Sunnydell Dryke Shooting Range
Sampling and Analysis Plan
292 Dryke Road
Sequim, WA

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Figure 1

Sunnydell Dryke Shooting Range

Table 1

Sample Containers, Preservation, and Holding Time Requirements

1 PROJECT MANAGEMENT

This Sampling and Analysis Plan (SAP) provides project overview, sampling, chemical testing, and data evaluation procedures to be implemented during the remedial activities on the subject property located at 292 Dryke Road in Sequim, Washington. During site characterization samples will be collected and analyzed to determine the nature and extent of discovered contaminants on the subject site. Data obtained under this SAP will be used to evaluate the nature and magnitude of contamination at the subject property.

1.1 Project/Task Organization

During the performance of remedial activities, the following staff or contract staff may be utilized:

Washington State Department of Ecology:

Guy Barrett: Environmental Project Manager

Clallam County health Department:

Jennifer Garcelon: Environmental Health Specialist II

1.2 Problem Definition/Background

Mr. Chuck Dryke and Rosemary Knotek are currently the owners and operators of the Sunnydell Dryke Shooting Range. On June 22, 2004, the Washington State Department of Ecology (Ecology) received a complaint from an adjacent property owner (ERTS # 541614) concerning pond water on the Dryke property draining onto their property and impacting the trees on the property owners land. An initial investigation was performed by the Clallam County Department of Health and Human Services on September 8, 2004. A composite soil sample was collected from the upper pond and lower pond of the shooting range and submitted for chemical analysis of lead by EPA Method 6010B. A discrete surface water samples were also collected from the upper and lower ponds on September 8, 2004 and submitted for chemical analysis of lead by EPA Method 7421.

Chemical analytical results indicated that lead was present in the upper pond sediments at a concentration of 77,800 milligrams per kilogram (mg/kg), exceeding the Washington State Department of Ecology's Model Toxics Control Act (MTCA) Method A cleanup level of 250 mg/kg. Chemical analytical results of the surface water sample collected from the upper pond indicated that lead was present in the upper pond water at a concentration of 30 micrograms per liter (µg/L), which exceeded the chronic water quality criteria for lead in surface water.

Chemical analytical results of the lower pond sediments indicated lead at concentrations below the MTCA cleanup level. Chemical analytical results of the lower pond water indicated lead concentrations at 10 µg/L, which exceeded the chronic water quality criteria.

Based on the September 8, 2004 chemical analytical results, Ecology mailed an Early Notice Letter to the owners of Sunnydell on November 3, 2004. The Sunnydell Dryke Shooting Range was placed on Ecology's Confirmed and Suspected Contaminated Sites List on November 8, 2004. On June 22, 2005, the Clallam County Department of Health and Human Services performed a Site Hazard Assessment on the subject property. The site was ranked as priority #1, and was subsequently placed on the Hazardous Sites List on February 3, 2006. On January 22, 2009, the Clallam County Department of Health and Human Services performed an initial investigation on the adjoining parcel #130050 located to the north of the Sunnydell Dryke Shooting range. Chemical analytical results indicated that lead was in the surface water at concentrations ranging from 14.6 to 101 µg/L, which exceeded the chronic water quality criteria. the sediment samples from the adjoining parcel contained lead at concentrations below the MTCA method A cleanup levels.

On August 10, 2009, an Agreed Order (N0. DE 6551) was signed by the Sunnydell property owners and a representative from Ecology to provide for remedial action at the facility where there was a release of hazardous substances. The Agreed Order required Chuck Dryke and Rosemary Knotek to undertake a remedial investigation and feasibility study for their property located at 292 Dryke Road. The Agreed Order was issued pursuant to the MTCA RCW 70.105D.050(1).

1.2.1 Project Understanding and Scope of Services

In order to support the objectives outlined in the Agreed Order No. DE 6551, ESA Associates, Inc. (ESA Associates) has prepared this draft site specific Sampling and Analysis Plan (SAP) for the Sunnydell Dryke Shooting Range located at 292 Dryke Road. The SAP is designed to develop chemical testing data to support soil and surface water management decisions, and to develop a cost effective subsurface investigation addressing the environmental contaminants at the subject property. This SAP was includes quality assurance quality control activities per the requirements of WAC 173-340-820. The proposed analytical procedures are in accordance with WAC 173-340-830. A Health and Safety Plan was also been prepared by ESA Associates in accordance with the provisions specified in WAC 173-340-810(1). The Health and Safety plan was also prepared per WAC 173-340-810(2).

This site specific SAP describes the procedures to be followed for the collection of soil and surface samples, laboratory analysis, quality assurance, procedures, and provides a summary of the data analysis approach for characterization sampling to be conducted at the subject property. This site-specific SAP also contains the summary of reporting requirements and project schedule. As appropriate, this site-specific SAP has incorporated by reference Standard Operating Procedures (SOPs) for monitoring and assessment activities as follows:

- Sample collection procedures
- Field documentation procedures
- Field equipment calibration and analysis
- Decontamination procedures
- Soil classification
- The number and type of QC samples to be collected and submitted for analysis
- Analytical Methods
- Analytical QC Requirements
- Reporting requirements
- Special safety or cautionary information

1.2.2 Description of the Work Performed

Collected soil and surface water samples will be used to characterize existing site conditions. ESA Associates will use the Washington State Model Toxics Control Act (MTCA) standards for site soils, surface water, and groundwater and a site specific cleanup standard will be developed after the collection of bioassays for on site sediments.

This site-specific SAP describes specific sample locations and analyses performed on the subject property. The site-specific SAP may not initially identify all possible field conditions. In the event of changing field conditions, the scope of sampling activities and parameters measured will be modified as needed. This may include the collection of additional samples and analysis of additional chemicals parameters that were not anticipated in this SAP. Any changes or alterations to the site-specific SAP will be reported in the final report submitted to Ecology upon the completion of the subsurface investigation.

1.3 Quality Objectives and Criteria for Measurement Data

The overall Data Quality Objectives (DQO) are to develop and implement QA/QC procedures for field sampling, chain-of-custody, laboratory analysis, and reporting as described in this site-specific SAP.

The primary goals of sampling and analysis during a subsurface investigation are to: 1) provide valid data of known and documented quality to characterize sources; 2) determine off-site migration of contaminants; and 3) document threats or potential threats that sites pose to human health or the environment.

Data for a subsurface investigation must be of known quality as defined by the standard Data Quality Indicators (DQIs) presented in the EPA Guidance for Quality Assurance Project Plans, Guidance for the Data Quality Objectives Process, and Data Quality Objectives Process for Hazardous Waste Site Investigations. Data Quality, as defined by the DQIs, is a function of both field and laboratory operations and can be addressed through the following seven elements, described below:

- Precision
- Bias
- Accuracy
- Representativeness
- Comparability
- Completeness
- Sensitivity

1.4 Special Training Requirements/Certification

An environmental contractor will conduct initial soil and surface water sampling of areas identified in the Agreed Order No. DE 6551 as potentially containing contaminants of concern. All environmental contractor personnel will have a minimum of Occupational Safety and Health Administration 40 hours of hazardous materials training (OSHA 40-hour HAZWOPER) supplemented by annual 8-hour refresher courses. Contractors are responsible for ensuring that their personnel are informed about and trained on relevant OSHA guidelines.

