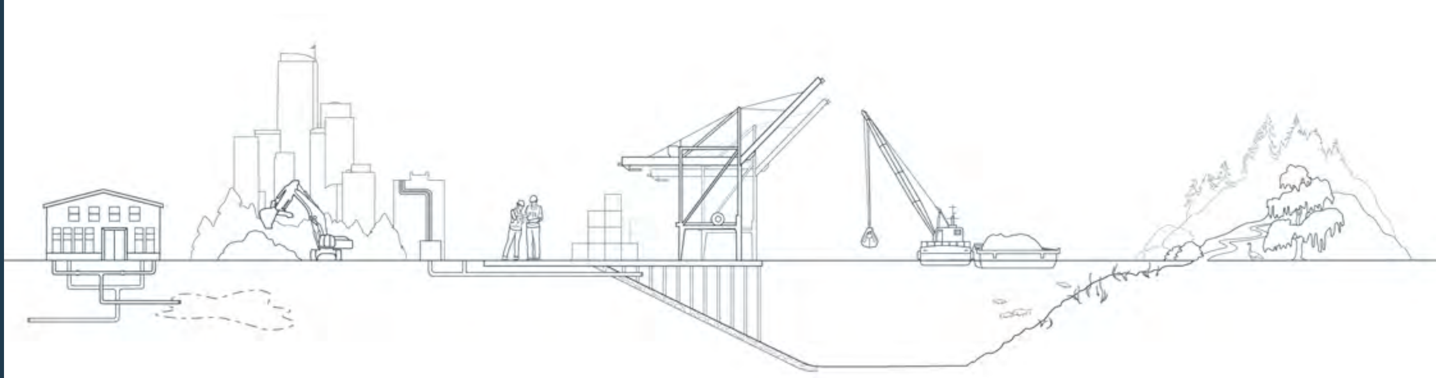
Remedial Investigation/Feasibility Study Work Plan

Silver Bay Logging Site

Prepared for
Seattle Public Utilities

May 2023



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The interpretations and conclusions contained in this report are based in part on site characterization data collected by others or obtained by publicly available sources. Floyd|Snider cannot assure the accuracy of this information.

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List of Abbreviations

Abbreviation	Definition
American Gypsum	American Gypsum Recycling-2, LLC
AO 5	Fifth Amendment to the Administrative Order on Consent for Remedial Investigation/Feasibility Study
AO	Agreed Order
AOC	Administrative Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirement
AST	Aboveground storage tank
BAZ	Biologically active zone
BER	Business environmental risk
bgs	Below ground surface
BSAF	Biota-sediment accumulation factor
BTEX	Benzene, toluene, ethylbenzene, and xylenes
City	City of Seattle
cm	Centimeters
COC	Contaminants of concern
COI	Contaminant of interest
COPC	Contaminant of potential concern
cPAH	Carcinogenic polycyclic aromatic hydrocarbon

Abbreviation	Definition
CSCSL	Confirmed and Suspected Contaminated Sites List
CSL	Cleanup Screening Level
CSM	Conceptual Site Model
CSO	Combined sewer overflow
CUL	Cleanup level
CVOC	Chlorinated volatile organic compound
DCA	Disproportionate Cost Analysis
DCE	*cis*-1,2-Dichloroethene
DDA	1,1-Dichloroethane
DQO	Data quality objective
DRO	Diesel-range organics
Ecology	Washington State Department of Ecology
EM	Electromagnetic
ESA	Environmental site assessment
FOD	Frequency of detection
FOE	Frequency of exceedance
GPR	Ground-penetrating radar
GRO	Gasoline-range organics
ISGP	Industrial Stormwater General Permit
LDWG	Lower Duwamish Waterway Group
LDW Middle Reach	River Mile 1.6 to River Mile 3.0 of the Lower Duwamish Waterway
LDW	Lower Duwamish Waterway
MCL	Maximum contaminant level
µg/L	Micrograms per liter
mg/kg	Milligrams per kilograms
mg/L	Milligrams per liter
MHHW	Mean higher high water
MLLW	Mean lower low water
MtBE	Methyl *tert*-butyl ether
MTCA	Model Toxics Control Act
NAVD 88	North American Vertical Datum of 1988
ORO	Oil-range organics
OWS	Oil-water separator
PCB	Polychlorinated biphenyl
PCE	Tetrachloroethene

Abbreviation	Definition
PCUL	Preliminary cleanup level
PDI	Pre-design Investigation
PID	Photoionization detector
PLP	Potentially liable person
PQL	Practical quantitation limit
project	South Park Water Quality Facility project
Property	Silver Bay Logging Property
PSL	Preliminary screening levels
QAPP	Quality Assurance Project Plan
RAL	Remedial action level
RAO	Remedial action objectives
RCRA	Resource Conservation and Recovery Act
REC	Recognized environmental conditions
RGI	Riley Group, Inc
RI/FS Work Plan	Remedial Investigation/Feasibility Study Work Plan
ROD	Record of Decision
ROW	Right-of-way
SAP	Sampling and Analysis Plan
SCUM	Sediment Cleanup User's Manual
Site	Silver Bay Logging Site
SMS	Sediment Management Standards
SPU	Seattle Public Utilities
SVOC	Semivolatile organic compound
TBT	Tributyltin
TCE	Trichloroethene
TCLP	Toxicity characteristic leaching procedure
TEE	Terrestrial ecological evaluation
TEQ	Toxic equivalent
TPH	Total petroleum hydrocarbons
USEPA	U.S. Environmental Protection Agency
UST	Underground storage tank
VOC	Volatile organic compound
WAC	Washington Administrative Code
XRF	X-ray fluorescence

1.0 Introduction

This Remedial Investigation/Feasibility Study Work Plan (RI/FS Work Plan) was prepared for the Silver Bay Logging Site (Site) pursuant to Agreed Order (AO) DE 21418 between the Washington State Department of Ecology (Ecology) and Silver Bay Logging and RJ & BA, LLC (collectively the potentially liable persons [PLPs]). This RI/FS Work Plan documents the scope, technical approach, and implementation details for completing an RI/FS addressing contamination located around 816 and 836 S. Kenyon St, 803 and 811 S. Chicago St, and 7760 and 7808 8th Ave S., Seattle, Washington (defined as the Silver Bay Logging Property [Property]).

The Site is currently on the Ecology's database of Confirmed and Suspected Contaminated Sites List (CSCSL), listed as Independent Metals Plant 2 under Facility/Site ID #16139 and Cleanup Site ID #12300. The PLPs have entered into an AO with Ecology to perform a Remedial Investigation for the Site, and to develop a Feasibility Study and Draft Cleanup Action Plan for the remediation of the uplands portion of the Site. The Property additionally lies adjacent to the Lower Duwamish Waterway (LDW) and contaminated sediments in the adjacent waterway are within the middle reach of the LDW Superfund Site. The LDW Superfund Site remedial action addresses sediments that pose a risk to humans from potential exposure to polychlorinated biphenyls (PCBs), arsenic, carcinogenic polycyclic aromatic hydrocarbons (cPAHs), and dioxins/furans, and to benthic invertebrates from exposure to PCBs and phthalates (USEPA 2014). Sediment cleanup adjacent to the Property will be concurrently evaluated through the LDW Superfund Site cleanup process.

Per the Washington State Model Toxics Control Act (MTCA; Washington Administrative Code [WAC] 173-340-100), the term Site can be defined as where hazardous substances have come to be located. The Site boundary will be refined as part of the RI work and will be documented in the RI/FS report. For clarity in this report, Site will be used when referring to the area of contamination resulting from releases at the Property, which may extend off-Property. A Study Area is additionally defined for the FS in the AO, and it consists of the Site above the elevation of mean higher high water (MHHW) of the adjacent Duwamish River. The boundaries of the Study Area will be refined in the RI/FS report. Figure 1.1 presents the geographic setting of the Property.

In a formal agreement with Silver Bay Logging, Seattle Public Utilities (SPU) has agreed to perform the RI and develop the RI/FS report required by the AO. SPU has assumed responsibility to conduct the RI/FS as part of an option to purchase a portion of the Property as the location for SPU's South Park Water Quality Facility project (Water Quality Facility project, or project). SPU is currently focused on the acquisition and cleanup of a portion of the Property. Following acquisition and cleanup, the Property will be the location for a regional stormwater quality treatment facility that is a critical piece of infrastructure in the City of Seattle's (City's) Plan to Protect Seattle's Waterways and is required to meet the City's obligations under a consent decree with Ecology's Water Quality Division (Combined Sewer Overflow [CSO] Control Consent Decree Action No. 2:13-cv-678). SPU is also committed to developing a significant portion of the Property to support community goals. Construction of the Water Quality Facility is expected to begin directly after Ecology approval of a cleanup action for the Study Area.

This RI/FS Work Plan has been prepared by Floyd|Snider, under contract to SPU and HDR, Inc., on behalf of the PLPs.

1.1 PURPOSE OF THE REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

The purpose of this RI/FS Work Plan is to describe the investigation activities that will be completed to characterize the nature and extent (both vertically and horizontally) of contamination in environmental media to provide sufficient information to evaluate and select cleanup actions. The RI/FS Work Plan is a specific requirement of the AO and complies with MTCA requirements (WAC 173-340-350). It also incorporates existing information collected as part of previous environmental investigation efforts at the Site. The RI/FS Work Plan includes a Sampling and Analysis Plan (SAP) and a Quality Assurance Project Plan (QAPP) that describe the organization, objectives, and specific quality assurance/quality control procedures for field and laboratory activities associated with sample collection proposed for the RI data collection and analyses.

1.2 REGULATORY BACKGROUND

The following sections summarize the Site's regulatory history.

1.2.1 Toxics Cleanup Program

The Site has been listed on Ecology's CSCSL since 2009. Ecology issued a Site Hazard Assessment in 2016 (Ecology 2016) and assigned an overall hazard ranking of 4, on a scale of 1 (most hazardous) to 5 (least hazardous). The hazard ranking was assigned primarily based on exceedances of water quality criteria in stormwater discharges from the Property and the presence of contaminants at elevated concentrations in samples of sediment collected from the Property's stormwater collection system.

1.2.2 Water Quality

Construction of the South Park Water Quality Facility will be completed by SPU pursuant to a Consent Decree with the Ecology's Water Quality Division (CSO Control Consent Decree Action No. 2:13-cv-678). The Consent Decree requires the City to implement a long-term control plan to address violations of criteria established under the Clean Water Act in stormwater discharge from municipal sewer outfalls. The water quality treatment facility must be completed prior to the Consent Decree deadline. The City is currently in negotiation with Ecology to extend the Consent Decree deadline to 2030.

Current stormwater discharges by the Property tenant, American Gypsum Recycling-2, LLC (American Gypsum), are monitored and reported under Industrial Stormwater General Permit (ISGP) WAR308860. Additional details regarding current and historical stormwater permits are presented in Section 3.3.

1.2.3 LDW Superfund Site

The City, King County, Port of Seattle, and Boeing Company (referred to collectively as the Lower Duwamish Waterway Group [LDWG]) entered into an Administrative Order on Consent for Remedial Investigation/Feasibility Study with the U.S. Environmental Protection Agency (USEPA) and Ecology to address the cleanup for the LDW Superfund Site in December 2000 (USEPA 2000). The shoreline of the Property lies adjacent to the LDW in the middle reach of the LDW Superfund Site. The LDW Superfund Site, Record of Decision (ROD; USEPA 2014) defines the selected remedy. The Fifth Amendment to the Administrative Order on Consent for Remedial Investigation/Feasibility Study (AO 5) addresses River Mile 1.6 to River Mile 3.0 of the LDW (LDW Middle Reach), which includes sediments adjacent to the uplands of the Property that are below the elevation of MHHW between approximately River Mile 2.8 and River Mile 3.0. The source control strategy for the LDW includes controlling sources before commencing in waterway remediation. Ecology is the lead agency for implementing the source control actions. USEPA intends to commence remedial action after a source control determination is made. Stormwater quality improvements achieved by the completion of the South Park Water Quality Facility will serve as one of the source control measures for the LDW.

1.3 DOCUMENT ORGANIZATION

This RI/FS Work Plan is organized in the following manner:

- **Section 2.0—Property Background.** Describes the physical setting, historical operations, and current land use at the Property and the immediate Property vicinity. Supporting appendices to this section include Appendix A (Historical Aerial Photographs and Current Conditions Information)
- **Section 3.0—Summary of Previous Investigations and Remedial Actions.** Describes the results of environmental investigations at the Property and adjacent LDW sediments and summarizes the scope of previous work to address contaminated media at the Property. Supporting appendices to this section include Appendix B (Soil Boring and Monitoring Well Installation Logs).
- **Section 4.0—Preliminary Conceptual Site Model.** Presents a description of the physical setting, contaminant transport, and exposure pathways at the Site.
- **Section 5.0—Preliminary Screening Level Development and Contaminants of Interest.** Provides a summary of the process to identify the preliminary screening levels (PSLs) based on Applicable or Relevant and Appropriate Requirements (ARARs) and the potential exposure and transport pathways; and presents an evaluation of contaminants of interest (COIs) based on existing environmental data and information about Property use.
- **Section 6.0—Proposed Remedial Investigation.** Determines data quality objectives (DQOs) for the RI and proposed environmental investigation to fulfill the DQOs. Supporting appendices to this section include Appendix C (SAP/QAPP), Appendix D (Health and Safety Plan), and Appendix E (Data Management Plan).

- **Section 7.0—Feasibility Study.** Describes how the data collected during the RI will be used to develop an FS for potential cleanup actions in the Study Area.
- **Section 8.0—Reporting and Schedule.** Presents an anticipated schedule for completion of the scope of work described in this RI/FS Work Plan and the development of RI/FS and Cleanup Action Plan reports for the Site.
- **Section 9.0—References**. Presents references cited in the RI/FS Work Plan.

2.0 Property Background

The Property comprises 2.8 acres of land along the western bank of the Duwamish River. It is bounded by S Portland Street to the north, 8th Avenue S to the west, S Kenyon Street to the south, and the Duwamish River to the east. The primary area of focus for environmental investigation includes the uplands portion of the Property above the elevation of MHHW and the adjacent vacated right-of-way (ROW) of S Chicago Street (referred to hereinafter as S Chicago Street end), which bisects the western portion of the Property. The environmental investigation will additionally include adjacent areas (above and below MHHW) where contamination associated with the Property may have come to lie. The geographic limits of the Site, defined as where contamination has come to lie, will be further defined as part of the RI.

The Property's geographic, geologic, and hydrogeologic settings, as well as current and former uses, are described in further detail in the following sections.

2.1 HISTORICAL OWNERSHIP AND OPERATIONS

Historical and current ownership of the Property and historical and current operations on the Property were determined using property sale records, information provided by Silver Bay Logging, Inc. during previous site assessments (RGI 2002, RGI 2015), historical aerial photographs, and a condition assessment of structures on the Property prepared by HDR in 2022.

2.1.1 Operations Prior to Silver Bay Logging

The Property was historically occupied by single-family residences in the majority of the upland areas. The review of available historical aerial photographs of the Property show the residential usage slowly transitioned to probable commercial/industrial uses from the 1930s through approximately the mid-1970s when industrial use began to predominate. During that time, a combination of informal public waterfront access (i.e., small boat launching) and formal waterfront industrial usage, followed by primarily formal waterfront industrial usage, was in evidence, and periodic filling produced localized areas of expanded and steepened shoreline. A significant wedge of fill material was placed along the shoreline in the northern portion of the Property before the late 1950s (refer to historical aerial photos in Appendix A1).

The earliest known commercial/industrial use on the Property was a gasoline service station/auto repair shop and battery shop, which operated in the northern corner of the Property beginning in 1929. Review of aerial photographs suggests that the gas station operations ceased in approximately 1961. Subsequent commercial/industrial property uses are summarized below. Key historical operational areas are shown on Figure 2.1.

A slug bait manufacturer, Corry's Slug Bait, conducted packing and warehouse operations on the parcel south of the S Chicago Street end from approximately 1960 until 1999 (RGI 2002). The loading area of the slug bait packing warehouse was situated along the southwest portion of the building.

A series of vessel manufacture and/or repair operations took place beginning in the early 1980s and continued through the mid-2000s, including the following:

- An entity variously operating as Marine Power & Equipment Company, Inc, Western Marine Construction, and Marine Logistics Corp. (which is also known as Marine Leasing Corp.) and successor United Marine Shipbuilding, which performed marine equipment services from approximately 1984 until 1992.
- Workboats Northwest, which manufactured aluminum-hulled workboats from approximately 1989 until 1999, and successor company North Wind Marine, which manufactured and repaired sailboats between approximately 2002 and 2005. Buildings potentially associated with boat building and repair operations appear in the central portion of the Property in aerial photographs beginning in the early 1990s, potentially associated with Workboats Northwest or earlier marine equipment services.
- Morton Marine Equipment, which performed vessel repair and maintenance from 1992 until 1997.

Several pad-mounted transformers on the Property, as well as pole-mounted transformers in the ROW south of the Property line, were noted during site assessments conducted in the 2000s (RGI 2015), which are assumed to have been conducted during boat building/repair operations. Other associated operations may have included fueling and fuel storage utilizing underground storage tanks (USTs) and aboveground storage tanks (ASTs) as shown on Figure 2.1.

2.1.2 Silver Bay Logging Operations

Silver Bay Logging, a timber and milled lumber sales company, purchased the Property in 1995 and has retained ownership. Silver Bay Logging operated at the Property between 1996 and 2015. Silver Bay Logging operations included the transfer of processed logs and milled lumber and included over-water loading/unloading and moorage in the wharf area. It is presumed that fueling and fuel storage activities on the Property continued during Silver Bay Logging's operations. Additional marine industries operated concurrently with Silver Bay Logging in buildings within the Property's southern portion. These industries included yacht builder North Wind Marine, which performed boat building and painting, and Rasmussen Wire Rope & Rigging, which manufactured synthetic harnesses. Other incidental operations during Silver Bay Logging's tenure on the Property included minor fuel, degreaser, paint, and battery storage in a shed area along the western portion of the Property and a drum and lumber storage yard in the southeast corner.

2.1.3 Independent Metals Operations

Independent Metals, a scrap metal sorting and handling facility, operated on the Property between 2006 and 2014. Independent Metals' operations included scrap metal loading in a ramp area in the central portion of the Property, loading/offloading and moorage in the wharf area, and scrap metal shredding in a warehouse building in the southern portion of the Property.

Independent Metals stored scrap metal in stockpiles and fuel and waste oil in ASTs, in various locations on the Property. Independent Metals implemented stormwater treatment in the area shown on Figure 2.1 under a National Pollution Discharge Elimination System individual permit.

2.2 CURRENT OWNERSHIP AND OPERATIONS

The Property is currently occupied by the tenant American Gypsum, a company that performs recycling of unused/damaged gypsum wallboard. American Gypsum currently maintains two large stockpiles of gypsum and paper waste on portions of the Property. The southeast portion of the Property (East Yard) was recently sold to JAMMA LLC.

Current structures on the Property include buildings with addresses 7808 8th Avenue S, 7814 8th Avenue S, 816 S Kenyon Street, and 836 S Kenyon Street, as shown on Figure 2.2. Additional structures include the shed along the west property line, which is in poor condition and not currently in use. The buildings are currently in use for office or warehouse/storage purposes.

The waterfront of the Property along the Duwamish River is approximately 650 feet long and is dominated by a dock and crane located in the northern quarter. See Appendices A2 and A3 for photos of the dock from the HDR (2022) Conditions Report and the LDWG (Windward 2018a) in-water structure assessment form. Windward (2018a) describes this structure as a pier and apron with steel pile and steel superstructure, with 20-foot by 10-foot pile spacing. The apron supports a steel-cladded building, and the shoreline is armored with riprap at a 2:1 slope. The south portion of the structure has a steel bulkhead. Additional details on the crane and superstructure are provided in the conditions assessment of the dock that was performed by SPU in 2022 (HDR 2022). There is a timber dolphin cluster for berthing north of the dock face and the adjacent property north of the structure has a shoreline access park.

South of the riprap at the edge of the dock structure and sheet pile wall, the shoreline adjacent to the Property becomes an intertidal mudflat that continues upstream past the end of Kenyon Street. The bank of the shoreline along the center portion of the Property consists of asphalt overlying fill layers that have eroded onto the mudflat, creating a steep bank angle down to the toe of the slope where the mudflat is intersected. In some places, the fill is undercut beneath the asphalt. Straw waddles have been placed on the asphalt at the top of the bank to contain surface flow at the shoreline. Along the toe of the slope and upper mudflat, there are variable amounts of riprap and other rock arming, as well as debris consisting of asphalt, concrete, and dimensional lumber. At the southern end of the Property, the shoreline bank transitions back to riprap armoring with timber pile stubs.

Access to the Main Yard portion of the Property is via a driveway that extends east from the S Chicago Street end. An additional access driveway is located along 8th Avenue S near the northern corner of the Property. Loading bays for the 816 and 836 S Kenyon Street buildings are facing S Kenyon Street. The uplands boundaries of the Property are fenced. A retaining wall runs along the south side of the storage building at 7808 8th Avenue S. The ground surface in the Property was primarily paved as of approximately 2019, and the current ground surface consists of a mixture of unpaved gravel areas, gravel surfacing overlying paved areas, asphalt, and concrete. In the future, it is anticipated that the properties purchased by SPU will be partially occupied by the water quality facility and the remaining SPU-owned portions of the uplands area will be used for community benefit purposes.

2.3 ADJACENT SITES AND FACILITIES OF INTEREST

Several contaminated sites and other facilities adjacent to the Property or in the immediate vicinity (within approximately 0.5 miles) of the Property are identified as sites of interest. These include upland cleanup sites, other upland sites with potential sources of contamination, and the adjacent LDW Superfund Site. Key findings from investigations at these adjacent sites, based on available reports and other documents available in Ecology files, reflecting the cleanup criteria selected for the sites by the authors of the documents, are below. Additionally, for sites with petroleum releases investigated prior to circa 2002, MTCA Method A cleanup levels (CULs) for soil referenced as screening or cleanup criteria did not specify whether these levels were intended to be protective of industrial or unrestricted property use. Adjacent sites of interest are shown on Figure 2.3.

2.3.1 Uplands Cleanup Sites

Upland cleanup sites include those listed on the CSCSL, which are described in the following sections.

2.3.1.1 Interstate Coatings, 754 S Chicago Street

Interstate Coatings is the site of a former painting company. In 1998, one gasoline UST was removed from the site. Soil samples collected from the UST excavation contained concentrations of gasoline and benzene, toluene, ethylbenzene, and xylenes (BTEX) exceeding their MTCA Method A CULs established at the time (ERM 1998). The additional excavation was completed to remove contaminated soils but was constrained by the active operations at the Site.

After excavation, soil borings were advanced along the perimeter of the excavation area. Benzene concentrations exceeded the MTCA Method A CUL (which was 0.5 milligrams per kilogram [mg/kg] at the time of sampling) were identified in the soil to the northeast, northwest surrounding the former UST, and off-site to the adjacent property to the north. One groundwater sample was collected from the north of the former UST and did not have detectable benzene (ERM 1998). Ecology also noted the presence of sandblast grit on the ground surface while performing a site hazard assessment in 1998; however, no further metals data were collected.

2.3.1.2 South Park Pump Station, 640 South Riverside Drive

The South Park Pump Station Site is currently owned by SPU and is located adjacent to the Duwamish River approximately 800 feet northwest of the Property (i.e., in the presumed cross-gradient direction). In 2009, soil contamination was identified in the north-northwest portion and southwest portion of the 640 South Riverside Drive property. Limited contamination was identified at 636 South Riverside Drive in the northeastern corner of the property. The contaminants in the soil were determined to be tetrachloroethene (PCE), trichloroethene (TCE), cPAHs, diesel-range organics (DRO), oil-range organics (ORO), and lead. The contaminants in groundwater were determined to be PCE, TCE, *cis*-1,2-dichloroethene (DCE), vinyl chloride, arsenic, and lead. Contamination was not found to extend off-property (PGG 2010).

SPU completed an interim cleanup at the site in 2012. Soils containing lead sufficient to create leachate with lead concentrations exceeding the Resource Conservation and Recovery Act (RCRA) regulatory level were excavated and treated with cement to render the material no longer hazardous (i.e., reduce the potential for leaching). In addition, PCE-contaminated soil was removed from the site in a separate excavation (PGG 2016a).

During groundwater monitoring in 2015, vinyl chloride exceeding the site's established screening level and MTCA Method A CUL of 0.2 micrograms per liter (µg/L) was detected in groundwater at the northeastern corner of the 636 South Riverside Drive property (PGG 2016b). Wells to the south and southwest and groundwater reconnaissance (i.e., grab) samples collected in the adjacent S Riverside Drive ROW did not have detectable vinyl chloride.

2.3.1.3 Hurlen Construction, 700 S Riverside Drive

The Hurlen Construction Site, currently owned by Hurlen Logistics, LLC, is used for construction operations. Previous occupants included multiple marine construction companies. Two USTs, which contained gasoline and diesel, were removed from the site in 1993. Approximately 60 cubic yards of soil were over-excavated below the USTs to remove gasoline-range organics (GRO) and xylenes exceeding MTCA Method A CULs established at the time, and excavation confirmation samples reportedly did not exceed CULs (Ecology 2015a).

2.3.1.4 Seattle Department of Transportation Duwamish Trail, S Portland Street

The Duwamish Trail Site is located along the S Portland Street ROW between W Marginal Way South/State Route 99 and 8th Avenue S. Soil borings were advanced in the ROW to evaluate soil and groundwater quality in preparation for the new trail and stormwater system installation.

Samples collected from fill soils above approximately 4 feet below ground surface (bgs) had elevated concentrations of ORO, cPAHs, arsenic, cadmium, and lead. Underlying native soil samples collected between 6 and 10 feet bgs were not impacted. ORO was also detected in groundwater reconnaissance samples.

In the central portion of the site (between 5th Avenue S and 7th Avenue S), ORO, cadmium, and lead exceeding the MTCA Method A CULs for unrestricted property use were detected in fill soil. This area of the site had significantly elevated concentrations of cadmium (maximum detection of 140 mg/kg, 70 times the CUL of 2 mg/kg) and lead (maximum detection of 2,100 mg/kg, 8.4 times the CUL of 250 mg/kg), and the most highly contaminated soil samples additionally had leachate lead concentrations exceeding the RCRA dangerous waste limits. These contaminated fill soils were reported to be fully removed and disposed of at a Subtitle C dangerous waste landfill during the 2014 construction (Ecology 2015b). In the eastern portion of the site (east of 7th Avenue S), ORO and arsenic exceeding the MTCA Method A CULs were detected in fill soil. ORO also exceeded the MTCA Method A CUL of 500 µg/L in groundwater (HWA 2013).

It is likely that some fill soils were also removed site-wide during grading for pavement; however, contaminated fill outside the targeted excavation is assumed to remain on the eastern portion of the site near the Property.

2.3.1.5 Marine Lumber Services, 525 S Chicago Street and 558 S Kenyon Street

Marine Lumber Services is composed of several properties. The main properties of concern near the Property are at 525 S Chicago Street and 558 S Kenyon Street.

The S Chicago Street and S Kenyon Street properties each previously had two gasoline USTs onsite. The UST areas were on the north-central portion of the S Chicago Street property and the southeast portion of the S Kenyon Street property. In June of 1994, all four tanks were removed, and the surrounding soil was excavated. GRO and BTEX exceeding the MTCA Method A CULs established at the time were detected in each post-excavation confirmation except the east sidewall of the S Kenyon Street excavation (Bison 1994).

The most elevated GRO and BTEX concentrations were detected at the S Chicago Street property, adjacent to the S Chicago Street ROW. A soil vapor extraction system was installed at this location to address the soil and groundwater contamination and was in operation from 1996 to 1998. Groundwater samples collected between 1998 and 2000 east of the USTs also had GRO and benzene concentrations exceeding the MTCA Method A CULs established at the time, with GRO and benzene detected at 24,000 µg/L and 10 µg/L, respectively, during the most recent reported sampling event. An oxygen-reducing compound was also reported to have been applied circa 2000; however, it is unknown whether any further remediation was performed. It is presumed that GRO contamination in soil and groundwater extends north into the S Chicago Street ROW nearby (QUEST 2001).

No further remedial action was documented at the S Kenyon Street property. It is assumed that the contaminated soil remains onsite to the north, south, and west and may also extend off-site to the south. Groundwater was not encountered during the UST excavation at this location, and no subsequent groundwater sampling has been documented.

2.3.1.6 Olympic Steel Door, 7800 7th Avenue S

Olympic Steel Door is a manufacturer of steel doors and frames. In 1988, a fuel oil UST located adjacent to the S Holden Street ROW was reportedly removed from the site. In October 2000, the contaminated soil surrounding the former UST was excavated. Soil with GRO exceeding the MTCA Method A CUL established at the time was left in place along the southern sidewall of the excavation, but GRO did not exceed the CULs at the other sidewalls (Global Environmental 2000).

Groundwater samples collected from a monitoring well to the south of the excavation had concentrations of GRO and total xylenes exceeding the MTCA Method A CULs established at the time in 2000 and again during subsequent sampling in 2002, with GRO most recently detected at 930 µg/L (EAI 2002). Groundwater to the east and west of the excavation did not have detectable GRO during any sampling events.

2.3.1.7 Long Painting, 8025 10th Avenue S

Long Painting was a commercial painting facility that began operations in 1973. In 1997, Phase I and Phase II environmental site assessments (ESAs) were conducted at the 5-acre parcel with the transfer of property ownership. Six monitoring wells were installed during this work, and soil and groundwater samples were collected and analyzed for total petroleum hydrocarbons (TPH) and BTEX. No compounds were detected (AGRA 1997).

In 1998, a UST closure was conducted onsite with the removal of two 10,000-gallon unleaded gasoline and diesel fuel USTs. Confirmation samples indicated that detectable DRO less than the MTCA Method A CUL established at the time was present in excavated soil and did not remain at the excavation limits. Groundwater was not encountered during the excavations, at 13 feet bgs. Two fiberglass USTs were installed in the same location as the removed USTs (AGRA 1998).

From 2000 to 2002, a site assessment and voluntary cleanup action was conducted in response to a historical diesel spill. The site assessment detected metals and volatile organic compounds (VOCs) in the soil (arsenic, TCE, and PCE) and metals in the groundwater (arsenic, chromium, and lead). Three USTs were decommissioned—two were removed from the property, while one was abandoned in place due to access issues. Two areas with TCE- and PCE-contaminated soils associated with a concrete sump were excavated. All confirmation soil samples indicated metals and/or VOC concentrations were less than applicable MTCA Method A CULs established at the time (Kleinfelder 2002). A No Further Action status was granted by Ecology for the soil and groundwater associated with this work on February 4, 2003.[1]

In 2003, the two 10,000-gallon fiberglass fuel USTs installed in 1998 were removed from the property. All confirmation soil samples were analyzed for GRO, DRO, ORO, and BTEX and were either not detected or less than the MTCA Method A CULs. A reconnaissance water sample collected from the bottom of the excavation was analyzed for GRO, DRO, ORO, BTEX, methyl *tert*-butyl ether (MtBE), and total lead, and it exceeded MTCA Method A CULs for GRO benzene, MtBE, and total lead. As a result, six geoprobe borings were advanced to 16 feet bgs around the UST area to determine whether the reconnaissance water sample was representative of the aquifer conditions. One groundwater sample was collected from each boring and analyzed for GRO, BTEX, and MtBE. All sample results were non-detect (RETEC 2003).

2.3.1.8 Duwamish Waterway Park, 7900 10th Avenue S

The Duwamish Waterway Park spans approximately 1.7 acres and includes a play area, picnic area, and beach with river access. The park is currently owned and operated by Seattle Parks and

1 https://apps.ecology.wa.gov/cleanupsearch/site/4732

Recreation and is currently in the process of entering into an AO with Ecology to fulfill remaining data gaps and assess remaining contamination (Ecology 2023).

After preliminary soil investigations in 2014 and 2019 and an Initial Investigation in 2020, an RI of the park was submitted to Ecology. Interim actions at the site began in October 2020 under the Voluntary Cleanup Program, which included soil excavation, removal, and replacement with clean fill; construction of concrete pathways; installation of various capping technologies; and placement of vegetation and sod material. A revised RI including information detailing the interim actions was submitted to Ecology; however, Ecology's Opinion Letter, in response, determined that significant data needs must be resolved—mainly the characterization of contamination in soil, groundwater, and surface water—before reaching a No Further Action determination.

Contaminants in the soil at the Duwamish Waterway Park include arsenic, lead, mercury, other metals, halogenated organics, non-halogenated organics, PCBs, and cPAHs. These contaminants are also suspected in groundwater and surface water.[2] The CULs for this Site are expected to be established in a future Cleanup Action Plan prepared under the AO.

2.3.2 Other UST Sites

Other USTs recorded in Ecology records without reported leaks may be sources of contamination if the tanks have not been properly maintained. The likelihood of releases increases as the UST ages and potentially corrodes or sustains other damage. In the Ecology UST files, many tanks have default dates of installation and removal, indicating that it is of indeterminate age and records were not maintained of the tank removal. Additional USTs of interest identified in the vicinity include the following:

- West Fork Nelson, 7918 8th Avenue S: one 1,000-gallon leaded gasoline UST
- Northern Freight Lines, 730 S Chicago Street: one UST of unknown size and contents

2.3.3 Lower Duwamish Waterway

The Property is situated adjacent to the middle reach of the LDW Superfund Site, located from RM 1.6 to RM 3.0. The Property abuts the LDW Middle Reach from approximately RM 2.8 to RM 3.0. The elevation of MHHW[3] (9.02 feet NAVD 88) defines the upper boundary of the LDW Superfund Site, as described in USEPA's ROD (USEPA 2014). PLP property ownership extends generally to the top of the bank above MHHW, although there are some areas of intertidal sediment inside of the Property boundary line where the bank has eroded. The adjacent Duwamish River intertidal and subtidal sediments are owned by the Port of Seattle. The central portion of the waterway is a federal navigation channel that is also part of the LDW Superfund Site.

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2 https://apps.ecology.wa.gov/cleanupsearch/site/15139#site-contaminants

3 The project vertical datum is North American Vertical Datum of 1988 (NAVD 88). The elevation for MHHW is taken from NAVD 88 elevation listed in the Elevation and Datums sheets in the City of Seattle Standard Plans for Municipal Construction (https://www.seattle.gov/util/cs/groups/public/@spu/@engineering/documents/webcontent/01_029210.pdf). The ROD states "in the LDW, MHHW is 11.3 feet above the mean lower low water [MLLW] level." The elevation of MLLW (-2.34 feet NAVD 88) and MHHW are derived by the National Ocean Service using observations from the 1983–2001 tidal epoch and are approximately 11.3 feet apart.

The original estuarine habitat along Duwamish River, including for the reach adjacent to the Property, has been lost over time through filling and dredging. The Property uplands were created in part from fill placed historically in the Duwamish River and tideflats. The ROD (USEPA 2014) provides a detailed description of the history and sources of contamination to the LDW.

The overarching ROD strategy is composed of three components: identification and cleanup of early action areas at the most contaminated areas on the waterway, controlling sources of contamination, and cleanup of the remaining contamination, including long-term monitoring. The contaminants of concern (COCs) identified in the LDW ROD include metals, PAHs, PCB Aroclors, phthalates, other semivolatile organic compounds (SVOCs), and dioxin/furan congeners. Design and implementation of the cleanup in the LDW under the Superfund cleanup process is being undertaken by the LDWG. Currently, the LDWG has submitted 30% of design documents for the upstream reach (RM 3.0 to RM 5.0), and as described in Section 1.2.3, is proceeding with remedial design for the middle reach (RM 3.0 to RM 1.6; Section 3.4). The anticipated remedial technologies adjacent to the Site (up to the edge of the navigation channel) include dredging of intertidal and subtidal sediment in the area under and adjacent to the dock and monitored natural recovery for the remaining intertidal and subtidal sediment upstream of the dock.

This RI/FS is related to the second component, for which Ecology's LDW Source Control Strategy (Ecology 2016) provides an organizational framework to implement source control by federal, state, and local agencies. This RI/FS addresses the cleanup of a confirmed contaminated upland facility with potential sources of contamination to the LDW. Ecology (2022a) has established preliminary cleanup levels (PCULs) for both upland receptors addressed under MTCA and receptors addressed by ROD remedial action objectives (RAOs). The PCULs incorporate pathways for potential upland sources associated with soil and groundwater to be transported to the LDW. For the purposes of the Site RI/FS, the current stormwater system components are not considered to be a potential mechanism of future releases because the construction of the Water Quality Facility will necessitate a reconfiguration of the system to support the needs of the area-wide stormwater collection and treatment project being undertaken by SPU. As part of the source control evaluation presented in the RI/FS, details will be provided about the timing of the site cleanup, site reconfiguration, and construction of the South Park Water Quality Facility.

