatile chemicals in commercial processes and/or during building maintenance);

b) the use of heating or air-conditioning systems during sampling shall be noted;

c) floor plan sketches shall be drawn that include the floor layout with sampling locations, chemical storage areas, garages, doorways, stairways, location of basement sumps or subsurface drains and utility perforations through building foundations, HVAC system air supply and return registers, compass orientation (north), footings that create separate foundation sections, and any other pertinent information should be completed;

d) outdoor plot sketches shall be drawn that include the building site, area streets, outdoor air sampling locations (if applicable), compass orientation (north) and paved areas;

e) weather conditions (e.g., precipitation and indoor outdoor temperature) and ventilation conditions (e.g., heating system active and windows closed) shall be reported; and

f) any pertinent observations, such as spills, floor stains, smoke tube results, odors and readings from field instrumentation (e.g., vapors via PID) shall be recorded.

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

a) sample identification’
b) date and time of sample collection,
c) sampling depth,
d) identity of samplers,
e) sampling methods and devices,
f) soil vapor purge volumes,
g) volume of soil vapor extracted,
h) if canisters are used, the vacuum before and after samples were collected,
i) apparent moisture content (dry moist , saturated, etc.) of the sampling zone, and
j) chain of custody protocols and records used to track samples from sampling point to analysis.

Each Summa® canister utilized for soil gas and indoor air sampling will be labeled, placed in containers for shipment, and picked up by a courier or shipped to Phoenix Environmental Laboratories, Inc. under proper chain-of-custody protocol for analysis. All vapor samples will be analyzed for VOCs by USEPA method TO-15, in accordance with the October 2006, NYSDOH Guidance document.

5.4 Sampling QA/QC

Sample containers to be used for soil and groundwater sample collection are specified by the analytical methodology. Galli Engineering will use new sample containers that are pre-cleaned to U.S. EPA protocols, which are supplied by the laboratory. Chemical preservatives, where necessary, will be added by the laboratory prior to shipping sample containers. After a sample is collected, Galli Engineering’s field personnel will take the necessary steps to preserve the chemical and physical integrity of the sample during shipment and storage prior to analysis. All samples will be capped immediately after sample collection and labeled. Table 5.2 lists the sample parameters, containers, preservation, holding times and the analytical methods.

TABLE 5.2

SAMPLING CONTAINERS, PRESERVATION AND HOLDING TIMES

PARAMETER	MATRIX	CONTAINER	PRESERVATION	HOLDING TIMES
TCL Volatiles	Aqueous	40 ml. VOA vial w/TFE lined septum cap	HCl to pH<2.0 4°C (2)	10 days
TCL Volatiles	Soils	40 ml. VOA vial w/TFE lined septum cap	4°C (2)	7 Days
TCL Semi-Volatiles	Aqueous	Amber glass w/TFE lined cap (1 liter)	4°C	5 days until extraction 40 days from extraction until analysis (1)
TCL Semi-Volatiles	Soils	Glass wide-mouth w/TFE lined septum cap/4 oz.	4°C	5 days until extraction 40 days from extraction until analysis (1)
Pest/PCBs	Aqueous	Amber glass w/TFE lined cap (1 liter)	None	5 days until extraction 40 days from extraction until analysis (1)
Pest/PCBs	Soils	Glass wide-mouth w/TFE lines septum cap/4 oz.	None	5 days until extraction 40 days from extraction until analysis (1)
TAL Metals (total)	Aqueous	Polyethylene 1 qt.	HNO_3 to pH<2.0 (2)	Hg 26 days All other metals 6 months
TAL Metals	Soil	Polyethylene 1 qt. (250 ml for soil borings)	4°C	Hg 28 days All other metals 6 months
Chromium, Hexavalent	Aqueous	Polyethylene (100 ml)	4°C	24 hours
Chromium, Hexavalent	Soil	Glass (125 ml)	4°C	5 days
Total Phenols	Aqueous	Amber glass w/TFE lined cap (1 liter)	4°C	5 days until extraction; 40 days form extraction until analysis
pH	Aqueous	None	None	Performed on-site
Conductivity	Aqueous	None	None	Performed on-site
Dissolved	Aqueous	None	None	Performed on-site

Oxygen				
Conductance	Aqueous	None	None	Performed on-site
Cyanide	Soil	1 liter wide-mouth polyethylene	4°C	
Cyanide	Aqueous	1 liter polyethylene	NaOH to pH>12.0 4°C	12 Days
TCLP Volatiles	Soil	Glass wide-mouth w/TFE line septum cap/4 oz.	4°C	7 days until TCLP extraction; 7 days from TCLP extraction until analysis
TCLP Semi-volatiles	Soil	Glass wide-mouth w/TFE line septum Cap/8 oz.	4°C	14 days until TCLP extraction; for Complete analysis, 7 days until extraction, 40 days from extraction until analysis.
TCLP Pesticides/PCBs	Soil	Glass wide-mouth w/TFE line septum cap/8 oz.	4°C	14 days until TCLP extraction; For complete analysis, 7 days until extraction and 40 days from extraction until analysis.
TCLP Metals	Soil	Glass wide-mouth w/TFE line septum cap/8 oz.	4°C	6 months until TCLP extraction (Hg: 5 days) 6 months from extraction to analysis (Hg: 28 days)
Ignitability	Soil	Glass wide-mouth w/TFE line septum cap/4 oz.	4°C	N/A
Corrosivity	Soil	Glass wide-mouth w/TFE line septum cap/4 oz.	4°C	14 days
TPH by GC	Aqueous	Amber glass w/TFE lined cap (1 Liter)	4°C	14 days until extraction; 40 days from extraction to analysis
TPH by GC	Soil	Glass wide-mouth w/TFE lined cap/8 oz.	4°C	14 days until extraction; 40 days from extraction to analysis
PFAS	Soil	250 ml HDPE bottle	4°C	14 days until extraction; 28 days to analysis
PFAS	Groundwater	2 x 250ml HDPE bottles	4°C	14 days until extraction; 28 days to analysis

TCL = Target Compound List

TCLP = Toxic Characteristics Leachate Procedure

TAL = Target Analyte List

(1) Technical Times (time from sample collection until sample analysis) will be used to audit results.

For solid samples being analyzed for any of the parameters listed in Table 3, the holding times are generally equal to or longer than the associated aqueous holding times. Given the Contract schedule for deliverables, it's recommended that the Contractor simply use the aqueous holding times as guidance for the timely analysis of samples. For exact holding time requirements, the laboratory should consult the applicable method documentation for the required holding times for matrices other than water. If the method documentation is unclear, the Contractor should consult with the NYSDEC Project Manager.

Preservation for all solid samples for all analyses is limited to cooling to 4°C. Chemical preservation is only required for the low level analysis of volatile organics in soil using EPA Method 5035 (sodium bisulfate or methanol).

Samples will be collected in the following order:

1. Volatile Organic Compounds
2. Semi-Volatile Organic Compounds
3. TAL Metals (Total and Dissolved)

Each set of groundwater samples will be packed in coolers inside separate, sturdy plastic bags to prevent cross contamination of samples. Ice, packed in separate plastic bags, will also be placed in the cooler. The samples will be packaged and cushioned to prevent breakage. The samples will either be shipped via overnight express delivery or will be hand delivered to the analytical laboratory.

6 DOCUMENTATION AND CHAIN OF CUSTODY

6.1 Field Documentation

Galli Engineering field sampling personnel will collect and accurately record relevant sample collection information on a field sampling data sheet, which is legibly prepared and maintained for each sample location. The information documented on the field sampling data sheet includes the name of the person(s) performing the sample collection, the date, project information, site location information, time of collection, analytes to be tested, and other specific information as may be necessary. For groundwater samples, additional information will include monitoring well location and condition, well depth measurements, casing and screen interval information, top of casing elevation, depth to water in the well, volume of purged water for each sample location, etc. The pH, specific conductivity, turbidity and temperature with the time the measurement collection will also be recorded on the field sampling data sheets. The field sampling data sheets provide a record of tasks associated with sampling collection activities.

Galli Engineering field sampling personnel will prepare a label in indelible ink for each of the samples collected that includes the following information:

- Project Name
- Date And Time Of Sample Collection
- Sample Location
- Sample Number
- Sample Parameters And Matrix
- Name Of Sample Collector

A completed label will be affixed to each sample container.

Documentation procedures should be conducted in accordance with EPA's record keeping requirements. Work plans and final reports will be generated and submitted to DEC for review and approval.

Field QA/QC documentation for site characterization reports and/or remedial action/risk management reports must consider the following details:

- Calibration and maintenance records for field instrumentation,

- Documentation of sample collection procedures,
- Reporting of any variances made in the field to sampling plans, SOPs or other applicable guidance documents,
- Reporting of all field analysis results,
- Documentation of sample custody (provide copies of chain-of-custody documents),
- Documentation of sample preservation, handling and transportation procedures,
- Documentation of field decontamination procedures (and if applicable, collection and analysis of equipment rinsate blanks),
- Collection and analysis of all required duplicate, replicate, background and trip blank samples, and
- Documentation of disposal of investigation-derived wastes.

6.2 Sample Custody

Proper Chain-of-Custody procedures will be implemented. Once a sample is collected, containerized, and labeled, Galli Engineering personnel will enter the appropriate information on the Chain-of-Custody form. This custody record will provide the necessary information to cross reference the sample number to the specific sampling location and will provide the date and time of collection as well as documentation of custody. The chain of custody document includes the following information:

- Project Name And Address
- Galli Engineering Project Manager
- Signature And Printed Name Of Sampler
- Date And Time Of Sample Collection
- Sample Type And Matrix
- Sample Number And Location
- Number Of Sample Containers Per Location
- Identification Of The Parameters For Which Sample Is To Be Analyzed
- Signature And Printed Name Of Relinquisher Of Samples
- Signature And Printed Name Of Receiver Of Samples
- Sample Turn Around Time
- QA/QC Type
- Any Comments And Special Instructions

A copy of a typical chain of custody document is provided in Appendix C.

All samples will be accompanied by a Chain of Custody form, which will be signed and dated with the time also referenced by Galli Engineering field sampling personnel. The Galli Engineering field sampling personnel will maintain custody of the samples until shipment or hand delivery to the analytical laboratory. Containers will be kept in a secure cooler, within visual contact of field sampling personnel, or in a locked vehicle or room. Only Galli Engineering field sampling personnel will have access to the samples. Chain of Custody documentation will accompany the samples to the analytical laboratory. If the samples are to be shipped, each sample container cooler will be affixed with a signed custody seal. The field chain of custody terminates upon laboratory receipt of the samples.

6.3 Laboratory Documentation

Once the samples reach the laboratory, the lab's sample custodian will accept custody of the samples and verify that the information on the sample labels matches that on the chain of custody form(s). The sample custodian will also check for any breakage or leakage that may have occurred during shipment or transport to the laboratory. The sample custodian will then enter the appropriate data into the laboratory tracking system during which a unique laboratory number will be assigned to each sample. The samples are then transferred to the appropriate analyst or the samples will be stored in a designated secure area.

Laboratory QA/QC documentation for site characterization reports and/or remedial action/risk management reports must consider the following details:

- If the published analytical method used specifies QA/QC requirements within the method, those requirements must be met and the QA/QC data reported with the sample results;
- At a minimum, QA/QC samples must consist of the following items (where applicable): method/instrument blank, extraction/digestion blank, initial calibration information, initial calibration verification, continuing calibration verification, laboratory fortified blanks/laboratory control samples, duplicate, and matrix spikes/matrix spike duplicates;
- Documentation of appropriate instrument performance data such as internal standard

and surrogate recovery.

- The laboratory will provide NYSDEC ASP Category B deliverables in EQuIS compatible format.

7 CALIBRATION ROCDURES AND FREQUENCY

Calibration is the process of establishing the relationship of a measurement system output to a known stimulus or quantity. Generally, calibration procedures are required for both field and laboratory instrumentation. In essence, calibration is a reproducible reference point to which all sample measurements can be correlated. This section describes the calibration procedures and the calibration frequency.

7.1 Field Instruments

The only field instrument to be used for groundwater sample collection at this site will be the Horiba U-10 Water Quality Checker multi-parameter instrument (or similar) for the measurement of pH, specific conductivity, turbidity and temperature. The Horiba U-10 will be manually calibrated according to manufacturer's instructions prior to the measurement of groundwater, and after data measurements are completed. Physical parameters (pH, temperature, conductivity, and turbidity) will be recorded. Calibration for pH, specific conductivity, and turbidity is done using commercially available laboratory grade standard solutions. The probe is rinsed with deionized water, and is then placed into a beaker containing the applicable standard solutions. The thermometric function does not require calibration.

The Photo Ionization Detector is set up as follows:

Rae MiniRae 2000 P.I.D.
Operating Temp: 32 to 100°F or 0 to 43°C

Start-up/zeroing/Calibration

- Attach probe tip and hydrophobic filter by screwing it to the unit.
- Press the MODE button to turn the unit on and let it warm up for 5-10 minutes in clean ambient air.
- The unit will display its settings during the warm up sequence. NOTE: *If calibrating, now is a good time to fill a tedlar bag with isobutylene.*
- When the unit has finished its warm up it will display a ppm reading.
- To enter the calibration mode, simultaneously press the MODE and N/- buttons until the screen displays “Calibrate/ select Gas?”
- Press Y/+
- Ensure that the unit is drawing clean ambient air or from a zero air source.

