Port of Chelan County

Former Cashmere Mill Site Removal Action Sampling and Analysis Plan/Quality Assurance Project Plan

February 2013

Prepared by RH2 Engineering, Inc.

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1. Introduction and Objectives

This combined Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP) was prepared by RH2 Engineering, Inc., (RH2) with the support of Maul Foster & Alongi, Inc., (MFA) on behalf of the Port of Chelan County (Port). This SAP/QAPP describes procedures for wood waste and soil field screening, wood waste and soil sampling, and groundwater sampling that will be conducted during implementation of the wood waste and petroleum contaminated soil (PCS) removal action at the Port's former mill site in Cashmere, Washington. This SAP/QAPP provides guidance for field and laboratory analysis activities and quality assurance objectives to be performed and tracked for the project. This SAP/QAPP is an appendix to the Cashmere Mill Site Removal Action Work Plan (Work Plan), prepared by RH2 Engineering in January 2013. The Work Plan describes removal action activities to meet the project objectives, summarizes background information, defines field activities and specifications, and identifies applicable regulatory requirements necessary to complete the removal action.

1.1. Background

The Port owns the former Cashmere Mill properties (**Figure 1**), and intends to transfer the site to a prospective purchaser (Crunch Pak, of Cashmere, Washington) that intends to redevelop the site for commercial use as fruit storage warehouse and fruit bin storage site. As a condition of purchase, Crunch Pak requires removal of all wood waste-related materials resulting from former mill activities from the developable areas of the site, removal of known PCS exceeding associated cleanup levels, and backfilling the site with structural import fill to regrade the site and to improve drainage. The Port intends to conduct wood waste and PCS removal actions and backfill the excavated areas (the removal action) in 2013.

The Port has conducted environmental site assessments at the site since 2007. Reports describing the activities and findings of the assessments pertaining to the nature and extent of wood waste and PCS at the site are summarized and referenced in the Work Plan.

1.2. Project Description

The field screening and confirmation sampling procedures and frequencies presented in this SAP/QAPP will provide characterization and confirmation data to support verification of removal action objectives at the site, which include removal of all of the wood waste at the developable areas of the site, as well as removal of all PCS at two or more sites containing total petroleum hydrocarbons (TPH) concentrations exceeding Model Toxics Control Act (MTCA) Method A Cleanup Levels. Non-contaminated wood waste and fill will be transported off site for reuse or disposal. Any soil or wood waste containing contaminants that exceed MTCA Cleanup Levels and discovered during removal actions will be removed, and soil confirmation samples from all excavated areas will be collected to confirm removal action objectives. Wood waste and soil stockpile sampling will support demonstration of compliance with acceptability criteria at the designated off-site disposal facility for any contaminated wood waste (CWW) and PCS excavated during the removal action. Following acceptance of characterization data at the disposal facility, the stockpiled PCS and CWW will be transported directly to the disposal facility. Upon verification of obtaining removal action objectives, the excavations will be backfilled with structural import fill to support site redevelopment.

Characterization sampling will also support the appropriate disposal of groundwater generated during construction dewatering that will facilitate excavation and removal of wood waste below the groundwater table. Characterization will demonstrate compliance with acceptability criteria of the permitted water treatment facility or for permitted on-site disposal. Any stormwater that collects into the excavation during the removal action will be discharged with dewatering discharge. Groundwater monitoring wells will be constructed and sampled to characterize groundwater conditions after removal actions are complete in order to characterize groundwater conditions upgradient (or background) and downgradient of known and discovered PCS and CWW areas at the site.

This SAP/QAPP includes procedures for field screening and collection of the confirmation and characterization samples, sampling methods, documentation of field activities, and laboratory analysis to ensure data quality objectives.

1.3. Project Objectives

The objectives of the removal actions include excavating and removing all wood waste at developable areas of the site, excavating and removing all PCS at the site exceeding MTCA Method A Cleanup Levels, excavating and removing all CWW at the site exceeding MTCA Method B Cleanup Levels, and backfilling the excavation with verified clean structural import fill.

The objectives of the removal actions also include characterizing groundwater conditions after removal actions to obtain sufficient information to establish natural upgradient/background conditions as well as groundwater conditions downgradient of known and discovered PCS and CWW, evaluate potential manmade effects on natural background conditions, and compare on-site groundwater water quality conditions to groundwater quality criteria. Characterization will be sufficient to determine whether the site groundwater meets MTCA Method A and/or B Cleanup Levels or if additional monitoring or groundwater remediation is warranted.

2. Removal Action Organization and Schedule

The Port, and its consultants at RH2 and the Washington State Department of Ecology (Ecology), are guiding and implementing this removal action. An Ecology-accredited laboratory will provide laboratory services. RH2 environmental staff is responsible for checking, downloading, and calibrating the field instruments, and collecting and transporting samples under chain of custody to the laboratory representatives. RH2 will evaluate all water quality and quantity data, using methods approved by Ecology.

