Remedial Investigation Project Plan
Sea K Fish Cleanup Site
205 and 225 Sigurdson Avenue
Blaine, Washington

July 8, 2021

Prepared for

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APPENDICES

LIST OF ABBREVIATIONS AND ACRONYMS

AO ..... Agreed Order No. DE 19573
bgs ..... below ground surface
CSCSL ..... Ecology's Confirmed and Suspected Contaminated Sites List
dCAP ..... draft Cleanup Action Plan
Ecology ..... Washington State Department of Ecology
EPA ..... US Environmental Protection Agency
FS ..... feasibility study
ft ..... foot/feet
LAI ..... Landau Associates, Inc.
LNAPL ..... light non-aqueous phase liquid
mg/kg ..... milligrams per kilogram
MTCA ..... Model Toxics Control Act
NWTPH-Dx ..... Northwest total petroleum hydrocarbon extended-range diesel analytical method
NWTPH-G ..... Northwest total petroleum hydrocarbon gasoline analytical method
PAH ..... polycyclic aromatic hydrocarbon
PCB ..... polychlorinated biphenyl
Port ..... Port of Bellingham
RI ..... remedial investigation
SAP ..... sampling and analysis plan
SEPA ..... State Environmental Policy Act
SIM ..... selected ion monitoring
Site ..... Sea K Fish Cleanup Site
SMS ..... Washington State Sediment Management Standards
SVOC ..... semivolatile organic compound
TPH-D ..... diesel-range total petroleum hydrocarbons
TPH-G ..... gasoline-range total petroleum hydrocarbons
TPH-O ..... motor oil-range total petroleum hydrocarbons
VOC ..... volatile organic compound
WAC ..... Washington Administrative Code

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1.0 INTRODUCTION

Landau Associates, Inc. (LAI) prepared the remedial investigation (RI) project plans contained herein to support investigation and cleanup of the of the Sea K Fish Cleanup site (Site) on behalf of the Port of Bellingham (Port). The Site is owned by the Port and the Washington State Department of Natural Resources. Several historical investigations have identified petroleum hydrocarbons in Site soil and groundwater, resulting in the need for additional investigation activities, and development of an appropriate plan to clean up the Site to the applicable regulatory standards.

The RI project plans contained herein were developed to guide upcoming investigation work that is necessary to assess the cleanup of petroleum hydrocarbon contamination present at the Site. The Port has entered into an Agreed Order (AO; Ecology 2020) with the Washington State Department of Ecology (Ecology), which requires the Port to complete the following tasks as part of the cleanup, in cooperation with and under the review of Ecology:

- **Task 1: Remedial Investigation Project Plans**
  - Addressed in this set of project plans
- **Task 2: Remedial Investigation**
  - Complete the RI to address data gaps in the existing dataset and adequately determine the nature and extent of contamination pursuant to the Model Toxics Control Act (MTCA) established in Washington Administrative Code (WAC) 173-340-350, and WAC 173-204-550.
- **Task 3: Interim Action**
  - None anticipated at this time.
- **Task 4: Remedial Investigation and Feasibility Study Report**
  - Prepare agency and public review draft reports, providing the results of the RI
  - Conduct a feasibility study (FS) to develop and evaluate various alternatives for remediating the contamination sufficiently to achieve MTCA cleanup standards per WAC 173-340-350.
- **Task 5: State Environmental Policy Act (SEPA) Compliance**
  - The Port will assist Ecology in complying with SEPA requirements
- **Task 6: Public Participation**
  - The Port will support Ecology in presenting the Public Review Draft RI/FS report, Cleanup Action Plan, and SEPA evaluations at public meetings
- **Task 7: Draft Cleanup Action Plan**
  - Develop and submit a draft Cleanup Action Plan (dCAP) meeting the requirements of WAC 173-340-380, to describe implementation of the preferred cleanup alternative, as selected by Ecology and the applicable MTCA and Washington State Sediment Management Standards (SMS) requirements.

The AO establishes the scope, schedule, and performance requirements for conducting and reporting this work. Preparation and submittal of these RI project plans are a required component of the AO, to ensure that the project will be executed in a manner approved by Ecology and satisfy the applicable standards noted above. Based on the intermittent observations of a sheen emanating from the shoreline, the Port intends to expedite procedural steps of this process where appropriately warranted, and appreciates Ecology's cooperation in executing this project without delay.

1.1 Project Background

The Site is located in Blaine Harbor, which is at the northern end of Drayton Harbor, in the northwest quarter of Section 1, Township 40 North, Range 1 West, Willamette Meridian. The properties encompassed by the Site generally include 225 and 205 Sigurdson Avenue in Blaine, Washington, at the location shown on Figure 1. The Site boundary will be determined during the RI, and will encompass the area where contaminated soil, groundwater, sediment, or surface water is determined to be located. A preliminary Site boundary is shown on Figures 2 and 3.

Several investigations summarized in Section 2 indicate petroleum contamination is present at concentrations above the applicable cleanup standards.

The Site is listed on Ecology's Confirmed and Suspected Contaminated Sites List (CSCSL) as Sea K Fish Company, Facility Site ID No. 80387768, and Cleanup Site ID No. 10583. Part of the Site is also listed on Ecology's CSCSL as T&M Protein, Facility Site ID No. 4433308, and Cleanup Site ID No. 7578.

1.2 Site Features and Uses

This section provides a brief overview of Site features and usage based on preliminary information that will be expanded on or updated during implementation of the RI. The RI report will provide a more accurate accounting of the information based on data collected in the field and from additional review of historical records during the RI.

The Site has been used solely for seafood processing, based on a limited review of historical operations. Specifically, processing activities appear to have included activities related to offloading finfish and shellfish from boats, processing and sorting fresh and frozen seafood, refrigeration and storage, and packaging and loading the seafood for export off the property. Historical features related to potential contamination sources include former underground storage tanks that housed diesel and gasoline products, a press used to separate fish oil (which reportedly operated using fish oil as an alternative to hydraulic oil), and, potentially, an underground fuel pipeline that may be buried along Marine Drive and that may have transported fuel from historical aboveground storage tanks. These features are shown on Figure 3.

Two main buildings are located at the Site. The Site shoreline is made up of a timber bulkhead and some large rockery slopes, in various conditions. Docks and some portions of the Site buildings are

considered over-water structures. The building to the north houses the active Starfish operations, and the southern building is partially condemned due to the deteriorating condition of the bulkhead upon which it is built. Starfish currently uses portions of the southern building for equipment storage.

Historical cleanup activities at the Site included the removal of underground storage tanks, removal of the fish press, and limited investigations conducted in 2007 and 2008. These activities are described in the associated reports (3 Kings Environmental 2007; Farallon 2008). Based on information in these reports and observation of an intermittent sheen seemingly emanating from the shoreline to the surface waters of Blaine Harbor, the Port conducted additional investigations in June and July 2019. The current conditions of the Site are summarized in Section 2, and will be further detailed in the RI report after completing the field activities described herein that develop a better understanding of Site conditions and assess the contaminant migration and exposure pathways.

The next phase of the cleanup process will primarily consist of conducting the additional remedial investigations, as needed, to fill in data gaps, to better determine the nature and extent of contamination, and to meet the requirements of WAC 173-340-350 (in the uplands) and WAC 173-204-550 (in the marine portion of the Site).

1.3 Nearby Cleanup Sites

Three active, contaminated cleanup sites are located within the vicinity of the Site: the Blaine Marina, Inc. cleanup site, Westman Marine cleanup site, and T&M Protein cleanup site. Nearby cleanup sites are shown on Figure 2, along with their approximate area boundaries.

The Blaine Marina, Inc. cleanup site is located southeast-east of the Sea K Fish cleanup Site upland area, as shown on Figure 2. Contamination associated with this cleanup site includes a mix of gasoline- and diesel-range petroleum hydrocarbons, and limited associated compounds. Cleanup of this adjacent site is underway, and includes a large-scale removal effort conducted in 2018 by excavating contaminated soil for offsite disposal, and removing light non-aqueous phase liquid (LNAPL) petroleum product. Bioremediation continues at this neighboring site to address residual contamination remaining in place after completion of the removal efforts. It does not appear that petroleum contamination from this site is impacting the Sea K Fish Site in the upland or marine areas.

The Westman Marine cleanup site is located farther southeast-east of the Sea K Fish cleanup Site, as shown on Figure 2. Contamination associated with this cleanup site generally includes metals, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and other compounds associated with boat building and boat repair. Although some petroleum hydrocarbon contamination has been identified at this cleanup site, it does not appear that it is impacting the Sea K Fish Site in the upland or marine areas. Trace levels of carcinogenic PAHs and PCBs are present throughout Blaine Harbor that have been evaluated as part of the Westman Marine cleanup site, and will be addressed as part of that cleanup effort.

The T&M Protein cleanup site is located generally east of the Sea K Fish cleanup Site, as shown on Figure 2. Due to T&M operating at multiple leased properties over its years of operation, another cleanup site described as T&M Protein is located within the Sea K Fish preliminary Site boundary.

2.0 CURRENT SITE CONDITIONS

This section summarizes current environmental conditions at the Site based on observations and sampling results presented in historical environmental reports (3 Kings Environmental 2007; Farallon 2008), recent preliminary investigations conducted in June and July 2019 (LAI 2020), and historical information related to the local geology that was collected from nearby projects (LAI 2012). Additional details regarding Site conditions will be presented in the RI report, after completing the investigations described herein.

The Site is relatively small in size, and based on the preliminary Site boundary drawn on Figure 3, likely encompasses an area slightly more than 200 feet (ft) by 200 ft. Soil and groundwater within a portion of this preliminary boundary are known to be contaminated with petroleum hydrocarbons at concentrations above MTCA cleanup levels. And based on intermittent observations of a sheen at the shoreline, the contamination may extend to the marine portion of the Site. The contamination is readily observable in soil samples collected throughout a large area confined within the preliminary Site boundary, evidenced by a visible sheen or LNAPL presence on the soil sample surfaces, and petroleum-like odors. These field-observable findings were also confirmed by laboratory analyses. Additional laboratory analyses to be conducted during this RI will improve the understanding of Site conditions through further assessment of the contaminant concentrations present at the Site.

The vertical extent of contamination was partially investigated in 2019, and results indicate that the highest levels of observable contamination appear to be within several feet of the groundwater table elevation. The groundwater table fluctuates in elevation throughout the year based on precipitation rates, and due to the close proximity of the adjacent Blaine Harbor, is also subject to tidal fluctuations. LNAPL contamination appears to persist in free-phase and sorbed to soil surfaces throughout this variable zone in elevation associated with the groundwater table. The approximate elevation and thickness of this zone of contamination will be further evaluated during the RI to effectively target the cleanup effort where it is necessary.

The preliminary investigation activities in June and July 2019 included collection and analysis of 16 soil samples, 6 groundwater samples, and 4 sediment samples. Sample collection locations are shown on Figure 3.

2.1 Geologic and Hydrogeologic Setting

The upland portion of the Site was created in the 1940s by dredging and filling over what previously existed as tideflat. General geologic information for the Site was obtained from the Geologic Map of the Bellingham 1:100,000 Quadrangle, Washington (Lapen 2000). According to Lapen, the fill present at the Site overlies glaciomarine drift. Glaciomarine drift can have various distributions of gravel, sand, silt, and clay, although finer sediments (silt, and clay with fine sand) are most typical, with coarse sand and gravel occurring as “dropstones.” Glaciomarine drift in the area is typically soft or loose, although where exposed to drying or other consolidation after deposition, it can form a

hardened crust several feet in thickness. Geotechnical borings were advanced near the Site in 1998 as part of breakwater improvements. Logs of these borings indicate that glaciomarine drift is present to a considerable depth in the area.

Additional information regarding subsurface conditions was collected in 2012 during a geotechnical exploration conducted for the repair of a section of failing bulkhead approximately 300 ft southeast of the Site (LAI 2012). Subsurface geologic conditions observed during the investigation consisted of up to 15 ft of dredge fill material consisting of sandy, silty clay, and lenses of silty sand. Below the fill, silty fine sand and fine sandy silt were present to a depth of about 25 ft below ground surface (bgs). Below a depth of about 25 ft bgs, the glaciomarine drift consisted of very soft to medium stiff, silty clay and pockets of sandy clay that were present to the maximum depth of the explorations (46 ft bgs).

Hydrogeology at the Site has not been characterized to date and will be evaluated during the RI process. Groundwater at or potentially affected by the Site is not currently used for drinking water. It is not considered to be a reasonable future source of drinking water due to its proximity to marine surface water, its limited productivity, and the high probability that it would have a high salinity content following extended periods of groundwater extraction that would make it unsuitable as a domestic water supply.

2.2 Soil Quality

The preliminary 2019 soil investigation included field observations for indications of contamination, and laboratory analyses. Where LNAPL was visibly noticed on the soil sample surfaces, it was assumed for the purposes of the evaluation that petroleum hydrocarbons were present at concentrations greater than the applicable MTCA Method A screening levels. During the investigation, LNAPL or sheen was observed in 10 of the 26 borings:

- SK-SB-2
- SK-SB-3
- SK-SB-4
- SK-SB-5
- SK-SB-9
- SK-SB-10
- SK-SB-11
- SK-SB-12
- SK-SB-15
- SK-SB-16.

Laboratory analysis indicated that diesel- and oil-range total petroleum hydrocarbons (TPH-D and TPH-O, respectively) are present at or above the MTCA Method A screening level within the area where LNAPL was observed. In the samples collected between 11 and 13 ft bgs at SK-SB-5, SK-SB-10, and SK-SB-12, TPH-D and TPH-O were present at concentrations of 2,000 milligrams per kilogram (mg/kg) or greater. Additionally, gasoline-range total petroleum hydrocarbons (TPH-G) were detected at SK-SB-5 and SK-SB-10 at concentrations greater than the MTCA Method A screening level of 30 mg/kg.

2.3 Groundwater Quality

Groundwater samples analyzed during the preliminary investigation were collected from the seven locations shown on Figure 3. These samples were collected using temporary well screens during drilling and soil sampling activities, which provides a screening-level assessment of the groundwater contaminant levels. The analytical results of these samples indicate that TPH-D, TPH-O, and TPH-G contamination is present within the central portion of the Site (SK-SB-10, SK-SB-11), and toward the shoreline to the south (SK-SB-16, SK-SB-17). The preliminary data indicate that contamination is not likely present outside of this focused area, as evidenced by samples collected from SK-SB-1, SK-SB-7, and SK-SB-18.

Groundwater samples have not been collected from borings north and northwest of the known contaminant plume to determine lateral migration in that direction, and seasonal fluctuations have not yet been evaluated using permanent monitoring wells.

2.4 Sediment Quality

During the preliminary investigation in 2019, sediment observations were conducted at the upper 1 ft of sediment adjacent to the shoreline, shown on Figure 3 at SK-SD-1 through SK-SD-4. These observations were made by digging into the surface sediment by hand during low-tide, when personnel could walk out to the area of interest. Visual observations indicated that the upland hydrocarbon plume is migrating to the marine environment. One water sample that was collected and analyzed had results showing TPH-D and TPH-O present in the groundwater-surface water interface. As discussed further below, the Port plans to collect sediment samples during the RI to better assess the nature and extent of contamination that may have originated from the upland area. The collection of sediment using a watercraft will also allow for samples from multiple interval depths to be collected and analyzed.

2.5 Conceptual Site Model

This section presents a preliminary conceptual Site model of contaminant distribution and migration related to potential releases of hazardous substances at the Site. The subsections below identify preliminarily potential sources of contamination, migration pathways, potentially affected media, and contaminant exposure routes to human or ecological receptors. This preliminary model will be used to guide investigation efforts during the RI and will be refined during the RI process as data are collected. The refined model will be presented in the RI report.

2.5.1 Potential Contaminant Sources, Migration Pathways, and Media of Potential Concern

The potential sources of contamination at the Site are generally related to the seafood processing operations conducted at the Site, described in Section 1.2. Releases of petroleum hydrocarbons used at the Site appear to have entered surface or subsurface soil. Based on the preliminary understanding

of Site conditions and potential contaminant sources, the potential pathways for contaminant migration at the Site could include:

1. Transport of contaminants from the subsurface soil to groundwater
2. Transport of contaminants in soil to outdoor air via wind or fugitive dust
3. Transport of volatile organic compounds (VOCs) from subsurface soil or groundwater to indoor air via vapor migration
4. Transport of contaminants in groundwater to adjacent marine surface water and sediment
5. Re-suspension and mixing of marine sediments via bioturbation (i.e., mixing of sediment by benthic animals), marine vessels coming in and out of the area, and/or tidal currents.

Potential media of concern include:

- Soil
- Groundwater
- Surface Water
- Sediment
- Soil Vapor.

2.5.2 Potential Receptors and Exposure Pathways

This section identifies potential receptors and the potential exposure pathways for the receptors based on the current and future land uses expected for the Site. Potential receptors of Site contaminants could be humans, terrestrial ecological receptors (i.e., wildlife, soil biota, and plants), or benthic organisms. Potential exposure pathways may be present that would allow Site releases to affect human health, aquatic ecological receptors, or terrestrial ecological receptors. These potential exposure pathways are presented by medium below. It has not yet been determined whether these exposure pathways are complete.

Soil:

- Direct contact (including incidental ingestion) by Site workers or visitors.
- Inhalation of dust or vapors (if applicable) from soil that has been impacted by contaminants.
- Leaching to groundwater and subsequent migration to marine surface waters and/or sediment where benthic or aquatic biota could be exposed.
- Erosion into the adjacent marine surface waters where benthic or aquatic biota could be exposed.

Groundwater:

- Direct contact (including incidental ingestion) by Site workers or visitors. Currently, direct contact with groundwater at the Site is unlikely. During construction or other intrusive

activities that could encounter groundwater, Site workers could be exposed to affected groundwater.

- Inhalation of vapors released from groundwater impacted by volatile contaminants (if applicable).
- Based on its close proximity to marine surface water, groundwater at the Site is likely highly saline and is not considered a potable source of drinking water. As a result, exposure through groundwater ingestion is not considered a potential pathway.
- Migration of groundwater to the adjacent marine surface water and/or sediment where benthic and aquatic biota could be exposed.

Surface Water:

- Exposure of aquatic organisms to contaminants released from the Site to surface water. This may result in the uptake of contaminants in these organisms.
- Human ingestion of marine organisms that were impacted by releases from the Site.

Sediment:

- Exposure of benthic organisms to contaminants released from the Site via groundwater discharge through the biologically active zone of sediment (the upper 10 centimeters [cm] below the mudline). This may result in the uptake of contaminants in these organisms.
- Human ingestion of marine organisms that were impacted by releases from the Site.

Soil Vapor:

- Soil vapors may be present related to contamination of soil and groundwater.

Soil vapors can impact Site workers or visitors conducting intrusive activities, or through vapor intrusion (soil vapor passing from the subsurface into building spaces and affecting indoor air quality). Preliminary indications are that this is not a concern, but it will be further investigated during the RI through collection and analysis of soil vapor samples.

3.0 PLANNED INVESTIGATION ACTIVITIES

This section summarizes the investigation activities planned to support further development of the ongoing plans to clean up the Site. Additional details for implementing these activities are provided in the appendices. Specifically, the Sampling and Analysis Plan (SAP; Appendix A) provides details for how these samples will be collected and analyzed in a manner to protect data integrity, and the Quality Assurance Project Plan (Appendix B) provides data quality requirements for ensuring the suitability of the data to support Site cleanup. A Site-specific Health and Safety Plan, and Inadvertent Discovery Plan are included as Appendices C and D, respectively, and will be followed by field personnel to ensure that workers are safe and that cultural resources are protected. The following sections summarize the planned RI activities in the upland and marine portions of the Site. Actual details of the investigation, including the collection of additional data or sampling media from slightly different locations than planned may occur based on the improved understanding of Site conditions while implementing the investigation. Significant deviations from what is presented below would be coordinated with Ecology; minor deviations would simply be noted as such and explained in further detail in the RI report.

3.1 Upland Investigation

The upland investigation will include characterization of soil, groundwater, and soil vapor quality. This will be achieved by collecting samples of each of these media to determine the lateral (horizontal) and vertical extent of contamination. The general approach to the upland investigation including planned analyses is summarized in this section and in Table 1. Additional information related to the planned analyses and the associated quality control procedures is included in the SAP and QAPP (Appendices A and B, respectively).

Site-specific cleanup levels will be developed in accordance with MTCA requirements as part of the RI/FS process, culminating in formal adoption in the Cleanup Action Plan. For the purposes of ensuring the laboratory reporting limits for the RI will be sufficiently adequate to support the investigation, preliminary screening levels composed of Method A and Method B concentrations, as tabulated in Chapter WAC 173-340 (MTCA Method A) and MTCA's CLARC database (Ecology; accessed February 4, 2021), are presented in the QAPP, along with the laboratory reporting limits for comparison. As noted, these values are preliminary and will be further refined through the RI/FS process when a clearer understanding of Site conditions and potential exposure pathways is developed.

3.1.1 Soil

The soil investigation will be conducted using a direct-push drilling rig to collect a relatively continuous core soil sample from the ground surface to a depth of 15 to 20 ft bgs at the 12 locations shown on Figure 4. Characterization will include a description of visual and olfactory conditions including notes of sheen, LNAPL, or odors. The vertical extents of the contaminated intervals (if found

present) will be approximated using a combination of field observations and laboratory analysis of soil samples. The SAP provides specific details for sample collection and handling.

To prevent misinterpretation of the vertical extent of contamination, the outer surface of the core sample will be carefully scraped away from the remaining sample core, as it could contain remnants of contamination from higher elevations, pushed downward by the advancing core sampler. The center of the core barrel is typically unaffected by this mechanism and preserves greater sample integrity for interpreting the vertical intervals of soil quality.

The soil sampling locations shown on Figure 4 are based on providing general Site coverage, and filling in data gaps to supplement the existing dataset. Primarily, the additional data will be used to better define the lateral and vertical extents of contamination to support focused cleanup efforts. Minor deviations from the planned locations may be required based on physical access or the existence of overhead or subsurface utilities. Additional soil sampling locations may be warranted based on findings and observations from the proposed locations.

Soil quality will be assessed based on the results of field screening of samples (visual or olfactory observations of contamination), screening for the presence of VOCs using a photoionization detector, and the results of laboratory analyses. The RI report will present details of the soil quality evaluation based on a comprehensive assessment of existing and newly collected data.

Soil samples will be collected for laboratory analysis based on field observations, and analyzed for TPH-G, TPH-D, and TPH-O by the Northwest total petroleum hydrocarbon gasoline and extended-range diesel analytical methods (NWTPH-G and NWTPH-Dx, respectively) and a limited group of VOCs and semivolatile organic compounds (SVOCs) related to petroleum hydrocarbon contamination by US Environmental Protection Agency (EPA) Method 8021 and EPA Method 8270E with selected ion monitoring (SIM). Soil samples from each location will be analyzed for lead by EPA Method 6020B. At two soil sampling locations from within the area where LNAPL has been observed, laboratory analysis will be expanded to include the Resource Conservation and Recovery Act (RCRA) 8 metals (arsenic, barium, cadmium, chromium, lead, selenium, and silver by EPA Method 6020B, and mercury by EPA Method 7471) to supplement the existing dataset and support disposal characterization. Table 1 provides a summary of the planned analyses.

3.1.2 Groundwater

Groundwater quality will be evaluated by collecting and analyzing groundwater samples from the five locations shown on Figure 4. At SK-SB-42, it is anticipated that the groundwater sample will be collected from the direct-push boring advanced at this location as part of the soil investigation described above. Groundwater monitoring wells will be installed at the other groundwater sampling locations shown on Figure 4 to provide for groundwater monitoring and evaluating for LNAPL.

Each of the groundwater samples will be analyzed for TPH-G, TPH-D, and TPH-O by Methods NWTPH-G and NWTPH-Dx, a subset of VOCs (benzene, toluene, ethylbenzene, and xylenes) by EPA Method 8021, and a subset of SVOCs (PAHs associated with petroleum hydrocarbons) by EPA Method 8270E (SIM). Groundwater grab samples are prone to high-bias based on entrainment of soil particles with sorbed contaminants. As a result, these screening-level data are useful only to provide a reasonable method by which to assess worst-case conditions and determine where cleanup actions may be required. Compliance with MTCA standards will ultimately be evaluated using permanent groundwater monitoring wells, which may not be required until completion of cleanup activities.

Installation of the permanent groundwater monitoring wells will be based on the results of the soil investigation noted in Section 3.1.1, and the laboratory results of the groundwater grab samples noted above. Permanent groundwater monitoring wells are anticipated to provide higher quality groundwater data, more representative of the actual aquifer conditions than is obtained through grab samples due to the construction and well development techniques, as described in the SAP (Appendix A). It is anticipated that up to four groundwater monitoring wells could be installed during a subsequent mobilization to the Site. The Port will evaluate Site data and propose installation locations to Ecology if they appear warranted based on the preliminary soil and groundwater grab-sample results, and will mobilize to install, develop, and sample the wells after receiving Ecology's approval. As noted above, this may be delayed until after implementation of the cleanup action, and used to determine compliance with cleanup standards.

Groundwater levels near the shoreline are likely to be significantly influenced by changing tides. During the recent exploration in summer 2019, groundwater was encountered at about 7.5 ft bgs at the time of drilling. In 2008, groundwater was reportedly encountered at about 10 ft bgs at the time of drilling (Farallon 2008).

3.1.3 Soil Vapor

Soil vapor samples will be collected from three locations below existing building slabs, as shown on Figure 4, and analyzed for VOCs by Method TO-15. The samples will be collected by drilling through the building slab and installing a sampling port allowing collection of soil vapor samples from the underlying soil. The actual sample collection locations may vary from what is shown on the figure and will be selected after examining the interior of the building and assessing access restrictions.

The data will be useful to confirm soil vapor quality, which may be impacted by contamination related to petroleum hydrocarbons. The data will support development of cleanup levels, and better define the lateral extent of contamination in the northern portion of the Site. Additional details regarding installation of the sub-slab sampling port and collection and analysis of the vapor samples are provided in the SAP (Appendix A).

3.2 Marine Sediment and Surface Water

As discussed in Section 2, there is a potential for contamination to migrate from the upland portion of the Site to sediment. The proposed RI sediment investigation is based on determining the nature and extent of potential Site contamination in sediment and in the surface water.

3.2.1 Sediment

As shown on Figure 5, the proposed sediment investigation will be conducted in aquatic areas near the shoreline, and up to approximately 240 ft from the shoreline. Ten sediment sampling locations are proposed for the RI: the eight locations proposed for immediate laboratory analysis, and two locations that will be sampled and archived. Both surface and subsurface (core) samples will be collected at each of these 10 locations and submitted to the laboratory. Surface and subsurface sediment will be analyzed immediately for the eight proposed sampling locations (SK-SED-1 through SK-SED-8), and the contingent samples will be processed and archived by the laboratory, and analyzed only if determined necessary based on the other results. Riprap located along the shoreline may influence the selection of the final sampling locations and could result in difficulty with sample recovery. Sediment sampling locations may require modification in the field if riprap is encountered.

Sediment cores will be subdivided into one surface sediment sample, followed by continuous core sampling of 1.5-ft intervals to provide adequate sample volume for the planned analyses. Surface sediment samples will be collected from the uppermost 10 cm of surface sediment using VanVeen or Ponar grab sample techniques. Subsurface samples will generally be extended to a maximum depth of 7 ft below the mudline (sediment surface) using a vibracorer drill rig. Detailed surface sediment and sediment coring methods are described in Section 3.5 of the SAP. The number of sediment samples submitted for laboratory analysis will be determined based on the lithology and other observations during core processing.

Each sediment sample (both surface sediment and sediment cores) will undergo analysis for TPH-D, TPH-O, and the SMS chemicals listed in WAC 173-204-320, including metals (arsenic, cadmium, chromium, copper, lead, mercury, silver, and zinc), SVOCs, PAHs, total PCBs, and conventional parameters (grain size, total organic carbon, and total solids).

3.2.2 Surface Water and Porewater

Due to the intermittent presence of a petroleum hydrocarbon sheen emanating from the shoreline bulkhead at the Site, surface water samples and porewater samples will be collected during the RI near the southern shoreline. Three porewater sampling locations are shown on Figure 4, labeled SK-PW-1, SK-PW-2, and SK-PW-3. The porewater samples will be collected from approximately 1 ft below the sandy surface, and the locations may vary slightly from what is shown on the figure, based on the presence of large rock along the shoreline. To collect the porewater samples, a decontaminated stainless steel porewater sampler will be driven into the sand; perforations in the

sampler allows porewater to enter the sampler. The sample will be retrieved from the sampler with new disposable Teflon® tubing using a peristaltic pump. The surface water samples will be collected from locations as near to the three porewater sampling locations as possible—once at high tide and once at low tide—in order to understand potential transport mechanisms of contamination along the shoreline. The surface water sampling locations will vary, in an attempt to collect the water from within 6 inches of the top surface of the water, and within 6 inches of the underlying sediment.

Surface water and porewater samples will be analyzed for TPH-G and TPH-D by Methods NWTPH-G and NWTPH-Dx, respectively.

4.0 INVESTIGATION AND REPORTING SCHEDULE

The table below presents the proposed schedule for implementation of the upcoming activities, based on meeting the requirements of the AO. The schedule will be accelerated where possible to address the urgency related to preventing further release or migration of contamination from the uplands to the marine environment.

Investigation Element	Field Activities	Duration and Notes	
Project Plan Preparations	None	Draft plans due 90 days from executing the AO; *March 30, 2021* Final plans will be due 30 days after receiving Ecology's comments on the draft plans	
Mobilization 1 (*Target completion in spring/summer 2021*)			
Site Reconnaissance Activities	Confirm access to proposed sampling locations; mark utilities; confirm access to sub-slab sampling locations	1 day	Port and tenant coordination required
Upland RI Activities: **Utility clearing, collecting soil samples, groundwater grab samples, and soil vapor samples**	10-12 direct-push soil sampling locations Groundwater grab sampling Monitoring well installation and sampling 3 soil vapor sampling locations	5-10 field days 14 days for lab analysis for each mobilization Additional laboratory analyses will extend the schedule	Port and tenant coordination required; Port to provide 7-day advance notice to Ecology prior to sample collection
Marine RI Activities: **Collecting sediment and surface water samples**	10 surface and core sediment samples Collection and core processing 3 surface water samples	5 field days 14 days for lab analysis Additional laboratory analyses will extend the schedule	Port and tenant coordination required; Port to provide 7-day advance notice to Ecology prior to sample collection
Reporting (*Target completion in July to October 2021*)			
Submit preliminary RI data to Ecology to request concurrence with RI completion	None	Within 14 days of validating RI data	Draft figures and preliminary data; EIM submission
RI/FS Report	None	Agency review draft 120 days after completing field work Public review draft 45 days after receipt of Ecology comments	

5.0 USE OF THIS PLANNING DOCUMENT

The project plans presented herein were prepared for the exclusive use of the Port of Bellingham for specific application to the Sea K Fish Cleanup Site Remedial Investigation and Feasibility Study project. No other party is entitled to rely on the information, conclusions, and recommendations included in this document without the express written consent of LAI. Further, the reuse of information, conclusions, and recommendations provided herein for extensions of the project or for any other project, without review and authorization by LAI, shall be at the user's sole risk. LAI warrants that within the limitations of scope, schedule, and budget, our services have been provided in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions as this project. LAI makes no other warranty, either express or implied.

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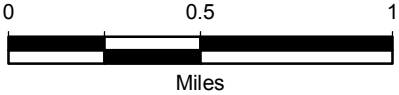

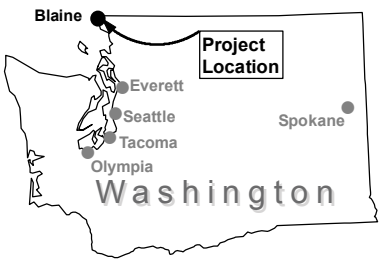

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LANDAU ASSOCIATES

Sea K Fish Remedial Investigation Blaine, Washington	**Vicinity Map**	Figure 1

Legend

- Nearby Cleanup Sites
- Preliminary Site Boundary

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 100 200

Scale in Feet

Data Source: Google Earth Pro.

