Harper Estuary Restoration Project Phase II

Sampling and Analysis Plan / Quality Assurance Project Plan

Prepared for

Toxics Cleanup Program
Washington State Department of Ecology
Lacey, Washington

Prepared by

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List of Acronyms

bgs	below ground surface
CAD	computer-aided design
CAS	Chemical Abstracts Service
CCV	continuing calibration verification
COC	chain of custody
cPAH	carcinogenic polycyclic aromatic hydrocarbon
Ecology	Washington State Department of Ecology
EDD	electronic data deliverable
EDL	estimated detection limit
EIM	Environmental Information Management
EMPC	estimated maximum possible concentration
EPA	Environmental Protection Agency
FM	field manager
GIS	Geographic Information Systems
GPM	Government Project Manager
GPS	global positioning system
HASP	Health and Safety Plan
HPAH	high molecular weight polycyclic aromatic hydrocarbon
IDW	investigation-derived waste
LCS/LCSD	laboratory control sample/laboratory control sample duplicate
LPAH	low molecular weight polycyclic aromatic hydrocarbon
MDL	method detection limit
MS/MSD	matrix spike/matrix spike duplicate
MTCA	Model Toxics Control Act
OPR	ongoing precision and recovery
PAH	polycyclic aromatic hydrocarbon
PEF	potency equivalency factor
PPE	personal protective equipment
prep	preparatory
PSEP	Puget Sound Estuary Program
PSNERP	Puget Sound Nearshore Ecosystem Restoration Program
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
RL	reporting limit
RPD	relative percent difference
SAP	Sampling and Analysis Plan
SVOC	semivolatile organic compound
TEF	toxic equivalent factors
TEQ	toxic equivalent
TPH	total petroleum hydrocarbons
USEPA	U.S. Environmental Protection Agency
VOA	volatile organic analysis
VOC	volatile organic compound
WHO	World Health Organization

1.0 Introduction

This sampling and analysis plan/quality assurance project plan (SAP/QAPP) describes activities to be conducted by Leidos to assist the Washington State Department of Ecology (Ecology) in the evaluation of the potential presence of environmental contaminants in the Harper Estuary restoration project area.

The Harper Estuary restoration project will restore unimpeded tidal influence and habitat processes to a pocket estuary currently impacted by an undersized culvert and historical fill. The project will build on past nearshore habitat restoration feasibility studies and conceptual design work developed by the Puget Sound Nearshore Ecosystem Restoration Program (PSNERP) in 2011. The project is intended to restore tidal inundation to the estuary by either removing the SE Olympiad Road completely or constructing a new bridge to span the estuary; removing bulkheads, debris, and fill associated with the boat ramp and former brick factory; and planting native vegetation to re-establish estuarine salt marsh.

In 2012 a Level I Survey was conducted at the site. This survey included a records search, on-site interviews, and an assessment of the project site. The Level I findings indicated the presence of fill and other debris including brick and industrial waste from the old brick making factory that existed near the project area. The records search did not reveal any contamination or potential contaminant sources on or in the vicinity of the project area. However, the survey did recommend that a Level II Survey be completed.

The project area is located approximately 0.5 mile east of Port Orchard on the Kitsap Peninsula near the community of Southworth. Harper estuary is located in Section 02 of Township 23N, Range 02E in southern Kitsap County. The current estuary is bounded to the west by SE Southworth Drive (State Route 160) and is divided by SE Olympiad Drive.

1.1 Project Planning and Coordination

Celina Abercrombie of Ecology will serve as the Government Project Manager (GPM) who will conduct overall project coordination, supply government-furnished services, review reports, and coordinate with Leidos. Megan Gay will serve as the Leidos project manager and be responsible for executing this SAP/QAPP, overseeing the collection and analysis of field samples, and reporting analytical results to Ecology.

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1.2 Sample Collection

Aaron Wisher of Leidos will serve as field manager (FM) responsible for collecting and processing samples in accordance with the SAP/QAPP, and transporting samples to the analytical laboratories for analysis. The FM will oversee field preparation to ensure all sampling equipment meets sampling guidelines.

1.3 Laboratory Coordination and QA/QC Management

Marina Mitchell of Leidos will serve as project chemist and laboratory coordinator responsible for subcontracting state-certified laboratories and the independent data validator, and ensuring observation of established protocols for field decontamination, sample preservation, and chain of custody (COC) documentation. Ms. Mitchell will provide quality assurance oversight for the laboratory programs including laboratory reporting and holding times, oversight of the data validation subcontractor to ensure that the laboratory analytical and quality assurance/quality control (QA/QC) data are considered valid, and that procedures meet the analytical requirements.

1.4 Health and Safety Manager

Aaron Wisher of Leidos will serve as the designated Health and Safety Manager. The Health and Safety Manager is responsible for ensuring that all personnel are properly trained, fully aware of potential site hazards, conduct all work in a safe manner, wear appropriate personal protective equipment (PPE), and abide by the conditions set forth in the site-specific Health and Safety Plan (HASP).

1.5 Data Manager

Marina Mitchell of Leidos will serve as the data manager for this project. Ms. Mitchell is responsible for following the data management procedures described in Appendix B, reporting data to the project team as scheduled, project data management, and submission of data to the Ecology database.

1.6 Subcontractor Support

The Leidos project team will consist of the following subcontractors to support the data collection activities and laboratory analytical services:

- *Analytical Chemistry*

  TestAmerica
  Kristine Allen
  5755 8th Street East
  Tacoma, WA 98424
  Phone: (253) 922-2310
  Kris.Allen@testamericainc.com

- *Data Validation*

  EcoChem, Inc.
  Christine Ransom
  1011 Western Avenue, Suite 1011
  Seattle, WA 98104
  Phone: (206)233-9332 ext. 109
  cransom@ecochem.net

- *Equipment Supply*

  Instrumentation Northwest
  8902 122nd Ave NE
  Kirkland, WA 98033
  Phone: (425)822-4434
  Tyler.messer@inw.com

1.7 Project Schedule

Fieldwork is expected to begin within two weeks following the approval of this SAP/QAPP. Soil sampling is expected to take a maximum of two days. Leidos will submit initial, draft data tables of raw data and calculations of toxic equivalents (TEQs) to Ecology within 10 days of receipt of the data from the laboratory. A draft data report presenting analytical results will be submitted to Ecology for review within 30 days of the receipt of the validated analytical data. A final data report will be completed within 20 days of receipt of Ecology comments on the draft report, but no later than April 30, 2014.

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2.0 Field Sampling Plan

The purpose of the field sampling plan is to describe the procedures that will be used during sample collection at Harper Estuary. Based on the Ecology Statement of Work and preliminary discussion between Leidos and Ecology, Leidos plans to collect a maximum of twelve (12) discrete soil samples from the southwestern shoreline near the former brick factory and the northeastern old roadway embankment area.

