AMERICAN BOILER WORKS/BAYSIDE MARINE SITE
WEST MARINE VIEW DRIVE AND 13TH STREET
EVERETT, WASHINGTON
SAMPLING AND ANALYSIS PLAN

Project No. 2013-066

July 18, 2014

Prepared For

Port of Everett

HWA GEOSCIENCES INC.

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SAMPLING AND ANALYSIS PLAN

1.0 INTRODUCTION

This Sampling and Analysis plan provides the scope and rationale for HWA GeoSciences Inc. (HWA's) field sampling efforts associated with a site investigation conducted for the Port of Everett at the American Boiler Works (ABW)/Bayview Marine (BM) Voluntary Cleanup Program (VCP) site in Everett, Washington (Site).

HWA prepared this plan in accordance with our understanding of the project, and Chapter 173-340-820 WAC in the Washington State Model Toxics Control Act (MTCA) Cleanup Regulations, and specific information requested by the Washington State Department of Ecology (Ecology). The body of this plan outlines our field sampling and laboratory analytical methods.

1.1 PURPOSE AND OBJECTIVES

We understand that soil remediation and soil and ground water characterization associated with hazardous materials releases have been completed at the Site, but that additional characterization has been requested by the Washington Department of Ecology. The purpose of this investigation is to 1) confirm the absence of any known contamination on the site exceeding current cleanup levels, and 2) to monitor ground water level and quality via permanent monitoring wells as requested by Ecology, in order to characterize areas adjacent to existing cleanup extents.

Sampling locations, depths and analytes are summarized in Table 1.

Table 1
Sampling Locations, Depths and Analytes

Boring ID	Exploration depth (ft bgs)	Soil sampling intervals*	Analytes	Complete as well
Soil				
A**	5	0-1	NWTPH-HCID***, MTCA Metals, cPAHs	Yes
		1-2	NWTPH-HCID, MTCA Metals, cPAHs	
		2-3	NWTPH-HCID, MTCA Metals, cPAHs	
B	5	0-1	NWTPH-HCID, MTCA Metals, cPAHs	No
		1-2	NWTPH-HCID, MTCA Metals, cPAHs	
		2-3	NWTPH-HCID, MTCA Metals, cPAHs	
C	5	0-1	NWTPH-HCID, MTCA Metals, cPAHs	Yes
		1-2	NWTPH-HCID, MTCA Metals, cPAHs	
		2-3	NWTPH-HCID, MTCA Metals, cPAHs	
D****	5	0-1	Archive	Yes
		1-2	Archive	
		2-3	Archive	
Contingent borings (7)	5	0-1	Archive	No
		1-2	Archive	
		2-3	Archive	
Ground Water***				
A	15		NWTPH-Dx, MTCA Metals (dissolved)	
C	15		NWTPH-Dx, MTCA Metals (dissolved)	
D	15		NWTPH-Dx, MTCA Metals (dissolved)	
P-26			NWTPH-Dx, MTCA Metals (dissolved)	Existing well
P-27			NWTPH-Dx, MTCA Metals (dissolved)	Existing well

* Sampling intervals are measured from below bottom of concrete slab and base-course fill
** Final Boring ID's will be determined with Port of Everett input
*** Additional analyses contingent on initial results
**** Laboratory analysis contingent on field screening
***** Two initial rounds, more if needed

1.2 PROJECT ORGANIZATION

Personnel involved with this project and roles are listed below:

- Arnie Sugar, HWA project manager (425) 774-0106, cell (206) 794-3130
- Rick Bagan, Laboratory project manager, ALS Laboratories (425) 356-2600
- Anisa Harnden, ESN Northwest, Geoprobe subcontractor, (360) 459 4670
- Elise Gronewald, Port of Everett project engineer, (425) 388-0630, cell (425) 922-8032

1.3 PROJECT SCHEDULE

A proposed project schedule is shown below:

Week	0	1	2	3	4	5	6	7
Schedule subs	xxxxxxxx	.	.	.	.	.	.	
Underground utilities	.	xxxx	.	.	.	.	.	.
Drilling	.	.	xx.	.	.	.	.	
Lab analysis	.	.	.	xxxxxxxxxxxxxx	.	.	.	.
Preliminary Reporting		.	.	.	xxxxxxxxxxxxxxxx		.	.