The environmental contractor will prepare and approve a site specific Health and Safety Plan (HASP) before fieldwork begins. All participating staff will be briefed on the risks associated with certain activities conducted during a subsurface investigation. All staff will obtain the proper training to recognize, and protect themselves from, hazardous chemicals known or suspected to be present at contaminated sites. Staff with questions about risks they might be dealing with should use existing resources (e.g., Material Safety Data Sheets {MSDS}, literature, laboratory staff) and contact environmental contractor’s Health and Safety Manager. The Health and Safety Manager can recommend and supply the most appropriate personal protective equipment for work at specific sites, and is responsible for managing the respiratory protection program.

The analytical laboratories selected to conduct analysis of water and soil samples are federally or state certified for the analytical methods requested. Laboratory personnel conducting analysis will be trained in accordance with the Laboratory’s internal QA/QC policy.

2 MEASUREMENT\DATA ACQUISITION

This SAP addresses how project data will be collected, measured, and documented. Proper implementation of these activities will help ensure that resulting data are scientifically sound, of known and documented quality, and suitable for their intended use. This section of the SAP addresses quality control activities that will be performed during each phase of data collection and generation, from sampling to data reporting, evaluating QC acceptance limits, and the performance of corrective actions for nonconformance.

2.1 Sampling Process Design

The objective of this effort is to collect and analyze a sample, which is representative of the media under investigation. The methods and equipment used for sampling environmental matrices vary with the associated physical and chemical properties. Based on the Agreed Order No. DE 6551, there are two areas of concern in association with lead contaminated medias (upper pond and lower pond) that require further investigation at the subject property. Four additional Areas were identified on July 29, 2005 by the Clallam County Department of Health and Human Services as follows: the rabbit run, the weeping willow, the dog jump, and the cattails. The dog jump area is located at the south end of the upper pond and the cattails area is located on the east side of the pond. The Weeping willow area is located to the northwest of the upper pond and is not connected to any bodies of water. The Rabbit run is located to the southwest of the upper pond and is not connected to any bodies of water. These areas are defined by the former site activities and land use practices that took place in each area. The sample location, sampling frequency, sample type, and chemical analyses chosen will be described for each area in the following sections. Sampling locations have been based on the results of the initial investigations performed by the Clallam County Department of health and Human Services. Please refer to Figure 1 for a site map and Figure 2 for proposed site sampling locations.

2.1.1 Area 1: Upper Pond

Area 1 is identified as the upper pond. The upper pond was excavated by Mr. Dryke approximately 25 years ago. The pond covers approximately ¾ of an acre and is 14 feet deep. The pond is fed by water that is directed from the state highway 101 via a ditch which runs down gradient to the north along Dryke Road. The Upper pond has been utilized for the past 25 years as a sporting clay target range. The clay targets are reportedly made up of lime and pitch. The ammunition that has been utilized in this area is 12 gage, 1 once, lead No. 8 shot.

The pond shall be divided into four quadrants: the northeast quadrant, the southeast quadrant, the southwest quadrant, and the northwest quadrant. In order to determine the vertical extent of contamination, discrete surface soil samples will be collected from each quadrant at the surface water/soil interface beginning at grade. Once grade samples have been collected, the auger will be advanced 3 inches and an additional sample will be collected. In this manner, subsurface soil samples will be collected at 3 inches below ground surface at the soil/water interface. Once the 3 inch samples have been collected, the auger will be advanced to 6 inches below ground surface to allow for the collection of a soil sample at 6 inches below ground surface at the surface water/soil interface. Therefore three soil samples will be collected at each sampling location for a total of nine soil samples per quadrant. One sediment sample and one surface water sample will be collected in the center of each quadrant. A total of 11 samples will be submitted for chemical analysis from each quadrant.

The contractor will utilize a stainless steel auger in this area to collect soil samples around the perimeter of the pond. The sample is extruded into an aluminum or stainless steel pan followed by immediate placement into appropriate sample containers. It is possible to obtain samples from discrete depths by forcing the soil core from the auger and collecting from the depth of interest. The environmental contractor shall assess whether a lined or stainless steel auger is necessary.

Nine soil samples, one sediment, and one surface water sample from each quadrant will be submitted to ESN Northwest, Inc. for the analyses described above for the following reasons: EPA Method 8270 will be used to determine the presence of polyaromatic hydrocarbons (PAHs) associated with clay pigeons; EPA Method 7421 and 6010B will be used to determine the presence of the metal lead associated with lead shot.

2.1.2 Area 2: Lower Pond

Area 2 is identified as the lower pond. Reportedly, the lower pond has always been present as a marshy area. The lower pond was dug out to its current configuration by Mr. Dryke in the last 20 years. The pond covers approximately 1/2 of an acre and is 6 feet deep. The pond is fed by water from the upper pond. Reportedly the water from the lower pond is pumped back up to the upper pond and recycled. The lower pond has been utilized as a dog training facility. Mr. Dryke reports that no ammunition has been utilized in this area.

The pond shall be divided into four quadrants: the northeast quadrant, the southeast quadrant, the southwest quadrant, and the northwest quadrant. In order to determine the vertical extent of contamination, discrete surface soil samples will be collected from each quadrant at the surface water/soil interface beginning at grade. Once grade samples have been collected, the auger will be advanced 3 inches and an additional sample will be collected. In this manner, subsurface soil samples will be collected at 3 inches below ground surface at the soil/water interface. Once the 3 inch samples have been collected, the auger will be advanced to 6 inches below ground surface to allow for the collection of a soil sample at 6 inches below ground surface at the surface water/soil interface. Therefore three soil samples will be collected at each sampling location for a total of nine soil samples per quadrant. One sediment sample and one surface water sample will be collected from the center of each quadrant.

The contractor will utilize a stainless steel auger in this area to collect soil samples around the perimeter of the pond. Hand augers can be used to collect soil samples to depths of approximately 10 feet. The sample is extruded into an aluminum or stainless steel pan followed by immediate placement into appropriate sample containers. It is possible to obtain samples from discrete depths by forcing the soil core from the auger and collecting from the depth of interest. Depending on site conditions, the environmental contractor shall assess whether a lined or stainless steel auger is necessary.

Nine soil samples, one sediment, and one surface water sample for a total of 11 samples from each quadrant will be submitted to ESN Northwest, Inc. for the analyses described above for the following reasons: EPA Method 8270 will be used to determine the presence of PAHs associated with clay targets; EPA Method 7421 and 6010B will be used to determine the presence of the metal lead associated lead shot.

2.1.3 Area 3: The Rabbit Run

Area 3 is identified as the rabbit run. The rabbit run is located to the southwest of the upper pond in the area identified as the Fur & Feather on the Sunnydell site map (Figure 1). The rabbit run has been utilized as a shooting range in which live rabbits are released and shot. Typically, 28 gage, 20 gage, 12 gage and 4-10 gage lead No. 8 and No. 9 shot has been used in this area. In July of 2005, a representative from DOH sampled the surface soils of the rabbit run shooting range. Chemical analytical results indicated concentrations of lead at 618 mg/kg and benzo(a)pyrene at 8.5 mg/kg, both concentrations exceeding the MTCA Method A cleanup level for those constituents. For that reason, the rabbit run area will be sampled for lead and PAHs.

Hand augers will be utilized to collect soil samples in order to determine extent of contamination. Samples will be collected from grade to one foot below grade. Based on the results of the scoping phase, sampling locations in the rabbit run area will be ascertained.