2.1. Organization

Key personnel involved in this project and their responsibilities are listed below.

Laura Jaecks, Port of Chelan County, is the owner's representative. The Port is responsible for development of documents and implementation of field activities necessary to meet the removal action objective, and for interacting with interested public and stakeholders. Phone: (509) 661-3118. Email: laura@ccpd.com.

Karen Kornher, P.E., RH2, Engineering, Inc., is the project manager and agent between the sampling staff at RH2 and the Port of Chelan County. Phone: (509) 886-6764. Email: kkornher@rh2.com.

Steve Nelson, L.G., L.HG., L.E.G., RH2, Engineering, Inc., is the project lead for the development of this work plan and analysis of data for the final project report. Phone: (425) 951-5406. Email: snelson@rh2.com.

Mary Monahan, Central Regional Office, Department of Ecology Toxics Program, is responsible for Ecology's review and approval of the work plan and construction-related documents, and will advise on sampling requirements, quality assurance, and quality control issues during project implementation and assessment. Phone: (509) 454-7840. Email: mmon461@ecy.wa.gov.

The primary contact for laboratory coordination for sample management and data quality will be determined upon selection of the contract lab.

2.2. Project Schedule

The wood waste and PCS removal action will begin in March 2013 and is expected to conclude in October 2013. Field and laboratory work will proceed concurrently with the removal action. Groundwater characterization will begin after the removal actions are complete, or as the site become finalized, with the installation of monitoring wells and will proceed through at least 1 year or 4 quarters of sampling and laboratory analysis. A final wood waste and PCS removal action report will be completed in November 2013. Quarterly groundwater monitoring summaries will begin in July 2013 and a final groundwater monitoring report will be completed in July 2014.

3. Quality Objectives

Procedures in this SAP/QAPP are used to collect representative samples and field measurements of the highest possible quality. Usability of the data will be based on both quantitative (precision, accuracy/bias, and completeness) and qualitative (representativeness and comparability) quality assurance objectives.

Measurement quality objectives (MQOs) specify how good the data must be in order to meet the objectives of the project. MQOs are the performance or acceptance thresholds or goals for the project data, based primarily on the data quality indicators precision. In practice, these are often the precision, bias, and accuracy guidelines against which laboratory indicators and field quality control results are compared. To confirm that project MQOs for precision and accuracy are achieved, analytical results for field and laboratory quality control samples will be evaluated. Quality control results that do not meet target values will be qualified during data validation, and their limitations will be noted in the data quality and usability report for the project. To ensure comparability and representativeness of the laboratory data, standard instrumentation will be used for the analyses and the instruments will be properly calibrated and maintained.

Precision is a measure of the variability in the results of replicate measurements due to random error. Random errors are always present because of normal variability in the many factors that affect measurement results. Precision can also be affected by the variations of the actual concentrations in the media being sampled. The closer the measured values are to each other, the more precise the measurement process. Precision error may affect data usefulness. Good precision is indicative of relative consistency and comparability between different samples. Precision will be expressed as percent relative standard deviation (% RSD) between sets of duplicate field samples. Project MQOs for laboratory analyses are contained in **Table 1**. Analytical sample bias will be largely investigated at the laboratory where samples will be analyzed, following a laboratory quality assurance process.

Table 1. Project Measurement Quality Objectives for Laboratory Analyses

Parameter	Check Standards/Lab Control Standards (% Recovery Limits)	Precision for Duplicate Samples (RPDs)	Matrix Spike Recoveries
Gasoline-Range Organics	80-120%	±50%	80-120%
Diesel and Oil-Range Organics	80-120%	±50%	80-120%
BTEX, EDB, EDC	75-125%	±25%	75-125%
Chlorophenols, PAHs, cresols, phenols	Varies - 15-150%	±40%	Varies - 15-150%
Metals:	80-120%	±20%	75-125%

Arsenic, Chromium, Copper, Lead			
Volatile Hydrocarbons (VPH)	80-120%	±50%	80-120%
Extractable Hydrocarbons (EPH)	Varies: 21-100% to 45-137%	±50%	Varies: 21-100% to 45-137%

RPD – Relative Percent Difference
BTEX – Benzene, Toluene, Ethylbenzene, Total Xylenes
EDB – Ethylene Dibromide
EDC – Ethylene Dichloride

4. Field Activities

4.1. Soil and Wood Waste Field Screening

Concurrent with the inspection of wood waste removal activities, the composition of the wood waste and the quality of the native soil underlying excavated wood waste will be inspected for evidence of stains, sheens, solid waste, and odor. Areas of exposed wood waste and soil exhibiting potential contamination during inspection will be field screened.