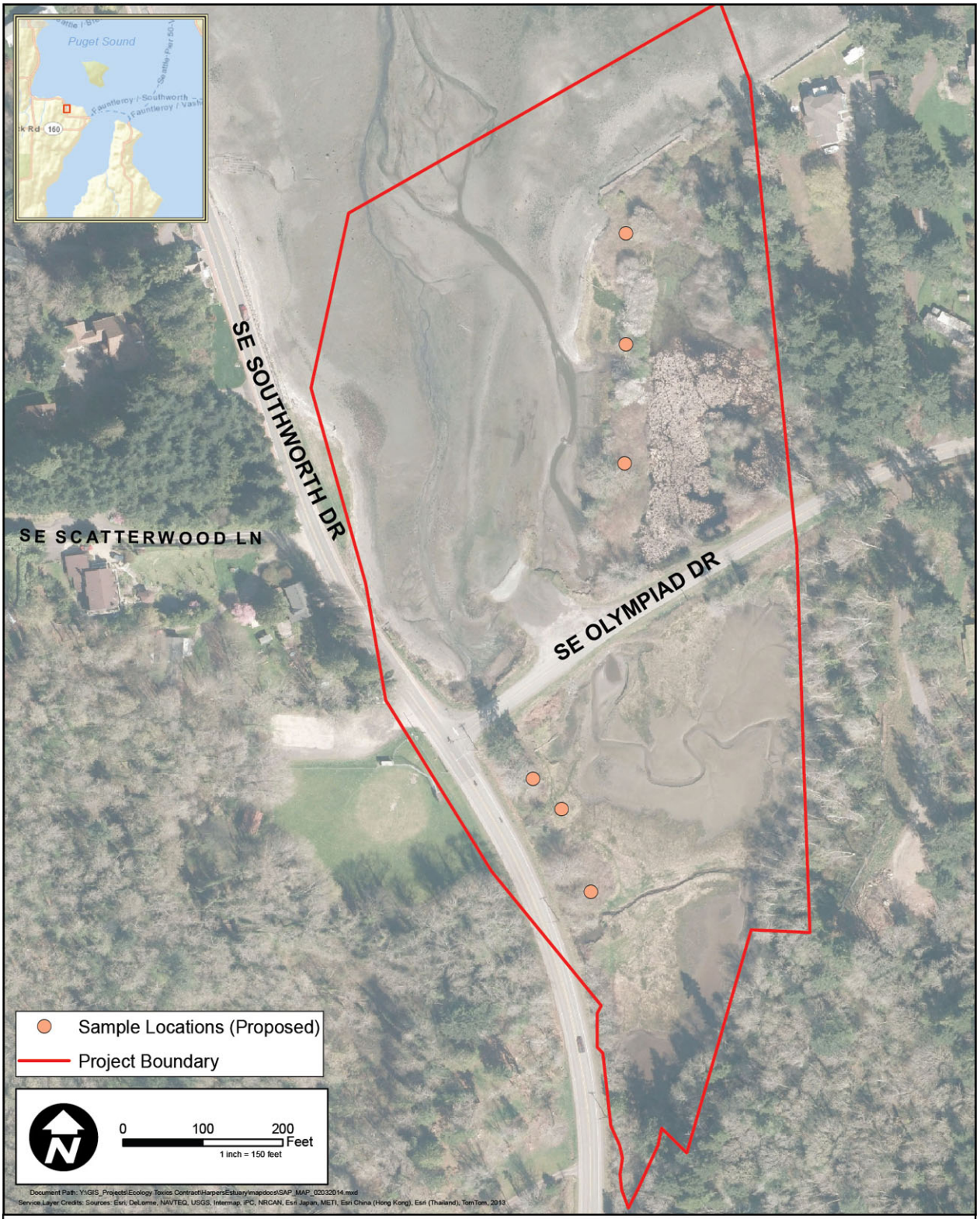
2.1 Soil Sampling

The field team will take photographs of each sample location during the beginning, middle, and end of each sample collection. Sampling locations' position, vegetative coverage, and soil characteristics will be documented. Two soil samples will be collected from each of six sampling locations, for a total of 12 discrete soil samples.

Twelve subsurface soil samples will be collected using a stainless steel hand auger at approximately 6 to 12 inches and 18 to 24 inches below ground surface (bgs). Sample intervals will be measured from the ground surface using a measuring tape until the desired sample interval is reached. The goal will be to collect soil samples beneath organic detritus at the surface and near the fill/native soil interface. In the northeastern old roadway embankment area, soil samples may be collected from the sides of the embankment. Preliminary sample locations are shown on Figure 1. Final sample locations will be determined in the field in consultation with Ecology.

Soil samples will be collected in two ways. Samples to be analyzed for volatile organic compounds (VOCs) will be collected using a terra core syringe (or equivalent) to collect undisturbed, non-homogenized soil directly from the hand auger. These samples will be collected first, prior to sampling for other analyses. For each sample, one plunger full (5 grams) will be placed in a 40 mL pre-weighed volatile organic analysis (VOA) vial containing a stir bar; this process is repeated to collect a second subsample for low level VOC analysis. Two plungers full (10 grams) will then be collected and placed into a pre-weighed 40 mL VOA vial containing 10 mL of methanol and a stir bar for medium level VOC analysis. Following subsampling for VOCs, one total petroleum hydrocarbon (TPH)-gasoline subsample will be collected for each sample, by placing two plunger's full (10 grams) of undisturbed soil into a pre-weighed 40 mL VOA vial containing 10 mL of methanol and a stir bar. The methanol vials are pre-weighed and pre-preserved.

Following VOC and TPH-G subsampling from unhomogenized material, subsamples for all other analyses will be collected from the hand auger using a stainless steel spoon and placed into appropriate laboratory supplied sampling containers (Table 1). If additional sample volume is needed, soil will be collected from the same sampling location over a greater depth or from an immediately adjacent secondary sampling location, to be determined in the field in consultation with Ecology. A decontaminated shovel may be used to obtain sufficient sample volume. The sample will be collected from soil on top of the shovel that is not in contact with the shovel surface to minimize the potential for cross contamination.



DEPARTMENT OF ECOLOGY
State of Washington

Figure 1. Harper Estuary Site Map

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Excluding the VOC and TPH-G subsamples, the subsamples for the discrete soil samples will be gently homogenized for the shortest time needed to achieve a well-mixed, homogenous sample volume in a decontaminated stainless steel bowl prior to filling pre-labeled sampling containers. Prior to analysis, each discrete subsample will be combined and sieved through a 2 mm mesh sieve at TestAmerica.

The two composite samples for analysis of dioxins/furans will be prepared in the field. Three discrete samples from the shallow horizon will be combined to make one composite sample from the north side of the site and one from the south side of the site. Approximately equal volumes of the component samples will be placed into a decontaminated stainless steel bowl and gently mixed with a decontaminated stainless steel spoon. However, any material greater than approximately 2 mm diameter (e.g., rocks, twigs, or foreign objects) may be removed from the sample with a decontaminated stainless steel spoon or freshly gloved hand. The homogenous composite sample is then transferred into a pre-labeled sampling container. Samples will be logged on the chain-of-custody form and placed on ice until delivery to the laboratory. TestAmerica Seattle will receive the samples and transfer them to their West Sacramento facility for analysis.

Hand-auger cuttings not intended for analysis will temporarily be placed on plastic sheeting and deposited back in the borehole at each location after sampling activities are completed. Each sampling location will be recorded using a Global Positioning System (GPS) unit. Following the collection of each hand auger sample, the sampling equipment will be decontaminated following procedures in Section 2.2.

All sampling containers will be provided by TestAmerica. Samples will be recorded on the COC form and placed on ice in a sturdy cooler until delivery to the laboratory.

2.1.1 Sample Identification

Soil samples will be identified by site abbreviation, location identifier, and sample depth. Each sample will be labeled with a unique alphanumeric sample identification number that identifies characteristics of the sample as follows:

Site Abbreviation	Location Identifier	Date	Sample Matrix	Sample Depth Interval
HE-	1-	YYYYMMDD-	S-	“6-12”

Where:

- *Facility Abbreviation* consists of the site abbreviation “HE” indicating Harper Estuary.
- *Location Identifier* consists of sequential numbers identifying the sample location. Composite samples will contain a sequential location identifier and noted on the COC as “COMP”. Location identifiers comprising the composite sample will be noted in the field notebook.
- *Date* is the date of sample collection *yyyymmdd* format.
- *Sample Matrix* consists of one character indicating the sample type where S = soil.
- *Sample Depth Interval* consists of “6-12” or “18-24” to indicate the upper and lower depth in inches of the subsurface samples.

Sample labels will be self-adhering, waterproof material. Indelible ink will be used to complete each sample label. Each sample label will contain the project name (Harper Estuary Phase II), sample identification, date and time of collection, analysis to be conducted (or a reference to a priority of analysis list on the COC form), preservation, and the initials of the person preparing the sample. Labels will be affixed to sample jars and bottles. All samples collected during the investigation will be labeled clearly and legibly when delivered to the laboratory.

2.1.2 Sample Storage and Delivery

All samples will be stored in sturdy, insulated coolers and preserved by cooling with ice or frozen gel-packs to a temperature of 0–6ºC. Maximum sample holding and extraction times will be strictly adhered to by field personnel for sample delivery and by the analytical laboratory.

Preparation of sample containers for delivery will be performed in the following manner:

- Sample containers will be placed inside Bubble Wrap Ziploc (or similar) bag and labeled.
- An empty insulated cooler will be prepared by lining the bottom of the cooler with bagged wet ice or ice packs. The wrapped sampling containers will be placed in the cooler upon completion of the collection and labeling of each sample.
- Samples for chemical analyses will be hand-delivered to TestAmerica upon completion of sampling. The COC form will be signed by the individual relinquishing samples to the onsite laboratory representative. Upon receipt of samples at the laboratory, the condition of the samples will be recorded by the receiver. The Leidos field personnel will be responsible for the following:
    - Packaging the samples,
    - Signing the COC form before placing inside the cooler or delivering to TestAmerica staff, and
    - Notifying the laboratory and Leidos project manager and chemist of when the samples are being delivered.