The subsequent ground water sampling round will take place in September, with the final technical memorandum prepared within three weeks of laboratory analytical report receipt.

1.4 SITE LOCATION

The Site is located adjacent west of West Marine View Drive between Port Gardner Way and 14th Street (Figure 1).

1.5 BACKGROUND

The Site has undergone several investigations and remedial actions. The Site was formerly part of the larger North Marina Site (VCP reference number NW1249), but was removed from the VCP and split into multiple sites under the Puget Sound Initiative (PSI). The Site was accepted back into the VCP in March, 2014 and is assigned VCP Number NW2842.

The ABW Plant I formerly was developed with a main manufacturing building, which occupied the majority of the western two thirds of the site. The building was built in the 1960s, and expanded in the 1970s. Although no USTs were known at the site, the milling and manufacturing at the site used significant quantities of cutting oil. The building was demolished in 2009.

The BM site formerly included a gravel boatyard, a dry stack building that was used for covered storage of boats, and a combination maintenance shop and office building. The dry stack building was constructed between 1961 and 1965 and the office/shop building was built between 1970 and 1971; both were demolished in early 2008. Two USTs were removed from the site in 1991, and

soils exceeding state cleanup levels in effect at that time were left in place. Soil remediation took place in 1991, and the site was reportedly cleaned up to the applicable standards.

Several Phase II ESAs and supplemental investigations took place between 2001 and 2014 to further characterize the site. Soils and ground water exceeding MTCA cleanup levels were identified at several locations. Contaminants of concern included petroleum hydrocarbons and metals.

The site is currently leased for storage.

2.0 SAMPLING

The scope of work for the environmental assessment is summarized below:

1) Review available data
2) Prepare this Sampling & Analysis Plan (SAP), and health and safety plan
3) Locate underground utilities
4) Advance and sample soil borings, install monitoring wells.
5) Collect soil and ground water samples at selected locations and depths
6) Submit samples for laboratory analysis
7) Prepare assessment report and recommendations

Planned site sampling is described in the following sections

2.1 SOIL BORINGS

All borings and wells will be drilled and installed according to Ecology Minimum Standards for Construction and Maintenance of Wells (Chapter 173-160 WAC).

2.1.1 Underground Utilities/Site Access

HWA will attempt to locate underground utilities by calling the Utilities Underground Location Center before drilling. HWA will also subcontract a private locating service (APS, Inc.) to attempt to locate and mark underground utilities at proposed boring locations. PVC and concrete utilities can not be located.

2.1.2 Soil Boring And Sample Designation

Soil borings will be designated as per Table 1. Soil samples will be designated with the boring number followed by the sample depth. For example, HWA-B2-10 would indicate the soil sample collected at 10 feet below ground surface (bgs) at soil boring HWA-B2. The depth designation is for the top of the sample, and the sample interval shall be denoted in the field logs.

Ground water samples will be numbered using the well designation (ex. P-27-W).

2.2.3 Direct-push Soil Boring and Sampling

HWA will employ a subcontracted mobile direct-push sampling device (e.g., Geoprobe) to collect soil samples. Under subcontract to the Port of Everett, ESN Northwest (ESN) will drill soil borings at the approximate locations shown in Figure1. The device consists of a hydraulic/ pneumatic drive assembly mounted on a pickup truck. Steel pipe (1.25-2 inch diameter) is driven into the ground using a pneumatic impact driver (air hammer), then withdrawn. Soil cores within a glycol modified polyethylene terephthalate (PETG) inner sleeve can then be retrieved from the sampler and removed for logging and sampling.

