# COMPLIANCE GROUND WATER MONITORING PLAN
# BOTHELL LANDING SITE
# BOTHELL, WASHINGTON
# HWA Project No. 2007-098

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**Prepared for:**
**City of Bothell**

HWA GeoSciences Inc.
• Geotechnical Engineering
• Hydrogeology
• Geoenvironmental Services
• Inspection & Testing

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# COMPLIANCE GROUND WATER MONITORING PLAN
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# BOTHELL, WASHINGTON

## 1.0 INTRODUCTION

This compliance monitoring plan has been prepared for the Bothell Landing site in Bothell, Washington (Figure 1). The Site is under an Agreed Order between the City of Bothell (City) and the Washington State Department of Ecology (Ecology). Remedial investigations and feasibility studies (RI/FS) have been completed for the Site. The Site has remaining impacts to ground water which were addressed with remedies that included interim action soil excavation and disposal and ground water monitoring. This plan describes the ground water monitoring to be conducted at the Site.

This compliance monitoring plan has been prepared to fulfill the requirements of the Agreed Order per Washington Administrative Code (WAC) 173-340-410(1)(b), and WAC 173-340-820 (sampling and analysis plans).

This plan describes the ground water sample collection wells, procedures, analysis, and Data Quality Objectives (DQOs) and criteria for the project. HWA GeoSciences Inc. prepared this plan in accordance with the U.S. Environmental Protection Agency (EPA) and Ecology requirements contained in the following:

- EPA QA/R-5, EPA Requirements for Quality Assurance Project Plans, Final, March 2001
- EPA QA/G-5, EPA Guidance for Quality Assurance Project Plans, December 2002
- EPA QA/G-4, EPA Guidance on Systematic Planning Using the Data Quality Objectives Process, February 2006
- Ecology Model Toxics Control Act (Ecology 2007)

# 2.0 PROJECT ORGANIZATION AND MANAGEMENT

## 2.1 PROJECT ORGANIZATION

Specific project roles and responsibilities for oversight and sampling are described in Table 2-1.

**Table 2-1**
**Project Roles and Responsibilities**

| Personnel | Responsibilities |
|---|---|
| Department of Ecology (Agency) | Provides regulatory oversight |
| City of Bothell (Owner)<br>Project Manager | Provides project oversight and performs contract administration |
| Owner's Representative (Environmental Consultant) | Conducts compliance sampling; coordinates analytical laboratory testing of samples; prepares reports |

## 2.2 PROBLEM DEFINITION/BACKGROUND

The Bothell Landing Site is located along Bothell Way NE / SR 522 at its (past and current) intersection with Bothell Way NE/ former SR 527, in Bothell, Washington. The Site formerly housed a strip mall, restaurants, and historic gas stations, with multiple former petroleum underground storage tanks (USTs). The City acquired properties on which the Site lies in 2008 for construction of the SR 522 realignment, and entered into an Agreed Order with Ecology in 2009. Remedial investigation activities were initiated in 2009, and finalized in 2016. Interim action soil cleanups for petroleum hydrocarbons were conducted in 2010, 2013, 2014, and 2015 at the Site. Chemicals of concern (COCs) at the Site following the interim action cleanups are:

- Soil: Gasoline-range petroleum hydrocarbons, benzene
- Ground water: arsenic

The selected remedy for the Site is a combination of excavation of contaminated soils (already completed as interim actions), engineering controls (capping under roadways) and institutional controls (environmental covenants restricting access to soil and ground water), as described below:

1. Remnant petroleum contaminated soil under roadway – leave in place and implement:
   - Engineering controls – paved SR 522 roadway capping petroleum impacted soils
   - Institutional controls – implement environmental covenants
2. Ground water arsenic – include institutional controls in new environmental covenant for the arsenic impacted area and provide compliance monitoring for ground water with option to remove arsenic from the covenant if monitoring shows naturally elevated concentrations unrelated to historical or current contamination at the Site.

This monitoring plan describes sample collection procedures and quality assurance and control methods to ensure representative data is collected during the interim action.

## 2.3 QUALITY OBJECTIVES AND CRITERIA

### 2.3.1 Data Quality Objectives

Data quality objectives (DQOs) were developed according to EPA's DQOs Process (EPA 2006), to provide data of known and appropriate quality. The DQO process is a seven-step planning approach to develop sampling designs for data collection activities that support decision-making. It provides a systematic procedure for defining the criteria that a data collection design should satisfy. The DQOs for the project are shown in Table 2-2.