2.2 Equipment Decontamination

Prior to field operations, all sample processing equipment will be thoroughly decontaminated. Decontamination will be performed in accordance with Puget Sound Estuary Program (PSEP 1997a) using a laboratory-grade detergent (e.g., Alconox or Liquinox) and water solution, rinsed with tap water and rinsed with deionized or distilled water. Equipment (i.e., spoons and bowls) will be wrapped or covered with aluminum foil following decontamination. All sampling equipment will be rinsed with reagent-free water prior to sample collection. No additional solvents or acids will be used during equipment decontamination in the field. Any deviations from these procedures will be documented in the field logbook.

All sampling will be conducted using phthalate-free, nitrile disposable gloves, which will be changed frequently, as appropriate, and between sampling locations to prevent cross-contamination between samples.

2.3 Waste Disposal and Handling Procedures

Investigation-derived waste (IDW) generated during field activities covered by this SAP may include decontamination fluids, PPE, and miscellaneous solid waste generated during sample collection activities. Decontamination fluids will consist of a small quantity of dilute solution of Liquinox (or equivalent) and distilled water. Following decontamination of sampling equipment at each location, the decontamination fluid will be combined with the hand auger cuttings or excess sample material and deposited back in the borehole. Non-hazardous wastes that may be generated during field sampling activities, including gloves, foil, paper, plastic bags, disposable sampling equipment and other miscellaneous types of debris, will be placed in plastic bags for disposal as municipal waste.

2.4 Field Documentation

A complete record of field activities will be maintained. Documentation necessary to meet data quality objectives for this project include field notes and field forms, sample container labels, and COC forms. The field documentation will provide descriptions of all sampling activities, sampling personnel, and weather conditions; and it will record all modifications, decisions, and/or corrective actions to the study design and procedures identified in this SAP.

A field logbook made of water-resistant paper will be maintained during field operations. All entries will be made legibly, in indelible ink, and will be signed and dated daily. Information recorded will include the following:

- Date, time, place, and location of sampling;
- Onsite personnel and visitors;
- Daily safety discussion and any safety issues;
- Field measurements (depth of soil sample) and their units;
- Observations about site, location, and samples (weather, odors, appearance, etc.); and
- Equipment decontamination verification.

Field logbooks are intended to provide sufficient data and observations to enable participants to reconstruct events that occur during project field activities. Entries will be factual, detailed, and objective. Unless restricted by weather conditions, all original data recorded in field logbooks and on sample identification tags, COC records, and field forms will be written in waterproof ink. If an error is made, the individual responsible may make corrections simply by crossing out the error with a single line and adjacently recording the correct information with their initials and the date of correction. The erroneous information must not be obliterated. All documentation, including voided entries, must be maintained within project files.

2.4.1 Chain-of-Custody Procedures

The Leidos field crew will retain custody of samples at all times until delivery to TestAmerica. COC forms will be initiated at the time of sample collection to ensure that all collected samples are properly documented and traceable through storage, transport, and analysis. When all line items on the form are completed or when the samples are relinquished, the sample collection custodian will sign and date the form, list the time, and confirm the completeness and accuracy

of all information contained on the form. Each individual who subsequently assumes responsibility for the sample will sign the COC form. Sample custody by Leidos terminates when the laboratory takes possession of the samples. The project manager will retain a copy of the completed, signed form(s) for project files.

2.5 Laboratory Analyses

All of the analytical procedures used in this program will be performed by TestAmerica in accordance with current U.S. Environmental Protection Agency (EPA) and Ecology (Ecology 2008), and PSEP guidelines (PSEP 1997a, b, c, d). The laboratory participating in this investigation is accredited by Ecology and has an internal quality assurance (QA) plan. Analyses are required to conform to referenced test methods and the laboratory's written QA plan and standard operating procedures.

TestAmerica will combine the sample volume provided for TPH-Dx, semivolatile organic compounds (SVOCs), and metals for each discrete sample, sieve the soil through 2 mm mesh, and homogenize the material prior to analysis. All discrete soil samples will be analyzed for the following:

- Gasoline-range hydrocarbons (TPH-G) by NWTPH-G,
- Diesel- and oil-range hydrocarbons (TPH-Dx) by NWTPH-Dx with sulfuric acid/silica gel cleanup,
- Volatile organic compounds (VOCs) by EPA 8260B,
- Semivolatile organic compounds (SVOCs) by EPA 8270C,
- Priority pollutant metals (As, Ag, Sb, Be, Cd, Cr, Cu, Hg, Pb, Ni, Se, Tl, and Zn) by EPA 6020/6010B/7471A.

Additionally, two composite soil samples will be analyzed for dioxins/furans by EPA 1613B by TestAmerica in West Sacramento, California. These samples will be shipped under proper chain-of-custody procedures to this TestAmerica laboratory by the TestAmerica laboratory personnel at the Seattle location.

Analytical methods, sampling containers, preservation, and holding times are presented in Table 1.

2.5.1 Laboratory Reports

Laboratory reports will be accompanied by sufficient raw data, supportive documentation, and quality control (QC) results to enable independent reviewers to evaluate the quality of the data and recalculate the results. The analytical laboratory deliverables will include but are not limited to the following:

- Method detection limits (MDLs) and reporting limits (RLs) for each sample;
- Laboratory qualifiers reported with analyte concentrations and a summary of qualifier definitions;
- Case narrative describing any problems encountered, protocol modifications, and/or corrective actions taken;

- Sample analytical and QC results with units and control limits;
- All method references used during analyses;
- Any protocol deviations from the approved sampling plan;
- Surrogate recovery results and control limits;
- Matrix spike/matrix spike duplicate (MS/MSD) results and control limits;
- Laboratory duplicate results and control limits;
- Method blank results;
- Laboratory control sample/laboratory control sample duplicate (LCS/LCSD) results;
- Initial and continuing calibration results and control limits;
- Internal standard recoveries;
- Instrument blank results (metals only);
- Interference check standard (ICSA/ICASB) results (metals only);
- Serial dilution results (metals only);
- Sample custody records (including original COC forms);
- Raw data (instrument printouts, tunes, chromatograms, ion traces, sample preparation bench sheets); and
- Sample and QC results in a previously agreed upon electronic data deliverable format, as listed in Appendix C.

Table 1. Analytical Methods, Sampling Containers, Preservation and Holding Time Requirements

Analyte Group	Analytical Method	Sampling Container	Preservation	Holding Time
TPH-G	NWTPH-G	(1) 40 mL VOA vial with Teflon-lined lid with septa pre-preserved with methanol[a]	methanol, cool (0-6°C)	14 days
VOCs	EPA 8260B	(2) 40 mL unpreserved VOA vials with stir bar; (1) 40 mL VOA vial pre-preserved with methanol[a]	unpreserved VOA vials will be preserved by lab upon receipt (i.e., frozen) and/or analyzed within 48 hours; methanol, cool (0-6°C)	14 days
SVOCs	EPA 8270C	8 oz glass widemouth with Teflon-lined lid	cool (0–6°C)	14 days to extract, 40 days to analyze (1 year to extract if frozen)
TPH-Dx	NWTPH-Dx		cool (0–6°C)	14 days to extract, 40 days to analyze (1 year to extract if frozen)
Metals[b]	EPA 6020 (or EPA 6010B)	4 oz glass jar	cool (0–6°C)	6 months (2 years if frozen)

Analyte Group	Analytical Method	Sampling Container	Preservation	Holding Time
Mercury	EPA 7471A		cool (0–6°C)	28 days (6 months if frozen)
Dioxins/ furans	EPA 1613B	8 oz clear or amber glass wide mouth with Teflon-lined lid	cool (0–6°C) or freeze (-20°C)	1 year to extract, 40 days to analyze

a Approximately 10 grams of soil is added to VOA vials pre-preserved with methanol for TPH-G and VOC analysis; approximately 5 grams of soil is added to unpreserved VOA vials for VOC analysis. A single 40 mL VOA vial preserved with methanol may be used for both the TPH-G and VOC analysis. The "unpreserved" VOA vials may contain approximately 5 mLs of deionized water.

b Metals include antimony arsenic, beryllium, cadmium, chromium, copper, lead, nickel, selenium, silver, thallium, and zinc.