Soil cuttings and all investigation-derived waste will be disposed of off site. Three characterization soil borings and seven contingent soil borings will be completed at the site. The characterization samples are shown on Figure 1. Contingent soil boring locations will be determined in the field with consultation with Port of Everett personnel. We anticipate completing all probe locations in one day. Maximum probe depth will be 5 feet, depending on soil recovery. We will collect continuous soil core samples, and submit soil samples to a laboratory for analysis.

All field work will be supervised by an HWA geologist or engineer. HWA field staff will collect continuous soil samples. At each sampling interval, HWA will log the soil samples and obtain and record pertinent information including soil sample depths, stratigraphy, ground water occurrence, and any visual or olfactory observations regarding the presence of contamination. HWA will log the sample for lithology and field screen the samples for organic vapors by headspace analysis using a photoionization detector (PID). For each boring, samples with the highest level of organic vapors and/or most discernible visual/olfactory contamination will be shipped to the laboratory for chemical analysis. In the absence of field screening indications, the sample immediately above ground water will be submitted for analysis.

HWA will deliver samples to the laboratory within 24 hours of sampling and will employ full chain-of-custody procedures to allow tracking and handling of the samples.

2.2.4 Ground Water Monitoring Wells

The Port of Everett will retain a Washington-licensed drilling contractor to complete three shallow monitoring wells at locations surrounding the former UST excavation using direct-push ('GeoProbe') drilling equipment.

Wells will be constructed of one-inch PVC casing and manufactured pre-packed screens. Wells will be completed to an estimated depth of 15 feet below ground surface, based on site observations and ground water elevation. The wells will be developed and wellhead elevations will be surveyed using an optical transit and stadia.

HWA will collect two rounds of ground water samples from the three new monitoring wells and existing monitoring wells P-26 and P-27 (Figure 1). Ground water samples will be collected utilizing low-flow methodology. Samples will be collected with a peristaltic pump via dedicated disposable HDPE tubing. Field parameters (pH, specific conductivity, temperature, and dissolved

oxygen) will be measured at intervals through a flow-through cell. Upon stabilization of parameters, samples will be collected. Samples for dissolved metals will be field-filtered through 0.45 μm filters. The samples will be collected in precleaned laboratory-provided sample containers and placed in a cooler filled with 'blue ice' and submitted for analysis to a Washington Department of Ecology-accredited analytical laboratory.

HWA will measure ground water depths, calculate ground water elevations, and prepare ground water gradient maps for each sampling round.

2.2.5 Borehole Abandonment

After all soil borings reach their maximum depth and are sampled, the holes will be grouted to the ground surface using hydrated granular or powdered bentonite. The drillers will also use concrete or asphalt to patch any boreholes installed through paved surfaces.

2.2.6 Decontamination Procedures

To prevent potential cross-contamination of samples, HWA will maintain appropriate decontamination procedures. Between sampling intervals in each boring, we will wash all sampling devices in a detergent solution, rinse with tap water and then rinse again with deionized water. Drillers will steam clean all probe rods, and other downhole tooling between boring locations.

2.3 FIELD SCREENING

HWA will screen soil samples by photoionization detector (PID) headspace analysis. Although the PID is not capable of quantifying or identifying specific organic compounds, this instrument is capable of measuring relative concentrations of a variety of organic vapors. The geologist/ engineer collecting samples will place approximately two ounces of soil in a resealable (i.e. ziplock) plastic bag with ample air headspace. After a minimum of five minutes at ambient temperature, the sampler will agitate the sample for ten seconds, insert the PID probe through a small opening in the plastic bag, and record the highest reading within ten seconds.