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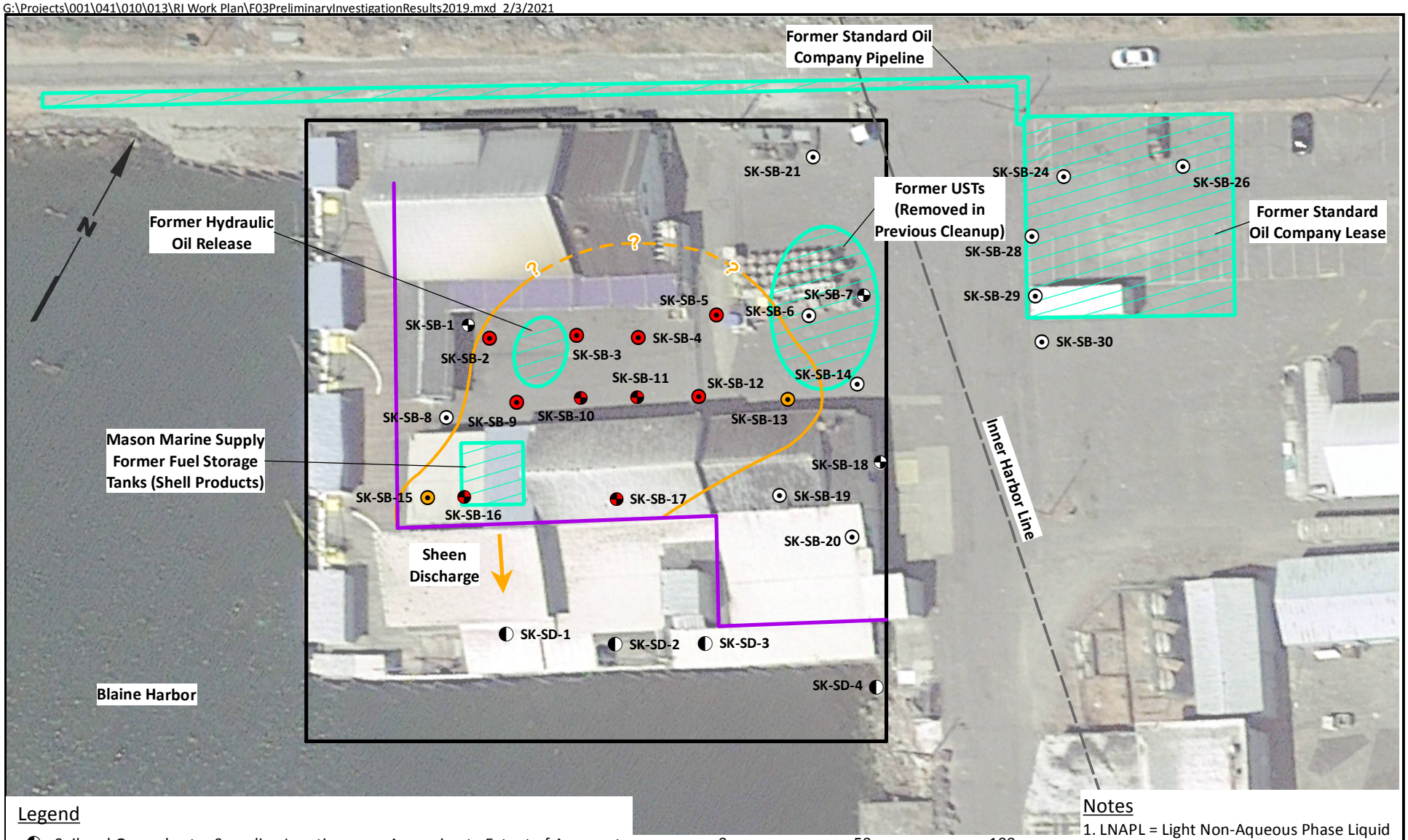
Sea K Fish Remedial Investigation Blaine, Washington	**Site Location and Nearby Cleanup Sites**	Figure 2

G:\Projects\001\041\010\013\RI Work Plan\F03PreliminaryInvestigationResults2019.mxd 2/3/2021



Legend

- Soil and Groundwater Sampling Location
- Inter-Tidal Sampling Location
- Soil Sampling Location
- Contamination Present
- LNAPL Present
- Approximate Extent of Apparent Soil and Groundwater Contamination
- Shoreline/Bulkhead
- Inner Harbor Line
- Potential Source Areas
- Preliminary Site Boundary

0 50 100

Scale in Feet

Data Source: Google Earth Pro.

Notes

1. LNAPL = Light Non-Aqueous Phase Liquid
   USTs = Underground Storage Tanks
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

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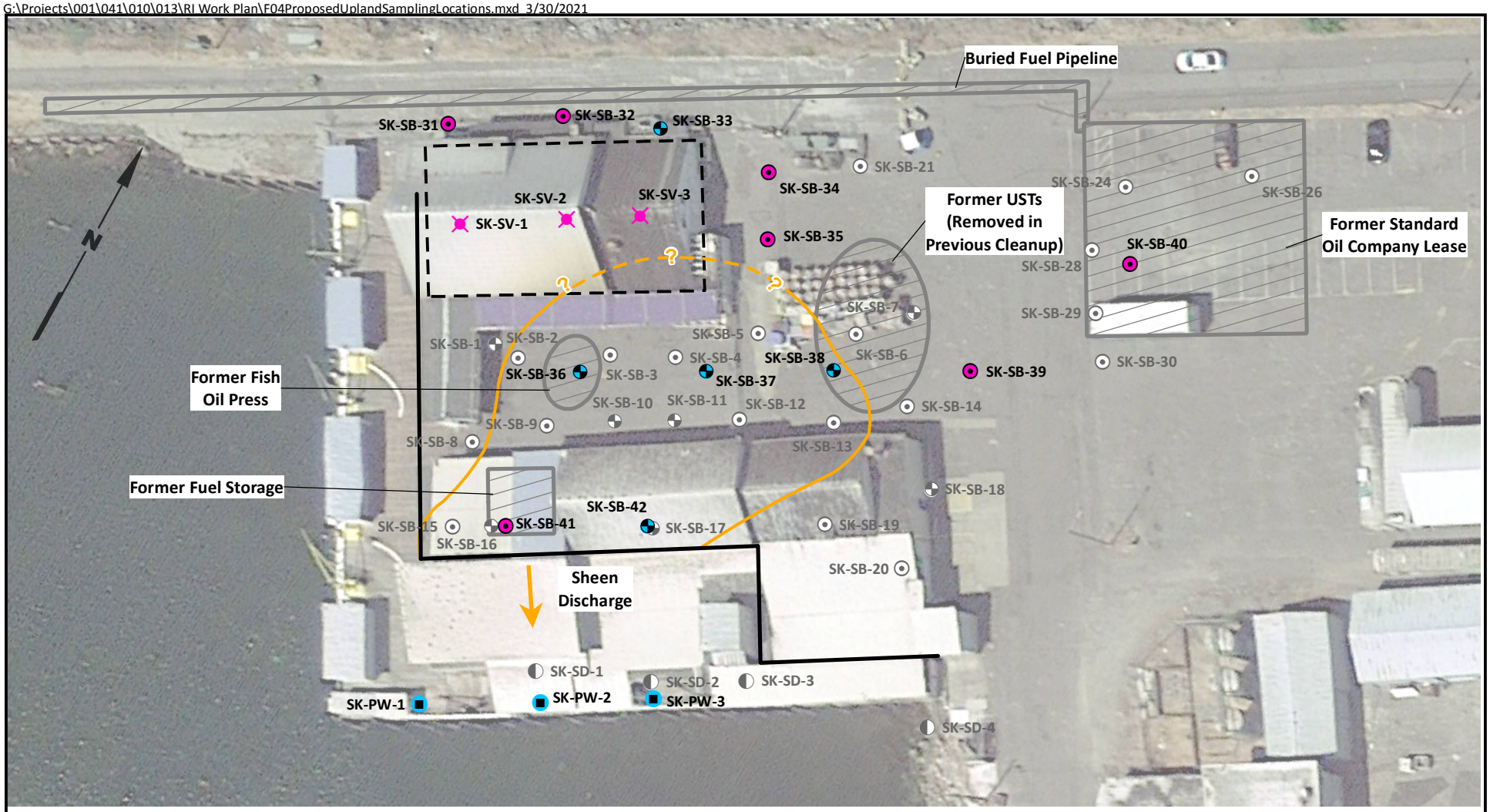
Sea K Fish Remedial Investigation
Blaine, Washington

Preliminary 2019 Investigation Results and Potential Contaminant Sources

Figure 3

G:\Projects\001\041\010\013\RI Work Plan\F04ProposedUplandSamplingLocations.mxd 3/30/2021



Legend

- Proposed Groundwater Sampling Location
- Proposed Porewater Sampling Location
- Proposed Soil Sampling Location
- Proposed Soil Vapor Sampling Location
- Previous Soil and Groundwater Sampling Location
- Previous Inter-Tidal Sampling Location
- Previous Soil Sampling Location
- Potential Source Areas
- Shoreline/Bulkhead
- Approximate Extent of Known Soil and Groundwater Contamination

Notes

1. Actual sampling locations may be adjusted slightly based on physical constraints or physical access restrictions.
2. USTs = underground storage tanks.
3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Data Source: Google Earth Pro.

0 50 100

Scale in Feet

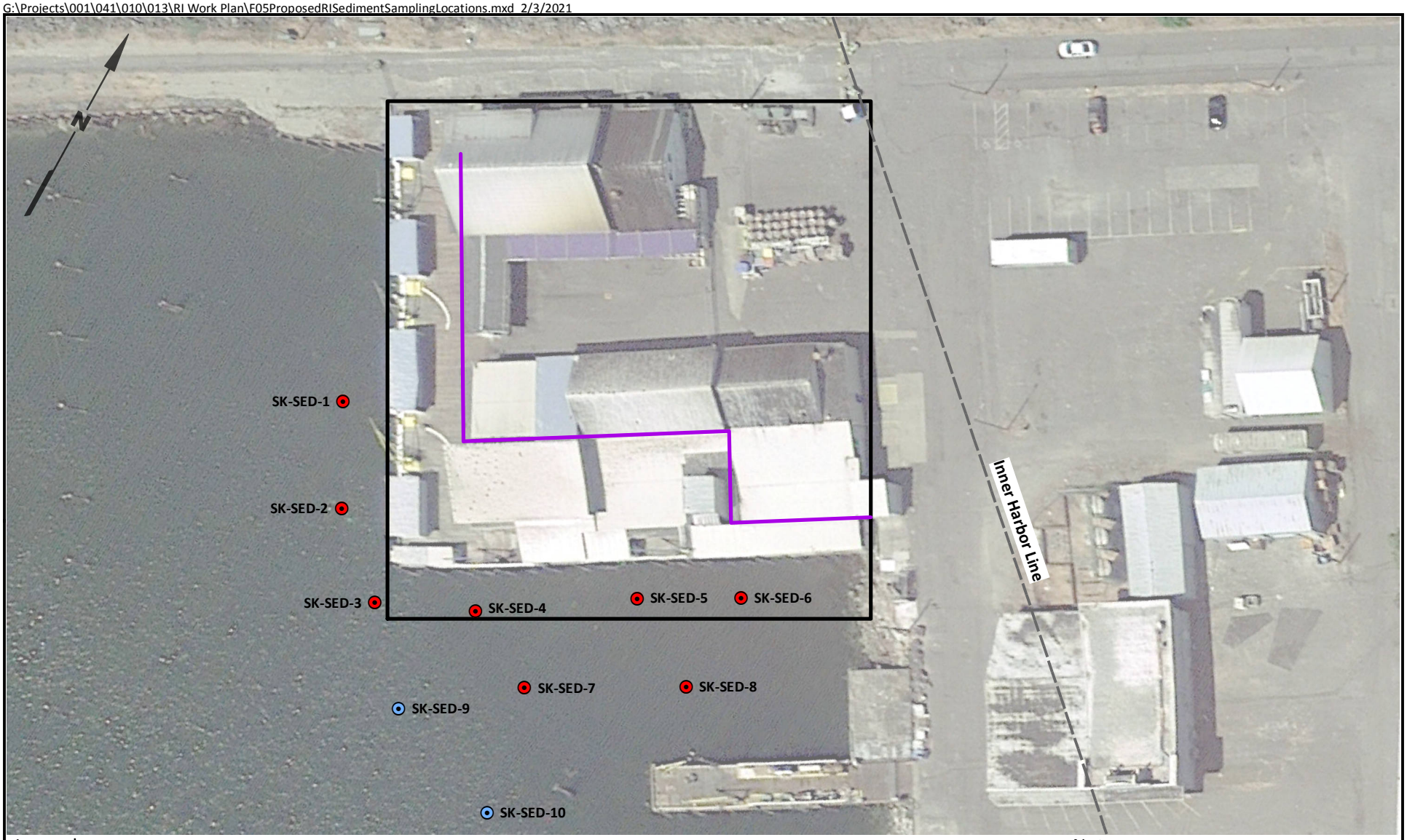
LANDAU ASSOCIATES

Sea K Fish Remedial Investigation
Blaine, Washington

Proposed Upland Sampling Locations

Figure 4

G:\Projects\001\041\010\013\RI Work Plan\F05ProposedRISedimentSamplingLocations.mxd 2/3/2021



Legend

- Proposed Primary Sediment Sampling Location
- Proposed Contingent Sediment Sampling Location
- Preliminary Site Boundary
- Inner Harbor Line
- Shoreline/Bulkhead

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Data Source: Google Earth Pro.

0 60 120

Scale in Feet

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Sea K Fish Remedial Investigation
Blaine, Washington

Proposed Sediment Sampling Locations

Figure 5

Table 1
Proposed Sampling Program
Remedial Investigation Project Plan
Sea K Fish Cleanup Site – Blaine, Washington

Sampling Location Location ID	Description/Location	Soil		Groundwater		Soil Vapor		Sediment		Surface Water	
		Analysis	Target Sample Depths	Analysis	Target Screen Interval Depth	Analysis	Target Sample Depths	Analysis	Target Depth(s) (ft bgs)	Analysis	Target Sample Depths
Upland Investigation											
SK-SB-31	Delineate extent of contamination along the northern edge of the Site to evaluate for potential northern migration, or releases along the (potential) location of a former pipeline	TPH [1], BTEX[2], lead, and PAHs[3] at each location; PCBs[5] and the full list of metals[4] from two LNAPL-impacted locations.	Sample collected at the water table and the most likely contaminated interval based on field observations. If no evidence of contamination, sample only at the water table.	TPH [1], BTEX[2], PAHs[3], and lead	Just below the current groundwater table at time of drilling.	N/A					
SK-SB-32											
SK-SB-33											
SK-SB-34	Delineate extent of contamination on the north end of the known contaminated area										
SK-SB-35											
SK-SB-36	Delineate extent and further characterize the known, contaminated area, and to the east										
SK-SB-37											
SK-SB-38											
SK-SB-39											
SK-SB-40	Delineate extent of contamination in the northeast area of the Site, and characterize groundwater in the former Standard Oil Company Lease area										
SK-SB-41	Delineate extent of contamination on the south end of the known contaminated area										
SK-SB-42											
SK-SV-1	Evaluate and characterize potential contaminants in soil vapor below the active operations building slab	N/A				VOCs[6]	Below concrete slab	N/A			
SK-SV-2											
SK-SV-3											
Marine Investigation											
SK-SED-1	Investigate for contamination in surface and subsurface sediment that may have released from the upland area to the marine environment	N/A						TPH-D, TPH-O, SMS chemicals[7]	1 to 3 Samples from 8 locations nearest the shoreline; 2 locations will be archived and analyzed only as-needed; samples will be collected from 0 to 7 ft below mudline	N/A	
SK-SED-2											
SK-SED-3											
SK-SED-4											
SK-SED-5											
SK-SED-6											
SK-SED-7											
SK-SED-8											
SK-SED-9											
SK-SED-10											
SK-SW-1	Investigate for surface water impacts	N/A								TPH[1]	Near the uplands where sheen has been observed
SK-SW-2											
SK-SW-3											
SK-PW-1	Investigate for porewater impacts	N/A								TPH[1]	Near the uplands where sheen has been observed
SK-PW-2											
SK-PW-3											

Notes:

(1) TPH-G, TPH‑D, and TPH-O by Methods NWTPH-G and NWTPH-Dx.
(2) BTEX by EPA Method 8021.
(3) Select PAHs by EPA Method 8270E SIM.
(4) Metals by EPA Methods 6020B for (arsenic, barium, cadmium, chromium, lead, selenium, and silver), and 7471 (mercury).
(5) PCBs by EPA Method 8082.
(6) VOCs by Method TO-15.
(7) SMS chemicals listed in WAC 173-204-320, including metals (arsenic, cadmium, chromium, copper, lead, mercury, silver, and zinc), SVOCs [EPA Method 8270E], PCBs, and conventional parameters (grain size, total organic carbon, total solids).

Table 1
Proposed Sampling Program
Remedial Investigation Project Plan
Sea K Fish Cleanup Site – Blaine, Washington

Abbreviations and Acronyms:

BTEX = benzene, toluene, ethylbenzene, and xylenes
ID = Identification
EPA = US Environmental Protection Agency
ft = feet
LNAPL = light non-aqueous phase liquid
N/A = not applicable
NWTPH-Dx = Northwest total petroleum hydrocarbon extended-range diesel analytical method
NWTPH-G = Northwest total petroleum hydrocarbon gasoline analytical method
PAHs = polycyclic aromatic hydrocarbons
PCBs = polychlorinated biphenyls
RCRA = Resource Conservation and Recovery Act
SIM = selected ion monitoring
SMS = Sediment Management Standards
SVOC = semivolatile organic compound
TBD = to be determined
TPH-D = diesel-range total petroleum hydrocarbons
TPH-G = gasoline-range total petroelum hydrocarbons
TPH-O = oil-range total petroleum hydrocarbons
VOC = volatile organic compound
WAC = Washington Administrative Code

APPENDIX A

Sampling and Analysis Plan

Remedial Investigation Sampling and Analysis Plan
Sea K Fish Cleanup Site
205 and 225 Sigurdson Avenue
Blaine, Washington

July 8, 2021

Prepared for

Port of Bellingham
P.O. Box 1677
Bellingham, Washington

LANDAU ASSOCIATES

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FIGURES

TABLES

ATTACHMENT

LIST OF ABBREVIATIONS AND ACRONYMS

ALS ..... Analytical Laboratory Services, Inc.
ASTM ..... ASTM International
bgs ..... below ground surface
BTEX ..... benzene, toluene, ethylbenzene, xylene
CFR ..... Code of Federal Regulations
cm ..... centimeters
COC ..... chain of custody
°C ..... degrees Celsius
Ecology ..... Washington State Department of Ecology
EPA ..... US Environmental Protection Agency
ft ..... foot/feet
GPS ..... Global Positioning System
H&S ..... health and safety
HASP ..... health and safety plan
IDW ..... investigation-derived waste
LAI ..... Landau Associates, Inc.
LNAPL ..... light non-aqueous phase liquid
mL ..... milliliters
mL/min ..... milliliters per minute
m/sec ..... meters per second
MW ..... monitoring well
NWTPH-Dx ..... Northwest total petroleum hydrocarbon extended-range diesel analytical method
NWTPH-G ..... Northwest total petroleum hydrocarbon gasoline analytical method
OSHA ..... US Occupational Safety and Health Administration
oz ..... ounces
PAH ..... polycyclic aromatic hydrocarbon
PCB ..... polychlorinated biphenyl
PID ..... photoionization detector
PM ..... project manager
Port ..... Port of Bellingham
PPE ..... personal protective equipment
PSL ..... preliminary screening level
PVC ..... polyvinyl chloride
QA ..... quality assurance
QAPP ..... quality assurance project plan
QC ..... quality control
RI ..... remedial investigation

LIST OF ABBREVIATIONS AND ACRONYMS

SAP ..... sampling and analysis plan
SIM ..... selected ion monitoring
Site ..... Sea K Fish cleanup site
SVOC ..... semivolatile organic compound
TPH-D ..... diesel-range total petroleum hydrocarbons
TPH-G ..... gasoline-range total petroleum hydrocarbons
TPH-O ..... oil-range total petroleum hydrocarbons
VOC ..... volatile organic compound
WAC ..... Washington Administrative Code

1.0 INTRODUCTION

Landau Associates, Inc. (LAI) prepared this Sampling and Analysis Plan (SAP) for the Port of Bellingham (Port) in support of the Sea K Fish cleanup site (Site) remedial investigation (RI), located in Blaine, Washington (Figure A-1). This SAP meets the requirements of the Model Toxics Control Act (MTCA; Washington Administrative Code [WAC] 173-340-820), and the Agreed Order (Ecology 2020) between the Port and the Washington State Department of Ecology (Ecology). This SAP describes the project organization, objectives, and environmental sampling techniques that will be used during the RI, to ensure that the precision, accuracy, representativeness, and completeness of the project data are sufficient to satisfy the project objectives, and that the data meet the appropriate quality assurance (QA) and quality control (QC) requirements. The project plans consist of:

- The RI Project Plan, presented in the main body of the text
- This SAP (Appendix A)
- Quality Assurance Project Plan (QAPP; Appendix B)
- Health and Safety Plan (HASP; Appendix C)
- Inadvertent Discovery Plan (Appendix D).

2.0 PROJECT ORGANIZATION

The organizational structure for the project will consist of a Project Manager (PM), Task Manager, Health and Safety Manager, Project Engineer/Scientist, QA Officer/Data Validator, Site Safety Officer, and Laboratory Coordinator.

2.1 Responsibilities of Project Personnel

The responsibilities of project personnel are described below.

Title/Role	Responsibilities
LAI Project Manager (PM)	Supervises and coordinates project team members and work associated with the project. These responsibilities include project planning and execution, scheduling, staffing, data evaluation, report preparation, subcontracts, and review and approval of project deliverables.
Task Manager*	Leads and coordinates field activities with Field Lead, including documentation, sampling, and sample handling. Assists with budget and invoice review, and monitoring of project deliverables. Prepares subcontractor agreements and reviews/approves related performance documentation and invoices. Reports directly to the LAI PM.
Field Lead/Field Engineer or Scientist**	Coordinates with subcontractors. Oversees and reviews subcontractors' work. Maintains field equipment and daily field notebook. Conducts sampling operations and verifies compliance with team members in accordance with this SAP. Coordinates and verifies bottle order with laboratory. Prepares chain-of-custody (COC) forms and verifies delivery of samples to laboratory. Supports preparation of project deliverables.
Quality Assurance (QA) Officer	Oversees and directs QA reviews for the project, including laboratory analytical results and necessary corrective actions. Coordinates and reviews data validation. Has oversight responsibility for management and integrity of project data.
Data Validator	Reviews laboratory analytical data and validates data.
Health and Safety (H&S) Manager	Coordinates with LAI PM/Task Manager as necessary on matters of health and safety. Approves Health and Safety Plan (HASP). If Site conditions change, amends and approves HASP. Ensures proper health and safety equipment is available for the project.
Site Safety Officer (SSO)	Leads daily Tailgate Safety Meeting and prepares necessary documentation. Modifies health and safety equipment or procedure requirements based on data gathered during Site work. Evaluates field health and safety conditions, and communicates and coordinates with H&S Manager, if conditions change (i.e., upgrade PPE requirements).

* Task Manager may operate as Field Lead and/or Site Safety Officer, as required.
** Field Lead/Field Engineer or Scientist may operate as Site Safety Officer, as required.

2.2 Special Training Requirements/Certification

Specific training requirements for performing fieldwork at the Site are as follows:

- Field personnel assigned to the Site must have successfully completed 40 hours of training for hazardous site work in accordance with US Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910.120(e)(3) and be current with their 8-hour refresher training in accordance with OSHA 29 CFR 1910.120(e)(8). Documentation of OSHA training is required prior to personnel being permitted to work on Site.

- Personnel assigned to the Site must be enrolled in a medical surveillance program meeting the requirements of OSHA 29 CFR 1910.120(f). Personnel must have successfully passed an occupational physical during the past 12 months and be medically cleared to work on a hazardous waste site and capable of wearing appropriate personal protective equipment (PPE) and respiratory protection as required.
- Personnel assigned to the Site who must wear a respirator must be familiar with the OSHA respiratory standard (29 CFR 1910.134). Personnel who are required to wear respirator protection must have successfully passed a respirator fit test within the past 12 months.

It is the responsibility of the employing organization to provide their employees with the required training, medical monitoring, and fit testing prior to assigning them to work at this Site. Each employing organization will be responsible for providing documentation of training, monitoring, and fit testing (with make/model of respirator) to the PM and H&S Manager prior to sending their employees to the Site to work.

3.0 DATA COLLECTION

This section outlines the sample collection procedures for conducting the soil, groundwater, soil vapor, sediment, and surface water sampling described generally in the Project Plan and summarized in Table A-1.

The planned sampling locations are presented in the attached Figures A-2 and A-3, for the upland and marine portions of the Site, respectively. Actual sampling locations will likely vary somewhat from those presented based on physical access constraints such as overhead or underground utilities, which will be assessed during implementation of the RI.

A Site reconnaissance will be conducted prior to intrusive activities to identify obstructions to planned boring locations (i.e., utilities, equipment, materials), and to evaluate the condition of certain features that may affect the approach to or need for investigation at that location. If practicable, boring locations will be adjusted to avoid obstructions. However, if planned boring locations are obstructed by equipment or materials, and a viable alternative location is not available nearby, the Port will coordinate with applicable tenants to move the obstruction to allow sampling. If borings cannot be relocated a safe distance from underground utilities, an air-knife and vac-truck will be used to advance the boring to below the elevation of the utilities. It is anticipated that this will be required at several locations.

Site-specific cleanup levels will be developed in accordance with MTCA requirements as part of the remedial investigation/feasibility study (RI/FS) process, culminating in formal adoption in the Cleanup Action Plan. For the purposes of ensuring the laboratory reporting limits for the RI will be sufficiently adequate to support the investigation, preliminary screening levels composed of Method A and Method B concentrations, as tabulated in Chapter 173-340 WAC (MTCA Method A) and MTCA's CLARC database (Ecology; accessed February 4, 2021) are presented in the QAPP, along with the laboratory reporting limits for comparison. As noted, these values are preliminary and will be further refined through the RI/FS process when a clearer understanding of Site conditions and potential exposure pathways is developed.

The following sections present the procedures to be used during the RI. Additional investigation and sampling activities, as required, will be detailed in future addenda, including associated figures and tables to support planning and approval of the efforts. Specific sampling equipment and methodology may vary based upon Site features and conditions, and planned activities. Minor modifications and/or deviations from what is presented herein may be necessary based on findings of the RI. Minor deviations would be documented in the RI report. Significant deviations, if necessary, would be coordinated with and approved by Ecology and documented in the RI report, as appropriate.

3.1 Soil Sampling

Soil core samples will be retrieved from the subsurface using direct-push drilling methods to collect a relatively continuous core soil sample from the ground surface to a depth of 15 to 20 feet (ft) in depth at the 10 locations shown on Figure A-2. The licensed driller will use either a truck-mounted or track-mounted (limited access) direct-push drill rig, collecting the soil core sample in increments of 4 to 5 ft in length, depending upon the tooling used. The maximum depth of the boring will be either 15 ft or 20 ft below ground surface (bgs), as decided during the RI based on ensuring the sampler is advanced at least 5 ft below the groundwater table as estimated at the time of drilling.

The driller's sample tooling will be lined with a disposable plastic liner to preserve sample integrity. The driller will provide the sample within the liner to the environmental field professional for processing. After collecting the soil samples, the driller will initiate groundwater grab-sample collection procedures discussed in Section 3.2 or abandon the borehole if no groundwater sample is needed. After sampling is complete, the borehole will be backfilled with hydrated bentonite chips and restoring the surface to match the original grade and surfacing type (e.g., gravel, asphalt patch, or concrete patch).

Field personnel will conduct sample processing, which will include recording descriptions of the soil physical characteristics on field forms, conducting field screening for indications of contamination, and collecting discrete soil samples from the sample core for further chemical evaluation by laboratory analysis. The sample processing will be conducted by a qualified environmental professional donning clean, disposable nitrile gloves, and the observations will be recorded on the boring log and the appropriate sample collection forms provided in Attachment 1.

3.1.1 Soil Description

Visual observations of the entire length of the core sample will be recorded on a soil sampling sheet that will include the sample number, sampling location, depth, Unified Soil Classification type, the results of field screening for indications of contamination, and the date and time of sample collection.

3.1.2 Field Screening for Indications of Contamination

Screening for indications of contamination will include a combination of visual and olfactory observations, photoionization detector (PID) screening, and sheen testing. Visual observations will note the presence of sheen, unusual staining, or the presence of light non-aqueous phase liquid (LNAPL, i.e., oily product). Olfactory observations will be recorded, but field personnel will not intentionally smell the soil sample for this purpose.

A PID will be used to evaluate the soil for indications of vapor-phase volatile organic compounds (VOCs) emanating from the soil surfaces. PID screening is conducted by placing a small portion of the soil sample into a Ziploc® bag and inserting the tip of the PID into the bag to measure the soil headspace for VOCs. Due to the small quantity of soil available for observation and laboratory

submission, it is sometimes necessary to conduct PID screening while the soil remains relatively undisturbed within the plastic liner. In these instances, field personnel will place a gloved hand over the top of the sample surface and insert the tip of the PID into the trapped headspace for VOC measurement.

Where sheen is suspected but not readily identified, field personnel will place a small portion of the suspect soil into a clean container or sample jar with clean tap water, and gently disturb the sample while observing for a sheen on the water.

Portions of the sample core that have been placed into a Ziploc bag for PID screening, or undergone sheen testing in a separate container will not be used for laboratory analyses.

3.1.3 Soil Sample Collection for Laboratory Analyses

Portions of the core sample will be placed into laboratory-supplied sample jars for the chemical analyses summarized in Table A-1. Table A-2 provides a summary of the appropriate sample collection jars and preservation requirements. Samples will be placed in a cooler with ice under chain-of-custody procedures, and submitted to the laboratory for the following analyses:

- Gasoline-range total petroleum hydrocarbons (TPH-G) by the Northwest total petroleum hydrocarbon gasoline analytical method (NWTPH-G)
- Diesel-, and oil-range total petroleum hydrocarbons (TPH-D, and TPH-O, respectively) by the Northwest total petroleum hydrocarbon extended-range diesel analytical method (NWTPH-Dx)
- VOCs, specifically the VOCs associated with petroleum hydrocarbon contamination (i.e., benzene, toluene, ethylbenzene, and xylenes [BTEX] by US Environmental Protection Agency (EPA) Method 8021
- Semivolatile organic compounds (SVOCs), specifically the SVOCs associated with petroleum hydrocarbon contamination, the polycyclic aromatic hydrocarbons (PAHs) as determined by EPA Method 8270E with selected ion monitoring (SIM)
- Total polychlorinated biphenyls (PCBs) by EPA Method 8082
  - Two soil samples will be analyzed for total PCBs, from locations selected during the RI from within the area where LNAPL has been observed
- Metals by EPA Method 6020 (mercury by EPA Method 7471)
  - At each location, samples will be analyzed for lead
  - Two soil samples will be analyzed for the full list of metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) from locations selected during the RI from within the area where LNAPL has been observed.

Table A-1 includes a list of analyses planned for each soil sampling location. Field personnel will collect one to two soil samples from each location for the full list of analyses. Table A-3 provides a summary of additional QC samples required to meet the requirements of the QAPP (Appendix B).

The portions of soil that will be analyzed for VOCs by EPA Method 8021 or NWTPH-G require special collection procedures that prevent degradation of sample integrity. For these analyses, a portion of the soil sample will be collected in accordance with EPA Method 5035A, which is a soil sampling method intended to reduce volatilization and biodegradation of samples. The EPA Method 5035A procedure for soil sample collection is as follows:

- Collect soil samples from the soil volume using coring devices (i.e., EnCore® sampler, EasyDraw Syringe®, or a Terra Core™ sampling device). Each core will consist of approximately 5 grams of soil. Collect three discrete cores from each sampling location. One EasyDraw Syringe or one Terra Core sampling device can be used to collect the three discrete cores at each sampling location; however, if the EnCore samplers are used, then three sampling devices are required (i.e., one for each sample collected).
- Remove excess soil from the coring device. If an EasyDraw Syringe or Terra Core sampling device is used for sample collection, place the "cored" soil directly into three preserved 40-milliliter (mL) vials with a stir bar. Vials will be preserved as indicated in Table A-2. If the EnCore sampler is used, then close the sampler for transport to the laboratory.
- Collect an additional 2 ounces (oz) of soil and place it in a laboratory-supplied jar for moisture content analysis and laboratory screening purposes. Fill the jar to minimize headspace.