- “Fresh air cal?” is displayed. Press Y/+.
- The unit will display “zero in progress” followed by “wait” and a 15 second countdown.
- When the unit is finished zeroing it will display “Zeroed! Reading 0.0 ppm.”
- Press Mode once.
- The unit is normally set for 100 ppm Isobutylene. If your cal. Gas is 100 ppm isobutylene, skip the next five steps. If your gas is not 100 ppm, conduct the following:

Changing the span value

- From the “Span cal” screen, press the N/- button twice or until the screen reads
- “Change span value.” Press Y/+.
- The screen will read “Cal gas = isobutylene, Span value = 0100. “Press the Mode button to move to cursor, and the Y/+ and N/- buttons to increase/decrease the span value to match your cylinder.
- When finished changing the value, press and hold the MODE button.
- The screen will read “Save?” Press the Y/+ button to save. The screen will read “Saved.”
- Press the MODE button until “Span cal” is displayed.
- “Span cal? is displayed.
- Press Y/+. The screen will read “Cal gas = Isobutylene, Span value = 0100.0, Apply gas now!”
- Open and connect a full tedlar bag of isobutylene to the probe tip. If the pump sounds like its restricted, the bag is not enough. The unit will recognize the gas and start to span. The screen will read “Wait.” while it counts down from 30 seconds. Some newer units will display, “Update data” after the countdown.
- When the countdown is finished the screen will read “cal’ed reading = 100 ppm” It should read within a few ppm of the span value.
- Press MODE once. The screen will read “cal done turn off gas.” Remove and close the tedlar bag.
- Press the MODE button twice to return to the run mode. The unit should read 0.0 ppm without gas and 100ppm with gas.
- The P.I.D. is calibrated and now ready for use.

7.2 Laboratory Instruments

Laboratory instruments will be subject to all the QA/QC procedures stated in the lab's qualifications and certifications packages. Before samples are analyzed on an instrument, chemical or physical calibration standards will be analyzed to establish that the instrument is functioning properly with the desired sensitivity. Calibration solutions will be documented with the preparer’s initials, date of preparation, concentration of solution, and standard materials used to prepare the solution. All standard materials used in the preparation of calibration solutions conform to the U.S. EPA, National Bureau of Standards (NBS).

8 SAMPLE PREPARATION AND ANALYTICAL PROCEDURES

Groundwater samples will be collected at the subject property according to the procedures described in Section 5.0. All samples will be submitted to a laboratory NYSDOH ELAP certified for the parameters of interest and able to provide a Category B data package per the July 2005 NYSDEC ASP. These samples will then be analyzed to determine the presence of

1. Volatile Organic Compounds - analyzed by EPA Method 8260C, method detection limit 1 ug/L
2. Semi-Volatile Organic Compounds - analyzed by EPA Method 8270D, method detection limit 1 ug/L.
3. Target Analyte List Metals – Aluminum, Antimony, Arsenic, Barium, Berylium, Cadmium, Calcium, Chromium (total), Cobalt, Copper, Iron, Lead, Mercury, Magnesium, Manganese, Mercury, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, and Zinc - analyzed by EPA Methods as outlined in Tables 4.1 and 4.2.
4. Pesticides – analyzed by EPA Method 8081A
5. PCB – analyzed by EPA Method 8082A
6. Hexavalent Chromium Method 3060A/7196A
7. Total Cyanide Method 9014

New monitoring wells will also be analyzed for:

1,4- Dionxane EPA Method 8270 SIM
PFAS EPA Method 537.1 modified

The soil and groundwater samples collected by Galli Engineering will be prepared and analyzed by the laboratory according to the matrix specific methods listed above from the following references.

1. Test Methods for Evaluating Solid Waste; SW-846. USEPA Office of Solids Waste and Emergency Response, Washington, D.C. 3rd Edition, 1986.
2. Standard Methods for the Analysis of Water and Wastewater, American Public Health Association, Washington, D.C. 16th Edition, 1985
3. EPA Water and Wastewater 600/4-79-020

The laboratory does not anticipate the need to modify standard procedures for referenced methods. The laboratory may use more stringent criteria based on statistical evaluation or laboratory practice. In such instances the laboratory-specific criteria will be used for data validation purposes as long as the criteria are more stringent than the targets set for this project. The reporting limits have been previously listed in Table 4.1.

9 DATA REDUCTION, VALIDATION, AND REPORTING

Data management, including chain-of-custody review and correction, data review, reduction and transfer to data management systems, quality control charts, quality control procedures, and sample receipt, storage and disposal, will be in accordance with applicable SOPs and accepted industry practices.

Documentation will be in accordance with applicable SOPs and accepted industry practices, and will include the sampling reports, copy of the chain-of-custody, and field QA controls with the analytical results. All sample documents will be legibly written in ink. Any corrections or revisions to sample documentation shall be made by lining through the original entry and initialing and dating any changes. Data reduction will occur in accordance with contractor analytical SOPs for each parameter. If difficulties are encountered during sample collection or sample analysis, a description of the problem will be provided in the sampling report prepared by contractor. Data reporting will be in accordance with applicable SOPs and will include, at a minimum:

- Sample documentation (location, date and time of collection and analysis, etc.)
- Chain-of-custody forms
- Initial and continuing calibration
- Determination and documentation of detection limits
- Analyte(s) identification
- Analyte(s) quantitation
- Quality Control sample results
- Duplicate results

Adequate precautions will be taken during the reduction, manipulation, and storage of data in order to prevent the introduction of errors or the loss or misinterpretation of data.

To ensure that measurement data generated when performing environmental sampling activities are of an appropriate quality, all data will be validated. Data validation is a systematic procedure for reviewing a body of data against a set of established criteria to provide a specified level of assurance of its validity prior to its intended use. The techniques used must be applied to the body of the data in a systematic and uniform manner. The process of data validation must be close to the origin of the data, independent of the data production, and objective in its approach. The review will evaluate the data in terms of adherence to sampling and analysis protocols and to quality control criteria outlined in this QAPP. The criteria for data validation include checks for internal consistency, duplicate sample analysis, spike addition recoveries, instrument calibration and transcription errors. The acceptance or rejection of data, depending on the adherence to the quality control criteria, will be in a uniform and consistent manner based on established validation criteria and as provided in this QAPP.

All data, as applicable, will be validated in accordance with EPA guidance, per Data Quality Objectives Process. Any deviations will be documented and provided with the analytical data report. When the individual who will prepare the Data Usability Summary Report (DUSR) is identified, that person’s resume will be provided to DER for review and approval. The DUSR will also contain copies of result forms with any changes made to the results by the data validator. The DUSR will be prepared in accordance with DER-10, Appendix 2B. When a Data Validator is selected, his or her resume will be provided to DEC.

The raw data will be reported in concentrations to two significant figures. Premature rounding of intermediate results can significantly affect the final result. Therefore, the reported results will be rounded to the correct number of significant figures only after all calculations and manipulations are completed. As many significant figures as are warranted by the analytical method will be used in reporting calculations. Only data meeting the validation criteria will be reported. Percent recovery and relative percent difference values will also be reported using two significant figures. Compounds that are not detected will be reported as less than the analytical method detection limit.

The final analytical data reports will be submitted to the Galli Engineering Project Manager and Quality Assurance Coordinator for their review and acceptance of the data in terms of completeness with respect to technical requirements of the project. All data will be assessed for accuracy, precision, completeness, representativeness and comparability. This data will then be presented in a technical report prepared by Galli Engineering, P.C. Upon receipt of validated analytical results, NYSDEC format electronic deliverables (EDDs) that are compatible with EqUIS will be prepared and submitted to NYSDEC.

10 INTERNAL QUALITY CONTROL CHECKS

The work plan for this site contains quality control requirements as they apply to each sampling task. Matrix spikes and duplicates will be analyzed per matrix in a sample group. For the purposes of this investigation the following quality control measures will be utilized by the laboratory:

Measure	Parameter	Frequency
Matrix Spike/Matrix Spike Duplicate	Organics	As necessary
Matrix Spike/Replicate	Inorganics	As necessary
Reagent Blank Sample	Organics & Inorganics	As necessary
Surrogate Spike Sample	Organics	As necessary
Calibration	Organics & Inorganics	As necessary
Field Blanks	Organics & Inorganics	1 per sampling
Trip Blanks	Organics & Inorganics	1 per cooler
Equipment Blanks	Organics & Inorganics	As necessary
	Organics & Inorganics	

11 PERFORMANCE AND SYSTEM AUDITS

Galli Engineering will document inspections and audits to confirm the quality or orderly progression of a portion of the work by outlining the procedures, acceptability of methods or personnel, qualifications, or other verifications of quality. Performance audits (performance samples) and system audits (site inspections) of the fixed laboratories are performed by the New York State Department of Health as part of the laboratory certification process. No audits for laboratories are scheduled as part of this project. Galli Engineering will perform audits of field sampling and analysis operations periodically throughout the project to document the implementation of the QA program. Galli Engineering will perform audits of the laboratory and field operations at the discretion of the NYSDEC and if deemed necessary as part of a corrective action for a problem encountered with sampling and analytical data.

12 PREVENTIVE MAINTENANCE

Preventive maintenance activities are performed in order to prevent loss of data due to malfunctions or delay. Critical functions are identified for field and laboratory and contingencies are accordingly established.

In order to minimize downtime of field sampling and monitoring equipment, all equipment will be cleaned and visually inspected before and after each day of use. Where applicable, all equipment will be charged when not in use and calibrated each day.

The subcontracted analytical laboratory employs a qualified technician for analytical instrument maintenance. An inventory of spare parts is maintained to minimize instrument downtime. Laboratory balances are under service contracts to the manufacturers.

12.1 Field Activities

The critical functions in the field require that extra sampling containers be on hand in the field, ready for use. Field screening kits and reagents may also be maintained as appropriate. Alternative sources (such as an instrument rental agency) for field screening or health and safety related monitoring devices may be identified prior to going into the field. This contingency will prevent loss of data or delays.

12.2 Laboratory Activities

The laboratory QA/QC plan will outline a formal preventive maintenance program including contingencies for sending samples to an alternate NYS certified laboratory if samples requiring analysis within the regulatory holding times are going to be compromised. Major and critical equipment should be on a service contract or under a laboratory program staffed by equipment technicians capable of emergency service. Back-up instrumentation should be available for larger projects. Routine maintenance for equipment will be performed.

13 DATA ASSESSMENT PROCEDURES

The procedures used to assess the precision, accuracy, and completeness of the data generated will begin with a review of the field notes and documents that correspond to the laboratory data report being reviewed. Any unusual or questionable observations will be noted and compare to the corresponding data. The following will be considered for all data:

1. Shipping information.
2. Adherence to holding times.
3. Calibration documentation.
4. Comparison of field assigned sample numbers and laboratory assigned sample numbers.
5. Comparison of values assigned to QA/QC samples (field and trip blanks, duplicates, method blanks and laboratory spiked samples) and environmental samples.
6. Review of chromatograms/spectra for values and tentatively identified compounds.
7. Units of measure reported.
8. Laboratory calculations.
9. Laboratory determined method detection limits.
10. Sample documentation.

Any errors, mistakes or deviations from the analysis requested identified by the data assessment will be presented in a validation report developed by the QA/QC Officer. Based on the validation report, Galli Engineering, P.C., the data users, will determine whether the data is usable for their purposes.

14 CORRECTIVE ACTIONS

Once the final report is submitted, the DEC Project Manager will review the field duplicates to determine if they appear to indicate a problem with meeting quality objectives. If problems are indicated, the Project Manager will contact the contractor to discuss and attempt to reconcile the issue. Completeness will also be evaluated to determine if the completeness goal for this project has been met. If data quality indicators do not meet the project's requirements as outlined in this QAPP, the data may be discarded and re-sampling may occur. The Project Manager will determine the cause of the failure (if possible) and make the decision to discard the data and re-sample. If the failure is tied to the analyses, calibration and maintenance techniques will be reassessed as identified by the appropriate lab personnel. If the failure is associated with the sample collection and re-sampling is needed, the sampling methods and procedures will be reassessed as identified by the field audit process.

Corrective action will be undertaken by all parties to address specific problems as they arise. Corrective actions required will be identified through the use of control charts for chemical analyses, precision and accuracy data, through performance auditing, and through systems audits.

In the event corrective actions are required to rectify an out of control laboratory or field measurement system the following steps will be taken by the QA/QC Officer:

1. Identification and definition of the problem;
2. Assignment of responsibility for investigating the problem;
3. Investigation and determination of the cause of the problem;
4. Determination of a corrective action to eliminate the problem;
5. Assigning and accepting responsibility for implementing the corrective action;
6. Implementing the corrective action and evaluating its effectiveness; and
7. Verifying that the corrective action has eliminated the problem.

QUALITY ASSURANCE REPORTS TO MANAGEMENT

The QA/QC Officer will report the status of the QA/QC program to the program management on a monthly basis. Each monthly report will include the following components:

- Periodic assessment of measurement data accuracy, precision, and completeness
- Results of audits
- Significant QA/QC problems and recommended solutions
- Resolutions of previously stated problems

The reports to management will be prepared using information from periodic reports from the field and laboratory to the quality assurance management organization. Field reports will describe the status of the project, daily field progress reports, compiled field data sets, and corrective action documentation at appropriate intervals. Laboratory analytical reports will include a summary of all quality assurance activities and quality control data for the project as related to the sample analysis. The project manager will be notified immediately of any laboratory quality assurance situations requiring immediate corrective action.