2.4 SOIL ANALYSIS

HWA will submit the soil and ground water samples to a Washington Department of Ecology-accredited analytical laboratory for analyses for one or more of the following analytes (based on preliminary data) by using the following test methods:

- Hydrocarbon Identification by Washington State Method NWTPH-HCID
- Gasoline Range Hydrocarbons and aromatic Hydrocarbons (BETX) – Washington State Method NWTPH-G/BETX (contingent on HCID results)
- Diesel and Oil-Range Hydrocarbons – Washington State Method NWTPH-Dx (contingent on HCID results)
- Carcinogenic Polynuclear aromatic hydrocarbons (cPAHs) – EPA Method # 8270 SIM

- MTCA Metals (Arsenic, Cadmium, Chromium, Lead, and Mercury) by EPA Method #6010/#7471A

HWA will submit the samples for standard turnaround time analysis (5 days). Follow-up analyses, based on initial analytical results may result in a total turnaround time of up to two weeks.

The sample bottle requirements are as follows:

Bottle Type	Method	Holding Time
VOAs – see below	NWTPH-G BTEX	see below
8 oz. Glass	NWTPH-Dx cPAHs EPA # 8270SIM Metals #6000/7000 series	14 days

After collection, the samples will be labeled, placed in a cooler with ice, and shipped to ALS Laboratories (ALS) for analysis.

2.4.1 Method 5035A for Collection of BTEX/VOC Soil Samples

Bottle Type	Method	Holding Time
(1) tared VOA (non-preserved)* (1) 4 oz. glass jar (moisture)	NWTPH-G / 5035A	14 days

* - if sample containers can not be delivered to lab within 48 hours,
** - if sample containers can not be delivered to lab within 48 hours

VOAs are pre-weighed (tared) at the lab
- Do not add any labels, tape, etc.
- Keep the same cap with each VOA

Collect Core Sample
- Geoprobe liner - slice open acetate liner, core immediately after opening

Soil types:
- Cohesive granular - use core
- Cemented (e.g. till) - break up with stainless steel spoon, place in VOA & cap as soon as possible
- Non cohesive (won't stay in core) - place in VOA & cap as soon as possible

Extrude core into VOA
- Wipe threads with clean tissue or dry wipe

- Cap VOA
- Label - ball point pen (e.g., write in the rain) only, no markers

Note in field notebook:

- Soil type, moisture
- Any bias e.g., gravels, organics (avoid both in core sample)
- Weather (temp, humidity, wind)
- Coring method used
- Preservation and storage method used

2.5 GROUND WATER SAMPLING

Ground water samples will be collected from the wells. Ground water samples will be retrieved using a peristaltic pump. New pump tubing will be used at each location.

Wells will be purged before sample collection to obtain groundwater samples that are representative of the formation water. Wells points will be purged and sampled using low-flow purging methods. Sampling staff will measure groundwater levels to the nearest 0.01-foot using a decontaminated electronic well probe prior to collection of samples. Prior to collection of groundwater 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 (0.13 gallons/minute). At a minimum, two pump and tubing volumes will be purged (1/2" I.D. tubing = 0.010 gallon/lineal foot, 0.17" I.D. tubing = 0.001 gallon/lineal foot = 5 ml/lineal foot). Samples will be collected once the parameter values have stabilized over the course of three sets of measurements as follows:

specific conductance	10 μS/cm
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 sample. New tubing will be used at each location.

Dissolved metals samples will be filtered through a disposable 0.45-micron filter at the time of sample collection. The filters will attach directly to the discharge tube of the sampling pump. The filter must be changed between wells, or more frequently if clogging occurs. Samples that have been field-filtered must be noted on the Chain-of-Custody forms in the comments section.