**Table 2-2**
**Design Characterization Sampling DQOs**

| DQO | Description |
|---|---|
| State the Problem | Is contaminated ground water present at the site?<br>Is contaminated ground water reaching the River? |
| Identify the Goal of the Study | Determine if ground water arsenic is high natural background or contamination induced; assess attenuation if the latter.<br>Reduce contaminant concentrations reaching the river<br>Is the collected chemical data adequate to identify and determine if contamination still exists? |
| Identify Information Inputs | Analytical results (what are the detected concentrations? are they above cleanup levels? was QA/QC criteria met?).<br>Actual sample locations (correct location and depth?). |
| Define the Study Boundaries | The selected locations are points of compliance. |
| Develop the Analytic Approach | Sampling and analysis strategies will be developed to support the decision making process.<br>Analytical results will be used to determine the presence or absence of contamination.<br>Results will be compared to site specific cleanup levels established in the interim action work plan |
| Specify Performance or Acceptance Criteria | The tolerable limits of uncertainty regarding the cleanup of contamination at the site will be based on exceedance or non-exceedance of cleanup levels.<br>Tolerable limits on analytical results are determined by the Quality Assurance/Quality Control (QA/QC) criteria defined in this plan. |
| Develop the Plan to Obtain Data | Presented in this plan. |

### 2.3.2 Data Quality Indicators

Data quality and usability are evaluated in terms of performance criteria. Performance and acceptance criteria are expressed in terms of data quality indicators (DQIs). The principal indicators of data quality are precision, accuracy, bias, sensitivity, completeness, comparability, and representativeness. Table 2-3 provides a description of project DQIs.

**Table 2-3**
**General Description of DQIs**

| DQI | Description |
|---|---|
| Precision: | A measure of agreement among repeated measurements of the same property under identical conditions. Usually assessed as a relative percent difference (RPD) between duplicate measurements. RPD guidelines for laboratory duplicate analyses are contained in the standard operating procedures (SOPs) for each analytical method and will be obtained from the laboratory for validation purposes. |
| Accuracy: | A measure of the overall agreement of a measurement to a known value. Analytical accuracy is assessed as percent recovery from matrix spike or reference material measurements. Percent recovery guidelines are contained in laboratory SOPs for each analytical method. |
| Bias: | The systematic or persistent distortion of a measurement process that causes error in one direction. Usually assessed with reference material or matrix spike measurements. Bias as reported by the laboratory will be used to assess data validity. |
| Sensitivity: | The capability of a method or instrument to meet prescribed reporting limits. Assessed by comparison with risk-based reporting limits, method reporting limits, instrument reporting limits, or laboratory quantitation limits, as appropriate. In general, reporting limits for the analytical methods used will be at or below applicable criteria. |
| Completeness: | A measurement of the amount of valid data needed to be obtained for a task. Assessed by comparing the amount of valid results to the total results set. Project requirements for completeness are 90%. |
| Comparability: | A qualitative term that expresses the measure of confidence that one data set can be compared to another. Assessed by comparing sample collection and handling methods, sample preparation and analytical procedures, holding times, reporting units, and other QA protocols. To ensure comparability of data collected for the Bus Barn to previous data, standard collection and measurement techniques will be used. |
| Representativeness: | A qualitative term that expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variation at a sample point, or environmental condition. To ensure representativeness, the sampling design will incorporate sufficient samples so that contamination is detected, if present. Additionally, all sampling procedures detailed in this plan will be followed. |

## 2.4 SPECIAL TRAINING AND CERTIFICATION

All personnel conducting sampling activities on the project site must be 40-hour Hazardous Waste Operation (HAZWOPER) trained per 29 Code of Federal Regulations (CFR) 1910.120 and be current with their annual 8-hour refresher course.

All personnel working at the project site will be briefed on potential site hazards, health and safety procedures, and sampling procedures. Following completion of this training, all personnel will be required to sign an acknowledgement form verifying that they have completed the task-specific training.

## 2.5 SAMPLING DOCUMENTATION AND RECORDS

Sampling documentation will be accomplished according to the procedures provided in Table 2-4.

**Table 2-4**
**Sampling and Sample Handling Records**

| Record | Use | Responsibility/Requirements |
|---|---|---|
| Field Notebook | Record significant events and observations. | Maintained by field sampler/geologist; must be bound; all entries must be factual, detailed, objective; entries must be signed and dated. |
| Sampling Field Data Sheet | Provide a record of each sample collected (Appendix A). | Completed, dated, and signed by sampler; maintained in project file. |
| Sample Label | Accompanies sample; contains specific sample identification information. | Completed and attached to sample container by sampler. |
| Chain-of-Custody Form | Documents chain-of-custody for sample handing (Appendix A). | Documented by sample number. Original accompanies sample. A copy is retained by QA Manager. |
| Chain-of-Custody Seal | Seals sample shipment container (e.g., cooler) to prevent tampering or sample transference. Individual samples do not require custody seals, unless they are to be archived, before going to the lab for possible analysis at a later date. | Completed, signed, and applied by sampler at time samples are transported. |
| Sampling and Analysis Request | Provides a record of each sample number, date of collection/transport, sample matrix, analytical parameters for which samples are to be analyzed. | Completed by sampler at time of sampling/transport; copies distributed to laboratory project file. |

### 2.5.1 Field Logs and Forms

A bound field notebook will be maintained to provide daily records of significant events and observations that occur during field investigations. All entries are to be made in waterproof ink, signed, and dated. Pages of the field notebook are not to be removed, destroyed, or thrown away. Corrections will be made by drawing a single line through the original entry (so that the original entry can still be read) and writing the corrected entry alongside. The correction will be initialed and dated. Most corrected errors will require a footnote explaining the correction.