The project management organization and the regulatory agency will be notified of all situations that indicate an imminent health risk. Written notification with supporting data will be forwarded within three business days.

APPENDICES

APPENDIX A

Site Plan with Sampling Locations

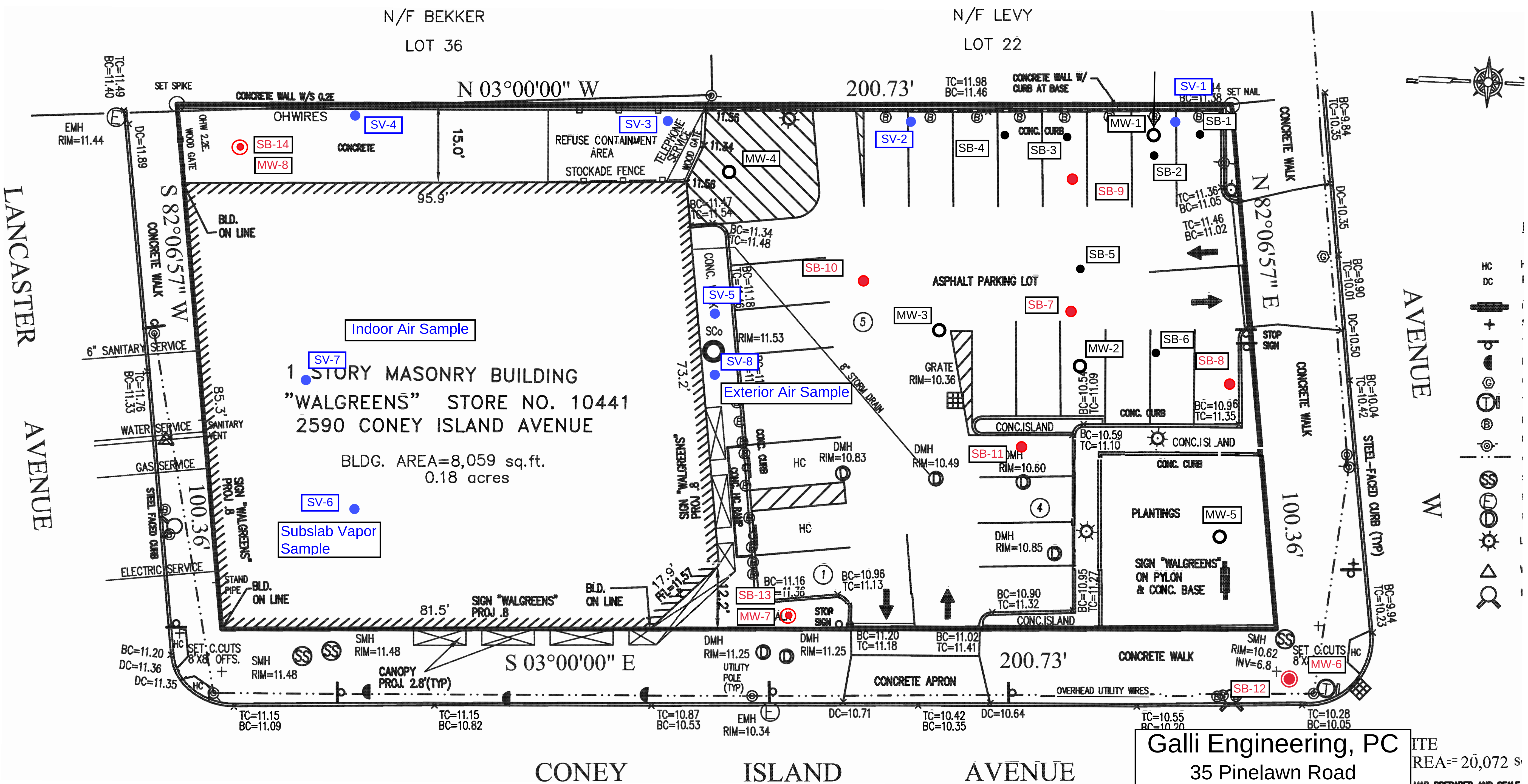
Debtor: 2586-2608 Coney Island Avenue LLC
Filing Date: 7/9/2007
Covers: Fixtures, etc.

Assignment filed on 4/28/2008 under CRFN 2008000168951 to Lasalle Bank National Association, as Trustee for the Holders of Morgan Stanley Capital I Inc., Commercial Mortgag
Certificates, Series 2007-IQ16.

Name of Surveyor Joseph M. Petito, LS

License No. 050335
Dated: September 23, 2009

Additional Sample Locations
figure 12



● Exiting Soil Borings and Monitoring Wells

🟥 New Soil Borings and Monitoring Wells

🔵 New Soil Vapor Sampling Points

OTES:

. THE SUBJECT PARCEL IS DESIGNATED ON THE BROOKLYN/KINGS COUNTY TAX MAP AS BLOCK 7184, LOT 26.
. VERTICAL DATUM SHOWN HEREON REFER TO BROOKLYN, KINGS COUNTY ELEVATIONS, WHICH IS 2.55 FEET ABOVE N.G.V.P. 1929.
. ZONED C 8-1 OP RE: ZONING MAP NO. 28 C
. FLOOD ZONE DESIGNATION "X" AS PER FEDERAL FLOOD INSURANCE RATE MAP.
MAP NO. 3604970354F DATED: REV: SEPT. 5, 2007
SEE PANEL NO. 354 OF 457

ALTA

Galli Engineering, PC
35 Pinelawn Road
Suite 209E
Melville, NY 11747

2590 Coney Island Avenue
Additional Sample Locations
2021-04-26

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MAP PREPARED AND SEALE
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APPENDIX B

Low Flow Groundwater Sampling Procedures

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION I

LOW STRESS (low flow) PURGING AND SAMPLING PROCEDURE FOR THE COLLECTION OF GROUNDWATER SAMPLES FROM MONITORING WELLS

Quality Assurance Unit
U.S. Environmental Protection Agency – Region 1
11 Technology Drive
North Chelmsford, MA 01863

The controlled version of this document is the electronic version viewed on-line only. If this is a printed copy of the document, it is an uncontrolled version and may or may not be the version currently in use.

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Prepared by:__________________________________ ____________
(Robert Reinhart, Quality Assurance Unit) Date

Approved by:__________________________________ ____________
(John Smaldone, Quality Assurance Unit) Date

Revision Page

Date	Rev #	Summary of changes	Sections
7/30/96	1	Finalized	
01/19/10	2	Updated	All sections
3/23/17	3	Updated	All sections
9/20/17	4	Updated	Section 7.0

Table of Contents

1.0 USE OF TERMS

Equipment blank: The equipment blank shall include the pump and the pump's tubing. If tubing is dedicated to the well, the equipment blank needs only to include the pump in subsequent sampling rounds. If the pump and tubing are dedicated to the well, the equipment blank is collected prior to its placement in the well. If the pump and tubing will be used to sample multiple wells, the equipment blank is normally collected after sampling from contaminated wells and not after background wells.

Field duplicates: Field duplicates are collected to determine precision of the sampling procedure. For this procedure, collect duplicate for each analyte group in consecutive order (VOC original, VOC duplicate, SVOC original, SVOC duplicate, etc.).

Indicator field parameters: This SOP uses field measurements of turbidity, dissolved oxygen, specific conductance, temperature, pH, and oxidation/reduction potential (ORP) as indicators of when purging operations are sufficient and sample collection may begin.

Matrix Spike/Matrix Spike Duplicates: Used by the laboratory in its quality assurance program. Consult the laboratory for the sample volume to be collected.

Potentiometric Surface: The level to which water rises in a tightly cased well constructed in a confined aquifer. In an unconfined aquifer, the potentiometric surface is the water table.

QAPP: Quality Assurance Project Plan

SAP: Sampling and Analysis Plan

SOP: Standard operating procedure

Stabilization: A condition that is achieved when all indicator field parameter measurements are sufficiently stable (as described in the “Monitoring Indicator Field Parameters” section) to allow sample collection to begin.

Temperature blank: A temperature blank is added to each sample cooler. The blank is measured upon receipt at the laboratory to assess whether the samples were properly cooled during transit.

Trip blank (VOCs): Trip blank is a sample of analyte-free water taken to the sampling site and returned to the laboratory. The trip blanks (one pair) are added to each sample cooler that contains VOC samples.

2.0 SCOPE & APPLICATION

The goal of this groundwater sampling procedure is to collect water samples that reflect the total mobile organic and inorganic loads (dissolved and colloidal sized fractions) transported through the subsurface under ambient flow conditions, with minimal physical and chemical alterations from sampling operations. This standard operating procedure (SOP) for collecting groundwater samples will help ensure that the project's data quality objectives (DQOs) are met under certain low-flow conditions.

The SOP emphasizes the need to minimize hydraulic stress at the well-aquifer interface by maintaining low water-level drawdowns, and by using low pumping rates during purging and sampling operations. Indicator field parameters (e.g., dissolved oxygen, pH, etc.) are monitored during purging in order to determine when sample collection may begin. Samples properly collected using this SOP are suitable for analysis of groundwater contaminants (volatile and semi-volatile organic analytes, dissolved gases, pesticides, PCBs, metals and other inorganics), or naturally occurring analytes. This SOP is based on Puls, and Barcelona (1996).

This procedure is designed for monitoring wells with an inside diameter (1.5-inches or greater) that can accommodate a positive lift pump with a screen length or open interval ten feet or less and with a water level above the top of the screen or open interval (Hereafter, the "screen or open interval" will be referred to only as "screen interval"). This SOP is not applicable to other well-sampling conditions.

While the use of dedicated sampling equipment is not mandatory, dedicated pumps and tubing can reduce sampling costs significantly by streamlining sampling activities and thereby reducing the overall field costs.

The goal of this procedure is to emphasize the need for consistency in deploying and operating equipment while purging and sampling monitoring wells during each sampling event. This will help to minimize sampling variability.

This procedure describes a general framework for groundwater sampling. Other site specific information (hydrogeological context, conceptual site model (CSM), DQOs, etc.) coupled with systematic planning must be added to the procedure in order to develop an appropriate site specific SAP/QAPP. In addition, the site specific SAP/QAPP must identify the specific equipment that will be used to collect the groundwater samples.

This procedure does not address the collection of water or free product samples from wells containing free phase LNAPLs and/or DNAPLs (light or dense non-aqueous phase liquids). For this type of situation, the reader may wish to check: Cohen, and Mercer (1993) or other pertinent documents.

This SOP is to be used when collecting groundwater samples from monitoring wells at all Superfund, Federal Facility and RCRA sites in Region 1 under the conditions described herein. Request for modification of this SOP, in order to better address specific situations at individual wells, must include adequate technical justification for proposed changes. <u>All changes and modifications must be approved and included in a revised SAP/QAPP before implementation in field.</u>

3.0 BACKGROUND FOR IMPLEMENTATION

It is expected that the monitoring well screen has been properly located (both laterally and vertically) to intercept existing contaminant plume(s) or along flow paths of potential contaminant migration. Problems with inappropriate monitoring well placement or faulty/improper well installation cannot be overcome by even the best water sampling procedures. This SOP presumes that the analytes of interest are moving (or will potentially move) primarily through the more permeable zones intercepted by the screen interval.

Proper well construction, development, and operation and maintenance cannot be overemphasized. The use of installation techniques that are appropriate to the hydrogeologic setting of the site often prevent "problem well" situations from occurring. During well development, or redevelopment, tests should be conducted to determine the hydraulic characteristics of the monitoring well. The data can then be used to set the purging/sampling rate, and provide a baseline for evaluating changes in well performance and the potential need for well rehabilitation. Note: if this installation data or well history (construction and sampling) is not available or discoverable, for all wells to be sampled, efforts to build a sampling history should commence with the next sampling event.

The pump intake should be located within the screen interval and at a depth that will remain under water at all times. It is recommended that the intake depth and pumping rate remain the same for all sampling events. The mid-point or the lowest historical midpoint of the saturated screen length is often used as the location of the pump intake. For new wells, or for wells without pump intake depth information, the site's SAP/QAPP must provide clear reasons and instructions on how the pump intake depth(s) will be selected, and reason(s) for the depth(s) selected. If the depths to top and bottom of the well screen are not known, the SAP/QAPP will need to describe how the sampling depth will be determined and how the data can be used.

Stabilization of indicator field parameters is used to indicate that conditions are suitable for sampling to begin. Achievement of turbidity levels of less than 5 NTU, and stable drawdowns of less than 0.3 feet, while desirable, are not mandatory. Sample collection may still take place provided the indicator field parameter criteria in this procedure are met. If after 2 hours of purging indicator field parameters have not stabilized, one of three optional courses of action may be taken: a) continue purging until stabilization is achieved, b) discontinue purging, do not collect any samples, and record in log book that stabilization could not be achieved (documentation must describe attempts to achieve stabilization), c) discontinue purging, collect samples and provide full explanation of attempts to achieve stabilization (note: there is a risk that the analytical data obtained, especially metals and strongly hydrophobic organic analytes, may reflect a sampling bias and therefore, the data may not meet the data quality objectives of the sampling event).