Soil samples will be collected using a stainless steel auger to the depth of one foot below ground surface. The soil samples selected from the rabbit run area will be analyzed for the following contaminants: Semi-Volatile Organic Compounds (SVOCs) by EPA Method 8270, Priority Pollutant Metal-lead by EPA Method by 6010B.

Approximately 10 soil samples from this area will be submitted to ESN Northwest, Inc. for the analyses described above for the following reasons: EPA Method 8270 will be used to determine the presence of PAHs associated with clay targets; EPA Method 6010B will be used to determine the presence of the metal lead associated lead shot.

2.1.4 Area 4: The Weeping Willow

Area 4 is identified as the weeping willow. The weeping willow area is located to the northwest of the upper pond in the lower front field indicated on Figure 1. The weeping willow area has been utilized as a shooting range in which live birds are released and shot. Reportedly, lead shot was not used frequently in this area. In July of 2005, a representative from DOH sampled the surface soils of the weeping willow shooting range. Chemical analytical results indicated concentrations of benzo(a)pyrene at 200 mg/kg and napthalenes at 0.33 mg/kg, both concentrations exceeding the MTCA Method A cleanup level for those constituents. For that reason, the weeping willow area will be sampled for PAHs.

Hand augers will be utilized to collect soil samples in order to determine extent of contamination. Samples will be collected from grade to one foot below grade. Based on the results of the scoping phase, sampling locations in the rabbit run area will be ascertained.

Soil samples will be collected using a stainless steel auger to the depth of one foot below ground surface. The soil samples selected from the rabbit run area will be analyzed for the following contaminants: Semi-Volatile Organic Compounds (SVOCs) by EPA Method 8270 and Priority Pollutant Metal-lead by EPA Method by 6010B.

Approximately 10 soil samples from this area will be submitted to ESN Northwest, Inc. for the analyses described above for the following reasons: EPA Method 8270 will be used to determine the extent of PAHs previously found in the surface soils of this area. EPA Method 6010B will be used to determine the presence of the metal lead associated lead shot.

2.1.5 Area 7: Adjacent Property

In January of 2009, a representative from DOH collected soil and surface water samples from the adjacent property to the north of the Sunnydell Dryke Shooting range. Chemical analytical data indicated that lead was present in the surface water of the adjacent property at concentrations exceeding MTCA Method A cleanup levels. Chemical analytical data from the soil samples taken from the adjacent property indicated lead concentrations just below the MTCA Method A cleanup level for soil. Based on the results of DOH sampling program, the adjacent property should be sampled to determine the lateral and vertical extent of lead contamination potentially originating from the lower pond of the Sunnydell Dryke Shooting Range.

Hand augers will be utilized along the property line to collect soil samples in order to determine the extent of contamination. Samples will be collected from grade to one foot below grade. Based on the results of the scoping phase, sampling locations along the property line may be altered. Soil samples will be collected using a stainless steel auger to the depth of one foot below ground surface.

The soil samples selected from the adjacent property will be analyzed for the following contaminants: lead by EPA Method 6010B. If standing water is present on the adjacent property at the time of site characterization, then three water samples will be collected and analyzed for lead by EPA Method 7421. If standing water is not present at the time of the site visit, then a time will be selected for sampling when water is present.

Approximately six soil samples and three surface water samples from this area will be submitted to ESN Northwest, Inc. for the analyses described above for the following reasons: EPA Method 7421 and 6010B will be used to determine the presence of lead associated with the potential leaching of lead-impacted waters from the lower pond of the subject property.

2.2 Sampling Methods Requirements

All samples must be collected in a manner consistent with the media being sampled and the analytes of interest. Collection of methods must follow EPA protocols as set forth in "Preparation of Soil Sampling Protocols: Sampling Techniques and Strategies" and Ecology's "Sediment Sampling Plan". Water sampling will follow the American Society for Testing Materials (ASTM) 'Standards on Environmental Sampling, Designation: D2270-Standard Practices for Sampling Water" and EPA's "Standard Methods for Examination of Water and Waste Water". Additional methods may be used with the approval of the EPA Project Officer.

Proper sample containers and appropriate preservation techniques will be used when collecting samples. Samples should normally be collected in containers supplied by the laboratory. Samples must be properly preserved or they may be rejected. The laboratory attachment: Table 1, summarizes required sample containers, preservation techniques, and holding times for the most commonly requested analytes in a subsurface investigation. For information about analytes not listed in Table 1, check with the analyzing laboratory.

2.2.1 Purpose/Background

Sampling locations are based on the results of the preliminary site assessments and institutional knowledge. The purpose of this Phase of exploration is to investigate the nature and extent of lead contamination on the subject property and to determine whether the on site activities have caused or contributed to the lead contamination present on the adjacent property to the north of the Sunnydell site.

2.2.2 Sample Collection, Preparation, and Decontamination Procedures

Standardized sampling procedures provide consistency between samplers, facilitate collection of accurate, precise, and representative samples, and help ensure data comparability, and usability.

2.2.2.1 Sampling Procedure for Soils

For the purposes of a subsurface investigation, several methods of soil sample collection can be utilized to obtain samples depending on site location, site access, soil type, and volume necessary to adequately identify the targeted contaminants. Subsurface soils can be collected during the installation of soil borings, or wells, from shallow test pits, or using geoprobe samplers, split spoons, or a hand auger.

Regardless of the method used to collect soil samples, the following field screening procedures will be followed for all samples collected:

For the protection of the crew, a photoionization detector (PID) is used to screen for the presence of volatile organic compounds in the breathing zone during all soil sampling activities. The PID is a thermo Environmental Model 580B OVM, or equivalent, with a 10.5 ev lamp. The instrument is calibrated to 100 parts per million by volume (ppmv) with an isobutylene gas standard. The PID measures volatile organic compounds (VOCs) in the air in ppmv.

Collected soil samples are evaluated for evidence of contamination by visual discoloration of the soil sample or VOCs detected by the PID. A portion of each sample is placed into a plastic zip-lock bag, and the vapors are drawn through the PID for qualitative screening of VOCs. The probe of the PID is inserted into the plastic bag to withdraw air from the bag. The instrument measures the concentration of headspace vapor testing decreases with heavier hydrocarbons; diesel and motor oil may not be detected with this method. The vapor readings are documented as the field screening results. A new plastic bag is used each time a sample is screened. The soil sample is removed from the sampler and placed directly into laboratory provided sample jars and sealed with a Teflon lid.

Field screening on soil samples collected during subsurface explorations provide a relative indication of the degree of contamination. Field screening consists of inspecting the soil for stains indicative of contamination. Visual screening is generally effective in detecting the presence of heavy hydrocarbons such as diesel fuel or when the contaminant concentrations are high. Water sheen screening is also an effective way to detect lighter hydrocarbons such as gasoline as well as the heavier end hydrocarbons such as hydraulic oil.

Water sheen screening involves placing soil in a pan of distilled water and observing the water surface for signs of sheen. Sheen classifications are as follows:

No Sheen (NS)	No visible sheen
Slight Sheen (SS)	Light, colorless, dull sheen; spread is irregular, not rapid; sheen dissipates rapidly
Moderate Sheen (MS)	Light to heavy sheen; may have some color/iridescence; spread is irregular to flowing, may be rapid; few remaining areas of no sheen on the water surface.
Heavy Sheen (HS)	Heavy sheen with color/iridescence; spread is rapid; entire water surface maybe covered with sheen.