2.4 GEOLOGY AND HYDROGEOLOGY

The Property is in the Lower Duwamish River Valley within the south-central portion of the Puget Sound Basin in southern Seattle. This region was heavily glaciated and most of the area is underlain by up to about 330 feet of glacial drift deposited during the Vashon stade of Fraser glaciation. Vashon Drift includes lacustrine clay and silt of the Lawton Clay, lacustrine and fluvial sand of the Esperance Sand, and concrete-like Vashon till. Bedrock consists of fluvial sandstone and volcanic rocks of the Puget Group overlain by the marine-deposited Blakely Formation. Unconsolidated Quaternary deposits are typically at the surface. However, beginning in the 1890s and ending in the 1920s, the City underwent extensive regrading—removing hills, decreasing slopes, and filling in low areas—to make the City more conducive to commerce. The lower Duwamish neighborhoods were some of those low-lying areas and are therefore largely built on unengineered fill placed over estuarine mud (USGS 2001; RGI 2002).

The unengineered fill is present at the Property and is underlain by Quaternary Alluvium, consisting chiefly of sand and silt but also including clay and peat (Grant, Perkins, and Youd 1992). The ground surface at the Property is relatively flat, sloping slightly upward from the east-central and central portions to gain approximately 1 foot in elevation at the northern corner and 3 feet in elevation at the southeast corner. Per Riley Group, Inc's (RGI's) Additional Subsurface Investigation (RGI 2016), subsurface soils at the Property generally consist of silty fine sand to depths ranging from 3 to 8 feet bgs, underlain by a grey silt and/or silt interbedded with sand to depths of 9 to 18 feet bgs. The grey silt or interbedded silt and sand was underlain by fine to medium sand to depths of 22 feet bgs, the maximum depth explored. However, sample recovery was poor in the lowest intervals sampled at multiple boring locations so the lithology and depth of the lower units are not well defined.

The local hydrogeology is controlled by alluvial aquifers within the Duwamish River Valley, by Pleistocene glacial deposits in the surrounding uplands, and, at the Property, by the semidiurnal tidal cycle of the Duwamish Waterway (i.e., two high and two low tides of different magnitude every lunar day). During previous investigations, depth to shallow groundwater measured at the time of drilling ranged on-site from 2.5 to 12 feet bgs; depth to water measurements in monitoring wells ranged from 4 to 8 feet bgs during the highest water level conditions and from 9 to 13 feet bgs during the lowest water level conditions.

Hydraulic gradients at the Property range from 0.006 to 0.021 feet per foot depending on the tides. The steepest hydraulic gradient (0.021 feet per foot, or a change in elevation of approximately 2.5 feet from west to east along the portion of the Property studied) was observed during the lowest tide. In general, the groundwater flow direction is to the east toward the Duwamish River; however, a temporary reversal of groundwater flow direction to the south/southwest was measured during the highest tide (RGI 2016). The greatest tidal fluctuations in water levels occurred along the shoreline of the Duwamish River with up to 5 feet of variability observed over the tide cycle. Farther inland, tidal fluctuations resulted in water level changes of approximately 1 foot to less than 2 feet (RGI 2016). The measured lag between the high tide measurements and the highest water levels was consistently approximately 3 hours across the Property. The measured lag between the low tide measurements and the lowest water levels was more variable, ranging from 2 hours to 4.5 hours. Overall, the assumed lag between tide elevations and resultant groundwater elevations at the Property is assumed to be approximately 3 hours.

The Duwamish River discharges to the saltwater embayment of Elliott Bay approximately 3 miles downstream of the Property. Due to tidally influenced saltwater intrusion from Elliott Bay, surface water in the river is considered brackish. The depth of saltwater intrusion to groundwater in the vicinity of the Property is expected to be several meters deep due to the distance that the Property lies upstream from Elliott Bay (Dawson and Tilley 1972). The alluvial aquifer at several sites in the Duwamish Valley has been determined to be non-potable due to several factors, including the risk of saltwater intrusion from pumping, natural background concentrations of organic and inorganic constituents, and various Washington State and King County policies and statutes that prohibit the use of groundwater as a potable supply in the area (Floyd|Snider 2011, EPI 2015). A site-specific assessment of groundwater potability has not been conducted for the Property. Recharge to the shallow aquifer near the Property is mainly via infiltration of surface water through unpaved surfaces and discharge from upland aquifers to the valley.

The groundwater that occurs within the Lower Duwamish Valley alluvial deposits is generally considered to be a single large aquifer system (Booth and Herman 1998); however, hydrogeologic studies conducted at other sites in the Lower Duwamish Valley have differentiated between water-bearing zones within the larger aquifer based on characteristics such as hydraulic conductivity, vertical gradients, or salinity. At the Property, the first occurrence of groundwater has been noted in both sandy and silty units and groundwater table elevations are consistent with a hydraulically connected, tidally influenced shallow water-bearing zone. However, within the shallow water-bearing zone, the sandy units of saturated soil are expected to have greater hydraulic conductivity.

2.5 ECOLOGICAL SETTING

This section describes the ecological setting and natural resources of the upland areas and adjacent aquatic habitats. Incorporation of RI/FS data needs related to upland ecological features at the site is described in the context of a MTCA terrestrial ecological evaluation (TEE). Because the Property shoreline and Duwamish River are adjacent, the aquatic ecological receptors are addressed in the context of both MTCA (i.e., Sediment Management Standards) and the Lower Duwamish Waterway Superfund Site, ROD, and AO 5.

2.5.1 Terrestrial Ecology

Currently, the Property is mostly paved and soil and plant habitat for terrestrial ecological receptors is limited to a narrow strip along the riverbank consisting primarily of grasses, invasive species like Himalayan blackberry, and one small area of trees near the East Yard. Soil invertebrates, small mammals, and terrestrial birds would utilize this area.

Areas adjacent to the site include commercial and industrial land use to the west and mixed commercial and residential areas to the south. Some portions of these adjacent properties include habitats that could be used by terrestrial ecological receptors. These areas primarily include the vegetated areas of the bank.

2.5.2 Aquatic Ecology

The LDW is at the mouth of the Green/Duwamish River. Like other large river estuaries in Puget Sound, the surface water has a salt wedge. The wedge forms because freshwater from the river remains on the surface, and, depending on the tide and river flow, heavier salt water from Puget Sound enters the river beneath it. The ROD (USEPA 2014) reports the saltwater wedge is always present from RM 0 to RM 2.2, and sometimes reaches upriver between RM 2.2 and RM 4, depending on conditions. The Property is adjacent to the river between RM 2.8 and RM 3.0 and aquatic species would be subject to a range of salinity conditions. Currently, a dock at the north corner of the Property covers approximately 20% of the shoreline. Intertidal features in the reach consist of armored riverbanks (e.g., riprap, pilings, retaining walls, etc.) and intertidal mudflats. Subtidal sediment in the reach is erosional and subject to vessel scour (USEPA 2014).

The surface sediment, defined as the 0 to 10 centimeters (cm) interval below the mudline (i.e., the interface between bedded sediment and overlying water) is a habitat for benthic invertebrate communities and defines the biologically active zone (BAZ) for subtidal and intertidal sediment that will be compared to benthic criteria (Section 5.0). Benthic invertebrate species will be distributed based on surface water salinity, sediment grain size, organic carbon, and the regime of sediment disturbance. Like other Puget Sound estuaries, the benthic invertebrate community is dominated by worms, clams, snails, shrimps, and crabs. Intertidal areas may have clams that burrow deeper than 10 cm. For the LDW, the ROD defines the 0 to 45 cm interval as the BAZ for clams being harvested by people.

USEPA (2014) identified benthic fish like sole, sculpin, and flounder, and water column fish such as perch and herring as abundant in the LDW, in addition to salmon, which migrate to the middle reaches of the Green River and its tributaries to spawn. Salmonid species utilizing the river include coho, Chinook, chum, sockeye, pink salmon, cutthroat trout, steelhead, and bull trout. The timing of the outmigration of juvenile salmon in the LDW typically occurs between March and early August, depending on the species.

Puget Sound Chinook salmon are listed as threatened under the federal Endangered Species Act. Other relevant fish species listed as threatened under the Endangered Species Act include the coastal Puget Sound bull trout and the Puget Sound steelhead. The LDW is designated as critical habitat for bull trout and Chinook salmon. The bald eagle was delisted in 2007 under the Endangered Species Act but is protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act.

The common shorebirds and wading birds observed in the LDW are sandpipers, killdeer, and great blue herons. Bald eagles, ospreys, and great blue herons build nests on or near the river and use the river for foraging. The river provides a habitat for mammal species including harbor seals, sea lions, and river otters.

The Windward (2010) Ecological Risk Assessment evaluated risks to four types of ecological receptors of concern exposed to the contaminants in the LDW, either directly or via ingestion of prey, as listed below:

- benthic invertebrates and crabs
- fish (juvenile Chinook salmon, Pacific staghorn sculpin, English sole)
- birds (spotted sandpiper, great blue heron, osprey)
- aquatic mammals (river otter and harbor seal)

2.6 CULTURAL RESOURCES

The Duwamish River Valley setting is associated with historic and pre-contact archaeological sites. The cultural resource monitoring protocols for RI fieldwork are detailed in the SAP/QAPP (Appendix C).

3.0 Summary of Previous Investigations and Remedial Actions

This section summarizes environmental investigations and independent remedial interim actions completed at the Property to date. Previous investigations and remedial actions performed as (independent remedial actions) were completed on behalf of Silver Bay Logging and prospective Property purchasers.

Investigations completed on behalf of Silver Bay Logging were completed by RGI. The scope and key findings of RGI's work are summarized in the following sections. The data obtained by RGI are summarized in this section as they were presented in the investigation reports, in which environmental data were primarily screened relative to MTCA Method A CULs. RGI selected screening levels based on the assumption that the Property would continue to be used for industrial operations. Further discussion about the usability of the existing data and comparison of these data to screening criteria applicable to this RI/FS Work Plan, which additionally considers anticipated future community use and protection of the adjacent LDW, is presented in Section 5.2.1 and Section 6.2. Additional evaluations, without collection of data, were performed on behalf of Independent Metals by Environmental Management Services, LLC.

The locations of the previous environmental investigations and independent remedial actions are shown on Figure 3.1, and the analytical results are presented in Table 3.1 (monitoring well groundwater samples), Table 3.2 (groundwater reconnaissance samples), Table 3.3 (in situ soil samples), and Table 3.4 (excavated soil samples). Available monitoring well and soil boring logs from previous investigations are reproduced in Appendix B.

3.1 PREVIOUS INVESTIGATIONS

Previous investigations were completed by RGI and Environmental Management Services between 2002 and 2016.

3.1.1 Initial Phase 1 and Phase 2 Environmental Site Assessment (2002 to 2004)

Silver Bay Logging contracted RGI to perform a Phase 1 ESA for informational purposes in 2002 and subsequently directed RGI to perform a Phase 2 ESA in 2003 to further investigate multiple recognized environmental conditions (RECs) and other business environmental risks (BERs). RECs investigated as part of the Phase 2 ESA included the following:

- Sediments contaminated with hexachlorobenzene were identified during the characterization of the adjacent LDW Superfund Site, which had the potential to be influenced by soil conditions on the uplands portion of the Property.
- Boat building/repair operations in the current shop/warehouse building along the southern property line. Chemicals used in boat building were presumed to have included lead-based paints, solvents, and/or wood treatment preservatives.

- A small shop/shed building along the western Property line utilized by Silver Bay Logging for chemical (spent degreaser, battery, and paint thinner) storage and performance of minor engine repairs.
- Records review from the Department of Construction and Land Use, Seattle Fire Department, and Ecology identified the installation and removal of several USTs. No records were found for the removal of some of the USTs.
- A service station located on the northern corner of the Property from at least 1929 to as late as 1961, based on aerial photographs.
- USTs containing gasoline and diesel installed in the southwestern portion of the Property in 1974 and a former pump island was identified in the southeastern portion of the Property.
- Single-family residences that occupied the Property during the early to mid-1900s may have utilized heating oil USTs.

A slug bait manufacturer packing and storage facility was also identified in a building along the western property line. The shop was not identified as a REC or BER because the primary ingredient in slug bait, metaldehyde, does not have established screening levels under MTCA However, the slug bait formulation also contained traces of acetaldehyde, which is a toxin that is produced by some plants and by the human liver during the metabolism of alcohol, and the current formulation also contains carbaryl, both of which have established screening levels under MTCA.

RGI performed a search for potential USTs by surveying the Property for potential buried metallic structures using electromagnetic (EM) locating methods, then performing ground-penetrating radar (GPR) surveys in any locations containing potentially large, buried structures identified by EM. The GPR survey identified potential USTs associated with the former gasoline service station in the northern corner of the Property and in a materials storage area east of the former pump island in the southeast corner. Potential heating oil USTs associated with former residences were not identified.

RGI subsequently completed 14 direct push soil borings (SB-01 through SB-14) to depths ranging from 6 to 10 feet bgs and two hand auger borings (HA-01 and HA-02) to investigate soil quality in the vicinity of the uplands adjacent to the LDW, boat building operations, chemical storage shed, GPR-identified potential USTs, known USTs, and pump islands. Field indications of potential contamination including sheens, staining, odors, or elevated headspace volatiles measured using a photoionization detector (PID) were not encountered in the soil at any locations.

Selected soil samples were analyzed for some or all contaminants potentially associated with prior or current operations: TPH (GRO, DRO, and ORO), selected VOCs (including chlorinated VOCs [CVOCs] and BTEX), SVOCs, the RCRA list of 8 metals, and PCB Aroclors. Soil analytical results were compared to MTCA Method A CULs for industrial property use. Soil analytical results generally did not exceed CULs; however, detections of TPH, metals, and PCBs were used to inform areas of interest for further investigation of groundwater quality.

After soil analysis, RGI installed monitoring wells (MW-01 through MW-05) in five interest areas. Groundwater samples were collected immediately after installation (i.e., minimal development was performed prior to sampling) and analyzed for constituents determined by initial soil results. Groundwater contaminants were generally the same as soil contaminants; however, an expanded list of VOCs was analyzed at some locations. Groundwater results were compared to MTCA Method A CULs. Soil and groundwater results are described by the area of interest, as follows.

- **LDW Shoreline:** CVOCs and SVOCs were analyzed and not detected (less than the reporting limit of 0.13 mg/kg) in soil samples (SB-05 and SB-06). MW-01 was installed at the SB-06 boring location to measure baseline groundwater quality in the presumed downgradient direction (note that soil results are associated with MW-01 in subsequent sections of this report). CVOCs, SVOCs, and metals were analyzed in groundwater, and only arsenic exceeded the CUL. Arsenic was detected at 25 µg/L, exceeding the MTCA Method A CUL of 5 µg/L.

- **Boat Repair Operations:** CVOCs and SVOCs, were analyzed and not detected in soil (SB-11), similar to the shoreline results. Metals were detected at SB-11 at concentrations less than the MTCA Method A CULs. Most notable metals detections include lead at 110 mg/kg, which was less than the MTCA Method A CUL of 1,000 mg/kg, and mercury at 0.1 mg/kg, which was less than the MTCA Method A CUL of 2 mg/kg; barium and total chromium were also detected but at concentrations significantly less than MTCA Method A CULs. MW-02 was installed to further investigate the potential impacts from the former operations. TPH, CVOCs, SVOCs, and metals were analyzed in groundwater, and only arsenic exceeded the CUL. Arsenic was detected at 9 µg/L, exceeding the MTCA Method A CUL of 5 µg/L.

- **Chemical Storage Shed:** TPH, BTEX, SVOCs, PCBs, and metals were analyzed in soil (SB-04) and did not exceed MTCA Method A CULs. However, the total DRO+ORO concentration was 611 mg/kg, slightly elevated but less than the total DRO+ORO MTCA Method A CUL of 2,000 mg/kg. MW-03 was installed to further investigate potential TPH impacts; however, GRO, DRO, and ORO were not detected in groundwater. VOCs were analyzed in groundwater and only 2-butanone (at 26 µg/L) and toluene (at 3 µg/L) were detected, both significantly less than the MTCA Method A CULs (10,500 µg/L and 1,000 µg/L, respectively). Metals were also analyzed in groundwater and did not exceed MTCA Method A CULs; arsenic and lead were not detected, and barium was detected at 70 µg/L, less than the CUL (MTCA Method C) of 1,230 µg/L established at the time of sampling.

- **Former Service Station:** TPH, BTEX, CVOCs, and lead were analyzed and not detected in soil (SB-02). MW-04 was installed to further investigate potential impacts from the former operations. TPH, BTEX, CVOCs, SVOCs, and metals were analyzed in groundwater. Total DRO+ORO was detected at 570 µg/L, exceeding the MTCA Method A CUL for total DRO+ORO of 500 µg/L. Arsenic was detected at 12 µg/L, also exceeding its MTCA Method A CUL of 5 µg/L.

- **Southeast Corner UST and Materials Storage Area:** TPH, BTEX, CVOCs, SVOCs, PCBs, and metals were analyzed in soil samples (SB-08 and HA-02). Cadmium was detected at 9.6 mg/kg, exceeding the MTCA Method A CUL of 2 mg/kg, and low-level total PCBs were detected at 0.2 mg/kg, which is less than the MTCA Method A CUL of 1 mg/kg. MW-05 was installed to further investigate potential impacts from the former operations. VOCs, SVOCs, and metals in groundwater were generally non-detect or less than MTCA Method A CULs, except for PCE, which was detected at 16 µg/L, exceeding the CUL of 5 µg/L.
- **Southwest Corner USTs:** TPH and BTEX were analyzed and not detected in soil (SB-12, SB-14). No further groundwater investigation was performed in this area.

Based on the results of the Phase 2 investigation, RGI concluded that the primary issues included TPH impacts in groundwater from the former service station, PCE impacts to groundwater in the southeast Property corner, and arsenic in groundwater throughout the Property. The sources of PCE and arsenic in groundwater were not identified and remained a data gap to be filled by further investigation.

3.1.2 Phase 1 Environmental Site Assessment for Prospective Purchase (2015)

Environmental Management Services prepared a Phase 1 ESA on behalf of Independent Metals in support of a potential property purchase in 2010 (Environmental Management Services 2010). The Phase 1 ESA included review of available records as well as site reconnaissance.

A review of available records identified RECs at the Property consistent with prior ESA reports prepared by RGI, including the gas station/battery shop, boat building and repair operations, log yard operations, slug bait packaging, and heating oil and petroleum USTs. Off-Property RECs included the east-adjacent LDW Superfund Site and the northwest-adjacent Interstate Coatings contaminated site. Property reconnaissance, which was conducted during Independent Metals' active operations, did not find evidence of solvent use at the Property.

3.1.3 Additional Phase 1 and Phase 2 Environmental Site Assessment (2015)

Silver Bay Logging contracted RGI to perform a second Phase 1 ESA in 2015 to assess potential risks associated with owning and/or selling the Property. Silver Bay Logging then directed RGI to perform a Phase 2 ESA to further investigate RECs identified in the Phase 1, including the following:

- Groundwater contamination in the vicinity of the former service station at the north Property corner and materials storage yard in the southeast corner, which were identified during the initial Phase 2 ESA conducted in 2003. Interviews with the Silver Bay Logging's representative also identified a former residence and associated heating oil UST in the southeast corner of the Property.
- The existence of diesel and gasoline USTs, which were previously believed to have been installed in the southwest corner of the Property, but after further research

were determined to be located along the southern property line south of the current building.

- Conditions related to the lease of the Property by Independent Metals, which included stormwater permit violations, complaints filed by neighbors of metal debris falling onto the riverbank, oily staining on the ground surface, large sections of missing pavement, stockpiled scrap metal and shredder residue, and several missing or damaged monitoring wells.

RGI performed additional GPR surveying to identify potential USTs. GPR survey in the vicinity of the former service station did not reveal any new information about potential USTs related to service station operations. GPR survey along the southern property line identified four possible USTs with estimated capacities ranging from 2,600 to 14,000 gallons.

RGI subsequently installed 13 direct push soil borings (P1 through P13) to depths ranging from 5 to 15 feet bgs to further investigate potential impacts from the former service station, newly located USTs along the southern property line, and stormwater system components and oil and scrap metal storage areas associated with Independent Metals operations. Field indications of potential contamination including sheens and odors were generally encountered in shallow fill soils above approximately 3 feet bgs.

Selected soil samples were analyzed for some or all contaminants potentially associated with operations on the Property: TPH including GRO, DRO, and ORO; VOCs including BTEX and CVOCs; SVOCs; PCB Aroclors; and metals including RCRA 8, toxicity characteristic leaching procedure (TCLP), and hexavalent chromium. Groundwater reconnaissance samples were collected from seven of the boring locations and samples were also collected from three accessible monitoring wells and analyzed for some or all of the soil contaminants. Consistent with the prior investigations, soil results were compared to MTCA Method A CULs for industrial property uses. Monitoring well groundwater results were compared to both MTCA Method A CULs and surface water ARARs for the LDW[4] established at the time of sampling; groundwater reconnaissance samples, which are normally biased high due to turbidity, were collected for informational purposes and not compared to regulatory criteria. Soil and groundwater results are described by the area of interest below.

- **Former Chemical Storage Shed:** MW-03, located within the former Silver Bay Logging chemical storage shed along the west property line, was resampled. However, further soil exploration was not conducted in this area. Detected concentrations of arsenic (8.13 µg/L) and lead (167 µg/L) at MW-03 exceeded both the MTCA Method A CULs (5 and 15 µg/L, respectively) and surface water ARARs (0.018 and 0.54 µg/L, respectively).

[4] ARARs for the LDW include National Recommended Water Quality Criteria, Washington State Ambient Water Quality Criteria for protection of aquatic life and human health, MTCA Method B criteria for protection of human health, and literature values for protection of aquatic life.

- **Former Service Station:** TPH and BTEX were analyzed in soil (P4 and P5). The sample P5-2 total DRO+ORO[5] result was 3,230 mg/kg, exceeding the MTCA Method A CUL of 2,000 mg/kg. Sample P5-2 metals results also exceeded CULs; cadmium was detected at 17.4 mg/kg and lead was detected at 4,100 mg/kg, both exceeding MTCA Method A CULs of 2 mg/kg and 1,000 mg/kg, respectively. The same sample resulted in a TCLP lead leachate concentration of 111 milligrams per liter (mg/L), exceeding the RCRA regulatory level (i.e., hazardous waste classification threshold) of 5 mg/L. MW-04, which was previously installed to assess groundwater impacts related to the service station, was not found, and groundwater reconnaissance samples were therefore collected from both soil borings. TPH and BTEX were analyzed in the reconnaissance groundwater sample from P5, and results suggested that elevated concentrations of DRO and ORO were present.
- **Southeast Corner Materials Storage Area:** TPH, BTEX, CVOCs, PCBs, and metals were analyzed in soil (P12) collected adjacent to a floor drain and did not exceed MTCA Method A CULs. MW-05 was resampled and analyzed for TPH, VOCs, PCBs, and metals. The detected PCE concentration was 7.7 µg/L at MW-05, exceeding both the MTCA Method A CUL of 5 µg/L and the surface water ARAR of 0.69 µg/L. The detected arsenic concentration was 1.59 µg/L, exceeding the surface water ARAR of 0.018 µg/L but less than the MTCA CUL of 5 µg/L.
- **Southern Property Line USTs:** TPH and BTEX were analyzed in soil (P9) and were not detected. A groundwater reconnaissance sample was collected from P9 and analyzed for TPH and BTEX, which were also not detected.
- **Independent Metals Stormwater Management Areas:** DRO, ORO, and PCBs were analyzed in soil (P1 and P2) collected adjacent to stormwater catch basins. The sample P2-1 total DRO+ORO concentration was 3,150 mg/kg, exceeding the MTCA Method A CUL of 2,000 mg/kg. TPH, BTEX, CVOCs, PCBs, and metals were analyzed in the shallow (1 foot bgs) soil at P3, located adjacent to the oil-water separator (OWS); the total DRO+ORO concentration was 36,700 mg/kg, exceeding the CUL. P3 was also collocated with a scrap metal loadout area. MW-01, located adjacent to the sand filter for stormwater and near the OWS, was resampled, and a groundwater reconnaissance sample was additionally collected from boring P3. Groundwater from MW-01 was analyzed for TPH, VOCs, and PCBs, and the reconnaissance sample from P3 was analyzed for TPH. The MW-01 total DRO+ORO concentration was 1,560 µg/L, exceeding the MTCA Method A CUL of 500 µg/L. The total DRO+ORO concentration in the groundwater reconnaissance sample from P3 was also elevated.
- **Independent Metals Oil Storage:** TPH, BTEX, CVOCs, SVOCs, PCBs, and metals were analyzed in soil (P6 and P7). The total DRO+ORO concentration at P6 was

[5] During the 2015 Phase 2 ESA, RGI presented the calculated total DRO+ORO compared to the CUL for DRO, consistent with Ecology guidance. The total DRO+ORO results were not presented by RGI for this supplemental investigation or subsequent work at the Property. The total DRO+ORO values for soil and groundwater were calculated for this Work Plan for the purposes of data discussion.

117,000 mg/kg, and the concentration at P7 was 15,900 mg/kg; both exceeded the CUL of 2,000 mg/kg. At P6, the PCE concentration was 0.15 mg/kg, and the TCE concentration was 0.044 mg/kg, exceeding their respective CULs of 0.05 and 0.03 mg/kg. Multiple individual PCB Aroclors were also detected at P6 at concentrations up to 2.9 mg/kg, exceeding the CUL of 1 mg/kg. Finally, the cadmium concentration at P6 was 8.8 mg/kg, exceeding the CUL of 2 mg/kg. P6 is in the vicinity of a former hydraulic oil storage area north-adjacent to the current warehouse along the south property line. MW-02, which was previously located between the two oil storage areas, was not found and groundwater reconnaissance samples were therefore collected from both borings. Groundwater reconnaissance samples from P6 and P7 were analyzed for DRO and ORO and the sample from P6 was additionally analyzed for VOCs. The results from groundwater reconnaissance samples suggested that elevated concentrations of DRO and ORO were present in groundwater at that location, which is the approximate location of a former hydraulic fluid AST.

- **Independent Metals Scrap Metal Storage Areas:** TPH, BTEX, PCBs, and metals were analyzed in soil (P8 and P13). The total DRO+ORO concentration was 11,100 mg/kg at P8 and 58,000 mg/kg at P13, both exceeding the MTCA Method A CUL of 2,000 mg/kg. Cadmium additionally exceeded the CUL at P8; the result was 4.42 mg/kg, and the MTCA Method A CUL is 2 mg/kg. P8 is located where metal shredding waste was stored in the southwest portion of the Property adjacent to the warehouse. CVOCs and VOCs were additionally analyzed at P13 near the west property line where oily staining was observed on the ground surface, but they did not exceed CULs. A groundwater reconnaissance sample was collected from P13 and analyzed for DRO, ORO, and VOCs. VOCs at P13 were generally non-detect and all were less than MTCA Method A CULs. However, in the groundwater reconnaissance sample collected at P13, the total DRO+ORO concentration was elevated.

Based on the results of the Phase 2 ESA, RGI concluded that shallow soils had been impacted by Independent Metals operations. However, the lateral extent of impacts remained a data gap. Additional data needs included identifying the source of elevated arsenic and lead at MW-03 along the west property line, the source and extent of significantly elevated concentrations of lead and other metals in the vicinity of the former service station at the north corner of the Property, and the source of PCE in groundwater in the vicinity of MW-5 at the southeast corner.

3.1.4 Supplemental Subsurface Investigation (2016)

RGI performed additional work in 2016 to further investigate data needs identified during the 2015 Phase 2 ESA, including the following:

- Assessment of soil and groundwater to determine the potential source of elevated lead and arsenic in the vicinity of the former Silver Bay Logging chemical storage shed along the western property line.
- Delineation of lead in soil and groundwater in the vicinity of the former service station in the north corner of the Property.

- Further investigation of conditions in the southeast corner of the Property (referred to beginning in 2016 as the East Yard), including potential sources of PCE in groundwater and potential impacts related to the former residence/heating oil UST.
- Assessment of groundwater quality in key areas with impacted soil due to Independent Metals operations, including oil storage and scrap metal storage/loading.

The scope of work for this investigation also included the replacement of key existing wells damaged during Independent Metals operations and a hydrogeologic study to determine groundwater gradients and tidal effects on groundwater flow.

RGI performed an additional GPR survey in the East Yard and identified a potential heating oil UST with an estimated capacity of approximately 500 gallons. RGI subsequently installed 13 direct push soil borings (P14 through P16, P18, P19, MW-03R, MW-06 through MW-12) to depths ranging from 5 to 21 feet bgs and installed monitoring wells at 8 boring locations (MW-03R, MW06 through MW-12) to further investigate the data needs described above. In most boring locations, field indications of contamination including odor, staining, and sheen were not encountered. However, a slight odor and slight sheen were encountered at P14, MW-03R, MW-10, and MW-12 from 0.5 to 3.5 feet bgs. Some debris (wood, charcoal, and brick) was noted in fill soils from 0.5 to 16 feet bgs at P15, P16, MW-3R, MW-08, MW-09, P17/MW-11, and MW-12; no odor or sheen was observed within the debris.

Selected soil samples were analyzed for some, or all, contaminants potentially associated with operations on the Property: TPH including GRO, DRO, and ORO; VOCs including BTEX and CVOCs; SVOCs; PCB Aroclors; and metals including RCRA 8, TCLP, and hexavalent chromium. Groundwater samples were collected from all the new monitoring wells and previously installed MW-05, and a groundwater reconnaissance sample was additionally collected at P15 and analyzed for some or all of the soil contaminants. Soil results were compared to MTCA Method A CULs for industrial property use and MTCA Method B CULs. Monitoring well groundwater results were compared to MTCA Method A CULs, MTCA Method B CULs, and surface water ARARs for the LDW. Soil and groundwater results are described by the area of interest below.

- **Former Chemical Storage Shed:** TPH, BTEX, CVOCs, SVOCs, PCBs, and metals were analyzed in soil collected from the shed area and in the downgradient direction to the east (MW-03R and MW-10). Total DRO+ORO at MW-3R was detected at 8,900 mg/kg, exceeding the MTCA Method A CUL of 2,000 mg/kg. MW-03R was installed adjacent to the existing, damaged well MW-03. Wells were installed at both borings, and the original MW-03 was decommissioned. TPH, BTEX, VOCs, SVOCs, PCBs, and metals were analyzed in groundwater samples from both wells. Dissolved arsenic was detected at a concentration of 1.83 µg/L at MW-03R, exceeding the surface water ARAR CUL of 0.018 µg/L. Vinyl chloride was detected at a concentration of 0.31 µg/L at MW-03, exceeding both the ARAR CUL of 0.025 µg/L and the MTCA Method A CUL of 0.2 µg/L. Total DRO+ORO concentrations at MW-03R and MW-10 of 640 µg/L and

2,600 µg/L, respectively, also exceeded the MTCA Method A CUL of 500 µg/L. MW-10 is located approximately 60 feet east of MW-03R.

- **Former Service Station:** TPH, BTEX, and metals were analyzed in soil (P14 through P16 and P17/MW-11). Soil cadmium concentrations ranged from 2.93 to 20.5 mg/kg, exceeding the MTCA Method A CUL of 2 mg/kg at all locations. Lead ranged from 1.92 to 2,040 mg/kg, exceeding the MTCA Method A CUL of 1,000 mg/kg at P14 through P16. Additionally, the most highly lead-contaminated soil sample located at P14 was analyzed for TCLP lead, and the result was 77.1 mg/L, which exceeded the RCRA regulatory level of 5 mg/L. Arsenic ranged from 2.39 to 110 mg/kg; the greatest result corresponded to P17/MW-11 and exceeded the MTCA Method A CUL of 20 mg/kg. Total DRO+ORO concentrations ranged from non-detect to 2,270 mg/kg, and only one sample (P17-3) exceeded the total DRO+ORO MTCA Method A CUL of 2,000 mg/kg. A well was installed at P17, becoming MW-11, to replace the missing well MW-04. TPH was analyzed in a groundwater reconnaissance sample collected at P15 and a groundwater sample collected from MW-11. The total DRO+ORO groundwater concentration was 760 µg/L at MW-11, exceeding the MTCA Method A CUL of 500 µg/L. DRO+ORO was also elevated at P15. VOCs and SVOCs were additionally analyzed in the sample collected from P15, and the results were non-detect. PCBs were analyzed in the sample collected from MW-11, and the result was non-detect. MW-11 was also analyzed for metals; the dissolved arsenic concentration was 2.23 µg/L, and the dissolved selenium concentration was 7.15 µg/L, both concentrations exceeding surface water ARARs of 0.018 and 5 µg/L, respectively.
- **East Yard (Southeast Corner):** TPH and selected metals were analyzed in the soil adjacent to the presumed heating oil UST (P18, P19), and BTEX, CVOCs, and naphthalene were additionally analyzed at P18. No analyte concentrations exceeded the applicable criteria in the soil. A well was installed at the MW-06 boring to assess the quality of groundwater flowing onto the Property from the upgradient. The groundwater sample from MW-06 was analyzed for TPH, BTEX, VOCs, SVOCs, and selected metals. In groundwater, PCE was detected at a concentration of 14 µg/L, exceeding the MTCA Method A CUL of 5 µg/L, and dissolved arsenic was detected at a concentration of 1.04 µg/L, exceeding the surface water ARAR of 0.018 µg/L.
- **Independent Metals Oil Storage:** TPH, VOCs, naphthalene, PCBs, and selected metals were analyzed in the soil at MW-08 and MW-09 near the former hydraulic fluid storage area north of the current warehouse building. No analyte concentrations exceeded the applicable criteria in the soil. Two wells were installed in the vicinity including MW-08 to the north of the storage area and MW-09 in the downgradient portion of the storage area, which also replaced the missing MW-02. TPH, PCBs, and selected metals were analyzed in groundwater from both wells. BTEX, VOCs, and SVOCs were additionally analyzed in the sample collected from MW-09. In the groundwater, dissolved arsenic ranged from 5.14 to 10.1 µg/L, exceeding the MTCA Method A CUL of 5 µg/L. At MW08, the total DRO+ORO groundwater concentration

was 1,570 µg/L, exceeding the MTCA Method A CUL of 500 µg/L; the total DRO+ORO concentration at MW-09 was less than the CUL. At MW-09, the vinyl chloride groundwater concentration was 0.30 µg/L, exceeding the MTCA Method A CUL of 0.2 µg/L.

- **Independent Metals Scrap Metal Storage:** TPH was analyzed in the soil in the vicinity of the scrap metal loading area (MW-12) and was not detected. Two wells were installed, including MW-07 near the former stockpile from the metal shredder adjacent to the current warehouse building and MW-12 in the vicinity of the former scrap metal loadout area; MW-12 also served as a replacement to decommissioned well MW-01. TPH and selected metals were analyzed in groundwater in both wells; BTEX, VOCs, and SVOCs were additionally analyzed in the sample collected from MW-07, and PCBs were additionally analyzed in the sample collected from MW-12. At MW-07 the total and dissolved arsenic concentrations were 1.55 and 1.37 µg/L, both exceeding the surface water ARAR of 0.018 µg/L. At MW-12 the total and dissolved arsenic concentrations were 5.14 and 4.87 µg/L, both exceeding the surface water ARAR. PCE was not detected at MW-12. At MW-12, total DRO+ORO was 2,210 µg/L, exceeding the MTCA Method A CUL. DRO and ORO were not detected at MW-07.

Based on the concentrations in soil exceeding the most stringent MTCA CULs, RGI concluded Independent Metals tenure on the Property contributed to the contamination. The contaminants include DRO, ORO, PCE, TCE, PCBs, cPAHs, arsenic, cadmium, and lead. Most of these locations were limited to shallow soils (less than 2 feet bgs), except for P6, which resulted in a cPAH detection at 5 feet bgs. The soil contamination was in or within the general vicinity of visibly oil-stained surficial soils.

Lead in the vicinity of the former service station in the northern portion of the Property exceeded TLCP limits, classifying it as hazardous waste. The vertical extent of lead- and TPH-contaminated soil in that vicinity was defined and limited to the upper 3 feet bgs. The lateral extent was not delineated.

Arsenic (total and dissolved) concentrations in groundwater beneath the Property exceeded MTCA Method A or B CULs and/or the surface water ARARs. Other metals were not considered contaminants for groundwater or surface water.

PCE concentrations in groundwater exceed the MTCA Method A and ARAR CULs in the vicinity of the East Yard; elevated PCE concentrations were detected in MW-05, MW-06, and MW-07. The source of PCE was not identified. Vinyl chloride concentrations in groundwater exceeded MTCA Method A and ARAR CULs in monitoring wells MW-3R, MW-09, and MW-10, located in the central position of the Property near the former chemical and hydraulic storage areas. The source of vinyl chloride was not identified.