It is recommended that low-flow sampling be conducted when the air temperature is above 32°F (0°C). If the procedure is used below 32°F, special precautions will need to be taken to prevent the groundwater from freezing in the equipment. Because sampling during freezing temperatures may adversely impact the data quality objectives, the need for water sample collection during months when these conditions are likely to occur should be evaluated during site planning and special sampling measures may need to be developed. Ice formation in the flow-through-cell will cause the monitoring probes to act erratically. A transparent flow-through-cell needs to be used to observe if ice is forming in the cell. If ice starts to form on the other pieces of the sampling equipment, additional problems may occur.

4.0 HEALTH & SAFETY

When working on-site, comply with all applicable OSHA requirements and the site's health/safety procedures. All proper personal protection clothing and equipment are to be worn. Some samples may contain biological and chemical hazards. These samples should be handled with suitable protection to skin, eyes, etc.

5.0 CAUTIONS

The following cautions need to be considered when planning to collect groundwater samples when the below conditions occur.

If the groundwater degasses during purging of the monitoring well, dissolved gases and VOCs will be lost. When this happens, the groundwater data for dissolved gases (e.g., methane, ethene, ethane, dissolved oxygen, etc.) and VOCs will need to be qualified. Some conditions that can promote degassing are the use of a vacuum pump (e.g., peristaltic pumps), changes in aperture along the sampling tubing, and squeezing/pinching the pump's tubing which results in a pressure change.

When collecting the samples for dissolved gases and VOCs analyses, avoid aerating the groundwater in the pump's tubing. This can cause loss of the dissolved gases and VOCs in the groundwater. Having the pump's tubing completely filled prior to sampling will avoid this problem when using a centrifugal pump or peristaltic pump.

Direct sun light and hot ambient air temperatures may cause the groundwater in the tubing and flow-through-cell to heat up. This may cause the groundwater to degas which will result in loss of VOCs and dissolved gases. When sampling under these conditions, the sampler will need to shade the equipment from the sunlight (e.g., umbrella, tent, etc.). If possible, sampling on hot days, or during the hottest time of the day, should be avoided. The tubing exiting the monitoring well should be kept as short as possible to avoid the sun light or ambient air from heating up the groundwater.

Thermal currents in the monitoring well may cause vertical mixing of water in the well bore. When the air temperature is colder than the groundwater temperature, it can cool the top of the water column. Colder water which is denser than warm water sinks to the bottom of the well and the warmer water at the bottom of the well rises, setting up a convection cell. "During low-flow sampling, the pumped water may be a mixture of convecting water from within the well casing and aquifer water moving inward through the screen. This mixing of water during low-flow sampling can substantially increase equilibration times, can cause false stabilization of indicator parameters, can give false indication of redox state, and can provide biological data that are not representative of the aquifer conditions" (Vroblesky 2007).

Failure to calibrate or perform proper maintenance on the sampling equipment and measurement instruments (e.g., dissolved oxygen meter, etc.) can result in faulty data being collected.

Interferences may result from using contaminated equipment, cleaning materials, sample containers, or uncontrolled ambient/surrounding air conditions (e.g., truck/vehicle exhaust nearby).

Cross contamination problems can be eliminated or minimized through the use of dedicated sampling equipment and/or proper planning to avoid ambient air interferences. Note that the use of dedicated sampling equipment can also significantly reduce the time needed to complete each sampling event, will promote consistency in the sampling, and may reduce sampling bias by having the pump's intake at a constant depth.

Clean and decontaminate all sampling equipment prior to use. All sampling equipment needs to be routinely checked to be free from contaminants and equipment blanks collected to ensure that the equipment is free of contaminants. Check the previous equipment blank data for the site (if they exist) to determine if the previous cleaning procedure removed the contaminants. If contaminants were detected and they are a concern, then a more vigorous cleaning procedure will be needed.

6.0 PERSONNEL QUALIFICATIONS

All field samplers working at sites containing hazardous waste must meet the requirements of the OSHA regulations. OSHA regulations may require the sampler to take the 40 hour OSHA health and safety training course and a refresher course prior to engaging in any field activities, depending upon the site and field conditions.

The field samplers must be trained prior to the use of the sampling equipment, field instruments, and procedures. Training is to be conducted by an experienced sampler before initiating any sampling procedure.

The entire sampling team needs to read, and be familiar with, the site Health and Safety Plan, all relevant SOPs, and SAP/QAPP (and the most recent amendments) before going onsite for the sampling event. It is recommended that the field sampling leader attest to the understanding of these site documents and that it is recorded.

7.0 EQUIPMENT AND SUPPLIES

A. Informational materials for sampling event

A copy of the current Health and Safety Plan, SAP/QAPP, monitoring well construction data, location map(s), field data from last sampling event, manuals for sampling, and the monitoring instruments' operation, maintenance, and calibration manuals should be brought to the site.

B. Well keys.

C. Extraction device

Adjustable rate, submersible pumps (e.g., centrifugal, bladder, etc.) which are constructed of stainless steel or polytetrafluoroethylene (PTFE, i.e. Teflon®) are preferred. PTFE, however, should not be used when sampling for per- and polyfluoroalkyl substances (PFAS) as it is likely to contain these substances.

Note: If extraction devices constructed of other materials are to be used, adequate information must be provided to show that the substituted materials do not leach contaminants nor cause interferences to the analytical procedures to be used. Acceptance of these materials must be obtained before the sampling event.

If bladder pumps are selected for the collection of VOCs and dissolved gases, the pump setting should be set so that one pulse will deliver a water volume that is sufficient to fill a 40 mL VOC vial. This is not mandatory, but is considered a "best practice". For the proper operation, the bladder pump will need a minimum amount of water above the pump; consult the manufacturer for the recommended submergence. The pump's recommended submergence value should be determined during the planning stage, since it may influence well construction and placement of dedicated pumps where water-level fluctuations are significant.

Adjustable rate, peristaltic pumps (suction) are to be used with caution when collecting samples for VOCs and dissolved gases (e.g., methane, carbon dioxide, etc.) analyses. Additional information on the use of peristaltic pumps can be found in Appendix A.
If peristaltic pumps are used, the inside diameter of the rotor head tubing needs to match the inside diameter of the tubing installed in the monitoring well.

Inertial pumping devices (motor driven or manual) are not recommended. These devices frequently cause greater disturbance during purging and sampling, and are less easily controlled than submersible pumps (potentially increasing turbidity and sampling variability, etc.). This can lead to sampling results that are adversely affected by purging and sampling operations, and a higher degree of data variability.

D. Tubing

PTFE (Teflon®) or PTFE-lined polyethylene tubing are preferred when sampling is to include VOCs, SVOCs, pesticides, PCBs and inorganics. As discussed in the previous section, PTFE tubing should not be used when sampling for PFAS. In this case, a suitable alternative such as high-density polyethylene tubing should be used.

PVC, polypropylene or polyethylene tubing may be used when collecting samples for metal and other inorganics analyses.

Note: If tubing constructed of other materials is to be used, adequate information must be provided to show that the substituted materials do not leach contaminants nor cause interferences to the analytical procedures to be used. Acceptance of these materials must be obtained before the sampling event.

The use of 1/4 inch or 3/8 inch (inside diameter) tubing is recommended. This will help ensure that the tubing remains liquid filled when operating at very low pumping rates when using centrifugal and peristaltic pumps.

Silastic tubing should be used for the section around the rotor head of a peristaltic pump. It should be less than a foot in length. The inside diameter of the tubing used at the pump rotor head must be the same as the inside diameter of tubing placed in the well. A tubing connector is used to connect the pump rotor head tubing to the well tubing. Alternatively, the two pieces of tubing can be connected to each other by placing the one end of the tubing inside the end of the other tubing. The tubing must not be reused.

E. The water level measuring device

Electronic ”tape”, pressure transducer, water level sounder/level indicator, etc. should be capable of measuring to 0.01 foot accuracy. Recording pressure transducers, mounted above the pump, are especially helpful in tracking water levels during pumping operations, but their use must include check measurements with a water level “tape” at the start and end of each sampling event.

F. Flow measurement supplies

Graduated cylinder (size according to flow rate) and stopwatch usually will suffice.

Large graduated bucket used to record total water purged from the well.

G. Interface probe

To be used to check on the presence of free phase liquids (LNAPL, or DNAPL) before purging begins (as needed).

H. Power source (generator, nitrogen tank, battery, etc.)

When a gasoline generator is used, locate it downwind and at least 30 feet from the well so that the exhaust fumes do not contaminate samples.

I. Indicator field parameter monitoring instruments

Use of a multi-parameter instrument capable of measuring pH, oxidation/reduction potential (ORP), dissolved oxygen (DO), specific conductance, temperature, and coupled with a flow-through-cell is required when measuring all indicator field parameters, except turbidity. Turbidity is collected using a separate instrument. Record equipment/instrument identification (manufacturer, and model number).

Transparent, small volume flow-through-cells (e.g., 250 mLs or less) are preferred. This allows observation of air bubbles and sediment buildup in the cell, which can interfere with the operation of the monitoring instrument probes, to be easily detected. A small volume cell facilitates rapid turnover of water in the cell between measurements of the indicator field parameters.

It is recommended to use a flow-through-cell and monitoring probes from the same manufacturer and model to avoid incompatibility between the probes and flow-through-cell.

Turbidity samples are collected before the flow-through-cell. A “T” connector coupled with a valve is connected between the pump’s tubing and flow-through-cell. When a turbidity measurement is required, the valve is opened to allow the groundwater to flow into a container. The valve is closed and the container sample is then placed in the turbidimeter.

Standards are necessary to perform field calibration of instruments. A minimum of two standards are needed to bracket the instrument measurement range for all parameters except ORP which use a Zobell solution as a standard. For dissolved oxygen, a wet sponge used for the 100% saturation and a zero dissolved oxygen solution are used for the calibration.

Barometer (used in the calibration of the Dissolved Oxygen probe) and the conversion formula to convert the barometric pressure into the units of measure used by the Dissolved Oxygen meter are needed.

J. Decontamination supplies

Includes (for example) non-phosphate detergent, distilled/deionized water, isopropyl alcohol, etc.

K. Record keeping supplies

Logbook(s), well purging forms, chain-of-custody forms, field instrument calibration forms, etc.

L. Sample bottles

M. Sample preservation supplies (as required by the analytical methods)

N. Sample tags or labels

O. PID or FID instrument

If appropriate, to detect VOCs for health and safety purposes, and provide qualitative field evaluations.

P. Miscellaneous Equipment

Equipment to keep the sampling apparatus shaded in the summer (e.g., umbrella) and from freezing in the winter. If the pump's tubing is allowed to heat up in the warm weather, the cold groundwater may degas as it is warmed in the tubing.

8.0 EQUIPMENT/INSTRUMENT CALIBRATION

Prior to the sampling event, perform maintenance checks on the equipment and instruments according to the manufacturer's manual and/or applicable SOP. This will ensure that the equipment/instruments are working properly before they are used in the field.

Prior to sampling, the monitoring instruments must be calibrated and the calibration documented. The instruments are calibrated using U.S Environmental Protection Agency Region 1 *Calibration of Field Instruments (temperature, pH, dissolved oxygen, conductivity/specific conductance, oxidation/reduction [ORP], and turbidity),* March 23, 2017, or latest version or from one of the methods listed in 40CFR136, 40CFR141 and SW-846.

The instruments shall be calibrated at the beginning of each day. If the field measurement falls outside the calibration range, the instrument must be re-calibrated so that all measurements fall within the calibration range. At the end of each day, a calibration check is performed to verify that instruments remained in calibration throughout the day. This check is performed while the instrument is in measurement mode, not calibration mode. If the field instruments are being used to monitor the natural attenuation parameters, then a calibration check at mid-day is highly recommended to ensure that the instruments did not drift out of calibration. Note: during the day if the instrument reads zero or a negative number for dissolved oxygen, pH, specific conductance, or turbidity (negative value only), this indicates that the instrument drifted out of calibration or the instrument is malfunctioning. If this situation occurs the data from this instrument will need to be qualified or rejected.

9.0 PRELIMINARY SITE ACTIVITIES (as applicable)

Check the well for security (damage, evidence of tampering, missing lock, etc.) and record pertinent observations (include photograph as warranted).

If needed, lay out a sheet of clean polyethylene for monitoring and sampling equipment, unless equipment is elevated above the ground (e.g., on a table, etc.).

Remove well cap and if appropriate measure VOCs at the rim of the well with a PID or FID instrument and record reading in field logbook or on the well purge form.

If the well casing does not have an established reference point (usually a V-cut or indelible mark in the well casing), make one. Describe its location and record the date of the mark in the logbook (consider a photographic record as well). All water level measurements must be recorded relative to this reference point (and the altitude of this point should be determined using techniques that are appropriate to site's DQOs.

If water-table or potentiometric surface map(s) are to be constructed for the sampling event, perform synoptic water level measurement round (in the shortest possible time) before any purging and sampling activities begin. If possible, measure water level depth (to 0.01 ft.) and total well depth (to 0.1 ft.) the day before sampling begins, in order to allow for re-settlement of any particulates in the water column. This is especially important for those wells that have not been recently sampled because sediment buildup in the well may require the well to be redeveloped. If measurement of total well depth is not made the day before, it should be measured after sampling of the well is complete. All measurements must be taken from the established referenced point. Care should be taken to minimize water column disturbance.

Check newly constructed wells for the presence of LNAPLs or DNAPLs before the initial sampling round. If none are encountered, subsequent check measurements with an interface probe may not be necessary unless analytical data or field analysis signal a worsening situation. This SOP cannot be used in the presence of LNAPLs or DNAPLs. If NAPLs are present, the project team must decide upon an alternate sampling method. All project modifications must be approved and documented prior to implementation.