Soil samples to be analyzed for non-volatile parameters will be collected from the identified soil sampling intervals using the following method:

- Scrape the top of the sample core surface to expose an undisturbed area using a clean, decontaminated stainless-steel spoon.
- Homogenize the soil in a decontaminated stainless-steel bowl using a newly decontaminated stainless-steel spoon.
- Transfer the homogenized soil into the appropriate laboratory-supplied sample container.

Each soil sample collected for laboratory analysis will be labeled, handled, and submitted under chain-of-custody procedures to the analytical laboratory, as described further in Section 4. In addition to the sample collected for laboratory analysis, approximately 4 oz to 10 oz of additional soil from two vertical intervals at each soil sampling location will be collected in a clean jar for subsequent visual inspection to confirm the recorded visual observations.

Laboratory reporting limits for assessing soil quality are provided in the QAPP (Appendix B).

3.2 Groundwater Sampling

Groundwater samples will be collected from the boreholes advanced during the soil sampling described in Section 3.1, and from groundwater monitoring wells. The grab samples collected from the direct-push borings should be of sufficient quality for the purposes of evaluating the nature and extent of contamination. Determining compliance with cleanup standards will likely require higher-quality groundwater data.

It is anticipated that up to four wells will be installed to evaluate conditions in the areas determined to be most impacted, and at the lateral extents of the contaminated area, to assist in evaluating compliance with groundwater cleanup standards.

Additional groundwater monitoring wells may be required later in the cleanup process to determine compliance with MTCA cleanup standards.

3.2.1 Direct-Push Groundwater Grab Samples

This section describes the activities to be conducted to collect and analyze groundwater grab samples from direct-push borings. Groundwater grab samples will be collected from six of the sampling locations shown on Figure A-2. Procedures for advancing the direct-push borings are provided in Section 3.1.

After collecting soil core samples from the borings, groundwater will be purged from each of the six borings selected for groundwater monitoring using a sampler consisting of a 4-ft-long, wire-wrapped, stainless-steel screen (0.010-inch slot size) with a retractable protective steel sheath. The groundwater sampler will be advanced into the open boring and submerged in groundwater to the target sample inlet depth of 1.5 to 2.5 ft below the groundwater table elevation. The sampler will be placed below the observed groundwater table elevation due to the confining nature of the silty and clayey soils observed at the Site. A shallower sample collection elevation in combination with the anticipated slow recharge rate would likely cause the purging process to deplete the temporary well screen of water. Once in place at the proper depth, the protective sheath will be retracted to expose the stainless-steel screen to the formation. Low-flow purging will be conducted for a minimum of 10 minutes, or until the purged water is clear for at least 2 minutes during pumping using a peristaltic pump. The purged water will be monitored for pH, specific conductance, and temperature, and the final values recorded on a sample collection form.

After purging, groundwater grab samples will be collected directly into the appropriate laboratory-supplied sample containers using disposable polyethylene tubing and a peristaltic pump.

To prevent degassing during sampling for VOCs (BTEX) or TPH-G, a pumping rate will be maintained below about 100 milliliters per minute (mL/min). VOC sample containers will be filled completely so that no headspace remains. Samples will be chilled to 4°C immediately after collecting the sample. Groundwater for dissolved lead analyses will be collected last and field-filtered through a 0.45 micron, in-line disposable filter and preserved. A note will be made on the sample label, sample collection form, and chain-of-custody form to indicate that the sample for dissolved metals analysis has been field-filtered and preserved, including the type of preservative used. The groundwater grab samples will be maintained in a cooler with ice under chain-of-custody procedures, and submitted to the laboratory for the analyses planned for each sampling location indicated in Table A-1, including:

- TPH-G, TPH-D, and TPH-O by Methods NWTPH-G and NWTPH-Dx

- BTEX compounds by EPA Method 8021
- PAHs by EPA Method 8270E SIM
- Dissolved lead by EPA Method 6020.

Particulates in groundwater samples can result in a high bias of the analytical results in comparison to actual aquifer conditions for organic compounds that partition heavily to soil, such as TPH-O and PAHs. This is particularly a concern for the groundwater grab samples that will be collected from the direct-push borings due to turbidity. As a result, the analytical results for grab samples collected from direct-push borings will be used for planning and construction purposes only. Compliance with cleanup standards will ultimately be determined using monitoring wells to obtain more representative groundwater samples.

Groundwater grab samples will be collected and preserved consistent with the method-specific requirements shown in Table A-2. Analyses will be conducted within the specified holding times and other quality control parameters presented in Appendix B. Target reporting limits are provided in the QAPP (Appendix B).

3.2.2 Groundwater Monitoring Well Installation

New monitoring wells will be constructed by a Washington State-licensed drilling contractor with a hollow-stem auger drilling rig at locations that will be determined after review of the groundwater grab-sample results, and as approved by Ecology. Prior to initiation of drilling, or any other invasive subsurface activity, the locations of each proposed exploration will be checked in the field to identify aboveground utilities or physical limitations that would prevent drilling at the proposed location. In addition, a public utility locate service will be contacted to locate underground utilities at the perimeter of the Site and a private utility locate service will be contacted to identify potential underground utilities. Based on the findings of the utility locating services, adjustments to the boring locations may be required. The final location for each borehole will be based on the findings of the field check.

The monitoring wells will be constructed in accordance with Washington State Minimum Standards for Construction and Maintenance of Wells (Chapter 173-160 WAC; Ecology 2008). Field personnel familiar with environmental sampling and construction of resource protection wells will oversee the drilling and well installation activities and maintain a detailed record of the well construction. The monitoring wells will be drilled using conventional hollow-stem auger techniques with 4.25-inch inside diameter augers.

The monitoring wells will be constructed with 0.010-slot, 2-inch-diameter, Schedule 40 polyvinyl chloride (PVC) screen with a flush-threaded bottom cap no greater than 6 inches long. As a standard, planned screen lengths will be 10 ft. Blank Schedule 40 PVC casings will extend from the top of the

screen to about 0.5 ft bgs for flush-mounted wells. The top of the PVC will be fitted with a standard lockable, sealing well plug.

Monitoring well borings will be drilled to the total desired depth of the well (approximately 5 ft below the seasonally/tidally low groundwater table elevation). The well screen location will be selected based on observed conditions. Previous water level observations indicate that screens will be placed from 5 to 15 ft bgs to intersect the water table.

A sand pack equivalent to 10/20 silica sand will be placed in the bottom of the borehole to 2 ft above the top of the screen in each monitoring well. The monitoring well will be surged prior to placement of the bentonite seal to prevent bridging and facilitate settling of the sand pack. A seal consisting of bentonite chips will be placed directly above the sand pack to a depth of approximately 1.5 ft below grade or less. The depth to the top of the sand pack and the bentonite will be tagged with a weighted tape to ensure well completion materials are installed to the correct depth.

Neat cement grout will then be placed on top of the bentonite seal extending to the ground surface. The neat cement grout shall consist of Portland cement types I, II, or III with 5 percent by dry weight of bentonite.

Flush-mount traffic-rated steel monuments will be constructed above the top of the well casing. The bolt-on well covers will be set slightly above the surrounding grade to promote stormwater runoff away from the well monument and will be embedded in concrete tapered away from the well cover.

3.2.3 Groundwater Monitoring Well Development

The newly installed monitoring wells will be developed after the cement used in constructing the wells has cured for at least 24 hours. Groundwater sampling will not occur at a newly installed well until at least 1 week after the well has been developed.

Groundwater monitoring wells must be developed prior to sampling to remove the clay, silt, and other fines (small particles) from the formation to reduce turbidity or suspended matter that would interfere with chemical analysis.

Before developing the well, water depth and well depth will be measured to determine the volume of water in the well under static conditions. Approximately 10 well casing volumes (calculated from the length of the water column and the well casing diameter) will be removed from the well during development. The discharge from the well will be monitored and development should be continued until a particulate-free discharge is apparent and the field parameters (pH, conductivity, and temperature) have stabilized within 10 percent of the previous reading. Field parameters should be recorded on the well development form after each volume is removed. Materials and equipment used in conjunction with development must be decontaminated prior to use and all provisions made to

prevent cross-contamination during development. Well depths will be measured before and after development to determine whether sand or silt has accumulated in the well.

At this Site, a surge block will be used initially to flush the sand pack followed up by purging with a submersible pump. A surge block is a round plunger with pliable edges that will not catch on the well screen. The surge block assembly is lowered by hand down the well by connecting sections of threaded pipe. Once within the screen interval, the block is rapidly raised and lowered to agitate the water within the well.

After purging with the surge block, a pump will be used to purge the well. If larger particles are present in the casing and/or the bottom of the well, a decontaminated, stainless-steel bailer will be lowered to the bottom of the well to remove larger particles that can be too heavy to pump out with a submersible pump. After the large particles are removed, the pump will be started and stopped so that the water is alternately pulled into the well through the screen and back-flushed through the screen. Periodically pumping the well water will remove the fines from the well and permit checking the progress to ensure that development is complete. Continue pumping until the well yields water with a turbidity of 50 nephelometric turbidity units or until a minimum of 10 casing volumes have been pumped from the well. If water is added to the well during drilling, a minimum of 200 percent of the volume of water added to the well must be purged during development. Record the final turbidity of the well on the well development log.

3.2.4 Groundwater Sample Collection (Low-Flow Methods)

Groundwater monitoring will consist of assessing well conditions, measuring the depth to groundwater, evaluating for the presence of LNAPL, purging stagnant groundwater from the well casing until withdrawn water adequately represents aquifer conditions, then collecting groundwater samples into appropriate containers.

After assessing and recording visible conditions, a static water-level measurement will be collected for later use in understanding groundwater flow patterns across the Site, and to use as a basis for assessing well draw-down during the purging process.

Groundwater will be purged from the casing using low-flow methods, with the intention of withdrawing water at a rate similar to the natural recharge rate of the well. This is assessed by monitoring the water table for draw-down during the purging process and adjusting the pumping flow rate to limit draw-down of the water table to 0.3 ft, if possible. Groundwater quality parameters are monitored during the purge to observe for stabilizing conditions. When an adequate volume of water has been removed, and the groundwater quality parameters have stabilized, it is assumed that additional water withdrawn from the well best represents aquifer conditions, rather than the water that was stagnant in the well prior to purging.

Specifically, groundwater parameters are considered stable when at least three consecutive measurements of turbidity, dissolved oxygen, oxidation reduction potential (redox), pH, specific conductance, and temperature are within 10 percent of the previous measurement.

Upon stabilization of parameters, the purge rate will be reduced to between approximately 100 and 200 mL/min. Samples are collected from the discharge tube of the pump into appropriate sample containers. The groundwater samples will be maintained in a cooler with ice under chain-of-custody procedures, and submitted to the laboratory for the analyses planned for each sampling location indicated in Table A-1, including:

- TPH-G, TPH-D, and TPH-O by Methods NWTPH-G and NWTPH-Dx
- BTEX compounds by EPA Method 8021
- PAHs by EPA Method 8270E SIM
- Dissolved Lead by EPA Method 6020.

Target reporting limits are provided in the QAPP (Appendix B).

3.3 Surface Water and Porewater Sampling

Surface water samples will be collected from the marine waters of Blaine Harbor, at three locations adjacent to and south of the Site uplands. The samples will be collected during both high and low tide (for a total of six samples) by lowering clean jars into the water from the dock, submerging the jars just below the surface of the water using an extendable pole, and retrieving the sample. The timing of sample collection will attempt to allow collection of the samples from about 0 to 6 inches below the water surface, and within about 6 inches of the underlying sediment.

In addition to the surface water samples, porewater samples will be collected to further investigate the potential for contaminant transport through the shoreline, from upland groundwater toward the marine environment. The porewater samplers will be decontaminated perforated stainless steel, and will be driven into the sandy surface when the tide is 0 to 1 ft below the mudline elevation at the sampling location. The sampler will be driven to a depth of approximately 1 to 2 ft below the mudline. A peristaltic pump will be used to collect a porewater sample from within the sampler.

Surface water and porewater samples will be collected into or carefully poured into the laboratory-supplied sample containers. The containers will be labeled and the samples will be maintained in a cooler with ice under chain-of-custody procedures, and submitted to the laboratory for the analyses planned for each sampling location indicated in Table A-1, including:

- TPH-G, TPH-D, and TPH-O by Methods NWTPH-G and NWTPH-Dx.

Target reporting limits are provided in the QAPP (Appendix B).

3.4 Soil Vapor Sampling

This section describes the activities to be conducted to collect soil vapor samples to evaluate the potential risks of volatile compounds in air that could impact human health.

Three soil vapor samples will be collected from beneath the existing building slab, as shown on Figure A-2. The three sampling locations were selected to evaluate soil vapor quality associated with petroleum hydrocarbon contamination. The samples will be collected through a ⅝-inch-diameter core in the concrete, drilled with a handheld rotary hammer drill.

The sampling port location will consist of a stainless-steel Vapor Pin™ with a silicone sleeve inserted into the core, and set flush with the concrete slab.

A bottle brush and shop-vac will be used to clean coring debris from the hole before the Vapor Pin is installed. To prevent the sampling port from being tampered with or damaged, a construction cone will be placed over the sampling assembly. To prevent dilution of the soil vapor samples from ambient air introduced during installation of the Vapor Pin, each sampling location will be allowed to equilibrate overnight before proceeding with sample collection. Before sample collection, approximately 2 ft of ¼-inch outside diameter Teflon® or nylaflow tubing will be attached to the barb fitting at the top of the Vapor Pin. A ball valve will be placed at the end of the tubing to prevent soil gas from escaping prior to sampling.

Samples will be collected from the sub-slab sampling port into 6 liter Summa canisters with a laboratory-supplied and calibrated flow control valve. The flow control valve will be calibrated to a flow rate not to exceed 200 mL/min (collection time of approximately 30 minutes). After connecting the flow controller to the Summa canister, and the sample tubing to the flow controller inlet, field personnel will open the valve on the sample tubing, then the needle valve on the Summa canister. A pressure gauge on the flow control valve will be monitored as the sample is collected. When the pressure gauge reads approximately 5 inches of mercury vacuum, the canister valve and then the tubing valve will be closed and the canister will be detached. The sub-slab vapor sampling port will be resealed after monitoring is complete, by removing the Vapor Pin with the extraction tool and filling in the hole with quick-set concrete.

One ambient air sample will be collected during the sub-slab vapor sampling activities to assess ambient air quality at the time of sampling. The ambient air sample will be placed in an upwind location at the Site, and will be fitted with an 8-hour flow controller to allow for a time-weighted average result that encompasses the duration of the soil vapor sampling activities. Each of the three soil vapor samples and the ambient air sample will be analyzed for VOCs by Method TO-15. Target laboratory reporting limits are provided in the QAPP (Appendix B).

3.5 Sediment Sampling

The objective of the sediment investigation is to determine if previous Site activities have impacted sediment quality to an extent that may pose a threat to human health or adversely affect biological resources. Based on indications that contaminants have migrated from the uplands portion of the Site, the proposed sediment investigation is designed to determine the lateral and vertical extent of contamination in marine sediment near the Site uplands. The proposed sediment investigation will include collection and analysis of both sediment surface samples and sediment core samples.

Figure A-3 shows the 10 planned sediment sampling locations. Both surface and sediment core samples will be collected and analyzed from the 8 locations closest to the uplands. As shown on Figure A-3 and summarized in Table A-1, 2 of the sampling locations located farthest from the uplands are considered contingent. These contingent locations will be sampled just as the others, but the collected samples will be archived at the laboratory, and only analyzed for the constituents determined necessary (if any) based on the results of the samples collected closer to the uplands.

Each sediment sample collected will undergo analysis for chemicals regulated under Washington State Sediment Management Standards (SMS; WAC 173-204-320) and the Site-specific parameters selected to determine the potential extent of contamination originating in the uplands. These parameters are discussed later in this section, and summarized in Table A-1.

Global positioning system (GPS) units will be used to confirm that the actual sampling locations are within 5 ft of the locations shown on Figure A-3, and the northings and eastings of the actual sampling locations will be recorded, relative to the North American Datum of 1983 (NAD83).

Riprap located along the shoreline or other marine structures may influence the selection of the final sampling locations and could result in difficulty with sample recovery. Sediment sampling locations may require modification but will not differ significantly from what is presented on Figure A-3 without prior consent from Ecology.

Vertical position control at each location will be evaluated by using a lead line (or weighted tape) to measure from the water surface to the sediment surface. The elevation of the mudline at each location will be calculated by measuring the depth of water at each location and subtracting it from the tide elevation. Mudline elevations will be recorded based on the mean lower low water datum.

Surface Sediment Sample Collection

Surface sediment samples for chemical testing will be collected using a standard VanVeen or Ponar grab sampler. A hydraulic winch system will be used to deploy the sampler at a rate not exceeding 1 meter/second (m/sec) to minimize the bow wake associated with sampler descent. Once the sampler hits the bottom, the jaws will be activated to capture the sample, then the sampler will be brought to the deck of the vessel at a rate not exceeding 1 m/sec to minimize any washing and

disturbance of the sediment contained within the sampler. The date, time, mudline elevation, sample depth, and location of sample acquisition will be recorded on the sample collection form.

Once onboard, the sampler will be secured, any overlying water will be carefully siphoned off, and the sample will be inspected to determine acceptability. Criteria used to determine acceptability are those detailed in EPA guidelines (EPA 2001). These criteria include but are not limited to:

- Minimal or no excessive water leakage from the jaws of the sampler
- No excessive turbidity in the water overlying the sample
- The sampler is not overfilled with sediment
- The sediment surface appears to be intact with minimal disturbance
- The penetration depth is sufficient (10 centimeters [cm]; dependent on grain size).

If the sample meets the acceptability criteria, the sediment will be characterized on the field sample collection form. This characterization will include color, odor, sheen, grain size, a soil description based on visual observation, and field-screening results (e.g., PID readings). If after multiple sampling attempts, a surface sediment sample does not meet the acceptability criteria (e.g., overpenetration), the sample will still be collected but the sampler will document the reasons for not meeting criteria on the sample collection form.

Once the sample has been characterized, the sediment will then be homogenized and sub-sampled for chemical analysis. Sediment will be collected from the bioactive zone (top 10 cm of the sediment) from an area large enough to ensure adequate sample volume and excluding portions that are touching the power-grab sampler. This collected sediment will exclude large, unrepresentative material (e.g., shells, woody debris). Sediment to be analyzed for total sulfides will be collected directly from the grab sampler, prior to collection of sediment for homogenization. Sediment will be homogenized to obtain a smooth consistency (based on color and texture) in decontaminated stainless-steel bowls, using a decontaminated stainless-steel spoon. After sufficient homogenization, sediment will be placed into laboratory-supplied containers, placed on ice, and stored in coolers at less than 6 degrees Celsius (°C) until transported to the laboratory.

Sediment Core Sample Collection

Subsurface sediment samples (core samples) will be collected using a vibracorer drill rig mounted aboard a research vessel. Prior to deployment of the vibracorer, the water depth will be measured using a weighted sounding line. This water depth, along with the known tide elevation, will be used to calculate the mudline at each location. A hydraulic winch system will be used to deploy the vibracorer to approximately 1 ft above the mudline. The vibracorer will be activated and driven to the target depth of 7 ft below the mudline.

The vibracorer will be returned to the deck of the vessel and the core tube will be removed. Collected cores will be allowed to settle until the overlying water is almost clear. Once the sediment has settled,

the recovery length will be measured. Cores that have more than 75 percent recovery length will be saved and numerically decompacted during processing (discussed in the following section). Cores that have less than 75 percent recovery length will be returned to the collection site and a new core will be collected in the nearby (within 5 ft) vicinity. If refusal is encountered prior to full penetration, the vibracorer will be repositioned and a new core sample will be collected. If refusal is met during the third such attempt, this core will be collected and noted in the field log. Cores will be drained of overlying water, capped, and labeled with the sample number, date, and surface direction. Cores will be stored on ice overnight in a secure location or will be transported to the laboratory for storage each night.

Sediment Core Processing

Core processing will be accomplished on the vessel. All working surfaces and instruments will be thoroughly cleaned, decontaminated, and covered with aluminum foil to minimize outside contamination between sampling events. Disposable gloves will be discarded after processing each station and replaced prior to handling decontaminated instruments or work surfaces. The steps for processing the samples are provided below.

1. Extrude sample material from sample core tube onto a stainless-steel tray using a vibrating core-extruder. Alternatively, the core may be cut longitudinally using a circular saw, taking care not to penetrate the sediment while cutting.
2. Fill container with sample as full as possible to eliminate air space in sample jar (it may be necessary to slightly overfill jar to reach a convex meniscus and slide the cap liner, with the PTFE side down, expelling the additional sample material).
3. Screw cap on the container and tighten.
4. Repeat steps 2 through 4 for the second 2-oz glass container.
5. Record the description of the core sample on the core log form for the following parameters as appropriate and present:
    - Sample recovery (depth in feet of penetration and sample compaction)
    - Physical soil description in accordance with the Unified Soil Classification System (includes soil type, density/consistency of soil, and color)
    - Odor (e.g., hydrogen sulfide, petroleum, etc.)
    - Vegetation
    - Debris
    - Biological activity (e.g., detritus, shells, tubes, bioturbation, and live or dead organisms)
    - Presence and depth (in feet) of the redox potential discontinuity layer
    - Presence of oil sheen
    - Any other distinguishing characteristics or features.

6. Using a clean spoon, place sample material from the core into a cleaned stainless-steel bowl or HDPE bucket, homogenize using a stainless-steel paddle and variable speed drill.
7. Thoroughly check all sample containers for proper identification, analysis type, and lid tightness.
8. Pack each container carefully to prevent breakage and place upright inside a cooler with ice for storage pending delivery to the analytical laboratory under the chain-of-custody procedures discussed in Section 5.

Sediment will be characterized on core exploration logs. This characterization will include stratification, color, odor, grain size, and a soil description based on visual observations. This description will also include any visual or olfactory indications of contamination, biological activity (e.g., shells, worms, etc.), debris, or other distinguishing features and the depth at which these occur.

Sediment will be collected from each interval, excluding sediment portions that are in contact with core tube walls. Sediment will be homogenized to obtain a smooth consistency (based on color and texture) in decontaminated stainless-steel bowls, using a decontaminated stainless-steel spoon.

The number of sediment samples to be analyzed will be determined based on the lithology observed during core processing. All core samples collected at the interpreted depth of native sediment will be initially analyzed and the remaining core samples archived. If the deepest initially tested sample exceeds one or more of the sediment quality standards presented in WAC 173-204-320, or if additional data are needed to determine the nature and extent of contamination, follow-up analyses will be conducted of archived samples.

Each sediment sample (both surface sediment and sediment cores) will undergo analysis for SMS chemicals listed in WAC 173-204-320, including metals (arsenic, cadmium, chromium, copper, lead, mercury, silver, and zinc), SVOCs, PAHs, PCBs, and conventional parameters (grain size, total organic carbon, total volatile solids, total solids, ammonia, and total sulfides). Target laboratory reporting limits are provided in the QAPP (Appendix B).

3.6 Waste Management

Investigation-derived waste (IDW), including soil cuttings and water generated during drilling and sampling, and waste/wastewater generated during decontamination of sampling equipment or devices, will be collected and managed in 55-gallon, steel drums provided by the driller. Analytical data collected during the investigation will be used to characterize the IDW, but additional sampling for Resource Conservation and Recovery Act metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) may also be required to properly characterize the IDW. All IDW will be disposed of at facilities approved by the Port of Bellingham and in accordance with applicable regulations.

4.0 FIELD QUALITY CONTROL PROCEDURES

The following procedures will be implemented to ensure that the data are collected in a consistent manner that maintains QC and data quality objectives.

4.1 Navigation, Positioning, and Location Control

Positioning and navigation for establishing and documenting sampling locations will be accomplished using a high-performance GPS receiver with an integrated antenna that allows sub-meter horizontal accuracy. For this project, sampling location information including latitude/longitude, northing/easting, and elevation, where applicable, will be recorded.

4.2 Sample Handling and Logging Procedures

Appropriate, pre-cleaned sample containers will be provided by the laboratories. Sample containers required for the media to be sampled during the RI are listed in Table A-2. Each sample container will be clearly labeled with the project name, sample identification, sample collection date and time, sample matrix, chemical analysis, and initials of person(s) preparing the sample. Soil, groundwater, sediment, and surface water samples will be stored in coolers at less than 6°C) until transported to the appropriate laboratory. Soil vapor samples will be collected into certified-clean stainless-steel Summa canisters. It is not necessary to maintain these samples in a cooler for preservation.

4.2.1 Sample Logging Procedures

Upon transfer of sample possession to the laboratory, the chain-of-custody (COC) form will be signed by the persons transferring custody of the sample containers. Archived samples awaiting chemical results will be maintained under LAI or laboratory custody. COC forms are used internally by LAI and laboratories to track sample handling and final disposition.

After sample collection, the following information will be recorded on the field log sheet, sampling form, and/or the field notebook (see Attachment 1).

- Date, time, and name of person logging sample
- Weather conditions
- Sampling location number and coordinates
- Sample name with field duplicate location where applicable
- Project designation
- Depth of water at the sampling location and surface elevation
- Number of samples collected
- Physical observations such as grain size, color, odor, density, layering, anoxic contact, and presence of sheen, shells, and/or debris.

4.2.2 Sample Designation and Labeling

Samples collected during this investigation will be identified by a unique sample designation. Sample naming schemas for each matrix are provided below:

- Soil samples collected from borings will include the soil boring location, followed by the sample depth interval. For example, soil samples collected from proposed boring SK-SB-31 will have a sample designation SK-SB-31-**10-12**. This identifies the soil sample is representative of conditions in the vertical interval from 10 ft to 12 ft bgs.
- Groundwater grab samples collected from temporary borings will include the boring name (SK-SB-##) followed by the media indicator (GW), then date of collection. For example, sample designation SK-SB-31-GW-**050321** identifies a groundwater sample collected from soil boring location SK-SB-31 on May 3, 2021.
- Groundwater samples collected from permanent monitoring wells will include the monitoring well (MW) name followed by the date of collection. For example, sample designation MW-01-**050321** identifies a groundwater sample collected from monitoring well MW-01 on May 3, 2021.
- Groundwater field duplicates will be submitted without the sampling location, following a sequential numbering scheme. For example, sample designation DUP01 is the first field duplicate collected; sample designation DUP02 is the second field duplicate collected.
- Surface water samples will be designated by location, followed by date of collection. For example, sample designation SK-SW-1-050321 identifies a surface water sample collected at SK-SW-1 on May 3, 2021.
- Porewater samples will be designated by location, followed by date of collection. For example, sample designation SK-PW-1-050321 identifies a porewater sample collected at SK-PW-1 on May 3, 2021.
- Sediment samples will be designated with the sampling location, followed by the depth interval the sample represents. A zero will be used to indicate depth for surface sediment samples. For example, the surface sediment sample collected from sampling location SED-4 will be designated SK-SED-4-0, and a sample collected from the interval from 1 to 2.5 ft below mudline at the same location would be designated SK-SED-4-1-2.5.

4.2.3 Quality Control of Sample Collection

Table A-3 provides the necessary frequencies for QC sample collection for all media.

At least one duplicate sample shall be collected for each 20 groundwater samples collected, and at least one for each sampling event. Duplicate groundwater samples will be collected by filling two containers (or sets of containers) simultaneously from the sampling device.

Trip blanks will be submitted each day that soil and groundwater are sampled for volatile constituents (i.e., TPH-G and BTEX). Trip blanks will be prepared by the laboratory by filling representative glassware with known de-ionized water. These samples will be transported with the sample collection glassware and analyzed for evidence of systematic contamination from sample transport, glassware

cleaning, and laboratory storage. Trip blanks will be sent with each cooler containing soil and water samples to be analyzed for VOCs.

Samples collected for VOC analysis will be placed in two 40-mL volatile organic analyte vials with zero headspace. Agitation will be minimized during sampling to reduce potential losses of volatile constituents.

4.2.4 Field Equipment Calibration

Field equipment will be calibrated to manufacturer's specifications, and as noted in Table A-4.

4.2.5 Documentation

Various documents will be completed and maintained as a part of groundwater sample collection. These documents will provide a summary of the sample collection procedures and conditions, shipment method, analyses requested, and the custody history. These documents will include:

- Field book
- Groundwater sampling forms
- Sample labels
- COC forms
- Shipping receipts.

Documentation will be stored in the project files (hard copy and electronic, as appropriate).

4.2.6 Decontamination

Decontamination is performed as a quality assurance measure and as a safety precaution, prevents cross-contamination between samples, and helps maintain a clean working environment. Equipment requiring decontamination may include hand tools, monitoring and testing equipment, and PPE.

Decontamination is achieved mainly by rinsing with liquids such as soap and/or detergent solutions, tap water, distilled water, and methanol. Equipment may be allowed to air-dry after being cleaned or may be wiped dry with paper towels or chemical-free cloths.

Sampling equipment will be decontaminated prior to use and between each sample collection point. Waste products produced by decontamination procedures such as rinse liquids, solids, rags, gloves, etc., will be collected and disposed of properly based on the nature of Site impacts and Site protocols. Materials and equipment that will be reused must be decontaminated or properly protected before being taken off Site.

The following are decontamination procedures:

- Remove gross visible solids from the equipment by brushing and then rinse with tap water.

- Wash with detergent or soap solution (e.g., Alconox® and tap water).
- Rinse with tap or distilled water.
- Repeat entire procedure or any parts of the procedure as necessary.
- Rinse with distilled water.
- After decontamination procedure is completed, avoid placing equipment directly on ground surface.

No additional decontamination procedures will be required if the equipment appears to be visually clean. If impacts are visible after hot-water/steam-cleaning, then a detergent wash solution with brushes (if necessary) will be used.

5.0 SAMPLE CUSTODY

The following sample custody and handling procedures will be followed during collection of RI data.

5.1 Procedures

COC procedures are intended to document sample possession from the time of collection to disposal. COC procedures are detailed below.

Samples must be packaged so that they do not leak, break, vaporize, or cause cross-contamination of other samples. Waste samples and environmental samples (e.g., soil, groundwater, etc.) should not be placed in the same container. Each individual sample must be properly labeled and identified. Each shipping container must be accompanied by a COC form. When refrigeration is required for sample preservation, samples must be kept cool during the time between collection and final packaging.

Samples must be clearly identified immediately upon collection. Each sample bottle label will include the following information:

- Client or project name, or unique identifier, if confidential
- A unique sample description
- Sample collection date and time
- Sampler's name or initials
- Indication of filtering or addition of preservative, if applicable
- Analyses to be performed.

After collection, identification, and preservation (if necessary), the samples will be maintained under COC procedures, described further in Section 5.2.

5.2 Chain-Of-Custody Procedures

A sample is considered to be under custody if it is in someone's possession, view, or in a designated secure area. Transfers of sample custody must be documented by COC forms. The COC form will include, at a minimum, the following information:

- Client or project name, or unique identifier, if confidential
- Sample collector's name
- Company's (LAI) mailing address and telephone number
- Designated recipient of data (name and telephone number)
- Analytical laboratory's name and city
- Description of each sample (i.e., unique identifier and matrix)
- Date and time of collection

- Quantity of each sample or number of containers
- Type of analysis required
- Date and method of shipment.

Additional information may include type of sample containers, shipping identification air bill numbers, etc.

When transferring custody, both the individual(s) relinquishing custody of samples and the individual(s) receiving custody of samples will sign, date, and note the time on the form. If samples are to leave the collector's possession for shipment to the laboratory, the packaging procedures described below will be followed.