All soil classification will be performed using the ASTM D2487 Soil Classification Method. See Appendix B: "*Soil Survey Standard test Method, Unified Soil Classification System: Field Method*". The goal of sampling is to collect sufficient data from the site to determine if a release has occurred by adequately identifying the presence of contamination where it is most likely to be present. When selecting sampling locations, it should be taken into consideration that pathways for released contaminants can also be created by sanitary and storm sewers, waterlines, and other buried utility lines and utility trenches. These pathways allow released contaminants, either liquid or vapor, to migrate in directions not anticipated by site soil characteristics or site hydrogeological conditions. Drywells, fill areas, basements, crawl spaces beneath residences and nearby wells are other possible migration paths for released contaminants.

Discrete grab samples should be collected and analyzed with one or more of the following sampling techniques: hand auger/soil corer, split spoon sampler/Shelby tube, or backhoe and hand tools. The collection of discrete soil samples minimizes the potential problems associated with contaminant loss due to volatilization, or non-detection of "hot spots" because of dilution (which frequently occurs when composite sampling. If composite sampling is used to minimize costs of multiple samples the following procedures should be followed: Collect a discrete soil sample from a freshly exposed soil surface. Place the soil in a steel bowl. A total of three discrete soil samples from similar soil horizons are generally adequate for compositing purposes. More than three discrete soil samples placed in the steel bowl creates dilution that may not properly define the contaminant levels in the soil horizon being sampled. Once three discrete soil samples have been placed in the steel bowl, a stainless steel spoon should be used to thoroughly

mix the soil. The spoon can then be used to place the composited soil into an appropriate soil container.
Where analysis of the complete suite of volatile organics is required, the procedure for sampling soils will include steps that are commensurate with EPA Method 5035a as follows: After a fresh surface of the solid material is exposed to the atmosphere, the subsample collection process (splitting the sample: one to submit and the other for screening purpose) should be completed in the least amount of time in order to minimize the loss of VOCs due to volatilization. Removing a subsample from a material should be done in the least amount of disruption as possible. Additionally, rough trimming of the sampling location's surface should be considered if the material may have already lost VOCs or if it may be contaminated by other waste, different soil strata, or vegetation. Removal of surface layers can be accomplished by scraping the surface using a clean spatula, scoop, knife, or shovel.

Subsamples of the appropriate size for analysis should be collected using a metal or rigid plastic coring tool. For example, coring tools for the purpose of transferring a subsample can be made from disposable plastic syringes by cutting off the tapered front end and removing the rubber cap from the plunger or can be purchased as either plastic or stainless steel coring devices. When inserting a clean coring tool into a fresh surface for sample collection, air should not be trapped behind the sample. If air is trapped, it could either pass through the samples material causing VOCs to be lost or cause the sample to be pushed prematurely form the coring tool. The commercially available EasyDraw Syringe^{TM} and Powerstop Handle^{TM} and Terra Core^{TM} sampler coring devices are designed to prevent headspace air above the sample contents.

After an undisturbed sample has been obtained by pushing the barrel of the coring tool into a freshly exposed surface and then removing the corer once filled, the exterior of the barrel should be quickly wiped with a clean disposable towel. If the coring device is used as a storage container, cap the open end after ensuring that the sealing surfaces are cleaned. If the device is to be solely used for collection and not for storage, immediately extrude the sample into a volatile organic analysis (VOA) vial or bottle by gently pushing the plunger. Obtaining and transferring a sample should be done rapidly to reduce volatilization losses. If the vial or bottle contains methanol or another liquid, it should be held at an angle when extruding the sample into the container to minimize splashing. Just before capping, a visual inspection of the lip and threads of the sample vessel should be made, and any foreign debris should be removed with a clean towel, allowing an airtight seal to form.

The soil samples are placed into an ice chest containing frozen “blue ice” for preservation. The sample is then forwarded to the analytical laboratory using proper chain-of-custody procedures and custody seals. All soil sample containers are labeled with sample identification numbers, the site name, the date, the sample depth, the analytical test required, and the sampler’s name. Refer to Appendix C for examples of Chain-of Custody reports, custody seals, and sample labels.

2.2.2.1.1 Direct Push Borings and Boreholes

Soil borings are drilled using a truck-mounted direct push drilling rig. Soil samples are collected using a Modified California split-spoon. Sample collection can be attempted at continuous sample intervals by driving the sampler directly into the ground.

Subsurface soil samples can also be collected from boreholes generated by a hollow stem auger using a split spoon sampler. Soil samples collected during direct push-probe activities are collected in 4-foot long acetate or PETG liners, and transferred to appropriate lab-supplied jars. During drilling, cuttings or sample materials are screened for VOC using a PID as described above. Each split spoon sample will be collected according to the American Society for Testing Materials (ASTM) D1586 standard penetration test method, with the sample being transferred directly from the split spoon into the appropriate sample container (4-8 ounce glass jar sealed with a Teflon lid). Refer to Appendix D for an example of a boring log.

2.2.2.1.2 Test Pits

Test pits may be excavated by hand or with power equipment such as a backhoe to permit detailed examination and a better understanding of the nature and extent of contamination. Samples are collected from the wall or base of the pit after removing on inch of soil from the surface with a stainless steel spoon, and are placed directly into appropriate containers supplied by the laboratory. Samples can also be taken from an undisturbed volume of soil within a backhoe bucket. Test pits deeper than four feet should not be entered for sample collection; in these cases, a backhoe is used to bring soil samples to the surface.

2.2.2.1.3 Hand Augers

Hand augers can be used to collect soil samples to depths of approximately 10 feet. The sample is extruded into an aluminum or stainless steel pan followed by immediate placement into appropriate sample containers. It is possible to obtain samples from discrete depths by forcing the soil core from the auger and collecting from the depth of interest. The environmental contractor shall assess whether a lined or stainless steel auger is necessary.

2.2.2.2 Sampling Procedure for Sediments

There are many factors to consider when choosing sediment sampling equipment, including, but not limited to: sample site access, sample volume requirements, sediment texture, and target depth for sediment collection. In general, piston samplers are best used for soft, fine-grained sediments where sediments at depth are required. Grab/dredge samplers are best for course, shallow sediments and where large volumes of sediment are required.

2.2.2.3 Monitoring Well Installation and Sampling Procedures for Dedicated Monitoring Wells

Based on the results of the scoping phase, protection monitoring will likely be required to confirm that human health and the environment are adequately protected. At least four monitoring wells will be required to assess the on site seasonal variation in groundwater, contaminant levels, and groundwater flow. The location of the groundwater monitoring wells shall be determined after the scoping and site characterization phases. Once monitoring wells have been installed at the subject property, quarterly monitoring will be conducted to take measurements of the water levels and groundwater flow as well as the collection of groundwater samples to determine contaminant concentrations if present.

When drilling in known or potential areas of contamination, the drill rig derrick and all drilling equipment shall be steam cleaned before and after well construction. The casing and screens shall be steam cleaned and rinsed before installation, and stored off the ground on secure clean racks. The filter pack shall be washed with clean water before installation and shall not interfere with the chemical, physical, radiological, or biological constituents of interest. [Statutory Authority: Chapter 18.104 RCW.88-08-070 (Order 88-58), §173-160-530, filed 4/6/88.]

Wells installed for water quality sampling shall include the following: commercially fabricated screen. The well screen shall be constructed of material that is nonreactive to subsurface conditions. A filter pack is preferred, but not required in coarse or granular formations. When used, it shall be installed from the bottom of the screen to at least three feet above the top of the screen. The well shall be developed to assure continuity between the well, well screen, and formation material. The well seal shall consist of at least two feet of bentonite placed above the filter pack. The annular space shall be grouted with bentonite; or a bentonite-cement sealant, which has a weight in the range of eleven to thirteen pounds per gallon as verified on site, with a mud balance.