If available check intake depth and drawdown information from previous sampling event(s) for each well. Duplicate, to the extent practicable, the intake depth and extraction rate (use final pump dial setting information) from previous event(s). If changes are made in the intake depth or extraction rate(s) used during previous sampling event(s), for either portable or dedicated extraction devices, record new values, and explain reasons for the changes in the field logbook.

10.0 PURGING AND SAMPLING PROCEDURE

Purging and sampling wells in order of increasing chemical concentrations (known or anticipated) are preferred.

The use of dedicated pumps is recommended to minimize artificial mobilization and entrainment of particulates each time the well is sampled. Note that the use of dedicated sampling equipment can also significantly reduce the time needed to complete each sampling event, will promote consistency in the sampling, and may reduce sampling bias by having the pump's intake at a constant depth.

A. Initial Water Level

Measure the water level in the well before installing the pump if a non-dedicated pump is being used. The initial water level is recorded on the purge form or in the field logbook.

B. Install Pump

Lower pump, safety cable, tubing and electrical lines slowly (to minimize disturbance) into the well to the appropriate depth (may not be the mid-point of the screen/open interval). The Sampling and Analysis Plan/Quality Assurance Project Plan should specify the sampling depth (used previously), or provide criteria for selection of intake depth for each new well. If possible keep the pump intake at least two feet above the bottom of the well, to minimize mobilization of particulates present in the bottom of the well.

Pump tubing lengths, above the top of well casing should be kept as short as possible to minimize heating the groundwater in the tubing by exposure to sun light and ambient air temperatures. Heating may cause the groundwater to degas, which is unacceptable for the collection of samples for VOC and dissolved gases analyses.

C. Measure Water Level

Before starting pump, measure water level. Install recording pressure transducer, if used to track drawdowns, to initialize starting condition.

D. Purge Well

From the time the pump starts purging and until the time the samples are collected, the purged water is discharged into a graduated bucket to determine the total volume of groundwater purged. This information is recorded on the purge form or in the field logbook.

Start the pump at low speed and slowly increase the speed until discharge occurs. Check water level. Check equipment for water leaks and if present fix or replace the affected equipment. Try to match pumping rate used during previous sampling event(s). Otherwise, adjust pump speed until there is little or no water level drawdown. If the minimal drawdown that can be achieved exceeds 0.3 feet, but remains stable, continue purging.

Monitor and record the water level and pumping rate every five minutes (or as appropriate) during purging. Record any pumping rate adjustments (both time and flow rate). Pumping rates should, as needed, be reduced to the minimum capabilities of the pump to ensure stabilization of the water level. Adjustments are best made in the first fifteen minutes of pumping in order to help minimize purging time. During pump start-up, drawdown may exceed the 0.3 feet target and then "recover" somewhat as pump flow adjustments are made. Purge volume calculations should utilize stabilized drawdown value, not the initial drawdown. If the initial water level is above the top of the screen do not allow the water level to fall into the well screen. The final purge volume must be greater than the stabilized drawdown volume plus the pump’s tubing volume. If the drawdown has exceeded 0.3 feet and stabilizes, calculate the volume of water between the initial water level and the stabilized water level. Add the volume of the water which occupies the pump’s tubing to this calculation. This combined volume of water needs to be purged from the well after the water level has stabilized before samples are collected.

Avoid the use of constriction devices on the tubing to decrease the flow rate because the constrictor will cause a pressure difference in the water column. This will cause the groundwater to degas and result in a loss of VOCs and dissolved gasses in the groundwater samples.

Note: the flow rate used to achieve a stable pumping level should remain constant while monitoring the indicator parameters for stabilization and while collecting the samples.

Wells with low recharge rates may require the use of special pumps capable of attaining very low pumping rates (e.g., bladder, peristaltic), and/or the use of dedicated equipment. For new monitoring wells, or wells where the following situation has not occurred before, if the recovery rate to the well is less than 50 mL/min., or the well is being essentially dewatered during purging, the well should be sampled as soon as the water level has recovered sufficiently to collect the volume needed for all anticipated samples. The project manager or field team leader will need to make the decision when samples should be collected, how the sample is to be collected, and the reasons recorded on the purge form or in the field logbook. A water level measurement needs to be performed and recorded before samples are collected. If the project manager decides to collect the samples using the pump, it is best during this recovery period that the pump intake tubing not be removed, since this will aggravate any turbidity problems. Samples in this specific situation may be collected without stabilization of indicator field parameters. Note that field conditions and efforts to overcome problematic situations must be recorded in order to support field decisions to deviate from normal procedures described in this SOP. If this type of problematic situation persists in a well, then water sample collection should be changed to a passive or no-purge method, if consistent with the site's DQOs, or have a new well installed.

E. Monitor Indicator Field Parameters

After the water level has stabilized, connect the "T" connector with a valve and the flow-through-cell to monitor the indicator field parameters. If excessive turbidity is anticipated or encountered with the pump startup, the well may be purged for a while without connecting up the flow-through-cell, in order to minimize particulate buildup in the cell (This is a judgment call made by the sampler). Water level drawdown measurements should be made as usual. If possible, the pump may be installed the day before purging to allow particulates that were disturbed during pump insertion to settle.

During well purging, monitor indicator field parameters (turbidity, temperature, specific conductance, pH, ORP, DO) at a frequency of five minute intervals or greater. The pump's flow rate must be able to "turn over" at least one flow-through-cell volume between measurements (for a 250 mL flow-through-cell with a flow rate of 50 mLs/min., the monitoring frequency would be every five minutes; for a 500 mL flow-through-cell it would be every ten minutes). If the cell volume cannot be replaced in the five minute interval, then the time between measurements must be increased accordingly. Note: during the early phase of purging, emphasis should be put on minimizing and stabilizing pumping stress, and recording those adjustments followed by stabilization of indicator parameters. Purging is considered complete and sampling may begin when all the above indicator field parameters have stabilized. Stabilization is considered to be achieved when three consecutive readings are within the following limits:

Turbidity (10% for values greater than 5 NTU; if three Turbidity values are less than 5 NTU, consider the values as stabilized),
Dissolved Oxygen (10% for values greater than 0.5 mg/L, if three Dissolved Oxygen values are less than 0.5 mg/L, consider the values as stabilized),
Specific Conductance (3%),
Temperature (3%),
pH (± 0.1 unit),
Oxidation/Reduction Potential (±10 millivolts).

All measurements, except turbidity, must be obtained using a flow-through-cell. Samples for turbidity measurements are obtained before water enters the flow-through-cell. Transparent flow-through-cells are preferred, because they allow field personnel to watch for particulate build-up within the cell. This build-up may affect indicator field parameter values measured within the cell. If the cell needs to be cleaned during purging operations, continue pumping and disconnect cell for cleaning, then reconnect after cleaning and continue monitoring activities. Record start and stop times and give a brief description of cleaning activities.

The flow-through-cell must be designed in a way that prevents gas bubble entrapment in the cell. Placing the flow-through-cell at a 45 degree angle with the port facing upward can help remove bubbles from the flow-through-cell (see Appendix B Low-Flow Setup Diagram). Throughout the measurement process, the flow-through-cell must remain free of any gas bubbles. Otherwise, the monitoring probes may act erratically. When the pump is turned off or cycling on/off (when using a bladder pump), water in the cell must not drain out. Monitoring probes must remain submerged in water at all times.

F. Collect Water Samples

When samples are collected for laboratory analyses, the pump's tubing is disconnected from the "T" connector with a valve and the flow-through-cell. The samples are collected directly from the pump's tubing. Samples must not be collected from the flow-through-cell or from the "T" connector with a valve.

VOC samples are normally collected first and directly into pre-preserved sample containers. However, this may not be the case for all sampling locations; the SAP/QAPP should list the order in which the samples are to be collected based on the project's objective(s). Fill all sample containers by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence.

If the pump's flow rate is too high to collect the VOC/dissolved gases samples, collect the other samples first. Lower the pump's flow rate to a reasonable rate and collect the VOC/dissolved gases samples and record the new flow rate.

During purging and sampling, the centrifugal/peristaltic pump tubing must remain filled with water to avoid aeration of the groundwater. It is recommended that 1/4 inch or 3/8 inch (inside diameter) tubing be used to help ensure that the sample tubing remains water filled. If the pump tubing is not completely filled to the sampling point, use the following procedure to collect samples: collect non-VOC/dissolved gases samples first, then increase flow rate slightly until the water completely fills the tubing, collect the VOC/dissolved gases samples, and record new drawdown depth and flow rate.

For bladder pumps that will be used to collect VOC or dissolved gas samples, it is recommended that the pump be set to deliver long pulses of water so that one pulse will fill a 40 mL VOC vial.

Use pre-preserved sample containers or add preservative, as required by analytical methods, to the samples immediately after they are collected. Check the analytical methods (e.g. EPA SW-846, 40 CFR 136, water supply, etc.) for additional information on preservation.

If determination of filtered metal concentrations is a sampling objective, collect filtered water samples using the same low flow procedures. The use of an in-line filter (transparent housing preferred) is required, and the filter size (0.45 µm is commonly used) should be based on the sampling objective. Pre-rinse the filter with groundwater prior to sample collection. Make sure the filter is free of air bubbles before samples are collected. Preserve the filtered water sample immediately. Note: filtered water samples are not an acceptable substitute for unfiltered samples when the monitoring objective is to obtain chemical concentrations of total mobile contaminants in groundwater for human health or ecological risk calculations.

Label each sample as collected. Samples requiring cooling will be placed into a cooler with ice or refrigerant for delivery to the laboratory. Metal samples after acidification to a pH less than 2 do not need to be cooled.

G. Post Sampling Activities

If a recording pressure transducer is used to track drawdown, re-measure water level with tape.

After collection of samples, the pump tubing may be dedicated to the well for re-sampling (by hanging the tubing inside the well), decontaminated, or properly discarded.

Before securing the well, measure and record the well depth (to 0.1 ft.), if not measured the day before purging began. Note: measurement of total well depth annually is usually sufficient after the initial low stress sampling event. However, a greater frequency may be needed if the well has a “silting” problem or if confirmation of well identity is needed.

Secure the well.

11.0 DECONTAMINATION

Decontaminate sampling equipment prior to use in the first well, and then following sampling of each subsequent well. Pumps should not be removed between purging and sampling operations. The pump, tubing, support cable and electrical wires which were in contact with the well should be decontaminated by one of the procedures listed below.

The use of dedicated pumps and tubing will reduce the amount of time spent on decontamination of the equipment. If dedicated pumps and tubing are used, only the initial sampling event will require decontamination of the pump and tubing.

Note if the previous equipment blank data showed that contaminant(s) were present after using the below procedure or the one described in the SAP/QAPP, a more vigorous procedure may be needed.

Procedure 1

Decontaminating solutions can be pumped from either buckets or short PVC casing sections through the pump and tubing. The pump may be disassembled and flushed with the decontaminating solutions. It is recommended that detergent and alcohol be used sparingly in the decontamination process and water flushing steps be extended to ensure that any sediment trapped in the pump is removed. The pump exterior and electrical wires must be rinsed with the decontaminating solutions, as well. The procedure is as follows:

Flush the equipment/pump with potable water.

Flush with non-phosphate detergent solution. If the solution is recycled, the solution must be changed periodically.

Flush with potable or distilled/deionized water to remove all of the detergent solution. If the water is recycled, the water must be changed periodically.

Optional - flush with isopropyl alcohol (pesticide grade; must be free of ketones {e.g., acetone}) or with methanol. This step may be required if the well is highly contaminated or if the equipment blank data from the previous sampling event show that the level of contaminants is significant.

Flush with distilled/deionized water. This step must remove all traces of alcohol (if used) from the equipment. The final water rinse must not be recycled.

Procedure 2

Steam clean the outside of the submersible pump.

Pump hot potable water from the steam cleaner through the inside of the pump. This can be accomplished by placing the pump inside a three or four inch diameter PVC pipe with end cap. Hot water from the steam cleaner jet will be directed inside the PVC pipe and the pump exterior will be cleaned. The hot water from the steam cleaner will then be pumped from the PVC pipe through the pump and collected into another container. Note: additives or solutions should not be added to the steam cleaner.

Pump non-phosphate detergent solution through the inside of the pump. If the solution is recycled, the solution must be changed periodically.

Pump potable water through the inside of the pump to remove all of the detergent solution. If the solution is recycled, the solution must be changed periodically.

Pump distilled/deionized water through the pump. The final water rinse must not be recycled.

12.0 FIELD QUALITY CONTROL

Quality control samples are required to verify that the sample collection and handling process has not compromised the quality of the groundwater samples. All field quality control samples must be prepared the same as regular investigation samples with regard to sample volume, containers, and preservation. Quality control samples include field duplicates, equipment blanks, matrix spike/matrix spike duplicates, trip blanks (VOCs), and temperature blanks.

13.0 FIELD LOGBOOK

A field log shall be kept to document all groundwater field monitoring activities (see Appendix C, example table), and record the following for each well:

Site name, municipality, state.

Well identifier, latitude-longitude or state grid coordinates.

Measuring point description (e.g., north side of PVC pipe).

Well depth, and measurement technique.

Well screen length.

Pump depth.

Static water level depth, date, time and measurement technique.

Presence and thickness of immiscible liquid (NAPL) layers and detection method.