The extent of PCS removal in the areas identified for PCS removal (Site 2 and Site 4; Figures 1, 2, and 3 in Work Plan) and in areas where PCS or CCW has been discovered during wood waste removal actions will be guided by field screening of exposed soil and wood waste during removal.

Field screening will consist of observing exposed soil and wood waste for evidence of stains or sheens, or unusual color, detection of any odors, and collecting representative samples of the upper 6 to 12 inches of soil or a representative sample of potentially contaminated wood waste using clean stainless steel spoons for organic vapor analysis using a Photoionization Detector (PID). A portion of the sample will be placed in an airtight bag for a minimum of 3 minutes, warmed, and then the air in the bag will evaluated for volatile organic compounds (VOCs) using a PID following manufacturers procedures. Field screening locations for which a PID reading exceeding 10 parts per million (ppm) above background observations will be located using a portable GPS unit, and the sampling observations, details and results of field screening will be recorded in a field notebook. All sample locations shall be located in this manner.

Wood waste or soil samples indicating the potential presence of VOC concentrations of greater than 10 parts per million (ppm) in air in samples tested with the PID or containing visible stains, sheens from a sheen test, or moderate to strong odors will be considered contaminated. PCS and CWW will be excavated and stockpiled on site for characterization and off-site disposal.

4.2. Soil Confirmation Sampling Rationale

Collection and analysis of confirmation soil samples from native soil exposed during wood waste removal will provide verification of the presence/absence of soil containing TPH and wood treatment chemical concentrations exceeding cleanup levels below wood waste. Wood treatment chemicals (WTCs) include polynuclear aromatic hydrocarbons (PAHs), methylphenols (cresols), chlorophenols, metals (arsenic, chromium, copper, lead), and TPH as gasoline and diesel/oil.

Collection and analysis of confirmation soil samples from native soil exposed during PCS and CWW removal actions will provide verification of the presence/absence of soil containing TPH and WTCs concentrations exceeding cleanup levels below these areas.

4.3. Soil Confirmation Sampling at Grid Locations

Concurrent with the inspection of wood waste removal activities, the native soil underlying excavated wood waste will be exposed and accessible for grid sampling (Figure 4 of the Work Plan). Representative samples of the upper 6 to 12 inches soil will be collected using clean stainless steel spoons and placed into laboratory-provided containers for semi-volatile organic compounds (SVOCs) and metals analysis. Representative samples of the upper 6 to 12 inches soil will be collected using the U.S. Environmental Protection Agency (EPA) Method 5035 for VOC analysis (see Ecology Fact Sheet 04-09-087). Samples will be analyzed for TPH as gasoline, TPH as diesel/oil, BTEX, and for WTCs. If TPH as gasoline is detected, the sample will also be analyzed for EDB/EDC, MTBE and total lead. The samples will be analyzed on a 24-hour turnaround schedule. **Table 2** in Section 4.6 summarizes sample management details and Section 5 summarizes laboratory methods for soil confirmation sampling. If laboratory results indicate that TPH or WTC concentrations in soil exceeds cleanup levels, soil removal actions and subsequent confirmation sampling will be conducted at the grid location. If laboratory results are below cleanup levels, the excavated area will be backfilled with clean imported structural fill or clean native soil.

If confirmation sample analytical results indicate an exceedance of an associated cleanup level, then four additional soil samples (referred to as "stepped out" samples) will be collected from the base of the excavation. The stepped out samples should generally be spaced evenly and located approximately 20 to 40 feet from the original confirmation sample location based on field conditions. These four stepped out soil samples will only be analyzed for the constituent(s) that indicated a cleanup level exceedance. If the analytical results from the stepped out samples indicate compliance with associated cleanup levels, then the area within the boundaries of the stepped out samples will be excavated and a confirmation sample will be collected from the new excavation. This confirmation sample will be analyzed for the constituent(s) that indicated a cleanup level exceedance. If the analytical results of the samples indicate an exceedance of the associated cleanup level, then consider continuing the process of stepping out or excavate the remaining area of the grid being sampled. This process could continue until confirmation samples indicate compliance with associated cleanup levels as site conditions allow.

4.4. Soil Confirmation Sampling for Known and Discovered PCS and CWW

PCS removal at Site 2, Site 4, and any discovered PCS or CWW sites will be guided by field screening results to establish the limits of probable contamination. Representative soil samples shall be collected up 6 to 12 inches below the excavation base and at the vertical center of each excavation sidewall using clean stainless steel spoons for SVOCs and metals analysis and using EPA Method 5035 for VOC analysis and placed into laboratory-provided containers. One sample will be collected for every 100 square feet of excavation floor and every 10 linear feet of excavation sidewall. For side walls greater than 20 feet in length samples shall be collected every 20 linear feet. Samples at locations where PCS has been removed at Site 2 and Site 4 will be collected and analyzed for TPH as diesel/oil and BTEX. Samples of soil at locations where PCS has been discovered will be collected and analyzed for TPH as gasoline, TPH as diesel/oil, BTEX (and EDC/EDB, MTBE

and total lead if gasoline is detected). Samples of soil at locations where CWW has been removed will be collected from the excavation base and analyzed for TPH as gasoline, TPH as diesel/oil, BTEX and WTC (and total lead, EDC/EDB and MTBE if gasoline is detected).