2.5.1 Ground Water Analysis

We will submit ground water samples to the analytical laboratory for the following analyses:

- Diesel and Oil-Range Hydrocarbons – Washington State Method NWTPH-Dx
- Dissolved MTCA Metals (Arsenic, Cadmium, Chromium, Lead, and Mercury) by EPA Method #6010/#7471A

The sample bottle requirements are as follows:

Bottle Type	Analytes	PRESERVATIVE
1 liter amber glass	NWTPH-Dx	none
500 ml poly	Dissolved metals (filtered)	HNO_3 to pH<2

After collection, the samples will be labeled, chilled in a cooler to 4^{o}C, and shipped to ALS for analysis. Samples will be submitted for standard laboratory turnaround time (5-10 days).

2.6 QUALITY ASSURANCE/QUALITY CONTROL

Samples will be collected and analyzed with sufficient quality assurance/quality control (QA/QC) to ensure representative and reliable results. The overall QA objective for this investigation is to ensure that all laboratory and field data on which decisions are based are technically sound, statistically valid, and properly documented. There are two parts to the QA/QC program for this project: field and laboratory.

Field QA/QC includes proper documentation of field activities and sampling/handling procedures, as described in Section 2.5. Field QA/QC samples will consist of the following:

SOIL
- None

GROUND WATER
- 1 field duplicate for ground water, if sample volume is sufficient

Field Duplicates are used to confirm analytical results from a given sample point. Duplicate samples are collected in the field using a matching set of laboratory-supplied bottles and sampling from the selected well, as requested. Each duplicate should be sampled by alternating between the regular and the duplicate sample bottles, proceeding in the designated sampling order (VOCs first). The location where the duplicate is collected must be identified on the field sampling data sheet. All duplicates shall be blind-labeled (i.e., the well designation is not listed on the sample bottle or Chain-of-Custody form). Once a duplicate is collected, it is handled and shipped in the same manner as the rest of the samples. Duplicate results will be reported in the laboratory results as separate samples, using the designation DUP-(#).

Split samples are collected when a location is sampled with a third party. Split samples are not anticipated for this investigation.

Trip blanks are used to detect contamination that may be introduced in bottle preparation, in transit to or from the sampling site, or in the field. Trip blanks are samples of volatile-organic-free, laboratory-quality water (Type II reagent grade) that are prepared at the laboratory. They remain with the sample bottles while in transit to the site, during sampling, and during the return trip to the laboratory. Trip blank sample bottles are not opened at any time during this process. Trip blanks are to be reported in the laboratory results as separate samples, using the designation TB-(#). Each sample cooler that includes bottles for VOC analysis must include a trip blank, whether it was requested or not.

Field blanks are used to detect contamination that may be introduced in the field. Field blanks are not anticipated for this investigation.

Equipment blanks are used to detect residue from decontaminated equipment. Equipment blanks are not anticipated for this investigation.

Laboratory QA/QC analyses provide information about accuracy, precision, and detection limits. Method-specific QA/QC samples may include the following, depending on the analysis:

- Method blanks
- Duplicates
- Instrument calibration verification standards
- Laboratory control samples
- Surrogate spiked samples
- Performance evaluation QC check samples

2.6.1 Data Evaluation

Data evaluation will include checking holding times, method blank results, surrogate recovery results, field and laboratory duplicate results, completeness, detection limits, laboratory control sample results, and Chain-of-Custody forms.

2.7 FIELD DOCUMENTATION AND CHAIN-OF-CUSTODY

The following sections describe the recording system for documenting all site field activities, and the sample chain-of-custody program.

2.7.1 Field Log Book

An accurate chronological recording of all field activities is vital to the documentation of any environmental investigation. To accomplish this, field team members will maintain field log books providing a daily record of significant events, observations, deviations from the sampling plan and measurements collected during the field activities.