The hydrogeologic study included the installation of pressure transducers to collect water levels at six wells for a period of 2 weeks. The resultant data demonstrated horizontal flow is eastward, with short-lived flow reversals at the shoreline during the highest tides. Horizontal gradients toward the river ranged from 0.006 to 0.21 feet per foot, with the steepest gradient observed during low tide. The magnitude of westward gradients during temporary tide reversals was slight, approximately 0.002 feet per foot.

3.2 INDEPENDENT REMEDIAL ACTIONS

Multiple independent remedial actions were completed by RGI at the Property between 2017 and 2019.

3.2.1 Underground Storage Tank Decommissioning (2017)

RGI returned in 2017 to perform additional geophysical surveys for USTs and decommission previously identified USTs. Previously identified USTs included four units in the southern portion of the Property (referred to as the South Yard for purposes of the UST decommissioning report produced by RGI) with capacities ranging from 2,600 to 14,000 gallons, that were detected in a 2015 geophysical survey and thought to be associated with a former garage, as well as a 300-gallon residential heating oil UST identified within the East Yard in 2016. The geophysical survey also included further exploration in the northern corner of the Property (referred to as the North Yard) by the former service station. Activities performed in connection with UST decommissioning and site assessment included the following:

- A geophysical survey using EM/GPR to determine the location, orientation, and approximate size of known and suspected USTs and underground utilities in the North, East, and South Yards.
- Decommissioning of five USTs ranging in capacity from 300 to 14,000 gallons in the South and East Yards, in accordance with applicable UST regulations at the time of decommissioning (WAC 173-360).
- Removal of a concrete slab overlying USTs and the removal and decommissioning of related piping in the South Yard.
- Assessment of soil at each UST excavation site to determine the presence of contaminants.
- Excavation of two test pits within the North Yard where the geophysical survey marked anomalies, to identify any additional USTs.
- Restoration of all excavated areas in the North, East, and South Yards.

The geophysical survey performed on April 21, 2017, confirmed the presence of at least three USTs in the South Yard and one UST in the East Yard. The survey did not conclusively identify additional USTs in the North Yard, nor did subsequent test pits identify USTs at that location. Therefore, RGI retained the services of IO Environmental to uncover and decommission the USTs in the South and East Yards. Decommissioning was consistent with all permitting requirements including the pumping, cleaning, inerting, fire department inspection, and removal of USTs.

A total of 31 soil samples were collected to support the UST site assessment. All soil samples were field screened using visual and olfactory observations for VOCs and/or petroleum hydrocarbons using a portable gas analyzer equipped with a PID and/or sheen testing. Soil samples were submitted to the laboratory for one or more of the following analyses: hydrocarbon identification by NWTPH-HCID, TPH, BTEX, and total metals. Soil analytical data collected during this task were compared to MTCA Method A soil CULs for industrial property use. Soil results are described by the area of interest below.

- **South Yard (USTs 1 through 4 and Product Piping):** Four USTs were excavated and decommissioned in the South Yard. USTs 1 and 3 were 5,000 gallons in capacity and USTs 2 and 4 were 10,000 gallons in capacity. Soils surrounding each UST were field screened, and no evidence of contamination was observed. Soil samples were collected from the sidewalls and bottom of each UST and were submitted for analysis. No contaminants were detected in soils at concentrations greater than CULs at any of the South Yard UST locations. Neither were contaminants detected in soil at concentrations greater than laboratory detection limits, with the following exceptions: toluene, ethylbenzene, and xylenes were detected at UST 1 and DRO, arsenic, barium, chromium, and lead were detected at UST 3. Product piping suspected of being associated with the former garage was observed above USTs 1 through 4. Soils beneath the product piping were field screened and submitted for analysis, but no evidence of contamination was found in field screening nor were contaminants detected in soil at concentrations greater than laboratory detection limits.
- **East Yard (UST 5):** Field screening of the soils surrounding UST 5, of 300-gallon capacity, uncovered the presence of petroleum hydrocarbon contamination beneath and to the north of the UST. Contamination was determined to be of a limited extent based on previous findings and no remedial excavation of contaminated soil was performed at that time. Five soil samples were collected from the sidewalls and bottom of UST 5. Total DRO+ORO exceeding the MTCA Method A CUL of 2,000 mg/kg was detected at two sample locations, including a detected concentration of 6,000 mg/kg beneath the UST at approximately 8 feet bgs (RT-B1-8) and 6,900 mg/kg on the north side of the UST at approximately 3.5 feet bgs (RT-NS-3.5).
- **North Yard (Test Pits 1 and 2):** Two test pits (TP1 and TP2) were excavated to approximately 6 to 7 feet bgs, and no USTs were encountered. A blueish-green layer with a distinct odor was present at each test pit from about 1.5 to 2 feet bgs, corresponding to known contamination identified in previous investigations. Between 2 and 7 feet bgs, fill soil was encountered with debris consisting of wood, sheet metal, concrete, and brick. No analytical soil samples were collected in association with the test pits. The removed soil was later used to backfill each test pit.

Based on the results of the UST site assessment, RGI concluded that a release occurred at UST 5 in the East Yard, with total DRO+ORO present in the soil at concentrations ranging from non-detect to 6,940 mg/kg, exceeding MTCA Method A soil CUL of 2,000 mg/kg. Soil analytical data obtained from the 2016 Supplemental Subsurface Investigation from test probes P18 and

P19 were non-detect near UST 5, suggesting that the lateral extent of soil impacts from the UST 5 release was limited.

3.2.2 Remedial Action – East Yard (2018)

Silver Bay Logging contracted RGI to perform soil cleanup at the East Yard in areas of known soil contamination exceeding industrial CULs, including the following:

- Elevated levels of cadmium were detected in soil borings from the Initial Phase 1 and Phase 2 ESA; test probe SB-08, drilled in 2003, intercepted soils at 1 foot bgs with a cadmium concentration of 9.68 mg/kg, greater than the soil MTCA Method A CUL of 2 mg/kg.
- Total DRO+ORO was detected in soil at concentrations up to 6,940 mg/kg (greater than the soil MTCA Method A CUL of 2,000 mg/kg) in samples associated with the removal of the heating oil UST (UST 5) in 2017.
- Arsenic, cadmium, and lead concentrations exceeded MTCA Method A CULs in soil samples collected at depths of 1 to 3 feet bgs from test pits TP1, TP5, and TP7 during the May 2018 East Yard test pit exploration; arsenic ranged from 2.68 to 789 mg/kg (compared to a CUL of 20 mg/kg), cadmium ranged from non-detect to 9.7 mg/kg (compared to a CUL of 2 mg/kg), and the lead concentrations ranged from 2.03 to 991 mg/kg (compared to a CUL of 1,000 mg/kg); contaminated soils corresponded to lenses of black sands that were interpreted as waste sandblast grit. TCLP analysis was conducted on sample TP5-3 with the 789 mg/kg arsenic result. The TCLP lead concentration was 10.6 mg/kg greater than the dangerous waste threshold of 5 mg/kg; however, the TCLP arsenic result was non-detect.
- PCE in shallow groundwater ranged from 7.7 to 16 µg/L, greater than the MTCA Method A CUL of 5 µg/L, for multiple sampling events at wells MW-05, MW-07, and MW-06; however, the 2018 remedial action focused on soil cleanup, and no additional groundwater sampling or testing was performed on the East Yard in association with the remedial action.

The scope of work for this cleanup included identifying contaminants for soil and groundwater underlying the East Yard, performing remedial excavations where soil contained concentrations of identified contaminants exceeding the Ecology MTCA Method A soil CULs for industrial property use, and collecting and assessing cleanup performance and confirmation soil samples from the remedial excavations.

The identified contaminants in soil were total DRO+ORO and metals including arsenic, cadmium, and lead. PCE was the identified contaminant in groundwater. Some or all of these contaminants were analyzed for confirmation and performance soil samples and compared against applicable CULs. Confirmation and performance sampling at excavation limits was used to direct and verify the success of remedial efforts in removing soil contamination.

RGI excavated two areas in the East Yard—one smaller area to the north, encompassing TP1, and a larger area to the southeast of the yard, encompassing TP5, TP7, and the former excavated UST. The southeast excavation area began as three separate excavations; however, performance samples taken after the initial excavations indicated that contaminated soil was still present to the north, east, and west of the TP5 and TP7 excavations, resulting in a single combined excavation. In addition, two test pits (TP10 and TP11) were dug to the west of the southeast excavation area, each 6 feet wide by 18 feet long and approximately 5 feet deep, to determine the lateral extent of the contaminated soil in the southeast corner of the East Yard. Excavation details and conclusions are described by the area of interest below:

- **North Excavation Area (TP1):** The footprint of the remedial excavation limits in the area of TP1 was approximately 10 feet by 10 feet and about 1.5 feet deep. This area was excavated to address shallow soil contamination at approximately 1 foot bgs observed in TP1; arsenic and cadmium concentrations of 27.1 mg/kg and 4.74 mg/kg, respectively, exceeded the MTCA Method A CULs of 20 mg/kg for arsenic and 2 mg/kg for cadmium. After excavation, metals concentrations in all five cleanup confirmation soil samples (TP1-N1, TP1-E1, TP-S1, TP-W1, and TP1-B1) were either non-detect or less than the MTCA Method A CULs.
- **Former Excavated UST Area (UST 5):** The original footprint of the remedial excavation associated with previously excavated UST 5 was extended to about 8 feet by 13 feet and 9.5 feet deep (although this area ultimately merged with the entire southeast excavation area). Per six cleanup confirmation soil samples (RT-NS2, RT-ES2, RTR-SS2, RT-WS2, RT-B2, and RT-B3) collected in 2018, residual TPH-contaminated soil was remediated to concentrations less than MTCA Method A CULs for total DRO+ORO, arsenic, cadmium, and lead.
- **Southeast Excavation Area (TP5, TP7, and Former Excavated UST):** The final footprint of the southeast excavation area, incorporating TP5, TP7, and the former UST (UST 5), was approximately 1,650 square feet with a depth of about 5 feet. Outside of the UST area, this excavation addressed the metals contamination associated with shallow imported fill and black sand lenses interpreted as waste sandblast grit. None of the 26 final cleanup confirmation samples collected from the excavation limits had concentrations of TPH or metals greater than MTCA Method A CULs.

Overall, analytical laboratory results indicated that the native soils underlying the fill soils and black sands were not adversely affected by the overlying contaminated fill. Although all cleanup confirmation soil samples from the final remedial excavation limits indicated that the in situ soils did not contain contamination exceeding the MTCA Method A CULs for industrial property use, the potential exists that other occurrences of contaminated fill or black sand may be present elsewhere in the East Yard. However, test pits TP10 and TP11 indicate that the metal-contaminated soils do not extend significantly to the west of cleanup areas TP5 and TP7, and prior investigations indicate that any occurrences of these thin black lenses would be limited in extent.

Because prior groundwater samples did not demonstrate elevated metals greater than applicable screening levels, RGI determined that the metal-contaminated fill soils did not adversely affect shallow groundwater in the East Yard. The source of PCE in groundwater was not identified during this cleanup action, and RGI concluded it may be related to an unidentified off-site and upgradient source.

3.2.3 Soil Cleanup Action (2019)

Concurrent with the East Yard remedial action, Silver Bay Logging contracted RGI to perform soil cleanup activities in the central portion of the Property, referred to as the Main Yard, based on findings and data needs identified during prior investigations, including the following:

- The northern portion of the Main Yard had elevated levels of total DRO+ORO, and metals (arsenic, cadmium, and lead) in soils to depths of about 4 feet bgs.
- The southern portion of the Main Yard had elevated levels of total DRO+ORO, PCE, TCE, cPAHs, and metals (arsenic, cadmium, chromium, and mercury), and the vertical extent of this contamination appeared to be limited to depths of 1 to 3 feet bgs.
- Groundwater within the Main Yard had elevated levels of total DRO+ORO, PCE, vinyl chloride, arsenic, and lead.
- The lateral extent of contaminated soil was not well understood in the northern or southern portions of the Main Yard.

The scope of work for this cleanup included identifying contaminants for soil and groundwater underlying the Main Yard, removing shredder residue and other debris from the round surface, performing remedial excavations where soil contained concentrations of identified contaminants exceeding the MTCA Method A CULs for industrial property use, collecting and assessing cleanup performance and confirmation soil samples from the remedial excavations, decommissioning groundwater monitoring well MW-11, and decommissioning and removing a presumed gasoline UST system encountered on the northern portion of the Main Yard.

Identified contaminants in soil were GRO, DRO, and ORO; PCE; TCE; cPAHs; and metals including arsenic, cadmium, lead, and copper. Contaminants identified for groundwater were total DRO+ORO, PCE, vinyl chloride, and arsenic.

RGI excavated a total of 13 areas within the Main Yard: A1A, A2A, A2B, A3A, A3B, A3C, A4A, A4B, A4C, A5A, A6A, A6B, and A6C. Excavation area A1A, within the northern portion of the Main Yard, corresponded to the approximate location of the former gas station; area A5A, located east of the storage building in the southern portion of the Main Yard, had visual oil staining at the surface associated with large hydraulic machinery; the remaining excavation sites corresponded to exposed soil areas after removal of shredder residue. Performance samples were taken at the limits of each excavation site (sidewalls and bottom) and used to direct further excavation, if necessary. Confirmation soil samples refer to samples taken at the final limits of excavation. All confirmation soil samples for each of the excavation sites were either non-detect or less than applicable screening levels of identified contaminants, with the following exceptions:

- **Remedial Excavation Area A1A:** The footprint of this excavation area measured approximately 40 feet by 60 feet with depths that ranged from 5 to 16 feet bgs. During the excavation, an abandoned UST system, consisting of a 300-gallon UST and 1,000-gallon UST, was encountered, likely associated with the former gasoline service station. The UST system was subsequently decommissioned, removed, and disposed of off-site. Excavation of the associated contaminated soils reached a maximum depth of 16 feet bgs. MW-11 was damaged during the A1A excavation and decommissioned prior to backfilling. Performance samples had concentrations of GRO and metals exceeding screening levels, and the corresponding areas were over-excavated. Out of 28 subsequent confirmation soil samples from the north, east, and south sidewall limits, collected at depths of 2 to 2.5 feet bgs, 3 samples (A1A-N5-2.5, A1A-E5-2, and A1A-S7-2.5) contained elevated cadmium (ranging from 5.03 to 8.76 mg/kg, compared to a MTCA Method A CUL of 2 mg/kg), arsenic (ranging from 8.25 to 21.5 mg/kg, compared to a CUL of 20 mg/kg), and/or lead (ranging from 388 to 1,120 mg/kg, compared to a CUL of 1,000 mg/kg). Based on field observations along the riverbank and a riverbank soil sample (WH-RBank) collected from blue-green stained fill soil beneath the wheelhouse, RGI determined that contaminated soils likely extend to the south and east of the A1A cleanup limits, reaching the river. However, the shallow metal-contaminated soils did not appear to have extended as far south as MW-3R and MW-10. As requested by Silver Bay Logging, no further remedial excavation at cleanup area A1A was performed.
- **Remedial Excavation Area A3B:** Remedial excavation area A3B, located just north of the storage building within the southern portion of the Main Yard, was originally excavated to 0.5 feet bgs. Performance soil samples, however, indicated that arsenic and total DRO+ORO were still present at the excavation limits, and the area was over-excavated to 2 feet bgs. Subsequent confirmation soil sampling indicated that shallow soil (2 feet bgs) with relatively low concentrations of arsenic (23.5 mg/kg) remains in situ at the southern extent of remedial excavation A3B (A3B-S1). Based on its shallow occurrence in this area, the exceedance is most likely associated with the former shredder residue waste material and likely limited in extent.
- **Remedial Excavation Area A5A:** Remedial excavation Area A5A was extended significantly from initial excavation limits due to the presence of extensive hydraulic oil contamination in the soils, both vertically and laterally, likely from a large hydraulic machine previously stationed in the area. The final excavation area of A5A was about 1,030 square feet, extending 6 to 9 feet bgs. Of the 32 soil samples collected from the final excavation limits, 4 samples contained total DRO+ORO concentrations ranging from 2,480 to 31,200 mg/kg, exceeding the soil MTCA Method A CUL of 2,000 mg/kg (A5A-W33-7, A5A-W7-9, A5A-W29-7, and A5A-W31-7). These soil samples were collected from the western sidewalls abutting the storage building at 7 feet bgs and

from the excavation bottom at 9 feet bgs. Further excavation of the TPH-impacted soil was not technically feasible due to the risk to the structural integrity of the adjacent storage building. The extent of any remaining TPH-contaminated soils and/or shallow groundwater northeast or east of the storage building is not defined.

Based on the results from this cleanup action, further investigation is needed to better define the nature and extent of contamination remaining in the northern portion of the Main Yard, surrounding area A1A and the wheelhouse, and in the southwest portion of the Main Yard, surrounding area A5A and the adjacent storage building.

3.3 STORMWATER TREATMENT AND CORRECTIVE ACTIONS

Independent Metals obtained ISGP coverage for the Property under permit number WAR009275 after an Ecology inspection in 2008 found that the facility's stormwater primarily flowed to a catch basin that ultimately discharged to the Duwamish River, without treatment or sampling (Ecology 2008). A stormwater treatment system consisting of catch basins, settling tanks, media filters, and an oil-water separator connecting to the existing stormwater catch basin and discharge line was installed at the Property in 2009. Ecology subsequently issued a source control enforcement action in 2014 (Ecology 2014a) due to repeated exceedances of permit limits for zinc. Ecology additionally inspected the Independent Metals facility and issued an enforcement action in July 2012 (Ecology 2012a) after observing auto shredder residue falling onto the LDW riverbank due to overtopping bermed storage areas, and backups in the stormwater treatment system, which caused an overflow of untreated water to the river.

Independent Metals declared bankruptcy and vacated the Property in early 2014. After Independent Metals vacated the Property, Ecology performed an additional inspection in April 2014. The inspection found that metal and other debris were left on the ground surface and valves to the stormwater treatment system were closed, resulting in a bypass of the treatment system and discharge of untreated stormwater to the river. This inspection resulted in an Administrative Order issued to Silver Bay Logging in April 2014 (Ecology 2014b), at which point Ecology noted PCB contamination was also documented in storm drains. The corrective actions required under the Administrative Order were to clean and restart the treatment system, clean catch basins, and remove debris from the yard. Silver Bay Logging completed this work and restarted the stormwater treatment system in May 2014 (Phoenix Environmental 2014).

American Gypsum applied for a Conditional No Exposure Exemption for their operations in May 2019. Ecology denied the exemption after an inspection found multiple materials stored outdoors with the potential to enter the river (Ecology 2019). American Gypsum obtained ISGP coverage under WAR308860 effective February 2020 (Ecology 2020a). Ecology completed an inspection in October 2020 and noted multiple issues related to stormwater management, including uncovered stockpiles, insufficient or missing berming adjacent to the river, catch basin inserts needing replacement, a lack of spill kits, and a lack of a stormwater pollution prevention plan document available at the facility (Ecology 2020b). American Gypsum was notified that its 2020 annual report was missing as of May 2021 (Ecology 2021a), and it is unclear whether an annual report was submitted subsequent to this notification.

3.4 LDW INVESTIGATIONS

As detailed in the LDW ROD, the investigations of sediment contamination in the LDW include waterway-wide investigations by National Oceanic and Atmospheric Administration and USEPA in 1997 and 1998, respectively, and at least 25 smaller, location-specific investigations conducted by King County, the City, Boeing, and other private entities.

The LDWG was formed in 2000 under an order by USEPA and Ecology to complete an RI/FS pursuant to both the Comprehensive Environmental Response, Compensation and Liability Act and MTCA. LDWG sediment investigations include those for the RI/FS, as documented in the ROD, and site-wide Pre-Design Studies conducted in 2017 and 2018 to address the Third Amendment to the Administrative Order on Consent (referred to as AOC3). The Technical Memorandum: Compilation of Existing Data (Windward 2018b) and Pre-Design Study Data Evaluation Report (Windward 2020) also presents other LDW sediment data including source-related Ecology outfall studies.

Across the river from the Property, the Boeing Plant 2 Early Action project remediated intertidal and subtidal sediment from Slip 4 and along the shoreline from approximately RM 2.8 to RM 3.7. The footprint extends to the edge of the navigation channel. The Boeing Plant 2 Early Action perimeter monitoring sample data adjacent to the Property is summarized in the AOC3 reports referenced above. The other ROD amendments that address sediment include AOC4, which addresses the Upper Reach design, and AOC5, the Middle Reach design. The AOC5 sediment investigations to be conducted in the vicinity of the Property are incorporated into this RI/FS Work Plan (Sections 6.2.1 and 6.2.3)

Adjacent to the southern portion of the Property, PCBs in the subtidal sediment have been detected at concentrations exceeding the LDW remedial action level (RAL) in two samples collected at separate locations in 2015 and 2018. Subtidal and intertidal samples associated with the 8th Avenue S CSO also exceeded the RAL for PCBs. Existing intertidal sediment data targeted at the outfalls on the Property had no RAL exceedances of PCBs, cPAHs, dioxin/furan toxic equivalent (TEQ), or arsenic. Intertidal sediment sample locations in the vicinity of the Property are shown on Figure 3.1.

4.0 Preliminary Conceptual Site Model

The preliminary Conceptual Site Model (CSM) was developed based on findings from previous investigations and has been used to identify DQOs for the RI that will be discussed in Sections 6.1 and 6.2. The CSM will be revised upon completion of the RI field activities and will inform the development of the feasibility study and selection of appropriate cleanup actions for the Study Area. A preliminary CSM is presented on Figure 4.1.

4.1 KEY PHYSICAL SETTING CHARACTERISTICS

The Property is composed of primarily paved and gravel-surfaced parcels of land, adjacent to the Duwamish River, used for industrial purposes. Shallow soil at the Property consists of surface fill from undocumented sources, potentially containing both material dredged from the river and material obtained from upland sources, underlain by native alluvium.

Shallow groundwater at the Property occurs within the native alluvium, generally flows from the uplands toward the river, and is recharged from a combination of infiltration through limited unpaved areas on the Property and horizontal flow from upgradient. Minor shallow groundwater flow direction reversals have been documented during high river levels. Stormwater at the Property is primarily collected via catch basins and discharged to the river after treatment; however, some potential for overland flow of stormwater is present, with the associated riverbank.

4.2 RELEASE MECHANISMS AND CONTAMINANT DISTRIBUTION

Multiple historical operations are potential sources of contaminant releases at the Property. Early historical operations included boat building, which likely caused incidental releases to the ground surface. The most likely potential contaminants introduced by boat building or maintenance include metals, butyltins, and PCBs, which are often present in marine paints or coatings and sandblast grit. Multiple petroleum USTs associated with various historical usages, including a gas station and equipment fueling, were also present at the Property. These USTs caused documented petroleum releases to subsurface soil due to weathering and failure of the tank structures and may also be associated with incidental spills to the ground surface during fueling or fuel transfer. Releases of both metals and petroleum to unpaved areas of the ground surface were also documented during later metals recycling operations. Additionally, areas of fill soil have been placed along the riverbank at the Property. Fill soil is also present in the uppermost layer of uplands soil on the Property and may be composed of dredge spoils, soil derived from uplands sources, fill soil containing shredder residue material, or a combination thereof. The existing sediment characterization data from samples collected in the LDW suggest that environmentally persistent chemicals such as dioxins/furans, PCBs, metals, cPAHs, and pesticides may be present in dredged material. Fill derived from upland sources may also be impacted by common industrial contaminants such as metals and petroleum.

Releases to soil are presumed to have impacted groundwater on the Property over time. Metals do not typically migrate downward through the soil column but may leach from vadose zone soil and migrate to groundwater via infiltration of stormwater through unpaved ground surfaces. Petroleum releases migrate downward and outward in the soil to the saturated zone, where they may be present as dissolved-phase petroleum and/or non-aqueous phase liquid. Although significant releases of CVOCs have not been identified, CVOCs also migrate downward and outward in the saturated zone; CVOCs are denser than water and may therefore continue to migrate downward in saturated soil. Metals such as arsenic and lead as well as petroleum have been detected at elevated concentrations in groundwater. Other suspected fill contaminants such as cPAHs, PCBs, and dioxins/furans are not readily soluble and are not expected to be present at significant concentrations in groundwater.

4.3 POTENTIAL EXPOSURE PATHWAYS AND RECEPTORS

The PSLs for soil, groundwater, air, and sediment are developed to address potential human and ecological receptors exposed to soil, groundwater, air, surface water, and sediment contamination. Ecology (2022a) describes the LDW PCULs as applicable to “upland MTCA sites that have environmental transport pathways to the LDW and may impact surface water, sediments, or organisms in the river”, and “cover transport pathways to the river as well as additional pathways to support full MTCA cleanup actions.” The potential exposure pathways and receptors for current and future uses of the Site are inherently addressed in the PSLs, which are based on the most stringent PCULs. To ensure that the characterization will be adequate to determine the risk to environmental receptors under a variety of potential future Property uses, all exposure pathways were considered to be potentially complete for the purposes of developing PSLs. Potential exposure pathways and associated receptors include the following:

- **Human Exposure via Direct Contact with Soil.** Contamination in soil has been historically observed on the surface with localized subsurface locations related to diesel and oil storage. Currently, direct contact exposure to surface soil is limited to occupational workers entering the Property for daily work and construction or maintenance activities. In the future, the redeveloped Property may include areas with unrestricted site use conditions. Unrestricted land use is assumed for the selection of PSLs.
- **Human Exposure via Air Inhalation.** Volatile contaminants in shallow soil and groundwater have the potential to rise through the soil column and discharge into indoor air. Currently, occupational workers are the primary potential receptor. Air pathways will be further evaluated in the RI.
- **Human Exposure via Drinking Water.** Humans have the potential to be exposed to contamination if using the groundwater as a drinking water source. The potability of Site groundwater has not yet been determined. A site-specific assessment of groundwater potability to determine if this pathway is complete will be included in the RI. The selection of groundwater PSLs assumes groundwater is potable.

- **Human Exposure via Direct Contact with Sediment.** Humans have the potential to be exposed to contamination in sediment from direct contact during beach play and clamming. The ROD identifies the intertidal area adjacent to the Property as an LDW reach with parks and habitat restoration, beach play activities including fishing, hand boat launch, swimming, and potential clamming. Target sediment concentrations developed by Ecology (2022), and used as PSLs, include Washington State Sediment Management Standards (SMS) and LDW ROD direct contact scenarios. The target sediment concentrations identify the interval from 0 to 45 cm as the applicable intertidal exposure interval.

- **Human Exposure via Seafood Consumption.** Humans have the potential to be exposed to contamination in surface water via consuming aquatic species (seafood) that may have accumulated toxic chemicals during their life cycle. LDW-specific fish consumption rates are used to calculate the surface water criteria used as the basis of the groundwater protection of surface water PCUL. The primary concern is the presence of persistent and bioaccumulative contamination in LDW sediments that can result in elevated tissue concentrations in organisms over a long period of time. In RM 2.8 to RM 3.0 reach, finfish are present, and the intertidal area is identified by the ROD as a potential clamming beach. Human exposure to seafood consumption is addressed via the groundwater-surface water pathway and the groundwater-to-sediment PCULs. In addition, target sediment concentrations used as PSLs incorporate SMS and LDW ROD assumptions for human exposure to seafood via bioaccumulation pathways to the BAZ (i.e., 0 to 10 cm) and use LDW-specific fish consumption rates.

- **Terrestrial Ecological Receptor Exposure via Direct Contact with Soil and Associated Food Chain.** Plants, soil biota, small mammals, and birds have the potential to be exposed to contamination in the soil through direct contact and uptake into plants and soil invertebrates, which are then consumed by small mammals and birds. The Property and surrounding vicinity currently contain very limited habitat areas; however, for this RI/FS Work Plan, the soil PSLs conservatively assume the terrestrial pathway to be complete. The terrestrial exposure pathway for current and future Property use will be further evaluated in the RI/FS.

- **Benthic Receptor Exposure via Groundwater Discharge to Sediment.** Exposure of the benthic community to contamination from groundwater discharge to sediment has the potential to cause acute or chronic survival, growth, and reproductive effects. The selection of groundwater PSLs addresses this pathway by using the target sediment concentrations. SMS and LDW ROD direct contact scenarios and identify surface sediment from 0 to 10 cm as the exposure interval (e.g., BAZ).

- **Aquatic Receptor Exposure via Groundwater Discharge to Surface Water.** Contamination can be transported via groundwater to surface water discharge to the LDW. Exposure to surface water contamination has the potential for acute and chronic effects on aquatic species. The groundwater PSLs incorporate the most stringent aquatic life criteria if it is lower than potable groundwater PCULs.

- **Ecological Wildlife Exposure via Fish Consumption.** This pathway evaluates aquatic mammals and bird risk from ingestion of aquatic species contaminated by bioaccumulated compounds. Target sediment concentrations used as PSLs incorporate LDW ROD wildlife exposure to fish via bioaccumulation pathways to the BAZ (i.e., 0 to 10 cm surface).

5.0 Preliminary Screening Level Development and Contaminants of Interest

This section provides a summary of the process to identify the PSLs and COIs for the RI. The PSL for each medium is based on applicable regulatory criteria for the potential exposure and transport pathways discussed in Section 4.3. COIs are contaminants that may be present at the Site due to its geographic setting, proximity to adjacent contaminated sites, historical operational history, and potential historical releases as well as contaminants that have previously been detected at concentrations of concern for potential receptors in Site environmental media. The development of PSLs is presented in further detail in Section 5.1 and the determination of COIs is presented in further detail in Section 5.2.

Once PSLs for the COIs in each medium are developed, data can be screened against the most stringent PSL by media to identify a comprehensive list of contaminants of potential concern (COPCs). Data collected during the RI will be screened per applicable PSLs by media that represent the most stringent pathways. This screening will be used to determine COPCs that may present a risk to receptors at the Site. For identification of COPCs in the RI, there will be a single PSL per analyte per medium, regardless of whether the pathway is currently complete and/or applicable, to be protective of a variety of future Property uses.

5.1 DEVELOPMENT OF PRELIMINARY SCREENING LEVELS BY MEDIA

Screening levels for the RI are established in accordance with applicable requirements defined in MTCA (WAC 173-340-350 and WAC 173-340-710) as regulatory cleanup standards; standards of control; and other environmental requirements, criteria, or limitations established under state or federal law that specifically address a COC, remedial action, location, or other circumstance at the site. The applicable requirements for establishing screening levels include cleanup regulations: WAC 173-340, SMS (WAC 173-204), Water Quality Standards for Surface Waters of the State of Washington (WAC 173-201A), and federal surface water quality ARARs for the protection of the adjacent groundwater receiving waterbody, the LDW (USEPA 2014).

Ecology has developed comprehensive PCUL summary tables for groundwater, soil, air, and target sediment concentrations specifically for sites near or adjacent to the LDW that are consistent with the applicable cleanup regulations (Ecology 2022a). The Ecology PCUL summary tables incorporate criteria protective of surface water and sediments as well as potential upland exposure pathways and receptors. The PCUL tables encompass a wide range of chemicals including TPH, metals, PCBs, dioxins/furans, SVOCs, VOCs, and pesticides. The PCUL tables were supplemented with available MTCA cleanup levels for a limited number of compounds, primarily those associated with historical slug bait formulations, which do not have established LDW PCUL criteria. The PSL tables present criteria protective of numerous potential exposure pathways, described further in the following sections.

Additionally, the natural background was considered in establishing PSLs. A number of the chemicals detected at the site are naturally occurring in the environment and MTCA allows for the adjustment of PSLs to be consistent with natural background concentrations. In soil, background concentrations for some metals and dioxins/furans have established statewide background concentrations. Values from Ecology's *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994) and *Natural Background Groundwater Arsenic Concentrations in Washington State* (Ecology 2022b) are used for the metals, and the value from Ecology's *Natural Background for Dioxins/Furans in Washington Soils—Technical Memorandum #8* (Ecology 2010) is used as a natural background number for dioxins/furans. Where the PSLs protective of direct contact or groundwater quality are less than the natural background value, the PSL is adjusted upward to the natural background.

5.1.1 Preliminary Screening Level Development for Groundwater

Table 5.1 presents the PSLs for groundwater for each of the exposure pathways identified in the CSM for all chemicals to be analyzed for the RI, and the most stringent PSL for each chemical is identified. The exposure pathways included in developing PSLs for groundwater are presented below.

- **Protection of Drinking Water.** Although groundwater is generally considered non-potable in the site vicinity, drinking water PSLs have been retained as a conservative measure for the purposes of screening. Applicable criteria for the protection of drinking water include maximum contaminant levels (MCLs) from the National Primary Drinking Water Regulations and MTCA Method B CULs. MCLs are selected as the PSLs (adjusted to a cancer risk no greater than 1 in 100,000). If MCLs are not available, MTCA Method B CULs are selected as the PSL.
- **Protection of Surface Water.** Consistent with requirements in MTCA, groundwater that discharges into surface water must meet the surface water quality standards (Water Quality Standards for Surface Waters of the State of Washington [WAC 173-201A] and federal surface water quality ARARs for protection of the adjacent groundwater receiving waterbody) at the point where the discharge occurs, without taking dilution into account.
- **Protection of Sediment.** Groundwater quality must be protective of surface sediment quality at the point where groundwater is discharged to surface sediments. To determine the PCULs, which are the basis of the PSLs in this RI/FS Work Plan, LDW-specific parameters for the fraction of organic carbon present, porosity, and particle density were applied to Ecology cleanup level equations (Ecology 2022a).
    - o The most restrictive sediment CULs in the LDW ROD were identified as preferred target sediment concentrations. For chemicals not in the ROD, Ecology SMS and the methods in the Sediment Cleanup User's Manual (SCUM, Ecology 2021) were used to determine target sediment concentrations.
    - o It is important to note that the three-phase model is a simple mass-balance equation and does not fully account for the complexity needed to accurately predict contaminant behavior in the transition zone or biologically active layer (Ecology 2022a).

- **Protection of Indoor Air Quality.** The PSLs were back-calculated from MTCA CULs for indoor air using generic attenuation factors provided in Ecology vapor intrusion guidance (Ecology 2022c).

5.1.2 Preliminary Screening Level Development for Soil

Table 5.2 presents the PSLs for soil for each of the potential exposure pathways for all chemicals to be analyzed for the RI, and the most stringent PSL is identified for each chemical. The exposure pathways considered in developing the PSLs for soil are presented below.

- **Protection of Human Health Direct Contact.** To be conservative, PSLs based on unrestricted land use are applied because the proposed redevelopment plans for the water quality facility may include associated community use.
- **Protection of Groundwater Quality.** PSLs were developed to protect drinking water, discharge to surface water, and discharge to sediments. The PSLs selected to represent this pathway conservatively assume leaching may occur from both unsaturated and saturated soils. The default MTCA three-phase models for the soil-to-groundwater pathway was used (Equations 747-1 and 747-2). The basis of the groundwater PSLs used in the calculation is described in Section 5.1.1.
- **Protection of Erosion to Sediment.** The most restrictive sediment CULs in the USEPA LDW ROD were identified as PSLs. For chemicals not in the ROD, SMS and the methods in the SCUM (Ecology 2021a) were used to determine PSLs.
- **Protection of Terrestrial Ecological Receptors**. Where habitat exists, plants, soil biota, and wildlife may be exposed to contaminants in soil. Although exclusion from the TEE or use of the simplified TEE in the RI may be appropriate, depending on the Property redevelopment plans, the most stringent criteria for terrestrial ecological receptors were applied because the redevelopment plans have not been determined.
- **Indoor Air**. Soil gas concentrations protective of indoor air can be back-calculated using standard attenuation factors provided in Ecology vapor intrusion guidance; however, PSLs protective of indoor air have not been included because soil gas data are not available in the existing dataset. The indoor air exposure pathway will be evaluated under current and future Site use in the RI. Groundwater PSLs include the protection of indoor air.

5.1.3 Preliminary Screening Level Development for Sediment

Table 5.3 presents the PSLs for sediment protection of potential ecological and human health effects. The most stringent PSL for each chemical is identified. The PSLs are the target sediment concentrations developed by Ecology (2022) that were used to calculate groundwater and soil PCULs in Sections 5.1.1 and 5.1.2. Target sediment concentrations were selected using the ROD minimum CUL as the preferred value. For chemicals that bioaccumulate, and those not addressed by the ROD, SMS SCUM (Ecology 2021a) methods were applied. The exposure pathways considered in developing target sediment concentrations, and therefore PSLs, are presented below.