If an error made on a document is assigned to one person, that individual may make corrections simply by crossing out the error and entering the correct information. The erroneous information should not be obliterated. Any error discovered on a document should be corrected by the person who made the entry.

All field logs and forms will be retained in the project files.

### 2.5.2 Photographs

All photographs taken of field activities will be documented with the following information noted in the field notebook:

- Date, time, and location of photograph taken
- Description of photograph taken
- Reasons photograph was taken
- Viewing direction

Digital photographs will be reviewed in the field to assess quality and need to re-shoot the photograph.

## 2.6 REPORTING

Following completion of the confirmation sampling and analysis, the results will be included in an interim remedial action report. Reporting will include the following:

- Summary of field activities completed.
- Figures showing sampling locations.
- Summary of laboratory analytical results and a comparison to relevant regulatory criteria.
- Field log forms and sampling forms.
- Laboratory data sheets and the results of data review/validation.
- Recommendations for further sampling, if needed.

Preliminary results will be communicated verbally as they become available.

# 3.0 SAMPLING PROCESS DESIGN

## 3.1 SAMPLING APPROACH

Compliance monitoring after the cleanup will include existing monitoring wells with documented past impacts, as summarized in Table 3-1.

**Table 3-1A**
**Sampling Approach– Ground Water**
**INITIAL ROUND**

| Sample type | Sampling location | Sampling Frequency / Rationale | Analytes |
|---|---|---|---|
| **Arsenic** | | | |
| Point of compliance | BLMW-11<br>BLMW-12<br>MW-1 | Initial Round | Total petroleum hydrocarbons, diesel and oil range (TPH-D, TPH-O)<br><br>Volatile Organic compounds (VOCs)<br><br>Semivolatile Organic compounds (SVOCs)<br><br>Total and dissolved metals (arsenic, cadmium, chromium, lead, mercury)<br><br>Field parameters: dissolved oxygen, redox potential, pH, conductivity, temperature, ferrous iron |

**Table 3-1B**
**Sampling Approach – Ground Water**
**SUBSEQUENT ROUNDS**

| Sample type | Sampling location | Sampling Frequency / Rationale | Analytes |
|---|---|---|---|
| **Arsenic** | | | |
| Point of compliance | BLMW-11<br>BLMW-12<br>MW-1 | Quarterly for two years, then modify based on results and consultation with Ecology* | Total Arsenic<br>Dissolved Arsenic<br>Total petroleum hydrocarbons, diesel and oil range<br>TPH-D, TPH-O<br>Field parameters |

* If compliance monitoring from the Site shows that the arsenic remains at elevated concentrations for eight quarters of monitoring, with no other detections of petroleum hydrocarbon contamination, this data can be used to demonstrate that the elevated concentrations represents a locally high natural background for arsenic. Based on this evidence, a request can be made to remove the institutional controls for ground water at the site and discontinue monitoring.

Figure 1 shows the well locations.

The objective of the sampling is to confirm that all COCs have met cleanup levels in ground water and establish if observed concentrations of arsenic are naturally occurring or induced by historical petroleum contamination in ground water at the site. Cleanup levels are provided in the cleanup action plan. The initial round of sampling will include a wider suite of analytes, to confirm the COC list. Note, however, that solvents are being addressed under separate agreements for the source sites, Bothell Service Center and Ultra Custom Cleaners.

Descriptions of the specific sampling methods for the above activities are presented in Sections 3.2. In addition, all sampling will be conducted in accordance with standard operating procedures.

## 3.2 SAMPLING METHODS AND PROCEDURES

Descriptions of the specific sampling and laboratory methods for the project are presented in this section.

### 3.2.1 Ground Water Sampling Procedures

Monitoring wells will be purged before sample collection to obtain ground water samples that are representative of the formation water rather than stagnant water from the well casing. Ground water that has occupied the well casing is often under oxidizing conditions, and thus may be chemically different from true formation water.