3.0 Quality Assurance Project Plan

The purpose of the project QAPP is to provide confidence in the analytical results through a system of QA/QC performance checks with respect to data collection methods, laboratory analysis, data reporting, and appropriate corrective actions to achieve compliance with established performance and data quality criteria. This section presents the QA/QC protocols used to ensure that the data obtained during the investigation are legally defensible and usable for their intended purpose. Target MDLs and RLs are presented in Appendix A.

3.1 Measurements of Data Quality

The quality of the data reported by the laboratory will be evaluated using accuracy, precision, representativeness, completeness, and comparability as described below.

Accuracy is the degree to which an observed measurement agrees with an accepted reference or true value. Accuracy is a measure of the bias in the system and is expressed as the percent recoveries of spiked analytes in laboratory control sample/laboratory control sample duplicate (LCS/LCSD) and matrix spike/matrix spike duplicate (MS/MSD) samples. Accuracy will also be evaluated through the surrogate spikes in each sample for the organic chemistry analyses. The performance-based (or method defined) laboratory control limits for accuracy will be used for the project.

Precision is a measure of mutual agreement among individual measurements of the same property under prescribed conditions. Precision will be assessed by the analysis of MS/MSD samples, laboratory duplicate samples, and LCS/LCSD samples. The calculated relative percent differences (RPDs) for laboratory duplicate and MS/MSD pairs will provide information on the precision of sampling and analytical procedures, and the RPDs for LCS/LCSD pairs will provide information on precision of the analytical procedures. The performance-based (or method defined) laboratory control limits for precision will be used for the project. A laboratory duplicate sample will be analyzed for all parameters.

Representativeness expresses the degree to which data accurately and precisely represent an actual condition or characteristic at a particular sampling point. Representativeness is achieved by collecting samples representative of the matrix at the time of collection. Representativeness can be evaluated using replicate samples and blanks.

Completeness refers to the amount of acceptable data points collected relative to the amount needed to achieve the project's technical objectives. Completeness is calculated as the number of valid data points achieved divided by the total number of data points expected for all requested analyses. For this project, the overall completeness objective is 95 percent.

Comparability is based on the use of established U.S. Environmental Protection Agency (USEPA)-approved methods for the analysis of the selected parameters. The quantification of the analytical parameters is based on published methods, supplemented with well-documented procedures used in the laboratory to ensure reproducibility of the data.

3.2 Quality Assurance and Quality Control

Instrument calibration and laboratory QA/QC sample requirements are defined in the test methods and the laboratory's written standard operating procedures. An LCSD should be analyzed if the laboratory does not have sufficient sample volume to prepare a project-specific MS/MSD or organic test methods, and/or a matrix spike and laboratory duplicate sample pair for inorganic test methods. The results of these samples will provide information on the accuracy and precision of the chemical analysis and will be used to qualify data, as necessary, during data validation using USEPA functional guidelines (USEPA 1994, 2008, 2009, 2010, 2011). The frequencies of analysis for laboratory QA/QC samples are summarized in Table 2.

A trip blank sample will be provided by TestAmerica consisting of laboratory-supplied organic-free water, and will follow the sample shipment through all phases of sample collection and transport to the laboratory. The trip blank sample will be included in the cooler containing VOC and TPH-G sub-samples and will be analyzed for VOCs and TPH-G. No other field QA/QC samples will be collected during this investigation; however, a laboratory duplicate sample is required for all analyses. A preparatory (prep) batch is defined as 20 environmental samples or less prepared (e.g., extracted or digested) at the same time.

Table 2. Laboratory QA/QC Requirements

Analysis Type	Initial Calibration	CCV	LCS/OPR	Method Blanks	Surrogates	Matrix Spike	Lab Duplicate
SVOCs	prior to analysis	start of 12-hour analytical batch	one per prep batch	one per prep batch	every sample	one MS/MSD	one
VOCs	prior to analysis	start of 12-hour analytical batch	one per prep batch	one per prep batch	every sample	one MS/MSD	one
TPH-G and TPH-Dx	prior to analysis	start of batch, every 12 hours and end of analytical batch	one per prep batch	one per prep batch	every sample	na	one
Metals including mercury	daily, prior to analysis	start of batch, every 10 samples and end of analytical batch	one per prep batch	one per prep batch	na	one MS	one
Dioxins/ Furans	prior to analysis	start of batch, every 12 hours	one per prep batch	one per prep batch	every sample	na	one

CCV = continuing calibration verification
LCS = laboratory control sample / an ongoing precision and recovery sample (OPR) may be substituted for an LCS for analysis of dioxins/furans
na = not applicable
MS/MSD = matrix spike/matrix spike duplicate

3.2.1 Data Validation

All analytical results obtained during this investigation will undergo independent full level data validation (EPA Stage 4) by EcoChem, Inc. of Seattle, WA. Data validation will be performed following USEPA guidance (USEPA 1994, 2008, 2009, 2010, 2011). If data quality concerns are noted, the laboratory will be contacted, as necessary, and the samples will be reanalyzed, data qualified, and/or the issue discussed in the data validation report. As a part of validation, 100% of the sample results in the EDD will be verified against the laboratory data package. The results

of the data validation will be summarized in a data validation report, which will be included as an appendix to the data report.

The analytical laboratories will provide electronic copies of the data packages to Leidos and EcoChem (hardcopies are not required). The data packages will contain sufficient information to allow for the full level data validation and review of all sample and laboratory QC sample results (i.e., calibration, method blanks, LCS/LCSD, and MS/MSD) including all raw data needed to evaluate and recalculate reported results.

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4.0 Data Analysis, Recordkeeping, and Reporting Requirements

4.1 Analysis of Chemistry Data

The chemical results for soil samples will be compared to Washington State Model Toxics Control Act (MTCA) Method A, Unrestricted Land Use regulatory criteria. See Appendix B for additional details regarding data management procedures.

4.2 Recordkeeping

At the conclusion of the study, all records including field records, laboratory data reports, data validation reports, and other relevant documentation will be provided to Ecology for archive.

4.3 Data Report

A data report presenting the chemical results and briefly summarizing activities associated with sample collection and chemical analyses of samples will be prepared by Leidos and submitted to Ecology at the end of the investigation. At a minimum, the following will be included in the memorandum:

- A description of sampling and analysis activities;
- Protocols used during sampling and testing and a summary of any deviations from the procedures described in this SAP/QAPP;
- Chain of custody records;
- Chemistry results summarized in data tables compared to MTCA criteria; exceedances will be highlighted (bold, underlined, or shaded);
- A QA/QC summary;
- Copies of laboratory reports; and
- A copy of the data validation report.

Leidos will provide all deliverables to Ecology electronically in Microsoft Word, Excel, and/or Adobe .pdf formats for all documents, as appropriate. Leidos will provide georeferenced data files in the appropriate format specified by Ecology for all figures created with computer-aided design (CAD) or Geographic Information Systems (GIS) software. The draft data report will be due to Ecology 30 days after Leidos receives the validated data. Leidos will submit the final data report to Ecology within 20 days following receipt of Ecology's comments on the draft report but no later than April 30, 2014.

In addition, the chemistry data will be uploaded into Ecology's Environmental Information Management (EIM) database. Information for entering environmental data into EIM can be found on Ecology's website: http://www.ecy.wa.gov/eim/.

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5.0 References

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Appendix A

Target Analytes, Method Detection Limits, and Reporting Limits

Sensitivity is a measure of an analytical method's ability to detect a chemical and the concentration that the chemical can be reliably quantified by that method. The minimum concentration of a chemical that can be detected is called the method detection limit (MDL). The minimum concentration that can be reliably quantified is called the reporting limit (RL). Detected concentrations above the RL will be reported by the laboratories without qualification. Values between the MDL and RL will be reported with a J-qualifier indicating that the reported concentration is estimated. Values below the MDL are reported as non-detect (U-qualified) at the RL value with the following exception. Non-detect results for dioxins/furans are reported at the sample specific estimated detection limit (EDL).

Target analytes, test methods MDLs, RLs, and quality assurance/quality control (QA/QC) limits for solids samples are presented in Table A-1. The analyses conducted for each sample will depend on the amount of sample volume collected and the priority of analyses for each sampling location.