If former sumps, drywells, or catch basins are encountered during removal actions, the structure will be removed and underlying soil will be field screened for evidence of stains, sheens, unusual color, or odors. If no contamination evidence is apparent, a representative of soil from below the structure will be collected and analyzed for TPH as gasoline, TPH as diesel/oil, BTEX (and EDC/EDB, MTBE, and total lead if gasoline is detected). If contamination evidence is apparent, the location will be remediated and confirmation sampling will be conducted similarly to a discovered PCS site as described in the previous section.

Samples of soil at locations where PCS has been discovered will be collected and analyzed for TPH as gasoline, TPH as diesel/oil, BTEX (and EDC/EDB, MTBE and total lead if gasoline is detected).

All soil confirmation sampling locations will be located using a portable GPS unit and the sampling observations and details will be recorded in a field book.

If laboratory results indicate that TPH/BTEX concentrations in soil exceeds MTCA Method A Cleanup Levels or WTC concentrations exceed Method B Cleanup Levels, additional soil removal actions, as defined in the Work Plan, and subsequent confirmation sampling will be conducted at the removal location.

If PCS cannot be removed due to risk to existing structures, encroachment into adjacent properties or wetland and stream buffers, analysis of representative soil samples on the excavation sidewall and floor will also include analysis of TPH composition by Ecology Methods VPH/EPH for subsequent risk analysis using MTCA Method B.

If confirmation samples indicate no exceedance of TPH and WTC cleanup levels, the excavation will be backfilled with clean fill and compacted. If confirmation samples contain TPH or WTC concentrations above cleanup levels, additional soil will be removed and additional confirmation samples will be collected. If the second confirmation samples contain TPH or WTC concentrations below cleanup levels, the excavation will be backfilled with clean fill. If the second confirmation samples contain TPH and/or WTC concentrations above cleanup levels, Ecology will be notified and an approach for addressing residual contamination at the location will be established.

4.5. Stockpiled Soil Characterization Sampling

Upon completion of excavation of PCS and CWW discovered during wood waste removal activities that generate stockpiles, soil and wood waste samples will be collected from the stockpiles for characterization purposes. Stockpiled PCS samples collected for characterization purposes for off-site disposal will be analyzed for TPH as diesel, BTEX, total lead (and gasoline/BTEX if present in discovered PCS). Stockpiled CWW samples collected for characterization purposes for off-site disposal will be analyzed for TPH and WTCs. Samples of unusual solid wastes discovered during wood waste removal actions and stockpiled will be analyzed for offsite disposal characterization. Appropriate analytical methods for samples of unusual solid wastes will be determined at the time of stockpiling and based on the types of waste materials identified.

Collection and analysis of composite soil samples from different locations of the stockpile will provide analytical data representative of the excavated soil. The analytical data will allow for demonstration of compliance with the acceptability criteria of the off-site disposal facility.

Stockpile soil sampling will consist of preparing one composite soil sample to represent each 500 cubic yards (yd^3) of stockpiled PCS or CWW. Composite samples shall consist of equal portions of discrete samples taken at a frequency of one sample for every 50 yd^3 of material.

4.6. Soil Sample Management

Upon collection, soil and wood waste samples will be individually labeled and immediately placed on ice in a cooler for delivery to the laboratory. All samples will either be delivered by field staff or via courier to the lab with chain of custody protocols to meet holding times. A Chain of Custody form provided by the lab will be submitted for each sampling event. Sample containers and analysis holding times are summarized in **Table 2**.

Table 2. Soil and CWW Sample Containers, Preservation, and Holding Time Requirements

Parameter	Container	Preservative	Holding Time
Gasoline-range TPH/BTEX (using EPA Method 5035), EDB/EDC, MTBE, VPH	4 x 40 mL glass vials	Na_2SO_4 (2 vials) Methanol (2 vials)	7 days
Diesel and Oil-range TPH, EPH	8 oz. glass	none	14 days
chlorophenols, PAHs, phenols, cresols	8 oz. glass	none	14 days
Metals (arsenic, chromium, copper, lead)	8 oz. glass	none	6 months

4.7. Decontamination and Investigation Derived Wastes

Decontamination of sampling equipment will be completed after collection of each sample. Spoons used for collecting soil samples for SVOC and metals analysis will be cleaned using detergent and multiple rinses of potable water. One rinsate sample will be collected for every 20 soil samples collected with non-disposable sampling equipment. Reusable personal safety gear will be decontaminated at the end of each day using detergent and multiple rinses of potable water. Disposable safety gear, such as gloves and ear protection, will be managed as investigation derived wastes (IDW). All investigation derived wastes (IDW) will be collected in a separate container at the site and disposed at a permitted waste facility. All wastewater generated from equipment decontamination will be collected into a separate container and disposed at the City of Cashmere (Cashmere) wastewater treatment plant (WWTP).