Monitoring wells will be purged and sampled using low-flow purging methods (Barcelona et al. 1994). Sampling staff will measure ground water levels to the nearest 0.01-foot using a decontaminated electronic well probe prior to collection of samples. Prior to collection of ground water samples, the wells will be purged by pumping a small volume of water to ensure sampled water represents aquifer conditions. The volume pumped will be determined in the field based on stabilization of field parameters: specific conductance, dissolved oxygen, and pH. Wells will be purged by very slowly lowering semi-rigid polyethylene tubing to a depth corresponding to roughly the midpoint of the screen, securing the tubing to prevent vertical movement, connecting it to a peristaltic pump, and then pumping at a rate not to exceed 0.5 liters/minute (0.132 gallons/minute). At a minimum, two pump and tubing volumes will be purged (1/2" I.D. tubing = 0.010 gallon/lineal foot). Samples from all wells will be collected once the parameter values have stabilized over the course of three sets of measurements as follows:

| | |
|---|---|
| specific conductance | 10 uS |
| dissolved oxygen | 2 mg/L |
| pH | 0.1 |

If a well can be pumped dry prior to reaching the desired purge volume, it will be allowed to recover prior to sampling, using the minimum time between purging and sampling that would allow collection of sufficient sample volume. Samples will be pumped directly into the appropriate containers, as provided by the laboratory. A Field Data Sampling Sheet (provided in Appendix A) will be filled out for each well. New tubing will be used for each well. All purge water will be collected and discharged to the sanitary sewer.

After collection, all samples will be labeled, chilled in a cooler to 4oC, and shipped to the testing laboratory for analysis. Full chain-of-custody and field documentation procedures will be employed, as described in Section 2.6. The laboratory will analyze the water samples for the constituents listed on Table 3-2.

### 3.2.2 Sample Collection

When filling the sample bottles, the following procedures and precautions will be adhered to:

- Sample bottles will be filled directly from dedicated pump tubing or sampling ports with minimal air contact.

- Bottle caps will be removed carefully so that the inside of the cap is not touched. Caps must never be put on the ground. Caps for volatile organic compound (VOC) vials will contain a Teflon-lined septum. The Teflon side of the septum must be facing the sample to prevent contamination of the sample through the septum.

- The sampling team will wear appropriate nonpowdered latex or nitrile gloves (PVC or vinyl gloves can leave trace levels of phthalate or vinyl chloride). Gloves will be changed between wells or more often.

- Tubing or hoses from the sampling systems must not touch or be placed in the sample bottles.

- VOC vials must be filled so that they are headspace-free. These sample bottles therefore need to be slightly overfilled (water tension will maintain a convex water surface in the bottle). The caps for these bottles will be replaced gently, to eliminate air bubbles in the sample. The bottles must then be checked by inverting them and tapping them sharply with a finger. If air bubbles appear, open the bottle, add more water, and repeat the process until all air bubbles are gone. Do not empty the bottle and refill it, as VOC bottles already contain preservatives.

- Sample bottles, caps, or septums that fall on the ground before filling will be discarded.

WATER LEVEL MONITORING

Samplers will measure ground water levels at each of the monitoring wells at the start of each sampling round in order to monitor changes in seasonal or long-term water elevations and ground water flow directions.

### 3.2.3 Sample Containers, Preservation, and Holding Times

Table 3-2 provides a summary of sample analyses and specifications for containers, preservation, and holding times. The analytical laboratory will provide the sample containers and necessary preservation.

**Table 3-2**
**Sample Containers, Preservation, and Holding Times**

| Analysis | Method | Matrix | Container | Preservation | Holding Time |
|---|---|---|---|---|---|
| Arsenic/ Metals | EPA#200.8 | Water | 500mL HDPE | HNO3 pH<2 Cool to 6°C | 6 months to analyze |
| TPH-D TPH-O | NWTPH-Dx | Water | (2) 500mL amber | HCl pH<2 Cool to 6°C | 14 days to extract, 40 days to analyze after extraction |
| VOCs | EPA 8021/8260 | Water | (3) 40mL glass vial (VOA) | HCl pH<2, 6oC | 14 days to analyze |
| SVOCs | EPA 8270 | Water | 1 liter amber | Cool to 6oC | 7 days to extract, 40 days to analyze after extraction |

### 3.2.4 Decontamination Procedures

Decontamination of all non-disposable tools and equipment will be conducted prior to each sampling event and between each sampling location in accordance with the standard operating procedures. The following steps will be taken during decontamination of sampling equipment used during field investigations:

- Scrub with non-phosphate detergent (i.e., Alconox or similar)
- Rinse with tap water
- Rinse thoroughly with deionized water
- Allow to air dry and place in a new plastic bag for storage

### 3.2.5 Investigation-Derived Waste

**Water** – Well purge water will be filtered through and activated granular carbon filter and discharged to the ground.

**Solid waste -** All disposable sampling materials and personal protective equipment, such as disposable coveralls, gloves, and paper towels used in sample processing will be placed inside polyethylene bags or other appropriate containers. Disposable materials will be placed in a normal refuse container and disposed of as normal solid waste.

## 3.3 SAMPLE HANDLING AND CUSTODY

The following sections describe sample handling and custody procedures.

### 3.3.1 Sample Identification and Labeling

Prior to the field investigation, each sample location will be assigned a unique code. Each sample collected at that location will be pre-assigned an identification code using the sampling site followed by other specific information describing the sample. The sample numbering protocol is shown in Table 3-3.