Table A-1. Target Analytes, Test Methods, Method Detection Limits, Reporting Limits, Accuracy Limits, and Precision Limits for Soil Samples

Chemical [a]	MDL [b]	RL [b]	Accuracy Limits % (LCS/LCSD) [c]	Accuracy Limits % (MS/MSD) [c]	Precision Limits % (LCS/LCSD) [c]	Precision Limits % (MS/MSD) [c]
Metals by 6020 (mg/kg) [d]						
Antimony	0.0420	0.200	80 - 120	80 - 120	20	20
Arsenic	0.180	0.500	80 - 120	80 - 120	20	20
Beryllium	0.0220	0.200	80 - 120	80 - 120	20	20
Cadmium	0.00800	0.200	80 - 120	80 - 120	20	20
Chromium	0.113	0.200	80 - 120	80 - 120	20	20
Copper	0.0980	0.400	80 - 120	80 - 120	20	20
Lead	0.0130	0.200	80 - 120	80 - 120	20	20
Nickel	0.0710	0.500	80 - 120	80 - 120	20	20
Selenium	0.202	0.700	80 - 120	80 - 120	20	20
Silver	0.0120	0.200	80 - 120	80 - 120	20	20
Thallium	0.130	0.500	80 - 120	80 - 120	20	20
Zinc	1.12	2.00	80 - 120	80 - 120	20	20
Mercury by 7471A (mg/kg)						
Mercury	0.00630	0.0200	80 - 120	80 - 120	20	20

Chemical [a]	MDL[b]	RL[b]	Accuracy Limits % (LCS/LCSD)[c]	Accuracy Limits % (MS/MSD) [c]	Precision Limits % (LCS/LCSD) [c]	Precision Limits % (MS/MSD) [c]
VOCs by 8260B (µg/kg dw)						
1,1,1,2-Tetrachloroethane	0.300	1.00	72 - 123	75 - 125	20	30
1,1,1-Trichloroethane	0.400	1.00	63 - 135	70 - 135	20	30
1,1,2,2-Tetrachloroethane	0.300	2.00	73 - 125	55 - 130	22	30
1,1,2-Trichloroethane	0.300	1.00	77 - 124	60 - 125	18	30
1,1-Dichloroethane	0.400	1.00	70 - 128	75 - 125	21	30
1,1-Dichloroethene	0.300	5.00	70 - 133	65 - 135	23	30
1,1-Dichloropropene	0.400	1.00	77 - 123	70 - 135	16	30
1,2,3-Trichlorobenzene	0.300	2.00	61 - 130	60 - 135	23	30
1,2,3-Trichloropropane	0.400	1.00	77 - 123	65 - 130	23	30
1,2,4-Trichlorobenzene	0.400	2.00	61 - 130	65 - 130	22	30
1,2,4-Trimethylbenzene	0.400	2.00	79 - 124	65 - 135	18	30
1,2-Dibromo-3-Chloropropane	0.300	2.00	53 - 132	40 - 135	27	30
1,2-Dichlorobenzene	0.400	1.00	79 - 117	75 - 120	17	30
1,2-Dichloroethane	0.300	1.00	71 - 128	70 - 135	18	30
1,2-Dichloropropane	0.300	1.00	76 - 161	70 - 120	15	30
1,3,5-Trimethylbenzene	0.400	5.00	80 - 125	65 - 135	18	30
1,3-Dichlorobenzene	0.400	1.00	79 - 119	70 - 125	17	30
1,3-Dichloropropane	0.300	1.00	77 - 123	75 - 125	19	30
1,4-Dichlorobenzene	0.400	1.00	79 - 117	70 - 125	18	30
2,2-Dichloropropane	0.400	1.00	56 - 144	65 - 135	21	30
2-Chlorotoluene	0.300	2.00	79 - 122	70 - 130	18	30
4-Chlorotoluene	0.400	2.00	80 - 122	75 - 125	18	30
4-Isopropyltoluene	0.400	2.00	78 - 126	75 - 135	18	30
Benzene	0.300	1.00	70 - 128	75 - 125	19	30
Bromobenzene	0.300	2.00	80 - 120	65 - 120	19	30
Bromoform	0.300	1.00	50 - 124	55 - 135	25	30
Bromomethane	0.400	1.00	57 - 148	30 - 160	29	30
Carbon tetrachloride	0.400	1.00	59 - 145	65 - 135	19	30
Chlorobenzene	0.300	1.00	75 - 120	75 - 125	21	30
Chlorobromomethane	0.300	1.00	78 - 123	70 - 125	19	30
Chlorodibromomethane	0.300	1.00	69 - 129	65 - 130	23	30
Chloroethane	0.300	1.00	48 - 167	40 - 155	53	30
Chloroform	0.300	1.00	78 - 125	70 - 125	17	30

Chemical [a]	MDL[b]	RL[b]	Accuracy Limits % (LCS/LCSD)[c]	Accuracy Limits % (MS/MSD) [c]	Precision Limits % (LCS/LCSD) [c]	Precision Limits % (MS/MSD) [c]
Chloromethane	0.300	1.00	55 - 136	50 - 130	26	30
cis-1,2-Dichloroethene	0.300	1.00	70 - 130	65 - 125	19	30
cis-1,3-Dichloropropene	0.300	1.00	69 - 129	70 - 125	19	30
Dibromomethane	0.300	1.00	78 - 126	75 - 130	18	30
Dichlorobromomethane	0.300	1.00	58 - 133	70 - 130	19	30
Dichlorodifluoromethane	0.300	1.00	38 - 150	35 - 135	26	30
Ethylbenzene	0.300	1.00	78 - 126	75 - 125	23	30
Ethylene Dibromide	0.300	1.00	69 - 126	70 - 125	21	30
Hexachlorobutadiene	0.400	1.00	68 - 134	55 - 140	21	30
Isopropylbenzene	0.300	2.00	79 - 127	75 - 130	20	30
Methyl tert-butyl ether	0.300	1.00	65 - 125	59 - 137	30	30
Methylene Chloride	3.20	15.0	57 - 146	55 - 140	21	30
m-Xylene & p-Xylene	0.600	2.00	78 - 126	80 - 125	23	30
Naphthalene	0.300	5.00	14 - 170	40 - 125	50	30
n-Butylbenzene	0.400	2.00	78 - 128	65 - 140	17	30
N-Propylbenzene	0.300	1.00	81 - 127	65 - 135	20	30
o-Xylene	0.300	1.00	77 - 127	75 - 125	22	30
sec-Butylbenzene	0.400	2.00	78 - 128	65 - 130	17	30
Styrene	0.400	2.00	79 - 127	75 - 125	21	30
tert-Butylbenzene	0.400	2.00	71 - 136	65 - 130	27	30
Tetrachloroethene	0.300	1.00	56 - 150	65 - 140	27	30
Toluene	0.300	2.00	75 - 126	70 - 125	19	30
trans-1,2-Dichloroethene	0.300	1.00	76 - 131	65 - 135	18	30
trans-1,3-Dichloropropene	0.300	1.00	72 - 129	65 - 125	20	30
Trichloroethene	0.300	1.00	83 - 124	75 - 125	17	30
Trichlorofluoromethane	0.300	1.00	47 - 165	25 - 185	54	30
Vinyl chloride	0.300	1.00	67 - 131	60 - 125	22	30
SVOCs by 8270C (µg/kg)						
1,2,4-Trichlorobenzene	15.0	50.0	63 - 128	70 - 125	28	28
1,2-Dichlorobenzene	15.0	55.0	68 - 118	75 - 125	60	60
1,3-Dichlorobenzene	15.0	50.0	64 - 124	75 - 125	60	60
1,4-Dichlorobenzene	15.0	50.0	62 - 132	75 - 125	32	32
1-Methylnaphthalene	5.00	30.0	48 - 148	75 - 125	30	30
2,2'-oxybis[1-chloropropane]	15.0	250	44 - 140	75 - 125	60	60