5.3 Packing for Shipment

To prepare a cooler for shipment, the sample bottles will be inventoried and logged on the COC form. At least one layer of protective material will be placed in the bottom of the container. As each sample bottle is logged on the COC form, it should be wrapped with protective material (e.g., bubble wrap, matting, plastic gridding, or similar material) to prevent breakage. Each sample bottle should be placed upright in the shipping container. Each sample bottle cap should be checked during wrapping and tightened if needed. Avoid over-tightening, which may cause the bottle cap to crack and allow leakage. Additional packaging material such as bubble wrap or Styrofoam™ pellets should be spread throughout the voids between the sample bottles.

Most samples require refrigeration as a minimum preservative. If needed, reusable cold packs or ice placed in heavy-duty Ziploc-type bags should be distributed over the top of the samples. Two or more cold packs or bags should be used. Additional packing material should then be placed to fill the balance of the cooler or container.

The original completed COC form will be placed in a Ziploc-type plastic bag and the bag will then be placed on top of the contents within the cooler or shipping container. Alternatively, the bag may be taped to the underside of the container lid. Retain a copy of the COC form with the field records.

The top or lid of the cooler or shipping container will then be closed and rotated/shaken to verify that the contents are packed so that they do not move. Add additional packaging if needed and reclose. Place the signed and dated COC seal at two different locations (front and back) on the cooler or container lid and overlap with transparent packaging tape. The COC seal should be placed on the container in such a way that opening the container will destroy the tape. Packaging tape should encircle each end of the cooler at the hinges.

Sample shipment should be sent via courier or an overnight express service that can guarantee 24-hour delivery. Retain copies of all shipment records as provided by the shipper.

COC forms will be maintained in an appropriate file with the PM. Copies of these records will be submitted in an appendix to the final report. COC information will also be recorded in field notebooks.

5.4 Sample Log-In

Upon receipt of samples (which will be accompanied by a completed COC record detailing requested analyses), the Laboratory Coordinator(s) or his/her designee will:

- Verify all paperwork, COC records, and similar documentation
- Log in samples, assign unique laboratory sample numbers, and attach the numbers to the sample container(s)
- Store samples in a refrigerated sample bank.

6.0 ANALYTICAL PROCEDURES

Analytical testing will be in accordance with the methodologies established in Test Methods for Evaluating Solid Waste: Physical/Chemical Methods (SW-846; EPA; accessed July 27, 2020), Standard Methods for the Examination of Water and Wastewater, 23rd edition (Baird et al. 2017), or approved ASTM standard methods. Analytical procedures are summarized in Table A-1, and detailed further in Appendix B.

6.1 Analytical Laboratories

Analytical Laboratory Services, Inc. (ALS) will perform the laboratory chemical analysis for all media. If laboratory analyses are requested that ALS is not accredited by Ecology to perform, an alternative laboratory with Ecology's accreditation will be subcontracted by ALS as needed. Environmental laboratories performing work under this SAP will maintain current accreditation through Ecology for applicable methods and analytes. Contact information for the primary consultant and laboratories is provided below.

Contact	Responsibility
LAI **155 NE 100th Street, Suite 302** **Seattle, WA 98125** **Telephone: (206) 631-8680**	Coordinate laboratory analyses Data validation Reporting
ALS **8620 Holly Drive, Suite 100** **Everett, WA** **Telephone: (425) 356-2600**	Chemical analysis
ALS **2655 Park Center Drive, Suite A** **Simi Valley, CA 93065** **Telephone: (805) 577-2086**	Soil Vapor analysis

7.0 REFERENCES

Baird, Roger B., Andrew D. Eaton, and Eugene W. Rice, eds. 2017. Standard Methods for the Examination of Water and Wastewater, 23rd Edition. American Public Health Association, American Water Works Association, and Water Environment Federation. January 1.

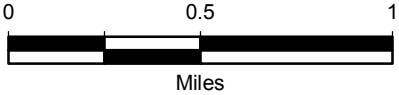
Ecology. CLARC Data Tables and Other Technical Information. Washington State Department of Ecology. https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Contamination-clean-up-tools/CLARC/Data-tables.

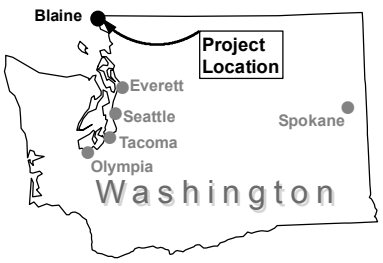
Ecology. 2008. Minimum Standards for Construction and Maintenance of Wells, Chapter 173-160 WAC. Chapter 173-160 WAC. Washington State Department of Ecology. December 19. http://apps.leg.wa.gov/WAC/default.aspx?cite=173-160.

Ecology. 2020. Agreed Order No. 19573 in the Matter of Remedial Action by The Port of Bellingham. Toxics Cleanup Program, Washington State Department of Ecology. December 30.

EPA. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. Third Edition Final Updates I (1993), II (1995), IIA (1994), IIB (1995), III (1997), IIIA (1999), IIIB (2005), IV (2008), and V (2015). SW-846. US Environmental Protection Agency. https://www.epa.gov/hw-sw846.

EPA. 2001. Methods for Collection, Storage and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual. EPA-823-B-01-002. Office of Water, US Environmental Protection Agency. October. https://semspub.epa.gov/work/11/100000049.pdf.





Data Source: Esri World Imagery.

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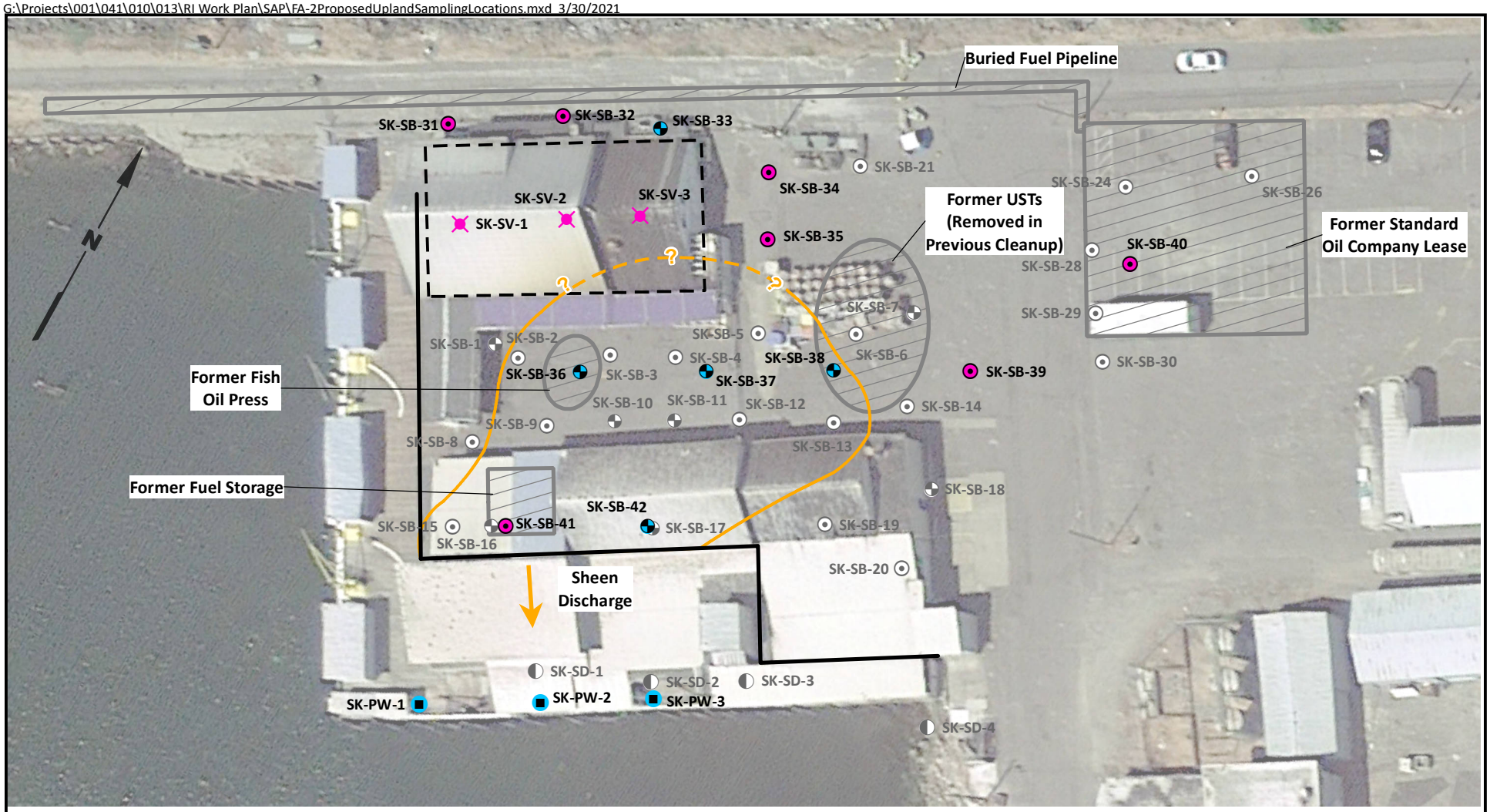
LANDAU ASSOCIATES

Sea K Fish Remedial Investigation Blaine, Washington	**Vicinity Map**	Figure A-1

G:\Projects\001\041\010\013\RI Work Plan\SAP\FA-2ProposedUplandSamplingLocations.mxd 3/30/2021



Legend

- Proposed Groundwater Sampling Location
- Proposed Porewater Sampling Location
- Proposed Soil Sampling Location
- Proposed Soil Vapor Sampling Location
- Previous Soil and Groundwater Sampling Location
- Previous Inter-Tidal Sampling Location
- Previous Soil Sampling Location
- Potential Source Areas
- Shoreline/Bulkhead
- Approximate Extent of Known Soil and Groundwater Contamination

Notes

1. Actual sampling locations may be adjusted slightly based on physical constraints or physical access restrictions.
2. USTs = underground storage tanks.
3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Data Source: Google Earth Pro.

0 50 100

Scale in Feet

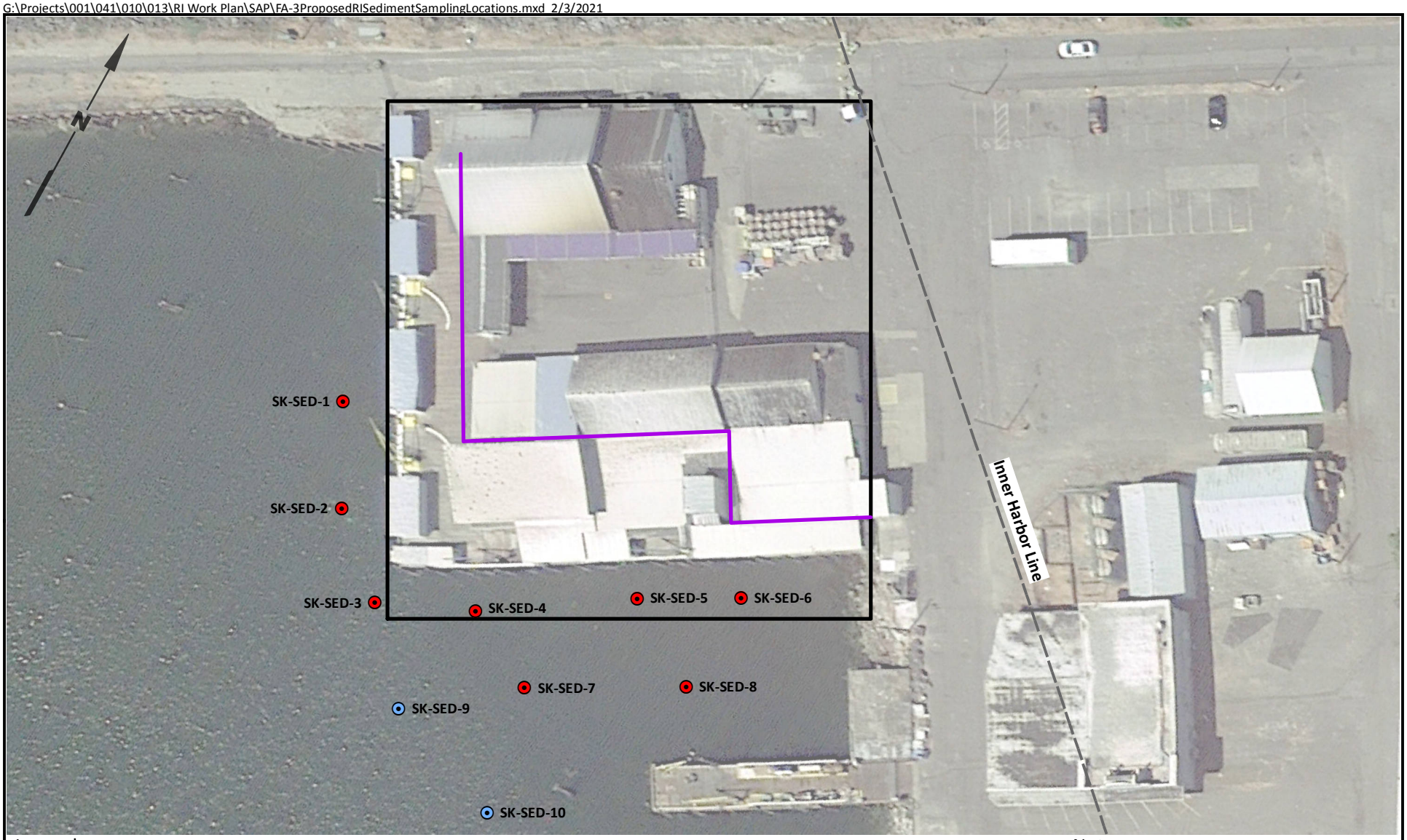
LANDAU ASSOCIATES

Sea K Fish Remedial Investigation
Blaine, Washington

Proposed Upland Sampling Locations

Figure
A-2

G:\Projects\001\041\010\013\RI Work Plan\SAP\FA-3ProposedRISedimentSamplingLocations.mxd 2/3/2021



Legend

- Proposed Primary Sediment Sampling Location
- Proposed Contingent Sediment Sampling Location
- Preliminary Site Boundary
- Inner Harbor Line
- Shoreline/Bulkhead

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Data Source: Google Earth Pro.

0 60 120

Scale in Feet

LANDAU ASSOCIATES

Sea K Fish Remedial Investigation
Blaine, Washington

Proposed Sediment Sampling Locations

Figure
A-3

Table A-1
Proposed Sampling Program
Remedial Investigation Sampling and Analysis Plan
Sea K Fish Cleanup Site – Blaine, Washington

Sampling Location Location ID	Description/Location	Soil		Groundwater		Soil Vapor		Sediment		Surface Water	
		Analysis	Target Sample Depths	Analysis	Target Screen Interval Depth	Analysis	Target Sample Depths	Analysis	Target Depth(s) (ft bgs)	Analysis	Target Sample Depths
Upland Investigation											
SK-SB-31	Delineate extent of contamination along the northern edge of the Site to evaluate for potential northern migration, or releases along the (potential) location of a former pipeline	TPH [1], BTEX[2], lead, and PAHs[3] at each location; PCBs[5] and the full list of metals[4] from two LNAPL-impacted locations.	Sample collected at the water table and the most likely contaminated interval based on field observations. If no evidence of contamination, sample only at the water table.	TPH [1], BTEX[2], PAHs[3], and lead	Just below the current groundwater table at time of drilling.	N/A					
SK-SB-32											
SK-SB-33											
SK-SB-34	Delineate extent of contamination on the north end of the known contaminated area										
SK-SB-35											
SK-SB-36	Delineate extent and further characterize the known, contaminated area, and to the east										
SK-SB-37											
SK-SB-38											
SK-SB-39											
SK-SB-40	Delineate extent of contamination in the northeast area of the Site, and characterize groundwater in the former Standard Oil Company Lease area										
SK-SB-41	Delineate extent of contamination on the south end of the known contaminated area										
SK-SB-42											
SK-SV-1	Evaluate and characterize potential contaminants in soil vapor below the active operations building slab	N/A				VOCs[6]	Below concrete slab	N/A			
SK-SV-2											
SK-SV-3											
Marine Investigation											
SK-SED-1	Investigate for contamination in surface and subsurface sediment that may have released from the upland area to the marine environment	N/A						TPH-D, TPH-O, SMS chemicals[7]	1 to 3 Samples from 8 locations nearest the shoreline; 2 locations will be archived and analyzed only as-needed; samples will be collected from 0 to 7 ft below mudline	N/A	
SK-SED-2											
SK-SED-3											
SK-SED-4											
SK-SED-5											
SK-SED-6											
SK-SED-7											
SK-SED-8											
SK-SED-9											
SK-SED-10											
SK-SW-1	Investigate for surface water impacts	N/A								TPH[1]	Near the uplands where sheen has been observed
SK-SW-2											
SK-SW-3											
SK-PW-1	Investigate for porewater impacts	N/A								TPH[1]	Near the uplands where sheen has been observed
SK-PW-2											
SK-PW-3											

Notes:

(1) TPH-G, TPH‑D, and TPH-O by Methods NWTPH-G and NWTPH-Dx.
(2) BTEX by EPA Method 8021.
(3) Select PAHs by EPA Method 8270E SIM.
(4) Metals by EPA Methods 6020B for (arsenic, barium, cadmium, chromium, lead, selenium, and silver), and 7471 (mercury).
(5) PCBs by EPA Method 8082.
(6) VOCs by Method TO-15.
(7) SMS chemicals listed in WAC 173-204-320, including metals (arsenic, cadmium, chromium, copper, lead, mercury, silver, and zinc), SVOCs [EPA Method 8270E], PCBs, and conventional parameters (grain size, total organic carbon, total solids).

Table A-1
Proposed Sampling Program
Remedial Investigation Sampling and Analysis Plan
Sea K Fish Cleanup Site – Blaine, Washington

Abbreviations and Acronyms:

BTEX = benzene, toluene, ethylbenzene, and xylenes
ID = Identification
EPA = US Environmental Protection Agency
ft = feet
LNAPL = light non-aqueous phase liquid
N/A = not applicable
NWTPH-Dx = Northwest total petroleum hydrocarbon extended-range diesel analytical method
NWTPH-G = Northwest total petroleum hydrocarbon gasoline analytical method
PAHs = polycyclic aromatic hydrocarbons
PCBs = polychlorinated biphenyls
RCRA = Resource Conservation and Recovery Act
SIM = selected ion monitoring
SMS = Sediment Management Standards
SVOC = semivolatile organic compound
TBD = to be determined
TPH-D = diesel-range total petroleum hydrocarbons
TPH-G = gasoline-range total petroelum hydrocarbons
TPH-O = oil-range total petroleum hydrocarbons
VOC = volatile organic compound
WAC = Washington Administrative Code

Table A-2
Sample Containers, Preservatives, and Holding Times
Remedial Investigation Sampling and Analysis Plan
Sea K Fish Cleanup Site – Blaine, Washington

Matrix	Analyte	Method	Container	Preservative	Holding Time (a)	Laboratory
Soil	TPH-G	NWTPH-G	2 x 40 mL vial	Cool to < 6°C, MeOH	14 days	ALS
Sediment	TPH-G	NWTPH-G	4 oz jar (b)	Cool to < 6°C	14 days	ALS
Soil/Sediment	TPH-D, TPH-O	NWTPH-Dx	4 oz jar (b)	Cool to < 6°C	14 days	ALS
Soil/Sediment	BTEX	EPA 8021	3 x 40 mL vial	Cool to < 6°C, 1 vial MeOH	14 days	ALS
Soil/Sediment	PAHs	EPA 8270E SIM	4 oz jar (b)	Cool to < 6°C	14 days	ALS
Soil/Sediment	SVOCs	EPA 8270E	4 oz jar (b)	Cool to < 6°C	14 days	ALS
Soil/Sediment	Metals	EPA 6020B	4 oz jar (b)	Cool to < 6°C	6 months	ALS
Soil/Sediment	Mercury	EPA 7471B	4 oz jar (b)	Cool to < 6°C	28 days	ALS
Soil/Sediment	PCBs	EPA 8082	4 oz jar (b)	Cool to < 6°C	1 year	ALS
Soil/Sediment	Total Organic Carbon	SM 5310C	4 oz jar (b)	Cool to < 6°C	14 days	ALS
Soil/Sediment	Grain Size/Hydrometer	ASTM D422	1 gallon plastic bag	N/A	N/A	ALS
Groundwater/ Surface Water	TPH-G	NWTPH-G	2 x 40 mL vial	Cool to < 6°C, HCl	14 days preserved 7 days unpreserved	ALS
Groundwater/ Surface Water	TPH-D, TPH-O	NWTPH-Dx	2 x 500 mL Amber	Cool to < 6°C	7 days	ALS
Groundwater/ Surface Water	BTEX	EPA 8021	2 x 40 mL vial	Cool to < 6°C, HCl	14 days preserved 7 days unpreserved	ALS
Groundwater/ Surface Water	SVOCs	EPA 8270E	2 x 500 mL Amber	Cool to < 6°C, HCl	7 days/40 days	ALS
Groundwater/ Surface Water	cPAHs	EPA 8270E SIM	2 x 500 mL Amber	Cool to < 6°C, HCl	7 days/40 days	ALS
Groundwater/ Surface Water	Dissolved Metals	EPA 6020B	500 mL HDPE	Cool to < 6°C HNO_3 (c)	6 months	ALS
Groundwater/ Surface Water	Dissolved Mercury	EPA 7470A	500 mL HDPE	Cool to < 6°C HNO3 (c)	28 days	ALS
Soil Vapor	VOCs, Gasoline	TO-15/TO-15 SIM, TO-3	6-L Summa	N/A	30 days	ALS

Table A-2
Sample Containers, Preservatives, and Holding Times
Remedial Investigation Sampling and Analysis Plan
Sea K Fish Cleanup Site – Blaine, Washington

Notes:

(a) Time from sample collection to extraction/time from sample extraction to analysis.

(b) Combined analytical suite may be analyzed using 1-8 oz jar per sample.

(c) Metals will be field-filtered.

Acronyms/Abbreviations:

^{o}C = degrees Celsius
ALS = Analytical Laboratory Services, Inc.
ASTM = ASTM International
BTEX = benzene, ethylbenzene, toluene, total xylenes
cPAHs = carcinogenic polycyclic aromatic hydrocarbons
EPA = US Environmental Protection Agency
HCl = hydrochloric acid
HDPE = high-density polyethylene
HNO_3 = nitric acid
L = liter
LAI = Landau Associates, Inc.
mL = milliliter
N/A = not applicable
NWTPH-Dx = Northwest total petroleum hydrocarbon extended-range diesel analysis
NWTPH-G = Northwest total petroleum hydrocarbon gasoline analysis
oz = ounces
SIM = selected ion monitoring
SM = Standard Methods
SVOCs = semivolatile organic compounds
TPH-D = diesel-range total petroleum hydrocarbons
TPH-G = gasoline-range total petroleum hydrocarbons
TPH-O = oil-range total petroleum hydrocarbons
UCT = universal cell technology
VOCs = volatile organic compounds

Table A-3
Field Quality Control Sample Summary
Remedial Investigation Sampling and Analysis Plan
Sea K Fish Cleanup Site – Blaine, Washington

Matrix	Collection Frequency		
	Field Duplicates	Matrix Spike/ Matrix Spike Duplicates	Trip Blanks
Soil	N/A	1 per 20 samples	1 per each cooler containing samples scheduled for volatile analyses
Groundwater	1 per 20 samples	1 per 20 samples	1 per each cooler containing samples scheduled for volatile analyses

Acronyms/Abbreviations:
N/A = not applicable

Table A-4
Equipment Calibration Requirements
Remedial Investigation Sampling and Analysis Plan
Sea K FIsh Cleanup Site – Blaine, Washington

Instrument	Calibration Procedure	Calibration Frequency
pH meter	Three-point calibration with pH buffers 7, 4, and 10, as appropriate	Daily
Conductivity meter	One-point calibration with 1,500 microSiemen/centimeter (µS/cm) standard solution for non-saline water, or 2,880 µS/cm standard solution for saline waters	Daily
Dissolved Oxygen meter	100% saturation using tap water exposed to ambient air, in accordance with manufacturer's specifications.	Daily and/or when weather (pressure and/or temperature) changes are significant
Redox meter	None	N/A
Thermometer	Check with ohm meter or standard thermometer	Annually
Electric water-level probe	Test probe in tap water; check tape against known length	Probe; as needed if malfunctions; tape length: annually
Photoionization detector (PID)	Isobutylene gas and bump test	Daily

Acronyms/Abbreviations:
N/A = not applicable

ATTACHMENT A-1

Field Forms

LANDAU ASSOCIATES

Chain-of-Custody Record

☐ **Seattle/Edmonds** (425) 778-0907 ☐ **Spokane** (509) 327-9737
☐ **Tacoma** (253) 926-2493 ☐ **Portland** (503) 542-1080
☐ _____

Date _____

Page _____ of _____

Turnaround Time:
Standard _____
Accelerated _____

Project Name _____ Project No. _____

Project Location/Event _____

Sampler's Name _____

Project Contact _____

Send Results To _____

Testing Parameters

Special Handling Requirements:

Shipment Method: _____

Stored on ice: Yes / No

Sample I.D.	Date	Time	Matrix	No. of Containers	Observations/Comments

_ Allow water samples to settle, collect aliquot from clear portion ☐

_ NWTPH-Dx - Acid wash cleanup ☐
- Silica gel cleanup ☐

_ Dissolved metal samples were field filtered

Other _____

Relinquished by	Received by	Relinquished by	Received by
Signature	Signature	Signature	Signature
Printed Name	Printed Name	Printed Name	Printed Name
Company	Company	Company	Company
Date Time	Date Time	Date Time	Date Time

Air - Chain of Custody Record & Analytical Service Request

Page _____ of _____

2655 Park Center Drive, Suite A
Simi Valley, California 93065
Phone (805) 526-7161
Fax (805) 526-7270

Requested Turnaround Time in Business Days (Surcharges) please circle
1 Day (100%) 2 Day (75%) 3 Day (50%) 4 Day (35%) 5 Day (25%) 10 Day-Standard

ALS Project No.

Company Name & Address (Reporting Information)

Project Name

Project Number

ALS Contact:

Analysis Method

Project Manager

P.O. # / Billing Information

Phone | Fax

Email Address for Result Reporting

Sampler (Print & Sign)

Comments
e.g. Actual Preservative or specific instructions

Client Sample ID	Laboratory ID Number	Date Collected	Time Collected	Canister ID (Bar code # - AC, SC, etc.)	Flow Controller ID (Bar code #- FC #)	Canister Start Pressure "Hg	Canister End Pressure "Hg/psig	Sample Volume			

Report Tier Levels - please select

Tier I - Results (Default if not specified) _____
Tier II (Results + QC Summaries) _____
Tier III (Results + QC & Calibration Summaries) _____
Tier IV (Data Validation Package) 10% Surcharge _____

EDD required Yes / No
Type: _____ Units:_____

Chain of Custody Seal: (Circle)
INTACT BROKEN ABSENT

Project Requirements (MRLs, QAPP)

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:

Cooler / Blank Temperature ____°C

Soil Sample Collection Form

Sample ID	Date	Time	Soil Description (classification, density, moisture, odor, sheen)	QA Sample ID (Duplicate or MS/MSD ID)	Sampling Equipment	Notes

LANDAU ASSOCIATES

Groundwater Low-Flow Sample Collection Form

Project Name: _____ Project Number: _____

Event: _____ Date/Time: _____

Sample Number: _____ Weather: _____

Landau Representative: _____

WATER LEVEL/WELL/PURGE DATA

Well Condition: Secure (YES or NO) Damaged (YES or NO) Describe: _____

DTW Before Purging (ft) _____ Time: _____ Flow through cell vol. _____ GW Meter No.(s) _____

Begin Purge: Date/Time: _____ End Purge: Date/Time: _____ Gallons Purged: _____

Purge water disposed to: ☐ 55-gal Drum ☐ Storage Tank ☐ Ground ☐ Other _____

Time	Temp (°F/°C)	Cond. (uS/cm)	D.O. (mg/L)	pH	ORP (mV)	Turbidity (NTU)	DTW (ft)	Internal Purge Volume (gal)	Comments/ Observations
	Purge Goals: Stablization of Parameters for three consecutive readings within the following limits							>/= 1 flow through cell	
	+/- 3%	+/- 3%	+/- 10%	+/- 0.1 units	+/- 10 mV	+/- 10%	< 0.3 ft		

SAMPLE COLLECTION DATA

Sample Collected With: ☐ Bailer ☐ Pump/Pump Type _____

Made of: ☐ Stainless Steel ☐ PVC ☐ Teflon ☐ Polyethylene ☐ Other ☐ Dedicated

Decon Procedure: ☐ Alconox Wash ☐ Tap Rinse ☐ DI Water ☐ Dedicated

(By Numerical Order) ☐ Other _____

Sample Description (color, turbidity, odor, sheen, etc.): _____

Replicate	Temp (°F/°C)	Cond. (uS/cm)	D.O. (mg/L)	pH	ORP (mV)	Turbidity (NTU)	DTW (ft)	Ferrous iron (Fe II)	Comments/ Observations
1									
2									
3									
4									
Average:									

QUANTITY	TYPICAL ANALYSIS ALLOWED PER BOTTLE TYPE (Circle applicable or write non-standard analysis below)
	(8260) (8010) (8020) (NWTPH-G) (NWTPH-Gx) (BTEX) WA ☐ OR ☐
	(8270) (PAH) (NWTPH-D) (NWTPH-Dx) (TPH-HCID) (8081) (8141) (Oil & Grease) WA ☐ OR ☐
	(pH) (Conductivity) (TDS) (TSS) (BOD) (Turbidity) (Alkalinity) (HCO3/CO3) (Cl) (SO4) (NO3) (NO2) (F)
	(COD) (TOC) (Total PO4) (Total Kiedahl Nitrogen) (NH3) (NO3/NO2)
	(Total Cyanide) (WAD Cyanide) (Free Cyanide)
	(Total Metals) (As) (Sb) (Ba) (Be) (Ca) (Cd) (Co) (Cr) (Cu) (Fe) (Pb) (Mg) (Mn) (Ni) (Ag) (Se) (Tl) (V) (Zn) (Hg) (K) (Na)
	(Dissolved Metals) (As) (Sb) (Ba) (Be) (Ca) (Cd) (Co) (Cr) (Cu) (Fe) (Pb) (Mg) (Mn) (Ni) (Ag) (Se) (Tl) (V) (Zn) (Hg) (K) (Na) (Hardness) (Silic
	VOC (Boeing short list)
	Methane Ethane Ethene Acetylene
	others

Duplicate Sample No(s): _____

Comments: _____

Signature: _____ Date: _____

LANDAU ASSOCIATES

Sub Slab Vapor / Soil Gas Sample Collection Form

Project Name: _____ Project Number: _____

Client: _____ Sample Number: _____

Landau Rep: _____ Date/Time Collected: _____

Location Information: _____

SAMPLE TYPE

☐ Sub Slab Vapor ☐ Soil Gas ☐ Other: _____

WEATHER DATA

Rainfall < 1" in 24 hrs.? (YES or **NO**) Irrigation not w/in 5 hrs.? (YES or **NO**) Standing water near sampling location? (YES or **NO**)

Air Temperature _____ °F or °C Wind Direction _____ Wind Speed _____ mph Humidity _____ %

Barometric Pressure _____ in HG or mBar Is sampling occurring after frontal system during stable pressure? (**YES** or NO)

SOIL GAS AND SUB SLAB INFORMATION AND AND PURGE DATA

Nature of Location: PERMENANT or TEMPORARY (circle one) ☐ Post-Run Tubing (PRT) ☐ Soil Gas Monitoring Well ☐ Other: _____

Installation Method : ☐ Direct Push Drill Rig ☐ Hollow Stem Auger ☐ Rotosonic ☐ Other: _____

☐ Hand Driven ☐ Rotohammer ☐ Vapor Pin Manufacturer:_____

If Permanent, Is Well Secure? (YES or NO or NA) Damaged (YES or NO) YES-Describe: _____

Materials: ☐ PVC Pipe ☐ Stainless Steel ☐ Teflon ☐ Nylon or Polyethylene Tubing ☐ Other: _____