- **ROD Minimum CULs**. The ROD (USEPA 2014) exposure scenarios are based on six remedial action objectives for the protection of human seafood consumption; human direct contact with sediment throughout the LDW, in clamming areas, and at beaches; protection of benthic invertebrates; and protection of upper trophic level ecological receptors. Ecology (2022) includes the CULs for the six ROD RAOs in the evaluation of the minimum Cleanup Screening Level (CSL). It also includes 13 remedial action levels assigned using the depth of sediment below the mudline, water depth (i.e., intertidal, or subtidal), and 3 recovery categories to areas with predicted stability and natural recovery of the benthic community from those areas with limited or indeterminate natural recovery potential. The LDW adjacent to the Property has areas of intertidal sediment predicted to recover (recovery category 3) and subtidal sediment adjacent to and within the navigation channel that is presumed to have limited recovery potential (recovery category 1).
- **Sediment Management Standards**. Non-ROD chemicals and bioaccumulative chemicals were addressed using methods from SCUM (Ecology 2021a). The SMS sediment cleanup objective and CSL are a two-tiered framework to establish numeric chemical and biological sediment criteria for the protection of benthic communities and are also used to frame the criteria for the protection of human health and ecological risks from bioaccumulative chemicals.
  - Chemicals were considered bioaccumulative if they: appeared on Ecology's list of persistent, bioaccumulative, and toxic chemicals (WAC 173-333-310) or the Puget Sound Dredged Materials Management Program's Lists 1 or 2; and also were identified as COCs for seafood consumption in the LDW human health risk assessment or exceeded no-observed-adverse-effect levels (NOAELs) for higher trophic level receptors in the LDW ecological risk assessment. SCUM provides two methods to calculate CULs for bioaccumulative chemicals, using a biota-sediment accumulation factor (BSAF) based on site-specific sediment-tissue relationships, or setting the concentration at natural background or the practical quantitation limit (PQL). Because site-specific BSAFs are not available for the LDW, Ecology (2022) used the simpler approach and set the PCUL to the maximum natural background and the PQL.

5.2 DETERMINATION OF CHEMICALS OF INTEREST

COIs were determined following a stepwise process to "rule in" chemicals presented below:

- Using the existing datasets, chemicals were screened according to the MTCA statistical data evaluation process referenced in WAC 173-340-720 and WAC 173-340-740. The screening includes the use of summary statistics such as frequency of detection (FOD) and frequency of exceedance (FOE; refer to Sections 5.2.1.2 and 5.2.1.3).

- Chemicals associated with historical operations and releases were identified using available information on the Property history, as summarized in Section 5.2.2.
- Other contributing factors related to the site setting such as known LDW COCs, fill material, stormwater, and adjacent cleanup sites were reviewed to identify additional COIs (refer to Section 5.2.3).

5.2.1 Comparison of Existing Data to PSLs

Existing soil and groundwater samples from previous investigations at the site described in Section 3.0 were evaluated by comparison to the PSLs to identify COIs for further evaluation.

5.2.1.1 Data Usability

Existing analytical data for Site environmental media were provided by Silver Bay Logging and their subcontractors. Data collected prior to 2015 were provided in report deliverable format, and data collected in 2015 and later were provided in original laboratory report electronic deliverables. The data were reviewed for completeness and compiled for use in this document but were not independently validated. Therefore, data qualifiers (such as chromatogram notes, flags indicating that compounds were not detected, and flags indicating that a concentration is estimated) are retained as reported by the laboratory. This data management approach is in accordance with the procedures for data collected by others presented in the project Data Management Plan (Appendix E) and the existing data are considered usable for the purposes of this RI/FS Work Plan.

The data were categorized into groups by media and their representativeness of current conditions. Soil data are organized in the following categories: in situ and removed; in situ represents current conditions and removed represents prior contaminated soil that was subsequently removed during remedial actions and is no longer present.

For many analytes, the PSLs are less than the laboratory quantitation limits achieved by the laboratory in the existing database. As a result, the usefulness of the existing dataset to identify COIs due to their detection in environmental media is limited. The results in the existing dataset were used to “rule in” detected contaminants, but they were not used to “rule out” any contaminants, and conclusions were not drawn for contaminants with quantitation limits exceeding their PSLs.

5.2.1.2 Groundwater

Summary statistics for the existing groundwater data compared to PSLs are presented in Table 5.4 (monitoring well groundwater) and Table 5.5 (reconnaissance groundwater). These tables include the FOD in the dataset and the FOE of the PSLs for both detected and non-detected results. Chemicals were ruled in as COIs if either: more than 10% of detected results exceeded the PSL (for datasets with 10 or more samples), or the maximum detected exceedance factor of the PSL was greater than 2 (for datasets of any size). It is important to note that the groundwater data from the monitoring wells were used to identify COIs, and reconnaissance grab data were used to corroborate the findings from monitoring well groundwater because these results are typically biased high due to turbidity. The grab samples were primarily analyzed for TPH and VOCs and exceeded the PSLs for total DRO+ORO at concentrations consistent with groundwater results from monitoring wells. There were no COIs that exceeded PSLs only in groundwater reconnaissance grab samples and COIs were therefore not identified solely on the basis of the reconnaissance sample results.

The laboratory quantitation limits in the existing groundwater dataset were not sufficiently low enough to draw conclusions regarding PCBs or the majority of pesticides, SVOCs, and VOCs, all of which were generally not detected. The COIs identified are listed below.

- Metals: arsenic and lead
- TPH: DRO and ORO
- VOCs: PCE, TCE, and vinyl chloride

5.2.1.3 Soil

Summary statistics for the existing soil data compared to PSLs are presented in Table 5 6 (in situ soil) and Table 5.7 (excavated soil). These tables include the FOD and FOE of the PSLs for both detected and non-detected results. Chemicals were ruled in as COIs if either: more than 10% of detected results exceeded the PSL (for datasets with 10 or more samples); or the maximum detected exceedance factor of the PSL was greater than 2 (for datasets of any size). Results for the removed soils were included in this analysis because the historical detections associated with the Site may indicate the presence of a contaminant source requiring further evaluation.

The laboratory quantitation limits in the existing soil dataset were not sufficiently low enough to draw conclusions regarding the majority of pesticides, SVOCs, and VOCs, all of which were generally not detected. The COIs identified in Tables 5.6 and 5.7 are listed below.

- Metals: arsenic, barium, cadmium, chromium, copper, lead, mercury, and silver
- TPH: GRO, DRO, and ORO
- PCBs
- PAHs (fluorene, naphthalenes, fluoranthene, and pyrene; cPAHs)
- VOCs: ethylbenzene and xylenes; PCE, TCE, DCE, 1,1-dichloroethane (DCA), and vinyl chloride; 1,2,4--trimethylbenzene, and 1,3,5-trimethylbenzene

5.2.2 Historical Property Use

This section lists historical operations of concern and associated COIs. Table 5.8 provides further information regarding the COIs associated with historical operations and processes. Key COIs that have associated PSLs are summarized below.

- Residential usage: residences historically present on the Property may have had heating oil tanks for oil-burning furnaces, which are associated with heavy TPH (DRO and ORO) and potentially with minor petroleum constituents such as naphthalenes or BTEX (refer to WAC Table 830-1 for a summary of constituents associated with petroleum releases).
- Shoreline and other fillings: the source of fill along the northern portion of the shoreline is undocumented and may include both dredge fill and fill from upland sources.
  - Fill derived from dredge sources may be associated with contaminants present in the LDW.
  - Dock pilings, which have the potential to contaminate dredge fill, may be associated with creosote (i.e., PAHs) or pentachlorophenol.
  - Fill derived from upland sources placed in the uplands area of the Property may be associated with common urban contaminants such as metals, TPH, and potentially PCBs or PAHs.
- Gasoline service stations/battery shop.
- Incidental releases during fueling may be associated with TPH, BTEX, PAHs (including naphthalenes), and lead.
  - Waste oil may be associated with PCBs or CVOCs.
  - Battery shop operations may be associated with metals (such as in lead-acid batteries) and artificially low-pH conditions.
- Boat yard operations (Eklund and Eklund 2014).
  - Boat building/maintenance may be associated with sandblast grit containing metals (cadmium, chromium, copper, lead, mercury, and zinc).
  - Marine paints may be associated with chemicals used to increase their durability or antifouling properties, including tributyltin (TBT), PCBs, and lead.
  - Incidental releases during fueling may be associated with TPH and BTEX.
  - Use of creosote-treated lumber may be associated with PAHs.
- Timber and lumber storage and handling and other shed storage operations.
  - Common wood preservatives include chromated arsenicals, creosote, and pentachlorophenol (USEPA 2022).
  - CVOCs may be associated with degreaser storage.
  - Lead may be associated with battery storage.
  - TPH and BTEX may be associated with fuel storage.
- Slug bait packing and handling.

  - Active ingredients in Corry's slug bait include two pesticides: metaldehyde and carbaryl (USEPA 2017). Acetaldehyde (a VOC) has also been used historically in the slug bait formulation (RGI 2003) and has applicable regulatory criteria.
- Metals recycling.
  - Metals.
  - Processing of metals is associated with PCBs that may be present in materials commingled with recycled metals (CalEPA 2021).
  - Commonly used degreasers and cleaners in the metal manufacturing industry include TCE; however, evidence of degreaser use was not found during prior Property reconnaissance.
- Gypsum recycling.
  - Gypsum materials consist of calcium sulfate dihydrate, which is not regulated as a hazardous substance on the basis of toxicity to environmental receptors. Gypsum dust may cause unacceptable air quality.

5.2.3 Site Setting Considerations

The Property lies adjacent to the middle reach of the LDW Superfund Site, which has established a list of COCs for sediment remediation. Contaminants identified in the LDW sediments may be present in fill derived from dredged sources. Additionally, the presence of a contaminant in adjacent LDW sediment may indicate a potential upland source of that contaminant at or near the Property. The LDW list of COCs includes the following:

- Metals: arsenic, cadmium, chromium, copper, lead, mercury, silver, zinc
- PCBs
- Dioxins/furans
- SVOCs: chlorobenzene, PAHs, phenols, phthalates

Additionally, the presence of contaminants in stormwater system solids or stormwater may indicate the presence of contaminants in shallow soil on or near the Property, of sources of contamination associated with Property operations, or of the intrusion of groundwater if stormwater system components are in poor condition.

Multiple samples of stormwater system solids collected at and near the Property by Ecology and SPU detected contaminants that exceeded screening criteria, including the following:

- Metals: cadmium, copper, lead, mercury, zinc
- PCBs
- TPH: DRO and ORO
- SVOCs: PAHs, phenols, phthalates, N-nitrosodiphenylamine
- Benzoic acid

Concentrations of copper, lead, mercury, nickel, zinc, and PCBs additionally exceeded the surface water criteria in stormwater samples.

Finally, adjacent sites with contamination may have the potential to impact Site media via migration of upgradient groundwater or via surface water runoff containing shallow soil contaminants. Contaminated sites in the approximate upgradient direction to the west of the Property, including the Interstate Coatings, Olympic Steel Door, and Marine Lumber Services sites, have documented releases of GRO and BTEX to soil and groundwater.

5.2.4 List of COIs for Remedial Investigation

The COIs identified in Sections 5.2.1, 5.2.2, and 5.2.3 were combined to determine a list of COIs for the Site. The project list of COIs includes the following.

- Metals: arsenic, barium, cadmium, chromium, copper, lead, mercury, silver, zinc
- Tributyltin
- TPH: GRO, DRO, ORO
- PCBs
- Dioxins/furans
- SVOCs potentially associated with historical Property operations: PAHs pentachlorophenol
- Additional SVOCs of concern for sediments: phenols, phthalates, N-nitrosodiphenylamine, benzoic acid
- VOCs: BTEX, CVOCs (PCE, TCE, DCE, DCA, and vinyl chloride), chlorobenzene, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene
- Pesticides: acetaldehyde, metaldehyde, and carbaryl

6.0 Proposed Remedial Investigation

The proposed RI field investigation will be completed to collect soil, groundwater, and sediment data to prepare a comprehensive RI for the Site and support the development of an FS to evaluate potential cleanup options for the Study Area. Objectives for data collection, identified data gaps, and the proposed sample collection to fulfill data gaps are presented in the following sections.

6.1 DETERMINATION OF DATA QUALITY OBJECTIVES

Per WAC 173-340-350(1), the overarching objective of the RI/FS is to collect sufficient data and information to evaluate remedial alternatives and develop and select a cleanup action. Remedial alternatives are combinations of cleanup technologies that may be used at a site based on the types and concentrations of contaminants present and the physical constraints of the site. The anticipated data needs were evaluated using a stepwise DQO analysis.

1. State the problem (or data gap).
2. Identify the goals of the study.
3. Identify information inputs.
4. Define the boundaries of the study.
5. Develop the analytical approach.
6. Specify the performance or acceptance criteria.
7. Develop the plan for obtaining data.

The outcome of the DQO analysis is a comprehensive RI designed to collect all the data necessary to perform the FS. The DQOs for the RI are presented in Table 6.1. The identified data needs and proposed plan for obtaining the data for each DQO are described in Section 6.2.

6.2 DATA QUALITY OBJECTIVES AND PROPOSED REMEDIAL INVESTIGATION

The objective of the RI is to collect additional soil, groundwater, and sediment characterization data, which will fill the DQOs described in Table 6.1 and adequately define the nature and extent of contamination at the Site for the development of the FS. DQOs were identified on the basis of existing analytical data, information regarding known and suspected historical operations at the Property, and the complete and potentially complete pathways for contaminant migration and exposure at the Site. Existing groundwater and soil data that inform the DQOs are shown on Figures 6.1 through 6.8, existing sediment data that informs the DQOs are shown on Figure 6.11, and the proposed RI locations are shown on Figures 6.9 through 6.11. The proposed groundwater and soil investigation to fulfill each DQO, including a description of specific samples to be collected at each location and laboratory analyses, are presented in the following sections. During all the field investigations, the soil will be screened for indications of contamination including sheens, odors, staining, debris, and elevated headspace volatiles measured using a PID. Soil borings will be advanced to a depth at least 2 feet below the lowest expected or observed water table unless otherwise noted. The lowest depth to water measured in existing wells on the Property is at 13 feet bgs; therefore, borings will be advanced to 15 feet bgs. The borings will be extended below the bottom of the field indications of contamination if observed below 15 feet bgs. Representative samples encompassing intervals of 2 feet or less will be collected across each fill soil unit (below the surface pavement and/or recently placed gravel surfacing material) and native soil unit encountered to the bottom depth of 15 feet bgs; however, sample intervals may be adjusted in the field to target smaller intervals with field indications of contamination. Where soil samples are not targeted for immediate laboratory analysis, they will be archived and may be additionally analyzed as needed to define the extent of PSL exceedances sufficient to complete the FS. Field procedures to accomplish the DQOs and detailed information regarding anticipated well screen and exploration depths at each sample station are presented in detail in Appendix C (SAP/QAPP). Where groundwater monitoring is specified to fill a DQO, samples will be collected during low tide; further detail regarding sampling windows for low-tide sampling is also presented in Appendix C. Health and Safety procedures for field data collection are presented in Appendix D (Health and Safety Plan). RI data will be managed in accordance with the Data Management Plan (Appendix E).

6.2.1 DQOs Identified on the Basis of the Existing Dataset

The existing dataset was useful for preliminary characterization; however, the additional data collected through this process will help develop and evaluate FS remedial alternatives. Results for detected analytes in groundwater in the existing dataset are compared to PSLs in Table 6.2 and results for detected analytes in in situ soil in the existing dataset are compared to PSLs in Table 6.4.

The goal for DQO-1, DQO-2, and DQO-3 is to establish a groundwater monitoring well network to define the extent of metals, petroleum, and CVOCs, respectively, detected at concentrations exceeding COI PSLs. The proposed groundwater investigation is shown on Figure 6.9. New monitoring wells will be installed with screened intervals spanning the water table unless otherwise noted.

DQO-3, DQO-4, and DQO-5 are also based on the existing dataset and focus on soil media delineation. The goal for DQO-3 is to further investigate potential upgradient soil sources of CVOCs, which were not found to exceed PSLs in Property soil during previous investigations, as well as to verify the results of previous soil investigation results for CVOCs. The goal for DQO-4 is to delineate the extent of TPH and metals exceedances to evaluate the effectiveness of the prior remedial actions (refer to Section 3.2). The goal of DQO-5 is to delineate the vertical and horizontal extents of the stained fill soil with elevated metals along the Duwamish riverbank in the northern portion of the Property.

DQO-1 Metals in Groundwater

Additional data are needed to determine the source, magnitude, and extent of elevated metals in the groundwater. This includes the evaluation of geochemical conditions which contribute to metals groundwater solubility migration. Existing monitoring well metals data show that arsenic exceeded the PSL in the vicinity of the former gas station (MW-04), the storage shed (MW-03), and downgradient of A5A (MW-02, MW-09), as shown on Figure 6.1. Lead was also historically detected at MW-03 and MW-04 (Figure 6.2).

The extent of metals along the eastern shoreline will be assessed through quarterly sampling at existing monitoring wells MW-05, 07, and 11 and new wells MW-01R, 20, and 21. The extent of metals near the former gas station operations will additionally be assessed through the quarterly sampling of new well MW-13. Historical PSL exceedances will be confirmed by sampling existing wells MW-03R, 08, 09, and 10. Groundwater samples will be analyzed for arsenic, cadmium, chromium, copper, lead, mercury, silver, and zinc. Groundwater field parameters (oxidation-reduction potential, dissolved oxygen, pH, etc.) will be collected to evaluate geochemical conditions.

DQO-2 TPH in Groundwater

Additional data are needed to characterize the magnitude and extent of elevated concentrations of petroleum in the groundwater related to known petroleum releases. Existing monitoring well data for TPH show elevated total DRO+ORO concentrations in the vicinity of the former gas station (MW-04 and MW-11), within and downgradient of the storage shed/hydraulic oil storage area used by Silver Bay Logging (MW-03/03R and MW-10), near remedial action excavation area A5A (MW-08), and along the shoreline south of the filled bank area (MW-01), as shown in Figure 6.3.

TPH, which is less dense than water, is expected to concentrate on the water table. Existing shallow monitoring wells MW-03R, 08, 09, 11, and 12, and new monitoring wells MW-01R, 13, 14, 20, and 21 will be sampled quarterly to assess petroleum concentrations and provide information to assist in bounding the extent of the contamination. Groundwater samples will be analyzed for GRO, DRO, ORO, and BTEX compounds. Samples collected from the vicinity of the former gasoline station will also be analyzed for lead as discussed in DQO-1. Existing wells MW-08, 09, 12, and new well MW-20 in the hydraulic oil storage area will additionally be analyzed for PCBs and PAHs.

DQO-3 CVOCs in Groundwater

Additional data are needed to determine the source, magnitude, and extent of elevated CVOCs in groundwater. CVOC data for the existing monitoring wells show that PCE exceeded the PSL in the southeastern corner (East Yard) of the Property (MW-05, MW-07) and off-property in the upgradient direction (MW-06), as shown on Figure 6.4. Prior investigations did not identify PCE releases or PCE-contaminated source soil at the Property, suggesting a potential off-Property source of PCE in groundwater. Additionally, vinyl chloride has historically exceeded PSLs in the East Yard (MW-03R, MW-10, and MW-09) and the vinyl chloride detection limits were greater than the PSL for all samples in the existing dataset. Figure 6.5 shows vinyl chloride detections in groundwater.

CVOCs will be monitored quarterly in the vicinity of PCE exceedances (existing wells MW-05 through MW-07 and new wells MW-17 through MW-20) to assess the lateral extent of the PCE contamination and potential presence of the other CVOCs that are breakdown products of PCE. Because CVOCs are denser than water, MW-05D will be installed adjacent to MW-05 and monitored to assess the vertical extent of CVOCs. All remaining wells will be sampled for CVOCs for the purposes of investigating the extent and potential sources of the scattered PSL exceedances for vinyl chloride and to characterize groundwater quality at the shoreline relative to CVOCs.

Soil from the capillary fringe and water table intervals, and any soil intervals with elevated PID readings, will additionally be analyzed from the new upgradient well borings FS-34/MW-17, FS-35/MW-18 to further investigate potential upgradient soil sources of PCE where soil has not previously been characterized for CVOCs. Samples will also be analyzed from the same interval at FS-33/MW-05D to confirm previous findings that did not detect PCE in soil in the southeast corner of the Property.

DQO-4 Remedial Action Area Soil

Additional data are needed to determine the extent of TPH and metals left in place following remedial excavations. Existing excavation confirmation sidewall samples have been used to identify additional boring locations to delineate previous remedial actions A3B and A5A exceedances. In situ arsenic, lead, and total DRO+ORO detections are shown on Figures 6.6, 6.7, and 6.8, along with previous remedial action areas and excavation confirmation samples.

Samples will be collected from boring location FS-28, adjacent to the building south of A3B and west of A5A, at the approximate intervals where previous remedial excavation sidewall confirmation sample results indicated that contamination remains in the soil. Soil samples from the 2 to 2.5 feet and 7 to 9 feet bgs intervals, corresponding to PSL exceedances in the confirmation samples, will be analyzed for metals, DRO, and ORO. Additionally, the two samples with the highest metals for this DQO will be analyzed for non-volatile COIs including PCBs, PAHs, PCP, and dioxins/furans. If field screening with a PID indicates that volatiles are present in any interval at concentrations exceeding 10 times ambient background measurements, samples for volatile COIs (VOCs and GRO) will be collected. If needed to further delineate PSL exceedances, a contingent step-out boring (FS-29C) will be advanced. Proposed soil borings are shown on Figure 6.10. Existing well MW-09, downgradient of the previous excavations where DRO+ORO exceeding the PSL remain in the soil, will be monitored for TPH.

DQO-5 Bank Fill Soil

Additional data are needed to identify the potential origin and extent of stained riverbank fill soil with elevated metals concentrations in the northern portion of the Property, which was placed before the late 1950s. This fill soil contamination is presumed to be related to releases caused by historical gas station/auto repair and battery shop operations which were active in the vicinity during the time of fill placement. Existing samples WH-RBank, A1A-N5-2.5, A1A-E5-2, and

A1A-S7-2.5 define the area with documented metals concentrations exceeding soil and sediment PSLs in the riverbank and adjacent to interim action excavation A1A; the next closest sample locations to the south are MW03R and MW-10 where stained soil and significantly elevated metals concentrations were not encountered. Historical aerial photographs show the fill placement along the riverbank in this area. Limited additional data are available for this fill unit, and it is unknown whether other COIs may have been commingled with the metals contamination in releases associated with the historical gas station/auto repair and battery shop.

Riverbank soils will be visually surveyed and field screened with x-ray fluorescence (XRF) spectrometry to determine the extent of elevated metals concentrations and inform field adjustment of the lateral extent of borings to define metals-contaminated fill. Soil samples will be collected from borings advanced along the riverbank (FS-01, FS-02, FS-03, FS-26, and FS-27), as shown on Figure 6.10. Lateral step-out borings will be advanced in the landward direction (FS-05, FS-06, FS-07, FS-10, FS-11) to horizontally delineate the area of known contamination and/or likely fill area. Samples will be collected at 1-foot intervals from approximately 2 to 5 feet bgs, equivalent to the vertical extent of stained fill observed at the WH-RBank location, and from any other intervals with staining for immediate analysis of metals. In order to determine the potential presence and concentration magnitude of other COIs in metals-contaminated bank fill soil, the five most highly metals-contaminated soil samples will be analyzed for additional COIs, including TPH-D, PCBs, dioxins/furans, and SVOCs. Any COIs exceeding PSLs will additionally be analyzed in the samples that bound the lateral and vertical extents of the metals-impacted shoreline fill. If field screening with a PID indicates that volatiles are present in any interval at concentrations exceeding 10 times ambient background measurements, samples for volatile COIs (VOCs and GRO) will also be collected. It is anticipated that most borings will be collected via direct-push drilling methodology; however, the sample stations closest to the shoreline may not be safely accessible by a drill rig. If access issues are encountered, a hand auger will be used to collect samples to a depth of 5 feet bgs or until refusal is encountered. Figures 6.6 and 6.7 present historical arsenic and lead detections, respectively, in areas of operations.

6.2.2 DQOs Regarding Historical Operations

A variety of historical operations at the Property have contributed to contamination in Site media. Historical operations are shown on Figure 2.1 and described in Section 2.1. Section 5.2.2 describes the COIs associated with historical Property use. The goal for DQO-6 through DQO-9 is to identify and determine the nature and extent of the resulting contamination contributed by historical operations sufficient to develop and evaluate FS remedial alternatives. The focus is on historical operations that have previously not been thoroughly evaluated by the existing dataset, such as fill soil, boat building, treated wood storage and other storage, and slug bait handling.

DQO-6 Fill Soil

Additional data are needed to characterize the COIs associated with soils placed during historical filling events at the Property. Some existing soil boring logs collected prior to Independent Metals operations or outside of areas where remedial action excavations were conducted due to impacts from Independent Metals operations indicate the presence of imported fill: HA-01, SB-04, SB-08, SB-13, P1, P4, P12, MW-03R, MW-10, and WH-RBank. Historical aerial photographs show the fill placement along the riverbank, including in the vicinity of the WH-RBank. Refer to Figure 3.1 for previous investigation and remedial action locations.

Representative soil samples will be collected from each fill unit observed at borings distributed across the site (FS-04, FS-05, FS-11, FS-12, FS-14, FS-15, FS-16, FS-18, FS-20, FS-21, FS-22, FS-23, FS-28, FS-32, and FS-33), as shown on Figure 6.10. The fill samples will be analyzed for likely urban or industrial contaminants and dredge fill contaminants including metals, TPH, PCBs, SVOCs, dioxins/furans, and VOCs. Native samples will be archived and analyzed, if needed, to delineate the vertical extent of PSL exceedances. Additional native soil samples will be analyzed if field indications of sheen or elevated PID measurements indicate potential contamination. Additional native samples will be analyzed for the list of analyses described above, and volatile COIs if their presence is indicated by PID measurements.

DQO-7 Boat Building

Additional data are needed to determine whether the historical boat building operations on the Property resulted in the release of contaminants. Refer to Figure 2.1 for historical property operation areas. The nature of historical boat building operations and operational areas have been determined from Property ownership records, aerial photographs, and records from site visits and interviews with the property owners/operators. An aerial photograph from 1993 shows several historical buildings in the center of the Property that were gone by 2002. Research regarding these industries and processes identified COIs potentially associated with historical operations.

Soil samples will be collected from borings advanced in the vicinity of and outside the former boat building area (FS-16, FS-17, FS-18, FS-19, FS-21, FS-23, FS-24, and FS-25), as shown on Figure 6.10. Fill soil samples and native soil samples down to the capillary fringe will be analyzed for COIs associated with boat building, which would have been released to the ground surface, including metals, chlorinated solvents, TBT, PCBs, TPH, and PAHs. Native samples will be archived and analyzed if needed to delineate the vertical extent of PSL exceedances. If floor drains are observed within the building along the southern Property line where boat building operations historically occurred, contingency borings FS-30C and FS-31C will be completed consistent with the above.

Groundwater samples from monitoring wells within the boat building area (MW-01R, 07, 09, 12, 16, 19, and 20) will also be archived for analysis of TBT, which is the COI unique to boat building, or other COIs if detected in the soil samples.

DQO-8 Treated Wood Storage Area

Additional data are needed to determine whether historically treated wood storage operations and other storage operations at the Property resulted in the release of contaminants. Refer to Figure 2.1 for historical property operation areas. The nature of historically treated wood storage and other storage operations and operational areas have been determined from Property ownership records, aerial photographs, and records from site visits and interviews with the Property owners/operators. Research regarding wood treatment processes identified COIs potentially associated with the historical operations. Property reconnaissance of the shed in the same vicinity identified storage of other materials including degreaser, fuel, and batteries.

Soil samples will be collected from borings advanced in the vicinity of the former treated wood and shed storage area (FS-05, FS-08, FS-09, and FS-12, and contingency boring FS-13C if field indications of contamination are observed), as shown on Figure 6.10. Fill soil samples and native soil samples down to the capillary fringe will be analyzed for COIs associated with treated wood, which may have been released to the ground surface, including metals (arsenic, chromium, copper), pentachlorophenol, and PAHs. Samples will also be analyzed for chemicals potentially associated with the storage shed, which would also have been released to the ground surface, including: CVOCs, TPH, BTEX, mercury, and lead. Native samples will be archived and analyzed if needed to delineate the vertical extent of the PSL exceedances. Additional native soil samples will be analyzed if field indications of sheen or elevated PID measurements indicate potential contamination. Archive sample volume will be collected from all intervals for potential future dioxin/furan analysis if pentachlorophenol is detected.

A new monitoring well (MW-14) will also be installed within the former treated wood storage area and will be monitored for COIs associated with the storage area if COIs are detected in the soil samples.

DQO-9 Slug Bait Handling

Additional data are needed to determine whether the slug bait packaging/handling at the Property resulted in releases of contaminants. Refer to Figure 2.1 for historical property operation areas. The nature of historical slug bait handling operations has been determined from Property ownership records, aerial photographs, and records from site visits and interviews with the Property owners/operators. Research regarding the historical formulation identified COIs potentially associated with the historical operations including acetaldehyde, metaldehyde, and carbaryl. Of these slug bait COIs, laboratory analytical capabilities and PSLs are available for only acetaldehyde and carbaryl. Given the nature of former slug bait operations, which included packaging and handling, it is assumed that potential releases would have occurred in the vicinity of the loading dock, which connects to 8th Avenue S via a paved driveway along the southwest portion of the building. Historical aerial photos show that the area east-southeast of the loading dock was unpaved (e.g., Figure A1.6 taken in 1969) and is therefore most likely to have been impacted by potential spills that may have occurred during transfers at the loading dock.

Soil samples will be collected from a boring advanced at the loading area of the former slug bait packaging building (FS-36) and near the building personnel entrance (FS-15), as shown on Figure 6.10. All fill soil samples and native soil samples down to the capillary fringe will be analyzed for slug bait COIs, which would have been released to the ground surface as incidental spills during loading/unloading. Deeper native samples will be archived and analyzed if needed to delineate the vertical extent of PSL exceedances. Additional native soil samples will be analyzed if field indications of sheen or elevated PID measurements indicate potential contamination. Archive samples will be collected from additional borings farther from the loading dock within the historical unpaved area (FS-16, FS-17) and the remaining sides of the building (FS-28, FS-29C) for analysis if slug bait COIs exceed PSLs at FS-36 or FS-15.

The existing monitoring well located downgradient of the former slug bait handling operations (MW-09) will also be monitored for acetaldehyde and carbaryl to detect potential releases to building floor drains. If groundwater at MW-09 is found to be impacted by slug bait COIs, additional downgradient wells may be sampled.

6.2.3 DQOs Regarding Contaminant Migration and Exposure Pathways

Additional data are needed to support the CSM and to further define the contaminant migration and exposure pathways at the Site. The purpose of DQO-10 through 14 is to understand contaminant fate and transport sufficiently enough to develop and evaluate remedial alternatives in the FS.

The goal for DQO-10 is to determine upgradient groundwater sources of COIs. The goal for DQO-11 is to determine whether groundwater discharges at the shoreline have the potential to impact surface water or sediment quality in the LDW. The goal for DQO-12 is to collect paired soil and groundwater results for COIs to support cleanup standards protective of the leaching pathway. The goal for DQO-13 is to determine groundwater flow directions and horizontal and vertical gradients, collect site-specific hydraulic conductivity measurements, and determine seepage velocities of groundwater flow toward the river. The goal for DQO-14 is to determine whether sediment quality along the shoreline of the LDW adjacent to the Property may be impacted by releases associated with the Site.

DQO-10 Upgradient Groundwater

Additional data are needed to characterize the quality of groundwater flowing into the Site from upgradient areas. Groundwater samples will be collected quarterly from existing monitoring wells (MW-03R, MW-06, and MW-10), and new monitoring wells (MW-13, MW-14, MW-15, MW-16, MW-17, and MW-18) along the eastern and southern perimeters of the Property and analyzed for key COIs that may be linked to off-Property or area-wide sources including metals, TPH, PCBs, SVOCs, VOCs, and dioxins/furans. Existing and new monitoring well locations are shown on Figure 6.9.

DQO-11 Groundwater Discharge to Surface Water

Additional data are needed to characterize the quality of groundwater discharging to the river. Groundwater at the approximate point of discharge to surface water will be characterized by quarterly sampling at existing wells (MW-05, MW-07, and MW-11), and new monitoring wells (MW-01R, MW-05D, MW-20, and MW-21) along the shoreline. Groundwater samples from shoreline wells will be analyzed for COIs including metals, TPH, PCBs, SVOCs, VOCs, and dioxins/furans. If TBT, acetaldehyde, or carbaryl are analyzed and detected in upgradient groundwater (refer to DQO-10), these analyses will also be added to the shoreline monitoring program. Existing and new monitoring well locations are shown on Figure 6.9.

The presence of groundwater seeps in the riverbank will additionally be noted during the visual survey of the bank conducted concurrently with the XRF survey described above (refer to DQO-5). The seep survey procedures are discussed in further detail in Appendix C. The occurrence of groundwater seeps, bank soil quality data, and groundwater quality data at the shoreline will be evaluated to determine, in coordination with Ecology, whether additional seep characterization is necessary to support the development of the RI/FS.

DQO-12 Contaminant Partitioning

Additional data are needed to determine the site-specific partitioning of the COIs to soil and groundwater. A limited number of soil sample results for metals in existing datasets have reporting limits sufficiently low enough to compare to the PSLs and corresponding groundwater metals results. The analytical sensitivity for other COIs in existing datasets is not sufficient to assess partitioning.

Paired soil and groundwater samples and samples for total organic carbon analysis will be collected from selected new monitoring wells (FS-32/MW-01R, FS-08/MW-14, and FS-19/MW-19). Samples of the representative soil units within the capillary fringe down to the bottom of the boring and monitoring well groundwater samples will be analyzed for all COIs and total organic carbon to assess contaminant partitioning. Additionally, alkane profiles and toxicity characteristics will be assessed with petroleum fractionation (extractable and volatile petroleum hydrocarbon) analysis from a select new monitoring well (MW-01R) and existing monitoring wells (MW-03R, MW-08, MW-09, MW-11, and MW-12) where petroleum constituents are confirmed or suspected to be present. Existing and new monitoring well locations are shown on Figure 6.9.

DQO-13 Hydrogeology

Additional data are needed to determine the range and magnitude of horizontal flow directions, tidal influence on groundwater flow, and the hydraulic conductivity of shallow water-bearing zones. Existing hydrogeologic studies identified horizontal gradients ranging from 0.0060 to 0.21 feet/foot and likely brief tidal reversals near the shoreline during high tides in the river.

Site-wide groundwater levels will be collected during low tide quarterly monitoring events and additionally at least once during high tide from all existing and proposed wells. Transducer studies will be performed at selected new wells at which all construction details will be available (MW-14, 16, 19, 20, and 21) to determine water level direction and pattern throughout tide cycles during one wet season and one dry season monitoring event; and the MW-05/MW-05D well pair will be included in the study to assess vertical gradients. Slug tests will be performed at low tide at all wells discussed under this DQO to determine the range of hydraulic conductivity values of shallow saturated soils. Transducer/slug test wells are shown on Figure 6.9.

DQO-14 Sediment Quality

Additional SMS analytical data are needed to assess the quality of intertidal and subtidal sediments in the LDW adjacent to the Site relative to COIs potentially associated with releases from former operations at the Site. The intertidal sediment area is the focus of this DQO because it is closest to the Property and it is depositional, therefore retaining potential contamination migrating from the Site uplands (Figure 6.11) from bank soil erosion, uncontrolled stormwater and sheet flow runoff, and potentially, groundwater discharge. The shallow subtidal areas farther into the river may provide additional data to define the extents of potential Site-specific sediment impacts, if necessary.[6]

The proposed RI/FS sediment data acquisition plan addresses sediment quality characterization requirements under SMS (Part III Sediment Quality Standards), informs the source control (SMS Part IV Sediment Source Control) evaluation for the Site using existing source control information from Ecology (2016), and collects data sufficient to demonstrate compliance with sediment cleanup standards for the protection of the benthic community, human health, and higher trophic level species (SMS Part V Sediment Cleanup Standards). The SMS evaluation will use the process outlined in SCUM to identify sites, develop the conceptual site model, conduct the RI/FS, establish sediment cleanup standards, and demonstrate compliance (Ecology 2021b).

The sediment quality SMS data needs for this RI/FS partially overlap those for the LDW Middle Reach because the ROD includes SMS as an ARAR (Section 5.1). RALs are included in the selection of the Lower Duwamish PCULs (Ecology 2022a) and therefore if a RAL is exceeded, the PCUL is also exceeded. Sediment quality will be addressed using sample data collected by LDWG (Windward 2022) under the middle reach Pre-design Investigation (PDI) QAPP and additional Site RI/FS sample data collected under this RI/FS Work Plan, as described below.