Dewatering discharge will be collected in a settling tank before discharge to the Cashmere WWTP. Samples of discharge water will be collected daily to comply with testing conditions established between the Port and Cashmere. Compliance testing may be adjusted depending on flow rates, time of year, and the location of the dewatering area. Representative samples of discharge water will be collected directly from a sampling port in the storage tank and placed into laboratory provided containers and analyzed for TPH/BTEX and any other water quality parameters (to be determined by Cashmere at the time of discharge) on a 24-hour turnaround.

4.8. Sample Chain of Custody/Documentation

Sampling details and field observations will be documentation in field logbooks. Soil and wood waste samples will be identified using sample labels placed on laboratory containers and the sample numbers will be recorded on field sampling data sheets, and laboratory-provided chain-of-custody forms. The sample numbering system for analytical samples collected will be dependent on the type of sample collected. Soil confirmation samples from grid locations will be identified starting with "S-G-###". Soil confirmation samples from PCS Sites 2 and 4 will be identified starting with "S-C-2-###" or "S-C-4-###", respectively. Soil confirmation samples from additionally discovered PCS sites will be identified starting with "S-C-#-###", where the first discovered PCS site will start with the number "6" and proceed sequentially for each subsequently discovered PCS site. Wood waste confirmation samples from CWW sites will be identified starting with "WW-C-#-###", where the first discovered CWW site will start with the number "1" and proceed sequentially for each subsequently discovered CWW site. Characterization samples from stockpiles of PCS and CWW will be identified starting with the identification "S-SP-###" and "WW-SP-###", respectively. Discharge water characterization samples will be identified with "W-###".

For field duplicates, the sample identification number will be XX-###-MMDDYY, where "MMDDYY" stands for month, date, and year of the sample collection. For example, for a field duplicate collected on June 15, 2013, the identification would be XX-###-061513. A sample time of 1700 will be recorded on the sample labels and Chain-of-Custody record for all field duplicates. In addition, it is imperative that the field duplicate number be referenced on the sample collection field sheet.

4.9. Groundwater Sampling

4.9.1. Dewatering Discharge Sample Collection and Analysis

Samples of groundwater will be collected during construction dewatering to characterize dewatering discharge. Water samples will be collected directly from the dewatering system storage containers and placed into laboratory-provided containers for laboratory analysis of TPH as gasoline, TPH as diesel and oil, and BTEX (Section 5).

4.9.2. Groundwater Monitoring Well Sampling

Samples of groundwater will be collected from existing monitoring wells before removal action begins, and from existing and new monitoring wells after removal action is complete. Water samples will be collected from the monitoring wells and placed into laboratory-provided containers for laboratory analysis of TPH as gasoline, TPH as diesel and oil, and BTEX. If gasoline is detected, samples will be analyzed for EDB/EDC, MTBE, and total lead. If CCW was present and removed upgradient of the monitoring well, groundwater samples will also be tested for WTC (Section 5). The Port will notify Ecology by telephone or email as early as possible prior to groundwater monitoring well sampling events. Duplicate samples will be collected at a rate of at least 1 per sampling event, or 1 per 10 samples collected.

Groundwater Monitoring Well sampling frequency will occur as follows:

1. Groundwater Monitoring wells (GMW) where no detection of contamination occurs will be sampled two (2) times. Sample events shall be three (3) to six (6) months apart.

2. Groundwater Monitoring wells (GMW) where contamination is detected but at levels below cleanup levels will be sampled four (4) times. Sample events shall be three (3) to six (6) months apart or quarterly.
3. Groundwater Monitoring wells (GMW) where contamination is detected at levels exceeding cleanup levels will be sampled at least eight (8) times. Sample events shall be three (3) to six (6) months apart or quarterly.

4.9.2.1. Field Meter Calibration Procedures

Field meters will be used to measure depth to water and water quality parameters prior to groundwater sample collection. The following field instruments will be used:

- Electrical well probe – Water level meter, marked every 0.01 foot. When the sensor at the tip of the probe contacts water, the circuit is completed, activating a steady tone and light on the reel.
- Water quality multimeters – Used to measure the following water quality parameters prior to sample collection: pH, dissolved oxygen (DO), turbidity, specific conductance, and temperature. Purge water will be continuously monitored, and parameters recorded to verify stability of groundwater conditions prior to collecting samples for lab analysis.

The meters will be calibrated and operated according to the manufacturer's specifications prior to sampling (once at the start of each day sampling will occur). Field meter calibration will be checked prior to use and at the conclusion of each sampling day. The calibration check will be recorded in the field logbook or on the Sample Collection Log. Results for field measurements will be recorded on the Sample Collection Log.