Well/Hole Diameter: _____ inches Total Depth of Well: _____ ft Depth to Groundwater: _____ ft

Vacuum/Pressure of source (in. H_2O): _____ Time: _____

Purge Volume Calculation: _____

Purge: Begin Time _____ End Time _____ Casing Volume (ft^3): _____

Flow Rate (liter or ml/min): _____ Volume Purged (ft^3): _____

VOLUME EXAMPLES

Diameter (in)	OD (in)	ID (in)	Vol (ft^3/ln ft)
0.25 (tubing)	0.250	0.170	0.00016
1 (sch. 40)	1.315	1.029	0.006
1.25 (sch. 40)	1.660	1.380	0.010
2 (sch. 40)	2.375	2.067	0.020

Vol. Purged (ft^3)	Temp. (°F/°C)	PID (ppm)	Other	Comments/Observations

LEAK TEST OPTIONS

☐ Shut-in Test Starting Vacuum: _____ in H2O *(target 100 inches H2O)* Test Duration: _____ minutes *(target > 1 min)*

Ending Vacuum: _____ in H2O *(target no noticable vacuum decrease)* Result: PASS FAIL (circle one)

☐ Helium Shroud Design: _____ Helium Source Concentration:_____

Shroud Tracer Concentration Fluctuation: _____ % *(target ± 10%)* Tracer Equilibration Time: _____*(target min. 5 min)*

Sample Air Tracer Concentration: _____ % of Shroud Conc. *(target <5%)*

☐ Water Bath (vapor pins only)

SAMPLE COLLECTION DATA

Sample Container: ☐ Summa Canister, Size (liters) _____ Canister #:_____ ☐ Tedlar Bag, Size (liters): _____

☐ Passive / Diffusive Manufacturer:_____ ☐ Other: _____

Sample Type: ☐ Grab ☐ Integrated (composite sample over time)

Sample Collection/Purge Pump (if used): _____

Summa Canister, Pre-Sampling and Post-Sampling: Initial Vacuum: _____ in Hg Vacuum After Sample Collection: _____ in Hg

LABORATORY ANALYSES: _____

Duplicate Sample Number(s) and Comments: _____

Signature: _____ Date: _____

LANDAU ASSOCIATES

Air Sample Collection Form: Ambient / Indoor / Crawlspace

Project Name: _____ Project Number: _____

Client: _____ Sample Number: _____

Landau Rep: _____ Date/Time Collected: _____

Location Information: _____

SAMPLE TYPE

☐ Ambient Air ☐ Indoor Air ☐ Crawlspace ☐ Basement ☐ Other: _____

WEATHER DATA

Rainfall < 1" in 24 hrs.? (YES or **NO**) Irrigation not w/in 5 hrs.? (YES or **NO**) Standing water near sampling location? (YES or **NO**)

Air Temperature _____ °F or °C Wind Direction _____ Wind Speed _____ mph Humidity _____ %

Barometric Pressure_____ in Hg or mBar Is sampling occurring after frontal system during stable pressure? (**YES** or NO)

SAMPLE COLLECTION DATA

Sample Container: ☐ Summa Canister, Size (liters) _____ ☐ Tedlar Bag, Size (liters): _____

Canister number: _____

☐ Passive / Diffusive ☐ Other: _____

Manufacturer: _____

Sample Type: ☐ Grab ☐ Integrated (composite sample over time)

Height of Sample Above Floor/Ground: _____ feet (to nearest tenth)

Ground/Floor Type: Soil, Wood, Carpet, Tile, Concrete Other: _____

Sample Collection/Purge Pump (if used): _____

Summa Canister, Pre-Sampling and Post-Sampling

Initial Vacuum: _____ in Hg Vacuum After Sample Collection: _____ in Hg

LABORATORY ANALYSES:

_____

_____

Duplicate Sample Number(s): _____

Comments: _____

_____

Signature: _____ Date: _____

LANDAU ASSOCIATES

Exploration No. _____
Date _____ Hour _____

Log of Exploration

Project Name _____ Project No. _____

Client/Owner _____ Exploration Operator _____

Exploration Method _ _____

_____

Logged by _ ___ Exploration Completed _____

Ground Surface Conditions _____

Weather Conditions _____

Location Sketch (show dimensions to mapped features)

North Arrow

(East) (North)

Coordinates: "x" _____ "y" _____ Method _____

Elevations _____ Datum _____

Sample Depth (top) (ft.)	Sample Length (ft.)	Recovery Length (ft.)	Retained Depth (top) (ft.)	Retained Length (ft.)	Sample Number	Sampler/Hammer Codes	Blow Counts	Other Test Data) _____	USCS Symbol / Unit Contact	Depth Scale (ft)	Sample Description Color, secondary soil type, PRIMARY SOIL TYPE with modifiers and minor components (density/consistency, moisture)(geologic unit)	Comments on Heave, Water Conditions, & Drilling Action
										0		
										1		
										2		
										3		
										4		
										5		
										6		
										7		
										8		
										9		
										0		
										1		
										2		
										3		
										4		
										5		
										6		
										7		
										8		
										9		
										0		

Sampler and Hammer Information

a = 3.25-in. O.D. – D&M	1 = 300-lb./30-in. Drop
b = 2.0-in. O.D. – SPT	2 = 140-lb./30-in. Drop
c = Shelby Tube	3 = Pushed
d = Grab Sample	4 = Vibrocore
g = 2.5-in. O.D.– WSDOT	5 = _____
h = 3.0-in. O.D. – M.Calif.	
i = _____	

Water Level Information

Date		
Time		
Depth to Water		
Hole Depth		
Casing Depth		

Total Depth _____ Finish Date _____ Hour _____ Continued

LANDAU ASSOCIATES

Drum/Tank Inventory

Project Name _____ Project Number _____

Location _____ Date _____

Client _____ Landau Representative _____

Drum/Tank Number	Date Generated	Contents	Estimated Quantity	Suspected Contaminants	Generation Source	Disposal Method / Date Disposed	Sketch of Site and Drum/Tank Location

Daily Health and Safety Report

Project Name: _____ Project Number: _____

Client: _____ Date: _____

Field Safety Manager: _____ Project Manager: _____

Safety Topics Discussed – As Reference in Project HASP (check topics covered)

- ☐ PPE and Exposure Monitoring
- ☐ Chemical of Concern
- ☐ Slip/Trips/Falls
- ☐ Traffic Control
- ☐ Drilling Safety
- ☐ Excavation Safety
- ☐ Confined Space Entry
- ☐ Hand-operated Power Tools
- ☐ Hot Work Permit Activities
- ☐ Work in Waterways
- ☐ Emergency Procedures
- ☐ COVID19 (social distancing, self-health check, masks): _____

Describe planned daily activities, potential hazards, and methods to mitigate risks: _____

Signature of People Participating in the Daily Safety Meeting

Signature	Firm

LANDAU ASSOCIATES

Field Report

Project No.: _____ Report No.: _____

Client: _____ Date: _____

Project Name: _____ DPD Permit No.: _____

Location: _____

Weather Conditions: _____

Prepared By: _____

Visitors: _____

Unsatisfactory Conditions & Recommended Correction: _____

Attachments: _____

Signed: _____

APPENDIX B

Quality Assurance Project Plan

Remedial Investigation
Quality Assurance Project Plan
Sea K Fish Cleanup Site
205 and 225 Sigurdson Avenue
Blaine, Washington

July 8, 2021

Prepared for

Port of Bellingham
P.O. Box 1677
Bellingham, Washington

LANDAU ASSOCIATES

155 NE 100th St, Ste 302
Seattle, WA 98125
206.631.8680

TABLE OF CONTENTS

TABLES

LIST OF ABBREVIATIONS AND ACRONYMS

ALS ..... Analytical Laboratory Services, Inc.
CLP ..... EPA's Contract Laboratory Program
CUL ..... cleanup level
COC ..... chain of custody
DQI ..... data quality indicator
DQO ..... data quality objective
Ecology ..... Washington State Department of Ecology
EDD ..... electronic data deliverable
EIM ..... Ecology's Environmental Information Management database
EPA ..... US Environmental Protection Agency
GC/MS ..... gas chromatography/mass spectrometry
HASP ..... health and safety plan
LAI ..... Landau Associates, Inc.
LCS ..... laboratory control sample
LCSD ..... laboratory control sample duplicate
MS ..... matrix spike
MSD ..... matrix spike duplicate
MQO ..... measurement quality objective
MTCA ..... Model Toxics Control Act
PCBs ..... polychlorinated biphenyls
PID ..... photoionization detector
PM ..... project manager
Port ..... Port of Bellingham
QA ..... quality assurance
QAPP ..... quality assurance project plan
QC ..... quality control
RL ..... reporting limit
RPD ..... relative percent difference
SAP ..... sampling and analysis plan
Site ..... Sea K Fish Cleanup Site
SMS ..... Washington State Sediment Management Standards
SOP ..... standard operating procedure
SVOC ..... semivolatile organic compound
TPH ..... total petroleum hydrocarbons
TPH-D ..... diesel-range total petroleum hydrocarbons
TPH-G ..... gasoline-range total petroleum hydrocarbons
TPH-O ..... oil-range total petroleum hydrocarbons
VOC ..... volatile organic compound

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1.0 INTRODUCTION AND BACKGROUND

Landau Associates, Inc. (LAI) prepared this Quality Assurance Project Plan (QAPP) on behalf of the Port of Bellingham (Port) in support of the remedial investigation (RI) for the Sea K Fish Cleanup site (Site) located in Blaine, Washington. This QAPP presents the data quality objectives, laboratory activities, and quality assurance procedures to be implemented during execution of the RI sampling at the Site. LAI prepared this QAPP following the Washington State Department of Ecology (Ecology) Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies (Ecology 2016). Details related to the scope of work are available in other components of the RI project plans, including a summary of the work in the main body of the RI Project Plan (to which this QAPP is an appendix), and specifics of the project organization and sample collection methodology in Appendix A, the Sampling and Analysis Plan (SAP).

LAI conducted a preliminary investigation of soil and groundwater conditions at the Site in June and July 2019. Results of the investigation indicated that previous releases of petroleum contamination at the Site have impacted subsurface conditions, including light non-aqueous phase liquid in soil near the groundwater table, that is migrating into Blaine Harbor. On December 30, 2020, the Port entered into an Agreed Order (Ecology 2020) with the Ecology. This QAPP and the associated RI project plans were developed pursuant to requirements of the Agreed Order.

The Port is conducting the RI in cooperation with Ecology to further delineate environmental conditions in the upland and marine portions of the Site. The purpose of this QAPP is to provide the quality assurance (QA) and quality control (QC) procedures that will be used in the collection of environmental data to support the RI.

The laboratory to be used for planned RI activities is Analytical Laboratory Services, Inc. (ALS). Analytical testing will be in accordance with the methodologies established in Test Methods for Evaluating Solid Waste: Physical/Chemical Methods (SW-846; EPA; accessed October 21, 2020) and Standard Methods for the Examination of Water and Wastewater, 23rd edition (Baird et al. 2017). Validation of the data will be performed by a data validator with guidance from applicable portions of the National Functional Guidelines for Organic Superfund Methods Data Review (EPA 2017b) and the National Functional Guidelines for Inorganic Superfund Methods Data Review (EPA 2017a). The proposed sampling program is summarized in Table B-1.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The specific roles, activities, and responsibilities of project participants are described in this section. The Port has the primary responsibility for managing the work completed at the Site. LAI is the primary consultant for management and execution of the RI. The daily management of the RI, along with validation of the data, will be completed by the LAI project team.

ALS will perform the laboratory chemical analysis of soil, groundwater, surface water, marine sediment and soil vapor. Environmental laboratories performing work under this QAPP will maintain current accreditation through Ecology for applicable methods and analytes. Contact information for the primary consultant and laboratories is provided below.

Contact	Responsibility
LAI 155 NE 100th Street, Suite 302 Seattle, WA 98125 Telephone: (206) 631-8680	Coordinate laboratory analyses Data validation Reporting
ALS 8620 Holly Drive, Suite 100 Everett, WA 98208 Telephone: (425) 356-2600	Chemical analysis
ALS 2655 Park Center Drive, Suite A Simi Valley, CA 93065 Telephone: (805) 577-2086	Soil vapor analysis

Key personnel and their roles and responsibilities are identified below.

Title/Role	Name	Organization	Responsibilities
Port Project Manager	Ben Howard	Port	Manages the project for Port of Bellingham.
Ecology Project Manager	Cris Matthews	Ecology	Oversees the project on behalf of the Washington State Department of Ecology.
Consultant Project Manager	Jeremy Davis	LAI	Supervises and coordinates all work for the project. These responsibilities include project planning and execution, scheduling, staffing, data evaluation, report preparation, subcontracts, and managing deliverables.
Quality Assurance (QA) Officer	Danille Jorgensen	LAI	Oversees and directs quality assurance reviews for the project, including laboratory procedures and actions. Coordinates and reviews data validation. Has oversight responsibility for management and integrity of the data.
Data Validator	Kristi Schultz	LAI	Reviews laboratory analytical data and provides data validation.
Field Lead	Stephanie Renando	LAI	Leads and coordinates field activities including documentation, sampling, and sample handling. Reports directly to the LAI project manager (PM).
Health and Safety Manager	Chris Kimmel	LAI	Responsible for review and implementation of the project Health and Safety Plan (HASP).

Title/Role	Name	Organization	Responsibilities
Field Equipment Manager	Devan Brandt	LAI	Ensures equipment is properly maintained and in good condition for project use.
Environmental Laboratory Project Manager(s)	Glen Perry Sue Anderson	ALS-Everett ALS-Simi Valley	Manages laboratory analysis and reporting, including supervising in-house chain of custody, scheduling sample analyses within required holding times; oversees data review and preparation of laboratory reports and electronic data deliverables (EDDs).

3.0 DATA QUALITY OBJECTIVES

Data quality objectives (DQOs) reflect the overall degree of data quality or uncertainty that the decision-maker is willing to accept during decision-making. DQOs are used to specify the quality of the data, usually in terms of precision, bias, representativeness, comparability, and completeness. DQOs apply to the entire measurement system (e.g., sampling locations, methods of collection and handling, field analysis, laboratory analysis). DQOs are used to ensure that environmental data are scientifically valid, defensible, and of an appropriate level of quality given the intended use for the data (EPA 2000). QA objectives for the project data include the qualitative guidelines outlined below, as well as quantitative determinations of the data quality indicators (DQIs), as described in this section.

3.1 Upland Investigation

The DQO for the upland investigation is to collect soil, groundwater, and soil vapor samples from the direct-push borings and sub-slab vapor pins for laboratory analysis in support of further delineation of the extent of contamination, as well as to provide information for the selection of locations for groundwater monitoring well installation. The results of the analyses will be used in combination with field screening to further delineate the extent of contamination, and to provide information that will be used to select the locations for installing groundwater monitoring wells. Analytical results will be compared to Ecology's Model Toxics Control Act (MTCA) cleanup levels (CULs) and Site-specific risk-based objectives, as appropriate.

Soil samples to be analyzed will include total petroleum hydrocarbons (TPH), selected volatile organic compounds (VOCs), and semivolatile organic compounds (SVOCs) related to TPH contamination. Soil samples may also be analyzed for total polychlorinated biphenyls (PCBs) and selected metals to address potential data gaps. Groundwater grab samples will be analyzed for TPH, VOCs, and SVOCs. Soil vapor samples will be analyzed for VOCs.

3.2 Groundwater Monitoring Wells

The DQO for the groundwater monitoring wells is to evaluate groundwater conditions during both the wet season (January through May) and the dry season (June through September). Analytical results will be compared to MTCA CULs and Site-specific risk-based objectives as appropriate.

Groundwater samples to be analyzed will include TPH, VOCs, SVOCs, and dissolved metals.

3.3 Marine Sediment

The DQO for the marine sediment investigation is to collect surface and subsurface sediment samples to evaluate the nature and extent of releases to the marine environment. Subsurface samples will be selected from the portion of the sediment core that is most likely impacted by potential contamination. Sample material from the sediment core deeper than the apparent contamination will

be archived for follow-up analyses on an as-needed basis. Analytical results will be compared to Washington State Sediment Management Standards (SMS; Ecology 2013) and Site-specific risk-based objectives, as appropriate.

Sediment samples to be analyzed will be in accordance with SMS constituents of concern including SVOCs, metals, grain size, PCBs and total organic carbon. TPH is not listed in the SMS criteria; however, sediment samples will be analyzed for TPH as it is the primary constituent of concern for this RI.

3.4 Data Quality Indicators

DQIs are used to establish quality objectives and are discussed in detail below. A summary of DQIs and their associated measurement quality objectives (MQOs) are presented in Tables B-2a, B-2b, and B-2c.

3.4.1 Precision

Precision is a measure of variability in the results of replicate measurements due to random error (Ecology 2016). Precision is best expressed in terms of the standard deviation or relative percent difference (RPD). QC sample types that can be used to evaluate precision include field and laboratory duplicates, matrix spike duplicates (MSDs), and laboratory control sample duplicates (LCSDs). The precision of duplicate measurements will be expressed as an RPD, which is calculated by dividing the absolute value of the difference of the two measurements by the average of the two measurements and expressing it as a percentage. The formula for RPD calculation is shown below:

$$\mathrm{RPD} = \left[\frac{|\mathrm{D1} - \mathrm{D2}|}{[(\mathrm{D1} + \mathrm{D2}) \div 2]}\right] \times 100\%$$

Where:

D1 = first measurement value

D2 = second measurement value (duplicate).

3.4.2 Accuracy

Accuracy is a combination of precision and bias (described in Section 3.1.7), in that it represents the degree to which a measured value represents the known value (Ecology 2016). Accuracy is expressed as the percent recovery of spiked samples (matrix spike [MS], laboratory control sample [LCS], and surrogate spike). The general formula used to calculate percent recovery is shown below (for MS/MSD percent recovery the result from the unspiked sample is taken into account in the formula):

$$\%R = \left[\frac{SSR}{C_s}\right] \times 100\%$$

Where:

%R = percent recovery

SSR = spiked sample result

C_s = concentration of the spike added.

3.4.3 Representativeness

Representativeness is an indicator of how accurately a result reflects the desired characteristic(s) of a defined population, accounting for both temporal and spatial variability (Ecology 2016). Representativeness qualitatively describes how well the analytical data characterize an area of concern. Representativeness is largely determined by the sampling design; analytical parameters for use in its evaluation include method-specified holding times and preservation requirements, and matrix heterogeneity. The sampling design for this project is presented in the SAP (Appendix A).

3.4.4 Comparability

Comparability is the "degree of confidence with which one data set can be compared to another" (Ecology 2016). QC procedures and MQOs, as stated in this QAPP, will provide for measurements that are consistent and representative of the media and conditions measured.

3.4.5 Completeness

Completeness is a measure of "the amount of valid data obtained from a measurement system compared to the amount that could be expected to be obtained under normal conditions" (EPA 2009). Field completeness is calculated as the number of actual samples collected divided by the number of planned samples. Analytical completeness is calculated as the number of valid data points divided by the total number of data points requested. Data points are considered invalid if they are rejected during data validation. The data validation approach for this project is provided in Section 9.0 and completeness objectives are provided in Tables B-2a, B-2b, and B-2c.

3.4.6 Sensitivity

Sensitivity is the capability of a method or an instrument to discern the difference between very small amounts of a substance. For the purposes of this project, sensitivity is the lowest concentration that can be accurately detected by the analytical method. Target reporting limits (RLs) are provided in Tables B-3a and B-3b.

3.4.7 Bias

Bias is the systematic or persistent distortion of a measurement process that causes errors in one direction. Bias of the laboratory results will be evaluated based on analysis of reference materials, method blanks, and MS samples, as presented in Tables B-2a, B-2b, and B-2c.

4.0 DATA GENERATION AND ACQUISITION

This section provides an overview of the data collecting and handling processes that will ensure data quality that meets project standards. More details about these processes are included in the SAP, as noted in the subsections below.

4.1 Sampling Process Design

The sampling design, including selection of locations and development of the sampling program and procedures, is presented in the RI Project Plan and the SAP (Appendix A). Samples for chemical analysis will be collected from each location and analyzed for the constituents listed in the SAP.

4.2 Sampling Methods

A detailed description of the sampling methods for each matrix is presented in the SAP.

Sampling containers will be provided by the laboratory. Extra containers will be requested to ensure that clean containers are available to replace any broken or misused containers during sampling events. The laboratory will provide kits (e.g., plunger for Method 5035 soil sampling) to collect samples for analyses that require special methods to fill the sample container.

4.3 Sample Handling and Custody

Soil, water, sediment, and soil vapor samples submitted to the analytical laboratories will be collected in the appropriate sample containers and preserved as specified in Table B-4. The storage temperatures and maximum holding times for physical/chemical analyses are also provided in Table B-4.

The transportation and handling of samples will be accomplished in a manner that not only protects the integrity of the sample, but also prevents any detrimental effects due to release of samples. Samples will be logged on a chain-of-custody (COC) form and will be kept in coolers on ice until delivery to the analytical laboratory. The COC form will accompany each shipment of samples to the laboratory. A sample is “in custody” if at least one of the following is true:

- It is in someone’s physical possession.
- It is in someone’s view.
- It is secured in a locked container or otherwise sealed so that tampering will be evident.
- It is kept in a secured area, restricted to authorized personnel only.

Sample control and COC in the field and during transport to the laboratory will be conducted in general conformance with the procedures described below.

- As few persons as possible will handle samples.

- Sample bottles will be obtained new or pre-cleaned from the laboratory performing the analyses.
- The sample collector will be personally responsible for the completion of the COC record and the care and custody of samples collected until they are transferred to another person or dispatched properly under COC protocols.
- The onsite LAI team leader will oversee implementation of the field custody procedures during the field work and, in the event of non-compliance, will determine if corrective action is required.
- The coolers in which the samples are shipped will be accompanied by the COC record identifying their contents. The original record and laboratory copy will accompany the shipment (sealed inside the shipping container). The other copy will be distributed as appropriate to LAI's QA Officer or designee.
- Shipping containers will be sealed with custody seals for shipment to the laboratory. The method of shipment, name of courier, and other pertinent information will be entered in the "remarks" section of the COC record.
- If sent by mail, the package will be registered with return receipt requested. If sent by common carrier, a bill of lading will be used. Freight bills, postal service receipts, and bills of lading will be retained as part of the permanent documentation.

When samples are transferred, the individuals relinquishing and receiving the samples will sign the COC form and record the date and time of transfer. The sample collector will sign the form in the first signature space. The only exception to this is the shipment of samples via commercial carriers. Because sample containers are sealed with the COC record inside prior to delivery to the carrier, the custody signature will be that of the individual taking possession of the samples from the carrier at its final destination. Each person taking custody will observe whether the shipping container is correctly sealed and in the same condition as noted by the previous custodian; deviations will be noted in the appropriate section of the COC record.

A designated sample custodian at the laboratory will accept custody of the shipped samples, verify the integrity of the custody seals, and certify that the sample identification numbers match those on the COC record. The custodian will then enter sample identification number data into a bound logbook, which is arranged by project code and station number. If containers arrive with broken custody seals, the laboratory will note this on the COC record and will immediately notify LAI.

Once the analytical work has been completed and the data report submitted by the laboratory, samples and extracts will be transferred from cold storage to a sample archiving area where they will be stored for 3 months, unless LAI provides other written instructions. Custody will be maintained in the long-term storage area and upon ultimate disposition, samples will be logged out, and the disposition recorded. Disposal will be in accordance with local, state, and federal regulations.

4.4 Analytical Methods

Soil chemical analyses will include TPH (gasoline-, diesel- and oil-range TPH [TPH-G, TPH-D, and TPH-O, respectively]), VOCs, SVOCs, PCBs, and selected total metals. Groundwater chemical analyses will include TPH-G, TPH-D, and TPH-O, VOCs, SVOCs, and selected dissolved metals. Surface water and porewater samples will be analyzed for TPH-G, TPH-D, and TPH-O. Soil vapor chemical analyses will include VOCs. Sediment chemical analyses will be in accordance with the SMS constituents of concerns, including SVOCs, total metals, grain size, PCBs, and total organic carbon, along with TPH-G, TPH-D, and TPH-O. Analyses will be performed in accordance with US Environmental Protection Agency (EPA) protocols or other methods, as appropriate.

For the purposes of ensuring the laboratory reporting limits for the RI will be sufficiently adequate to support the investigation, preliminary screening levels composed of Method A and Method B concentrations, as tabulated in Chapter WAC 173-340 (MTCA Method A) and MTCA's CLARC database (Ecology; accessed February 4, 2021), are presented in Tables B-3a and B-3b, along with the laboratory reporting limits for comparison. The preliminary screening levels will likely be adjusted throughout the RI/FS process to ensure adequate planning for cleanup and assessment of compliance with MTCA. Laboratory methods and target RLs for each matrix are provided in Tables B-3a and B-3b.

Dissolved metals will be field-filtered. For analysis of samples by EPA Method 6010C/D, a collision cell may be used to reduce interference.

The contracted chemical laboratory will implement project-required standard operating procedures (SOPs) for sample preparation, cleanup, and analysis. These SOPs will be based on EPA Method SW-846 (EPA; accessed July 31, 2020). Documentation of these SOPs will be kept on file at the contracted laboratory.

Documentation of appropriate method performance for the project target compounds will be available from the selected laboratory and will include the criteria for acceptance, rejection, or qualification of data. The laboratory is also required to periodically update method performance data such as control limits and method detection limits.

5.0 QUALITY CONTROL

This section details the measurement checks required to meet the DQIs for this program.

5.1 Field Quality Control

Field and analytical laboratory control samples will be collected to evaluate data precision, accuracy, representativeness, comparability, completeness, bias, and sensitivity of the analytical results for this investigation. The field QC samples and the frequency at which they will be collected and/or analyzed by matrix and analysis is specified in the SAP (Appendix A); the evaluation of these samples is discussed in Section 9.0 and provided in Tables B-2a, B-2b, and B-2c.

The QC procedures for measuring field parameters such as pH, redox potential, conductance, dissolved oxygen, turbidity, and temperature in groundwater samples are discussed in the SAP and will include calibrating the instruments, measuring duplicate samples, and checking the reproducibility of the measurements by taking multiple readings on a single sample or reference standard. To ensure that field measurement is accomplished accurately, field equipment will undergo routine maintenance and calibration as described below.

5.1.1 Testing, Inspection, and Maintenance

LAI performs routine inspections and preventive maintenance (parts replacement and cleaning) for all pieces of field equipment in the supply and equipment room. Maintenance activities are conducted by field technicians, who are specifically trained in the use, operation, and maintenance of the equipment. Field equipment used during this project, including water level indicators, photoionization detectors (PIDs), water field parameter meters, flow through cells, and pumps will be cleaned and decontaminated prior to use. Each piece of equipment will be inspected and tested to ensure proper working function and facilitate replacement or repair of broken or non-operational components. Extra batteries will be included in the equipment cases or in field vehicles for replacing dead batteries during field work. Extra disposables will be packed for equipment requiring disposables for use, such as ferrous iron kits or groundwater filters.

Field equipment is maintained by the Field Equipment Manager. Field staff continually notify the Field Equipment Manager when equipment maintenance is needed. This system ensures that the equipment is maintained and working for the next field project.

Meters used to make field measurements will be further inspected and tested during calibration, as described below.

5.1.2 Calibration and Frequency

Field equipment is calibrated according to the manufacturers' guidelines and recommendations. A PID will be used during this project and will be calibrated on a daily basis according to the manufacturer's specifications.

The PID preferred by LAI field personnel uses a 10.2-eV probe and is calibrated using a manufacturer-supplied standard gas (isobutylene, equivalent to 34 parts per million benzene). Similarly, water field parameter meters will be calibrated at the start of each sampling day with laboratory-prepared calibration standards within the range of the anticipated measurement. An instrument will also be recalibrated at any time an anomalous reading suggests instrument imprecision or inaccuracy.

5.1.3 Inspection/Acceptance of Supplies and Consumables

Supplies are ordered and maintained by the LAI Field Equipment Manager. Disposables and consumables include nitrile gloves, Ziploc® bags for sample ice, field test kits, and polyethylene tubing, etc.

5.1.4 Laboratory Quality Control

Analytical procedures will be documented in writing as laboratory SOPs, with each SOP including a QA section that addresses the minimum QC requirements for the procedure. Certain QC requirements are matrix- or method-specific, but in general, the QA program must include the following:

- Instrument calibration
- Preparation and analysis of reagent/preparation blanks
- Analysis of instrument and/or method blanks
- Preparation and analysis of matrix spikes and matrix spike duplicates
- Preparation and analysis of surrogate spikes
- Analysis of laboratory duplicates for inorganics
- Preparation and analysis of laboratory control samples and standards
- Identification of internal standard areas and control limits, for gas chromatography/mass spectrometry (GC/MS) analysis
- System performance checks for both organic and metals analyses.

5.1.4.1 Laboratory Quality Control Samples

An analytical batch is defined as 20 samples or less of the same type of matrix, prepared and analyzed as a group. The following analytical QC samples will be associated with each batch if the control procedure is applicable to the analysis.

Method Blank

A reagent or media blank will be analyzed as a check on laboratory contamination (glassware, reagents, analytical hardware) that might affect analytical results. A sample consisting of laboratory reagent-grade water (distilled and de-ionized water) or a solid matrix will be analyzed to monitor the analytical instrument for contamination. The method blank will be processed through the entire analytical procedure, including sample preparation. The results will be used in conjunction with other control data to validate overall system performance and identify bias that may impact data quality. Method blanks must be analyzed per EPA Method SW-846 for applicable analyses, at least once with each analytical batch, with a 1 in 20 sample minimum.

Laboratory Control Samples

Independently prepared control samples will be processed through the entire analytical procedure. The purpose of these samples is to monitor and assure the accuracy of the procedure in the absence of matrix interference. Results of the LCSs will be charted and must meet acceptance criteria. Laboratory control samples must be analyzed per EPA Method SW-846 for applicable analyses, at least once with each analytical batch, with a 1 in 20 sample minimum.

Laboratory Control Sample Duplicates

Independently prepared control sample duplicates will be processed through the entire analytical procedure. The purpose of the LCSD is to assure the precision of the procedure in the absence of matrix interference. Precision results in RPD will be tabulated and charted. The RPD equation is given below under Duplicate Samples or MSDs. LCSDs must be analyzed per Method SW-846 for applicable analyses, at least once with each analytical batch, with a 1 in 20 sample minimum.

Surrogates

Sample aliquots and laboratory QC samples scheduled for organic analysis will be spiked with surrogates. The surrogates to be added will be in compliance with the SW-846 analytical method referenced and will be detailed in the laboratory method SOP. The purpose of the surrogates is to monitor and assure the accuracy of the analytical performance on individual samples and to indicate the presence of system bias, extraction inefficiencies, and/or matrix interferences. The recoveries of the surrogates will be charted and must meet acceptance criteria.

Internal Standards

Sample aliquots and laboratory QC samples scheduled for GC/MS analysis will be spiked with interval standards prior to extraction or analysis as applicable. The internal standards to be added will be in compliance with the SW-846 analytical method referenced and will be detailed in the laboratory method SOP. The purpose of the internal standards is to ensure GC/MS instrument sensitivity and stability, and to provide for accurate target analyte quantitation. The internal standard area counts and retention times will be charted and must meet acceptance criteria.

Matrix Spike

An aliquot of a sample will be spiked with a known amount of the selected analyte(s). Percent recoveries of the selected spiked analytes will be tabulated by subtracting the non-spiked concentration from the spiked sample results. Results are used to assess accuracy in specific matrices. Matrix spikes must be analyzed per Method SW-846 for applicable analyses, at least once with each matrix-specific analytical batch, with a 1 in 20 sample minimum.

Percent recovery is calculated as follows:

$$\%R = \frac{(C_1 - C_0)}{C_2} \times 100$$

Where:

$\%R$	=	Percent recovery
C_1	=	Measured concentration in spiked sample aliquot
C_0	=	Measured concentration in unspiked sample aliquot
C_2	=	Actual concentration of spike added.