Pumping rate, drawdown, indicator parameters values, calculated or measured total volume pumped, and clock time of each set of measurements.

Type of tubing used and its length.

Type of pump used.

Clock time of start and end of purging and sampling activity.

Types of sample bottles used and sample identification numbers.

Preservatives used.

Parameters requested for analyses.

Field observations during sampling event.

Name of sample collector(s).

Weather conditions, including approximate ambient air temperature.

QA/QC data for field instruments.

Any problems encountered should be highlighted.

Description of all sampling/monitoring equipment used, including trade names, model number, instrument identification number, diameters, material composition, etc.

14.0 DATA REPORT

Data reports are to include laboratory analytical results, QA/QC information, field indicator parameters measured during purging, field instrument calibration information, and whatever other field logbook information is needed to allow for a full evaluation of data usability.

Note: the use of trade, product, or firm names in this sampling procedure is for descriptive purposes only and does not constitute endorsement by the U.S. EPA.

15.0 REFERENCES

Cohen, R.M. and J.W. Mercer, 1993, *DNAPL Site Evaluation*; C.K. Smoley (CRC Press), Boca Raton, Florida.

Robert W. Puls and Michael J. Barcelona, *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*, April 1996 (EPA/540/S-95/504).

U.S. Environmental Protection Agency, 1992, *RCRA Ground-Water Monitoring: Draft Technical Guidance*; Washington, DC (EPA/530-R-93-001).

U.S. Environmental Protection Agency, 1987, *A Compendium of Superfund Field Operations Methods*; Washington, DC (EPA/540/P-87/001).

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U.S Environmental Protection Agency, EPA SW-846.

U.S Environmental Protection Agency, 40 CFR 136.

U.S Environmental Protection Agency, 40 CFR 141.

Vroblesky, Don A., Clifton C. Casey, and Mark A. Lowery, Summer 2007, Influence of Dissolved Oxygen Convection on Well Sampling, *Ground Water Monitoring & Remediation* 27, no. 3: 49-58.

APPENDIX A

PERISTALTIC PUMPS

Before selecting a peristaltic pump to collect groundwater samples for VOCs and/or dissolved gases, (e.g., methane, carbon dioxide, etc.) consideration should be given to the following:

- The decision of whether or not to use a peristaltic pump is dependent on the intended use of the data.
- If the additional sampling error that may be introduced by this device is NOT of concern for the VOC/dissolved gases data's intended use, then this device may be acceptable.
- If minor differences in the groundwater concentrations could affect the decision, such as to continue or terminate groundwater cleanup or whether the cleanup goals have been reached, then this device should NOT be used for VOC/dissolved gases sampling. In these cases, centrifugal or bladder pumps are a better choice for more accurate results.

EPA and USGS have documented their concerns with the use of the peristaltic pumps to collect water sample in the below documents.

- "Suction Pumps are not recommended because they may cause degassing, pH modification, and loss of volatile compounds" *A Compendium of Superfund Field Operations Methods*, EPA/540/P-87/001, December 1987.
- "The agency does not recommend the use of peristaltic pumps to sample ground water particularly for volatile organic analytes" *RCRA Ground-Water Monitoring Draft Technical Guidance*, EPA Office of Solid Waste, November 1992.
- "The peristaltic pump is limited to shallow applications and can cause degassing resulting in alteration of pH, alkalinity, and volatiles loss", *Low-flow (Minimal drawdown) Ground-Water Sampling Procedures*, by Robert Puls & Michael Barcelona, April 1996, EPA/540/S-95/504.
- "Suction-lift pumps, such as peristaltic pumps, can operate at a very low pumping rate; however, using negative pressure to lift the sample can result in the loss of volatile analytes", USGS Book 9 Techniques of Water-Resources Investigation, Chapter A4. (Version 2.0, 9/2006).

APPENDIX B

SUMMARY OF SAMPLING INSTRUCTIONS

These instructions are for using an adjustable rate, submersible pump or a peristaltic pump with the pump's intake placed at the midpoint of a 10 foot or less well screen or an open interval. The water level in the monitoring well is above the top of the well screen or open interval, the ambient temperature is above 32°F, and the equipment is not dedicated. Field instruments are already calibrated. The equipment is setup according to the diagram at the end of these instructions.

1. Review well installation information. Record well depth, length of screen or open interval, and depth to top of the well screen. Determine the pump's intake depth (e.g., mid-point of screen/open interval).

2. On the day of sampling, check security of the well casing, perform any safety checks needed for the site, lay out a sheet of polyethylene around the well (if necessary), and setup the equipment. If necessary a canopy or an equivalent item can be setup to shade the pump's tubing and flow-through-cell from the sun light to prevent the sun light from heating the groundwater.

3. Check well casing for a reference mark. If missing, make a reference mark. Measure the water level (initial) to 0.01 ft. and record this information.

4. Install the pump's intake to the appropriate depth (e.g., midpoint) of the well screen or open interval. Do not turn-on the pump at this time.

5. Measure water level and record this information.

6. Turn-on the pump and discharge the groundwater into a graduated waste bucket. Slowly increase the flow rate until the water level starts to drop. Reduce the flow rate slightly so the water level stabilizes. Record the pump's settings. Calculate the flow rate using a graduated container and a stop watch. Record the flow rate. Do not let the water level drop below the top of the well screen.

If the groundwater is highly turbid or discolored, continue to discharge the water into the bucket until the water clears (visual observation); this usually takes a few minutes. The turbid or discolored water is usually from the well-being disturbed during the pump installation. If the water does not clear, then you need to make a choice whether to continue purging the well (hoping that it will clear after a reasonable time) or continue to the next step. Note, it is sometimes helpful to install the pump the day before the sampling event so that the disturbed materials in the well can settle out.

If the water level drops to the top of the well screen during the purging of the well, stop purging the well, and do the following:

> Wait for the well to recharge to a sufficient volume so samples can be collected. This may take a while (pump may be removed from well, if turbidity is not a problem). The project manager will need to make the decision when samples should be collected and the reasons recorded in the site's log book. A water level measurement needs to be performed and recorded before samples are collected. When samples are being collected, the water level must not drop below the top of the screen or open interval. Collect the samples from the pump's tubing. Always collect the VOCs and dissolved gases samples first. Normally, the samples requiring a small volume are collected before the large volume samples are collected just in case there is not sufficient water in the well to fill all the sample containers. All samples must be collected, preserved, and stored according to the analytical method. Remove the pump from the well and decontaminate the sampling equipment.

If the water level has dropped 0.3 feet or less from the initial water level (water level measure before the pump was installed); proceed to Step 7. If the water level has dropped more than 0.3 feet, calculate the volume of water between the initial water level and the stabilized water level. Add the volume of the water which occupies the pump's tubing to this calculation. This combined volume of water needs to be purged from the well after the water level has stabilized before samples are be collected.

7. Attach the pump's tubing to the "T" connector with a valve (or a three-way stop cock). The pump's tubing from the well casing to the "T" connector must be as short as possible to prevent the groundwater in the tubing from heating up from the sun light or from the ambient air. Attach a short piece of tubing to the other end of the end of the "T" connector to serve as a sampling port for the turbidity samples. Attach the remaining end of the "T" connector to a short piece of tubing and connect the tubing to the flow-through-cell bottom port. To the top port, attach a small piece of tubing to direct the water into a calibrated waste bucket. Fill the cell with the groundwater and remove all gas bubbles from the cell. Position the flow-through-cell in such a way that if gas bubbles enter the cell they can easily exit the cell. If the ports are on the same side of the cell and the cell is cylindrical shape, the cell can be placed at a 45-degree angle with the ports facing upwards; this position should keep any gas bubbles entering the cell away from the monitoring probes and allow the gas bubbles to exit the cell easily (see Low-Flow Setup Diagram). Note:

make sure there are no gas bubbles caught in the probes' protective guard; you may need to shake the cell to remove these bubbles.

8. Turn-on the monitoring probes and turbidity meter.

9. Record the temperature, pH, dissolved oxygen, specific conductance, and oxidation/reduction potential measurements. Open the valve on the "T" connector to collect a sample for the turbidity measurement, close the valve, do the measurement, and record this measurement. Calculate the pump's flow rate from the water exiting the flow-through-cell using a graduated container and a stop watch, and record the measurement. Measure and record the water level. Check flow-through-cell for gas bubbles and sediment; if present, remove them.

10. Repeat Step 9 every 5 minutes or as appropriate until monitoring parameters stabilized. Note: at least one flow-through-cell volume must be exchanged between readings. If not, the time interval between readings will need to be increased. Stabilization is achieved when three consecutive measurements are within the following limits:

> **Turbidity** (10% for values greater than 5 NTUs; if three Turbidity values are less than 5 NTUs, consider the values as stabilized),
> **Dissolved Oxygen** (10% for values greater than 0.5 mg/L, if three Dissolved Oxygen values are less than 0.5 mg/L, consider the values as stabilized),
> **Specific Conductance** (3%),
> **Temperature** (3%),
> **pH** (± 0.1 unit),
> **Oxidation/Reduction Potential** (±10 millivolts).

If these stabilization requirements do not stabilize in a reasonable time, the probes may have been coated from the materials in the groundwater, from a buildup of sediment in the flow-through-cell, or a gas bubble is lodged in the probe. The cell and the probes will need to be cleaned. Turn-off the probes (not the pump), disconnect the cell from the "T" connector and continue to purge the well. Disassemble the cell, remove the sediment, and clean the probes according to the manufacturer's instructions. Reassemble the cell and connect the cell to the "T" connector. Remove all gas bubbles from the cell, turn-on the probes, and continue the measurements. Record the time the cell was cleaned.

11. When it is time to collect the groundwater samples, turn-off the monitoring probes, and disconnect the pump's tubing from the "T" connector. If you are using a centrifugal or peristaltic pump check the pump's tubing to determine if the tubing is completely filled with water (no air space).

All samples must be collected and preserved according to the analytical method. VOCs and dissolved gases samples are normally collected first and directly into pre-preserved sample containers. However, this may not be the case for all sampling locations; the SAP/QAPP should list the order in which the samples are to be collected based on the project's objective(s). Fill all sample containers by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence.

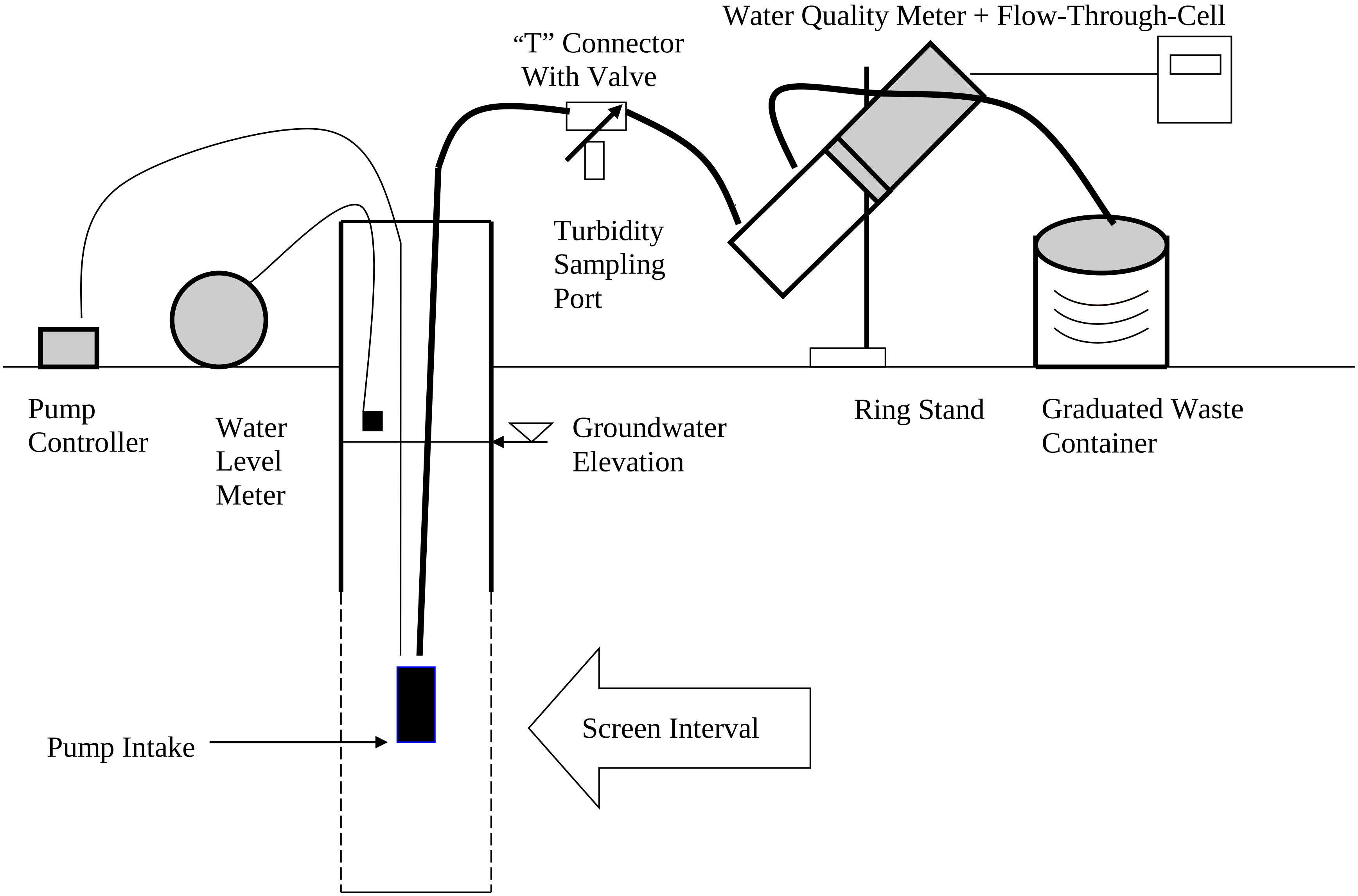
If the pump's tubing is not completely filled with water and the samples are being collected for VOCs and/or dissolved gases analyses using a centrifugal or peristaltic pump, do the following:

> All samples must be collected and preserved according to the analytical method. The VOCs and the dissolved gases (e.g., methane, ethane, ethene, and carbon dioxide) samples are collected last. When it becomes time to collect these samples increase the pump's flow rate until the tubing is completely filled. Collect the samples and record the new flow rate.