Existing sediment samples adjacent to the Property collected within the last 10 years include those collected during the LDW RI/FS, as documented in the ROD, and site-wide PDI conducted in 2017 and 2018 (Windward 2020). Sediment sample results in the existing dataset are compared to PSLs in Table 6.4. For the existing LDW surface sediment sample locations sampled in 2011 and 2018, sediment results compared to PSLs are shown for arsenic, benzyl alcohol, cPAHs, dioxin/furan TEQ, and PCB TEQ on Figure 6.11. The three outfall locations, existing LDW intertidal sample locations, the proposed LDW PDI QAPP intertidal and adjacent subtidal sampling locations, and the additional samples proposed to be collected for this RI are also shown on Figure 6.11.

The LDWG (2022) PDI QAPP provides detailed information on the sampling analysis plan to obtain surface and subsurface sediment data for the middle reach, which will occur within the time frame of data collection conducted under this RI/FS Work Plan at the Site. The PDI uses a grid-based sampling approach for overall location placement and the sample depth and the

[6] The LDW PDI samples located farther away in the navigation channel are excluded from this DQO assessment because of the lack of connection to the Site due to sediment disturbance from vessel scour. See Appendix C.2, which provides the LDWG PDI QAPP (2022) for detailed maps and discussion of the PDI sampling design.

analytical chemical list is designed around the DQO process. Near-outfall samples are also addressed, which are supplemented in the Site RI sampling proposed under this DQO. Samples will be analyzed for the full suite of SMS chemicals including: metals, SVOCs, PAHs, and PCBs. A subset of the Site COIs are also LDW COCs, including metals, PAHs, PCP, PCBs, and dioxins/furans, and data for these samples will be incorporated into the Site RI/FS dataset.

Sediment split samples have been provided to Silver Bay Logging by LDWG for potential TBT analysis. If detected in Site soils, TBT will be analyzed in one or more of the sediment samples based on the results of soil analysis.

The Site RI sediment quality characterization uses the forthcoming LDWG sample information to address sediment quality in adjacent intertidal areas and offshore subtidal areas. In addition, this DQO addresses localized areas potentially impacted by stormwater outfalls that have been identified at the Site by Ecology (outfalls #2011, #2010 [currently permitted], and #2009; Ecology 2012b). As shown on Figure 6.11, Site RI sediment sample locations are placed within the immediate radius of the end of the three stormwater outfall pipes and downstream of the pipe ends.

The middle reach PDI QAPP (Appendix C, Attachment C.2) identifies DQOs for two phases of sampling. Phase 1 of the sampling is focused on delineating exceedances of ROD RALs and Phase 2 involves the additional refinement of the extent of RAL exceedances and collection of engineering data, including bathymetry. Phase 1 work of the middle reach PDI started January 2023.

The Phase 1 DQOs are based on RAL exposure depth (e.g., 0 to 10 cm), bathymetry (e.g., intertidal, subtidal), and recovery category. The LDW intertidal sediment is defined as recovery category 2/3 (e.g., natural recovery is possible or predicted). The subtidal sediment offshore from the Property is a potential vessel scour area that extends into the Federal navigation channel and is categorized as recovery category 1 (e.g., limited natural recovery).

PDI phase 1 DQO-1 and DQO-3 address delineating 0 to 10 cm and 0 to 45 cm RAL exceedances intertidal recovery category 2/3 areas, respectively. DQO-2 and DQO-4 address delineating 0 to 10 cm and 0 to 60 cm RAL exceedances for the subtidal recovery category 1 areas. In addition, DQO-8 addresses under-structure samples to delineate RAL exceedances.

Figure 6.11 presents location and sample depth information for the PDI study design. Overall, the proposed LDWG middle reach PDI samples will provide a robust surface and subsurface dataset adjacent to the Property and are suitable to address the sediment quality data needs of the SMS for use in this RI/FS Work Plan. Once finalized, the LDWG middle reach PDI sediment investigation data from the LDW adjacent to the Site will be obtained from LDW database sources and incorporated into the Silver Bay Logging RI/FS database.

Some RI chemicals may not be analyzed for the PDI, including TBT. Split samples from PDI locations 1269 and 1275 will be obtained from LDWG field staff and transported under chain-of-custody to the laboratory and archived for potential use if TBT is detected in upland soil samples (refer to Appendix C).

Four additional intertidal sediment surface samples (i.e., 0 to 10 cm) will be obtained during the RI to supplement the LDWG PDI information and existing sediment data adjacent to the outfalls. FS-SE-01 will be located approximately 25 feet offshore of outfall #2111, the location of which will be confirmed during the initial shoreline survey (refer to the SAP). FS-SE-02 will be located approximately 25 feet offshore of the current stormwater outfall (#2110), adjacent to PDI location 1269. The sediment adjacent to outfall #2009 is characterized by LDW18-2109-1 and LDW-2109-2, which are located less than 50 feet offshore from the outfall. Because the PDI surface samples for locations 1269 and 1275 are archived for potential phase 2 analysis, FS-SE-02 and FS-SE-03 will be collected adjacent to the two LDW PDI samples so that analytical data are available at these locations for the Site RI/FS. An under-structure intertidal location (FS-USSE-01) will be sampled (0 to 10 cm) near the riverbank where metals contaminated fill has been identified (refer to Section 6.2.1, DQO-5).

6.3 ADDITIONAL REMEDIAL INVESTIGATION

Additional phase(s) of remedial investigation may be necessary to achieve the overall objective of site characterization sufficient to support the development of an FS. After a review of RI data, it may be determined that additional data (for example soil borings, monitoring wells, and/or sediment samples) will be needed to define the nature and extent of soil and/or groundwater contamination. Additional locations would be determined based on field observations of contamination and/or after a review of analytical data that indicates additional delineation is warranted.

Additional phases of remedial investigation may be needed for the following reasons:

- Further delineate, laterally or vertically, known areas of soil or groundwater where COIs exceed PSLs due to Site releases.
- Further delineate any additionally identified “hotspot” areas of soil or groundwater contamination where concentrations of COIs are found to be present at concentrations consistently greater than those observed elsewhere at that Site, such that the area may be of particular concern for the development of remedial alternatives. Delineation of groundwater hotspot areas may include off-Property delineation and/or delineation of deeper water-bearing zones and analysis of vertical groundwater gradients. Further evaluation of groundwater may also be needed if soil hotspot areas are identified at locations without collocated monitoring wells or if additional assessment of the groundwater to surface water pathway is needed.
- Gain additional information regarding geochemical or hydrogeologic conditions that may be necessary to determine applicable remedial technologies.

Additional phase(s) of remedial investigation would be determined after consultation with Ecology. Proposed additional investigation details would be provided to Ecology in a technical memorandum as a supplement to this RI/FS Work Plan. The additional investigation would be initiated within 30 days of Ecology approval of the technical memorandum.

7.0 Feasibility Study

Data will be gathered as part of the RI to characterize soil, groundwater, and sediment conditions to fill the DQOs defined in Section 6.0. The characterization outlined in Section 6.0 will inform the development of an updated CSM. This site characterization will inform the definition of COCs and the identification of areas of concern relative to cleanup standards in order to develop an FS. The FS will include the following elements.

Remedial Action Objectives: RAOs will be determined for the Study Area, defined as those areas of the Site above the elevation of MHHW of the adjacent Duwamish River, as a mechanism for meeting the requirements of the MTCA Cleanup Regulations (WAC 173-340). RAOs are simple statements that clearly define what the remedy must accomplish to address the concerns identified in the CSM. RAOs are used to facilitate the development and evaluation of remedial alternatives. RAOs will consider anticipated future land use, which is assumed to include a combined water quality facility and community beneficial use on the portion of the Site uplands that will be owned by SPU and may include continued commercial or industrial use in portions of the uplands owned by other parties, as well as future sediment cleanup actions in the adjacent LDW, which may be required by the Superfund cleanup process.

Areas of Concern: Areas of concern will be defined for achieving the RAOs within the Study Area. Areas of concern are characterized by specific physical and contaminant conditions that determine how cleanup standards and remedial technologies may be applied.

Proposed Cleanup Standards: Proposed CULs and points of compliance for cleanup actions will be established for the Site. The establishment of proposed CULs will consider site-specific factors such as achievable PQLs for Site media consistent with MTCA (WAC 173-340-700(6)(a-d)) and site-specific partitioning behavior that determines concentrations protective of various transport and exposure pathways. Additional site-specific proposed cleanup standards applicable to the RAOs and AOCs, such as remediation levels, may be established in conjunction with Ecology.

Remedial Technology Screening: Remedial technologies for each impacted media will be identified and evaluated to determine applicability to the individual areas of concern.

Remedial Alternatives: Remedial alternatives will be developed in accordance with the MTCA Regulation (WAC 173-340-350(8)) and evaluated for their fulfillment of the MTCA threshold criteria (refer to WAC 173-340-360(2)) and RAOs.

Disproportionate Cost Analysis: The Disproportionate Cost Analysis will evaluate the net benefit of the remedial alternatives in comparison to their projected implementation costs according to the criteria presented in MTCA (WAC 173-340-360(3)(e)).

Preferred Alternative: A preferred remedial alternative will be recommended for the Study Area based on the outcome of the Disproportionate Cost Analysis. The preferred alternative will additionally consider SPU's goals for future Site use.

Applicable or Relevant and Appropriate Requirements: ARARs will be determined for the implementation of the preferred alternative. ARARs are often categorized as chemical-specific, location-specific, or action-specific. Chemical-specific ARARs include regulatory CULs for the relevant chemicals of concern. Location-specific ARARs include any regulations or guidance relevant to a specific location at the Site. Action-specific ARARs include regulations or guidance governing any activities proposed to remediate a Site.

8.0 Reporting and Schedule

The anticipated submittal dates for field investigation activities and major deliverables associated with the RI/FS are detailed in Exhibit C of the AO. In addition to the milestones in the schedule, all analytical data will be submitted to Ecology in both printed and electronic formats in accordance with Section VII of the AO (Work to be Performed), Ecology's Toxics Cleanup Program Policy 840 (Data Submittal Requirements), and/or any subsequent procedures specified by Ecology for data submittal.

9.0 References

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Remedial Investigation/Feasibility Study Work Plan

Silver Bay Logging Site

Tables

Table 3.1
Monitoring Well Groundwater Data

		Location Name	MW-01				MW-02			MW-03			
		Sample Name	MW-01-12162003	MW-01-12182003-WL	MW-01-01082004-WL	MW-01-04232015	MW-02-12162003	MW-02-12182003-WL	MW-02-01082004-WL	MW-03-12162003	MW-03-12182003-WL	MW-03-01082004-WL	MW-03-04232015
		Sample Date	12/16/2003	12/18/2003	1/8/2004	4/23/2015	12/16/2003	12/18/2003	1/8/2004	12/16/2003	12/18/2003	1/8/2004	4/23/2015
Analyte	**CAS No.**	**Unit**											
Field Measurements													
Depth to Water	WDepth	ft		3.85	3.8	4.39		7.69	7.41		6.6	6.42	6.4
Conventionals													
Total Organic Carbon	TOC	mg/L											
Total Petroleum Hydrocarbons (TPH)													
Gasoline-range organics	GRO	µg/L				100 U				50 U			100 U
Diesel-range organics	DRO	µg/L				630 (1)	130 U			130 U			270 (1)
Oil-range organics	ORO	µg/L				1,200	250 U			250 U			250 U
Total DRO & ORO (2)	T_DRO&ORO (U=0)	µg/L				1,800	250 U			250 U			270
Total Metals													
Arsenic	7440-38-2	µg/L											
Barium	7440-39-3	µg/L											
Cadmium	7440-43-9	µg/L											
Chromium	7440-47-3	µg/L											
Lead	7439-92-1	µg/L											
Mercury	7439-97-6	µg/L											
Selenium	7782-49-2	µg/L											
Silver	7440-22-4	µg/L											
Dissolved Metals													
Arsenic	7440-38-2	µg/L	25 U				9.0			5.0 U			8.1
Barium	7440-39-3	µg/L	200 U				160 U			70			16
Cadmium	7440-43-9	µg/L	5.0 U				40 U			5.0 U			1.0 U
Chromium	7440-47-3	µg/L	7.0 U				560 U			7.0 U			1.2
Lead	7439-92-1	µg/L	3.0 U				3.0 U			3.0 U			170
Mercury	7439-97-6	µg/L	0.20 U				0.20 U			0.20 U			1.0 U
Selenium	7782-49-2	µg/L	40 U				320 U			40 U			1.3
Silver	7440-22-4	µg/L	30 U				240 U			30 U			1.0 U
Polychlorinated Biphenyls													
Aroclor 1016	12674-11-2	µg/L				0.10 U							0.10 U
Aroclor 1221	11104-28-2	µg/L				0.10 U							0.10 U
Aroclor 1232	11141-16-5	µg/L				0.10 U							0.10 U
Aroclor 1242	53469-21-9	µg/L				0.10 U							0.10 U
Aroclor 1248	12672-29-6	µg/L				0.10 U							0.10 U
Aroclor 1254	11097-69-1	µg/L				0.10 U							0.10 U
Aroclor 1260	11096-82-5	µg/L				0.10 U							0.10 U
Aroclor 1262	37324-23-5	µg/L											
Aroclor 1268	11100-14-4	µg/L											
Total PCB Aroclors (U=0) (3)	T_PCB (U=0)	µg/L				0.10 U							0.10 U
Polybrominated Diphenyl Ether (PBDE)													
PBDE-003	101-55-3	µg/L	2.0 U				2.0 U						
Semi-Volatile Organic Compound (SVOCs)													
1-Methylnaphthalene	90-12-0	µg/L	2.0 U				2.0 U						
2-Methylnaphthalene	91-57-6	µg/L	2.0 U				2.0 U						
Acenaphthene	83-32-9	µg/L	2.0 U				2.0 U						
Acenaphthylene	208-96-8	µg/L	2.0 U				2.0 U						
Anthracene	120-12-7	µg/L	2.0 U				2.0 U						
Benzo(a)anthracene	56-55-3	µg/L	2.0 U				2.0 U						
Benzo(a)pyrene	50-32-8	µg/L	2.0 U				2.0 U						
Benzo(b)fluoranthene	205-99-2	µg/L	2.0 U				2.0 U						
Benzo(g,h,i)perylene	191-24-2	µg/L	2.0 U				2.0 U						
Benzo(k)fluoranthene	207-08-9	µg/L	2.0 U				2.0 U						
Chrysene	218-01-9	µg/L	2.0 U				2.0 U						

Table 3.1
Monitoring Well Groundwater Data

		Location Name	MW-01				MW-02			MW-03			
		Sample Name	MW-01-12162003	MW-01-12182003-WL	MW-01-01082004-WL	MW-01-04232015	MW-02-12162003	MW-02-12182003-WL	MW-02-01082004-WL	MW-03-12162003	MW-03-12182003-WL	MW-03-01082004-WL	MW-03-04232015
		Sample Date	12/16/2003	12/18/2003	1/8/2004	4/23/2015	12/16/2003	12/18/2003	1/8/2004	12/16/2003	12/18/2003	1/8/2004	4/23/2015
Analyte	CAS No.	Unit											
Semi-Volatile Organic Compound (SVOCs) (cont.)													
Dibenzo(a,h)anthracene	53-70-3	µg/L	2.0 U				2.0 U						
Fluoranthene	206-44-0	µg/L	2.0 U				2.0 U						
Fluorene	86-73-7	µg/L	2.0 U				2.0 U						
Indeno(1,2,3-c,d)pyrene	193-39-5	µg/L	2.0 U				2.0 U						
Naphthalene	91-20-3	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
Phenanthrene	85-01-8	µg/L	2.0 U				2.0 U						
Pyrene	129-00-0	µg/L	2.0 U				2.0 U						
Total Naphthalenes (U=0) [(2)]	T_Napth (U=0)	µg/L	2.0 U				2.0 U						
cPAHs (MTCA TEQ-ZeroND) [(3,4)]	BaPEq (U=0)	µg/L	2.0 U				2.0 U						
cPAHs (MTCA TEQ-HalfND) [(3,5)]	BaPEq (U=1/2)	µg/L	2.0 U				2.0 U						
Total HPAH (U=0) 2[3)]	T_HPAH (U=0)	µg/L	2.0 U				2.0 U						
Total LPAH (U=0) [(2)]	T_LPAH (U=0)	µg/L	2.0 U				2.0 U						
Total PAH (U=0) [(2)]	T_PAH (U=0)	µg/L	2.0 U				2.0 U						
2,3,4,6-Tetrachlorophenol	58-90-2	µg/L	5.0 U				5.0 U						
2,4,5-Trichlorophenol	95-95-4	µg/L	2.0 U				2.0 U						
2,4,6-Trichlorophenol	88-06-2	µg/L	2.0 U				2.0 U						
2,4-Dichlorophenol	120-83-2	µg/L	2.0 U				2.0 U						
2,4-Dimethylphenol	105-67-9	µg/L	2.0 U				2.0 U						
2,4-Dinitrophenol	51-28-5	µg/L	10 U				10 U						
2,6-Dichlorophenol	87-65-0	µg/L	2.0 U				2.0 U						
2-Chlorophenol	95-57-8	µg/L	2.0 U				2.0 U						
2-Methylphenol	95-48-7	µg/L	2.0 U				2.0 U						
2-Nitrophenol	88-75-5	µg/L	5.0 U				5.0 U						
4,6-Dinitro-o-cresol	534-52-1	µg/L	10 U				10 U						
4-Chloro-3-methylphenol	59-50-7	µg/L	2.0 U				2.0 U						
4-Methylphenol	106-44-5	µg/L	2.0 U				2.0 U						
4-Nitrophenol	100-02-7	µg/L	10 U				10 U						
Pentachlorophenol	87-86-5	µg/L	10 U				10 U						
Phenol	108-95-2	µg/L	2.0 U				2.0 U						
Bis(2-ethylhexyl)phthalate	117-81-7	µg/L	3.0 U				3.0 U						
Butyl benzyl phthalate	85-68-7	µg/L	2.0 U				2.0 U						
Di-n-butyl phthalate	84-74-2	µg/L	3.0 U				3.0 U						
Di-n-octyl phthalate	117-84-0	µg/L	2.0 U				2.0 U						
Diethylphthalate	84-66-2	µg/L	12				7.0						
Dimethyl phthalate	131-11-3	µg/L	2.0 U				2.0 U						
2-Chloronaphthalene	91-58-7	µg/L	2.0 U				2.0 U						
Acrylonitrile	107-13-1	µg/L					10 U			10 U			
Aniline	62-53-3	µg/L	2.0 U				2.0 U						
Azobenzene	103-33-3	µg/L	2.0 U				2.0 U						
Benzoic acid	65-85-0	µg/L	20 U				20 U						
Benzyl alcohol	100-51-6	µg/L	2.0 U				2.0 U						
Bis(2-chloroethoxy)methane	111-91-1	µg/L	2.0 U				2.0 U						
Carbazole	86-74-8	µg/L	2.0 U				2.0 U						
Dibenzofuran	132-64-9	µg/L	2.0 U				2.0 U						
Hexachlorobenzene	118-74-1	µg/L	2.0 U				2.0 U						
Hexachlorobutadiene	87-68-3	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
Hexachlorocyclopentadiene	77-47-4	µg/L	10 U				10 U						
Isophorone	78-59-1	µg/L	2.0 U				2.0 U						
N-Nitrosodimethylamine	62-75-9	µg/L	2.0 U				2.0 U						
N-Nitroso-di-n-propylamine	621-64-7	µg/L	2.0 U				2.0 U						
N-Nitrosodiphenylamine	86-30-6	µg/L	2.0 U				2.0 U						

Table 3.1
Monitoring Well Groundwater Data

		Location Name	MW-01				MW-02			MW-03			
		Sample Name	**MW-01-12162003**	**MW-01-12182003-WL**	**MW-01-01082004-WL**	**MW-01-04232015**	**MW-02-12162003**	**MW-02-12182003-WL**	**MW-02-01082004-WL**	**MW-03-12162003**	**MW-03-12182003-WL**	**MW-03-01082004-WL**	**MW-03-04232015**
		Sample Date	**12/16/2003**	**12/18/2003**	**1/8/2004**	**4/23/2015**	**12/16/2003**	**12/18/2003**	**1/8/2004**	**12/16/2003**	**12/18/2003**	**1/8/2004**	**4/23/2015**
Analyte	**CAS No.**	**Unit**											
Volatile Organic Compounds (VOCs)													
Benzene	71-43-2	µg/L				0.35 U	2.0 U			2.0 U			0.35 U
Ethylbenzene	100-41-4	µg/L				1.0 U	2.0 U			2.0 U			1.0 U
Toluene	108-88-3	µg/L				1.0 U	2.0 U			3.0			1.0 U
Xylene (meta & para)	108-38-3/106-42-3	µg/L				2.0 U	4.0 U			4.0 U			2.0 U
Xylene (ortho)	95-47-6	µg/L				1.0 U	2.0 U			2.0 U			1.0 U
Xylene (total)	1330-20-7	µg/L				2.0 U	4.0 U			4.0 U			2.0 U
Chloroethane	75-00-3	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
cis-1,2-Dichloroethene	156-59-2	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
trans-1,2-Dichloroethene	156-60-5	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
Vinyl chloride	75-01-4	µg/L	2.0 U			0.20 U	2.0 U			2.0 U			0.20 U
Tetrachloroethene	127-18-4	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
Trichloroethene	79-01-6	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
1,1,1,2-Tetrachloroethane	630-20-6	µg/L				1.0 U	2.0 U			2.0 U			1.0 U
1,1,1-Trichloroethane	71-55-6	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
1,1,2,2-Tetrachloroethane	79-34-5	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
1,1,2-Trichloroethane	79-00-5	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
1,1-Dichloroethane	75-34-3	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
1,1-Dichloroethene	75-35-4	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
1,1-Dichloropropene	563-58-6	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
1,2,3-Trichlorobenzene	87-61-6	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
1,2,3-Trichloropropane	96-18-4	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
1,2,4-Trichlorobenzene	120-82-1	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
1,2,4-Trimethylbenzene	95-63-6	µg/L				1.0 U	2.0 U			2.0 U			1.0 U
1,2-Dibromo-3-chloropropane	96-12-8	µg/L	10 U			10 U	10 U			10 U			10 U
1,2-Dibromoethane	106-93-4	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
1,2-Dichlorobenzene	95-50-1	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
1,2-Dichloroethane	107-06-2	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
1,2-Dichloropropane	78-87-5	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
1,3,5-Trimethylbenzene	108-67-8	µg/L				1.0 U	2.0 U			2.0 U			1.0 U
1,3-Dichlorobenzene	541-73-1	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
1,3-Dichloropropane	142-28-9	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
1,4-Dichlorobenzene	106-46-7	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
2,2-Dichloropropane	594-20-7	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
2,4-Dinitrotoluene	121-14-2	µg/L	5.0 U				5.0 U						
2,6-Dinitrotoluene	606-20-2	µg/L	5.0 U				5.0 U						
2-Chlorotoluene	95-49-8	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
2-Hexanone	591-78-6	µg/L				10 U	10 U			10 U			10 U
2-Nitroaniline	88-74-4	µg/L	5.0 U				5.0 U						
3,3'-Dichlorobenzidine	91-94-1	µg/L	2.0 U				2.0 U						
3-Nitroaniline	99-09-2	µg/L	5.0 U				5.0 U						
4-Chloroaniline	106-47-8	µg/L	2.0 U				2.0 U						
4-Chlorophenyl phenyl ether	7005-72-3	µg/L	2.0 U				2.0 U						
4-Chlorotoluene	106-43-4	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
4-Nitroaniline	100-01-6	µg/L	5.0 U				5.0 U						
Acetone	67-64-1	µg/L				10 U	30			25 U			10 U
Bis(2-chloroethyl)ether	111-44-4	µg/L	2.0 U				2.0 U						
Bis(2-chloroisopropyl)ether	39638-32-9	µg/L	2.0 U				2.0 U						
Bromobenzene	108-86-1	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
Bromochloromethane	74-97-5	µg/L	2.0 U				2.0 U			2.0 U			
Bromodichloromethane	75-27-4	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
Bromoform	75-25-2	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U

Table 3.1
Monitoring Well Groundwater Data

		Location Name	MW-01				MW-02			MW-03			
		Sample Name	MW-01-12162003	MW-01-12182003-WL	MW-01-01082004-WL	MW-01-04232015	MW-02-12162003	MW-02-12182003-WL	MW-02-01082004-WL	MW-03-12162003	MW-03-12182003-WL	MW-03-01082004-WL	MW-03-04232015
		Sample Date	12/16/2003	12/18/2003	1/8/2004	4/23/2015	12/16/2003	12/18/2003	1/8/2004	12/16/2003	12/18/2003	1/8/2004	4/23/2015
Analyte	**CAS No.**	**Unit**											
Volatile Organic Compounds (VOCs) (cont.)													
Bromomethane	74-83-9	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
Carbon tetrachloride	56-23-5	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
Chlorobenzene	108-90-7	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
Chloroform	67-66-3	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
Chloromethane	74-87-3	µg/L	2.0 U			10 U	2.0 U			2.0 U			10 U
cis-1,3-Dichloropropene	10061-01-5	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
Cymene	99-87-6	µg/L				1.0 U	2.0 U			2.0 U			1.0 U
Dibromochloromethane	124-48-1	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
Dibromomethane	74-95-3	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
Dichlorodifluoromethane	75-71-8	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
Hexachloroethane	67-72-1	µg/L	2.0 U				2.0 U						
Isopropylbenzene	98-82-8	µg/L				1.0 U	2.0 U			2.0 U			1.0 U
Methyl ethyl ketone	78-93-3	µg/L				10 U	52			26			10 U
Methyl isobutyl ketone	108-10-1	µg/L				10 U	10 U			10 U			10 U
Methylene chloride	75-09-2	µg/L	5.0 U			5.0 U	5.0 U			5.0 U			5.0 U
Methyl-tert-butyl ether	1634-04-4	µg/L					2.0 U			2.0 U			
n-Butylbenzene	104-51-8	µg/L					2.0 U			2.0 U			
n-Hexane	110-54-3	µg/L											
Nitrobenzene	98-95-3	µg/L	2.0 U				2.0 U						
n-Propylbenzene	103-65-1	µg/L				1.0 U	2.0 U			2.0 U			1.0 U
Pyridine	110-86-1	µg/L	4.0 U				4.0 U						
sec-Butylbenzene	135-98-8	µg/L				1.0 U	2.0 U			2.0 U			1.0 U
Styrene	100-42-5	µg/L				1.0 U	2.0 U			2.0 U			1.0 U
tert-Butylbenzene	98-06-6	µg/L				1.0 U	2.0 U			2.0 U			1.0 U
trans-1,3-Dichloropropene	10061-02-6	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U
Trichlorofluoromethane	75-69-4	µg/L	2.0 U			1.0 U	2.0 U			2.0 U			1.0 U

Notes:

Blank cells are intentional

All results are rounded to two significant figures.

1 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

2 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

3 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Table 708-2 of WAC 173-340-900.

4 Calculation was performed using only detected cPAH concentrations.

5 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

Abbreviations:

CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbon
ft Feet
µg/L Micrograms per liter
mg/L Milligrams per liter
MTCA Model Toxics Control Act
PAH Polycyclic aromatic hydrocarbon
PCB Polychlorinated biphenyls
TEQ Toxic equivalency

Qualifier:

U Analyte was not detected at the associated reporting limit.

Table 3.1
Monitoring Well Groundwater Data

		Location Name	MW-03R		MW-04			MW-05				
		Sample Name	MW-03R-03092016-WL	MW-03R-04082016	MW-04-12162003	MW-04-12182003-WL	MW-04-01082004-WL	MW-05-12162003	MW-05-12182003-WL	MW-05-01082004-WL	MW-05-04232015	MW-05-04112016
		Sample Date	3/9/2016	4/8/2016	12/16/2003	12/18/2003	1/8/2004	12/16/2003	12/18/2003	1/8/2004	4/23/2015	4/11/2016
Analyte	**CAS No.**	**Unit**										
Field Measurements												
Depth to Water	WDepth	ft	8.0			6.35	6.04		8.39	8.43	9.13	
Conventionals												
Total Organic Carbon	TOC	mg/L		4.89								
Total Petroleum Hydrocarbons												
Gasoline-range organics	GRO	µg/L			50 U						100 U	
Diesel-range organics	DRO	µg/L		370 (1)	570 (1)						50 U	50 U
Oil-range organics	ORO	µg/L		270 (1)	250 U						250 U	250 U
Total DRO & ORO (2)	T_DRO&ORO (U=0)	µg/L		640	570						250 U	250 U
Total Metals												
Arsenic	7440-38-2	µg/L		2.1								1.6
Barium	7440-39-3	µg/L		23								
Cadmium	7440-43-9	µg/L		1.0 U								1.0 U
Chromium	7440-47-3	µg/L		1.0 U								
Lead	7439-92-1	µg/L		1.0 U								1.0 U
Mercury	7439-97-6	µg/L		1.0 U								
Selenium	7782-49-2	µg/L		4.6								
Silver	7440-22-4	µg/L		1.0 U								
Dissolved Metals												
Arsenic	7440-38-2	µg/L		1.8	12			5.0 U			1.6	1.5
Barium	7440-39-3	µg/L		22	160 U			20 U			2.0	
Cadmium	7440-43-9	µg/L		1.0 U	40 U			5.0 U			1.0 U	1.0 U
Chromium	7440-47-3	µg/L		1.0 U	56 U			7.0 U			1.0 U	
Lead	7439-92-1	µg/L		1.0 U	4.0			3.0 U			1.0 U	1.0 U
Mercury	7439-97-6	µg/L		1.0 U	0.20 U			0.20 U			1.0 U	
Selenium	7782-49-2	µg/L		4.4	320 U			40 U			1.7	
Silver	7440-22-4	µg/L		1.0 U	240 U			30 U			1.0 U	
Polychlorinated Biphenyls												
Aroclor 1016	12674-11-2	µg/L		0.10 U							0.10 U	
Aroclor 1221	11104-28-2	µg/L		0.10 U							0.10 U	
Aroclor 1232	11141-16-5	µg/L		0.10 U							0.10 U	
Aroclor 1242	53469-21-9	µg/L		0.10 U							0.10 U	
Aroclor 1248	12672-29-6	µg/L		0.10 U							0.10 U	
Aroclor 1254	11097-69-1	µg/L		0.10 U							0.10 U	
Aroclor 1260	11096-82-5	µg/L		0.10 U							0.10 U	
Aroclor 1262	37324-23-5	µg/L		0.10 U								
Aroclor 1268	11100-14-4	µg/L		0.10 U								
Total PCB Aroclors (U=0) (3)	T_PCB (U=0)	µg/L		0.10 U							0.10 U	
Polybrominated Diphenyl Ether (PBDE)												
PBDE-003	101-55-3	µg/L			2.0 U			2.0 U				
Semi-Volatile Organic Compound (SVOCs)												
1-Methylnaphthalene	90-12-0	µg/L			2.0 U			2.0 U				
2-Methylnaphthalene	91-57-6	µg/L			2.0 U			2.0 U				
Acenaphthene	83-32-9	µg/L			2.0 U			2.0 U				
Acenaphthylene	208-96-8	µg/L			2.0 U			2.0 U				
Anthracene	120-12-7	µg/L			2.0 U			2.0 U				
Benzo(a)anthracene	56-55-3	µg/L		0.060 U	2.0 U			2.0 U				
Benzo(a)pyrene	50-32-8	µg/L		0.060 U	2.0 U			2.0 U				
Benzo(b)fluoranthene	205-99-2	µg/L		0.060 U	2.0 U			2.0 U				
Benzo(g,h,i)perylene	191-24-2	µg/L			2.0 U			2.0 U				
Benzo(k)fluoranthene	207-08-9	µg/L		0.060 U	2.0 U			2.0 U				
Chrysene	218-01-9	µg/L		0.060 U	2.0 U			2.0 U				

Table 3.1
Monitoring Well Groundwater Data

		Location Name	MW-03R		MW-04			MW-05				
		Sample Name	MW-03R-03092016-WL	MW-03R-04082016	MW-04-12162003	MW-04-12182003-WL	MW-04-01082004-WL	MW-05-12162003	MW-05-12182003-WL	MW-05-01082004-WL	MW-05-04232015	MW-05-04112016
		Sample Date	3/9/2016	4/8/2016	12/16/2003	12/18/2003	1/8/2004	12/16/2003	12/18/2003	1/8/2004	4/23/2015	4/11/2016
Analyte	**CAS No.**	**Unit**										
Semi-Volatile Organic Compound (SVOCs) (cont.)												
Dibenzo(a,h)anthracene	53-70-3	µg/L		0.060 U	2.0 U			2.0 U				
Fluoranthene	206-44-0	µg/L			2.0 U			2.0 U				
Fluorene	86-73-7	µg/L			2.0 U			2.0 U				
Indeno(1,2,3-c,d)pyrene	193-39-5	µg/L		0.060 U	2.0 U			2.0 U				
Naphthalene	91-20-3	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
Phenanthrene	85-01-8	µg/L			2.0 U			2.0 U				
Pyrene	129-00-0	µg/L			2.0 U			2.0 U				
Total Naphthalenes (U=0) [2]	T_Napth (U=0)	µg/L			2.0 U			2.0 U				
cPAHs (MTCA TEQ-ZeroND) [3,4]	BaPEq (U=0)	µg/L		0.060 U	2.0 U			2.0 U				
cPAHs (MTCA TEQ-HalfND) [3,5]	BaPEq (U=1/2)	µg/L		0.060 U	2.0 U			2.0 U				
Total HPAH (U=0) 2[3]	T_HPAH (U=0)	µg/L			2.0 U			2.0 U				
Total LPAH (U=0) [2]	T_LPAH (U=0)	µg/L			2.0 U			2.0 U				
Total PAH (U=0) [2]	T_PAH (U=0)	µg/L			2.0 U			2.0 U				
2,3,4,6-Tetrachlorophenol	58-90-2	µg/L			5.0 U			5.0 U				
2,4,5-Trichlorophenol	95-95-4	µg/L			2.0 U			2.0 U				
2,4,6-Trichlorophenol	88-06-2	µg/L			2.0 U			2.0 U				
2,4-Dichlorophenol	120-83-2	µg/L			2.0 U			2.0 U				
2,4-Dimethylphenol	105-67-9	µg/L			2.0 U			2.0 U				
2,4-Dinitrophenol	51-28-5	µg/L			10 U			10 U				
2,6-Dichlorophenol	87-65-0	µg/L			2.0 U			2.0 U				
2-Chlorophenol	95-57-8	µg/L			2.0 U			2.0 U				
2-Methylphenol	95-48-7	µg/L			2.0 U			2.0 U				
2-Nitrophenol	88-75-5	µg/L			5.0 U			5.0 U				
4,6-Dinitro-o-cresol	534-52-1	µg/L			10 U			10 U				
4-Chloro-3-methylphenol	59-50-7	µg/L			2.0 U			2.0 U				
4-Methylphenol	106-44-5	µg/L			2.0 U			2.0 U				
4-Nitrophenol	100-02-7	µg/L			10 U			10 U				
Pentachlorophenol	87-86-5	µg/L			10 U			10 U				
Phenol	108-95-2	µg/L			2.0 U			2.0 U				
Bis(2-ethylhexyl)phthalate	117-81-7	µg/L			3.0 U			3.0 U				
Butyl benzyl phthalate	85-68-7	µg/L			2.0 U			2.0 U				
Di-n-butyl phthalate	84-74-2	µg/L			3.0 U			5.0				
Di-n-octyl phthalate	117-84-0	µg/L			2.0 U			2.0 U				
Diethylphthalate	84-66-2	µg/L			3.0			12				
Dimethyl phthalate	131-11-3	µg/L			2.0 U			2.0 U				
2-Chloronaphthalene	91-58-7	µg/L			2.0 U			2.0 U				
Acrylonitrile	107-13-1	µg/L						10 U				
Aniline	62-53-3	µg/L			2.0 U			2.0 U				
Azobenzene	103-33-3	µg/L			2.0 U			2.0 U				
Benzoic acid	65-85-0	µg/L			20 U			20 U				
Benzyl alcohol	100-51-6	µg/L			2.0 U			4.0				
Bis(2-chloroethoxy)methane	111-91-1	µg/L			2.0 U			2.0 U				
Carbazole	86-74-8	µg/L			2.0 U			2.0 U				
Dibenzofuran	132-64-9	µg/L			2.0 U			2.0 U				
Hexachlorobenzene	118-74-1	µg/L			2.0 U			2.0 U				
Hexachlorobutadiene	87-68-3	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
Hexachlorocyclopentadiene	77-47-4	µg/L			10 U			10 U				
Isophorone	78-59-1	µg/L			2.0 U			3.0				
N-Nitrosodimethylamine	62-75-9	µg/L			2.0 U			2.0 U				
N-Nitroso-di-n-propylamine	621-64-7	µg/L			2.0 U			2.0 U				
N-Nitrosodiphenylamine	86-30-6	µg/L			2.0 U			2.0 U				