Duplicate Samples or Matrix Spike Duplicates

MSDs will be analyzed to monitor the method precision. Results in RPD will be tabulated and charted. The RPD calculation (for two samples, C_1 and C_2) is shown below. For analytical methods in which spiking is not applicable, sample duplicates will be used to assess precision. Duplicates or MSDs must be analyzed per Method SW-846 for applicable analyses, at least once with each matrix-specific analytical batch, and with a 1 in 20 sample minimum.

$$RPD = \frac{C_1 - C_2}{\left(\frac{C_1 + C_2}{2}\right)} \times 100$$

Where:

RPD	=	Relative percent difference
C_1	=	Larger of the two observed values
C_2	=	Smaller of the two observed values.

The laboratory's QA program will be reviewed by the QA Officer with specific emphasis on the acceptance criteria for QC samples, and on related corrective action should the QC criteria not be met. Acceptance criteria and corrective action consistent with Method SW-846 Update III criteria will be deemed acceptable.

Data obtained will be properly recorded. The required QC summary package for organic and inorganic data and the EDD format is detailed in Section 6.0. The laboratory will reanalyze samples not handled

or analyzed in conformance with the QC criteria, if sufficient sample volume is available. It is expected that sufficient volumes/weights of samples will be collected to allow for reanalysis when necessary.

Completed data reports from the laboratory will include a narrative outlining any problems, corrections, anomalies, and conclusions, as well as COC documentation and results for all analyses and laboratory QC.

6.0 DATA MANAGEMENT

Field data (groundwater field parameter data and water-level measurements) will be entered into an Excel spreadsheet and verified to determine that the entered data are correct and without omissions and errors.

Laboratory analytical results, including QC data, will be submitted electronically. The electronic formats will include a PDF file of the laboratory report, and EDD files that will be uploaded by LAI to Ecology's Environmental Information Management (EIM) database. Laboratories will provide EDDs in EIM format and Level 2A reports.

Level 2A laboratory analytical reports will include the following:

- Case narrative, including adherence to prescribed protocols, non-conformity events, corrective measures, and/or data deficiencies (including initial and continuing instrument calibrations, and explanations for any missed target RLs)
- COC documentation
- Sample receipt and condition documentation
- Sample summary or equivalent
- Method summary or equivalent
- Sample results (with date, units, and RLs)
- Laboratory data qualifier definitions
- EPA Contract Laboratory Program (CLP)-equivalent forms
- Method/laboratory blank results
- Sample surrogate results
- Field QC results
- Laboratory control sample results
- Matrix spike results
- Duplicate and/or matrix spike duplicate results
- Post-digestion spike sample results
- Inductively coupled plasma serial dilution results.

6.1 Data Reduction

This section summarizes the procedures for ensuring the accuracy of the data reduction process. Both field and laboratory data reduction procedures are summarized. Responsibilities for the data reduction process are delegated as follows:

- Technical personnel will document and review their own work and are responsible for the accuracy of the work.

- Calculations will receive a method and calculation check by a secondary reviewer prior to reporting (peer review).
- The Laboratory PM will be responsible for ensuring that data reduction is performed according to protocols discussed in this QAPP.

The laboratories will follow the data reduction and calculation procedures set forth in EPA-approved methods and 40 Code of Federal Regulations Part 136. Data reports and EDDs generated by the laboratory will undergo internal data approval in accordance with the laboratory's Quality Services Manual before being reported.

Automated data calculation and reduction, using instrument data system software or electronic spreadsheet software, will be used by the laboratory to the greatest extent practicable. Analyses will be programmed to allow for raw data entry and editing at the keyboard, with integrated software performing calculations and permanent database generation. Data-entry errors will be checked by comparing the raw data printouts against the chemist's original work, minimizing the common sources of error in data reduction.

The Laboratory PM must ensure that the EDD matches the laboratory hard copy data report. This data review must be completed before deliverables are reported by the laboratory. Raw and final data will be stored electronically, with regularly scheduled backups performed and maintained at the laboratory.

Logbooks will be maintained for each instrument. Computer record file identification will readily allow retrieval by the client name. Worksheets and spreadsheets will be prepared using an electronic spreadsheet or related software package.

Raw data from the chemists' notebooks or bench sheets will include all analytical variables compiled for samples, replicates, blanks, standards, and matrix spikes. The Laboratory PM will approve submittal of the final data report and EDD after internal review.

7.0 DOCUMENTS AND RECORDS

This section describes the management requirements for production, distribution, and storage of documents and records associated with planned activities at the Site.

7.1 Document Distribution

Prior to beginning field activities, field staff will receive and have an opportunity to review plan-related documents pertinent to the field activities, including the Project Plan, SAP, and Health and Safety Plan (HASP), as appropriate to support the planned activities. The Project Plan, SAP, and HASP (and required future addenda) for each phase of the project will be finalized prior to commencement of field activities, and only the finalized versions will be distributed to field staff. Changes to procedures and plans after finalization will be documented as addenda and distributed along with the original finalized versions.

7.2 Field Documentation

Field equipment will have reference and related manuals stored in with the equipment. In addition, equipment that requires calibration will be accompanied by a calibration logbook. Field staff will record the calibration process in the logbook every time a calibration is performed.

A complete record of field activities will be maintained for the duration of the field phase of the work. Documentation will include the following:

- Daily recordkeeping by field personnel of field activities
- Recordkeeping of samples collected for analysis (field sampling forms)
- Use of sample labels and tracking forms for samples collected for analysis.

The field logs will provide a description of sampling activities completed, sampling personnel, daily weather conditions, and a record of modifications to the procedures and plans identified in the Project Plan or related documentation. The field logs are intended to provide sufficient data and observations to enable project staff to reconstruct events that occurred during the sampling period.

Field logs will be supplemented by sample collection forms, boring logs, and groundwater well logs completed by field staff, as applicable. The information that will be recorded on these forms is specified in the SAP.

Sample possession and handling will also be documented with COC forms so that it is traceable from the time of sample processing in the field, to delivery to the laboratory, and finally to the data analysis.

7.3 Analytical Data Records

Laboratory analytical data reports will be provided in electronic format by the laboratory. These reports will be included as appendices in documents where data are reported and will be kept along with all other documents in the project files.

7.4 Storage

Documents and records associated with the project (i.e., final documents, billing and invoice records) and the documents described in Sections 7.2 and 7.3 will be stored in electronic form in project files on LAI's servers for the duration of the project.

8.0 AUDITS AND CORRECTIVE ACTIONS

Field and/or laboratory audits are not planned for this project.

Corrective action will be required if there are deviations from the methods or QA requirements established in this QAPP or if there are equipment or analytical malfunctions. Corrective action procedures will be implemented based on the type of unacceptable data and will be developed on a case-by-case basis. The following corrective actions may be included:

- Altering procedures in the field
- Using a different batch of sample containers
- Performing an audit of field or laboratory procedures
- Reanalyzing samples (if holding times allow)
- Resampling
- Evaluating sampling and analytical procedures to determine possible causes of the discrepancies
- Accepting the data with no action, acknowledging the level of uncertainty
- Qualification of the data
- Rejecting the data as unusable.

During field operations and sampling procedures, the field personnel will be responsible for conducting and reporting required corrective actions. A description of any corrective action taken will be entered in the daily field notebook. If field conditions do not allow for conformance with this QAPP, the LAI PM will be consulted immediately. For any corrective action or field condition resulting in a revision of this QAPP, the LAI PM will authorize changes or exceptions to this QAPP, as necessary and appropriate.

Incidents of QA failure and associated corrective action will be documented and reports will be placed in the appropriate project file. Also, corrective action will be taken promptly for deficiencies noted during spot-checks of raw data. As soon as sufficient time has elapsed for corrective action to be implemented, evidence of correction of deficiencies will be presented.

Corrective action in the analytical laboratory may be required due to equipment malfunction, failure of internal QA/QC checks, method blank contamination, non-compliance with QA requirements, or failure of performance or system audits. When measurement equipment or analytical methods fail QA/QC checks, the problem will be immediately brought to the attention of the appropriate persons in the laboratory, in accordance with the laboratory's SOPs. If failure is due to equipment malfunction, the equipment will be repaired, precision and accuracy will be reassessed, and the analysis will be rerun. Attempts will be made to reanalyze all affected parts of the analysis so that, in the end, results are not affected by failure of QA requirements.

During laboratory analysis, the Laboratory PM will be responsible for taking required corrective actions in response to equipment malfunctions. If an analysis does not meet the data quality goals outlined in this QAPP, corrective action generally will follow the guidelines in the EPA analytical methods noted in this QAPP and the EPA guidelines for data validation (EPA 2017a, b). If analytical conditions are such that non-conformance with this SAP/QAPP is indicated, the LAI PM will be notified as soon as possible so that any additional corrective actions can be taken.

The LAI PM is ultimately responsible for implementation of appropriate corrective actions and maintenance of a complete record of QC issues and corrective actions.

9.0 DATA VERIFICATION AND VALIDATION

The processes that will be used to verify and validate data are described in the subsections below.

9.1 Verification

Sample collection forms, field notes, and water-level measurements will be reviewed by LAI and placed in the electronic project files. Field data (groundwater field parameter data and water-level measurements) will be entered into an Excel spreadsheet and verified to determine all entered data are correct and without omissions and errors.

Technical verification requires comparison of QC and instrument performance standard results to required control limits. Technical verification is conducted throughout the analytical process, first by analysts, and finally by the Laboratory PM or designee and Laboratory PM. Laboratory data packages will be verified internally by the laboratory performing the work for completeness and technical accuracy prior to submittal.

9.2 Data Validation

Soil, groundwater, sediment, and soil vapor analytical data will undergo EPA Level 2A validation to determine that the results are acceptable and meet the quality objectives described in Section 3.0.

Validation of the data will be performed by an LAI data validator with guidance from applicable portions of the National Functional Guidelines for Organic Superfund Methods Data Review (EPA 2017b) and the National Functional Guidelines for Inorganic Superfund Methods Data Review (EPA 2017a), analytical methods, and LAI SOPs.

The EPA Level 2A-equivalent validation and verification will include the following:

- Verification that the laboratory data package contains all necessary documentation (including COC records; identification of samples received by the laboratory; date and time of receipt of the samples at the laboratory; sample conditions upon receipt at the laboratory; date and time of sample analysis; and, if applicable, date of extraction, definition of laboratory data qualifiers, all sample-related QC data, and QC acceptance criteria)
- Verification that all requested analyses, special cleanups, and special handling methods were conducted
- Verification that QC samples were analyzed as specified in the Project Plan
- Evaluation of sample holding times
- Evaluation of QC data compared to acceptance criteria, including method blanks, surrogate recoveries, laboratory duplicate and/or replicate results, and LCS results
- Evaluation of RLs compared to target RLs specified in this QAPP.

Analytical data may be qualified based on the data validation review. Qualifiers will be consistent with applicable EPA national functional guidelines and will be used to provide data users with an estimate of the level of uncertainty associated with the qualified result. Data validation results will be evaluated with respect to assigned qualifiers to determine any data usability issues.

The following qualifiers may be assigned during the data validation process:

- J The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- J+ The result is an estimated quantity, but the result may be biased high.
- J– The result is an estimated quantity, but the result may be biased low.
- NJ The analyte has been "tentatively identified" or "presumptively identified" as present and the associated numerical value is the estimated concentration in the sample.
- R The data are unusable. The sample results are rejected due to serious deficiencies in meeting QC criteria. The analyte may or may not be present in the sample.
- U The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
- UJ The analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.

The objectives, evaluations, and actions employed during the data validation process will be guided by EPA national functional guidelines. Laboratories will be permitted to provide CLP-like forms in lieu of true CLP forms. The data validation criteria will not strictly adhere to national functional guidelines, but will also take into consideration method criteria for preservation and holding times; laboratory-specified criteria for surrogate, laboratory control samples, laboratory duplicates, and matrix spikes; and the data validator's professional judgment.

Data qualification arising from data validation activities will be documented in validation worksheets and as qualifiers in the EIM and EQuIS databases.

10.0 DATA QUALITY ASSESSMENT

This section describes the steps required to reconcile project results with DQOs. Upon completion of data validation, the LAI PM will be provided a summary of qualified data. Data are considered valid and usable as long as they were not rejected during validation. The LAI PM or designee will review the data along with field documentation to ensure project DQOs were met.

Completeness of sampling will be determined by the number of samples collected divided by the number of samples to be collected as specified in the SAP, expressed as a percentage. The minimum requirement for sampling completeness is 90 percent.

Completeness for laboratory analyses will be determined by the number of valid results (results not qualified with a rejected [R] flag) divided by the number of possible individual analyte results, expressed as a percentage. The minimum requirement for analytical completeness is 90 percent.

11.0 REFERENCES

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Table B-1
Proposed Sampling Program
Remedial Investigation Quality Assurance Project Plan
Sea K Fish Cleanup Site – Blaine, Washington

Sampling Location Location ID	Description/Location	Soil		Groundwater		Soil Vapor		Sediment		Surface Water	
		Analysis	Target Sample Depths	Analysis	Target Screen Interval Depth	Analysis	Target Sample Depths	Analysis	Target Depth(s) (ft bgs)	Analysis	Target Sample Depths
Upland Investigation											
SK-SB-31	Delineate extent of contamination along the northern edge of the Site to evaluate for potential northern migration, or releases along the (potential) location of a former pipeline	TPH [1], BTEX[2], lead, and PAHs[3] at each location; PCBs[5] and the full list of metals[4] from two LNAPL-impacted locations.	Sample collected at the water table and the most likely contaminated interval based on field observations. If no evidence of contamination, sample only at the water table.	TPH [1], BTEX[2], PAHs[3], and lead	Just below the current groundwater table at time of drilling.	N/A					
SK-SB-32											
SK-SB-33											
SK-SB-34	Delineate extent of contamination on the north end of the known contaminated area										
SK-SB-35											
SK-SB-36	Delineate extent and further characterize the known, contaminated area, and to the east										
SK-SB-37											
SK-SB-38											
SK-SB-39											
SK-SB-40	Delineate extent of contamination in the northeast area of the Site, and characterize groundwater in the former Standard Oil Company Lease area										
SK-SB-41	Delineate extent of contamination on the south end of the known contaminated area										
SK-SB-42											
SK-SV-1	Evaluate and characterize potential contaminants in soil vapor below the active operations building slab	N/A				VOCs[6]	Below concrete slab	N/A			
SK-SV-2											
SK-SV-3											
Marine Investigation											
SK-SED-1	Investigate for contamination in surface and subsurface sediment that may have released from the upland area to the marine environment	N/A						TPH-D, TPH-O, SMS chemicals[7]	1 to 3 Samples from 8 locations nearest the shoreline; 2 locations will be archived and analyzed only as-needed; samples will be collected from 0 to 7 ft below mudline	N/A	
SK-SED-2											
SK-SED-3											
SK-SED-4											
SK-SED-5											
SK-SED-6											
SK-SED-7											
SK-SED-8											
SK-SED-9											
SK-SED-10											
SK-SW-1	Investigate for surface water impacts	N/A								TPH[1]	Near the uplands where sheen has been observed
SK-SW-2											
SK-SW-3											
SK-PW-1	Investigate for porewater impacts	N/A								TPH[1]	Near the uplands where sheen has been observed
SK-PW-2											
SK-PW-3											

Notes:

(1) TPH-G, TPH‑D, and TPH-O by Methods NWTPH-G and NWTPH-Dx.
(2) BTEX by EPA Method 8021.
(3) Select PAHs by EPA Method 8270E SIM.
(4) Metals by EPA Methods 6020B for (arsenic, barium, cadmium, chromium, lead, selenium, and silver), and 7471 (mercury).
(5) PCBs by EPA Method 8082.
(6) VOCs by Method TO-15.
(7) SMS chemicals listed in WAC 173-204-320, including metals (arsenic, cadmium, chromium, copper, lead, mercury, silver, and zinc), SVOCs [EPA Method 8270E], PCBs, and conventional parameters (grain size, total organic carbon, total solids).

Table B-1
Proposed Sampling Program
Remedial Investigation Quality Assurance Project Plan
Sea K Fish Cleanup Site – Blaine, Washington

Abbreviations and Acronyms:

BTEX = benzene, toluene, ethylbenzene, and xylenes
ID = Identification
EPA = US Environmental Protection Agency
ft = feet
LNAPL = light non-aqueous phase liquid
N/A = not applicable
NWTPH-Dx = Northwest total petroleum hydrocarbon extended-range diesel analytical method
NWTPH-G = Northwest total petroleum hydrocarbon gasoline analytical method
PAHs = polycyclic aromatic hydrocarbons
PCBs = polychlorinated biphenyls
RCRA = Resource Conservation and Recovery Act
SIM = selected ion monitoring
SMS = Sediment Management Standards
SVOC = semivolatile organic compound
TBD = to be determined
TPH-D = diesel-range total petroleum hydrocarbons
TPH-G = gasoline-range total petroelum hydrocarbons
TPH-O = oil-range total petroleum hydrocarbons
VOC = volatile organic compound
WAC = Washington Administrative Code

Table B-2a
Measurement Quality Objectives for Soil and Sediment
Remedial Investigation Quality Assurance Project Plan
Sea K Fish Cleanup Site – Blaine, Washington

DQI	QC Sample or Activity Used to Assess MQO	MQO	Frequency	Sampling or Analytical DQI
Soil/Sediment Samples Analyzed for Gasoline-Range Petroleum Hydrocarbons by Method NWTPH-G				
Representativeness	Cooler Temperature	< 6°C	All project samples	S
Bias	Surrogates	Recoveries within laboratory-specified control limits	All project and QA samples	A
Accuracy	LCS/LCSD	Recoveries within laboratory-specified control limits	1 per 20 samples or one per analytical batch	A
Precision	LCS/LCSD and MS/MSD	RPDs within laboratory-specified control limits	1 per 20 samples or one per analytical batch	A
Method performance for matrix, bias	MS/MSD	Recoveries within laboratory-specified control limits	1 per 20 samples or one per analytical batch	S&A
Bias/Contamination	Method Blank, Trip Blank	Target analytes not detected at concentrations > 1/2 the RL	1 method blank per 20 samples, 1 every 12 hours, or 1 per analytical batch	S&A
Analytical Completeness	Number of usable (not rejected) results out of total number of results	90%	N/A	S&A
Field Completeness	Number of samples collected out of planned samples	90%	N/A	S
Soil/Sediment Samples Analyzed for TPH-D and TPH-O by Method NWTPH-Dx				
Representativeness	Cooler Temperature	< 6°C	All project samples	S
Bias	Surrogates	Recoveries within laboratory-specified control limits	All project and QA samples	A
Accuracy	LCS/LCSD	Recoveries within laboratory-specified control limits	1 per 20 samples or one per analytical batch	A
Precision	LCS/LCSD and MS/MSD	RPDs within laboratory-specified control limits	1 per 20 samples or one per analytical batch	A
Method performance for matrix, bias	MS/MSD	Recoveries within laboratory-specified control limits	1 per 20 samples or one per analytical batch	S&A
Bias/Contamination	Method Blank	Target analytes not detected at concentrations > 1/2 the RL	1 method blank per 20 samples, 1 every 12 hours, or 1 per analytical batch	S&A
Analytical Completeness	Number of usable (not rejected) results out of total number of results	90%	N/A	S&A

Table B-2a
Measurement Quality Objectives for Soil and Sediment
Remedial Investigation Quality Assurance Project Plan
Sea K Fish Cleanup Site – Blaine, Washington

DQI	QC Sample or Activity Used to Assess MQO	MQO	Frequency	Sampling or Analytical DQI
Field Completeness	Number of samples collected out of planned samples	90%	N/A	S
Soil/Sediment Analyzed for Total Metals by EPA Methods 6010C and 7471B				
Representativeness	Cooler Temperature	< 6°C	All project samples	S
Accuracy	LCS	Recoveries within laboratory-specified control limits	1 per 20 samples or one per analytical batch	A
Precision	LCS and MS/Laboratory Duplicate	RPDs within laboratory-specified control limits	1 per 20 samples or one per analytical batch	A
Method performance for matrix, bias	MS/Laboratory Duplicate	Recoveries within laboratory-specified control limits	1 per 20 samples or one per analytical batch	S&A
Bias/Contamination	Method Blank	Target analytes not detected at concentrations > 1/2 the RL	1 method blank per 20 samples, 1 every 12 hours, or 1 per analytical batch	S&A
Analytical Completeness	Number of usable (not rejected) results out of total number of results	90%	N/A	S&A
Field Completeness	Number of samples collected out of planned samples	90%	N/A	S
Soil/Sediment Analyzed for VOCs by EPA 8021, EPA Method 8260D				
Representativeness	Cooler Temperature	< 6°C	All project samples	S
Bias	Surrogates	Recoveries within laboratory-specified control limits	All project and QA samples	A
Accuracy	LCS/LCSD	Recoveries within laboratory-specified control limits	1 per 20 samples or one per analytical batch	A
Precision	LCS/LCSD and MS/MSD	RPDs within laboratory-specified control limits	1 per 20 samples or one per analytical batch	A
Method performance for matrix, bias	MS/MSD	Recoveries within laboratory-specified control limits	1 per 20 samples or one per analytical batch	S&A
Bias/Contamination	Method Blank, Trip Blank	Target analytes not detected at concentrations > 1/2 the RL	1 method blank per 20 samples, 1 every 12 hours, or 1 per analytical batch	S&A
Analytical Completeness	Number of usable (not rejected) results out of total number of results	90%	N/A	S&A

Table B-2a
Measurement Quality Objectives for Soil and Sediment
Remedial Investigation Quality Assurance Project Plan
Sea K Fish Cleanup Site – Blaine, Washington

DQI	QC Sample or Activity Used to Assess MQO	MQO	Frequency	Sampling or Analytical DQI
Field Completeness	Number of samples collected out of planned samples	90%	N/A	S
Soil/Sediment Samples Analyzed for SVOCs by EPA Method 8270E, 8270E SIM				
Representativeness	Cooler Temperature	< 6°C	All project samples	S
Bias	Surrogates	Recoveries within laboratory-specified control limits	All project and QA samples	A
Accuracy	LCS/LCSD	Recoveries within laboratory-specified control limits	1 per 20 samples or one per analytical batch	A
Precision	LCS/LCSD and MS/MSD	RPDs within laboratory-specified control limits	1 per 20 samples or one per analytical batch	A
Method performance for matrix, bias	MS/MSD	Recoveries within laboratory-specified control limits	1 per 20 samples or one per analytical batch	S&A
Bias/Contamination	Method Blank	Target analytes not detected at concentrations > 1/2 the RL	1 method blank per 20 samples, 1 every 12 hours, or 1 per analytical batch	S&A
Analytical Completeness	Number of usable (not rejected) results out of total number of results	90%	N/A	S&A
Field Completeness	Number of samples collected out of planned samples	90%	N/A	S
Soil/Sediment Samples Analyzed for PCBs by EPA 8082				
Representativeness	Cooler Temperature	< 6°C	All project samples	S
Accuracy	LCS	Recoveries within laboratory-specified control limits	1 per 20 samples or one per analytical batch	A
Precision	LCS and MS/Laboratory Duplicate	RPDs within laboratory-specified control limits	1 per 20 samples or one per analytical batch	A
Method performance for matrix, bias	MS/Laboratory Duplicate	Recoveries within laboratory-specified control limits	1 per 20 samples or one per analytical batch	S&A
Bias/Contamination	Method Blank	Target analytes not detected at concentrations > 1/2 the RL	1 method blank per 20 samples, 1 every 12 hours, or 1 per analytical batch	S&A
Analytical Completeness	Number of usable (not rejected) results out of total number of results	90%	N/A	S&A

Table B-2a
Measurement Quality Objectives for Soil and Sediment
Remedial Investigation Quality Assurance Project Plan
Sea K Fish Cleanup Site – Blaine, Washington

DQI	QC Sample or Activity Used to Assess MQO	MQO	Frequency	Sampling or Analytical DQI
Field Completeness	Number of samples collected out of planned samples	90%	N/A	S
Soil/Sediment Samples Analyzed for Total Organic Carbon by SM 5310C				
Representativeness	Cooler Temperature	< 6°C	All project samples	S
Accuracy	LCS	Recoveries within laboratory-specified control limits	1 per 20 samples or one per analytical batch	A
Precision	LCS and MS/Laboratory Duplicate	RPDs within laboratory-specified control limits	1 per 20 samples or one per analytical batch	A
Method performance for matrix, bias	MS/Laboratory Duplicate	Recoveries within laboratory-specified control limits	1 per 20 samples or one per analytical batch	S&A
Bias/Contamination	Method Blank	Target analytes not detected at concentrations > 1/2 the RL	1 method blank per 20 samples, 1 every 12 hours, or 1 per analytical batch	S&A
Analytical Completeness	Number of usable (not rejected) results out of total number of results	90%	N/A	S&A
Field Completeness	Number of samples collected out of planned samples	90%	N/A	S

Acronyms/Abbreviations:

°C = degrees Celsius
A = analytical
DQI = data quality indicator
EPA = US Environmental Protection Agency
LCS = laboratory control spike
LCSD = laboratory control spike duplicate
MQO = measurement quality objective
MS = matrix spike
MSD = matrix spike duplicate
N/A = not applicable
NWTPH-Dx = Northwest total petroleum hydrocarbon extended-range diesel analytical method
NWTPH-G = Northwest total petroleum hydrocarbon gasoline analytical method
PCB = polychlorinated biphenyl
QA = quality assurance
QC = quality control
RL = reporting limit
RPD = relative percent difference
S = sampling
SIM = selected ion monitoring
SVOC = semivolatile organic compound
TPH-D = diesel-range total petroleum hydrocarbons
TPH-O = oil-range total petroleum hydrocarbons
VOC = volatile organic compound

Table B-2b
Measurement Quality Objectives for Groundwater
Remedial Investigation Quality Assurance Project Plan
Sea K Fish Cleanup Site – Blaine, Washington

DQI	QC Sample or Activity Used to Assess MQO	MQO	Frequency	Sampling or Analytical DQI
Groundwater/Surface Water Samples Analyzed for Gasoline-Range Petroleum Hydrocarbons by Method NWTPH-G				
Representativeness	Cooler Temperature	< 6°C	All project samples	S
Bias	Surrogates	Recoveries within laboratory-specified control limits	All project and QA samples	A
Accuracy	LCS/LCSD	Recoveries within laboratory-specified control limits	1 per 20 samples or one per analytical batch	A
Precision	LCS/LCSD and MS/MSD	RPDs within laboratory-specified control limits	1 per 20 samples or one per analytical batch	A
Method performance for matrix, bias	MS/MSD	Recoveries within laboratory-specified control limits	1 per 20 samples or one per analytical batch	S&A
Precision	Field Duplicates	RPD <20%	1 per 20 samples or one per analytical group	S&A
Bias/Contamination	Method Blank, Trip Blank	Target analytes not detected at concentrations > 1/2 the RL	1 method blank per 20 samples, 1 every 12 hours, or 1 per analytical batch	S&A
Representativeness	Number of usable (not rejected) results out of total number of results	90%	N/A	S&A
Field Completeness	Number of samples collected out of planned samples	90%	N/A	S
Groundwater/Surface Water Samples Analyzed for TPH-D and TPH-O by Method NWTPH-Dx				
Representativeness	Cooler Temperature	< 6°C	All project samples	S
Bias	Surrogates	Recoveries within laboratory-specified control limits	All project and QA samples	A
Accuracy	LCS/LCSD	Recoveries within laboratory-specified control limits	1 per 20 samples or one per analytical batch	A
Precision	LCS/LCSD and MS/MSD	RPDs within laboratory-specified control limits	1 per 20 samples or one per analytical batch	A
Method performance for matrix, bias	MS/MSD	Recoveries within laboratory-specified control limits	1 per 20 samples or one per analytical batch	S&A
Precision	Field Duplicates	RPD <20%	1 per 20 samples or one per analytical group	S&A

Table B-2b
Measurement Quality Objectives for Groundwater
Remedial Investigation Quality Assurance Project Plan
Sea K Fish Cleanup Site – Blaine, Washington

DQI	QC Sample or Activity Used to Assess MQO	MQO	Frequency	Sampling or Analytical DQI
Bias/Contamination	Method Blank	Target analytes not detected at concentrations > 1/2 the RL	1 method blank per 20 samples, 1 every 12 hours, or 1 per analytical batch	S&A
Analytical Completeness	Number of usable (not rejected) results out of total number of results	90%	N/A	S&A
Field Completeness	Number of samples collected out of planned samples	90%	N/A	S
Groundwater/Surface Water Samples Analyzed for SVOCs by EPA Methods 8270E, 8270E SIM				
Representativeness	Cooler Temperature	< 6°C	All project samples	S
Bias	Surrogates	Recoveries within laboratory-specified control limits	All project and QA samples	A
Accuracy	LCS/LCSD	Recoveries within laboratory-specified control limits	1 per 20 samples or one per analytical batch	A
Precision	LCS/LCSD and MS/MSD	RPDs within laboratory-specified control limits	1 per 20 samples or one per analytical batch	A
Method performance for matrix, bias	MS/MSD	Recoveries within laboratory-specified control limits	1 per 20 samples or one per analytical batch	S&A
Precision	Field Duplicates	RPD <20%	1 per 20 samples or one per analytical group	S&A
Bias/Contamination	Method Blank	Target analytes not detected at concentrations > 1/2 the RL	1 method blank per 20 samples, 1 every 12 hours, or 1 per analytical batch	S&A
Analytical Completeness	Number of usable (not rejected) results out of total number of results	90%	N/A	S&A
Field Completeness	Number of samples collected out of planned samples	90%	N/A	S
Groundwater/Surface Water Samples Analyzed for Dissolved Metals by EPA Methods 6020B, 7470A				
Representativeness	Cooler Temperature	< 6°C	All project samples	S
Accuracy	LCS	Recoveries within laboratory-specified control limits	1 per 20 samples or one per analytical batch	A
Precision	LCS and MS/Laboratory Duplicate	RPDs within laboratory-specified control limits	1 per 20 samples or one per analytical batch	A
Method performance for matrix, bias	MS/Laboratory Duplicate	Recoveries within laboratory-specified control limits	1 per 20 samples or one per analytical batch	S&A

Table B-2b
Measurement Quality Objectives for Groundwater
Remedial Investigation Quality Assurance Project Plan
Sea K Fish Cleanup Site – Blaine, Washington

DQI	QC Sample or Activity Used to Assess MQO	MQO	Frequency	Sampling or Analytical DQI
Precision	Field Duplicates	RPD <20%	1 per 20 samples or one per analytical group	S&A
Bias/Contamination	Method Blank	Target analytes not detected at concentrations > 1/2 the RL	1 method blank per 20 samples, 1 every 12 hours, or 1 per analytical batch	S&A
Analytical Completeness	Number of usable (not rejected) results out of total number of results	90%	N/A	S&A
Field Completeness	Number of samples collected out of planned samples	90%	N/A	S
Groundwater/Surface Water Samples Analyzed for Volatile Organic Compounds EPA Methods 8021, 8260D, 8260D SIM				
Representativeness	Cooler Temperature	< 6°C	All project samples	S
Bias	Surrogates	Recoveries within laboratory-specified control limits	All project and QA samples	A
Accuracy	LCS/LCSD	Recoveries within laboratory-specified control limits	1 per 20 samples or one per analytical batch	A
Precision	LCS/LCSD and MS/MSD	RPDs within laboratory-specified control limits	1 per 20 samples or one per analytical batch	A
Method performance for matrix, bias	MS/MSD	Recoveries within laboratory-specified control limits	1 per 20 samples or one per analytical batch	S&A
Bias/Contamination	Method Blank, Trip Blank	Target analytes not detected at concentrations > 1/2 the RL	1 method blank per 20 samples, 1 every 12 hours, or 1 per analytical batch	S&A
Analytical Completeness	Number of usable (not rejected) results out of total number of results	90%	N/A	S&A
Field Completeness	Number of samples collected out of planned samples	90%	N/A	S

Table B-2b
Measurement Quality Objectives for Groundwater
Remedial Investigation Quality Assurance Project Plan
Sea K Fish Cleanup Site – Blaine, Washington

Acronyms/Abbreviations:

°C = degrees Celsius
A = analytical
DQI = data quality indicator
EPA = US Environmental Protection Agency
LCS = laboratory control spike
LCSD = laboratory control spike duplicate
MQO = measurement quality objective
MS = matrix spike
MSD = matrix spike duplicate
N/A = not applicable
NWTPH-Dx = Northwest total petroleum hydrocarbon extended-range diesel analytical method
NWTPH-G = Northwest total petroleum hydrocarbon gasoline analytical method
PCB = polychlorinated biphenyl
QA = quality assurance
QC = quality control
RL = reporting limit
RPD = relative percent difference
S = sampling
SIM = selected ion monitoring
SVOC = semivolatile organic compound
TPH-D = diesel-range total petroleum hydrocarbons
TPH-O = oil-range total petroleum hydrocarbons
VOC = volatile organic compound

Table B-2c
Measurement Quality Objectives for Soil Vapor
Remedial Investigation Quality Assurance Project Plan
Sea K Fish Cleanup Site – Blaine, Washington

DQI	QC Sample or Activity Used to Assess MQO	MQO	Frequency	Sampling or Analytical DQI
Soil Vapor Samples Analyzed for Volatile Organic Compounds by Method TO-15/TO-15 SIM				
Bias	Surrogates	Recoveries within laboratory-specified control limits	All project and QA samples	A
Accuracy	LCS/LCSD	Recoveries within laboratory-specified control limits	1 per 20 samples or one per analytical batch	A
Precision	LCS/LCSD	RPDs within laboratory-specified control limits	1 per 20 samples or one per analytical batch	A
Bias/Contamination	Method Blank	Target analytes not detected at concentrations > 1/2 the RL	1 method blank per 20 samples, 1 every 12 hours, or 1 per analytical batch	S&A
Bias/Contamination	Individual (100%) Canister Cleaning	Target analytes not detected at laboratory-specified SIM limits	1 for each canister	S&A
Analytical Completeness	Number of usable (not rejected) results out of total number of results	90%	N/A	S&A
Field Completeness	Number of samples collected out of planned samples	90%	N/A	S

Acronyms/Abbreviations:

A = analytical
DQI = data quality indicator
LCS = laboratory control spike
LCSD = laboratory control spike duplicate
MQO = measurement quality objective
N/A = not applicable
QA = quality assurance
QC = quality control
RL = reporting limit
RPD = relative percent difference
S = sampling
SIM = selected ion monitoring

Table B-3a
Target Reporting Limits for Soil, Sediment, and Water
Remedial Investigation Quality Assurance Project Plan
Sea K Fish Cleanup Site – Blaine, Washington

Analyte	CAS No.	Soil			Sediment			Groundwater/Surface Water		
		Method	Reporting Limit (mg/kg) (a)	PSL (b)	Method	Reporting Limit (mg/kg) (a)	PSL (c)	Method	Reporting Limit (µg/L)	PSL (d)
Volatile Organic Compounds										
Benzene	71-43-2	EPA 8021	0.030	0.00056	--	--	--	EPA 8021	1.0	0.8
Toluene	108-88-3	EPA 8021	0.050	0.055	--	--	--	EPA 8021	1.0	640
Ethylbenzene	100-41-4	EPA 8021	0.050	0.015	--	--	--	EPA 8021	1.0	800
Total Xylenes	1330-20-7	EPA 8021	0.20	N/A	--	--	--	EPA 8021	3.0	1,600
Petroleum Hydrocarbons										
TPH-G (NWTPH-G)	N/A	NWTPH-G	3	N/A	NWTPH-G	3	N/A	NWTPH-G	50	N/A
TPH-D (NWTPH-Dx)	N/A	NWTPH-Dx	25	N/A	NWTPH-Dx	25	N/A	NWTPH-Dx	130	N/A
TPH-O (NWTPH-Dx)	N/A	NWTPH-Dx	50	N/A	NWTPH-Dx	50	N/A	NWTPH-Dx	250	N/A
Semivolatile Organic Compounds										
1,2,4-Trichlorobenzene	120-82-1	--	--	0.000072	EPA 8270E	0.02	0.81	--	--	--
1,2-Dichlorobenzene	95-50-1	--	--	0.53	EPA 8270E	0.02	2.3	--	--	--
1,4-Dichlorobenzene	106-46-7	--	--	0.18	EPA 8270E	0.02	3.1	--	--	--
2,4-Dimethyl phenol	105-67-9	--	--	0.048	EPA 8270E	0.1	0.029	--	--	--
2-Methylnaphthalene	91-57-6	EPA 8270E SIM	0.020	320	EPA 8270E	0.02	38	--	--	--
2-Methylphenol	95-48-7	--	--	--	EPA 8270E	0.02	0.063	--	--	--
4-Methylphenol	106-44-5	--	--	--	EPA 8270E	0.02	0.67	--	--	--
Acenaphthene	83-32-9	--	--	0.16	EPA 8270E	0.02	16	--	--	--
Acenaphthylene	208-96-8	--	--	N/A	EPA 8270E	0.02	66	--	--	--
Anthracene	120-12-7	--	--	2.4	EPA 8270E	0.02	220	--	--	--
Benzo(g,h,i)perylene	191-24-2	--	--	N/A	EPA 8270E	0.02	31	--	--	--
Benzoic Acid	65-85-0	--	--	--	EPA 8270E	0.2	0.65	--	--	--
Benzyl Alcohol	100-51-6	--	--	--	EPA 8270E	0.02	0.057	--	--	--
Bis (2-ethylhexyl) phthalate	117-81-7	--	--	0.0051	EPA 8270E	0.05	47	--	--	--
Butyl benzyl phthalate	85-68-7	--	--	0.00018	EPA 8270E	0.02	4.9	--	--	--
Dibenzofuran	132-64-9	--	--	--	EPA 8270E	0.02	0.015	--	--	--
Diethyl phthalate	84-66-2	--	--	0.074	EPA 8270E	0.02	61	--	--	--
Dimethyl phthalate	131-11-3	--	--	0.19	EPA 8270E	0.02	53	--	--	--
Di-n-butyl phthalate	84-74-2	--	--	0.015	EPA 8270E	0.02	220	--	--	--
Di-n-octyl phthalate	117-84-0	--	--	--	EPA 8270E	0.02	58	--	--	--
Fluoranthene	206-44-0	--	--	0.3	EPA 8270E	0.02	160	--	--	--

Table B-3a
Target Reporting Limits for Soil, Sediment, and Water
Remedial Investigation Quality Assurance Project Plan
Sea K Fish Cleanup Site – Blaine, Washington

Analyte	CAS No.	Soil			Sediment			Groundwater/Surface Water		
		Method	Reporting Limit (mg/kg) (a)	PSL (b)	Method	Reporting Limit (mg/kg) (a)	PSL (c)	Method	Reporting Limit (µg/L)	PSL (d)
Fluorene	86-73-7	--	--	0.08	EPA 8270E	0.02	23	--	--	--
Hexachlorobenzene	118-74-1	--	--	0.0000004	EPA 8270E	0.02	0.38	--	--	--
Hexachlorobutadiene	87-68-3	--	--	0.00054	EPA 8270E	0.02	3.9	--	--	--
HPAH	N/A	--	--	N/A	Calculation	N/A	960	--	--	--
LPAH	N/A	--	--	N/A	Calculation	N/A	370	--	--	--
Naphthalene	91-20-3	EPA 8270E SIM	0.020	7.3	EPA 8270E	0.02	99	--	--	--
N-Nitrosodiphenylamine	86-30-6	--	--	0.0011	EPA 8270E	0.02	0.011	--	--	--
Pentachlorophenol	87-86-5	--	--	0.0000018	EPA 8270E	0.1	360	--	--	--
Phenanthrene	85-01-8	--	--	N/A	EPA 8270E	0.02	100	--	--	--
Phenol	108-95-2	--	--	22	EPA 8270E	0.02	0.42	--	--	--
Pyrene	129-00-0	--	--	0.55	EPA 8270E	0.02	1,000	--	--	--
cPAHs										
Benzo(a)anthracene	56-55-3	EPA 8270E SIM	0.020	N/A	EPA 8270E SIM	0.020	110	EPA 8270E SIM	0.020	N/A
Benzo(a)pyrene	50-32-8	EPA 8270E SIM	0.020	0.000016	EPA 8270E SIM	0.020	99	EPA 8270E SIM	0.020	0.023
Benzo(b)fluoranthene	205-99-2	EPA 8270E SIM	0.020	N/A	EPA 8270E SIM	0.020	N/A	EPA 8270E SIM	0.020	N/A
Benzo(k)fluoranthene	207-08-9	EPA 8270E SIM	0.020	N/A	EPA 8270E SIM	0.020	N/A	EPA 8270E SIM	0.020	N/A
Chrysene	218-01-9	EPA 8270E SIM	0.020	N/A	EPA 8270E SIM	0.020	110	EPA 8270E SIM	0.020	N/A
Dibenzo(a,h)anthracene	53-70-3	EPA 8270E SIM	0.020	N/A	EPA 8270E SIM	0.020	12	EPA 8270E SIM	0.020	N/A
Indeno(1,2,3-cd)pyrene	193-39-5	EPA 8270E SIM	0.020	N/A	EPA 8270E SIM	0.020	34	EPA 8270E SIM	0.020	N/A
Total Benzofluoranthenes	N/A	--	--	--	EPA 8270E SIM	0.040	230	--	--	--
cPAH TEQ (e)	N/A	Calculation	N/A	N/A	Calculation	N/A	N/A	Calculation	N/A	N/A
Conventionals										
Total Organic Carbon	N/A	--	--	--	SM 5310	500	N/A	--	--	N/A
Total/Dissolved Metals (f)										
Arsenic	7440-38-2	EPA 6020B	0.2	0.15	EPA 6020B	0.2	57	EPA 6020B	1	0.058
Barium	7440-39-3	EPA 6020B	0.1	N/A	--	--	--	EPA 6020B	1	3,200
Cadmium	7440-43-9	EPA 6020B	0.1	0.1	EPA 6020B	0.1	5.1	EPA 6020B	1	8
Chromium, Total	7440-47-3	EPA 6020B	0.1	N/A	EPA 6020B	0.1	260	EPA 6020B	2	N/A
Copper	7440-50-8	--	--	--	EPA 6020B	0.1	390	--	--	--
Lead	7439-92-1	EPA 6020B	0.1	56.0	EPA 6020B	0.1	450	EPA 6020B	1	N/A
Mercury	7439-97-6	--	--	--	EPA 7471B	0.02	0.41	--	--	--

Table B-3a
Target Reporting Limits for Soil, Sediment, and Water
Remedial Investigation Quality Assurance Project Plan
Sea K Fish Cleanup Site – Blaine, Washington

Analyte	CAS No.	Soil			Sediment			Groundwater/Surface Water		
		Method	Reporting Limit (mg/kg) (a)	PSL (b)	Method	Reporting Limit (mg/kg) (a)	PSL (c)	Method	Reporting Limit (µg/L)	PSL (d)
Selenium	7782-49-2	EPA 6020B	1	0.38	--	--	--	EPA 6020B	4	80
Silver	7440-22-4	EPA 6020B	0.1	0.016	EPA 6020B	0.1	6.1	EPA 6020B	1	80
Zinc	7440-66-6	--	--	--	EPA 6020B	0.1	410	--	--	--
Polychlorinated Biphyenls										
Aroclor 1016	12674-11-2	EPA 8082	0.1	0.00032	EPA 8082	0.1	N/A	--	--	--
Aroclor 1221	11104-28-2	EPA 8082	0.1	N/A	EPA 8082	0.1	N/A	--	--	--
Aroclor 1232	11141-16-5	EPA 8082	0.1	N/A	EPA 8082	0.1	N/A	--	--	--
Aroclor 1242	53469-21-9	EPA 8082	0.1	N/A	EPA 8082	0.1	N/A	--	--	--
Aroclor 1248	12672-29-6	EPA 8082	0.1	N/A	EPA 8082	0.1	N/A	--	--	--
Aroclor 1254	11097-69-1	EPA 8082	0.1	0.000084	EPA 8082	0.1	N/A	--	--	--
Aroclor 1260	11096-82-5	EPA 8082	0.1	N/A	EPA 8082	0.1	N/A	--	--	--
Aroclor 1268	11100-14-4	EPA 8082	0.1	N/A	EPA 8082	0.1	N/A	--	--	--
Total PCBs	N/A	Calculation	N/A	0.0000022	Calculation	N/A	12	--	--	--

Notes:

(a) Reporting limits for solid matrices will be elevated due to dry weight reporting.

(b) Method B Protective of Groundwater, Saturated, Marine Water CUL. All sediment PSL units are in mg/kg OC except for metals and organic chemicals which are ir mg/kg dry weight.

(c) SCUM marine sediment cleanup objective.

(d) Minimum of Method B groundwater noncancer and cancer CULs.

(e) PAH TEQs will be calculated following WAC 173-340-708(8)(e)(iii)(A)(II)

(f) Groundwater samples scheduled for metals analysis will be field-filtered.

Acronyms/Abbreviations:

CAS = Chemical Abstracts Service
cPAH = carcinogenic PAH
CUL = cleanup level
EPA = US Environmental Protection Agency
HPAH = heavy PAH
LPAH = light PAH
µg/L = micrograms per liter
mg/kg = milligrams per kilogram
N/A = not applicable
-- = not scheduled for analysis
NWTPH-Dx = Northwest total petroleum hydrocarbon extended-range diesel analysis
NWTPH-G = Northwest total petroleum hydrocarbon gasoline analysis
PAH = polycyclic aromatic hydrocarbon
PCBs = polychlorinated biphenyls
PSL = preliminary screening level
SCUM = Ecology Sediment Cleanup User's Manual
SIM = selected ion monitoring
SM = Standard Methods
TEQ = toxicity equivalence
TPH = total petroleum hydrocarbons
TPH-D = diesel-range total petroleum hydrocarbo
TPH-G = gasoline-range total petroleum hydrocarl
TPH-O = oil-range total petroleum hydrocarbons
WAC = Washington Administrative Code

Table B-3b
Target Reporting Limits for Soil Vapor
Remedial Investigation Quality Assurance Project Plan
Sea K Fish Cleanup Site – Blaine, Washington

Analyte	CAS No.	Target Reporting Limits	
		Soil Vapor ($\mu g/m^3$)	PSL (a)
Volatile Organic Compounds by EPA Method TO-15			
1,1,1-Trichloroethane	71-55-6	0.54	76,000
1,1,2,2-Tetrachloroethane	79-34-5	0.54	1.4
1,1,2-Trichloroethane	79-00-5	0.54	3
1,1-Dichloroethane	75-34-3	0.55	52
1,1-Dichloroethene	75-35-4	0.54	3,000
1,2,4-Trichlorobenzene	120-82-1	0.54	30
1,2,4-Trimethylbenzene	95-63-6	0.54	910
1,2-Dibromo-3-chloropropane	96-12-8	0.53	0.014
1,2-Dibromoethane	106-93-4	0.54	0.14
1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	76-14-2	0.53	N/A
1,2-Dichlorobenzene	95-50-1	0.54	3,000
1,2-Dichloroethane	107-06-2	0.54	3.2
1,2-Dichloropropane	78-87-5	0.54	23
1,3,5-Trimethylbenzene	108-67-8	0.53	910
1,3-Butadiene	106-99-0	0.53	2.8
1,3-Dichlorobenzene	541-73-1	0.54	N/A
1,4-Dichlorobenzene	106-46-7	0.54	7.6
1,4-Dioxane	123-91-1	0.54	17
2-Butanone (MEK)	78-93-3	1.1	76,000
2-Hexanone	591-78-6	0.54	460
2-Propanol (Isopropyl Alcohol)	67-63-0	2.1	N/A
3-Chloro-1-propene (Allyl Chloride)	107-05-1	0.54	14
4-Ethyltoluene	622-96-8	0.54	N/A
4-Methyl-2-pentanone	108-10-1	0.53	46,000
Acetone	67-64-1	5.3	470,000
Acetonitrile	75-05-8	0.53	910
Acrolein	107-02-8	1.0	0.3
Acrylonitrile	107-13-1	0.53	1.2
alpha-Pinene	80-56-8	0.54	N/A
Benzene	71-43-2	0.53	11
Benzyl Chloride	100-44-7	1.1	1.7
Bromodichloromethane	75-27-4	0.54	2.3
Bromoform	75-25-2	0.54	76
Bromomethane	74-83-9	0.54	76
Carbon Disulfide	75-15-0	1.1	11,000
Carbon Tetrachloride	56-23-5	0.53	14
Chlorobenzene	108-90-7	0.54	760
Chloroethane	75-00-3	0.54	150,000
Chloroform	67-66-3	0.54	3.6
Chloromethane	74-87-3	0.53	1,400
cis-1,2-Dichloroethene	156-59-2	0.53	N/A
cis-1,3-Dichloropropene	10061-01-5	0.52	N/A
Cumene	98-82-8	0.54	6,100
Cyclohexane	110-82-7	1.1	91,000
Dibromochloromethane	124-48-1	0.54	N/A

Table B-3b
Target Reporting Limits for Soil Vapor
Remedial Investigation Quality Assurance Project Plan
Sea K Fish Cleanup Site – Blaine, Washington

Analyte	CAS No.	Target Reporting Limits	
		Soil Vapor ($\mu g/m^3$)	PSL (a)
Dichlorodifluoromethane (CFC 12)	75-71-8	0.53	1,500
d-Limonene	5989-27-5	0.54	N/A
Ethanol	64-17-5	5.2	N/A
Ethyl Acetate	141-78-6	1.1	1,100
Ethylbenzene	100-41-4	0.54	15,000
Hexachlorobutadiene	87-68-3	0.53	3.8
m,p-Xylenes	179601-23-1	1.1	N/A
Methyl Methacrylate	80-62-6	1.1	11,000
Methyl tert-Butyl Ether	1634-04-4	0.54	320
Methylene Chloride	75-09-2	0.53	2,200
Naphthalene	91-20-3	0.52	2.5
n-Butyl Acetate	123-86-4	0.55	N/A
n-Heptane	142-82-5	0.54	6,100
n-Hexane	110-54-3	0.54	11,000
n-Nonane	111-84-2	0.54	N/A
n-Octane	111-65-9	0.54	N/A
n-Propylbenzene	103-65-1	0.54	15,000
o-Xylene	95-47-6	0.54	N/A
Propene	115-07-1	0.53	N/A
Styrene	100-42-5	0.53	15,000
Tetrachloroethene	127-18-4	0.52	320
Tetrahydrofuran (THF)	109-99-9	0.55	30,000
Toluene	108-88-3	0.54	76,000
trans-1,2-Dichloroethene	156-60-5	0.54	610
trans-1,3-Dichloropropene	10061-02-6	0.53	N/A
Trichloroethene	79-01-6	0.54	11
Trichlorofluoromethane	75-69-4	0.53	11,000
Trichlorotrifluoroethane	76-13-1	0.54	76,000
Vinyl Acetate	108-05-4	5.4	3,000
Vinyl Chloride	75-01-4	0.54	9.5

Acronyms/Abbreviations:

CAS = Chemical Abstracts Service
CUL = cleanup level
EPA = US Environmental Protection Agency
$\mu g/m^3$ = micrograms per cubic meter
PSL = preliminary screening level

Note:

(a) Minimum of Method B sub-slab soil gas noncancer and cancer CULs.

Table B-4
Sample Containers, Preservatives, and Holding Times
Remedial Investigation Quality Assurance Project Plan
Sea K Fish Cleanup Site – Blaine, Washington

Matrix	Analyte	Method	Container	Preservative	Holding Time (a)	Laboratory
Soil	TPH-G	NWTPH-G	2 x 40 mL vial	Cool to < 6°C, MeOH	14 days	ALS
Sediment	TPH-G	NWTPH-G	4 oz jar (b)	Cool to < 6°C	14 days	ALS
Soil/Sediment	TPH-D, TPH-O	NWTPH-Dx	4 oz jar (b)	Cool to < 6°C	14 days	ALS
Soil/Sediment	BTEX	EPA 8021	3 x 40 mL vial	Cool to < 6°C, 1 vial MeOH	14 days	ALS
Soil/Sediment	PAHs	EPA 8270E SIM	4 oz jar (b)	Cool to < 6°C	14 days	ALS
Soil/Sediment	SVOCs	EPA 8270E	4 oz jar (b)	Cool to < 6°C	14 days	ALS
Soil/Sediment	Metals	EPA 6020B	4 oz jar (b)	Cool to < 6°C	6 months	ALS
Soil/Sediment	Mercury	EPA 7471B	4 oz jar (b)	Cool to < 6°C	28 days	ALS
Soil/Sediment	PCBs	EPA 8082	4 oz jar (b)	Cool to < 6°C	1 year	ALS
Soil/Sediment	Total Organic Carbon	SM 5310C	4 oz jar (b)	Cool to < 6°C	14 days	ALS
Soil/Sediment	Grain Size/Hydrometer	ASTM D422	1 gallon plastic bag	N/A	N/A	ALS
Groundwater/ Surface Water	TPH-G	NWTPH-G	2 x 40 mL vial	Cool to < 6°C, HCl	14 days preserved 7 days unpreserved	ALS
Groundwater/ Surface Water	TPH-D, TPH-O	NWTPH-Dx	2 x 500 mL Amber	Cool to < 6°C	7 days	ALS
Groundwater/ Surface Water	BTEX	EPA 8021	2 x 40 mL vial	Cool to < 6°C, HCl	14 days preserved 7 days unpreserved	ALS
Groundwater/ Surface Water	SVOCs	EPA 8270E	2 x 500 mL Amber	Cool to < 6°C, HCl	7 days/40 days	ALS
Groundwater/ Surface Water	cPAHs	EPA 8270E SIM	2 x 500 mL Amber	Cool to < 6°C, HCl	7 days/40 days	ALS
Groundwater/ Surface Water	Dissolved Metals	EPA 6020B	500 mL HDPE	Cool to < 6°C HNO_3 (c)	6 months	ALS
Groundwater/ Surface Water	Dissolved Mercury	EPA 7470A	500 mL HDPE	Cool to < 6°C HNO3 (c)	28 days	ALS
Soil Vapor	VOCs	TO-15/TO-15 SIM	6-L Summa	N/A	30 days	ALS

Table B-4
Sample Containers, Preservatives, and Holding Times
Remedial Investigation Quality Assurance Project Plan
Sea K Fish Cleanup Site – Blaine, Washington

Notes:

(a) Time from sample collection to extraction/time from sample extraction to analysis.

(b) Combined analytical suite may be analyzed using 1-8 oz jar per sample.

(c) Metals will be field-filtered.

Acronyms/Abbreviations:

^{o}C = degrees Celsius
ALS = Analytical Laboratory Services, Inc.
ASTM = ASTM International
BTEX = benzene, ethylbenzene, toluene, total xylenes
EPA = US Environmental Protection Agency
HCl = hydrochloric acid
HDPE = high-density polyethylene
HNO_3 = nitric acid
L = liter
LAI = Landau Associates, Inc.
mL = milliliter
N/A = not applicable
NWTPH-Dx = Northwest Total Petroleum Hydrocarbon extended-range diesel analysis
NWTPH-G = Northwest Total Petroleum Hydrocarbon gasoline analysis
oz = ounces
cPAHs = carcinogenic polycyclic aromatic hydrocarbons
SIM = selected ion monitoring
SM = Standard Methods
SVOCs = semivolatile organic compounds
TPH-D = diesel-range total petroleum hydrocarbons
TPH-G = gasoline-range total petroleum hydrocarbons
TPH-O = oil-range total petroleum hydrocarbons
UCT = universal cell technology
VOCs = volatile organic compounds

APPENDIX C

Health and Safety Plan

Work Location Personnel Protection and Safety Evaluation Form

Sea K Fish Remedial Investigation

Project Number:	001041.010	Reviewed by:	Christine Kimmel
Prepared by:	Stephanie Renando	Date:	January 15, 2021
Date:	January 15, 2021		

A. Work Location Description

1.	**Project Name:**	Sea K Fish Cleanup
2.	**Location:**	225 Sigurdson Avenue, Blaine, WA
3.	**Anticipated Activities**	Direct-push drilling, soil and groundwater grab sampling, groundwater well installation, well development and sampling, overwater sediment sampling, surface water sampling, and sub-slab vapor pin installation and sampling.
4.	**Size:**	0.6 acres
5.	**Surrounding Population:**	Boat marina, marine industries, commercial, public parks
6.	**Buildings/Homes/Industry:**	Industry, commercial buildings
7.	**Topography:**	Flat
8.	**Anticipated Weather:**	Mostly dry and sunny
9.	**Unusual Features:**	Working next to bulkhead in need of repairs and under pier, which also needs repairs. Working from a watercraft up to 500 feet from shoreline.
10.	**Site History:**	The Port has owned the upland areas since the mid-1940s and leased this property to various tenants, including fish processing operators. Contamination at the property was confirmed from historical commercial activities associated with underground storage tanks, petroleum distribution, and a hydraulic press used for fish oil production. Petroleum contamination has been confirmed at the site above MTCA Method A cleanup levels (CULs). Known contaminant concentrations are summarized in Section 5 of this plan.

B. Hazard Description

1. Background Review: ☒ Complete ☐ Partial

If partial, why?

2. Hazardous Level: ☐ B ☐ C ☒ D ☐ Unknown

Justification: Limited contact with environmentally impacted media

3. Types of Hazards: (Attach additional sheets as necessary)

A. ☒ Chemical ☒ Inhalation ☒ Explosive
☒ Biological ☒ Ingestion ☐ O_2 Def. ☒ Skin Contact

Describe: Inhalation, ingestion, and direct skin contact with environmentally impacted media. Proper PPE and monitoring to be conducted. Potential explosive if elevated subsurface vapors are encountered. Site work will be conducted during the coronavirus (COVID-19) pandemic, proper protective measures will be established to minimize biological spread (see Attachment B).

B. ☒ Physical ☐ Cold Stress ☒ Noise ☒ Heat Stress ☐ Other

Describe: Likely hazards at the site are exposure to soil, soil dust, groundwater, surface water, and/or sediment containing total petroleum hydrocarbons (TPH) contaminants. Proper PPE will be worn with upgraded PPE kept on site and will be worn if necessary (as described below). Other hazards include working near drill rigs, forklifts, near and over water, and near void spaces behind bulkhead, and working with hand-operated power tools.

C. ☐ Radiation

Describe:

4. Nature of Hazards:

☒ Air Describe: Possible exposure to volatile organic compounds (VOCs), TPH, and silica in concrete drilling dust. Drilling indoors will implement dust suppression methods using water and vacuum. Wash hands and face prior to eating and do not eat while drilling or handling samples. COVID-19 protective measures include: wearing a face mask at all times while on site, maintaining a minimum 6-foot separation from others, and not sharing equipment/supplies.

☒ Soil and Sediment Describe: Possible exposure to metals, semivolatile organic compounds (SVOCs), PCBs, VOCs, and TPH in soil. Nitrile gloves will be worn when handling soil and equipment to minimize dermal contact with soil. Conduct screening with PID and visual indication for potentially impacted soil. Wash hands and face prior to eating and do not eat while drilling or handling samples.

☒ Surface Water Describe: Sediment samples will be collected during low tide from shoreline. Surface water could be impacted with SVOCs, PCBs, VOCs, and TPH. Use buddy system when sampling and be cautious of trip and drowning hazards and water level in marina.

☒ Groundwater Describe: Possible exposure to groundwater during drilling activities and sampling activities. Groundwater could be impacted with SVOCs, PCBs, VOCs, and TPH. Nitrile gloves and safety glasses will be worn when handling groundwater and sampling equipment.

☐ Other Describe:

5. Chemical Contaminants of Concern ☐ N/A

Contaminant	PEL (ppm)	IDLH (ppm)	Source/Quantity Characteristics	Route of Exposure	Symptoms of Acute Exposure	Instruments Used to Monitor Contaminant
Total petroleum hydrocarbons	100	400	Diesel concentrations in soil may be up to 12,000 mg/kg and up to 23,000 µg/L in groundwater, and 10,000 µg/L in surface water. Gasoline concentrations in soil may exceed 1,100 mg/kg and 1,000 in µg/L groundwater. Diesel and gasoline concentrations detected in shallow sediment, and likely in surface water where sheen is present.	Inhalation, skin/eye absorption, ingestion	Irritation of eyes, skin, mucous membrane; dermatitis; headaches; lassitude; blurred vision; dizziness; slurred speech; confusion; convulsion; chemical pneumonitis (aspiration liquid); possible liver, kidney damage (potential occupational carcinogen)	Olfactory signs, visual screening for sheen
Benzene, toluene, ethylbenzene, and xylenes (BTEX) (protective for benzene)	1.0	100/5.0	Benzene concentrations detected in soil up to 0.94 mg/kg and 4.7 µg/L in groundwater.	Inhalation, skin/eye absorption, ingestion	Irritated eyes, skin, nose, and respiratory system; giddiness; headache; nausea; staggered gait; dermatitis; fatigue; anorexia (carcinogenic)	PID and/or Draeger tube
PCBs	1 mg/m^3	5 mg/m^3	PCB concentrations detected in soil	Inhalation, skin/eye absorption, ingestion	Irritated eyes; chloracne; liver damage; reproductive effects (potential occupational carcinogen)	Dust control

PAHs [protective to benzo(a)pyrene]	0.2 mg/m^3	80 mg/m^3	Some polycyclic aromatic hydrocarbons (PAHs) detected in soil and known benzo(a)pyrene up to 0.87 mg/kg in soil.	Inhalation, skin/eye absorption	Dermatitis; bronchitis (potential occupational carcinogen)	Dust control
Arsenic	0.010 mg/m^3	5 mg/m^3	Potential soil and groundwater concentrations above MTCA CULs.	Ingestion, dermal contact	Vomiting; abdominal pain; diarrhea; numbness and tingling in extremities; muscle cramping	Dust control
Lead	0.050 mg/m^3	100 mg/m^3	Potential soil and groundwater concentrations above MTCA CULs.	Ingestion, dermal contact	Weakness/exhaustion; insomnia; facial pallor; abdominal pain; anemia; irritated eyes	Dust control
Mercury	0.05 mg/m^3	10 mg/m^3	Potential soil and groundwater concentrations above MTCA CULs.	Inhalation eye contact, dermal contact	Irritated eyes, skin; cough; chest pains	Dust control

Notes:

6. Physical Hazards of Concern ☐ N/A

Hazard	Description	Location	Procedures Used to Monitor Hazard
Heavy machinery/equipment	Moving parts of drill rig can result in injury to appendages or digits. Moving rigs or forklifts are a hazard for collisions.	Near drill rig	Alert observation of surroundings; minimize time spent near drill rig; no loose clothing; wear highly visibly safety vest. Make eye contact with driller prior to advancing near the rig. Isolate work area from the public with barriers (cones, caution tape).
Uneven terrain or obstacles on ground in work area.	Slips, trips, and falls.	Uneven terrain underneath pier inside building where subsidence has occurred	Visual observations. Keep work area clear of obstacles. Keep hands free when moving on uneven terrain.
Weather stress	Overheating can lead to heat stress, stroke, or dehydration.	All areas of site	Have drinking water accessible, wear appropriate clothing (light for heat, warm for cold), and take short breaks as needed.
Overhead and underground utilities	Falling objects and damage to utilities.	All areas of site	Wear hardhat at all times. Review of available utility site maps along with public and private utility locating service will be conducted. No intrusive work to be conducted within 20 feet of overhead power lines.
Explosive vapors in subsurface explorations	Elevated organic vapors and possible sparks from drill rig.	Explorations with possible non-aqueous phase liquid	Properly ground drill rig to prevent sparks, monitor borehole vapor and oxygen concentrations.

Hazard	Description	Location	Procedures Used to Monitor Hazard
Travel to and from site	Motor vehicle accidents.	Route to and from site from Landau Associates office	Operate motor vehicle while well rested and physically able to drive safely. Conduct pre-trip vehicle inspection; all vehicles to be maintained and in good working order. Obey all traffic laws including no cell phone use while driving. Secure all cargo properly to avoid shifting. Allow sufficient time for travel to site at safe speeds. Engage emergency brake when parking vehicles. Establish planned route prior to departure.
Working from a watercraft	Slips, trips, falls, hypothermia, and drowning.	Marine sediment investigation	Alert observation of surroundings; minimize time spent near moving sampling equipment; no loose clothing; wear highly visibly safety vest and approved personal floatation device. Make eye contact with boat and sampling equipment operator prior to adjusting work space or when watercraft is in motion.
COVID-19 virus	Transmission of virus.	All areas of the site	Wear face mask, maintain minimum 6-foot separation from other, do not share equipment/supplies, and disinfect hands/face.