Monitoring wells designed to retain the outer casing shall be sealed into the first impermeable layer. The sealant shall be installed with a tremie tube from the bottom up. Only use potable water to hydrate the mixture.

The elevations of all wells will be surveyed to a common datum using a surveyor's level and rod. Well elevations will be recorded to 0.01 foot and accurate to 0.05 foot as determined by closure. Wells will be located on topographic maps (1:24,000) and using a Magellan Global Positioning System (GPS). GPS well locations will be recorded as latitude and longitude. When the study is completed, all wells will be decommissioned in accordance with Chapter 173-160 WAC.

A licensed driller under subcontract to the environmental contractor will install the monitoring wells. The wells will meet or exceed the requirements of Minimum Standards for Construction and Maintenance of Wells (Chapter 173-160 WAC). Wells will be constructed with 2-inch diameter PVC, flush-threaded casing, and commercially fabricated seven-or ten-foot long screens. Clean, inert sand pack materials will be placed over the screened interval to two feet above the top of the screen. Bentonite and cement/bentonite seals will be placed along the entire length of the annular space (between the boring and the PVC well) from the top of the gravel pack to the surface. Samples can be collected at 5-foot intervals during drilling using a split spoon sampler. Core samples will be placed in labeled plastic zip-lock bags. A portion of the split spoon samples will be analyzed for grain size. Detailed notes will be taken during the drilling process, and photos will be taken of the drilling site and of representative core samples.

After completion, the wells will be developed by the driller until the water removed from the borehole is free of sediment. A state well tag with a unique ID number will be attached to each new well. . Monitoring wells will be secured with a lock.

Well caps will be removed and the well allowed to vent for approximately 15 minutes. The depth of water will be measured to the nearest 100th of a foot (.01) using a decontaminated electric water level sounder.

Measurements will be based on standard operating procedures and the preexisting control points on each monitoring well as follows:

- To ensure consistency, prior to measuring any groundwater levels, the top of each well casing to be measured should be marked so that all measurements are collected from the same point.
- Remove the well cap and allow the well to vent for approximately 15 minutes.
- Turn on sounder and check the battery.
- Rinse the sounder probe with deionized water to decontaminate the probe and check the sensitivity of the probe.
- At the survey mark on the top of the well casing, slowly lower the probe into the well until it sounds.
- Record the depth at which the probe first sounds. The measurement should be taken from the top of the well casing. Record the depth measurement to the nearest 0.01 foot.
- Retrieve the probe from the well and rinse with deionized water, dry, and store.
- Repeat this process for each well.

Water resource technicians should take steps necessary to avoid any potential hazards that may be associated with the well or surrounding area. Also the technicians should take steps necessary to ensure that the electric water level sounder is operating correctly to avoid inaccurate measurements. The technician should make sure the battery is fully charged and test the sounder probe for water sensitivity prior to beginning measurement.

After initial measurements have been recorded, the monitoring well will be purged. During purging pH and electrical conductivity will be measured and recorded. Indicator parameters will be considered stabilized when three successive measurements, in 5-gallon increments, vary less than 10 percent. A minimum of three well casing volumes will be removed during purging.

Groundwater samples will be collected using a disposable bailer suspended by a nylon cord or through a peristaltic pump and dedicated tubing. Samples that will be submitted for organic analysis will be collected with Teflon bailers or with Teflon-lined tubing. When using disposable bailers, the bailer will be slowly lowered, retrieved, and emptied to avoid degassing the sample. When using a peristaltic pump to collect samples, the sample line will be first flushed at a rate sufficiently high to remove all sediment and gas pockets. The sample line flow rate will be regulated to not less than 500 milliliters per minute during sample collection. Samples collected from the bailer or peristaltic pump tubing will be transferred directly into the sample bottles.

2.2.2.4 Sampling Procedure for Open Bodies of Water

Grab sampling is the methodology most frequently used for sampling open bodies of water. This procedure is applicable for water sampling from sources such as rivers, streams, lakes, reservoirs, ditches, and pipelines or conduits.

Normally, samples collected from open bodies of water are taken without separation of particulate matter. If constituents are present in colloidal or flocculent suspension, the sample is taken so that they are present in representative proportion.

Sampling points will be determined during the development of the site-specific SAP. Because of the wide variety of conditions found in streams, lakes, reservoirs, and other bodies of water, it is not possible to prescribe the exact point of sampling. The location of the sampling point will be chosen with respect to the information desired and in conformity to local conditions.

2.2.2.5 Sample Preparation for Various Chemical Analytical Methods

During the collection of soil, sediment, groundwater, or surface water samples, the following procedures must be performed and documented:

- A new pair of protective gloves should be worn for each sample collected
- Check sample container for cleanliness or sterility
- Ensure that the container has the appropriate laboratory required preservative
- Fill entire sample container
- Do not leave headspace in containers used to collect volatile organic compounds
- Carefully label container with indelible ink
- Secure label to container and fasten tape over label if necessary; label cap
- Record on the label: sample ID number, sample location, sample depth, project number, site name, sampler's name, date and time sampled, and analysis on the sample label and field logbook
- Manufacturer, model number and calibration results of meters/instruments to be used to measure field parameters
- Transfer sample to a cooler that contains frozen "blue ice" to achieve 4 degrees C
- The completed chain-of-custody report will be sealed in a zip lock plastic bag and taped to the inside lid of the cooler
- Filled coolers will be sealed with the appropriate custody seals
- Freight bills and bills of lading will be maintained as part of the permanent record

Pertinent information on the chain-of-custody report will be recorded. This information will also be recorded on the field logbook. The information on the sample label should match the information on the chain-of-custody and the field logbook.

The following information should be recorded in the field logbook:

- Sample location
- Sample location condition and observations of surrounding area
- Soil/sediment classification
- Soil/sediment depth
- Water conditions during sediment sampling such as suspended sediments, color, flow, and pH
- Time of sample collection
- Initials of sampler
- Laboratory analysis requested
- Weather conditions/temperature
- Field screening results
- Equipment calibration result

Additional requirements for well water sampling are as follows:

- Well number or sample location designation
- Well purge volume calculations or time required to reach parameter equilibrium
- Well purging or equilibrium start time, finish time, rate, and total estimated volume
- Field parameter measurements made for each required volume measurement
- Preservatives used

When collecting samples for multiple analyses, collect water samples in the order of the analytical parameters’ degassing sensitivity. Each sample location will have a designated suite of analysis to be collected. Collect the number of designated analysis or suite of analyses for the specific sample location in the order presented in Table 2.