Chemical [a]	MDL[b]	RL[b]	Accuracy Limits % (LCS/LCSD)[c]	Accuracy Limits % (MS/MSD) [c]	Precision Limits % (LCS/LCSD) [c]	Precision Limits % (MS/MSD) [c]
2,4,5-Trichlorophenol	15.0	100	64 - 124	75 - 125	60	60
2,4,6-Trichlorophenol	15.0	150	66 - 131	65 - 140	60	60
2,4-Dichlorophenol	15.0	100	59 - 124	65 - 130	60	60
2,4-Dimethylphenol	15.0	100	58 - 133	65 - 140	60	60
2,4-Dinitrophenol	200	1000	53 - 168	60 - 135	60	60
2,4-Dinitrotoluene	15.0	100	57 - 122	75 - 125	31	31
2,6-Dinitrotoluene	15.0	100	65 - 125	75 - 125	60	60
2-Chloronaphthalene	5.00	20.0	69 - 129	75 - 125	25	25
2-Chlorophenol	15.0	100	65 - 125	65 - 135	27	27
2-Methylnaphthalene	5.00	20.0	65 - 125	75 - 125	27	27
2-Methylphenol	15.0	100	56 - 121	75 - 130	25	25
2-Nitroaniline	15.0	100	58 - 133	75 - 135	60	60
2-Nitrophenol	15.0	100	58 - 128	65 - 140	60	60
3 & 4 Methylphenol	15.0	200	61 - 126	75 - 130	27	27
3,3'-Dichlorobenzidine	30.0	200	73 - 163	20 - 160	60	60
3-Nitroaniline	15.0	100	80 - 165	60 - 140	60	60
4,6-Dinitro-2-methylphenol	100	1000	38 - 143	50 - 135	60	60
4-Bromophenyl phenyl ether	15.0	100	64 - 134	75 - 125	60	60
4-Chloro-3-methylphenol	15.0	100	58 - 128	75 - 135	27	27
4-Chloroaniline	15.0	100	20 - 181	20 - 160	60	60
4-Chlorophenyl phenyl ether	15.0	100	65 - 130	75 - 125	60	60
4-Nitroaniline	20.0	100	70 - 150	65 - 125	60	60
4-Nitrophenol	250	1000	47 - 172	65 - 125	33	33
Acenaphthene	5.00	20.0	65 - 130	75 - 125	27	27
Acenaphthylene	5.00	20.0	69 - 129	75 - 125	28	28
Anthracene	5.00	20.0	73 - 123	75 - 125	27	27
Benzo[a]anthracene	5.00	20.0	64 - 124	75 - 125	27	27
Benzo[a]pyrene	5.00	30.0	68 - 128	75 - 125	30	30
Benzo[b]fluoranthene	5.00	20.0	66 - 136	75 - 125	31	31
Benzo[g,h,i]perylene	5.00	25.0	57 - 142	75 - 125	28	28
Benzo[k]fluoranthene	5.00	25.0	63 - 143	75 - 125	31	31
Benzoic acid	750	2500	10 - 130	20 - 175	60	60
Benzyl alcohol	15.0	100	42 - 147	55 - 125	60	60
Bis(2-chloroethoxy)methane	5.00	100	63 - 128	75 - 125	60	60

Chemical [a]	MDL[b]	RL[b]	Accuracy Limits % (LCS/LCSD)[c]	Accuracy Limits % (MS/MSD) [c]	Precision Limits % (LCS/LCSD) [c]	Precision Limits % (MS/MSD) [c]
Bis(2-chloroethyl)ether	15.0	100	57 - 122	70 - 125	60	60
Bis(2-ethylhexyl) phthalate	50.0	600	64 - 144	55 - 145	60	60
Butyl benzyl phthalate	50.0	200	65 - 140	55 - 145	60	60
Carbazole	5.00	100	88 - 158	75 - 125	60	60
Chrysene	5.00	25.0	71 - 126	75 - 125	26	26
Dibenz(a,h)anthracene	5.00	40.0	57 - 142	75 - 125	30	30
Dibenzofuran	5.00	100	70 - 125	75 - 125	60	60
Diethyl phthalate	15.0	200	64 - 129	60 - 155	26	26
Dimethyl phthalate	5.00	100	65 - 125	60 - 160	60	60
Di-n-butyl phthalate	50.0	500	69 - 124	55 - 145	60	60
Di-n-octyl phthalate	5.00	500	58 - 148	55 - 145	31	31
Fluoranthene	5.00	20.0	61 - 121	70 - 125	36	36
Fluorene	5.00	20.0	68 - 128	75 - 125	31	31
Hexachlorobenzene	5.00	50.0	61 - 136	75 - 125	60	60
Hexachlorobutadiene	15.0	50.0	59 - 134	75 - 125	60	60
Hexachlorocyclopentadiene	10.0	100	30 - 132	30 - 125	60	60
Hexachloroethane	15.0	100	56 - 131	75 - 125	60	60
Indeno[1,2,3-cd]pyrene	5.00	40.0	59 - 139	75 - 125	29	29
Isophorone	5.00	100	53 - 118	75 - 125	60	60
Naphthalene	5.00	20.0	64 - 129	75 - 125	26	26
Nitrobenzene	34.0	100	59 - 134	75 - 125	60	60
N-Nitrosodi-n-propylamine	15.0	100	52 - 127	75 - 140	28	28
N-Nitrosodiphenylamine	5.00	50.0	88 - 153	75 - 125	60	60
Pentachlorophenol	20.0	200	29 - 124	55 - 125	68	68
Phenanthrene	5.00	20.0	65 - 125	75 - 125	28	28
Phenol	15.0	100	66 - 126	70 - 140	26	26
Pyrene	5.00	20.0	54 - 134	75 - 125	31	31
Total Petroleum Hydrocarbons by NWTPH-G (mg/kg dw)						
Gasoline Range Organics	0.500	4.00	68 - 120	50 - 150	25	35
Total Petroleum Hydrocarbons by NWTPH-Dx (mg/kg dw)						
Diesel Range Organics	5.70	25.0	70 - 125	70 - 125	16	16
Motor Oil Range Organics	9.10	50.0	64 - 127	64 - 127	17	17
Dioxins/Furans by 1613B (ng/kg)						
2,3,7,8-TCDD	na	1.00	67 - 158	na	50	50

Chemical [a]	MDL[b]	RL[b]	Accuracy Limits % (LCS/LCSD)[c]	Accuracy Limits % (MS/MSD) [c]	Precision Limits % (LCS/LCSD) [c]	Precision Limits % (MS/MSD) [c]
2,3,7,8-TCDF	na	1.00	75 - 158	na	50	50
1,2,3,7,8-PeCDD	na	5.00	70 - 142	na	50	50
1,2,3,7,8-PeCDF	na	5.00	80 - 134	na	50	50
2,3,4,7,8-PeCDF	na	5.00	68 - 160	na	50	50
1,2,3,4,7,8-HxCDD	na	5.00	70 - 164	na	50	50
1,2,3,6,7,8-HxCDD	na	5.00	76 - 134	na	50	50
1,2,3,7,8,9-HxCDD	na	5.00	64 - 162	na	50	50
1,2,3,4,7,8-HxCDF	na	5.00	72 - 134	na	50	50
1,2,3,6,7,8-HxCDF	na	5.00	84 - 130	na	50	50
1,2,3,7,8,9-HxCDF	na	5.00	78 - 130	na	50	50
2,3,4,6,7,8-HxCDF	na	5.00	70 - 156	na	50	50
1,2,3,4,6,7,8-HpCDD	na	5.00	70 - 140	na	50	50
1,2,3,4,6,7,8-HpCDF	na	5.00	82 - 122	na	50	50
1,2,3,4,7,8,9-HpCDF	na	5.00	78 - 138	na	50	50
OCDD	na	10.0	78 - 144	na	50	50
OCDF	na	10.0	63 - 170	na	50	50
Total TCDD	na	1.00	na	na	na	na
Total TCDF	na	1.00	na	na	na	na
Total PeCDD	na	5.00	na	na	na	na
Total PeCDF	na	5.00	na	na	na	na
Total HxCDD	na	5.00	na	na	na	na
Total HxCDF	na	5.00	na	na	na	na
Total HpCDD	na	5.00	na	na	na	na
Total HpCDF	na	5.00	na	na	na	na

LCS/LCSD = laboratory control sample/laboratory control sample duplicate; MDL = method detection limit; MS/MSD = matrix spike/matrix spike duplicate; na = not applicable; RL = reporting limit

a. Recommended analytical methods are from SW-846 (USEPA 1986) and USEPA updates. Preparation and cleanup methods will be employed at the laboratory's discretion, with the following exception. All samples will undergo sulfuric acid/silica gel cleanup prior to TPH-Dx analysis.

b. Actual EDLs/MDLs and RLs will vary based on the sample volumes used for analysis, percent moisture, dilution factors, matrix interferences, and the analytical conditions at the time of analysis. The EDLs generated for dioxins/furans will be sample-specific based on the analytical conditions at the time of analysis.

c. The EDLs, MDLs, RLs, and QC limits used to evaluate analytical sensitivity, accuracy, and precision will be provided by the laboratory in each data package using performance-based results. Control charted limits in effect at the time of analysis may vary. The precision limits provided for MS/MSD samples will also be used to evaluate laboratory duplicate samples.

d. EPA 6020 and low-level EPA 8260B are the preferred methods of analysis for metals and VOCs. If EPA 6010B or medium-level EPA 8260B are employed (at the discretion of the laboratory based on the initial results), then the analytical results by these methods will have different MDLs, RL, and control limits and will be provided in the data package and EDD.