7. Work Location Instrument Readings ☐ N/A

Location:	
Percent O_2:	Percent LEL:
Radioactivity:	PID:
FID:	Other:
Other:	Other:
Other:	Other:

Location:	
Percent O_2:	Percent LEL:
Radioactivity:	PID:
FID:	Other:
Other:	Other:
Other:	Other:

Location:	
Percent O_2:	Percent LEL:
Radioactivity:	PID:
FID:	Other:
Other:	Other:
Other:	Other:

Location:	
Percent O_2:	Percent LEL:
Radioactivity:	PID:
FID:	Other:
Other:	Other:
Other:	Other:

8. Hazards Expected in Preparation for Work Assignment ☐ N/A

Describe:

C. Personal Protective Equipment

1. Level of Protection

☐ A ☐ B ☐ C ☒ D

Location/Activity: Soil, groundwater, surface water, and sediment sampling

☐ A ☐ B ☒ C ☐ D

Location/Activity: If action levels are observed or exceeded, see Appendix A.

2. Protective Equipment (specify probable quantity required)

Respirator ☐ N/A

- ☐ SCBA, Airline
- ☐ Full-Face Respirator
- ☒ Half-Face Respirator (Cart. organic vapor) (Only if upgrade to Level C)
- ☐ Escape mask
- ☐ None
- ☐ Other: COVID-19 face mask
- ☒ Other: Ear plugs

Clothing ☐ N/A

- ☐ Fully Encapsulating Suit
- ☐ Chemically Resistant Splash Suit
- ☐ Apron, Specify:
- ☒ Tyvek Coverall (only if upgrade to Level C)
- ☐ Saranex Coverall
- ☐ Coverall, Specify
- ☒ Other: High-visibility vest
- ☒ Other: Life jacket (working near/on waterway)

Head & Eye ☐ N/A

- ☒ Hard Hat
- ☐ Goggles
- ☐ Face Shield
- ☒ Safety Eyeglasses
- ☐ Other:

Hand Protection ☐ N/A

- ☒ Undergloves; Type:
- ☐ Gloves; Type:
- ☐ Overgloves; Type:
- ☐ None
- ☐ Other:

Foot Protection ☐ N/A

- ☒ Neoprene Safety Boots with Steel Toe/Shank
- ☐ Disposable Overboots
- ☐ Other: Steel-toed boots

3. Monitoring Equipment ☐ N/A

- ☐ CGI
- ☐ O_2 Meter
- ☐ Rad Survey
- ☒ Detector Tubes (optional)

Type: Benzene

- ☒ PID
- ☐ FID
- ☐ Other

D. Decontamination

Personal Decontamination ☒ Required ☐ Not Required
If required, describe: Wash hands often and disinfect with alcohol wipes, avoid hand to mouth contact, and exchange PPE often.
Equipment Decontamination ☒ Required ☐ Not Required
If required, describe:

All sampling equipment will be decontaminated using wet decontamination procedures:

- Wash and scrub equipment with Alconox/tap water solution.
- Rinse with tap water.
- Rinse with de-ionized water.
- Repeat entire procedure or any parts of the procedure, as necessary.

In addition to the wet decontamination procedures, other measures will be taken to prevent cross-contamination. These measures include changing out disposable gloves between each sampling location, using fresh paper towels at each sampling location, maintaining a clean work area, and working from known or suspected "clean" areas of the site toward more environmentally impacted areas.

Non-dedicated, down-the hole drilling and sampling equipment will be decontaminated between borings using a hot-water steam cleaner. Decontamination water will be stored for disposal. When possible, investigation will be conducted from "clean" areas toward more environmentally impacted areas.

E. Activities Covered Under This Plan

Task No.	Description	Preliminary Schedule
016	Direct-push drilling for soil and groundwater sampling, sediment sampling, and surface water sampling	February/March 2021
016	Monitoring well installation, development and sampling	April/May 2021

F. Subcontractor's Health and Safety Program Evaluation

☐ **N/A**

Name and Address of Subcontractor: Cascade Drilling Inc.
19404 Woodinville Snohomish Road
Woodinville, WA 98072

Item	Evaluation Criteria: Adequate	Inadequate	Comments
Medical Surveillance Program	☒	☐	
Personal Protective Equipment Availability	☒	☐	
Onsite Monitoring Equipment Availability	☒	☐	
Safe Working Procedures Specification	☒	☐	
Training Protocols	☒	☐	
Ancillary Support Procedures (if any)	☐	☐	
Emergency Procedures	☒	☐	
Evacuation Procedures Contingency Plan	☒	☐	
Decontamination Procedures Equipment	☒	☐	
Decontamination Procedures Personnel	☒	☐	

General Health and Safety Program Evaluation: ☒ Adequate ☐ Inadequate

Additional Comments: Health and safety program approved per the language in basic agreement between Landau Associates and Cascade Drilling

Evaluation Conducted by: Christine Kimmel Date: 1/15/21

Emergency Facilities and Numbers

Hospital: PeaceHealth St. Joseph Medical Center
2901 Squalicum Parkway, Bellingham, WA 98225
Directions: See next page

Telephone: 360-734-5400

Emergency Transportation Systems (Fire, Police, Ambulance) -- 911

Emergency Routes – Map (next page)

Emergency Contacts:

Name	Offsite	Onsite
Stephanie Renando	425-329-0252	509-863-3900
Christine Kimmel	425-329-0254	206-786-3801

In the event of an emergency, do the following:

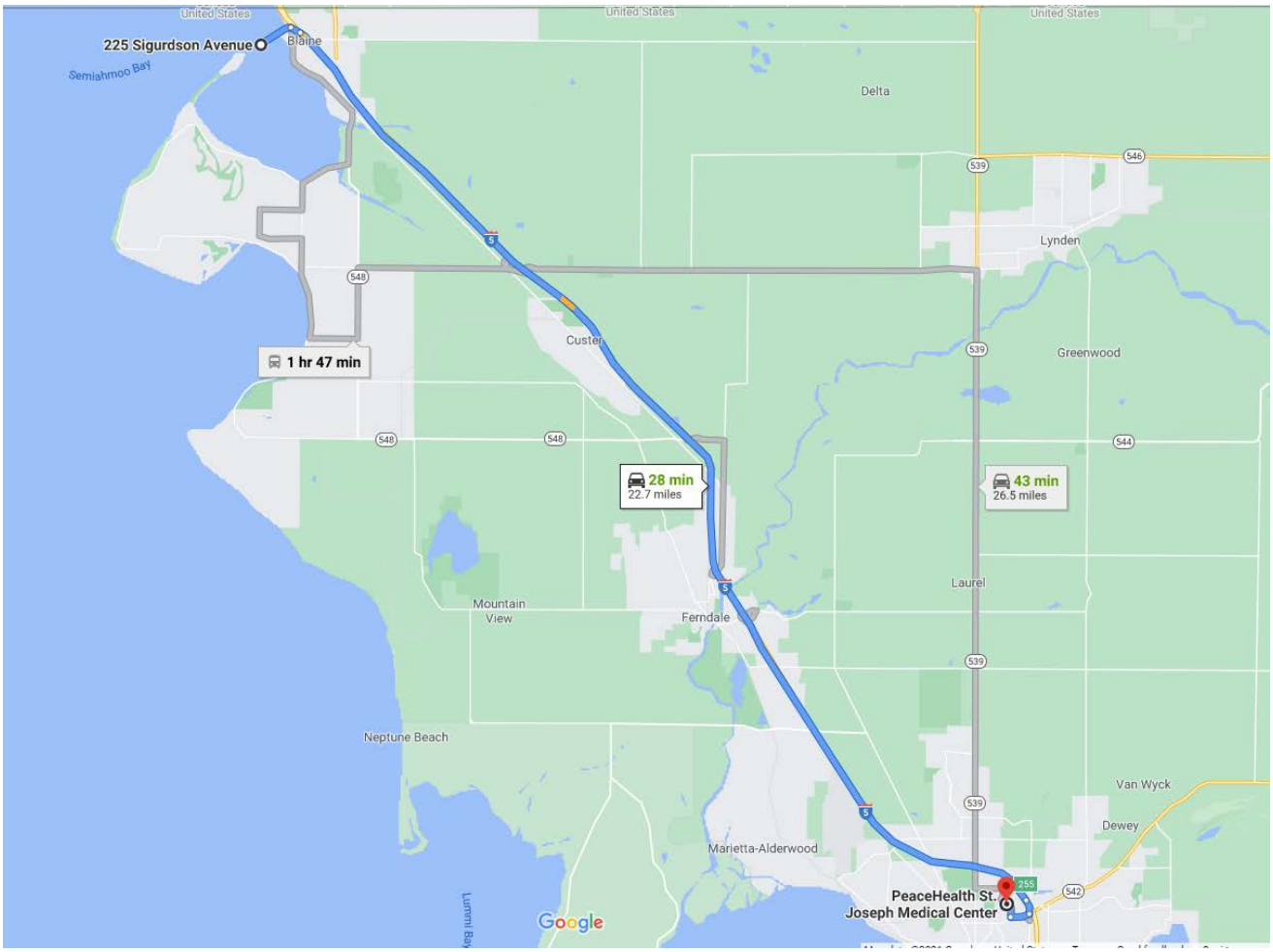
1. Call for help as soon as possible. Call 911. Give the following information:
    - WHERE the emergency is – use cross streets or landmarks
    - PHONE NUMBER you are calling from
    - WHAT HAPPENED – type of injury
    - WHAT is being done for the victim(s)
    - YOU HANG UP LAST – let the person you called hang up first.
2. If the victim can be moved, paramedics will transport to the hospital. If the injury or exposure is not life-threatening, decontaminate the individual first. If decontamination is not feasible, wrap the individual in a blanket or sheet of plastic prior to transport.

Route to Hospital

225 Sigurdson Ave
Blaine, WA 98230

- Get on I-5 S
  4 min (0.8 mi)
- Follow I-5 S to E Sunset Dr in Bellingham. Take exit 255 from I-5 S
  20 min (21.2 mi)
- Continue on E Sunset Dr to your destination
  4 min (0.7 mi)

PeaceHealth St. Joseph Medical Center
2901 Squalicum Pkwy, Bellingham, WA 98225



Health and Safety Plan
Approval/Sign Off Form

I have read, understood, and agreed with the information set forth in this Health and Safety Plan (and attachments) and discussed in the Personnel Health and Safety briefing.

Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Stephanie Renando	Stephanie Renando	1/15/2021
Site Safety Coordinator	Signature	Date
Christine Kimmel	Christine Kimmel	1/15/21
LAI Health and Safety Manager	Signature	Date
Project Manager	Signature	Date

Personnel Health and Safety Briefing Conducted by:

Name	Signature	Date

Attachment A
Action Levels for Respiratory Protection

Monitoring Parameter	Reading	Level of Protection
Organic Vapors	PID readings 0.5 to 0.9 ppm in breathing zone for more than 1 minute.	Collect colorimetric tube for benzene readings and refer to action levels below.
	PID reading >15 ppm at point of operations for more than 1 minute	Establish 25-foot diameter exclusion zone around work area, monitor worker's breathing zone
	PID reading >25 ppm in worker's breathing zone for more than 1 minute or instantaneous reading >50ppm	Upgrade to Level C-half face respirator with organic vapor/HEPA cartridge, establish contamination reduction zone with waste containers and decontamination fluids provided for personal decontamination
Colorimetric Tube	PID reading >75 ppm in worker's breathing zone for more than 1 minute.	Evacuate area and move upwind to allow vapors to dissipate, may resume work in Level C PPE after vapors dissipate.
	Benzene 0.05 to 0.1 ppm	Establish 25-foot diameter exclusion zone around water area and upgade to Level C PPE.
	Benzene >0.1 ppm	Evacuate area and move upwind. Establish 50-foot diameter exclusion zone around work area. Notify LAI health and safety manager.
Contaminated Particulates	Visible Dust	Stop work and control dust with water, resume work. If dust persists, upgrade to Level C – half-face respirator with organic vapor/HEPA combination cartridges.
Explosive Vapors	>10%LEL	Discontinue work immediately and allow vapors to reduce to background prior to resuming work.

Attachment B
COVID-19 Field Guidance and Best Practices

The COVID-19 pandemic continues to be rapidly evolving, and Landau Associates, Inc. (LAI) continues to work diligently to provide services using protective guidance from global and regional health authorities to help protect the health and safety of our employees, the public, and our clients. This attachment has been prepared to provide guidance on managing the risks associated with COVID-19 for LAI employees that perform or manage field work.

Symptoms

People infected with COVID-19 may have little to no symptoms and in some cases, symptoms (when they appear) can take up to 14 days to present after exposure to COVID-19. Symptoms can include the following: fever, cough, and difficulty breathing.

Worksite Considerations

Employees working on project sites or in client settings will work to maintain LAI's company standards and will work transparently with the client to coordinate work approaches. Such topics include, but are not limited to:

- Site Access
- Social Distancing and Working in Isolation
- Fitness for Duty
- Emergency Responses.

Site Access

Prior to mobilization to the project site, the field lead will contact the client to verify that LAI has access to the site and to determine if any new clearance or site procedures are present related to the COVID-19 outbreak.

In addition to reaching out to our clients, LAI will contact vendors and subcontractors to evaluate their capacity to meet project milestones. We will work closely with the vendors and subcontractors to minimize impacts on project timing.

Social Distancing and Working in Isolation

Health and governing agencies are requiring social distancing as a method to flatten the contagion curve of the virus. Washington and Oregon both have a "Stay at Home" or "Shelter in Place" ruling, which are currently in effect. All non-essential businesses have been temporarily shut down to enforce the social distancing requirements. Additionally, large gatherings in crowded places have also been temporarily stopped. Experts recommend staying a minimum of 6 feet away from others.

LAI employees are asked to follow the direction of regional government and health agencies regarding social distancing or other measures by maintaining a minimum of 6 feet separation between people. If an LAI employee needs to be within 50 feet of others, a face mask/shield will be worn. Field employees are asked to practice social distancing by driving separate vehicles to a project site and work

independently (as much as the task will allow) by not sharing tools and/or equipment. If reasonably practicable, conduct toolbox meetings outside, practice social distancing, and keep group sizes small.

LAI's field services are typically operated independent of project site operations, and we require very little to no assistance. Our field services are also typically conducted by working in isolation by placing safety cones and/or barriers around the work area to minimize interaction with the public.

Where possible, adjust work planning to maximize social distancing between workers, teams, and site personnel.

If a meeting must take place in-person on site, meet outdoors whenever possible. If indoors or under shelter, the meeting location must be large enough to permit 6 feet of separation between attendees; surfaces will be wiped down prior to convening the meeting; hand sanitizer and wipes must be available to all participants; invitees will be asked not to attend if they are not feeling well; person-to-person contact must be avoided (shaking hands, etc.); and all attendees are reminded to cover any coughs or sneezes using the crook of their arm.

Fitness for Duty

As part of the fitness-for-duty checks, LAI's field employees are asked to confirm that they are in good health and are symptom-free. They must verify that they:

- Do not have any of the following symptoms: fever (no matter how mild), new onset or an exacerbation of chronic cough, or difficulty breathing; and
- Have not traveled outside their home country within the last 14 days; and
- Have not had close contact with a confirmed or probable COVID-19 case or a person who has been outside your home country in the last 14 days.

The following personal hygiene and wellness practices are recommended to prevent or control the transmission of viruses:

- Wash your hands with soap and water for at least 20 seconds after using toilet facilities, before and after eating, after handling potentially contaminated or infectious materials, after removing hand protection and other personal protective equipment (PPE), and after sneezing, coughing, or touching your face. When soap and water are not available, use an alcohol-based hand sanitizer.
- Avoid touching your eyes, nose, and mouth with unwashed hands.
- Cover your mouth and nose when coughing or sneezing with a tissue or the crook of your elbow. Throw the used tissue in the trash and wash your hands.
- Maintain vehicles through regular cleaning and disinfecting of surfaces.
- Do not share tools or equipment (e.g., cell phones, shovels, etc.) between employees without disinfecting them first.
- Avoid handling common-use items such as pens and clipboards; equip each worker with their own. If it is necessary to have common-use items, include them in the cleaning and disinfecting cycle outlined below.
- Get adequate rest, eat a healthy and balanced diet, and stay hydrated.

If an LAI employee experiences signs or symptoms of illness, they are advised to distance themselves from others and notify their supervisor. Supervisors and managers will work with the Corporate Health and Safety Manager and the Human Resources Director to help manage the response.

Cleaning and Disinfecting

COVID-19 can survive on different surfaces but can be killed by most cleaners and disinfectants. To prevent transmission of COVID-19 while cleaning, good hygiene measures and consistent use of appropriate PPE is recommended. Cleaning refers to the removal of germs, dirt, and impurities from surfaces. Cleaning does not kill germs; but by removing them, it lowers their numbers and the risk of spreading infection. Disinfecting refers to using chemicals to kill germs on surfaces. This process does not necessarily clean dirty surfaces or remove germs, but by killing germs on a surface after cleaning, it can further lower the risk of spreading infection.

All LAI offices are routinely cleaned and disinfection practices have been implemented. Employees are asked to practice routine cleaning of frequently touched surfaces (e.g., vehicle door handles, interior of vehicle such as steering wheel and control panel, equipment controls, handles, stair railings, toilet facility doors, etc.) with household cleaners and disinfectants that are appropriate for the surface, following label instructions.

It is important to keep vehicles clean. Each vehicle has an ample supply of clean tissues and hand sanitizer, as well as cleaning supplies and disinfectants. Employees are asked to clean vehicles after each use and wear appropriate PPE when cleaning.

COVID-19 Field Guidance and Best Practices 4 April 14, 2020

Drinking Water

A reasonable supply of potable drinking water is to be kept readily accessible at the project site for the use of workers. Drinking water is to be supplied from a piping system, individual servings, or from a clean, covered container with a drain faucet or pump. Workers will be given a sanitary means of drinking the drinking water and must not be required to share a common drinking container. If using water coolers to provide drinking water, wear clean gloves to operate the spigot and verify that a clean source of disposable cups is available. Verify that the cooler is cleaned and sanitized on a regular basis. If using bottled water sources, employees should take measures such as labeling bottles to avoid drinking out of someone else’s bottle.

Personal Protective Equipment

LAI shall review the site-specific health and safety plans and requirements for PPE prior to mobilization to the site. Required PPE shall be donned prior to leaving the vehicle at the site.

LAI has PPE available for employees consisting of disposable nitrile gloves, soap, and disinfectant solutions. Additionally, each employee routinely conducting field services has been trained and fit with a personnel respirator with high-efficiency particulate air (HEPA) filter cartridges. The personnel respirators are rated above an N95 mask for protection against airborne particles and chemicals. Respirators will be worn in confined spaces and while working inside facility buildings.

If field services are being conducted in the open air, employees will be encouraged to wear either face masks/shields or N95 masks. Masks/shields are easily acceptable and provide a semipermeable barrier

to ward against sneezes and airborne spray from the person wearing the shield to others. The supply of N95 masks is limited on a global basis; however, LAI will continue to seek the purchase of N95 masks as they become available.

Gloves shall be worn to match the type of work to be conducted and may consist of, but not be limited to: nitrile gloves, cotton gloves, or leather gloves.

APPENDIX D

Inadvertent Discovery Plan

Remedial Investigation Inadvertent Discovery Plan Sea K Fish Cleanup Site Blaine, Washington

July 8, 2021

Prepared for

Port of Bellingham
Bellingham, Washington

LANDAU ASSOCIATES

155 NE 100th St, Ste 302
Seattle, WA 98125
206.631.8680

TABLE OF CONTENTS

ATTACHMENT

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1.0 INTRODUCTION

This Inadvertent Discovery Plan (IDP) outlines procedures to perform in the event of the discovery of archaeological materials or human remains during work activities, in accordance with state and federal laws.

2.0 RECOGNIZING CULTURAL RESOURCES

A cultural resource discovery could be prehistoric or historic. Some examples include:

- An accumulation of shell, burned rocks, or other food-related materials
- Bones or small pieces of bone
- An area of charcoal or very dark-stained soil with artifacts
- Stone tools or waste flakes (e.g., an arrowhead or stone chips)
- Clusters of tin cans or bottles, logging or agricultural equipment that appears to be older than 50 years
- Buried railroad tracks, decking, or industrial materials.

If the item(s) inadvertently discovered are unknown in age and origin, assume the material is a cultural resource. See Attachment D-1 for photographs of the examples of the items listed above.

3.0 ONSITE RESPONSIBILITIES

Step 1: *Stop Work.* If an employee, contractor, or subcontractor believes that he or she has uncovered a cultural resource at any point in the project, project work must stop immediately. Notify the appropriate party(s). Leave the surrounding area untouched, and provide a demarcation adequate to provide for the security, protection, and integrity of the discovery. The discovery location must be secured at all times by a temporary fence or other form of onsite security.

Step 2: *Notify Licensed Archaeologist/Cultural Resource Specialist.* This project does not have an established Archaeological Monitor. In the event of an inadvertent discovery, Landau Associates, Inc. (LAI) will contact the following licensed Archaeologist/Cultural Resource Specialist in the Bellingham, Washington area.

- Caldera Archaeology, LLC
  1155 North State, Suite 428
  Bellingham, Washington 98227
  (360) 332-2600

Step 3: *Notify the Project Manager.* Notify the Port of Bellingham Project Manager, involved consultant and subcontractor Project Managers, and the Washington State Department of Ecology (Ecology) Project Manager, or other applicable contacts:

Company Tile	Name	Phone	Email
Port of Bellingham Project Manager	Ben Howard	(360) 715-7365	benh@portofbellingham.com
LAI Project Manager	Jeremy Davis	(206) 601-7614	jdavis@landauinc.com
Ecology Project Manager	Cris Matthews	(360) 255-4379	cris.matthews@ecy.wa.gov

The Project Manager or applicable representative will make the necessary calls and notifications. If human remains are encountered, treat them with dignity and respect at all times. Cover the remains with a tarp or other materials (not soil or rocks) for temporary protection and to shield them from being photographed. **Do not call 911 or speak with the media. Do not take pictures unless directed to do so by representatives of the Washington State Department of Archaeology and Historic Preservation (DAHP).**

4.0 FURTHER CONTACTS AND CONSULTATION

Project Manager Responsibilities (LAI):

- Project Find: The Project Manager (LAI) is responsible for taking appropriate steps to protect the discovery site, if a cultural resource is discovered. Work will stop immediately in a surrounding area adequate to provide for the complete security of the location, the protection, and the integrity of the resource. Vehicles, equipment, and unauthorized personnel will not be permitted to traverse the discovery site. Work in the immediate area will not resume until treatment of the discovery has been completed following provisions for treating archaeological/cultural material as set forth in this document.
- Direct Construction Elsewhere: The Project Manager may direct construction away from the discovered cultural resources to work in other areas prior to contacting the concerned parties.
- Contact Senior Support Staff: If the Senior Support Staff person has not yet been contacted, the Project Manager must do so.

Senior Support Staff/Delegated Cultural Resource Specialist Responsibilities:

- Identify the Find: The Senior Support Staff (or delegated Cultural Resource Specialist), will ensure that a qualified professional archaeologist examines the area to determine if an archaeological find has been identified.
  - If it is determined not to be an archaeological or historic find, or human remains, work may proceed with no further delay.
  - If it is determined to be an archaeological find, the Senior Support Staff or Cultural Resource Specialist will continue with necessary notifications.
  - If the find may be human remains or funerary objects, the Senior Support Staff or Cultural Resource Specialist will ensure that a qualified physical anthropologist examines the find. If it is determined to be human remains, refer to the procedure described below.

- Notification of DAHP: The Senior Support Staff (or delegated Cultural Resource Specialist) will contact the involved agencies (if any) and the DAHP.
- Notification of Tribes: If the discovery may be of interest to Native American Tribes, the DAHP and Ecology Coordinator will coordinate with the interested and/or affected tribes.

Washington State Department of Archaeology and Historic Preservation contacts:

Name	Title	Phone
Dr. Allyson Brooks	State Historic Preservation Officer	(360) 586-3066 allyson.brooks@dahp.wa.gov
Rob Whitlam, Ph.D.	Staff Archaeologist	(360) 586-3050 rob.whitlam@dahp.wa.gov

5.0 SPECIAL PROCEDURES FOR THE DISCOVERY OF HUMAN SKELETAL MATERIAL

Human skeletal remains, regardless of antiquity or ethnic origin, will at all times be treated with dignity and respect. Photographs will not be taken at any time, unless pre-approved to do so.

The LAI Project Manager and project team will comply with applicable state and federal laws for non-federal lands, and the following procedure:

1) In all cases you must notify a law enforcement agency or Medical Examiner/Coroner's Office
    a. The LAI Project Manager or designated member of the project team will comply with actions described above and immediately notify the local law enforcement agency or medical examiner/coroner's office.
    b. The Medical Examiner/Coroner (with assistance of law enforcement personnel) will determine if the remains are human, whether the discovery site constitutes a crime scene, and will then notify DAHP.
        i. Bellingham Police Department
        505 Grand Avenue
        Bellingham, Washington 98225
            1. Emergency phone number: 911
            2. Non-Emergency phone number: (360) 778-8804
            3. Main Office: (360) 778-8800
2) Participate in Consultation:
    a. Per the Revised Code of Washington (RCW; RCW 27.44.055, RCW 68.50, and RCW 68.60), DAHP will have jurisdiction over non-forensic human remains. Ecology staff will participate in consultation.
3) Further Activities:
    a. Documentation of human skeletal remains and funerary objects will be agreed upon through the consultation process described in RCW 27.44.055, RCW 68.50, and RCW 68.60.

b. When consultation and documentation activities are complete, construction in the discovery area may resume as described above.

6.0 DOCUMENTATION OF ARCHAEOLOGICAL MATERIALS

Archaeological deposits discovered during construction will be assumed eligible for inclusion in the National Register of Historic Places (under Criterion D) until a formal Determination of Eligibility is made.

Project staff will ensure the proper documentation and field assessment will be made of discovered cultural resources in cooperation with the involved parties: federal agencies (if appropriate), DAHP, Ecology, affected tribes, and a contracted consultant (if required).

Prehistoric and historic cultural material discovered during project activities will be recorded by a professional archaeologist/cultural resource specialist on a cultural resource site or isolate form using standard and approved techniques. Site overviews, features, and artifacts will be photographed; stratigraphic profiles and soil/sediment descriptions will be prepared for minimal subsurface exposures. Discovery locations will be documented on scaled site plans and site location maps.

Cultural features, horizons, and artifacts detected in buried sediments may require further evaluation using hand-dug test units. Units may be dug in controlled fashion to expose features, collect samples from undisturbed contexts, or to interpret complex stratigraphy. A test excavation unit or small trench might also be used to determine if an intact occupation surface is present. Test units will be used only when necessary to gather information on the nature, extent, and integrity of subsurface cultural deposits to evaluate the site's significance. Excavations will be conducted using state-of-the-art techniques for controlling provenance, and the chronology of ownership, custody, and location recorded with precision.

Spatial information, depth of excavation levels, natural and cultural stratigraphy, presence or absence of cultural material, and depth to sterile soil, regolith, or bedrock will be recorded for each probe on a standard form. Test excavation units will be recorded on unit-level forms, which will include plan maps for each excavated level, and material type, number, and vertical provenance (depth below surface and stratum association where applicable) for the artifacts recovered from the level. A stratigraphic profile will be drawn for at least one wall of each test excavation unit, as appropriate.

If relevant, sediments excavated for purposes of cultural resources investigation will be screened through ⅛-inch mesh, unless soil conditions warrant ¼-inch mesh.

Prehistoric and historic artifacts collected from the surface and from probes and excavation units will be analyzed, catalogued, and temporarily curated. Ultimate disposition of cultural materials will be determined in consultation with the federal agencies (if appropriate, DAHP, Ecology, and the affected tribes.

Within 90 days of concluding field activities, a technical report describing the monitored and resultant archaeological excavations will be provided to the Project Manager (LAI), who will forward the report for review and delivery to Ecology, the federal agencies (if appropriate), DAHP, and the affected tribe(s).

If assessment activities expose human remains (e.g., burials, isolated teeth, or bones), the procedures described above will be followed.

7.0 PROCEEDING WITH WORK

Work outside the discovery location may continue while documentation and assessment of the archaeological/cultural resources proceeds. A professional archaeologist/cultural resource specialist must determine the boundaries of the discovery location. In consultation with Ecology, DAHP, and affected tribes, the Project Manager (LAI) will determine the appropriate level of documentation and treatment of the resource. If there is a federal nexus, Section 106 consultation and associated federal laws may need to be considered to support the final determinations about treatment and documentation.

Project work may continue at the discovery location only after the procedures outlined in this IDP are followed and the Project Manager (LAI), DAHP, any affected tribes, Ecology (and the federal agencies, if appropriate) determine that compliance with state and federal law is complete.

8.0 RECIPIENT/PROJECT PARTNER RESPONSIBILITY

This IDP must be immediately available on site, be implemented to address any discovery, and be available by request by any party.

9.0 USE OF THIS REPORT

This IDP has been prepared for the exclusive use of the Port of Bellingham for specific application to Sea K Fish Remedial Investigation project. No other party is entitled to rely on the information, conclusions, and recommendations included in this document without the express written consent of LAI. Further, the reuse of information, conclusions, and recommendations provided herein for extensions of the project or for any other project, without review and authorization by LAI, shall be at the user's sole risk. LAI warrants that within the limitations of scope, schedule, and budget, our services have been provided in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions as this project. LAI makes no other warranty, either express or implied.

ATTACHMENT D-1

Support for Inadvertent Discovery Plan Implementation

Implement the IDP if …

You see chipped stone artifacts.

- Glass-like material
- Angular
- “Unusual” material for area
- “Unusual” shape
- Regularity of flaking
- Variability of size

Implement the IDP if …

You see ground or pecked stone artifacts.

- Striations or scratching
- Unusual or unnatural shapes
- Unusual stone
- Etching
- Perforations
- Pecking
- Regularity in modifications
- Variability of size, function, and complexity

Implement the IDP if …

You see bone or shell artifacts.

- Often smooth
- Unusual shape
- Carved
- Often pointed if used as a tool
- Often wedge shaped like a "shoehorn"

Bone Awls from Oregon and Bone Wedge from California

Implement the IDP if …

You see bone or shell artifacts.

- Often smooth
- Unusual shape
- Perforated
- Variability of size

Implement the IDP if …

You see fiber or wood artifacts.

- Wet environments needed for preservation
- Variability of size, function, and complexity
- Rare

Artifacts from Mud Bay, Olympia, Washington

Implement the IDP if …

You see historic period artifacts.

Artifacts from Downtown Seattle, Alaskan Way Viaduct (Upper Left and Lower) and Unknown Site (Upper Right)

Implement the IDP if …

You see strange, different or interesting looking dirt, rocks, or

- Human activities leave traces in the ground that may or may not have artifacts associated with them
- “Unusual” accumulations of rock (especially fire-cracked rock)
- “Unusual” shaped accumulations of rock (e.g., similar to a fire ring)
- Charcoal or charcoal-stained soils
- Oxidized or burnt-looking soils
- Accumulations of shell
- Accumulations of bones or artifacts
- Look for the “unusual” or out of place (e.g., rock piles or accumulations in areas with few rock)

Implement the IDP if …

You see strange, different or interesting looking dirt, rocks, or

- "Unusual" accumulations of rock (especially fire-cracked rock)
- "Unusual" shaped accumulations of rock (e.g., similar to a fire ring)
- Look for the "unusual" or out of place (e.g., rock piles or accumulations in areas with few rock)

Site on Muckleshoot Indian Reservation, near WSDOT ROW along SR 164

Implement the IDP if …

You see strange, different or interesting looking dirt, rocks, or

- Often have a layered or “layer cake” appearance
- Often associated with black or blackish soil
- Often have very crushed and compacted shells

Implement the IDP if …

You see historic foundations or buried structures.