Table 3.1
Monitoring Well Groundwater Data

		Location Name	MW-03R		MW-04			MW-05				
		Sample Name	MW-03R-03092016-WL	MW-03R-04082016	MW-04-12162003	MW-04-12182003-WL	MW-04-01082004-WL	MW-05-12162003	MW-05-12182003-WL	MW-05-01082004-WL	MW-05-04232015	MW-05-04112016
		Sample Date	3/9/2016	4/8/2016	12/16/2003	12/18/2003	1/8/2004	12/16/2003	12/18/2003	1/8/2004	4/23/2015	4/11/2016
Analyte	**CAS No.**	**Unit**										
Volatile Organic Compounds (VOCs)												
Benzene	71-43-2	µg/L		0.35 U	1.0 U			2.0 U			0.35 U	0.35 U
Ethylbenzene	100-41-4	µg/L		1.0 U	1.0 U			2.0 U			1.0 U	1.0 U
Toluene	108-88-3	µg/L		1.0 U	1.0 U			2.0 U			1.0 U	1.0 U
Xylene (meta & para)	108-38-3/106-42-3	µg/L		2.0 U				4.0 U			2.0 U	2.0 U
Xylene (ortho)	95-47-6	µg/L		1.0 U				2.0 U			1.0 U	1.0 U
Xylene (total)	1330-20-7	µg/L		2.0 U	3.0 U			4.0 U			2.0 U	2.0 U
Chloroethane	75-00-3	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
cis-1,2-Dichloroethene	156-59-2	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
trans-1,2-Dichloroethene	156-60-5	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
Vinyl chloride	75-01-4	µg/L		0.31	2.0 U			2.0 U			0.20 U	0.20 U
Tetrachloroethene	127-18-4	µg/L		1.0 U	2.0 U			16			7.7	8.0
Trichloroethene	79-01-6	µg/L		1.0 U	2.0 U			2.0			1.0 U	1.0 U
1,1,1,2-Tetrachloroethane	630-20-6	µg/L		1.0 U				2.0 U			1.0 U	1.0 U
1,1,1-Trichloroethane	71-55-6	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	79-34-5	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
1,1,2-Trichloroethane	79-00-5	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
1,1-Dichloroethane	75-34-3	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
1,1-Dichloroethene	75-35-4	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
1,1-Dichloropropene	563-58-6	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
1,2,3-Trichlorobenzene	87-61-6	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
1,2,3-Trichloropropane	96-18-4	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
1,2,4-Trichlorobenzene	120-82-1	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
1,2,4-Trimethylbenzene	95-63-6	µg/L		1.0 U				2.0 U			1.0 U	1.0 U
1,2-Dibromo-3-chloropropane	96-12-8	µg/L		10 U	10 U			10 U			10 U	10 U
1,2-Dibromoethane	106-93-4	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
1,2-Dichlorobenzene	95-50-1	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
1,2-Dichloroethane	107-06-2	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
1,2-Dichloropropane	78-87-5	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
1,3,5-Trimethylbenzene	108-67-8	µg/L		1.0 U				2.0 U			1.0 U	1.0 U
1,3-Dichlorobenzene	541-73-1	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
1,3-Dichloropropane	142-28-9	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
1,4-Dichlorobenzene	106-46-7	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
2,2-Dichloropropane	594-20-7	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
2,4-Dinitrotoluene	121-14-2	µg/L			5.0 U			5.0 U				
2,6-Dinitrotoluene	606-20-2	µg/L			5.0 U			5.0 U				
2-Chlorotoluene	95-49-8	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
2-Hexanone	591-78-6	µg/L		10 U				10 U			10 U	10 U
2-Nitroaniline	88-74-4	µg/L			5.0 U			5.0 U				
3,3'-Dichlorobenzidine	91-94-1	µg/L			2.0 U			2.0 U				
3-Nitroaniline	99-09-2	µg/L			5.0 U			5.0 U				
4-Chloroaniline	106-47-8	µg/L			2.0 U			2.0 U				
4-Chlorophenyl phenyl ether	7005-72-3	µg/L			2.0 U			2.0 U				
4-Chlorotoluene	106-43-4	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
4-Nitroaniline	100-01-6	µg/L			5.0 U			5.0 U				
Acetone	67-64-1	µg/L		10 U				25 U			10 U	10 U
Bis(2-chloroethyl)ether	111-44-4	µg/L			2.0 U			2.0 U				
Bis(2-chloroisopropyl)ether	39638-32-9	µg/L			2.0 U			2.0 U				
Bromobenzene	108-86-1	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
Bromochloromethane	74-97-5	µg/L			2.0 U			2.0 U				
Bromodichloromethane	75-27-4	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
Bromoform	75-25-2	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U

Table 3.1
Monitoring Well Groundwater Data

		Location Name	MW-03R		MW-04			MW-05				
		Sample Name	**MW-03R-03092016-WL**	**MW-03R-04082016**	**MW-04-12162003**	**MW-04-12182003-WL**	**MW-04-01082004-WL**	**MW-05-12162003**	**MW-05-12182003-WL**	**MW-05-01082004-WL**	**MW-05-04232015**	**MW-05-04112016**
		Sample Date	**3/9/2016**	**4/8/2016**	**12/16/2003**	**12/18/2003**	**1/8/2004**	**12/16/2003**	**12/18/2003**	**1/8/2004**	**4/23/2015**	**4/11/2016**
Analyte	**CAS No.**	**Unit**										
Volatile Organic Compounds (VOCs) (cont.)												
Bromomethane	74-83-9	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
Carbon tetrachloride	56-23-5	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
Chlorobenzene	108-90-7	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
Chloroform	67-66-3	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
Chloromethane	74-87-3	µg/L		10 U	2.0 U			2.0 U			10 U	10 U
cis-1,3-Dichloropropene	10061-01-5	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
Cymene	99-87-6	µg/L		1.0 U				2.0 U			1.0 U	1.0 U
Dibromochloromethane	124-48-1	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
Dibromomethane	74-95-3	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
Dichlorodifluoromethane	75-71-8	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
Hexachloroethane	67-72-1	µg/L			2.0 U			2.0 U				
Isopropylbenzene	98-82-8	µg/L		1.0 U				2.0 U			1.0 U	1.0 U
Methyl ethyl ketone	78-93-3	µg/L		10 U				12			10 U	10 U
Methyl isobutyl ketone	108-10-1	µg/L		10 U				10 U			10 U	10 U
Methylene chloride	75-09-2	µg/L		5.0 U	5.0 U			5.0 U			5.0 U	5.0 U
Methyl-tert-butyl ether	1634-04-4	µg/L		1.0 U				2.0 U				1.0 U
n-Butylbenzene	104-51-8	µg/L						2.0 U				
n-Hexane	110-54-3	µg/L		1.0 U								1.0 U
Nitrobenzene	98-95-3	µg/L			2.0 U			2.0 U				
n-Propylbenzene	103-65-1	µg/L		1.0 U				2.0 U			1.0 U	1.0 U
Pyridine	110-86-1	µg/L			4.0 U			4.0 U				
sec-Butylbenzene	135-98-8	µg/L		1.0 U				2.0 U			1.0 U	1.0 U
Styrene	100-42-5	µg/L		1.0 U				2.0 U			1.0 U	1.0 U
tert-Butylbenzene	98-06-6	µg/L		1.0 U				2.0 U			1.0 U	1.0 U
trans-1,3-Dichloropropene	10061-02-6	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U
Trichlorofluoromethane	75-69-4	µg/L		1.0 U	2.0 U			2.0 U			1.0 U	1.0 U

Notes:

Blank cells are intentional

All results are rounded to two significant figures.

1 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

2 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

3 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Table 708-2 of WAC 173-340-900.

4 Calculation was performed using only detected cPAH concentrations.

5 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

Abbreviations:

CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbon
ft Feet
µg/L Micrograms per liter
mg/L Milligrams per liter
MTCA Model Toxics Control Act
PAH Polycyclic aromatic hydrocarbon
PCB Polychlorinated biphenyls
TEQ Toxic equivalency

Qualifier:

U Analyte was not detected at the associated reporting limit.

Table 3.1
Monitoring Well Groundwater Data

		Location Name	MW-06		MW-07		MW-08		MW-09			MW-10	
		Sample Name	**MW-06-03082016-WL**	**MW-06-04082016**	**MW-07-03082016-WL**	**MW-07-04082016**	**MW-08-03092016-WL**	**MW-08-04082016**	**MW-09-03092016a-WL**	**MW-09-03092016b-WL**	**MW-09-04082016**	**MW-10-03082016-WL**	**MW-10-04082016**
		Sample Date	**3/8/2016**	**4/8/2016**	**3/8/2016**	**4/8/2016**	**3/9/2016**	**4/8/2016**	**3/9/2016**	**3/9/2016**	**4/8/2016**	**3/8/2016**	**4/8/2016**
Analyte	**CAS No.**	**Unit**											
Field Measurements													
Depth to Water	WDepth	ft	7.5		9.5		5.45		5.5	9.5		6.0	
Conventionals													
Total Organic Carbon	TOC	mg/L						16.1			11.5		
Total Petroleum Hydrocarbons (TPH)													
Gasoline-range organics	GRO	µg/L											
Diesel-range organics	DRO	µg/L		50 U		50 U		970 [1]			440 [1]		1,100 [1]
Oil-range organics	ORO	µg/L		250 U		250 U		600 [1]			250 U		940 [1]
Total DRO & ORO [2]	T_DRO&ORO (U=0)	µg/L		250 U		250 U		1,600			440		2,000
Total Metals													
Arsenic	7440-38-2	µg/L		1.0		1.6		7.0			10		1.9
Barium	7440-39-3	µg/L											18
Cadmium	7440-43-9	µg/L		1.0 U		1.0 U		1.0 U			1.0 U		1.0 U
Chromium	7440-47-3	µg/L											1.3
Lead	7439-92-1	µg/L		1.0 U		1.0 U		1.0 U			1.0 U		1.0 U
Mercury	7439-97-6	µg/L											1.0 U
Selenium	7782-49-2	µg/L											3.2
Silver	7440-22-4	µg/L											1.0 U
Dissolved Metals													
Arsenic	7440-38-2	µg/L		1.0		1.4		5.1			10		1.5
Barium	7440-39-3	µg/L											17
Cadmium	7440-43-9	µg/L		1.0 U		1.0 U		1.0 U			1.0 U		1.0 U
Chromium	7440-47-3	µg/L											1.1
Lead	7439-92-1	µg/L		1.0 U		1.0 U		1.0 U			1.0 U		1.0 U
Mercury	7439-97-6	µg/L											1.0 U
Selenium	7782-49-2	µg/L											3.0
Silver	7440-22-4	µg/L											1.0 U
Polychlorinated Biphenyls													
Aroclor 1016	12674-11-2	µg/L						0.10 U			0.10 U		
Aroclor 1221	11104-28-2	µg/L						0.10 U			0.10 U		
Aroclor 1232	11141-16-5	µg/L						0.10 U			0.10 U		
Aroclor 1242	53469-21-9	µg/L						0.10 U			0.10 U		
Aroclor 1248	12672-29-6	µg/L						0.10 U			0.10 U		
Aroclor 1254	11097-69-1	µg/L						0.10 U			0.10 U		
Aroclor 1260	11096-82-5	µg/L						0.10 U			0.10 U		
Aroclor 1262	37324-23-5	µg/L						0.10 U			0.10 U		
Aroclor 1268	11100-14-4	µg/L						0.10 U			0.10 U		
Total PCB Aroclors (U=0) [3]	T_PCB (U=0)	µg/L						0.10 U			0.10 U		
Polybrominated Diphenyl Ether (PBDE)													
PBDE-003	101-55-3	µg/L											
Semi-Volatile Organic Compound (SVOCs)													
1-Methylnaphthalene	90-12-0	µg/L											
2-Methylnaphthalene	91-57-6	µg/L											
Acenaphthene	83-32-9	µg/L											
Acenaphthylene	208-96-8	µg/L											
Anthracene	120-12-7	µg/L											
Benzo(a)anthracene	56-55-3	µg/L						0.060 U					
Benzo(a)pyrene	50-32-8	µg/L						0.060 U					
Benzo(b)fluoranthene	205-99-2	µg/L						0.060 U					
Benzo(g,h,i)perylene	191-24-2	µg/L											
Benzo(k)fluoranthene	207-08-9	µg/L						0.060 U					
Chrysene	218-01-9	µg/L						0.060 U					

Table 3.1
Monitoring Well Groundwater Data

		Location Name	MW-06		MW-07		MW-08		MW-09			MW-10	
		Sample Name	MW-06-03082016-WL	MW-06-04082016	MW-07-03082016-WL	MW-07-04082016	MW-08-03092016-WL	MW-08-04082016	MW-09-03092016a-WL	MW-09-03092016b-WL	MW-09-04082016	MW-10-03082016-WL	MW-10-04082016
		Sample Date	3/8/2016	4/8/2016	3/8/2016	4/8/2016	3/9/2016	4/8/2016	3/9/2016	3/9/2016	4/8/2016	3/8/2016	4/8/2016
Analyte	**CAS No.**	**Unit**											
Semi-Volatile Organic Compound (SVOCs) (cont.)													
Dibenzo(a,h)anthracene	53-70-3	µg/L						0.060 U					
Fluoranthene	206-44-0	µg/L											
Fluorene	86-73-7	µg/L											
Indeno(1,2,3-c,d)pyrene	193-39-5	µg/L						0.060 U					
Naphthalene	91-20-3	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
Phenanthrene	85-01-8	µg/L											
Pyrene	129-00-0	µg/L											
Total Naphthalenes (U=0) (2)	T_Napth (U=0)	µg/L											
cPAHs (MTCA TEQ-ZeroND) (3,4)	BaPEq (U=0)	µg/L						0.060 U					
cPAHs (MTCA TEQ-HalfND) (3,5)	BaPEq (U=1/2)	µg/L						0.060 U					
Total HPAH (U=0) 2[3)]	T_HPAH (U=0)	µg/L											
Total LPAH (U=0) (2)	T_LPAH (U=0)	µg/L											
Total PAH (U=0) (2)	T_PAH (U=0)	µg/L											
2,3,4,6-Tetrachlorophenol	58-90-2	µg/L											
2,4,5-Trichlorophenol	95-95-4	µg/L											
2,4,6-Trichlorophenol	88-06-2	µg/L											
2,4-Dichlorophenol	120-83-2	µg/L											
2,4-Dimethylphenol	105-67-9	µg/L											
2,4-Dinitrophenol	51-28-5	µg/L											
2,6-Dichlorophenol	87-65-0	µg/L											
2-Chlorophenol	95-57-8	µg/L											
2-Methylphenol	95-48-7	µg/L											
2-Nitrophenol	88-75-5	µg/L											
4,6-Dinitro-o-cresol	534-52-1	µg/L											
4-Chloro-3-methylphenol	59-50-7	µg/L											
4-Methylphenol	106-44-5	µg/L											
4-Nitrophenol	100-02-7	µg/L											
Pentachlorophenol	87-86-5	µg/L											
Phenol	108-95-2	µg/L											
Bis(2-ethylhexyl)phthalate	117-81-7	µg/L											
Butyl benzyl phthalate	85-68-7	µg/L											
Di-n-butyl phthalate	84-74-2	µg/L											
Di-n-octyl phthalate	117-84-0	µg/L											
Diethylphthalate	84-66-2	µg/L											
Dimethyl phthalate	131-11-3	µg/L											
2-Chloronaphthalene	91-58-7	µg/L											
Acrylonitrile	107-13-1	µg/L											
Aniline	62-53-3	µg/L											
Azobenzene	103-33-3	µg/L											
Benzoic acid	65-85-0	µg/L											
Benzyl alcohol	100-51-6	µg/L											
Bis(2-chloroethoxy)methane	111-91-1	µg/L											
Carbazole	86-74-8	µg/L											
Dibenzofuran	132-64-9	µg/L											
Hexachlorobenzene	118-74-1	µg/L											
Hexachlorobutadiene	87-68-3	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
Hexachlorocyclopentadiene	77-47-4	µg/L											
Isophorone	78-59-1	µg/L											
N-Nitrosodimethylamine	62-75-9	µg/L											
N-Nitroso-di-n-propylamine	621-64-7	µg/L											
N-Nitrosodiphenylamine	86-30-6	µg/L											

Table 3.1
Monitoring Well Groundwater Data

		Location Name	MW-06		MW-07		MW-08		MW-09			MW-10	
		Sample Name	**MW-06-03082016-WL**	**MW-06-04082016**	**MW-07-03082016-WL**	**MW-07-04082016**	**MW-08-03092016-WL**	**MW-08-04082016**	**MW-09-03092016a-WL**	**MW-09-03092016b-WL**	**MW-09-04082016**	**MW-10-03082016-WL**	**MW-10-04082016**
		Sample Date	**3/8/2016**	**4/8/2016**	**3/8/2016**	**4/8/2016**	**3/9/2016**	**4/8/2016**	**3/9/2016**	**3/9/2016**	**4/8/2016**	**3/8/2016**	**4/8/2016**
Analyte	**CAS No.**	**Unit**											
Volatile Organic Compounds (VOCs)													
Benzene	71-43-2	µg/L		0.35 U		0.35 U					0.35 U		0.35 U
Ethylbenzene	100-41-4	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
Toluene	108-88-3	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
Xylene (meta & para)	108-38-3/106-42-3	µg/L		2.0 U		2.0 U					2.0 U		2.0 U
Xylene (ortho)	95-47-6	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
Xylene (total)	1330-20-7	µg/L		2.0 U		2.0 U					2.0 U		2.0 U
Chloroethane	75-00-3	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
cis-1,2-Dichloroethene	156-59-2	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
trans-1,2-Dichloroethene	156-60-5	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
Vinyl chloride	75-01-4	µg/L		0.20 U		0.20 U					0.30		0.46
Tetrachloroethene	127-18-4	µg/L		14		12					1.0 U		1.0 U
Trichloroethene	79-01-6	µg/L		1.0 U		2.0					1.0 U		1.0 U
1,1,1,2-Tetrachloroethane	630-20-6	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
1,1,1-Trichloroethane	71-55-6	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
1,1,2,2-Tetrachloroethane	79-34-5	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
1,1,2-Trichloroethane	79-00-5	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
1,1-Dichloroethane	75-34-3	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
1,1-Dichloroethene	75-35-4	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
1,1-Dichloropropene	563-58-6	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
1,2,3-Trichlorobenzene	87-61-6	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
1,2,3-Trichloropropane	96-18-4	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
1,2,4-Trichlorobenzene	120-82-1	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
1,2,4-Trimethylbenzene	95-63-6	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
1,2-Dibromo-3-chloropropane	96-12-8	µg/L		10 U		10 U					10 U		10 U
1,2-Dibromoethane	106-93-4	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
1,2-Dichlorobenzene	95-50-1	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
1,2-Dichloroethane	107-06-2	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
1,2-Dichloropropane	78-87-5	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
1,3,5-Trimethylbenzene	108-67-8	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
1,3-Dichlorobenzene	541-73-1	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
1,3-Dichloropropane	142-28-9	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
1,4-Dichlorobenzene	106-46-7	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
2,2-Dichloropropane	594-20-7	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
2,4-Dinitrotoluene	121-14-2	µg/L											
2,6-Dinitrotoluene	606-20-2	µg/L											
2-Chlorotoluene	95-49-8	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
2-Hexanone	591-78-6	µg/L		10 U		10 U					10 U		10 U
2-Nitroaniline	88-74-4	µg/L											
3,3'-Dichlorobenzidine	91-94-1	µg/L											
3-Nitroaniline	99-09-2	µg/L											
4-Chloroaniline	106-47-8	µg/L											
4-Chlorophenyl phenyl ether	7005-72-3	µg/L											
4-Chlorotoluene	106-43-4	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
4-Nitroaniline	100-01-6	µg/L											
Acetone	67-64-1	µg/L		10 U		10 U					10 U		10 U
Bis(2-chloroethyl)ether	111-44-4	µg/L											
Bis(2-chloroisopropyl)ether	39638-32-9	µg/L											
Bromobenzene	108-86-1	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
Bromochloromethane	74-97-5	µg/L											
Bromodichloromethane	75-27-4	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
Bromoform	75-25-2	µg/L		1.0 U		1.0 U					1.0 U		1.0 U

Table 3.1
Monitoring Well Groundwater Data

		Location Name	MW-06		MW-07		MW-08		MW-09			MW-10	
		Sample Name	MW-06-03082016-WL	MW-06-04082016	MW-07-03082016-WL	MW-07-04082016	MW-08-03092016-WL	MW-08-04082016	MW-09-03092016a-WL	MW-09-03092016b-WL	MW-09-04082016	MW-10-03082016-WL	MW-10-04082016
		Sample Date	3/8/2016	4/8/2016	3/8/2016	4/8/2016	3/9/2016	4/8/2016	3/9/2016	3/9/2016	4/8/2016	3/8/2016	4/8/2016
Analyte	**CAS No.**	**Unit**											
Volatile Organic Compounds (VOCs) (cont.)													
Bromomethane	74-83-9	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
Carbon tetrachloride	56-23-5	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
Chlorobenzene	108-90-7	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
Chloroform	67-66-3	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
Chloromethane	74-87-3	µg/L		10 U		10 U					10 U		10 U
cis-1,3-Dichloropropene	10061-01-5	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
Cymene	99-87-6	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
Dibromochloromethane	124-48-1	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
Dibromomethane	74-95-3	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
Dichlorodifluoromethane	75-71-8	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
Hexachloroethane	67-72-1	µg/L											
Isopropylbenzene	98-82-8	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
Methyl ethyl ketone	78-93-3	µg/L		10 U		10 U					10 U		10 U
Methyl isobutyl ketone	108-10-1	µg/L		10 U		10 U					10 U		10 U
Methylene chloride	75-09-2	µg/L		5.0 U		5.0 U					5.0 U		5.0 U
Methyl-tert-butyl ether	1634-04-4	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
n-Butylbenzene	104-51-8	µg/L											
n-Hexane	110-54-3	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
Nitrobenzene	98-95-3	µg/L											
n-Propylbenzene	103-65-1	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
Pyridine	110-86-1	µg/L											
sec-Butylbenzene	135-98-8	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
Styrene	100-42-5	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
tert-Butylbenzene	98-06-6	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
trans-1,3-Dichloropropene	10061-02-6	µg/L		1.0 U		1.0 U					1.0 U		1.0 U
Trichlorofluoromethane	75-69-4	µg/L		1.0 U		1.0 U					1.0 U		1.0 U

Notes:

Blank cells are intentional

All results are rounded to two significant figures.

1 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

2 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

3 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Table 708-2 of WAC 173-340-900.

4 Calculation was performed using only detected cPAH concentrations.

5 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

Abbreviations:

CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbon
ft Feet
µg/L Micrograms per liter
mg/L Milligrams per liter
MTCA Model Toxics Control Act
PAH Polycyclic aromatic hydrocarbon
PCB Polychlorinated biphenyls
TEQ Toxic equivalency

Qualifier:

U Analyte was not detected at the associated reporting limit.

Table 3.1
Monitoring Well Groundwater Data

		Location Name	MW-11		MW-12	
		Sample Name	MW-11-03092016-WL	MW-11-04082016	MW-12-03082016-WL	MW-12-04082016
		Sample Date	3/9/2016	4/8/2016	3/8/2016	4/8/2016
Analyte	**CAS No.**	**Unit**				
Field Measurements						
Depth to Water	WDepth	ft	12		2.75	
Conventionals						
Total Organic Carbon	TOC	mg/L		3.59		
Total Petroleum Hydrocarbons (TPH)						
Gasoline-range organics	GRO	µg/L				
Diesel-range organics	DRO	µg/L		360 (1)		1,600 (1)
Oil-range organics	ORO	µg/L		400 (1)		610 (1)
Total DRO & ORO (2)	T_DRO&ORO (U=0)	µg/L		760		2,200
Total Metals						
Arsenic	7440-38-2	µg/L		2.7		5.1
Barium	7440-39-3	µg/L		44		
Cadmium	7440-43-9	µg/L		1.0 U		1.0 U
Chromium	7440-47-3	µg/L		1.0 U		
Lead	7439-92-1	µg/L		1.0 U		1.0 U
Mercury	7439-97-6	µg/L		1.0 U		
Selenium	7782-49-2	µg/L		7.4		
Silver	7440-22-4	µg/L		1.0 U		
Dissolved Metals						
Arsenic	7440-38-2	µg/L		2.2		4.9
Barium	7440-39-3	µg/L		44		
Cadmium	7440-43-9	µg/L		1.0 U		1.0 U
Chromium	7440-47-3	µg/L		1.0 U		
Lead	7439-92-1	µg/L		1.0 U		1.0 U
Mercury	7439-97-6	µg/L		1.0 U		
Selenium	7782-49-2	µg/L		7.2		
Silver	7440-22-4	µg/L		1.0 U		
Polychlorinated Biphenyls						
Aroclor 1016	12674-11-2	µg/L		0.10 U		0.10 U
Aroclor 1221	11104-28-2	µg/L		0.10 U		0.10 U
Aroclor 1232	11141-16-5	µg/L		0.10 U		0.10 U
Aroclor 1242	53469-21-9	µg/L		0.10 U		0.10 U
Aroclor 1248	12672-29-6	µg/L		0.10 U		0.10 U
Aroclor 1254	11097-69-1	µg/L		0.10 U		0.10 U
Aroclor 1260	11096-82-5	µg/L		0.10 U		0.10 U
Aroclor 1262	37324-23-5	µg/L		0.10 U		0.10 U
Aroclor 1268	11100-14-4	µg/L		0.10 U		0.10 U
Total PCB Aroclors (U=0) (3)	T_PCB (U=0)	µg/L		0.10 U		0.10 U
Polybrominated Diphenyl Ether (PBDE)						
PBDE-003	101-55-3	µg/L				
Semi-Volatile Organic Compound (SVOCs)						
1-Methylnaphthalene	90-12-0	µg/L				
2-Methylnaphthalene	91-57-6	µg/L				
Acenaphthene	83-32-9	µg/L				
Acenaphthylene	208-96-8	µg/L				
Anthracene	120-12-7	µg/L				
Benzo(a)anthracene	56-55-3	µg/L				
Benzo(a)pyrene	50-32-8	µg/L				
Benzo(b)fluoranthene	205-99-2	µg/L				
Benzo(g,h,i)perylene	191-24-2	µg/L				
Benzo(k)fluoranthene	207-08-9	µg/L				
Chrysene	218-01-9	µg/L				

Table 3.1
Monitoring Well Groundwater Data

		Location Name	MW-11		MW-12	
		Sample Name	MW-11-03092016-WL	MW-11-04082016	MW-12-03082016-WL	MW-12-04082016
		Sample Date	3/9/2016	4/8/2016	3/8/2016	4/8/2016
Analyte	CAS No.	Unit				
Semi-Volatile Organic Compound (SVOCs) (cont.)						
Dibenzo(a,h)anthracene	53-70-3	µg/L				
Fluoranthene	206-44-0	µg/L				
Fluorene	86-73-7	µg/L				
Indeno(1,2,3-c,d)pyrene	193-39-5	µg/L				
Naphthalene	91-20-3	µg/L				
Phenanthrene	85-01-8	µg/L				
Pyrene	129-00-0	µg/L				
Total Naphthalenes (U=0) (2)	T_Napth (U=0)	µg/L				
cPAHs (MTCA TEQ-ZeroND) (3,4)	BaPEq (U=0)	µg/L				
cPAHs (MTCA TEQ-HalfND) (3,5)	BaPEq (U=1/2)	µg/L				
Total HPAH (U=0) 2(3)	T_HPAH (U=0)	µg/L				
Total LPAH (U=0) (2)	T_LPAH (U=0)	µg/L				
Total PAH (U=0) (2)	T_PAH (U=0)	µg/L				
2,3,4,6-Tetrachlorophenol	58-90-2	µg/L				
2,4,5-Trichlorophenol	95-95-4	µg/L				
2,4,6-Trichlorophenol	88-06-2	µg/L				
2,4-Dichlorophenol	120-83-2	µg/L				
2,4-Dimethylphenol	105-67-9	µg/L				
2,4-Dinitrophenol	51-28-5	µg/L				
2,6-Dichlorophenol	87-65-0	µg/L				
2-Chlorophenol	95-57-8	µg/L				
2-Methylphenol	95-48-7	µg/L				
2-Nitrophenol	88-75-5	µg/L				
4,6-Dinitro-o-cresol	534-52-1	µg/L				
4-Chloro-3-methylphenol	59-50-7	µg/L				
4-Methylphenol	106-44-5	µg/L				
4-Nitrophenol	100-02-7	µg/L				
Pentachlorophenol	87-86-5	µg/L				
Phenol	108-95-2	µg/L				
Bis(2-ethylhexyl)phthalate	117-81-7	µg/L				
Butyl benzyl phthalate	85-68-7	µg/L				
Di-n-butyl phthalate	84-74-2	µg/L				
Di-n-octyl phthalate	117-84-0	µg/L				
Diethylphthalate	84-66-2	µg/L				
Dimethyl phthalate	131-11-3	µg/L				
2-Chloronaphthalene	91-58-7	µg/L				
Acrylonitrile	107-13-1	µg/L				
Aniline	62-53-3	µg/L				
Azobenzene	103-33-3	µg/L				
Benzoic acid	65-85-0	µg/L				
Benzyl alcohol	100-51-6	µg/L				
Bis(2-chloroethoxy)methane	111-91-1	µg/L				
Carbazole	86-74-8	µg/L				
Dibenzofuran	132-64-9	µg/L				
Hexachlorobenzene	118-74-1	µg/L				
Hexachlorobutadiene	87-68-3	µg/L				
Hexachlorocyclopentadiene	77-47-4	µg/L				
Isophorone	78-59-1	µg/L				
N-Nitrosodimethylamine	62-75-9	µg/L				
N-Nitroso-di-n-propylamine	621-64-7	µg/L				
N-Nitrosodiphenylamine	86-30-6	µg/L				

Table 3.1
Monitoring Well Groundwater Data

		Location Name	MW-11		MW-12	
		Sample Name	MW-11-03092016-WL	MW-11-04082016	MW-12-03082016-WL	MW-12-04082016
		Sample Date	3/9/2016	4/8/2016	3/8/2016	4/8/2016
Analyte	CAS No.	Unit				
Volatile Organic Compounds (VOCs)						
Benzene	71-43-2	µg/L				
Ethylbenzene	100-41-4	µg/L				
Toluene	108-88-3	µg/L				
Xylene (meta & para)	108-38-3/106-42-3	µg/L				
Xylene (ortho)	95-47-6	µg/L				
Xylene (total)	1330-20-7	µg/L				
Chloroethane	75-00-3	µg/L				
cis-1,2-Dichloroethene	156-59-2	µg/L				
trans-1,2-Dichloroethene	156-60-5	µg/L				
Vinyl chloride	75-01-4	µg/L				
Tetrachloroethene	127-18-4	µg/L				
Trichloroethene	79-01-6	µg/L				
1,1,1,2-Tetrachloroethane	630-20-6	µg/L				
1,1,1-Trichloroethane	71-55-6	µg/L				
1,1,2,2-Tetrachloroethane	79-34-5	µg/L				
1,1,2-Trichloroethane	79-00-5	µg/L				
1,1-Dichloroethane	75-34-3	µg/L				
1,1-Dichloroethene	75-35-4	µg/L				
1,1-Dichloropropene	563-58-6	µg/L				
1,2,3-Trichlorobenzene	87-61-6	µg/L				
1,2,3-Trichloropropane	96-18-4	µg/L				
1,2,4-Trichlorobenzene	120-82-1	µg/L				
1,2,4-Trimethylbenzene	95-63-6	µg/L				
1,2-Dibromo-3-chloropropane	96-12-8	µg/L				
1,2-Dibromoethane	106-93-4	µg/L				
1,2-Dichlorobenzene	95-50-1	µg/L				
1,2-Dichloroethane	107-06-2	µg/L				
1,2-Dichloropropane	78-87-5	µg/L				
1,3,5-Trimethylbenzene	108-67-8	µg/L				
1,3-Dichlorobenzene	541-73-1	µg/L				
1,3-Dichloropropane	142-28-9	µg/L				
1,4-Dichlorobenzene	106-46-7	µg/L				
2,2-Dichloropropane	594-20-7	µg/L				
2,4-Dinitrotoluene	121-14-2	µg/L				
2,6-Dinitrotoluene	606-20-2	µg/L				
2-Chlorotoluene	95-49-8	µg/L				
2-Hexanone	591-78-6	µg/L				
2-Nitroaniline	88-74-4	µg/L				
3,3'-Dichlorobenzidine	91-94-1	µg/L				
3-Nitroaniline	99-09-2	µg/L				
4-Chloroaniline	106-47-8	µg/L				
4-Chlorophenyl phenyl ether	7005-72-3	µg/L				
4-Chlorotoluene	106-43-4	µg/L				
4-Nitroaniline	100-01-6	µg/L				
Acetone	67-64-1	µg/L				
Bis(2-chloroethyl)ether	111-44-4	µg/L				
Bis(2-chloroisopropyl)ether	39638-32-9	µg/L				
Bromobenzene	108-86-1	µg/L				
Bromochloromethane	74-97-5	µg/L				
Bromodichloromethane	75-27-4	µg/L				
Bromoform	75-25-2	µg/L				

Table 3.1
Monitoring Well Groundwater Data

		Location Name	MW-11		MW-12	
		Sample Name	MW-11-03092016-WL	MW-11-04082016	MW-12-03082016-WL	MW-12-04082016
		Sample Date	3/9/2016	4/8/2016	3/8/2016	4/8/2016
Analyte	CAS No.	Unit				
Volatile Organic Compounds (VOCs) (cont.)						
Bromomethane	74-83-9	μg/L				
Carbon tetrachloride	56-23-5	μg/L				
Chlorobenzene	108-90-7	μg/L				
Chloroform	67-66-3	μg/L				
Chloromethane	74-87-3	μg/L				
cis-1,3-Dichloropropene	10061-01-5	μg/L				
Cymene	99-87-6	μg/L				
Dibromochloromethane	124-48-1	μg/L				
Dibromomethane	74-95-3	μg/L				
Dichlorodifluoromethane	75-71-8	μg/L				
Hexachloroethane	67-72-1	μg/L				
Isopropylbenzene	98-82-8	μg/L				
Methyl ethyl ketone	78-93-3	μg/L				
Methyl isobutyl ketone	108-10-1	μg/L				
Methylene chloride	75-09-2	μg/L				
Methyl-tert-butyl ether	1634-04-4	μg/L				
n-Butylbenzene	104-51-8	μg/L				
n-Hexane	110-54-3	μg/L				
Nitrobenzene	98-95-3	μg/L				
n-Propylbenzene	103-65-1	μg/L				
Pyridine	110-86-1	μg/L				
sec-Butylbenzene	135-98-8	μg/L				
Styrene	100-42-5	μg/L				
tert-Butylbenzene	98-06-6	μg/L				
trans-1,3-Dichloropropene	10061-02-6	μg/L				
Trichlorofluoromethane	75-69-4	μg/L				

Notes:

Blank cells are intentional
All results are rounded to two significant figures.
1 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.
2 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.
3 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Table 708-2 of WAC 173-340-900.
4 Calculation was performed using only detected cPAH concentrations.
5 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

Abbreviations:

CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbon
ft Feet
μg/L Micrograms per liter
mg/L Milligrams per liter
MTCA Model Toxics Control Act
PAH Polycyclic aromatic hydrocarbon
PCB Polychlorinated biphenyls
TEQ Toxic equivalency

Qualifier:

U Analyte was not detected at the associated reporting limit.