12. Store the samples according to the analytical method.

13. Record the total purged volume (graduated waste bucket). Remove the pump from the well and decontaminate the sampling equipment.

Low-Flow Setup Diagram



APPENDIX C

EXAMPLE (Minimum Requirements)

WELL PURGING-FIELD WATER QUALITY MEASUREMENTS FORM

Location (Site/Facility Name)________________________________
Well Number_________________ Date________________________
Field Personnel____
Sampling Organization_______________________________________
Identify MP____

Depth to ________/_________ of screen
(below MP) top bottom
Pump Intake at (ft. below MP)_________
Purging Device; (pump type)__________
Total Volume Purged ________________

Clock Time 24 HR	Water Depth below MP ft	Pump Dial[1]	Purge Rate ml/min	Cum. Volume Purged liters	Temp. "C	Spec. Cond.[2] µS/cm	pH	ORP[3] mv	DO mg/L	Tur-bidity NTU	Comments

Stabilization Criteria 3% 3% ±0.1 ±10 mv 10% 10%

1. Pump dial setting (for example: hertz, cycles/min, etc).
2. µSiemens per cm(same as µmhos/cm)at 25°C.
3. Oxidation reduction potential (ORP)

APPENDIX C

FORMS

PHOENIX
Environmental Laboratories, Inc.

NY/NJ CHAIN OF CUSTODY RECORD

587 East Middle Turnpike, P.O. Box 370, Manchester, CT 06040
Email: info@phoenixlabs.com   Fax (860) 645-0823
Client Services (860) 645-8726

Temp   Pg   of

Data Delivery:
☐ Fax #:
☐ Email:

Customer:
Address:
Project:
Report to:
Invoice to:
Project P.O:
Phone #:
Fax #:

Client Sample - Information - Identification

Sampler's Signature ________ Date: ________

Matrix Code:
DW=drinking water   WW=wastewater   S=soil/solid   O=oil
GW=groundwater   SL=sludge   A=air   X=other

Analysis Request

Phoenix Sample #	Customer Sample Identification	Sample Matrix	Date Sampled	Time Sampled													Soil VOA [ ] Methanol [ ] S. Bisulfate [ ] H2O	GL Soil container ( ) oz	GL Soil container ( ) oz	40 ml VOA Vial [ ] As is [ ] HCl	GL Amber 1000ml [ ] As is [ ] H2SO4	PL As is [ ] 250ml [ ] 500ml [ ] 1000ml	PL H2SO4 [ ] 250ml [ ] 500ml	PL HNO3 250ml	PL NaOH 250ml	Bacteria Bottle	

Relinquished by:	Accepted by:	Date:	Time:

Comments, Special Requirements or Regulations:

Turnaround:
☐ 1 Day*
☐ 2 Days*
☐ 3 Days*
☐ 5 Days
☐ 10 Days
☐ Other

* SURCHARGE APPLIES

NJ
☐ Res. Criteria
☐ Non-Res. Criteria
☐ Impact to GW Soil Cleanup Criteria
☐ GW Criteria

NY
☐ TOGS GA GW
☐ CP-51 Soil
☐ NY375 Unrestricted Soil
☐ NY375 Residential Soil
☐ NY375 Restricted Non-Residential Soil

Data Format
☐ Phoenix Std Report
☐ Excel
☐ PDF
☐ GIS/Key
☐ EQuIS
☐ NJ Hazsite EDD
☐ NY EZ EDD (ASP)
☐ Other

Data Package
☐ NJ Reduced Deliv. *
☐ NY Enhanced (ASP B) *
☐ Other

State where samples were collected: ________

APPENDIX D

GLOSSARY OF QA/QC TERMS

GLOSSARY OF QUALITY ASSURANCE AND RELATED TERMS

acceptance criteria — address the adequacy of existing information proposed for inclusion into the project. These criteria often apply to data drawn from existing sources (“secondary” data).

accuracy — a measure of the overall agreement of a measurement to a known value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that are due to sampling and analytical operations; EPA recommends using the terms *“precision”* and *“bias*,” rather than “accuracy,” to convey the information usually associated with accuracy.

assessment — the evaluation process used to measure the performance or effectiveness of a system and its elements.

audit — a systematic and independent examination to determine whether quality activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve objectives.

bias — the systematic or persistent distortion of a measurement process that causes errors in one direction (i.e., the expected sample measurement is different from the sample’s true value).

blank — a sample subjected to the usual analytical or measurement process to establish a zero baseline or background value. Sometimes used to adjust or correct routine analytical results. A sample that is intended to contain none of the analytes of interest. A blank is used to detect contamination during sample handling preparation and/or analysis.

chain-of-custody — an unbroken trail of accountability that ensures the physical security of samples, data, and records.

collocated samples — two or more portions collected at the same point in time and space so as to be considered identical. These samples are also known as field replicates and should be identified as such.

comparability — a measure of the confidence with which one data set or method can be compared to another.

completeness — a measure of the amount of valid data obtained from a measurement system.

conformance — an affirmative indication or judgment that a product or service satisfies the relevant specification, contract, or regulation.

corrective action — any measures taken to rectify conditions adverse to quality and, where possible, to prevent recurrence.

data quality — a measure of the degree of acceptability or utility of data for a particular purpose.

data quality assessment — the scientific and statistical evaluation of data to determine if data obtained from environmental operations are of the right type, quality, and quantity to support their intended use.

data quality indicators — the quantitative statistics and qualitative descriptors used to interpret the degree of acceptability or utility of data to the user. The principal data quality indicators are bias, precision, accuracy (bias is preferred), comparability, completeness, representativeness, and sensitivity.

data quality objectives — the qualitative and quantitative statements derived from the DQO Process that clarifies study's technical and quality objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions.

data quality objective process — a systematic planning tool based on the scientific method that identifies and defines the type, quality, and quantity of data needed to satisfy a specified use. DQOs are the qualitative and quantitative outputs from the DQO Process.

data reduction — the process of transforming the number of data items by arithmetic or statistical calculations, standard curves, and concentration factors, and collating them into a more useful form. Data reduction is irreversible and generally results in a reduced data set and an associated loss of detail.

data validation — an analyte- and sample-specific process that extends the evaluation of data beyond method, procedural, or contractual compliance (i.e., data verification) to determine the analytical quality of a specific data set.

data verification — the process of evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual specifications.

design — the specifications, drawings, design criteria, and performance specifications. Also, the result of deliberate planning, analysis, mathematical manipulations, and design processes.

detection limit — a measure of the capability of an analytical method to distinguish samples that do not contain a specific analyte from samples that contain low concentrations of the analyte; the lowest concentration or amount of the target analyte that can be determined to be different from zero by a single measurement at a stated level of probability. DLs are analyte- and matrix-specific and may be laboratory-dependent.

document control — the policies and procedures used by an organization to ensure that its documents and their revisions are proposed, reviewed, approved for release, inventoried, distributed, archived, stored, and retrieved in accordance with the organization's specifications.

environmental conditions — the description of a physical medium (for example, air, water, soil, sediment) or a biological system expressed in terms of its physical, chemical, radiological, or biological characteristics.

environmental data — any measurements or information that describe environmental processes, location, or conditions; ecological or health effects and consequences; or the performance of environmental technology. For EPA, environmental data include information collected directly from measurements, produced from models. Compiled from other sources such as data bases or the literature.

environmental data operation — work performed to obtain, use, or report information pertaining to environmental processes and conditions.

environmental monitoring — the process of measuring or collecting environmental data.

environmental processes — any manufactured or natural processes that produce discharges to, or that impact, the ambient environment.

environmental technology — an all-inclusive term used to describe pollution control devices and systems, waste treatment processes and storage facilities, and site remediation technologies and their components that may be used to remove pollutants or contaminants from, or to prevent them from entering, the environment. Examples include wet scrubbers (air), soil washing (soil), granulated activated carbon unit (water), and filtration (air, water). Usually, this term applies to hardware-based systems; however, it can also apply to methods or techniques used for pollution prevention, pollutant reduction, or containment of contamination to prevent further movement of the contaminants, such as capping, solidification or vitrification, and biological treatment.

field blank — a clean analyte-free sample which is carried to the sampling site and then exposed to sampling conditions, returned to the laboratory, and treated as an environmental sample. This blank is used to provide information about contaminants that may be introduced during sample collection, storage, and transport.

financial assistance — the process by which funds are provided by one organization (usually governmental) to another organization for the purpose of performing work or furnishing services or items. Financial assistance mechanisms include grants, cooperative agreements, and governmental interagency agreements.

graded approach — the process of applying managerial controls to an item or work according to the intended use of the results and the degree of confidence needed in the quality of the results.

guidance — a suggested practice that is not mandatory, intended as an aid or example in complying with a standard or specification.

holding time — the period of time a sample may be stored before analysis. While exceeding the holding time does not necessarily negate the veracity of analytical results, it causes the qualifying or “flagging” of any data not meeting all of the specified acceptance criteria.

independent assessment — an assessment performed by a qualified individual, group, or organization that is not a part of the organization directly performing and accountable for the work being assessed.

inspection — the examination or measurement of an item or activity to verify conformance to specifications.

matrix spike sample — a sample prepared by adding a known amount of the target analyte to a specified amount of a matrix. Spiked samples are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

measurement quality objectives — the individual performance or acceptance goals for the individual Data Quality Indicators such as precision or bias.

metadata — information that describes the data and the quality criteria associated with their generation.

method — a body of procedures and techniques for performing an activity (for example, sampling, chemical analysis, quantification), systematically presented in the order in which they are to be executed.

method blank — a blank prepared to represent the sample matrix as closely as possible and analyzed exactly like the calibration standards, samples, and quality control (QC) samples. Results of method blanks provide an estimate of the within-batch variability of the blank response and an indication of bias introduced by the analytical procedure.

outlier — an extreme observation that is shown to have a low probability of belonging to a specified data population.

parameter — a quantity, usually unknown, such as a mean or a standard deviation characterizing a population. Commonly misused for “variable,” “characteristic,” or “property.”

performance criteria — address the adequacy of information that is to be collected for the project. These criteria often apply to new data collected for a specific use (“primary” data).

precision — a measure of agreement among repeated measurements of the same property under identical, of substantially similar, conditions; expressed generally in terms of the standard deviation.

process — a set of interrelated resources and activities that transforms inputs into outputs. Examples of processes include analysis, design, data collection, operation, fabrication, and calculation.

proficiency test — a type of assessment in which a sample, the composition of which is unknown to the analyst, is provided to test whether the analyst/laboratory can produce analytical results within the specified acceptance criteria.

quality — the totality of features and characteristics of a product or service that bears on its ability to meet the stated or implied needs and expectations of the user.

quality assurance — 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.

quality assurance project plan — a formal document describing in comprehensive detail the necessary quality assurance procedures, quality control activities, and other technical activities that need to be implemented to ensure that the results of the work performed will satisfy the stated performance or acceptance criteria.

quality control — 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 specifications established by the customer; operational techniques and activities that are used to fulfill the need for quality.

quality control sample — an uncontaminated sample matrix spiked with known amounts of analytes from a source independent of the calibration standards. Generally used to establish intra- laboratory or analyst-specific precision and bias or to assess the performance of all or a portion of the measurement system.

quality management plan — a document that describes the quality system in terms of the organization’s structure, the functional responsibilities of management and staff, the lines of authority, and the interfaces for those planning, implementing, and assessing all activities conducted.

quality system — 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 quality assurance procedures and quality control activities.

readiness review — a systematic, documented review of the readiness for the start-up or continued use of a facility, process, or activity. Readiness reviews are typically conducted before proceeding beyond project milestones and before initiation of a major phase of work.

record — a completed document that provides objective evidence of an item or process. Records may include photographs, drawings, magnetic tape, and other data recording media.

recovery — the act of determining whether or not the methodology measures all of the analyte contained in a sample.

representativeness - the measure of the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

self-assessment — the assessments of work conducted by individuals, groups, or organizations directly responsible for overseeing and/or performing the work.

sensitivity — the capability of a method or instrument to discriminate between measurement responses representing different levels of a variable of interest.

spike — a substance that is added to an environmental sample to increase the concentration of the target analyte by known amount; used to assess measurement accuracy (spike recovery). Spike duplicates are used to assess measurement precision.

split samples — two or more representative portions taken from one sample in the field or in the laboratory and analyzed by different analysts or laboratories. Split samples are quality control samples that are used to assess analytical variability and comparability.

standard operating procedure — a document that details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps to be followed. It is officially approved as the method for performing certain routine or repetitive tasks.

surveillance (quality) — continual or frequent monitoring and verification of the status of an entity and the analysis of records to ensure that specifications are being fulfilled.

technical systems audit — a thorough, systematic, on-site qualitative audit of facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a system.

validation — an analyte- and sample-specific process that extends the evaluation of data beyond method, procedural, or contractural compliance (i.e., data verification) to determine the analytical quality of a specific data set.

verification — the process of evaluating the completeness, correctness, and conformance / compliance of a specific data set against the method, procedural, or contractural specifications.