Appendix B

Data Management Procedures

Significant Figures

Results will be reported by Leidos using the same number of significant figures reported by the laboratory. Dioxin/furan toxic equivalents (TEQs) will be reported to three significant figures.

Best Result Selection

When multiple results for a single chemical are available for a sample and analyte, one single result must be selected for reporting purposes. Chemicals analyzed by the same analytical method will be qualified by EcoChem. However, if multiple analyses are involved, then the final result is selected by Leidos. Results not selected as the final result are qualified with a "DNR" to indicate "Do Not Report" in the project database. Results selected as the final result are reported without additional data qualification. The rationale used for best result selection is summarized below.

- When all results are detected, the result with the highest concentration is selected as the final result. If, however, the results are from diluted and non-diluted analyses by the same analytical method, the result from the analysis with the lowest dilution factor is selected. If more than one result with the same concentration and dilution factor is available, then the result with the most certainty is selected; for example, a non-qualified result would be given preference over a result qualified as estimated (J-qualified).
- When all results are non-detected, the result with the lowest reporting limit is selected as the final result. If more than one result with the same reporting limit is available, then the result with the most certainty is selected, if known; for example, a non-qualified result (U-qualified) would be given preference over a result qualified as estimated (UJ-qualified).
- If both detected and non-detected results are available, the detected result will be selected as the final result.

Calculated Totals

Total polycyclic aromatic hydrocarbons (PAHs), low molecular weight PAHs (LPAHs), high molecular weight PAHs (HPAHs), and total benzofluoranthenes are calculated by summing detected concentrations only. Total LPAHs are the sum of detected concentrations of naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene. Total HPAHs are the sum of detected concentrations of fluoranthene, pyrene, benzo(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene. Total PAHs include all chemicals listed above for LPAH and HPAH. Total benzofluoranthenes are the sum of the b (i.e., benzo(b)fluoranthene), j, and k isomers when data for these individual isomers are available. Alternately, a total benzofluoranthenes result may be reported by the laboratory, depending on the analytical conditions. For samples in which all

individual compounds within the groups described above are undetected, the single highest RL for the component chemical in that sample represents the associated total result.

Weighted Totals

The TEQ is a weighted calculated total. The TEQ concentration of dioxin/furan compounds will be normalized to the toxicity of 2,3,7,8-TCDD using toxic equivalent factors (TEFs) updated by the World Health Organization (WHO) in 2005 (Van den Berg et al. 2006) and incorporated into the Model Toxics Control Act (MTCA) (WAC 173-340-900; Ecology 2007). The TEQ is equivalent to the sum of the concentrations of individual congeners multiplied by their TEF (potency relative to 2,3,7,8-TCDD). Non-detected values will be assessed using zero, half the detection limit, and/or the full value of the detection limit for data evaluation purposes. Any result qualified as an estimated maximum possible concentration (EMPC) by the laboratory will be treated as non-detect at the reported value when calculating TEQs. Dioxin/Furan TEFs are listed in Table B–1 below.

Table B–1. Dioxin/Furan TEFs

Analyte	TEF
1,2,3,4,6,7,8-HPCDD	0.01
1,2,3,4,6,7,8-HPCDF	0.01
1,2,3,4,7,8,9-HPCDF	0.01
1,2,3,4,7,8-HXCDD	0.1
1,2,3,4,7,8-HXCDF	0.1
1,2,3,6,7,8-HXCDD	0.1
1,2,3,6,7,8-HXCDF	0.1
1,2,3,7,8,9-HXCDD	0.1
1,2,3,7,8,9-HXCDF	0.1
1,2,3,7,8-PECDD	1
1,2,3,7,8-PECDF	0.03
2,3,4,6,7,8-HXCDF	0.1
2,3,4,7,8-PECDF	0.3
2,3,7,8-TCDD	1
2,3,7,8-TCDF	0.1
OCDD	0.0003
OCDF	0.0003

Carcinogenic PAH (cPAH) values will be calculated using potency equivalency factor (PEF) values (MTCA 2001) based on an individual compound's relative toxicity to benzo(a)pyrene. Final cPAH concentrations are equivalent to the sum of the concentrations of the seven individual cPAH compounds multiplied by their associated PEF. Non-detected values will be half of the reporting limit for data evaluation purposes.

Table B-2. cPAH PEFs

Analyte	PEF
Benzo(a)anthracene	0.1
Benzo(a)pyrene	1
Benzo(b)fluoranthene	0.1
Benzo(k)fluoranthene	0.1
Benzofluoranthene	0.1
Chrysene	0.01
Dibenzo(a,h)anthracene	0.1
Indeno(1,2,3-cd)pyrene	0.1

Qualifier Mapping

Data qualifiers will be reported by the laboratory, as defined in the data packages. Additional data qualifiers may be applied during data validation using USEPA functional guidelines. Leidos will review the combination of both laboratory and validation qualifiers and report final results with a single set of interpreted qualifiers, listed in Table B–2. Dioxin/furan results qualified as EMPC by the laboratory will be re-qualified as non-detect (U- or UJ-qualifiers) per USEPA functional guidelines (USEPA 2011). All data qualifiers will be retained in the project records. Results rejected for QA/QC reasons will be reported as rejected without quantitative values.

Table B–2. Final Data Qualifiers

Final Data Qualifier	Qualifier Definition
J	estimated concentration
U	non-detect at the given reporting limit
UJ	non-detect at the given reporting limit, which is estimated
R	rejected

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Appendix C

Electronic Data Deliverable Specifications

Laboratory electronic data deliverables (EDDs) will be submitted as tab delimited text or csv files and will conform to the specifications listed below. This format provides all data required for an EIM submittal.

Field	Name	Type[1]	Data Required[2]
1	PROJID	T	No
2	STUDYID	T	No
3	FIELDID	T	No
4	LABID	T	Yes
5	LABBATCH	T	Yes
6	CAS NUMBER	T	Special
7	ANALYTE	T	Yes
8	VALUE	N	Yes
9	VALUESF	N	No
10	LABQUAL	T	Special
11	UNITS	T	Yes
12	MDL	N	Special
13	REPLIMIT	N	Yes
14	ANLGROUP	T	No
15	PREPMETHOD	T	No
16	ANLMETHOD	T	Yes
17	MATTYPE	T	Yes
18	BASIS	T	Yes
19	LEACHDATE	T	No
20	EXTRDATE	D	Special
21	ANLDATE	D	Yes
22	DILFACTOR	N	Yes
23	COLUMN	T	Yes
24	FRACTION	T	Yes
25	LABNAME	T	Yes
26	PARENTID	T	Special
27	SAMPLEQTY	N	No
28	QTYUNITS	T	No
29	MOISTURE	N	No
30	QCTYPE1	T	Special
31	QCTYPE2	T	Special
32	SURROGATE	N	Special
33	SPIKE	N	Special
34	RECOVERY	N	No
35	RPD	N	No
36	LOWLIMIT	N	No
37	UPPLIMIT	N	No
38	RPDLIMIT	N	No

Notes:

1. ***Type*** field refers to the following data types:
   - **T** Text, preferably left justified.
   - **N** Numeric, no decimal defined.
   - **D** Date/time, Date must be 8 characters long for the date with the format MM/DD/YY. Time must be 6 or 8 characters long in the format of HH:MM (hours and minutes) or HH:MM:SS (hours, minutes, and seconds). The time must be presented in 24 hour clock (not 12 hour clock).
2. ***Data required*** field indicates the following:
   - **Yes** The field must contain some information and a blank value is not acceptable.
   - **No** The field does not require information and if left blank, is assumed to mean no information was supplied.
   - **Special** A special case where the field may be left blank if appropriate; however, a blank field does not represent a lack of information, rather, it indicates some meaning (i.e., a blank in LABQUAL indicates a detected result).

Field Descriptions:

1. **PROJID:** Project name, provided by the client at the beginning of the work assignment and is also listed on the COC forms, sample labels, and other project documentation.
2. **STUDYID:** Unique 8 character ID to identify the study in the Washington Department of Ecology's EIM database.
3. **FIELDID:** The sample identification number as reported on the COC form and on sample labels, or the laboratory QC sample identification.