Table 3.2
Reconnaissance Groundwater Data

		Location Name	P3	P5	P6	P7	P9	P13	P15	A1A-S6
		Sample Name	P3-W	P5-W	P6-W	P7-W	P9-W	P13-W	P15-W	A1A-G5-1
		Sample Date	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015	3/9/2016	7/9/2018
Analyte	**CAS No.**	**Unit**								
Total Petroleum Hydrocarbons (TPHs)										
Gasoline-range organics	GRO	µg/L	210	100 U			100 U		100 U	100 U
Diesel-range organics	DRO	µg/L	1,900 (1)	770 (1)	190 (1)	710 (1)	50 U	800 (1)	390 (2)	
Oil-range organics	ORO	µg/L	560 (1)	600 (1)	250 U	430 (1)	250 U	390 (1)	280 (2)	
Total DRO & ORO (3)	T_DRO&ORO (U=0)	µg/L	2,500	1,400	190	1,100	250 U	1,200	670	
Dissolved Metals										
Arsenic	7440-38-2	µg/L								11
Cadmium	7440-43-9	µg/L								1.0 U
Lead	7439-92-1	µg/L								1.0 U
Volatile Organic Compound (VOCs)										
Benzene	71-43-2	µg/L		1.0 U	0.35 U		1.0 U	0.35 U	0.35 U	0.35 U
Ethylbenzene	100-41-4	µg/L		1.0 U	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U
Toluene	108-88-3	µg/L		11	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U
Xylene (meta & para)	108-38-3/106-42-3	µg/L			2.0 U			2.0 U	2.0 U	2.0 U
Xylene (ortho)	95-47-6	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
Xylene (total)	1330-20-7	µg/L		3.0 U	2.0 U		3.0 U	2.0 U	2.0 U	2.0 U
Chloroethane	75-00-3	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
cis-1,2-Dichloroethene	156-59-2	µg/L			1.9			5.3	1.0 U	1.0 U
trans-1,2-Dichloroethene	156-60-5	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
Vinyl chloride	75-01-4	µg/L			0.20 U			0.20 U	0.20 U	0.20 U
Tetrachloroethene	127-18-4	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
Trichloroethene	79-01-6	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
1,1,1,2-Tetrachloroethane	630-20-6	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
1,1,1-Trichloroethane	71-55-6	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	79-34-5	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
1,1,2-Trichloroethane	79-00-5	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
1,1-Dichloroethane	75-34-3	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
1,1-Dichloroethene	75-35-4	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
1,1-Dichloropropene	563-58-6	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
1,2,3-Trichlorobenzene	87-61-6	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
1,2,3-Trichloropropane	96-18-4	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
1,2,4-Trichlorobenzene	120-82-1	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
1,2,4-Trimethylbenzene	95-63-6	µg/L			1.0 U			1.9	1.0 U	1.0 U
1,2-Dibromo-3-chloropropane	96-12-8	µg/L			10 U			10 U	10 U	10 U
1,2-Dibromoethane	106-93-4	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
1,2-Dichlorobenzene	95-50-1	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
1,2-Dichloroethane	107-06-2	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
1,2-Dichloropropane	78-87-5	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
1,3,5-Trimethylbenzene	108-67-8	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
1,3-Dichlorobenzene	541-73-1	µg/L			1.1			1.0 U	1.0 U	1.0 U
1,3-Dichloropropane	142-28-9	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
1,4-Dichlorobenzene	106-46-7	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
2,2-Dichloropropane	594-20-7	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
2-Chlorotoluene	95-49-8	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
2-Hexanone	591-78-6	µg/L			10 U			10 U	10 U	10 U
4-Chlorotoluene	106-43-4	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
Acetone	67-64-1	µg/L			10 U			10 U	10 U	50 U
Bromobenzene	108-86-1	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
Bromodichloromethane	75-27-4	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
Bromoform	75-25-2	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
Bromomethane	74-83-9	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
Carbon tetrachloride	56-23-5	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
Chlorobenzene	108-90-7	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
Chloroform	67-66-3	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
Chloromethane	74-87-3	µg/L			10 U			10 U	10 U	10 U
cis-1,3-Dichloropropene	10061-01-5	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
Cymene	99-87-6	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
Dibromochloromethane	124-48-1	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
Dibromomethane	74-95-3	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
Dichlorodifluoromethane	75-71-8	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
Hexachlorobutadiene	87-68-3	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
Isopropylbenzene	98-82-8	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
Methyl ethyl ketone	78-93-3	µg/L			10 U			10 U	10 U	10 U
Methyl isobutyl ketone	108-10-1	µg/L			10 U			10 U	10 U	10 U
Methylene chloride	75-09-2	µg/L			5.0 U			5.0 U	5.0 U	5.0 U
Methyl-tert-butyl ether	1634-04-4	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
n-Hexane	110-54-3	µg/L							1.0 U	1.0 U
n-Propylbenzene	103-65-1	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
Naphthalene	91-20-3	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
sec-Butylbenzene	135-98-8	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
Styrene	100-42-5	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
tert-Butylbenzene	98-06-6	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
trans-1,3-Dichloropropene	10061-02-6	µg/L			1.0 U			1.0 U	1.0 U	1.0 U
Trichlorofluoromethane	75-69-4	µg/L			1.0 U			1.0 U	1.0 U	1.0 U

Notes:

Blank cells are intentional.

All results are rounded to two significant figures.

1 The laboratory noted detections are not indicative of a typical petroleum distillate. The material most closely resembles polar organic material that would be removed by a silica gel cleanup procedure.

2 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

3 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

Abbreviations:

CAS Chemical Abstracts Service

µg/L Micrograms per liter

Qualifier:

U Analyte was not detected at the associated reporting limit.

Table 3.3
In Situ Soil Data

		Location Name	A1A-B5	A1A-B7	A1A-B8	A1A-B9	A1A-B10	A1A-B11	A1A-B12	A1A-B13	A1A-B14	A1A-B15	A1A-B19	A1A-B20	A1A-B21	A1A-E4
		Sample Name	A1A-B5-5	A1A-B7-5	A1A-B8-5	A1A-B9-5	A1A-B10-5	A1A-B11-5	A1A-B12-5	A1A-B13-5	A1A-B14-5	A1A-B15-5	A1A-B19-5	A1A-B20-9.5	A1A-B21-7	A1A-E4-2
		Sample Date	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/9/2018	7/12/2018	7/12/2018	7/6/2018
		Sample Depth	5 ft	5 ft	5 ft	5 ft	5 ft	5 ft	5 ft	5 ft	5 ft	5 ft	5 ft	9.5 ft	7 ft	2 ft
Analyte	**CAS No.**	**Unit**														
Total Petroleum Hydrocarbons (TPHs)																
Gasoline-range organics	GRO	mg/kg											5.0 U	5.0 U		
Diesel-range organics	DRO	mg/kg											50 U	50 U		
Oil-range organics	ORO	mg/kg											250 U	250 U		
Total DRO & ORO (4)	T_DRO&ORO (U=0)	mg/kg											250 U	250 U		
Gasoline (5)	86290-81-5	mg/kg														
Diesel (5)	Dies	mg/kg														
Heavy Oil (5)	Oil_Heavy	mg/kg														
Metals																
Arsenic	7440-38-2	mg/kg	2.4	2.1	3.1	2.0	4.9	4.5	1.8	1.9	3.1	3.1	2.1	6.1	2.6	3.6
Barium	7440-39-3	mg/kg														
Cadmium	7440-43-9	mg/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chromium	7440-47-3	mg/kg														
Chromium(VI)	18540-29-9	mg/kg														
Copper	7440-50-8	mg/kg														
Lead	7439-92-1	mg/kg	1.9	1.3	140	17	12	8.5	1.5	3.4	1.9	7.8	1.6	4.5	1.8	13
Mercury	7439-97-6	mg/kg														
Selenium	7782-49-2	mg/kg														
Silver	7440-22-4	mg/kg														
Polychlorinated Biphenyls																
Aroclor 1016	12674-11-2	mg/kg														
Aroclor 1221	11104-28-2	mg/kg														
Aroclor 1232	11141-16-5	mg/kg														
Aroclor 1242	53469-21-9	mg/kg														
Aroclor 1248	12672-29-6	mg/kg														
Aroclor 1254	11097-69-1	mg/kg														
Aroclor 1260	11096-82-5	mg/kg														
Aroclor 1262	37324-23-5	mg/kg														
Aroclor 1268	11100-14-4	mg/kg														
Total PCB Aroclors (U=0) (4)	T_PCB (U=0)	mg/kg														
Polybrominated Diphenyl Ethers (PBDEs)																
PBDE-003	101-55-3	mg/kg														
Semi-Volatile Organic Compound (SVOCs)																
1-Methylnaphthalene	90-12-0	mg/kg														
2-Methylnaphthalene	91-57-6	mg/kg														
Acenaphthene	83-32-9	mg/kg														
Acenaphthylene	208-96-8	mg/kg														
Anthracene	120-12-7	mg/kg														
Benzo(a)anthracene	56-55-3	mg/kg														
Benzo(a)pyrene	50-32-8	mg/kg														
Benzo(b)fluoranthene	205-99-2	mg/kg														
Benzo(g,h,i)perylene	191-24-2	mg/kg														
Benzo(k)fluoranthene	207-08-9	mg/kg														
Chrysene	218-01-9	mg/kg														
Dibenzo(a,h)anthracene	53-70-3	mg/kg														
Fluoranthene	206-44-0	mg/kg														
Fluorene	86-73-7	mg/kg														
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg														
Naphthalene	91-20-3	mg/kg														

Table 3.3
In Situ Soil Data

		Location Name	A1A-B5	A1A-B7	A1A-B8	A1A-B9	A1A-B10	A1A-B11	A1A-B12	A1A-B13	A1A-B14	A1A-B15	A1A-B19	A1A-B20	A1A-B21	A1A-E4
		Sample Name	A1A-B5-5	A1A-B7-5	A1A-B8-5	A1A-B9-5	A1A-B10-5	A1A-B11-5	A1A-B12-5	A1A-B13-5	A1A-B14-5	A1A-B15-5	A1A-B19-5	A1A-B20-9.5	A1A-B21-7	A1A-E4-2
		Sample Date	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/9/2018	7/12/2018	7/12/2018	7/6/2018
		Sample Depth	5 ft	5 ft	5 ft	5 ft	5 ft	5 ft	5 ft	5 ft	5 ft	5 ft	5 ft	9.5 ft	7 ft	2 ft
Analyte	**CAS No.**	**Unit**														
Semi-Volatile Organic Compound (SVOCs) (cont.)																
Phenanthrene	85-01-8	mg/kg														
Pyrene	129-00-0	mg/kg														
Total Naphthalenes (U=0) (4)	T_Napth (U=0)	mg/kg														
cPAHs (MTCA TEQ-ZeroND) (6,7)	BaPEq (U=0)	mg/kg														
cPAHs (MTCA TEQ-HalfND) (5,8)	BaPEq (U=1/2)	mg/kg														
Total HPAH (U=0) (4)	T_HPAH (U=0)	mg/kg														
Total LPAH (U=0) (4)	T_LPAH (U=0)	mg/kg														
Total PAH (U=0) (4)	T_PAH (U=0)	mg/kg														
2,3,4,6-Tetrachlorophenol	58-90-2	mg/kg														
2,4,5-Trichlorophenol	95-95-4	mg/kg														
2,4,6-Trichlorophenol	88-06-2	mg/kg														
2,4-Dichlorophenol	120-83-2	mg/kg														
2,4-Dimethylphenol	105-67-9	mg/kg														
2,4-Dinitrophenol	51-28-5	mg/kg														
2,6-Dichlorophenol	87-65-0	mg/kg														
2-Chlorophenol	95-57-8	mg/kg														
2-Methylphenol	95-48-7	mg/kg														
2-Nitrophenol	88-75-5	mg/kg														
3- & 4-Methylphenol	15831-10-4	mg/kg														
4,6-Dinitro-o-cresol	534-52-1	mg/kg														
4-Chloro-3-methylphenol	59-50-7	mg/kg														
4-Methylphenol	106-44-5	mg/kg														
4-Nitrophenol	100-02-7	mg/kg														
Pentachlorophenol	87-86-5	mg/kg														
Phenol	108-95-2	mg/kg														
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg														
Butyl benzyl phthalate	85-68-7	mg/kg														
Di-n-butyl phthalate	84-74-2	mg/kg														
Di-n-octyl phthalate	117-84-0	mg/kg														
Diethylphthalate	84-66-2	mg/kg														
Dimethyl phthalate	131-11-3	mg/kg														
2-Chloronaphthalene	91-58-7	mg/kg														
Aniline	62-53-3	mg/kg														
Azobenzene	103-33-3	mg/kg														
Benzoic acid	65-85-0	mg/kg														
Benzyl alcohol	100-51-6	mg/kg														
Bis(2-chloroethoxy)methane	111-91-1	mg/kg														
Bis-chloroisopropyl ether	108-60-1	mg/kg														
Carbazole	86-74-8	mg/kg														
Dibenzofuran	132-64-9	mg/kg														
Hexachlorobenzene	118-74-1	mg/kg														
Hexachlorobutadiene	87-68-3	mg/kg														
Hexachlorocyclopentadiene	77-47-4	mg/kg														
Isophorone	78-59-1	mg/kg														
N-Nitrosodimethylamine	62-75-9	mg/kg														
N-Nitroso-di-n-propylamine	621-64-7	mg/kg														
N-Nitrosodiphenylamine	86-30-6	mg/kg														

Table 3.3
In Situ Soil Data

		Location Name	A1A-B5	A1A-B7	A1A-B8	A1A-B9	A1A-B10	A1A-B11	A1A-B12	A1A-B13	A1A-B14	A1A-B15	A1A-B19	A1A-B20	A1A-B21	A1A-E4
		Sample Name	A1A-B5-5	A1A-B7-5	A1A-B8-5	A1A-B9-5	A1A-B10-5	A1A-B11-5	A1A-B12-5	A1A-B13-5	A1A-B14-5	A1A-B15-5	A1A-B19-5	A1A-B20-9.5	A1A-B21-7	A1A-E4-2
		Sample Date	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/9/2018	7/12/2018	7/12/2018	7/6/2018
		Sample Depth	5 ft	5 ft	5 ft	5 ft	5 ft	5 ft	5 ft	5 ft	5 ft	5 ft	5 ft	9.5 ft	7 ft	2 ft
Analyte	**CAS No.**	**Unit**														
Volatile Organic Compound (VOCs)																
Benzene	71-43-2	mg/kg											0.020 U	0.020 U		
Ethylbenzene	100-41-4	mg/kg											0.020 U	0.020 U		
Toluene	108-88-3	mg/kg											0.020 U	0.020 U		
Xylene (meta & para)	108-38-3/106-42-3	mg/kg														
Xylene (ortho)	95-47-6	mg/kg														
Xylene (total)	1330-20-7	mg/kg											0.060 U	0.060 U		
Chloroethane	75-00-3	mg/kg														
cis-1,2-Dichloroethene	156-59-2	mg/kg														
Tetrachloroethene	127-18-4	mg/kg														
trans-1,2-Dichloroethene	156-60-5	mg/kg														
Trichloroethene	79-01-6	mg/kg														
Vinyl chloride	75-01-4	mg/kg														
1,1,1,2-Tetrachloroethane	630-20-6	mg/kg														
1,1,1-Trichloroethane	71-55-6	mg/kg														
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg														
1,1,2-Trichloroethane	79-00-5	mg/kg														
1,1-Dichloroethane	75-34-3	mg/kg														
1,1-Dichloroethene	75-35-4	mg/kg														
1,1-Dichloropropene	563-58-6	mg/kg														
1,2,3-Trichlorobenzene	87-61-6	mg/kg														
1,2,3-Trichloropropane	96-18-4	mg/kg														
1,2,4-Trichlorobenzene	120-82-1	mg/kg														
1,2,4-Trimethylbenzene	95-63-6	mg/kg														
1,2-Dibromo-3-chloropropane	96-12-8	mg/kg														
1,2-Dibromoethane	106-93-4	mg/kg														
1,2-Dichlorobenzene	95-50-1	mg/kg														
1,2-Dichloroethane	107-06-2	mg/kg														
1,2-Dichloropropane	78-87-5	mg/kg														
1,3,5-Trimethylbenzene	108-67-8	mg/kg														
1,3-Dichlorobenzene	541-73-1	mg/kg														
1,3-Dichloropropane	142-28-9	mg/kg														
1,4-Dichlorobenzene	106-46-7	mg/kg														
2,2-Dichloropropane	594-20-7	mg/kg														
2,4-Dinitrotoluene	121-14-2	mg/kg														
2,6-Dinitrotoluene	606-20-2	mg/kg														
2-Chlorotoluene	95-49-8	mg/kg														
2-Hexanone	591-78-6	mg/kg														
2-Nitroaniline	88-74-4	mg/kg														
3,3'-Dichlorobenzidine	91-94-1	mg/kg														
3-Nitroaniline	99-09-2	mg/kg														
4-Chloroaniline	106-47-8	mg/kg														
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg														
4-Chlorotoluene	106-43-4	mg/kg														
4-Nitroaniline	100-01-6	mg/kg														
Acetone	67-64-1	mg/kg														
Bis(2-chloroethyl)ether	111-44-4	mg/kg														
Bis(2-chloroisopropyl)ether	39638-32-9	mg/kg														
Bromobenzene	108-86-1	mg/kg														

Table 3.3
In Situ Soil Data

		Location Name	A1A-B5	A1A-B7	A1A-B8	A1A-B9	A1A-B10	A1A-B11	A1A-B12	A1A-B13	A1A-B14	A1A-B15	A1A-B19	A1A-B20	A1A-B21	A1A-E4
		Sample Name	A1A-B5-5	A1A-B7-5	A1A-B8-5	A1A-B9-5	A1A-B10-5	A1A-B11-5	A1A-B12-5	A1A-B13-5	A1A-B14-5	A1A-B15-5	A1A-B19-5	A1A-B20-9.5	A1A-B21-7	A1A-E4-2
		Sample Date	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/9/2018	7/12/2018	7/12/2018	7/6/2018
		Sample Depth	5 ft	5 ft	5 ft	5 ft	5 ft	5 ft	5 ft	5 ft	5 ft	5 ft	5 ft	9.5 ft	7 ft	2 ft
Analyte	**CAS No.**	**Unit**														
Volatile Organic Compound (VOCs) (cont.)																
Bromochloromethane	74-97-5	mg/kg														
Bromodichloromethane	75-27-4	mg/kg														
Bromoform	75-25-2	mg/kg														
Bromomethane	74-83-9	mg/kg														
Carbon tetrachloride	56-23-5	mg/kg														
Chlorobenzene	108-90-7	mg/kg														
Chloroform	67-66-3	mg/kg														
Chloromethane	74-87-3	mg/kg														
cis-1,3-Dichloropropene	10061-01-5	mg/kg														
Cymene	99-87-6	mg/kg														
Dibromochloromethane	124-48-1	mg/kg														
Dibromomethane	74-95-3	mg/kg														
Dichlorodifluoromethane	75-71-8	mg/kg														
Hexachloroethane	67-72-1	mg/kg														
Isopropylbenzene	98-82-8	mg/kg														
Methyl ethyl ketone	78-93-3	mg/kg														
Methyl isobutyl ketone	108-10-1	mg/kg														
Methylene chloride	75-09-2	mg/kg														
Methyl-tert-butyl ether	1634-04-4	mg/kg														
n-Hexane	110-54-3	mg/kg														
Nitrobenzene	98-95-3	mg/kg														
n-Propylbenzene	103-65-1	mg/kg														
Pyridine	110-86-1	mg/kg														
sec-Butylbenzene	135-98-8	mg/kg														
Styrene	100-42-5	mg/kg														
tert-Butylbenzene	98-06-6	mg/kg														
trans-1,3-Dichloropropene	10061-02-6	mg/kg														
Trichlorofluoromethane	75-69-4	mg/kg														

Notes:

Blank cells are intentional

All results are rounded to two significant figures.

1 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

2 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

3 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.

4 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

5 Result reported by HCID Analysis

6 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Table 708-2 of WAC 173-340-900.

7 Calculation was performed using only detected cPAH concentrations.

8 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

Abbreviations:

CAS Chemical Abstracts Service

cPAH Carcinogenic polycyclic aromatic hydrocarbon

ft Feet

mg/kg Milligrams per kilogram

MTCA Model Toxics Control Act

PAH Polycyclic aromatic hydrocarbons

PCB Polychlorinated biphenyl

TEQ Toxic equivalency

Qualifiers:

J Analyte was detected; concentration is an estimate.

U Analyte was not detected at the associated reporting limit.

UJ Analyte was not detected at the associated reporting limit, which is an estimate.

Table 3.3
In Situ Soil Data

		Location Name	A1A-E5	A1A-N3	A1A-N5	A1A-S5	A1A-S6	A1A-S7	A1A-T2-B3	A1A-T2-E2	A1A-T2-N2	A1A-T2-PF	A1A-T2-S1	A1A-T2-W1	A1A-W3	A1A-W4
		Sample Name	**A1A-E5-2**	**A1A-N3-2**	**A1A-N5-2.5**	**A1A-S5-2**	**A1A-S6-9**	**A1A-S7-2.5**	**A1A-T2-B3-16**	**A1A-T2-E2-10**	**A1A-T2-N2-10**	**A1A-T2-PF-3**	**A1A-T2-S1-7.5**	**A1A-T2-W1-7.5**	**A1A-W3-2**	**A1A-W4-2**
		Sample Date	**7/12/2018**	**7/5/2018**	**7/12/2018**	**7/6/2018**	**7/9/2018**	**7/12/2018**	**7/18/2018**	**7/18/2018**	**7/18/2018**	**7/18/2018**	**7/18/2018**	**7/18/2018**	**7/6/2018**	**7/12/2018**
		Sample Depth	**2 ft**	**2 ft**	**2.5 ft**	**2 ft**	**9 ft**	**2.5 ft**	**16 ft**	**10 ft**	**10 ft**	**3 ft**	**7.5 ft**	**7.5 ft**	**2 ft**	**2 ft**
Analyte	**CAS No.**	**Unit**														
Total Petroleum Hydrocarbons (TPHs)																
Gasoline-range organics	GRO	mg/kg				54	5.0 U		25	27 J	44 J					
Diesel-range organics	DRO	mg/kg					50 U		50 U	50 U	50 U	50 U	50 U	50 U		
Oil-range organics	ORO	mg/kg					250 U		250 U	250 U	250 U	250 U	250 U	250 U		
Total DRO & ORO (4)	T_DRO&ORO (U=0)	mg/kg					250 U		250 U	250 U	250 U	250 U	250 U	250 U		
Gasoline (5)	86290-81-5	mg/kg														
Diesel (5)	Dies	mg/kg														
Heavy Oil (5)	Oil_Heavy	mg/kg														
Metals																
Arsenic	7440-38-2	mg/kg	8.3	14	22	5.0	3.6	10							17	4.6
Barium	7440-39-3	mg/kg														
Cadmium	7440-43-9	mg/kg	8.8	1.4	7.4	1.0 U	1.0 U	5.0							1.7	1.0 U
Chromium	7440-47-3	mg/kg														
Chromium(VI)	18540-29-9	mg/kg														
Copper	7440-50-8	mg/kg														
Lead	7439-92-1	mg/kg	1,100	150	720	39	3.4	390							270	18
Mercury	7439-97-6	mg/kg														
Selenium	7782-49-2	mg/kg														
Silver	7440-22-4	mg/kg														
Polychlorinated Biphenyls																
Aroclor 1016	12674-11-2	mg/kg														
Aroclor 1221	11104-28-2	mg/kg														
Aroclor 1232	11141-16-5	mg/kg														
Aroclor 1242	53469-21-9	mg/kg														
Aroclor 1248	12672-29-6	mg/kg														
Aroclor 1254	11097-69-1	mg/kg														
Aroclor 1260	11096-82-5	mg/kg														
Aroclor 1262	37324-23-5	mg/kg														
Aroclor 1268	11100-14-4	mg/kg														
Total PCB Aroclors (U=0) (4)	T_PCB (U=0)	mg/kg														
Polybrominated Diphenyl Ethers (PBDEs)																
PBDE-003	101-55-3	mg/kg														
Semi-Volatile Organic Compound (SVOCs)																
1-Methylnaphthalene	90-12-0	mg/kg							**0.15**							
2-Methylnaphthalene	91-57-6	mg/kg							0.010 U							
Acenaphthene	83-32-9	mg/kg														
Acenaphthylene	208-96-8	mg/kg														
Anthracene	120-12-7	mg/kg														
Benzo(a)anthracene	56-55-3	mg/kg							0.010 U							
Benzo(a)pyrene	50-32-8	mg/kg							0.010 U							
Benzo(b)fluoranthene	205-99-2	mg/kg							0.010 U							
Benzo(g,h,i)perylene	191-24-2	mg/kg														
Benzo(k)fluoranthene	207-08-9	mg/kg							0.010 U							
Chrysene	218-01-9	mg/kg							0.010 U							
Dibenzo(a,h)anthracene	53-70-3	mg/kg							0.010 U							
Fluoranthene	206-44-0	mg/kg														
Fluorene	86-73-7	mg/kg														
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg							0.010 U							
Naphthalene	91-20-3	mg/kg							**0.028**	0.050 UJ						

Table 3.3
In Situ Soil Data

		Location Name	A1A-E5	A1A-N3	A1A-N5	A1A-S5	A1A-S6	A1A-S7	A1A-T2-B3	A1A-T2-E2	A1A-T2-N2	A1A-T2-PF	A1A-T2-S1	A1A-T2-W1	A1A-W3	A1A-W4
		Sample Name	A1A-E5-2	A1A-N3-2	A1A-N5-2.5	A1A-S5-2	A1A-S6-9	A1A-S7-2.5	A1A-T2-B3-16	A1A-T2-E2-10	A1A-T2-N2-10	A1A-T2-PF-3	A1A-T2-S1-7.5	A1A-T2-W1-7.5	A1A-W3-2	A1A-W4-2
		Sample Date	7/12/2018	7/5/2018	7/12/2018	7/6/2018	7/9/2018	7/12/2018	7/18/2018	7/18/2018	7/18/2018	7/18/2018	7/18/2018	7/18/2018	7/6/2018	7/12/2018
		Sample Depth	2 ft	2 ft	2.5 ft	2 ft	9 ft	2.5 ft	16 ft	10 ft	10 ft	3 ft	7.5 ft	7.5 ft	2 ft	2 ft
Analyte	**CAS No.**	**Unit**														
Semi-Volatile Organic Compound (SVOCs) (cont.)																
Phenanthrene	85-01-8	mg/kg														
Pyrene	129-00-0	mg/kg														
Total Naphthalenes (U=0) (4)	T_Napth (U=0)	mg/kg							0.18							
cPAHs (MTCA TEQ-ZeroND) (6,7)	BaPEq (U=0)	mg/kg							0.010 U							
cPAHs (MTCA TEQ-HalfND) (5,8)	BaPEq (U=1/2)	mg/kg							0.010 U							
Total HPAH (U=0) (4)	T_HPAH (U=0)	mg/kg														
Total LPAH (U=0) (4)	T_LPAH (U=0)	mg/kg														
Total PAH (U=0) (4)	T_PAH (U=0)	mg/kg														
2,3,4,6-Tetrachlorophenol	58-90-2	mg/kg														
2,4,5-Trichlorophenol	95-95-4	mg/kg														
2,4,6-Trichlorophenol	88-06-2	mg/kg														
2,4-Dichlorophenol	120-83-2	mg/kg														
2,4-Dimethylphenol	105-67-9	mg/kg														
2,4-Dinitrophenol	51-28-5	mg/kg														
2,6-Dichlorophenol	87-65-0	mg/kg														
2-Chlorophenol	95-57-8	mg/kg														
2-Methylphenol	95-48-7	mg/kg														
2-Nitrophenol	88-75-5	mg/kg														
3- & 4-Methylphenol	15831-10-4	mg/kg														
4,6-Dinitro-o-cresol	534-52-1	mg/kg														
4-Chloro-3-methylphenol	59-50-7	mg/kg														
4-Methylphenol	106-44-5	mg/kg														
4-Nitrophenol	100-02-7	mg/kg														
Pentachlorophenol	87-86-5	mg/kg														
Phenol	108-95-2	mg/kg														
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg														
Butyl benzyl phthalate	85-68-7	mg/kg														
Di-n-butyl phthalate	84-74-2	mg/kg														
Di-n-octyl phthalate	117-84-0	mg/kg														
Diethylphthalate	84-66-2	mg/kg														
Dimethyl phthalate	131-11-3	mg/kg														
2-Chloronaphthalene	91-58-7	mg/kg														
Aniline	62-53-3	mg/kg														
Azobenzene	103-33-3	mg/kg														
Benzoic acid	65-85-0	mg/kg														
Benzyl alcohol	100-51-6	mg/kg														
Bis(2-chloroethoxy)methane	111-91-1	mg/kg														
Bis-chloroisopropyl ether	108-60-1	mg/kg														
Carbazole	86-74-8	mg/kg														
Dibenzofuran	132-64-9	mg/kg														
Hexachlorobenzene	118-74-1	mg/kg														
Hexachlorobutadiene	87-68-3	mg/kg								0.25 UJ						
Hexachlorocyclopentadiene	77-47-4	mg/kg														
Isophorone	78-59-1	mg/kg														
N-Nitrosodimethylamine	62-75-9	mg/kg														
N-Nitroso-di-n-propylamine	621-64-7	mg/kg														
N-Nitrosodiphenylamine	86-30-6	mg/kg														

Table 3.3
In Situ Soil Data

		Location Name	A1A-E5	A1A-N3	A1A-N5	A1A-S5	A1A-S6	A1A-S7	A1A-T2-B3	A1A-T2-E2	A1A-T2-N2	A1A-T2-PF	A1A-T2-S1	A1A-T2-W1	A1A-W3	A1A-W4
		Sample Name	A1A-E5-2	A1A-N3-2	A1A-N5-2.5	A1A-S5-2	A1A-S6-9	A1A-S7-2.5	A1A-T2-B3-16	A1A-T2-E2-10	A1A-T2-N2-10	A1A-T2-PF-3	A1A-T2-S1-7.5	A1A-T2-W1-7.5	A1A-W3-2	A1A-W4-2
		Sample Date	7/12/2018	7/5/2018	7/12/2018	7/6/2018	7/9/2018	7/12/2018	7/18/2018	7/18/2018	7/18/2018	7/18/2018	7/18/2018	7/18/2018	7/6/2018	7/12/2018
		Sample Depth	2 ft	2 ft	2.5 ft	2 ft	9 ft	2.5 ft	16 ft	10 ft	10 ft	3 ft	7.5 ft	7.5 ft	2 ft	2 ft
Analyte	**CAS No.**	**Unit**														
Volatile Organic Compound (VOCs)																
Benzene	71-43-2	mg/kg				0.020 U	0.020 U		0.020 U	0.030 UJ	0.020 UJ					
Ethylbenzene	100-41-4	mg/kg				0.044	0.020 U		0.064	0.050 UJ	0.36 J					
Toluene	108-88-3	mg/kg				0.020 U	0.020 U		0.18	0.050 UJ	0.020 UJ					
Xylene (meta & para)	108-38-3/106-42-3	mg/kg								0.10 UJ						
Xylene (ortho)	95-47-6	mg/kg								0.050 UJ						
Xylene (total)	1330-20-7	mg/kg				0.060 U	0.060 U		0.21	0.10 UJ	0.24 J					
Chloroethane	75-00-3	mg/kg								0.50 UJ						
cis-1,2-Dichloroethene	156-59-2	mg/kg								0.050 UJ						
Tetrachloroethene	127-18-4	mg/kg								0.025 UJ						
trans-1,2-Dichloroethene	156-60-5	mg/kg								0.050 UJ						
Trichloroethene	79-01-6	mg/kg								0.020 UJ						
Vinyl chloride	75-01-4	mg/kg								0.050 UJ						
1,1,1,2-Tetrachloroethane	630-20-6	mg/kg								0.050 UJ						
1,1,1-Trichloroethane	71-55-6	mg/kg								0.050 UJ						
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg								0.050 UJ						
1,1,2-Trichloroethane	79-00-5	mg/kg								0.050 UJ						
1,1-Dichloroethane	75-34-3	mg/kg								0.050 UJ						
1,1-Dichloroethene	75-35-4	mg/kg								0.050 UJ						
1,1-Dichloropropene	563-58-6	mg/kg								0.050 UJ						
1,2,3-Trichlorobenzene	87-61-6	mg/kg								0.25 UJ						
1,2,3-Trichloropropane	96-18-4	mg/kg								0.050 UJ						
1,2,4-Trichlorobenzene	120-82-1	mg/kg								0.25 UJ						
1,2,4-Trimethylbenzene	95-63-6	mg/kg								0.050 UJ						
1,2-Dibromo-3-chloropropane	96-12-8	mg/kg								0.50 UJ						
1,2-Dibromoethane	106-93-4	mg/kg								0.050 UJ						
1,2-Dichlorobenzene	95-50-1	mg/kg								0.050 UJ						
1,2-Dichloroethane	107-06-2	mg/kg								0.050 UJ						
1,2-Dichloropropane	78-87-5	mg/kg								0.050 UJ						
1,3,5-Trimethylbenzene	108-67-8	mg/kg								0.050 UJ						
1,3-Dichlorobenzene	541-73-1	mg/kg								0.050 UJ						
1,3-Dichloropropane	142-28-9	mg/kg								0.050 UJ						
1,4-Dichlorobenzene	106-46-7	mg/kg								0.050 UJ						
2,2-Dichloropropane	594-20-7	mg/kg								0.050 UJ						
2,4-Dinitrotoluene	121-14-2	mg/kg														
2,6-Dinitrotoluene	606-20-2	mg/kg														
2-Chlorotoluene	95-49-8	mg/kg								0.050 UJ						
2-Hexanone	591-78-6	mg/kg								0.50 UJ						
2-Nitroaniline	88-74-4	mg/kg														
3,3'-Dichlorobenzidine	91-94-1	mg/kg														
3-Nitroaniline	99-09-2	mg/kg														
4-Chloroaniline	106-47-8	mg/kg														
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg														
4-Chlorotoluene	106-43-4	mg/kg								0.050 UJ						
4-Nitroaniline	100-01-6	mg/kg														
Acetone	67-64-1	mg/kg								0.50 UJ						
Bis(2-chloroethyl)ether	111-44-4	mg/kg														
Bis(2-chloroisopropyl)ether	39638-32-9	mg/kg														
Bromobenzene	108-86-1	mg/kg								0.050 UJ						

Table 3.3
In Situ Soil Data

		Location Name	A1A-E5	A1A-N3	A1A-N5	A1A-S5	A1A-S6	A1A-S7	A1A-T2-B3	A1A-T2-E2	A1A-T2-N2	A1A-T2-PF	A1A-T2-S1	A1A-T2-W1	A1A-W3	A1A-W4
		Sample Name	A1A-E5-2	A1A-N3-2	A1A-N5-2.5	A1A-S5-2	A1A-S6-9	A1A-S7-2.5	A1A-T2-B3-16	A1A-T2-E2-10	A1A-T2-N2-10	A1A-T2-PF-3	A1A-T2-S1-7.5	A1A-T2-W1-7.5	A1A-W3-2	A1A-W4-2
		Sample Date	7/12/2018	7/5/2018	7/12/2018	7/6/2018	7/9/2018	7/12/2018	7/18/2018	7/18/2018	7/18/2018	7/18/2018	7/18/2018	7/18/2018	7/6/2018	7/12/2018
		Sample Depth	2 ft	2 ft	2.5 ft	2 ft	9 ft	2.5 ft	16 ft	10 ft	10 ft	3 ft	7.5 ft	7.5 ft	2 ft	2 ft
Analyte	**CAS No.**	**Unit**														
Volatile Organic Compound (VOCs) (cont.)																
Bromochloromethane	74-97-5	mg/kg								0.050 UJ						
Bromodichloromethane	75-27-4	mg/kg														
Bromoform	75-25-2	mg/kg								0.050 UJ						
Bromomethane	74-83-9	mg/kg								0.50 UJ						
Carbon tetrachloride	56-23-5	mg/kg								0.050 UJ						
Chlorobenzene	108-90-7	mg/kg								0.050 UJ						
Chloroform	67-66-3	mg/kg								0.050 UJ						
Chloromethane	74-87-3	mg/kg								0.50 UJ						
cis-1,3-Dichloropropene	10061-01-5	mg/kg								0.050 UJ						
Cymene	99-87-6	mg/kg								0.050 UJ						
Dibromochloromethane	124-48-1	mg/kg								0.050 UJ						
Dibromomethane	74-95-3	mg/kg								0.050 UJ						
Dichlorodifluoromethane	75-71-8	mg/kg								0.50 UJ						
Hexachloroethane	67-72-1	mg/kg														
Isopropylbenzene	98-82-8	mg/kg								0.050 UJ						
Methyl ethyl ketone	78-93-3	mg/kg								0.50 UJ						
Methyl isobutyl ketone	108-10-1	mg/kg								0.50 UJ						
Methylene chloride	75-09-2	mg/kg								0.50 UJ						
Methyl-tert-butyl ether	1634-04-4	mg/kg								0.050 UJ						
n-Hexane	110-54-3	mg/kg								0.25 UJ						
Nitrobenzene	98-95-3	mg/kg														
n-Propylbenzene	103-65-1	mg/kg								0.050 UJ						
Pyridine	110-86-1	mg/kg														
sec-Butylbenzene	135-98-8	mg/kg								0.050 UJ						
Styrene	100-42-5	mg/kg								0.050 UJ						
tert-Butylbenzene	98-06-6	mg/kg								0.050 UJ						
trans-1,3-Dichloropropene	10061-02-6	mg/kg								0.050 UJ						
Trichlorofluoromethane	75-69-4	mg/kg								0.50 UJ						

Notes:

Blank cells are intentional

All results are rounded to two significant figures.