2.7.2 Sample Identification

Following sample collection, field personnel will affix labels to each sample container. Samplers will use waterproof ink, plastic bags, or clear tape to ensure labels remain legible even when wet. Samplers will record the following information on the labels:

- Project name and number
- Sample identification number
- Date and time of collection
- Required test methods
- Name of sample collector

2.7.3 Chain-Of-Custody Record

The objective of the chain-of-custody program is to allow the tracking of possession and handling of individual samples from the time of field collection through laboratory analysis. Once a sample is collected, it becomes part of the chain-of-custody process. A sample is "in custody" when (1) it is in

someone's possession, (2) it is within visual proximity of that person, (3) it is in that person's possession, but locked up and sealed (e.g., during transport), or (4) it is in a designated secure sample storage area. Sampling staff will complete a chain-of-custody record which will accompany each batch of samples. The record will contain the following information:

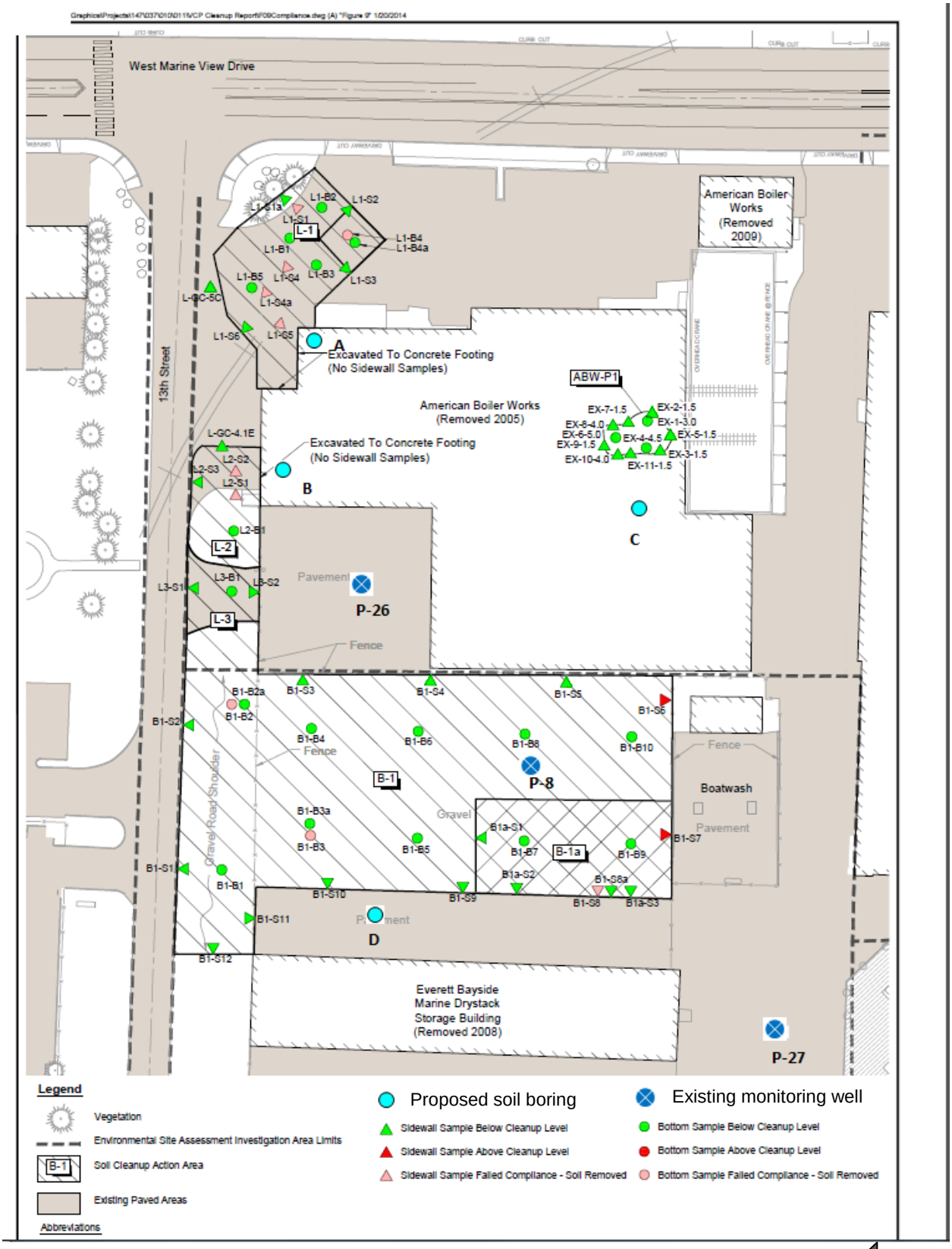
- Project name and number
- Names of sampling team members
- Requested testing program
- Required turnaround time
- Sample number
- Date and time collected
- Sample type
- Number of containers
- Special Instructions
- Signatures of persons involved in the chain of possession