2.2.2.5.1 Procedures for Collection of Volatile Organic Compounds, Total Petroleum Hydrocarbons: Gasoline, Benzene, Toluene, Ethyl benzene, and Xylenes (TPH-G/BTEX) in Water Samples

Because of their potential to evaporate and degrade, VOC and TPH-G/(BTEX) samples require special procedures for collection, preservation, and handling. Use laboratory-cleaned 40-ml amber glass vials (VOA vials) for sample collection. Fill the containers using low-flow rates (<0.5 liter per minute). Preserve collected samples in accordance with the analytical laboratory. Ship refrigerated samples under chain-of-custody to the laboratory within the recommended holding times. Unless modified by site-specific factors, use the following method for VOC and TPH-G/BTEX sampling:

- Obtain one plus the required number of labeled, pre-preserved amber 40-ml vials for each sampling station. For samples being submitted for TPH-G/BTEX analysis, use the first vial to verify that the correct amount of hydrochloric acid (HCL) has been added to reduce the sample pH to below 2. Use the other vials to collect the samples and duplicates.
- Wearing gloves and splash-proof goggles fill the TPH-G/BTEX pH test vial completely from the pump, open container, or faucet. Cap the vial with the Teflon side down, and shake vigorously for one minute. Open vial and test with a pH meter or special litmus paper. If pH is below 2 then the required number of sample vials can be collected.
- If the pH is not below 2 after testing the TPH-G/BTEX test vial, additional preservative will need to be added. Add one drop of 1:1 HCL to the sample with a clean pipette. The acid is heavier than water and will sink to the bottom. Cap the vial and shake vigorously to promote mixing. Then reset the pH of the sample with a pH meter or special litmus paper.
- Repeat this procedure until the sample pH is less than 2. Note the amount of acid used at this station in your field log book. This is the amount of preservative that will need to be added to the required number of sample vials to be collected. Set the test vial aside pending final disposal of the acified contents.
- Fill out the sample labels for remaining sample containers (required number of vials to be submitted for analysis) in waterproof ink. In addition to your name and the sample number, note the preservative used, and the exact location, date, and time of sample collection.

- Based on the pH test conducted above, use a clean pipette add the total number of additional drops of 1:1 HCL to each TPH-G/BTEX vial required to drop the pH below 2. Use caution when handling HCL, it can cause severe burns.
- Holding vial at an angle, slowly fill it at a low-flow rate of 0.11/min. to as close to the top as possible. As the sample fills, slowly tip the vial upright so as to form a meniscus (the curved upper surface of the water formed by surface tension) at the vial top. Be careful not to wash out preservative used. To avoid aeration, an alternative method is to insert the tubing into the vial and draw the tubing up as the water rises.
- If a meniscus is not formed, or cannot be formed without overfilling the vial and washing out the preservative, fill the cap with sample water and slowly pour it into the vial to form a meniscus.
- Screw the cap so that the Teflon side of the septum is down. Do not over tighten.
- Turn the vial upside down and tap it with a finger. If any bubbles appear, uncap the vial, add more water to the meniscus, recap, turnover, and repeat until none appear.
- Shake the vial for one minute.
- Repeat steps 4-9 above for QA/QC duplicates, blanks, and split samples.
- Wrap vials in a bubble pack or other type of padded packing material to prevent breakage. Store the vials upside down in an ice-filled cooler at 4 degrees C with a maximum/minimum thermometer, and ship overnight mail.
- Analyze the samples within 14 days.

2.2.2.5.2 Procedures for Collection of Chlorinated VOCs, Semi-Volatile Organics, Pesticides/PCBs, Tannin/Lignin, Chloride, Oil and grease, Nutrients, Total Organic Carbon, Sulfate, Total Solids, Color, and Alkalinity in Water Samples

Use the following procedure to collect samples for chlorinated VOCs, semi-volatile organics, pesticide/PCB and tannin/lignin analysis:

- Determine if the water source being sampled is chlorinated. Semi-volatile organic analysis and Pesticide/PCB analysis have different preservation requirements for chlorinated water (sodium thiosulfate) than non-chlorinated water (HCL).
- Select the appropriately pre-preserved container for the analysis desired.
- Fill the pre-preserved containers required for the analysis desired with the water sample.
- Add additional preservative, as necessary to meet the requirement specified for the analysis desired.
- Cap with Teflon-lined septum and plastic screw cap.
- Fill additional bottles for field and equipment blank, duplicates, or split samples.
- Store bottles in an ice-filled cooler with a minimum/maximum thermometer at 4 degrees C.
- Analyze sample within laboratory requested holding times.

2.2.2.5.3 Procedures for Collection of Nitrate, Nitrites, Metals, ID IOC and Hardness of Water Samples

Use the following procedure for nitrate/nitrites and metals. Consult the analytical laboratory if filtered or non-filtered samples are required.

- If dissolved metals are to be analyzed, filter sample with a capsule filter.
- Fill one labeled pre-preserved 500 ml plastic bottle, avoiding aeration, for metals analysis.
- If required to reduce ph below 2, add additional nitric acid. Use gloves and splash-proof goggles when handling acid.
- Cap with plastic screw cap liner.
- Collect a second unfiltered sample in a labeled un-preserved 500 ml plastic bottle, avoiding aeration, for nitrate/nitrite analysis.
- Cap the second plastic bottle with a plastic screw cap liner.

- Fill additional bottles as described above for field and equipment blanks, duplicates, or split samples.
- Store bottles in an ice-filled cooler with a minimum/maximum thermometer at 4 degrees C.
- Analyze within the holding times recommended by the analytical laboratory.

2.2.2.5.4 Procedures for Collection of Total and Fecal Coliform, Biological Oxygen Demand in Water Samples from Well Water or Drinking Water

Use the following procedure to collect samples for total bacteria and fecal coliform analysis:

- When taking a sample from a sample line or tap, allow the water to run for at least 5 minutes, or long enough to flush six to ten times the volume of any part of the system that has been stagnant for 2 hours or more.
- Choose a sterile plastic sample bottle containing sodium thiosulfate ($Na_2S_2O_3$) if the water being sampled contains residual chlorine. Preservative is not required if water being sample is unchlorinated.
- Remove the stopper from the sample bottle. Grasp the stopper by the dust cover so as not to contaminate it by touching it; do not lay it down.
- Hold the bottle by the bottom to avoid touching the neck.
- Do not rinse the bottle with the sample.
- Quickly hold the bottle under flowing water to be sampled until it is about three-fourths full to permit mixing by shaking prior to testing.
- Replace the stopper and promptly crimp the dust cover in place over the neck of the bottle. Take care that the stopper and bottle neck are not touched during this operation and that no dust blows into the bottle.

2.2.2.6 Decontamination

All field equipment that is used to directly collect soil, sediment, groundwater, or surface water samples will be decontaminated prior to use and between each sampling event. The following procedures will be use to prevent cross contamination of samples collected during all subsurface explorations.

The field equipment will be initially scrubbed with a dry brush to remove heavy particles. The equipment will then be washed in a solution of Alconox or Trisodium Phosphate (TSP) and deionized water. The washed equipment will then be placed on clean plastic sheeting and allowed to air dry.

When using a drilling contractor, subsurface soil samplers (i.e., split spoons, core barrels, and SPTs) can be decontaminated by using a heated pressure washer (steam cleaner). The decontaminated samplers (if not to be used immediately) will be stored in a plastic bag until ready for use. Drilling equipment must be steam cleaned after each sampling event and prior to setup at next sampling location.

The sample containers will be supplied by the analytical laboratory and will be precleaned as required by SW-846, Standard Methods for the Examination of Water and Wastewater, and laboratory QA/QC protocol prior to shipping for sample collection. Sample containers will not be used for sample collection and storage without being certified clean by the manufacturer or analytical laboratory.

Disposable latex gloves will be used while collecting samples. New disposable gloves will be used for each sample location. All disposable sampling equipment will be wrapped in plastic and disposed of in an appropriate waste facility.

All wastewaters generated during the decontamination process will be collected and placed in drums for further sampling and disposal at an appropriate wastewater disposal facility.