   QC samples created by the Laboratory from field samples (e.g., laboratory duplicates) must contain the exact SAMPID of the field sample. Other Laboratory QC samples (e.g., blanks, spikes, duplicates) must have unique sample identifiers which may be identical to the LABID below.
4. **LABID:** The Laboratory internal identification number. The combination of the FIELDID and LABID field should be sufficient to uniquely define either an environmental or QC sample; but may not be sufficient to distinguish reanalyses and dilutions.
5. **LABBATCH:** The laboratory identification number used to associate laboratory generated QC samples.
6. **CAS NUMBER:** A unique identifying number assigned by the Chemical Abstracts Service (CAS) Division of the American Chemical Society to each distinct chemical substance recorded in the CAS Chemical Registry System. The CAS Number is accepted nationally and internationally as an identifier for specific, definable chemical substances.
7. **ANALYTE:** Analyte or parameter reported. All compounds should be reported in upper case.
8. **VALUE:** Concentration, value, or result of the compound tested, reported to the correct number of significant figures. The reporting limit (RL) will be reported for non-detect values. Only numbers are acceptable for this field.

In the case of spiked results, the VALUE will be the spiked sample result and will not be adjusted for the original sample results. If spiked compounds are diluted beyond detection, then RL shall be reported in the VALUE field and a "U" added with other qualifiers in the LABQUAL field.

9. **VALUESF:** The number of significant figures that should be reported for the VALUE field.
10. **LABQUAL:** Lab flags or qualifiers are reported in this field.

    Qualifier codes may be used from the *Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration,* and Document OLM01.0 through revision OLM01.8 (USEPA, August 1991). More than one qualifier may be used per record. If other qualifiers are used, then the Laboratory must include a list of the definitions of the codes with the electronics. The list may be present as a paper copy or an electronic text file.

    All non-detected results shall be reported with a "U" qualifier. The qualification "ND" for non-detected results is unacceptable. Blank values are acceptable and implied to mean a detected result. If a range will be reported (e.g., greater than 50) the symbol ">"shall be reported in this field.
11. **UNITS:** The units of measure for each record will be reported in this field.
12. **MDL:** Used to report the method detection limit (MDL), a value determined by MDL studies performed in accordance with 40 CFR or sample specific estimated detection limits (e.g., 2.5 x signal to noise ratio) for high resolution, isotope dilution test methods. This value is corrected for dilution, percent moisture, or related factors that affect the MDL and/or RL. MDLs are required for all results, as applicable (e.g., not applicable for total solids).
13. **REPLIMIT:** Used to report the reporting limit (RL presented in REPLIMIT field). Non-detect results reported in the VALUE field should contain the RL corrected for dilution, percent moisture, or related factors that affect the RL.
14. **ANLGROUP:** Field used to group results from various methods. For instance, an entry of 'METALS' may be entered to report results from methods SW-846 6010, SW-846 7041, and SW-846 7470.
15. **PREPMETHOD:** Indicate the extraction or digestion method used (e.g., SW-846 3550B).
16. **ANLMETHOD:** Indicate the analytical method used (e.g., SW-846 8270). Dissolved metals must be clearly identified versus total metals results.
17. **MATTYPE:** Indicate one of the following for the matrix analyzed: SOIL, SEDIMENT, TISSUE, and WATER. If a sample or laboratory QC material does not match one of these, indicate with a code of "X" and explain in the cover letter.
18. **BASIS:** Indicate whether results are reported on a dry weight or wet weight basis, using the terms DRY or WET. If a sample or laboratory QC material does not match one of these, indicate with a code of "X" and explain in the cover letter.
19. **LEACHDATE:** Date the sample was extracted for TCLP or SPLP test methods. If leaching extraction is not applicable, then the field must be left blank.
20. **EXTRDATE:** Date the sample was extracted or prepared. If an extraction or preparation step is not applicable, then the field may be blank.

21. **ANLDATE:** Date the sample was analyzed.
22. **DILFACTOR:** The dilution factor. This should also reflect "effective" dilutions achieved by increasing or decreasing sample or extracting solvent volumes from standard amounts. That is, pre-concentration steps will result in a dilution factor of less than 1; this is OK.
23. **COLUMN:** This field is used to identify the analytical column from which the result was reported, if applicable.

Code	Definition
1	Primary column
2	Secondary column, also known as conformational column
N	Not applicable

24. **FRACTION:** This field identifies when an aqueous sample is filtered prior to analysis to determine the "dissolved" portion of the chemical of interest. Unfiltered aqueous samples are reported as the "total" fraction. This nomenclature is typically used for metals analysis.

Code	Definition
T	Total
D	Dissolved
N	Not applicable

25. **LABNAME:** The full name (and location if appropriate) of or abbreviated name (and location) of the laboratory performing the analysis.
26. **PARENTID:** For duplicate samples only (i.e., laboratory duplicate, MSD, or LCSD). List the parent sample ID.
27. **SAMPLEQTY:** Quantity or weight of the sample aliquot used for analysis.
28. **QTYUNITS:** The units of measure for the quantity or weight of the sample used for analysis.
29. **MOISTURE:** Moisture content of solid samples, expressed as percent moisture.
30. **QCTYPE1:** This field is used to identify laboratory QC samples. A blank value is acceptable, indicating the record is not one of the sample types below. One of the following codes must be used to identify the laboratory QC sample type:

Code	Definition
RM	Reference material.
MB	Method blank.
LCS	Laboratory control sample (blank spike or ongoing precision and recovery check).
MS/MSD	Matrix spike / matrix spike duplicate samples.
DUP	Duplicate (Laboratory duplicates only; field duplicates will have a unique SAMPID).

31. **QCTYPE2:** This field is used to identify analyte types, including tentatively identified compounds (TICs), surrogate compounds, internal standards (IS), and labeled compounds (LC). A blank value is acceptable, indicating the record is not one of the analyte types below. One of the following codes must be used to identify the analyte type:

Code	Definition
SUR	Surrogate or labeled compound result.
TIC	Tentatively identified compound.
IS	Internal standard.

32. **SURROGATE:** If added, this refers to the surrogate or labeled compound concentration or amount expected, for example 100 for 100 ug/kg. Units of measure are implied from the UNITS field.
33. **SPIKE:** If added, this refers to the spike concentration or amount expected, for example 100 for 100 ug/kg. Units of measure are implied from the UNITS field.
34. **RECOVERY:** Percent (%) recovery. A blank value is acceptable, indicating a non-spiked, non-reference material result. This field should be filled in for surrogates and labeled compounds as well as spiked QC samples and reference materials.
35. **RPD:** Relative percent difference. This field should be filled in for field and laboratory duplicate, matrix spike duplicates, and laboratory control sample duplicates.
36. **LOWLIMIT:** Lower recovery control limit. This field should be filled in for surrogates, QC samples and reference materials.
37. **UPPLIMIT:** Upper recovery control limit. This field should be filled in for surrogates, QC samples and reference materials.
38. **RPDLIMIT:** Relative percent difference control limit. This field should be filled in for laboratory duplicates and spiked sample duplicates.

The EDD used for data validation will include all of the fields noted above with data populated by the laboratory, and the following additional fields populated by the data validator.

Field	Name	Type[1]	Data Required[2]
39	val_name	T	Yes
40	val_date	D	Yes
41	val_qual	T	Special
42	val_level	T	Yes
43	val_reason	T	Special
44	val_notes	T	No

Notes:

1. ***Type*** field refers to the following data types:
   - **T** Text, preferably left justified.
   - **D** Date/time, Date must be 8 characters long for the date with the format MM/DD/YY. Time must be 6 or 8 characters long in the format of HH:MM (hours and minutes) or HH:MM:SS (hours, minutes, and seconds). The time must be presented in 24 hour clock (not 12 hour clock).
2. ***Data required*** field indicates the following:
   - **Yes** The field must contain some information and a blank value is not acceptable.
   - **No** The field does not require information and if left blank, is assumed to mean no information was supplied.
   - **Special** A special case where the field may be left blank if appropriate; however, a blank field does not represent a lack of information, rather, it indicates some meaning (i.e., a blank in LABQUAL indicates a detected result).

39. **val_name:** The full or abbreviated name of the data validation firm.
40. **val_date:** The date on which data validation was completed.
41. **val_qual:** Any data qualifiers added during data validation.
42. **val_level:** The level of data validation (e.g., full or summary, S2AVEM).
43. **val_reason:** The reason (or reason code) for data qualification. This field is required if validation qualifiers were added.
44. **val_notes:** Any additional notes. If numeric results changed during data validation, it must be noted here.