4.9.2.2. Groundwater Level Measurement

The depth to groundwater will be measured in each well before purging begins. Water level will be measured directly using an electric well probe. Results will be recorded to the nearest 0.01 foot in the field log book. The top of well casing will be surveyed to the nearest 0.01 feet and referenced to NAVD 88.

4.9.2.3. Purging

The wells will be purged using a peristaltic pump and dedicated Teflon-coated tubing that will remain in the well between sampling events. The pump and tubing will be installed and handled for each event while wearing clean disposable gloves. The tubing intake will be positioned at a depth of 2 to 3 feet below the static water level. The well will be purged at a rate of 0.5 to 1 liter per minute. Field parameters to be measured include temperature, pH, turbidity, specific conductance, and dissolved oxygen prior to the water being exposed to the atmosphere. Purging will continue until these parameters have stabilized, with measurements taken at five minute intervals. Purging will be considered complete when two consecutive sets of parameter readings show changes less than the criteria listed in **Table 3**. Well drawdown will be monitored using a well probe during purging and recorded in the field notes.

Table 3. Field Parameter Stability Criteria

Field Parameter	Criteria

pH	± 0.1 Standard Unit (SU)
Temperature	± 0.3°C
Turbidity	± 1 Nephelometric Turbidity Unit (NTU)
Specific Conductance	± 5 microSiemens per centimeter (mS/cm)
Dissolved Oxygen	± 0.3 mg/L

Purge water will be collected and disposed at the Cashmere WWTP.

4.9.2.4. Field Measurement Procedures

Measurements made in the field will include direct measurement of water level at the start of purging; and direct measurement of pH, temperature, specific conductivity, DO, and turbidity during purging. Field instruments will be calibrated according to manufacturer's specifications within 4 hours before purging. The field instrumentation and respective ranges of results and accuracies are summarized in **Table 4**.

Table 4. Summary of Field Measurement Analytical Reporting Limits for Groundwater Quality and Level Monitoring

Parameter	Measurement Method	Accuracy	Expected Range of Results
Temperature (C)	YSI 556 MPS	0.01C	10 to 13 degrees
pH	YSI 556 MPS	0.01 pH units	6.5 to 7.5 pH units
Specific Conductance (mS/cm)	YSI 556 MPS	1 µs/cm	100 to 200 µmhos/cm
Turbidity (NTU)*	HF Scientific MicroTPW	0.01 NTU	5 to 50 NTU
Dissolved Oxygen (DO)	YSI 556 MPS	0.01 mg/L	0.5 to 5 mg/L
Water level (feet)	Solinst Well Probe	0.01 feet	3 to 15 feet

NTU - Nephelometric
TDS – Total Dissolved Solids

4.9.2.5. Groundwater Sample Collection

Groundwater samples will be collected directly from the discharge tubing immediately after purging; samples will be collected while the pump is running at less than 0.5 liters per minute. Sample containers will be filled in the following sequence.

1. Unpreserved samples.
2. Preserved samples.

Samples shall be labeled in the format of [well number]-[date] (date to be in DDMMYY format). Every individual sample container shall be labeled with the date and time of sampling, location, sampler's initials, and preservatives. Replicates will be collected and handled in the same manner.

4.9.3. Groundwater Sample Management

Upon collection, water samples will be individually labeled and immediately placed on ice in a cooler for delivery to the laboratory. All samples will either be delivered by field staff or via courier (i.e. Fed Ex) to the lab with chain of custody protocols to meet holding times. A Chain of Custody form provided by the lab will be submitted for each sampling event. Sample containers and analysis holding times are summarized in **Table 5**.

Table 5. Groundwater Sample Containers, Preservation, and Holding Time Requirements

Parameter	Container	Preservative	Holding Time
Gasoline-range hydrocarbons/BTEX, EDB/EDC, MTBE	3 x 40 mL vial	HCl	14 days
Diesel-range hydrocarbons	2 x 500 ml amber glass	None	30 days
chlorophenols, phenols, cresols, PAHs	2 x 500 ml amber glass	None	7 days
Metals: Arsenic, Chromium, Copper, Lead	500 mL – polyethylene	HNO_3	6 months

The date and time of sample collection, sampler name, purging volumes, field water quality measurements, water levels, time of instrument calibration, and environmental conditions shall be recorded at the time of sampling on a field sampling data sheet. Any deviation from the sampling protocol will be noted.

4.10. Field Logbooks

Field logbooks will provide the means of recording data-collecting activities performed at the site. Entries will be described in as much detail as possible so that persons going to the site can reconstruct a particular situation without reliance on memory.

Field logbooks will be bound and assigned to field personnel, but will be stored in the project file when not in use. Each logbook will be identified by the project name and, if applicable a project number.