When sample custody is transferred to another individual, the samples must be relinquished by the present custodian and received by the new custodian. This will be recorded at the bottom of the chain-of-custody report where the persons involved will sign, date and note the time of transfer.

Sampling team members will keep sample coolers in locked vehicles while not in active use or visual range. If couriers are used to transport samples, chain of custody seals will be affixed to sample coolers.

3.0 HEALTH AND SAFETY

HWA personnel conducting this field program are required to follow the health and safety protocol presented in the HWA site specific Health and Safety Plan. Subcontractors and other authorized visitors to the site are responsible for their own health and safety. The Health and Safety Plan will be made available to subcontractors and other site visitors who request it. Health and Safety precautions will be communicated to subcontractors by HWA personnel in site safety briefings at the beginning of each field day. To acknowledge review and comprehension of this plan, HWA personnel must sign the appropriate section included in the back of the document.



SOIL AND GROUND WATER SAMPLING LOCTIONS

BAYSIDE MARINE VCP SITE
PORT OF EVERETT
EVERETT, WASHINGTON

FIGURE NO. 1

PROJECT NO. 2013-066

HWA GEOSCIENCES INC.

APPENDIX A

CHAIN OF CUSTODY FORM
FIELD SAMPLING DATA SHEET

HWA GEOSCIENCES INC.
19730 64th Ave. W., Suite 200, Lynnwood, WA 98036 (425)774-0106
4500 Kruse Way, Suite 300, Lake Oswego, OR 97035 (503)675-2424

Chain of Custody and Laboratory Analysis Request

DATE: _____

PAGE: _____ of _____

PROJECT NAME: _____ #: _____

SITE CODE: _____

SAMPLERS NAME: _____ PHONE: _____

SAMPLERS SIGNATURE: _____

HWA CONTACT: _____ PHONE: _____

HWA SAMPLE ID	DATE	TIME	MATRIX	LAB ID	# OF BOTTLE	ANALYSIS REQUESTED	REMARKS

PRINT NAME	SIGNATURE	COMPANY	DATE	TIME	REMARKS
Relinquished by:					
Received by:					
Relinquished by:					
Received by:					

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

HWA GEOSCIENCES INC.
19730 64th Avenue West, Suite 200 Lynnwood, WA 98036
Tel: 425-774-0106 / Fax: 425-774-2714 / E-Mail: hwa@hongwest.com

FIELD SAMPLING DATA SHEET

Project Name: _____ Well Number: _____
Project Number: _____ Sample Number: _____
Project Location: _____ Weather: _____
Client/Contact: _____ Date: _____

WELL MONITORING:

Time	Well Depth	Depth to Water	Measuring Point (TOC?)	Measuring Point Elevation	Water Level Elevation	Gallons in Well (Pore Volume)

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

WELL PURGING:

Time	Method	Gallons	Pore Volumes	pH	Conductivity	Temperature		

WELL SAMPLING:

Time	Sampling Method	Sample Analysis	Container Number	Container Volume	Container Type	Field Filtered (Y/N)	Preservative	Iced (Y/N)

COMMENTS/NOTES:

(Include equipment used: Bailers, Filters, Well Probe, pH/Conductivity Meter, etc.)

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