**Table 3-3**
**Sample Numbering Protocol**

| | |
|---|---|
| Sample designations | BL = Bothell Landing Site<br>MW= Monitoring well<br>DUP= blind duplicate sample |
| Examples | BLMW-1-030517: Monitoring well BLMW-1, collected on 03/05/2017<br>DUP-1-030517: Blind duplicate collected on 03/05/2017 |

### 3.3.2 Sample Storage, Packaging, and Transportation

Samples will be placed in a cooler following collection and chilled to approximately 6ºC. Following completion of each days sampling, all samples will be transported and/or shipped to the analytical laboratory, as appropriate. Samples which are routinely delivered to the laboratory on the same day as collection may not have sufficient time to chill to 6ºC.

### 3.3.3 Sample Custody

The chain-of-custody procedures used for this project provide an accurate written or computerized record that can be used to trace the possession of each sample from the time each is collected until the completion of all required analyses. A sample is in custody if it is in any of the following places:

- In someone's physical possession
- In someone's view
- In a secured container
- In a designated secure area

The following information will be provided on the chain-of-custody form:

- Sample identification numbers
- Matrix type for each sample
- Analytical methods to be performed for each sample
- Number of containers for each sample
- Sampling date and time for each sample
- Names of all sampling personnel
- Signature and dates indicating the transfer of sample custody

All samples will be maintained in custody until formally transferred to the laboratory under a written chain-of-custody. Samples will be kept in sight of the sampling crew or in a secure, locked vehicle at all times. Samples that leave the custody of field personnel will be sealed by placing a signed and dated Custody Seal across the seam of the shipping container.

## 3.4 ANALYTICAL METHODS

All samples will be submitted to a commercial analytical laboratory certified by Ecology to perform the required analyses. Analytical methods are listed in Table 3-2. Laboratory reporting limits will be verified prior to analyses to ensure that, at a minimum, reporting limits for each analyte are equal to or lower than MTCA Method A cleanup levels. Matrix interferences may make it impossible to achieve the desired reporting limits and associated quality control (QC) criteria. In such instances, the laboratory shall report the reason for noncompliance with QC criteria or elevated detection limits.

## 3.5 QUALITY ASSURANCE/QUALITY CONTROL

Quality assurance (QA)/QC checks consist of measurements performed in the field and laboratory. The analytical methods referenced in Section 3.4 specify routine methods required to evaluate data precision and accuracy, and determine whether the data are within acceptable limits.

### 3.5.1 Field Methods

Guidelines for minimum samples for field QA/QC sampling are summarized in Table 3-4.

**Table 3-4**
**Guidelines for Minimum QA/QC Samples for Field Sampling**

| Media | Field Duplicate | Trip Blank | Equipment Blank |
|---|---|---|---|
| Water | 1 per batch, including other sites sampled during same event (Max 20 samples) | None – no volatile analyses planned | None – no reusable equipment |

#### Field Duplicates

A minimum of one blind field duplicate will be analyzed per 20 samples, including other nearby sites (i.e., Bothell Hertz, Bothell Landing) sampled during the same event. Field duplicates will be collected following field samples. Duplicate samples will be coded so the laboratory cannot discern which samples are field duplicates.

**Trip Blanks**

No trip blanks will be collected because no volatile organic analyses are planned. Arsenic is unlikely to cause cross-contamination of samples.

### 3.5.2 Equipment/Rinsate Blanks

No equipment blanks will be collected because no non-disposable sampling equipment will be used.

### 3.5.3 Laboratory Methods and Quality Control

Specific procedures and frequencies for laboratory QA procedures and QC analyses are detailed in the laboratory's QA Plan and SOPs for each method. QC analyses will be performed by the laboratory according to their Ecology-approved SOPs.

Accuracy and precision are determined through QC parameters such as surrogate recoveries, matrix spikes, QC check samples, and blind field duplicates. A blind field duplicate sample will be analyzed as a QC sample for verification of precision and accuracy. If results of the blind field duplicate are outside the control limits, corrective action and/or data qualification will be determined after review by the Data QA Manager or his/her designee. Blind field duplication can be of poor quality because of sample heterogeneity. Therefore, the Data QA Manager will determine corrective action. QC sample requirements are listed in Table 3-4.

All analyses performed for this project must reference QC results to enable reviewers to validate (or determine the quality of) the data. Sample analysis data, when reported by the laboratory, will include QC results. All data will be checked for internal consistency, transmittal errors, laboratory protocols, and for complete adherence to the QC elements.

### 3.5.4 Laboratory Instruments

All instruments and equipment used during analysis will be operated, calibrated, and maintained according to manufacturer's guidelines and recommendations, and in accordance with procedures in the analytical method cited, as documented in the laboratory QA plan. Properly trained personnel will operate, calibrate, and maintain laboratory instruments. Calibration blanks and check standards will be analyzed daily for each parameter to verify instrument performance and calibration before beginning sample analysis.

Where applicable, all calibration procedures will meet or exceed regulatory guidelines. The Data QA Manager must approve any variations from these procedures before beginning sample analysis.