The title page of each logbook will contain the following:

- Logbook Number (if applicable)
- Project Name
- Log Entry Start Date and End Date

The following information will be recorded in the logbook at the beginning of each daily entry:

- Date, start time, weather conditions.
- Names of sampling personnel present.

- A summary of sample activities including sample location, sample time, sample description, depth at which the sample was collected, sample volume, the number of containers for the sample and any field notes relating to the well or sample.
- The names of any visitors along with a description of the purpose of the visit.
- Decontamination procedures.
- Field quality control samples including identification numbers used.
- Signature of the person recording any entries into the logbook.

5. Laboratory Analysis Methods

An Ecology-accredited analytical laboratory will conduct analysis for the project. Laboratory standard operating procedures will be on file with the laboratory.

Table 6 summarizes laboratory analysis methods for PCS and MTCA Method A Cleanup Levels, and **Table 7** summarizes laboratory analysis methods for confirmation soil below wood waste and for CWW and MTCA Method A Cleanup Levels.

Table 6. Analytical Summary for PCS at Site 2 and 4

Parameter	Analytical Method	Method Detection Limit (mg/kg)	MTCA Method A Cleanup Level[b] (mg/kg)
Diesel-Range Hydrocarbons	Ecology NWTPH-Dx + Acid/Silica Gel Cleanup	5.0 – 10.0	2,000 – Diesel 2,000 – Heavy Oil 4,000 – Mineral Oil
BETX	EPA 8021	0.01255	0.3 – benzene 6 – ethylbenzene 7 – toluene 9 – total xylenes
EPH[a]	Ecology EPH	5.0 – 10.0	na

[a] If Method B Cleanup Level is used.
[b] From Table 740-1 in WAC 173-340-900.
na = not available

Table 7. Analytical Summary for Confirmation Soil Samples and Contaminated Wood Waste

Parameter	Analytical Method	Detection Limit (mg/kg)	MTCA Method A Cleanup Level[b] (mg/kg)
Gasoline-Range Hydrocarbons	Ecology NWTPH-Gx/5035	5.0	30 (100 if benzene - ND, TEX < 1 %)
BETX	EPA 8021	0.01255	0.3 - benzene 6 - ethylbenzene 7 - toluene 9 – total xylenes
Ethylene dibromide (EDB)[a] Ethylene dichloride (EDC)[a] MTBE[a]	EPA 8260	0.001	0.005 – EDB EDC – Method B 0.1 - MTBE MTBE
Diesel-Range Hydrocarbons	Ecology NWTPH-Dx + Acid/Silica Gel Cleanup	5 – Diesel 10 – Heavy, Mineral	2,000 – Diesel 2,000 – Heavy Oil 4,000 – Mineral Oil
Chlorophenols	EPA SW8041	0.00625	Method B
PAHs	EPA SW8270-SIM	0.005	0.1
Phenols, Cresols	EPA SW8270	0.2 to 0.0201	Method B
Arsenic	EPA 6010C	5	20
Chromium III	EPA 6010C	0.5	2,000
Copper	EPA 6010C	0.2	Method B
Lead[a]	EPA 6010C	0.2	250

[a] If gasoline is detected in the soil or wood waste.
[b] From Table 740-1 in WAC 173-340-900.

Table 8 summarizes laboratory analysis methods for groundwater and MTCA Method A Cleanup Levels.

Table 8. Analytical Summary for Groundwater

Parameter	Analytical Method	Detection Limit (mg/L)	MTCA Method A Cleanup Level[b] (mg/L)
Gasoline-Range Hydrocarbons	NWTPH-Gx	0.25	800 (1,000 if benzene - ND)
BETX	EPA 8021	1 – BTE 2 - Xylenes	5 – Benzene 700 – Ethylbenzene 1,000 – Toluene 1,000 – Xylenes
EDB, EDC[a] MTBE[a]	EPA 8260	0.2 0.00036	0.01 – EDB 5 – EDC 20 – MTBE
Diesel-Range Hydrocarbons	NWTPH-Dx with Acid/Silica Gel Cleanup	0.05 – Diesel 0.1 – Heavy, Mineral	500
Chlorophenols[cc]	EPA SW8041	0.25	Method B
PAHs[c]	EPA SW8270-SIM	0.0001	0.1
Phenols, Cresols[c]	EPA SW8270	0.001 to 0.02	Method B
Arsenic[c]	EPA 200.7	0.5	5
Chromium (total)[c]	EPA 200.7	0.5	50
Copper[c]	EPA 200.7	0.5	Method B
Lead[a,c]	EPA 200.7	0.1	15

[a] If gasoline is detected in groundwater.
[b] From Table 720-1 in WAC 173-340-900.
[c] If CWW was present and removed upgradient of the monitoring well.