2.2.3 Sample Containers, Preservation, and Holding Time Requirements

The laboratory attachment: Table 1, summarizes required sample containers, preservation techniques, and holding times for the most commonly requested analytes during a subsurface investigation. For information about analytes not listed in Table 1, check with the analyzing laboratory.

3 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

Sample quality must be maintained throughout the collection, transport, storage, and analysis process. All field activities will be fully documented, the samples clearly identified, and custody procedures followed in both the field and laboratory operations.

3.1 Sample Custody Procedure

The primary objective of chain-of-custody procedures is to provide an accurate written or computerized record that can be used to trace the possession and handling of a sample from collection through completion of all required laboratory analysis. A sample is in custody when it is in someone's physical possession, in someone's view, or locked in a secure and restricted area. All changes in sample possession must be fully documented with the person relinquishing the sample possession along with the date and time of separation. The person the sample is relinquished to must also be documented on the chain-of -custody record.

3.1.1 Field Sample Custody Procedure

The following custody procedures should be performed in order to ensure proper custody of samples while in the field:

- The designated field representative collects, labels, and packages the samples
- Sample containers showing signs of improper handling will not be used
- Samples will be placed directly into appropriately preserved coolers
- Once cooler is filled, the samples will be sealed within the cooler with the appropriate chain-of-custody report
- Coolers will be personally delivered, UPS'd, or Fed-Ex'd overnight to the analytical laboratory
- All changes in sample possession will be fully and completely documented, with the date, time, and persons relinquishing and receiving the samples on the appropriate chain-of-custody

3.1.2 Laboratory Sample Custody Procedure

Standard custody procedures will be followed during the transfer of samples into the laboratory custody. The chain-of-custody report will be fully documented. The sample receiver will record the condition of the containers and the custody seal (i.e. broken, unbroken). The laboratory representative responsible for sample intake shall document the condition of individual samples in the shipping container as well as the temperature of the container upon receipt. If the shipping container, any individual sample containers, or the shipping temperature is out of control, the laboratory will contact the environmental contractor for instruction on how to proceed with the sample event. The laboratory should follow the procedures documented in its Quality Manual for chain-of-custody sample handling, unless otherwise specified by the environmental contractor's project manager.

4 ANALYTICAL METHODS REQUIREMENTS

All analytical methods used on samples from the subsurface investigation must comply with relevant requirements of applicable federal or state programs for which they were collected, or EPA-approved alternate methods. The most recently approved methods under the Clean Water Act (CWA) and Safe Drinking Water Act (SDWA) were promulgated in the Code of Federal Requirements (40 CFR Part 136) on March 12, 2007. The relevant "Standards Methods" references are still promulgated for these analytes. Since the list of approved methods is subject to routine updates, the environmental contractor and the analytical laboratory will be expected to maintain a list of currently approved methods. Table 1 serves as a starting point for selecting analytical methods for subsurface investigations.

Analytical procedures for establishing compliance with state and federal drinking water standards are specified by regulation. Even though the purpose of this SAP is not to demonstrate compliance with drinking water standards, comparison of the water data generated in this SAP with drinking water standards is one of several benchmarks of groundwater quality that may be utilized. For that reason, analytical methods selected for water sampling are generally consistent with applicable regulatory guidelines and standards for drinking water analysis. Any specific analytical methods required by the project shall be explicitly identified in the site-specific SAP. Laboratories must use any methods specifically identified in the site-specific SAP unless the environmental contractor's project manager gives an exception to the laboratory in writing.

5 QUALITY CONTROL REQUIREMENTS

Regulatory actions and environmental decision-making requires data and information of the highest possible quality. Every procedural aspect, from project planning, sample collection, laboratory analysis, to data assessment, imparts a significant and often critical bearing on environmental decisions. This SAP describes and defines the general quality objectives of the subsurface investigation to be conducted at the subject property. Site-specific quality objectives are further defined by during each phase of investigation. This "phased" approach to quality system management ensures quality activities are conducted throughout the project, but allows flexibility to tailor-related activities to individual phases.

5.1 Field QC Requirements

All field personnel will be trained in acceptable sampling techniques, sample collection, preservation, and handling procedures, and field instrument operation and documentation procedures.

Field transport (trip) blanks will be submitted for each subsurface investigation that involves sampling for VOCs. These blanks are prepared by the analyzing laboratory using distilled, deionzed water, shipped with the other sample bottles to he field, and then returned to the analyzing laboratory with the samples for analysis. Field transport blanks are not separated from other samples, but are packaged with the environmental samples collected during the sampling event.

Rinsate blanks will also be collected for each sampling event. Each blank consists of two VOC purge vials filled with purified water at the site and shipped back with the samples. Rinsate blanks are used to assess potential contamination of samples resulting from improperly decontaminated sampling equipment.

Field duplicates will be collected at a rate of one per 20 samples in each media, with a minimum of one duplicate within each media per sampling event. Field duplicates are taken within five minutes of collecting the original samples, and include any additional samples. These samples are shipped back with the other sample bottles for analysis.

5.2 Laboratory QA/QC Requirements

Routine laboratory QA activities are documented in the analyzing laboratory's *Quality Manual.* Laboratory quality manuals must adhere to consensus standards adopted by the National Environmental Laboratory Accreditation Conference (NELAC), which include at a minimum the following elements:

- Daily instrument calibration or calibration verification prior to analysis of any samples.
- Method blank analysis daily or at a frequency of 1/20 samples, whichever is greater.
- Analysis of an independent reference standard daily to assess the accuracy of the calibration. This reference standard check should cover low, mid-level, and high ranges when appropriate.
- Analysis of laboratory samples duplicates or matrix spike/matrix spike duplicates (MS/MSD) on a frequency of 1/20 samples to assess the precision of the analysis.
- Determination of the minimum reporting limit based on detection limit studies and the concentration of calibration standards.

Precision and accuracy will vary with the analytical method and laboratory procedures. The analyzing laboratory must make precision and accuracy statements available upon request. The analyzing laboratory must prepare a quality assurance report evaluating the QC measurements listed above. Any deviations from the QC requirements presented in this SAP must be documented and approved by Ecology.

6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQIUREMENTS

Field instruments and equipment will be inspected and tested prior to, and at the end of each day’s sampling to ensure proper function and integrity. Should any instrument be dropped or adversely impacted during the sampling day, the instrument will be inspected for damage and recalibrated if necessary.

The instruments used in the field during each sampling day will be maintained as described by the manufacturer recommendations. All maintenance, testing, and inspection will be kept in an equipment maintenance log and kept on file for the duration of the project-sampling event.

7 INSTRUMENT CALIBRATION AND FREQUENCY

The PID is a thermo Environmental Model 580B OVM, or equivalent, with a 10.5 ev lamp. The instrument is calibrated to 100 parts per million by volume (ppmv) with an isobutylene gas standard. The PID will be calibrated at the beginning of each workday.

Water sampling field instruments that require calibration are stream velocity (flow), groundwater level sounder, or water level measuring devices, turbidity, pH, dissolved oxygen, temperature, and conductivity meters. These field instruments will be calibrated prior to each day’s use in accordance with the procedures and schedules recommended by the manufacturer. All calibration data will be recorded in the instrument log and field notebook. Operation calibration procedures for each field instrument will be conducted prior to the start of sampling.

Geospacial positioning system (GPS) equipment will be checked daily with a known position (latitude, longitude, and elevation).