APPENDIX E

RESUMES

Frank Gehrling, P.G.
Senior Geologist
516-205-8438

EDUCATION

Adelphi University
Bachelor of Science in Earth Science, 1977

University of Cincinnati – Department of Geology
Graduate Program 1977-1980

NYS Professional Geologist - 2018

GENERAL BACKGROUND

Mr. Gehrling has been a geologist since 1980 and has been in the environmental field for over 25 years. He has experience in both the regulatory and private sectors. As a member of the Maine DEP Division of Response Services, he was the underground tank coordinator in his region and covered underground tank removals for his office. Many of these removal actions were for older, bare steel tanks and a large number of them required remedial actions which Mr. Gehrling managed. Additionally he gained experience in industrial, marine and transportation incidents both in the immediate response and long term remediation. Mr. Gehrling was also the safety officer for the response team.

Since leaving Maine DEP, Mr. Gehrling has been employed by environmental firms where he gained experience in, site monitoring, Phase I and II Environmental Site Assessments, RCRA closure investigations, brownfield remediation and management..

While working for Galli Engineering, Mr. Gehrling has participated on Brownfield projects in the preparation of Remedial Investigation Workplans, Remedial Investigation Reports, conducting remedial investigations and supervising inspection and monitoring at a NYC OER brownfield and a NYSDEC Inactive Hazardous Waste site. He has also conducted preconstruction investigations for public projects in New York City for DDC and SCA.

Also while working for Galli Engineering, Mr. Gehrling has managed the review process for accepting material at four fill sites. Three of the sites are in New Jersey and have been completed. One site is currently active and is in New York State. Mr. Gehrling is currently reviewing laboratory results and application packages under the revised NYS DEC Part 360 fill regulations for General Fill.

REPRESENTATIVE PROJECTS

BROOKLYN PROSPECT CHARTER SCHOOL – 17TH Street, Brooklyn, NY
Project manager for an OER Voluntary Cleanup Program site for the development of an eight story, mixed use, zero lot line building. Primary use of the building will house the Brooklyn Prospect Charter School. I oversaw the application preparation and submission, prepared remedial investigation work plan, performed remedial investigation and prepared remedial action work plan. Supervised staffing on site to perform CAMP and inspect contaminated soil excavation and handling. Managed the acceptance of

contaminated soil into permitted facilities and will oversee movement of excess soil to permitted disposal sites. This is an ongoing project.

MOUNT HOPE PLAYGROUND – Bronx, NY
Project was a complete reconstruction of Mount Hope Playground in the Bronx for NYC DPR. The project consisted of total excavation of the site, installation of new retaining walls, new drainage, and new facilities. Representing Gianco Environmental Services, Mr. Gehrling prepared the Field Sampling Plan, Excess Material and Disposal Plan, Spill Prevention and Control Plan and a Health and Safety Plan. Work also included sampling of soil on site for waste characterization, and preparing a Sampling Report for submission to DPR. Hazardous Waste was discovered during the waste characterization sampling. Mr. Gehrling prepared plans for delineating the hazardous waste and were implemented by GES. During excavation for the hazardous waste, Mr. Gehrling for GES was on site to witness and help manage the removal of the hazardous waste and conducted the post hazardous waste removal end point sampling. He also produced the Final Hazardous Waste Delineation Sampling Report. Acceptance of that report allowed the remaining soil to be excavated and disposed of as non-hazardous contaminated material. Work was mainly in 2017.

DEMATTI PLAYGROUND – Staten Island – NYC DP&R
Project was a major reconstruction of DeMatti Playground on Staten Island for NYC DPR. The project consisted of new drainage, new grading and new facilities. Working for Gianco Environmental Services, Mr. Gehrling prepared of the Field Sampling Plan, Excess Material and Disposal Plan, Spill Prevention and Control Plan and a Health and Safety Plan. Additional work included sampling of soil on site for waste characterization, interpreting sample results for the general contractor and assisting in management and disposal of contaminated soil. Work was mainly in 2016

TAMARES REALTY 38th Avenue, Queens – MOER VCP Site
Project manager for a Mayors Office of Environmental Protection Voluntary Cleanup Program site for the development of a seven story, mixed use, zero lot line building. Oversaw the application preparation and submission, remedial investigation and preparation of remedial action work plan. Arranged for staffing of site to perform CAMP and inspect contaminated soil excavation and handling. Managed the acceptance of contaminated soil into permitted facilities, documented all truckloads of contaminated soil leaving the site. Performed end point sampling and inspection of vapor barrier installation. Prepared a Remedial Action Report which was accepted by MOER.

MALANKA FILL SITE- Secaucus, New Jersey. Fill site in New Jersey, reviewed applications for soil disposal at a fill site in Secaucus. Site was being filled for future development. Reviewed waste characterization lab reports to determine if proposed soil met Malanka Fill Site chemical standards for acceptance. The acceptance review also included reviewing all environmental documents such as additional Phase II Site Assessments. Review letters were drafted accepting or rejecting the applications. All records were organized to allow for review by public officials. Prepared monthly reports of activity at the site detailing where on the site approved materials were placed. Completed over 250 reviews for the project which was successfully completed.

Laurel Hill – NYS DEC Inactive Hazardous Waste Site, Maspeth

Senior Field Inspector at a hazardous waste remediation site. It was formally a copper smelting site last owned by Phelps-Dodge. The remedy was capping the entire site. Work consisted of daily inspections of construction, preparing daily reports, monitoring the site for dust and VOCs, assuring the work was conforming to the established plans. Prepared a Construction Completion Report to DEC which reported on 18 months of work. It was accepted by DEC.

EXPERT RECYCLING – Old Bridge, NJ
Prepared Remedial Investigation Workplan, conducted Remedial Investigation and prepared Remedial Investigation Report, and Remedial Action Workplan/Soil Reuse Plan for closure of a former C&D landfill. Completed Class B recycling permit modifications for current activities on site. Soil Reuse Plan emphasized reuse of on-site materials and allowed off site materials for capping purposes. Off-site materials were reviewed and approved for placement at the site.

HUXLEY ENVELOPE SITE - 145 West Street, Brooklyn
For a NYS DEC Brownfield, with others, prepared the Remedial Investigation Workplan and QAPP and Performed Remedial Investigation; prepared Remedial Investigation Report.

81 FLEET PLACE – Brooklyn, New York
In charge of site management for a NYC OER Brownfield during soil excavation and disposal. Approved disposal facilities for multiple waste types, supervised on site personnel implementing the CAMP, monitoring of soil excavation with multiple waste types and monitoring of offsite transport of multiple waste types to different facilities. Prepared daily reports, reconciled manifests with other transport records and was project contact with OER. Prepared Remedial Action Report; accepted by OER.

LENOX AVENUE – Preconstruction sampling
Working for General Contractor on a NYCTA project, Prepared Soil Sampling Plan, Material Handling Plan and HASP, conducted soil sampling for waste characterization for a six block length of Lenox Avenue. Sampled groundwater and prepared application and report for groundwater sewer discharge permit.

IVY HILL GRAPHICS - RCRA Closure - Farmingdale, New York
Designed sampling plan for the closure of a large graphics plant which contained a hazardous waste storage room. Prepared Work Plan, Health and Safety Plan and Quality Assurance Project Plan; included full NYSDEC Category B sampling QA/QC protocols. Conducted field work, analyzed laboratory sample results, and wrote report which recommended additional sampling. Additional sampling with full Category B QA/QC was completed and the final report recommending site closure was prepared and submitted.

PHASE II ESA AND REMEDIAL INVESTIGATION
W 145th St, New York, New York
Planned a phase II site assessment for an E designated site in Manhattan. Site was a commercial building that is scheduled for demolition and redevelopment. Consulted with NYCDEP and NYSDEC for additional required work after contamination was found next to an adjacent gas station; prepared Remedial Investigation Plan and Remedial Work Plan which were approved by NYSDEC.

EMPLOYMENT HISTORY

Gianco Environmental Services Senior Geologist, 2015 to present.
Working for Gianco Environmental Services on a part time basis, overseeing sampling, preparing work plans and report preparation.

Galli Engineering, P.C. Senior Geologist, 2007 to present.
Phase II EAS, Remedial Investigations, Remedial Work Plans, Remedial Action Reports and Spill Closure Reports for commercial and residential properties in New York City. Remedial Investigation and Remedial Action Workplan for former landfill, Environmental oversight and site safety officer for Residential development on former landfill property. Pre-construction environmental investigations for DDC and SCA. Brownfield planning and management. Groundwater investigation around Public Works garage in Sussex County, NJ

Fenley & Nicol Environmental, Inc. - Senior Geologist, 2006-2007
Multiple Phase I ESA and Phase II ESA at commercial properties, UST removal reports and remedial actions, RCRA closure activities and Remedial Investigations at gas stations. Developed proposals and budgets for above work; Acquired Corporate Safety Officer duties in addition to Senior Geologist duties in unit reorganization. Responsible for all F&N safety policies, HASP preparation and review, HAZWOPER training, major client safety program certification

Maine Dept of Environmental Protection - Division of Response Services
Oil and Hazardous Materials Specialist I & II, 1990-2004
Promoted to OHMS II. Position included all duties of OHMS I in spill response. Additional duties included Safety and Training Officer for Augusta Regional team, Safety program development and implementation, Documentation of all OSHA required programs for a Hazardous Materials Response Team, Training local team members in safety and spill response procedures, Participated in Division level training programs and committees. In charge of maintenance and documentation of life safety equipment and field instruments. Team leader when supervisor was unavailable.

Response OHMS I in the Division of Response Services, Augusta. Duties included: Respond to spill incidents involving oil and hazardous materials. These incidents involve various facilities including above and underground storage tanks, marine and land transportation, and fixed industrial facilities. Initiate spill containment and cleanup of the spills which may include assisting local public safety officials, hiring contractors, determining work goals and directing the work. Plan and implement long term remedial actions with emphasis on UST sites; Review and/or write site safety plans for these spill activities. Participate in safety training which involves both classroom and field exercises in proper use of PPE up to fully encapsulating suits. Participate in various oil and chemical spill response exercises held by local and multi-agency task groups. Review invoices to DEP for work done by contractors on spill remediation.

PROFESSIONAL TRAINING

5/90	Transportation Incident – Tank Truck Rollover – NMTC 12 hr
6/90	Hazardous Material Incident for Response Operations – EPA 165.5 40 hr
7/90	Confined Space Entry – Hazard Recognition and Accident Prevention, MSC 8 hr
10/90	How to Install Underground Fuel Storage Tanks and Piping – 8 hr
2/91	Oil Spill Control Course – Texas A&M University, Galveston, TX 40 hr
3/91	Excavation Safety and Health – Maine Safety Council 8 hr
3/91	Petroleum Products: Chemistry, Analysis and Fate – UMass 8 hr
9/91	Hydrocarbon Contaminated Soil: Analysis, Fate, Environmental and Public Health Effects, Remediation and Regulation – Amherst, Massachusetts
9/91	Soil Remediation Workshop – Shell Development, Amherst, MA 3 hr
10/91	Underground Storage Tank Regulations – Maine Oil Dealers Association 8 hr
11/91	Introduction to Groundwater Investigation – EPA 165.7 24 hr
5/92	Proper Installation of Leak Detection Equipment – MODA Augusta, ME 8 hr
6/92	Chemistry of Hazardous Materials – National Fire Academy, Bangor, ME 80 hr
5/93	Maine Hazardous Waste Regulations – DEP Augusta, ME 6 hr
11/93	Tank Car Specialist (Railroad) AAR Pueblo, CO 40 hr
10/94	Assessment, Control and Remediation of LNAPL Contaminated Sites 8 hr
6/95	Radiological Emergency Management – independent study course
2/96	Radiological Emergency Response - independent study course
3/96	Cold Weather Response Seminar 12 hr
1997	NIIMS Incident Command System modules 1-12 32 hr
4/97	Emergency Spill Response Training and Exercise, DFSP Searsport 12 hr
9/97	Radiological Response Team, MEMA, Kittery, ME 32 hr
10/97	Facility Response Training, Portsmouth Naval Shipyard 40 hr
6/98	Hazardous Waste Management, Clean Harbors 6 hr
11/99	FPL Eastern Emergency Response Team, Command Post Exercise 8 hr
2/01	Disaster Stress Management Seminar, Portland, ME 12 hr
6/01	Hazardous Material Technician, Transportation Test Center, Pueblo, CO 80 hr
4/03	WMD Hazmat Technician Course, CDP, Anniston, AL 40 hr
2/04	Air Monitoring for Hazardous Materials - EPA 164.4 40 hr
3/05	OSHA General Industry Guide to Voluntary Compliance, Augusta, ME 30 hr
4/10	10 hr OSHA Construction Safety and Health
2/15	NYC OER Turbo Training
2/16	4 hr Certificate of Erosion & Sediment Control Training
11/16	NYC OER Turbo Training