After the instruments are calibrated and standardized within acceptable limits, precision and accuracy will be evaluated by analyzing a QC check sample for each analysis performed that

day. Acceptable performance of the QC check sample verifies the instrument performance on a daily basis. Analysis of a QC check standard is also required. QC check samples containing all analytes of interest will be either purchased commercially or prepared from pure standard materials independently from calibration standards. The QC check samples will be analyzed and evaluated according to the EPA method criteria.

Instrument performance check standards and calibration blank results will be recorded in a laboratory instrument logbook that will also contain evaluation parameters, benchmark criteria, and maintenance information. If the instrument logbook does not provide maintenance information, a separate maintenance logbook will be maintained for the instrument.

## 3.6 FIELD INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

The types of field instruments and equipment that are anticipated to be used during sampling include:

- Water level meters
- Sampling pumps
- Field parameter instrument (pH, DO, SC, Temp, ORP)

Equipment maintenance will be performed according to manufacturers' specifications. The frequency of inspection, testing, and maintenance will be established, based on operation procedures and manufacturers' specifications. Field personnel will be responsible for inspection, testing, and maintenance of field equipment. A hard copy of procedures and manufacturer's specifications will be provided to all field personnel working with the equipment. All equipment will be inspected and tested prior to use.

The results of inspection and testing, as well as any problems encountered and corrective actions, will be documented in the activity field notebook. The equipment serial number and date of activity will be included in notebooks so that a complete record is maintained. If problems are encountered, they will be reported to the Manager.

## 3.7 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

Field supplies such as sample containers and trip/rinsate blank water shall be obtained from reputable suppliers and shall be certified analyte-free. Records of certification shall be kept by the laboratory (for laboratory-supplied supplies) or by the Owner's Representative in the project file.

## 3.8 DATA MANAGEMENT

The objectives of data management are to assure that large volumes of information and data are technically complete, accessible, and efficiently handled.

### 3.8.1 Field Data

The original hard (paper) copies of all field notes and laboratory reports will be stored in the project file. Photocopies of these documents should be prepared for working copies as needed.

Field data should be recorded in bound notebooks or individual sampling sheets. The field team members should review the field data for completeness prior to placing it in the files. All filed data will be digitized (scanned) to electronic media and placed in the project file.

### 3.8.2 Laboratory Data

The laboratory data reports will be archived in the project files. The electronic data will be incorporated into Excel spreadsheets and archived on electronic media and placed in the project file.

# 4.0 DATA VERIFICATION AND VALIDATION

Data verification is confirmation by examination and provision of objective evidence that specified requirements have been fulfilled. Validation is confirmation by examination and provision of objective evidence that the particular requirement for a specific intended use have been fulfilled. Techniques for data verification and validation will be in accordance with the Guidance on Environmental Data Validation and Verification (EPA 2001b).

## 4.1 DATA REVIEW, VERIFICATION AND VALIDATION

All data packages provided by the laboratory must provide a summary of quality control results adequate to enable reviewers to validate or determine the quality of the data. The Data QA Manager is responsible for conducting checks for internal consistency, transmittal errors, and for adherence to specified quality control elements.

Field measurements (pH, specific conductance, temperature) will be verified and checked through review of instrument calibration, measurement, and recording procedures.

A verification level validation will be performed on all field documentation and analytical data reports. The data validation process will be used to verify the data quality. The following QC elements will be reviewed, as appropriate:

- Trip blank and rinsate blank results.
- Analytical holding times.
- Preparation blank contamination.
- Check standard precision.
- Analytical accuracy (blank and matrix spike recoveries and laboratory control sample recoveries).
- Analytical precision (comparison of replicate sample results, expressed as relative percent difference [RPD]).
- Each data package will be assessed to determine whether the required documentation is of known and verifiable quality. This includes the following items:
  - Field chain-of-custody record is present, complete and signed.
  - Certified analytical report.
  - QA/QC sample results.

Data will be qualified using guidance provided in the Contract Laboratory Program (CLP) functional guidelines for assessing data (EPA 1994a, 1994b).

The Data QA Manager will prepare a quality assurance text section for each report deliverable describing the results of the data validation and describing any qualifiers that are added to the data.

## 4.2 VERIFICATION AND VALIDATION METHODS

The Data QA Manager will review the following:

- Chain-of-custody documentation
- Holding times
- Equipment/trip blank results
- Field Duplicate results
- Method blank results

A limited review (minimum 10 percent) of the following laboratory QC data results will be conducted:

- Laboratory matrix spike/matrix spike duplicate (MS/MSD) and/or matrix duplicate results
- Laboratory surrogate recoveries
- Laboratory check samples

If, based on this limited review the QC data results indicate potential data quality problems, further evaluations will be conducted.