6. Quality Control Procedures

6.1. Field

Field quality control will consist of collecting field duplicates, rinsate blanks, and field blanks (groundwater only). Field duplicates consist of two or more samples collected at the same time and place. Field duplicates will be collected at a rate of 1 duplicate sample per 20 field samples. In the case of a quarterly groundwater monitoring event, one duplicate groundwater sample will be collected per monitoring event.

Rinsate blanks are samples obtained by running distilled/deionized water over non-disposable decontaminated sampling equipment used to collect soil samples for SVOCs and metals analysis. The blank water is collected in sample containers for handling, shipment, and analysis. These samples are treated identically to the other samples collected that day. A rinsate blank is used to assess cross contamination brought about by improper decontamination procedures. Rinsate blanks

will be collected at a rate of 1 sample per 20 collected samples that are collected using non-disposable sampling equipment.

Field blanks are prepared in the field by filling the appropriate sample container with distilled/deionized water and are then submitted to the laboratory for analysis. A field blank is primarily used to evaluate contamination errors associated with field operations and shipping but may also be used to evaluate contamination errors associated with laboratory procedures. Field blanks will be collected at a rate of one per day per sampling event.

Water quality control measures for dissolved oxygen, temperature, specific conductance, turbidity, and pH, will be measured. Measurement will consist of allowing the water quality multimeter to continuously monitor field parameters until they have stabilized, at which point sampling may occur. All field measurements will be recorded in the field log. Field water quality control requirements are contained in **Table 9**.

Table 9. Field Quality Control Measurements

Parameter	Replicate Samples	Field Calibration Check Standards	Calibration Drift End Check
DO	RPD ≤ 20%	NA	±4%
Temperature	± 0.3℃	NA	N/A
Specific Conductance	± 5 mS/cm	± 5 mS/cm	± 5 mS/cm
Turbidity	± 2 NTU	± 2 NTU	± 2 NTU
pH	± 0.2 pH units	± 0.2 pH units	± 0.2 pH units

6.2. Laboratory

Sample precision will be assessed by collecting replicates at the rate of 1 per batch of 10, or 1 per batch if less than 10 samples are included in a batch of samples. Samples will undergo laboratory standard analytical techniques with standard laboratory quality control procedures.

6.3. Data Management Procedures

All field observations and monitoring results will be recorded on individual well sampling sheets that will be maintained throughout the length of the project and included in all draft and final reports. Field observations and all data will be checked for legibility and completeness before leaving the site locations. Field data will be entered into tables or spreadsheet and included with the laboratory data in all draft and final reports.

Analytical data from the laboratory will be entered in electronic format. After the data are verified, they will be summarized in case narratives and provided in all draft and final reports.

After completing the sampling, staff will compile and evaluate all field and laboratory analytical data against the project MQOs.

6.4. Audits and Reports

Ecology's Laboratory Accreditation Program establishes whether the laboratory has the capability to provide accurate and defensible data. The accreditation involves an evaluation of the laboratory's quality system, staff, facilities, equipment, test methods, records, and reports.

The final report will include a quality assurance section describing data quality. These reports will undergo scientific peer review by staff who have appropriate expertise and who are not directly connected with this project.

6.5. Data Verification and Validation

Data verification is a quality assurance review process to determine the quality and the completeness of the field and analytical data. This is done by determining that all quality control samples meet the acceptance criteria as specified in the standard operating procedure for that method.

Analytical laboratory staff will review all laboratory analysis for the project to verify that the methods and protocols specified in the SAP/QAPP were followed; that all instrument calibrations, quality control checks, and intermediate calculations were performed appropriately; and that the final reported data are consistent, correct, and complete with no omissions or errors. Evaluation criteria will include the acceptability of instrument calibrations, procedural blanks, spike sample analysis, precision data, laboratory control sample analysis, and the appropriateness of assigned data qualifiers. The laboratory staff will prepare a written case narrative describing the results of their data review.

Precision will be estimated by calculating the relative percent difference (RPD) for field duplicate results. Analytical bias will be assumed to be within acceptable limits if laboratory quality control limits are achieved for blanks, matrix spikes, matrix spike duplicates and check standards. Sampling bias will be assessed by verifying that the correct sampling and handling procedures were used. Goals for completeness will be evaluated and, if needed, replacement samples will be obtained and adjustments in subsequent sampling events will be made.

Field quality control procedures include reviewing field notes for completeness, errors, and consistency. Duplicate measurements and documentation of conditions in field notes will support verification of analytical measurements and field measurements.

The project lead will review the data package and case narrative to determine if the results meet the MQOs for accuracy, precision, and bias for that sampling episode. Field duplicate results will be evaluated and compared to the MQOs shown in **Table 1**. Based on these assessments, the data will be accepted, accepted with appropriate qualifications, or rejected.

After the laboratory and field data have been reviewed and verified by the project manager, data submittals will be independently reviewed for errors by another staff person before finalizing.