Equipment that fails calibration or becomes inoperable during use will be removed from service and either segregated to prevent inadvertent use or tagged to indicate it is out of calibration. Such equipment will be repaired and satisfactorily recalibrated prior to reuse. Equipment that cannot be repaired will be replaced. Data collected with equipment that latter fails recalibration will be evaluated. If data appears to be affected, the results of the evaluation will be documented and the appropriate personnel notified.

8 INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES

All supplies and consumables should be examined for damage or other characteristics that would otherwise compromise data quality. Contractors and laboratories shall have written procedures for inspecting and accepting supplies and consumables in their Quality Management Plans or Quality System Manual.

8.1 Identification of Critical Supplies and Consumables

The following is a list of the minimum supplies and consumables required to conduct soil and sediment sampling.

- Write on rain field notebooks or field logs
- Sampling equipment for soils and shallow sediments (augers, probes, liners, stainless steel shovel/spoon, sheen pan, pH paper for soil and water, color chart for soil sediments and water)
- Sampling equipment for deep water sediments (Bottom dredge, core sediment sampler, color chart for soil/sediments and water)
- Rubber latex gloves
- Decontamination equipment
- 5-gallon buckets
- Scrub brush
- TSP
- Distilled/deionized water
- Towels
- Camera
- Compass
- Tyvek suit
- Rubber boots
- Sample containers
- Sample labels
- Blue ice
- Chain-of-custody reports
- Coolers
- PID

Additional supplies needed for water sampling are as follows:

- Disposable bailers
- Peristaltic pump
- Sampling tubing
- Nylon cord
- Field instruments (Flow; groundwater sounder or water table measuring device, temperature, turbidity, dissolved oxygen, pH, and electrical conductivity meters)
- Multi-probe such as Hydrolab
- Thermometer, hand held
- Refractometer

9 DATA ACQUISITION REQUIREMENTS (NON-DIRECT MEASUREMENTS)

Data from non-measurement sources, such as computer databases, computer programs, or scientific publications, must be approved for use by Ecology. The site-specific SAP must perform the following:

- Identify the data sources
- Describe the intended use of the data
- Cite any acceptance criteria for the data
- Clearly describe any limitations for use of the data

10 DATA MANAGEMENT

Data from all Phases of investigation, such as sample ID and Latitude/longitude coordinates, are recorded on field data sheets or hand held computers. Field data is reported through submission of field notebooks or field sampling data sheets. Laboratory analytical data should be submitted to the environmental contractor in both printed and electronic form. The environmental contractor or his/her designee will update the database with field and analytical data in a narrative form. All sampling data must be submitted consistent with procedures in Ecology’s Environmental Information Management (EIM) system. Data will be submitted in both printed and electronic form capable of being transferred into EIM, Chapter 173-340-840 WAC.

11 ASSESSMENT/OVERSITE

Data generated by the sampling activities will be assessed by Ecology as outlined in the Agreed Oder No. DE 6551. There will be no other formal oversight of this project from outside agencies. Ecology's Project Manager will track and report on the number, frequency and types of assessments, the personnel required to complete the assessment, and a completion schedule for unfinished assessment activities. Discrepancies in project data, objectives, or assessment schedules will be resolved in a timely manner.

11.1 Procedures for Calculating Precision and Accuracy

Precision and Accuracy are defined in Section 1.5 of this SAP. The following are the calculations used that correspond to each.

Precision can be measured with duplicate samples and calculated as standard deviation or relative percent difference (RPD). For purposes of this SAP, precision is calculated as RPD. *Relative percent Difference (RPD):* The difference between duplicate results for analysis of a sample, relative to the mean (average) value of those results, and expressed as a percent.

$$RPD=100(d_1-d_2)/\{(d_1 + d_2)/2)$$

$$=200(d_1-d_2)/(d_1-d_2)$$

where d_1 is the result of the first analysis, and d_2 is the second.

Accuracy will be measured with laboratory-spike samples and calculated as Percent Recovery (%R) and defined as 100 times the observed concentration, divided by the true concentration.

Percent recovery (%R): That percent of a known amount of material “spiked” or added to a sample being analyzed which is reported at the end of the analysis.

$$\%R = 100 (R_1 – R_2)/A$$

Where R_1 is the result for the sample without the spike, and R_2, the result for the spiked sample, and A is the equivalent concentration added in the spike sample.

12 DATA VALIDATION AND USABILITY

All data generated during the sampling activities is for Agency use and assessment. The Ecology's Project Manager, in coordination with the environmental and laboratory contractors, is responsible for assessing sampling design, sample collection procedures, sample handling, analytical procedures, quality control, calibration, data reduction, and data processing to determine if they have been satisfactorily instituted during the sampling activities. Further data review, verification, and validation procedures and requirements are discussed in Section 2 of this SAP.

12.1 Data Review, Verification, and Validation

The data validation will follow EPA "Guidance on Environmental Data Verification and Data validation (G-8) (November 2002)". These documents contain the details on technical data review criteria such as Precision, Bias, Accuracy, Representativeness, Comparability, and Completeness.

12.1.1 Precision

Precision is a measure of data variation when more than one measurement is taken on the sample. The precision estimate for duplicate measurements can be expressed as the relative percent difference (RPD).

12.1.2 Accuracy

Accuracy of laboratory analysis is assessed by measuring standard reference material and spiked samples. Standard reference materials are utilized to calibrate laboratory measurement instruments. Splitting a sample into two portions, spiking one portion with a known quantity of a constituent of interest, and analyzing both portions determine spike recovery. Spike recovery is expressed as percent recovery.

12.1.3 Representativeness

This term expresses the degree to which the data accurately and precisely represent actual conditions or characteristics of the site. Representativeness may be evaluated at the site using background samples collected from areas isolated from, yet similar to, the site and analyzed for the same constituents.

12.1.4 Completeness

Completeness is an estimate of the amount of valid data obtained from the analytical measurement system for a given set of data. The percent completeness is defined as the number of samples analyzed that meet the data quality goals divided by the total number of samples analyzed multiplied by 100. The completeness goal for this project is 95%.

12.1.5 Comparability

Using standard EPA accepted protocols; all matrix-specific samples will be collected, processed, and analyzed at sufficient detection limits, precision, and accuracy for correlation with previous available data.

12.2 Verification and Validation Methods

EPA National Functional Guidelines for Data validation that contain the details on technical review criteria such as Precision, Bias, Accuracy, Representativenes, Comparability, and Completeness shall be used for data validation. The analytical laboratory will perform data validation on each sample delivery group to determine if any systematic errors have occurred with the data.

12.3 Reconciliation with User Requirements

Data verification will be performed to ensure that the criteria specified in Section 11.1 have been met. Methods for verifying the compliance, correctness, consistency, and completeness of the data are described below.

<u>Compliance</u>-Field and laboratory QA/QC sample concentrations and recoveries will be examined to ensure they will fall within acceptable ranges.

<u>Correctness</u>-Log books will be reviewed to confirm that no deviations from the protocol occurred that would affect data usability. Any calculations performed will be double-checked.

<u>Consistency</u>-Logbooks will be reviewed to confirm that the same protocols were followed at every location.

<u>Completeness</u>- Master Log of samples collected will be compared against data received to confirm receipt of all results.

Data that are confirmed in error but cannot be corrected will be marked as rejected in the study database and will not be used in calculations and analyses. Data that appear suspicious, but have no reason for which to invalidate them will qualify as estimates.

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