### 4.2.1 Precision

Precision measures the mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. QA/QC sample types that measure precision include field duplicates, MSD, and matrix duplicates. The estimate of precision of duplicate measurements is expressed as a RPD (Relative Percent Difference), which is calculated:

$$RPD = \frac{D_1 - D_2}{(D_1 + D_2) \div 2} \; x \; 100$$

Where D1 = First sample value
D2 = Second sample value.

The RPDs will be routinely calculated and compared with DQOs.

### 4.2.2 Accuracy

Accuracy is assessed using the results of standard reference material, linear check samples, and MS analyses. It is normally expressed as a percent recovery, which is calculated:

$$\text{Percent Recovery} = \frac{\text{(Total Analyte Found - Analyte Originally Present)} \times 100}{\text{Analyte Added}}$$

The percent recovery will be routinely calculated and checked against DQOs.

### 4.2.3 Bias

Bias is the systematic or persistent distortion of a measurement process that causes errors in one direction. Bias will be assessed with field duplicate and laboratory matrix spike samples, similar to that described for accuracy. Bias measurements are usually carried out with a minimum frequency of 1 in 20, or one per batch of samples analyzed, under the same sampling episode.

### 4.2.4 Sensitivity

Sensitivity expresses the capability of a method or instrument for meeting prescribed measurement reporting limits. Sensitivity will be assessed by comparing data reporting limits with applicable cleanup criteria and analytical or instrument method reporting limits.

### 4.2.5 Completeness

The amount of valid data produced will be compared with the total analyses performed to assess the percent of completeness. Completeness will be routinely calculated and compared with the DQOs.

### 4.2.6 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. Sample data will be comparable with other measurement data for similar samples and sample conditions. Comparability of the data will be maintained by using consistent methods and units.

### 4.2.7 Representativeness

Sample locations and sampling procedures will have been chosen to maximize representativeness. A qualitative assessment (based on professional experience and judgment) will be made of sample data representativeness based on review of sampling records and QA audit of field activities.

### 4.3 RECONCILIATION AND USER REQUIREMENTS

The Data QA Manager will prepare a text section for each report deliverable describing the results of the data review and describing any qualifiers that were added to the data. The QC section will also summarize the laboratory's QC criteria and will include recommendations on whether additional actions such as re-sampling are necessary.

### 4.4 DATA REPORTING

All laboratory data packages will contain the following information:

- Cover letter
- Chain-of-custody forms
- Summary of sample results
- Summary of QC results
- Ecology Environmental Information Management (EIM) electronic data deliverable (EDD)

The minimum information to be presented for each sample for each parameter or parameters group:

Client sample number and laboratory sample number

- Sample matrix
- Date of analysis
- Dilution factors (as reflected by practical quantitation limits (PQL)
- Analytical method
- Detection/quantitation limits
- Definitions of any data qualifiers used

Additionally, sample weights/volumes used in sample preparation/analysis and identification of analytical instrument will not be reported but will be kept in laboratory records for future reference.

The minimum QC summary information to be presented for each sample for each parameters or parameter group will include:

- Surrogate standard recovery results
- Matrix QC results (matrix spike/matrix spike duplicate, duplicate)
- Method blank results

EIM EDDs will be in accordance with the most recent version of the results spreadsheet submittal capable of being quickly uploaded into the Ecology EIM database.

## 5.0 REFERENCES

Ecology. 1995. Guidance for Remediation of Petroleum Contaminated Soils. November 1995.

Ecology. 2007. Model Toxics Control Act Cleanup Regulations. Washington Administrative Code (WAC) 173-340. November 2007.

EPA. 1983. Methods for chemical analysis of water and wastes.

EPA. 1984. NEIC procedures manual for the evidence audit of enforcement investigations by contractor evidence audit teams. Technical Report EPA-330/9-81-003-R. U.S. Environmental Protection Agency, Washington, D.C.

EPA. 1986. Test methods for evaluating solid waste, 3rd edition. U.S. Environmental Protection Agency, Washington, D.C. November 1986, as updated.

EPA. 1994a. USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. Office of Emergency and Remedial Response. USEPA, Washington, D.C.

EPA. 1994b. USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review. Office of Emergency and Remedial Response. USEPA, Washington, D.C.

EPA. 2001a. EPA Requirements for Quality Assurance Project Plans. EPA QA/R-5, EPA/240/B-01/003, March 2001.

EPA. 2001b. Guidance on Environmental Data Validation and Verification. EPA QA/G-8.

EPA. 2002. Guidance for Quality Assurance Project Plans. EPA QA/G-5. EPA/240/R-02/009, December 2002.

EPA. 2004. Contract Laboratory Program (CLP) Guidance for Field Samplers. Appendix B. EPA/540/R-00003. August 2004.

EPA. 2006. Guidance on Systematic Planning Using the Data Quality Objectives Process. EPA QA/G-4. February 2006.

HWA, 2008a Phase I Site Assessment, Hertz Rentals Property, Bothell, WA.. Prepared by HWA Geosciences, Inc. October 8, 2008

HWA, 2008b. Phase II Site Assessment, Hertz Rentals Property, Bothell, WA.. Prepared by HWA Geosciences, Inc. October 10, 2008

EXPLANATION OF SYMBOLS

- MW — AREA WIDE WELLS MONITORED
- UCCMW — ULTRA CUSTOM CARE CLEANERS WELL MONITORED
- MW — RIVERSIDE WELLS MONITORED
- MW — BOTHELL PAINT WELLS MONITORED
- MW — WELLS NOT MONITORED
- MW — DECOMMISSIONED WELLS
- SB — SOIL BORINGS
- CLEANUP CONFIRMATION SOIL SAMPLE > MTCA
- SOIL CLEANUP AREAS
- SITE
- HVOC PLUMES
- ORIGINAL PARCELS
- NEW PARCELS

N W E S

0 25 50 75 100

SR-527 BOTHELL WAY NE

NE 183rd ST

MAIN ST

ULTRA CUSTOM CARE CLEANERS

*Ultra Custom Care Cleaners HVOC Plume*

BOTHELL HERTZ SITE AND ARSENIC INSTITUTIONAL CONTROL AREA

BOTHELL SERVICE CENTER

BOTHELL LANDING SITE TPH INSTITUTIONAL CONTROL AREA

*Bothell Service Center HVOC Plume*

*Riverside HVOC Plume*

BOTHELL PAINT ARSENIC AND TPH INSTITUTIONAL CONTROL AREA

LOT D

BOTHELL LANDING

LOT E F G

LOT C

CITY ROW

CITY PARCEL

BOTHELL PAINT

BOTHELL HERTZ

BOTHELL LANDING ARSENIC INSTITUTIONAL CONTROL AREA

RIVERSIDE TPH SITE

RIVERSIDE HVOC SITE

HWA GEOSCIENCES INC.

BOTHELL LANDING SITE
BOTHELL WASHINGTON

SITE AND WELL LOCATIONS

DRAWN BY BFM
CHECK BY NN
DATE

FIGURE NO. 1

PROJECT NO. 2007-098 T2020

S:\2007 PROJECTS\2007-098-22 BOTHELL CROSSROADS\CAD 2007-098\12.15.2017\HWA 2007-098-21 T2020 (FIG 2).DWG <Fig 2> Plotted: 12/17/2017 10:43 AM

# APPENDIX A

# OF COMPLIANCE MONITORING PLAN

## Chain of Custody Form

## Field Sampling Data Sheet

HWA GEOSCIENCES INC.

21312 30th Drive SE, Suite 110, Bothell, Washington 98021-7010
Tel 425.774.0106 Fax 425.774.2714 www.hwageo.com

# Chain of Custody and Laboratory Anaylsis Request

DATE: _____

PAGE: ___ of ___

PROJECT NAME: _____ #: _____

SAMPLERS NAME: _____ PHONE: _____

SAMPLERS SIGNATURE: _____ DATE: _____

HWA CONTACT: _____ PHONE: _____

ANALYSIS REQUESTED

TURNAROUND TIME

☐ DAYS

☐ STANDARD

| HWA SAMPLE ID | DATE | TIME | MATRIX | LAB ID | # OF BOTTLE | EDD | REMARKS |
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| PRINT NAME | SIGNATURE | COMPANY | DATE | TIME | REMARKS |
|---|---|---|---|---|---|
| Relinquished by: | | | | | |
| Received by: | | | | | |
| Relinquished by: | | | | | |
| Received by: | | | | | |

**DISTRIBUTION: WHITE - Return to HWA GeoSciences; YELLOW - Retain by Lab; PINK - Retain by Sampler**

HWA GEOSCIENCES INC.
21312 30th Drive SE, Suite 110, Bothell, WA 98021
Tel: 425-774-0106 / Fax: 425-774-2714

# *FIELD SAMPLING DATA SHEET*

Project Name: _____ Well Number:_____

Project Number:_____ Sample Number:_____

Project Location:_____ Weather: _____

Client/Contact:_____ Date:_____

*WELL MONITORING:*

| Time | Pump Depth | Depth to Water | Measuring Point (TOC?) | Measuring Point Elevation | Water Level Elevation | Gallons in Well (Case Volume) |
|---|---|---|---|---|---|---|
| | | | | | | |

(2" dia=0.163 gal/ft)
(4" dia=0.653 gal/ft)

*WELL PURGING:*

| Time | Method | Gallons | Case Volume | pH | Conductivity | Temperature | Dissolved Oxygen | | |
|---|---|---|---|---|---|---|---|---|---|
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*WELL SAMPLING:*

| Time | Sampling Method | Sample Analysis | Container Number | Container Volume | Container Type | Field Filtered (Y/N) | Preservative | Iced (Y/N) |
|---|---|---|---|---|---|---|---|---|
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*COMMENTS/NOTES:* (Include equipment used: Bailers, Filters, Well Probe, pH/Conductivity, Meter, etc.)

Total # of Bottles:_____ Sampler**:**_____ Signature:_____