1 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.
2 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.
3 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.
4 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.
5 Result reported by HCID Analysis
6 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Table 708-2 of WAC 173-340-900.
7 Calculation was performed using only detected cPAH concentrations.
8 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

Abbreviations:

CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbon
ft Feet
mg/kg Milligrams per kilogram
MTCA Model Toxics Control Act
PAH Polycyclic aromatic hydrocarbons
PCB Polychlorinated biphenyl
TEQ Toxic equivalency

Qualifiers:

J Analyte was detected; concentration is an estimate.
U Analyte was not detected at the associated reporting limit.
UJ Analyte was not detected at the associated reporting limit, which is an estimate.

Table 3.3
In Situ Soil Data

		Location Name	A2A-B1	A2A-N1/W1-Comp	A2A-S1/E1-Comp	A2B-N1/S1-Comp	A3A-B1	A3A-E1	A3A-N1	A3A-S1	A3A-N1/S1-Comp	A3A-W1	A3B-B1	A3B-E1	A3B-N1
		Sample Name	A2A-B1-2.5	A2A-Comp1	A2A-Comp2	A2B-Comp1	A3A-B1-0.5	A3A-E1-2	A3A-N1-0.5	A3A-S1-2	A3A-Comp2	A3A-W1-2	A3B-B1-0.5	A3B-E1-2	A3B-N1-0.5
		Sample Date	6/20/2018	6/20/2018	6/20/2018	6/21/2018	6/20/2018	7/2/2018	6/20/2018	7/2/2018	6/20/2018	7/2/2018	6/20/2018	7/5/2018	6/20/2018
		Sample Depth	2.5 ft	2.5-3 ft	2 ft	2 ft	0.5 ft	2 ft	0.5 ft	2 ft	0.5 ft	2 ft	0.5 ft	2 ft	0.5 ft
Analyte	**CAS No.**	**Unit**													
Total Petroleum Hydrocarbons (TPHs)															
Gasoline-range organics	GRO	mg/kg													
Diesel-range organics	DRO	mg/kg	50 U	50 U	50 U	96 (1)	50 U	50 U			50 U	50 U	110 (1)		
Oil-range organics	ORO	mg/kg	250 U	250 U	250 U	300	250 U	250 U			250 U	250 U	540		
Total DRO & ORO (4)	T_DRO&ORO (U=0)	mg/kg	250 U	250 U	250 U	400	250 U	250 U			250 U	250 U	650		
Gasoline (5)	86290-81-5	mg/kg													
Diesel (5)	Dies	mg/kg													
Heavy Oil (5)	Oil_Heavy	mg/kg													
Metals															
Arsenic	7440-38-2	mg/kg					2.4	5.1	2.4	7.8		12	19	6.8	9.7
Barium	7440-39-3	mg/kg													
Cadmium	7440-43-9	mg/kg				1.0 U	1.0 U	1.0 U	1.0 U	1.0 U		1.0 U	1.1	1.0 U	1.0 U
Chromium	7440-47-3	mg/kg					11		12				33		44
Chromium(VI)	18540-29-9	mg/kg													
Copper	7440-50-8	mg/kg													
Lead	7439-92-1	mg/kg					7.6		13				65		31
Mercury	7439-97-6	mg/kg					1.0 U		1.0 U				1.0 U		1.0 U
Selenium	7782-49-2	mg/kg													
Silver	7440-22-4	mg/kg													
Polychlorinated Biphenyls															
Aroclor 1016	12674-11-2	mg/kg					0.020 U				0.020 U		0.020 U		
Aroclor 1221	11104-28-2	mg/kg					0.020 U				0.020 U		0.020 U		
Aroclor 1232	11141-16-5	mg/kg					0.020 U				0.020 U		0.020 U		
Aroclor 1242	53469-21-9	mg/kg					0.020 U				0.020 U		0.020 U		
Aroclor 1248	12672-29-6	mg/kg					0.020 U				0.020 U		0.020 U		
Aroclor 1254	11097-69-1	mg/kg					0.020 U				0.020 U		0.020 U		
Aroclor 1260	11096-82-5	mg/kg					0.020 U				0.020 U		0.062		
Aroclor 1262	37324-23-5	mg/kg					0.020 U				0.020 U		0.020 U		
Aroclor 1268	11100-14-4	mg/kg					0.020 U				0.020 U		0.020 U		
Total PCB Aroclors (U=0) (4)	T_PCB (U=0)	mg/kg					0.020 U				0.020 U		0.062		
Polybrominated Diphenyl Ethers (PBDEs)															
PBDE-003	101-55-3	mg/kg													
Semi-Volatile Organic Compound (SVOCs)															
1-Methylnaphthalene	90-12-0	mg/kg													
2-Methylnaphthalene	91-57-6	mg/kg													
Acenaphthene	83-32-9	mg/kg													
Acenaphthylene	208-96-8	mg/kg													
Anthracene	120-12-7	mg/kg													
Benzo(a)anthracene	56-55-3	mg/kg	0.010 U	0.10 U	0.010 U	1.0 U	0.10 U				0.010 U		1.0 U		
Benzo(a)pyrene	50-32-8	mg/kg	0.010 U	0.10 U	0.010 U	1.0 U	0.10 U				0.010 U		1.0 U		
Benzo(b)fluoranthene	205-99-2	mg/kg	0.010 U	0.10 U	0.010 U	1.0 U	0.10 U				0.011		1.0 U		
Benzo(g,h,i)perylene	191-24-2	mg/kg													
Benzo(k)fluoranthene	207-08-9	mg/kg	0.010 U	0.10 U	0.010 U	1.0 U	0.10 U				0.010 U		1.0 U		
Chrysene	218-01-9	mg/kg	0.010 U	0.10 U	0.010 U	1.0 U	0.10 U				0.010 U		1.0 U		
Dibenzo(a,h)anthracene	53-70-3	mg/kg	0.010 U	0.10 U	0.010 U	1.0 U	0.10 U				0.010 U		1.0 U		
Fluoranthene	206-44-0	mg/kg													
Fluorene	86-73-7	mg/kg													
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg	0.010 U	0.10 U	0.010 U	1.0 U	0.10 U				0.010 U		1.0 U		
Naphthalene	91-20-3	mg/kg													

Table 3.3
In Situ Soil Data

		Location Name	A2A-B1	A2A-N1/W1-Comp	A2A-S1/E1-Comp	A2B-N1/S1-Comp	A3A-B1	A3A-E1	A3A-N1	A3A-S1	A3A-N1/S1-Comp	A3A-W1	A3B-B1	A3B-E1	A3B-N1
		Sample Name	**A2A-B1-2.5**	**A2A-Comp1**	**A2A-Comp2**	**A2B-Comp1**	**A3A-B1-0.5**	**A3A-E1-2**	**A3A-N1-0.5**	**A3A-S1-2**	**A3A-Comp2**	**A3A-W1-2**	**A3B-B1-0.5**	**A3B-E1-2**	**A3B-N1-0.5**
		Sample Date	**6/20/2018**	**6/20/2018**	**6/20/2018**	**6/21/2018**	**6/20/2018**	**7/2/2018**	**6/20/2018**	**7/2/2018**	**6/20/2018**	**7/2/2018**	**6/20/2018**	**7/5/2018**	**6/20/2018**
		Sample Depth	**2.5 ft**	**2.5-3 ft**	**2 ft**	**2 ft**	**0.5 ft**	**2 ft**	**0.5 ft**	**2 ft**	**0.5 ft**	**2 ft**	**0.5 ft**	**2 ft**	**0.5 ft**
Analyte	**CAS No.**	**Unit**													
Semi-Volatile Organic Compound (SVOCs) (cont.)															
Phenanthrene	85-01-8	mg/kg													
Pyrene	129-00-0	mg/kg													
Total Naphthalenes (U=0) (4)	T_Napth (U=0)	mg/kg													
cPAHs (MTCA TEQ-ZeroND) (6,7)	BaPEq (U=0)	mg/kg	0.010 U	0.10 U	0.010 U	1.0 U	0.10 U				**0.0011**		1.0 U		
cPAHs (MTCA TEQ-HalfND) (5,8)	BaPEq (U=1/2)	mg/kg	0.010 U	0.10 U	0.010 U	1.0 U	0.10 U				**0.0082**		1.0 U		
Total HPAH (U=0) (4)	T_HPAH (U=0)	mg/kg													
Total LPAH (U=0) (4)	T_LPAH (U=0)	mg/kg													
Total PAH (U=0) (4)	T_PAH (U=0)	mg/kg													
2,3,4,6-Tetrachlorophenol	58-90-2	mg/kg													
2,4,5-Trichlorophenol	95-95-4	mg/kg													
2,4,6-Trichlorophenol	88-06-2	mg/kg													
2,4-Dichlorophenol	120-83-2	mg/kg													
2,4-Dimethylphenol	105-67-9	mg/kg													
2,4-Dinitrophenol	51-28-5	mg/kg													
2,6-Dichlorophenol	87-65-0	mg/kg													
2-Chlorophenol	95-57-8	mg/kg													
2-Methylphenol	95-48-7	mg/kg													
2-Nitrophenol	88-75-5	mg/kg													
3- & 4-Methylphenol	15831-10-4	mg/kg													
4,6-Dinitro-o-cresol	534-52-1	mg/kg													
4-Chloro-3-methylphenol	59-50-7	mg/kg													
4-Methylphenol	106-44-5	mg/kg													
4-Nitrophenol	100-02-7	mg/kg													
Pentachlorophenol	87-86-5	mg/kg													
Phenol	108-95-2	mg/kg													
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg													
Butyl benzyl phthalate	85-68-7	mg/kg													
Di-n-butyl phthalate	84-74-2	mg/kg													
Di-n-octyl phthalate	117-84-0	mg/kg													
Diethylphthalate	84-66-2	mg/kg													
Dimethyl phthalate	131-11-3	mg/kg													
2-Chloronaphthalene	91-58-7	mg/kg													
Aniline	62-53-3	mg/kg													
Azobenzene	103-33-3	mg/kg													
Benzoic acid	65-85-0	mg/kg													
Benzyl alcohol	100-51-6	mg/kg													
Bis(2-chloroethoxy)methane	111-91-1	mg/kg													
Bis-chloroisopropyl ether	108-60-1	mg/kg													
Carbazole	86-74-8	mg/kg													
Dibenzofuran	132-64-9	mg/kg													
Hexachlorobenzene	118-74-1	mg/kg													
Hexachlorobutadiene	87-68-3	mg/kg													
Hexachlorocyclopentadiene	77-47-4	mg/kg													
Isophorone	78-59-1	mg/kg													
N-Nitrosodimethylamine	62-75-9	mg/kg													
N-Nitroso-di-n-propylamine	621-64-7	mg/kg													
N-Nitrosodiphenylamine	86-30-6	mg/kg													

Table 3.3
In Situ Soil Data

		Location Name	A2A-B1	A2A-N1/W1-Comp	A2A-S1/E1-Comp	A2B-N1/S1-Comp	A3A-B1	A3A-E1	A3A-N1	A3A-S1	A3A-N1/S1-Comp	A3A-W1	A3B-B1	A3B-E1	A3B-N1
		Sample Name	A2A-B1-2.5	A2A-Comp1	A2A-Comp2	A2B-Comp1	A3A-B1-0.5	A3A-E1-2	A3A-N1-0.5	A3A-S1-2	A3A-Comp2	A3A-W1-2	A3B-B1-0.5	A3B-E1-2	A3B-N1-0.5
		Sample Date	6/20/2018	6/20/2018	6/20/2018	6/21/2018	6/20/2018	7/2/2018	6/20/2018	7/2/2018	6/20/2018	7/2/2018	6/20/2018	7/5/2018	6/20/2018
		Sample Depth	2.5 ft	2.5-3 ft	2 ft	2 ft	0.5 ft	2 ft	0.5 ft	2 ft	0.5 ft	2 ft	0.5 ft	2 ft	0.5 ft
Analyte	**CAS No.**	**Unit**													
Volatile Organic Compound (VOCs)															
Benzene	71-43-2	mg/kg													
Ethylbenzene	100-41-4	mg/kg													
Toluene	108-88-3	mg/kg													
Xylene (meta & para)	108-38-3/106-42-3	mg/kg													
Xylene (ortho)	95-47-6	mg/kg													
Xylene (total)	1330-20-7	mg/kg													
Chloroethane	75-00-3	mg/kg													
cis-1,2-Dichloroethene	156-59-2	mg/kg													
Tetrachloroethene	127-18-4	mg/kg													
trans-1,2-Dichloroethene	156-60-5	mg/kg													
Trichloroethene	79-01-6	mg/kg													
Vinyl chloride	75-01-4	mg/kg													
1,1,1,2-Tetrachloroethane	630-20-6	mg/kg													
1,1,1-Trichloroethane	71-55-6	mg/kg													
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg													
1,1,2-Trichloroethane	79-00-5	mg/kg													
1,1-Dichloroethane	75-34-3	mg/kg													
1,1-Dichloroethene	75-35-4	mg/kg													
1,1-Dichloropropene	563-58-6	mg/kg													
1,2,3-Trichlorobenzene	87-61-6	mg/kg													
1,2,3-Trichloropropane	96-18-4	mg/kg													
1,2,4-Trichlorobenzene	120-82-1	mg/kg													
1,2,4-Trimethylbenzene	95-63-6	mg/kg													
1,2-Dibromo-3-chloropropane	96-12-8	mg/kg													
1,2-Dibromoethane	106-93-4	mg/kg													
1,2-Dichlorobenzene	95-50-1	mg/kg													
1,2-Dichloroethane	107-06-2	mg/kg													
1,2-Dichloropropane	78-87-5	mg/kg													
1,3,5-Trimethylbenzene	108-67-8	mg/kg													
1,3-Dichlorobenzene	541-73-1	mg/kg													
1,3-Dichloropropane	142-28-9	mg/kg													
1,4-Dichlorobenzene	106-46-7	mg/kg													
2,2-Dichloropropane	594-20-7	mg/kg													
2,4-Dinitrotoluene	121-14-2	mg/kg													
2,6-Dinitrotoluene	606-20-2	mg/kg													
2-Chlorotoluene	95-49-8	mg/kg													
2-Hexanone	591-78-6	mg/kg													
2-Nitroaniline	88-74-4	mg/kg													
3,3'-Dichlorobenzidine	91-94-1	mg/kg													
3-Nitroaniline	99-09-2	mg/kg													
4-Chloroaniline	106-47-8	mg/kg													
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg													
4-Chlorotoluene	106-43-4	mg/kg													
4-Nitroaniline	100-01-6	mg/kg													
Acetone	67-64-1	mg/kg													
Bis(2-chloroethyl)ether	111-44-4	mg/kg													
Bis(2-chloroisopropyl)ether	39638-32-9	mg/kg													
Bromobenzene	108-86-1	mg/kg													

Table 3.3
In Situ Soil Data

		Location Name	A2A-B1	A2A-N1/W1-Comp	A2A-S1/E1-Comp	A2B-N1/S1-Comp	A3A-B1	A3A-E1	A3A-N1	A3A-S1	A3A-N1/S1-Comp	A3A-W1	A3B-B1	A3B-E1	A3B-N1
		Sample Name	A2A-B1-2.5	A2A-Comp1	A2A-Comp2	A2B-Comp1	A3A-B1-0.5	A3A-E1-2	A3A-N1-0.5	A3A-S1-2	A3A-Comp2	A3A-W1-2	A3B-B1-0.5	A3B-E1-2	A3B-N1-0.5
		Sample Date	6/20/2018	6/20/2018	6/20/2018	6/21/2018	6/20/2018	7/2/2018	6/20/2018	7/2/2018	6/20/2018	7/2/2018	6/20/2018	7/5/2018	6/20/2018
		Sample Depth	2.5 ft	2.5-3 ft	2 ft	2 ft	0.5 ft	2 ft	0.5 ft	2 ft	0.5 ft	2 ft	0.5 ft	2 ft	0.5 ft
Analyte	**CAS No.**	**Unit**													
Volatile Organic Compound (VOCs) (cont.)															
Bromochloromethane	74-97-5	mg/kg													
Bromodichloromethane	75-27-4	mg/kg													
Bromoform	75-25-2	mg/kg													
Bromomethane	74-83-9	mg/kg													
Carbon tetrachloride	56-23-5	mg/kg													
Chlorobenzene	108-90-7	mg/kg													
Chloroform	67-66-3	mg/kg													
Chloromethane	74-87-3	mg/kg													
cis-1,3-Dichloropropene	10061-01-5	mg/kg													
Cymene	99-87-6	mg/kg													
Dibromochloromethane	124-48-1	mg/kg													
Dibromomethane	74-95-3	mg/kg													
Dichlorodifluoromethane	75-71-8	mg/kg													
Hexachloroethane	67-72-1	mg/kg													
Isopropylbenzene	98-82-8	mg/kg													
Methyl ethyl ketone	78-93-3	mg/kg													
Methyl isobutyl ketone	108-10-1	mg/kg													
Methylene chloride	75-09-2	mg/kg													
Methyl-tert-butyl ether	1634-04-4	mg/kg													
n-Hexane	110-54-3	mg/kg													
Nitrobenzene	98-95-3	mg/kg													
n-Propylbenzene	103-65-1	mg/kg													
Pyridine	110-86-1	mg/kg													
sec-Butylbenzene	135-98-8	mg/kg													
Styrene	100-42-5	mg/kg													
tert-Butylbenzene	98-06-6	mg/kg													
trans-1,3-Dichloropropene	10061-02-6	mg/kg													
Trichlorofluoromethane	75-69-4	mg/kg													

Notes:

Blank cells are intentional

All results are rounded to two significant figures.

1 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

2 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

3 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.

4 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

5 Result reported by HCID Analysis

6 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Table 708-2 of WAC 173-340-900.

7 Calculation was performed using only detected cPAH concentrations.

8 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

Abbreviations:

CAS Chemical Abstracts Service

cPAH Carcinogenic polycyclic aromatic hydrocarbon

ft Feet

mg/kg Milligrams per kilogram

MTCA Model Toxics Control Act

PAH Polycyclic aromatic hydrocarbons

Qualifiers:

J Analyte was detected; concentration is an estimate.

U Analyte was not detected at the associated reporting limit.

UJ Analyte was not detected at the associated reporting limit, which is an estimate.

Table 3.3
In Situ Soil Data

Location Name			A3B-S1	A3B-N1/S1-Comp	A3B-W1	A3C-B1	A3C-B2	A3C-B1/B2-Comp	A3C-E1	A3C-W1	A3C-E1/W1-Comp	A3C-N1	A3C-S1	A3C-N1/S1-Comp
Sample Name			A3B-S1-2	A3B-Comp1	A3B-W1-2	A3C-B1-1	A3C-B2-1	A3C-Comp3	A3C-E1-0.5	A3C-W1-1	A3C-Comp2	A3C-N1-0.5	A3C-S1-0.5	A3C-Comp1
Sample Date			7/2/2018	6/20/2018	7/2/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018
Sample Depth			2 ft	0.5 ft	2 ft	1 ft	1 ft	1 ft	0.5 ft	1 ft	0.5-1 ft	0.5 ft	0.5 ft	0.5 ft
Analyte	**CAS No.**	**Unit**												
Total Petroleum Hydrocarbons (TPHs)														
Gasoline-range organics	GRO	mg/kg					5.0 U							
Diesel-range organics	DRO	mg/kg		700	50 U			50 U			50 U			50 U
Oil-range organics	ORO	mg/kg		620	250 U			250 U			250 U			250 U
Total DRO & ORO (4)	T_DRO&ORO (U=0)	mg/kg		1,300	250 U			250 U			250 U			250 U
Gasoline (5)	86290-81-5	mg/kg												
Diesel (5)	Dies	mg/kg												
Heavy Oil (5)	Oil_Heavy	mg/kg												
Metals														
Arsenic	7440-38-2	mg/kg	24		7.5	4.8	3.3		4.6	4.0		5.1	4.8	
Barium	7440-39-3	mg/kg												
Cadmium	7440-43-9	mg/kg	1.0 U		1.0 U	1.0 U	1.0 U		1.0 U	1.0 U		1.0 U	1.0 U	
Chromium	7440-47-3	mg/kg				22	20		36	25		21	26	
Chromium(VI)	18540-29-9	mg/kg												
Copper	7440-50-8	mg/kg												
Lead	7439-92-1	mg/kg				51	34		24	30		34	43	
Mercury	7439-97-6	mg/kg				1.0 U	1.0 U		1.0 U	1.0 U		1.0 U	1.0 U	
Selenium	7782-49-2	mg/kg												
Silver	7440-22-4	mg/kg												
Polychlorinated Biphenyls														
Aroclor 1016	12674-11-2	mg/kg		0.020 U				0.020 U			0.020 U			0.020 U
Aroclor 1221	11104-28-2	mg/kg		0.020 U				0.020 U			0.020 U			0.020 U
Aroclor 1232	11141-16-5	mg/kg		0.020 U				0.020 U			0.020 U			0.020 U
Aroclor 1242	53469-21-9	mg/kg		0.020 U				0.020 U			0.020 U			0.020 U
Aroclor 1248	12672-29-6	mg/kg		0.020 U				0.020 U			0.020 U			0.020 U
Aroclor 1254	11097-69-1	mg/kg		0.020 U				0.020 U			0.020 U			0.020 U
Aroclor 1260	11096-82-5	mg/kg		0.020 U				0.020 U			0.020 U			0.020 U
Aroclor 1262	37324-23-5	mg/kg		0.020 U				0.020 U			0.020 U			0.020 U
Aroclor 1268	11100-14-4	mg/kg		0.020 U				0.020 U			0.020 U			0.020 U
Total PCB Aroclors (U=0) (4)	T_PCB (U=0)	mg/kg		0.020 U				0.020 U			0.020 U			0.020 U
Polybrominated Diphenyl Ethers (PBDEs)														
PBDE-003	101-55-3	mg/kg												
Semi-Volatile Organic Compound (SVOCs)														
1-Methylnaphthalene	90-12-0	mg/kg												
2-Methylnaphthalene	91-57-6	mg/kg												
Acenaphthene	83-32-9	mg/kg												
Acenaphthylene	208-96-8	mg/kg												
Anthracene	120-12-7	mg/kg												
Benzo(a)anthracene	56-55-3	mg/kg		0.50 U				0.017			0.10			0.038
Benzo(a)pyrene	50-32-8	mg/kg		0.50 U				**0.018**			**0.085**			**0.033**
Benzo(b)fluoranthene	205-99-2	mg/kg		0.50 U				0.027			0.11			0.095
Benzo(g,h,i)perylene	191-24-2	mg/kg												
Benzo(k)fluoranthene	207-08-9	mg/kg		0.50 U				0.010 U			0.041			0.030
Chrysene	218-01-9	mg/kg		0.50 U				0.019			0.11			0.14
Dibenzo(a,h)anthracene	53-70-3	mg/kg		0.50 U				0.010 U			0.010 U			0.010 U
Fluoranthene	206-44-0	mg/kg												
Fluorene	86-73-7	mg/kg												
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg		0.50 U				0.010			0.028			0.020
Naphthalene	91-20-3	mg/kg												

Table 3.3
In Situ Soil Data

		Location Name	A3B-S1	A3B-N1/S1-Comp	A3B-W1	A3C-B1	A3C-B2	A3C-B1/B2-Comp	A3C-E1	A3C-W1	A3C-E1/W1-Comp	A3C-N1	A3C-S1	A3C-N1/S1-Comp
		Sample Name	A3B-S1-2	A3B-Comp1	A3B-W1-2	A3C-B1-1	A3C-B2-1	A3C-Comp3	A3C-E1-0.5	A3C-W1-1	A3C-Comp2	A3C-N1-0.5	A3C-S1-0.5	A3C-Comp1
		Sample Date	7/2/2018	6/20/2018	7/2/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018
		Sample Depth	2 ft	0.5 ft	2 ft	1 ft	1 ft	1 ft	0.5 ft	1 ft	0.5-1 ft	0.5 ft	0.5 ft	0.5 ft
Analyte	**CAS No.**	**Unit**												
Semi-Volatile Organic Compound (SVOCs) (cont.)														
Phenanthrene	85-01-8	mg/kg												
Pyrene	129-00-0	mg/kg												
Total Naphthalenes (U=0) (4)	T_Napth (U=0)	mg/kg												
cPAHs (MTCA TEQ-ZeroND) (6,7)	BaPEq (U=0)	mg/kg		0.50 U				**0.024**			**0.11**			**0.053**
cPAHs (MTCA TEQ-HalfND) (5,8)	BaPEq (U=1/2)	mg/kg		0.50 U				**0.025**			**0.11**			**0.053**
Total HPAH (U=0) (4)	T_HPAH (U=0)	mg/kg												
Total LPAH (U=0) (4)	T_LPAH (U=0)	mg/kg												
Total PAH (U=0) (4)	T_PAH (U=0)	mg/kg												
2,3,4,6-Tetrachlorophenol	58-90-2	mg/kg												
2,4,5-Trichlorophenol	95-95-4	mg/kg												
2,4,6-Trichlorophenol	88-06-2	mg/kg												
2,4-Dichlorophenol	120-83-2	mg/kg												
2,4-Dimethylphenol	105-67-9	mg/kg												
2,4-Dinitrophenol	51-28-5	mg/kg												
2,6-Dichlorophenol	87-65-0	mg/kg												
2-Chlorophenol	95-57-8	mg/kg												
2-Methylphenol	95-48-7	mg/kg												
2-Nitrophenol	88-75-5	mg/kg												
3- & 4-Methylphenol	15831-10-4	mg/kg												
4,6-Dinitro-o-cresol	534-52-1	mg/kg												
4-Chloro-3-methylphenol	59-50-7	mg/kg												
4-Methylphenol	106-44-5	mg/kg												
4-Nitrophenol	100-02-7	mg/kg												
Pentachlorophenol	87-86-5	mg/kg												
Phenol	108-95-2	mg/kg												
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg												
Butyl benzyl phthalate	85-68-7	mg/kg												
Di-n-butyl phthalate	84-74-2	mg/kg												
Di-n-octyl phthalate	117-84-0	mg/kg												
Diethylphthalate	84-66-2	mg/kg												
Dimethyl phthalate	131-11-3	mg/kg												
2-Chloronaphthalene	91-58-7	mg/kg												
Aniline	62-53-3	mg/kg												
Azobenzene	103-33-3	mg/kg												
Benzoic acid	65-85-0	mg/kg												
Benzyl alcohol	100-51-6	mg/kg												
Bis(2-chloroethoxy)methane	111-91-1	mg/kg												
Bis-chloroisopropyl ether	108-60-1	mg/kg												
Carbazole	86-74-8	mg/kg												
Dibenzofuran	132-64-9	mg/kg												
Hexachlorobenzene	118-74-1	mg/kg												
Hexachlorobutadiene	87-68-3	mg/kg												
Hexachlorocyclopentadiene	77-47-4	mg/kg												
Isophorone	78-59-1	mg/kg												
N-Nitrosodimethylamine	62-75-9	mg/kg												
N-Nitroso-di-n-propylamine	621-64-7	mg/kg												
N-Nitrosodiphenylamine	86-30-6	mg/kg												

Table 3.3
In Situ Soil Data

		Location Name	A3B-S1	A3B-N1/S1-Comp	A3B-W1	A3C-B1	A3C-B2	A3C-B1/B2-Comp	A3C-E1	A3C-W1	A3C-E1/W1-Comp	A3C-N1	A3C-S1	A3C-N1/S1-Comp
		Sample Name	A3B-S1-2	A3B-Comp1	A3B-W1-2	A3C-B1-1	A3C-B2-1	A3C-Comp3	A3C-E1-0.5	A3C-W1-1	A3C-Comp2	A3C-N1-0.5	A3C-S1-0.5	A3C-Comp1
		Sample Date	7/2/2018	6/20/2018	7/2/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018
		Sample Depth	2 ft	0.5 ft	2 ft	1 ft	1 ft	1 ft	0.5 ft	1 ft	0.5-1 ft	0.5 ft	0.5 ft	0.5 ft
Analyte	**CAS No.**	**Unit**												
Volatile Organic Compound (VOCs)														
Benzene	71-43-2	mg/kg					0.020 U							
Ethylbenzene	100-41-4	mg/kg					0.020 U							
Toluene	108-88-3	mg/kg					0.020 U							
Xylene (meta & para)	108-38-3/106-42-3	mg/kg												
Xylene (ortho)	95-47-6	mg/kg												
Xylene (total)	1330-20-7	mg/kg					0.060 U							
Chloroethane	75-00-3	mg/kg												
cis-1,2-Dichloroethene	156-59-2	mg/kg												
Tetrachloroethene	127-18-4	mg/kg												
trans-1,2-Dichloroethene	156-60-5	mg/kg												
Trichloroethene	79-01-6	mg/kg												
Vinyl chloride	75-01-4	mg/kg												
1,1,1,2-Tetrachloroethane	630-20-6	mg/kg												
1,1,1-Trichloroethane	71-55-6	mg/kg												
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg												
1,1,2-Trichloroethane	79-00-5	mg/kg												
1,1-Dichloroethane	75-34-3	mg/kg												
1,1-Dichloroethene	75-35-4	mg/kg												
1,1-Dichloropropene	563-58-6	mg/kg												
1,2,3-Trichlorobenzene	87-61-6	mg/kg												
1,2,3-Trichloropropane	96-18-4	mg/kg												
1,2,4-Trichlorobenzene	120-82-1	mg/kg												
1,2,4-Trimethylbenzene	95-63-6	mg/kg												
1,2-Dibromo-3-chloropropane	96-12-8	mg/kg												
1,2-Dibromoethane	106-93-4	mg/kg												
1,2-Dichlorobenzene	95-50-1	mg/kg												
1,2-Dichloroethane	107-06-2	mg/kg												
1,2-Dichloropropane	78-87-5	mg/kg												
1,3,5-Trimethylbenzene	108-67-8	mg/kg												
1,3-Dichlorobenzene	541-73-1	mg/kg												
1,3-Dichloropropane	142-28-9	mg/kg												
1,4-Dichlorobenzene	106-46-7	mg/kg												
2,2-Dichloropropane	594-20-7	mg/kg												
2,4-Dinitrotoluene	121-14-2	mg/kg												
2,6-Dinitrotoluene	606-20-2	mg/kg												
2-Chlorotoluene	95-49-8	mg/kg												
2-Hexanone	591-78-6	mg/kg												
2-Nitroaniline	88-74-4	mg/kg												
3,3'-Dichlorobenzidine	91-94-1	mg/kg												
3-Nitroaniline	99-09-2	mg/kg												
4-Chloroaniline	106-47-8	mg/kg												
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg												
4-Chlorotoluene	106-43-4	mg/kg												
4-Nitroaniline	100-01-6	mg/kg												
Acetone	67-64-1	mg/kg												
Bis(2-chloroethyl)ether	111-44-4	mg/kg												
Bis(2-chloroisopropyl)ether	39638-32-9	mg/kg												
Bromobenzene	108-86-1	mg/kg												

Table 3.3
In Situ Soil Data

		Location Name	A3B-S1	A3B-N1/S1-Comp	A3B-W1	A3C-B1	A3C-B2	A3C-B1/B2-Comp	A3C-E1	A3C-W1	A3C-E1/W1-Comp	A3C-N1	A3C-S1	A3C-N1/S1-Comp
		Sample Name	A3B-S1-2	A3B-Comp1	A3B-W1-2	A3C-B1-1	A3C-B2-1	A3C-Comp3	A3C-E1-0.5	A3C-W1-1	A3C-Comp2	A3C-N1-0.5	A3C-S1-0.5	A3C-Comp1
		Sample Date	7/2/2018	6/20/2018	7/2/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018
		Sample Depth	2 ft	0.5 ft	2 ft	1 ft	1 ft	1 ft	0.5 ft	1 ft	0.5-1 ft	0.5 ft	0.5 ft	0.5 ft
Analyte	**CAS No.**	**Unit**												
Volatile Organic Compound (VOCs) (cont.)														
Bromochloromethane	74-97-5	mg/kg												
Bromodichloromethane	75-27-4	mg/kg												
Bromoform	75-25-2	mg/kg												
Bromomethane	74-83-9	mg/kg												
Carbon tetrachloride	56-23-5	mg/kg												
Chlorobenzene	108-90-7	mg/kg												
Chloroform	67-66-3	mg/kg												
Chloromethane	74-87-3	mg/kg												
cis-1,3-Dichloropropene	10061-01-5	mg/kg												
Cymene	99-87-6	mg/kg												
Dibromochloromethane	124-48-1	mg/kg												
Dibromomethane	74-95-3	mg/kg												
Dichlorodifluoromethane	75-71-8	mg/kg												
Hexachloroethane	67-72-1	mg/kg												
Isopropylbenzene	98-82-8	mg/kg												
Methyl ethyl ketone	78-93-3	mg/kg												
Methyl isobutyl ketone	108-10-1	mg/kg												
Methylene chloride	75-09-2	mg/kg												
Methyl-tert-butyl ether	1634-04-4	mg/kg												
n-Hexane	110-54-3	mg/kg												
Nitrobenzene	98-95-3	mg/kg												
n-Propylbenzene	103-65-1	mg/kg												
Pyridine	110-86-1	mg/kg												
sec-Butylbenzene	135-98-8	mg/kg												
Styrene	100-42-5	mg/kg												
tert-Butylbenzene	98-06-6	mg/kg												
trans-1,3-Dichloropropene	10061-02-6	mg/kg												
Trichlorofluoromethane	75-69-4	mg/kg												

Notes:

Blank cells are intentional

All results are rounded to two significant figures.

1 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

2 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

3 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.

4 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

5 Result reported by HCID Analysis

6 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Table 708-2 of WAC 173-340-900.

7 Calculation was performed using only detected cPAH concentrations.

8 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

Abbreviations:

CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbon
ft Feet
mg/kg Milligrams per kilogram
MTCA Model Toxics Control Act
PAH Polycyclic aromatic hydrocarbons
PCB Polychlorinated biphenyl
TEQ Toxic equivalency

Qualifiers:

J Analyte was detected; concentration is an estimate.
U Analyte was not detected at the associated reporting limit.
UJ Analyte was not detected at the associated reporting limit, which is an estimate.

Table 3.3
In Situ Soil Data

		Location Name	A4A-B1	A4A-E1	A4A-N1	A4A-S1	A4A-W1	A4B-B1	A4B-E1	A4B-S1	A4B-E1/S1-Comp	A4B-N1	A4B-W1	A4B-N1/W1-Comp	A4B-N2
		Sample Name	A4A-B1-2	A4A-E1-2	A4A-N1-2	A4A-S1-2	A4A-W1-2	A4B-B1-2	A4B-E1-2	A4B-S1-2	A4B-Comp2	A4B-N1-3	A4B-W1-2	A4B-Comp1	A4B-N2-2
		Sample Date	7/2/2018	7/2/2018	7/2/2018	7/2/2018	7/2/2018	6/19/2018	6/19/2018	6/19/2018	6/19/2018	7/3/2018	6/19/2018	6/19/2018	6/25/2018
		Sample Depth	2 ft	2 ft	2 ft	2 ft	2 ft	2 ft	2 ft	2 ft	2 ft	3 ft	2 ft	2 ft	2 ft
Analyte	**CAS No.**	**Unit**													
Total Petroleum Hydrocarbons (TPHs)															
Gasoline-range organics	GRO	mg/kg													
Diesel-range organics	DRO	mg/kg	130 [1]	50 U	50 U	170 [1]	50 U	50 U			62 [1]			50 U	50 U
Oil-range organics	ORO	mg/kg	280	250 U	250 U	370	250 U	330			390			340	250 U
Total DRO & ORO [4]	T_DRO&ORO (U=0)	mg/kg	410	250 U	250 U	540	250 U	330			450			340	250 U
Gasoline [5]	86290-81-5	mg/kg													
Diesel [5]	Dies	mg/kg													
Heavy Oil [5]	Oil_Heavy	mg/kg													
Metals															
Arsenic	7440-38-2	mg/kg						4.4	16	9.5		9.1	6.4		
Barium	7440-39-3	mg/kg													
Cadmium	7440-43-9	mg/kg						1.0 U	1.1	1.0 U		1.3	1.0 U		
Chromium	7440-47-3	mg/kg						17	41	19			19		
Chromium(VI)	18540-29-9	mg/kg													
Copper	7440-50-8	mg/kg													
Lead	7439-92-1	mg/kg						160	260	230			200		
Mercury	7439-97-6	mg/kg						1.0 U	1.0 U	1.0 U			1.0 U		
Selenium	7782-49-2	mg/kg													
Silver	7440-22-4	mg/kg													
Polychlorinated Biphenyls															
Aroclor 1016	12674-11-2	mg/kg						0.020 U			0.020 U			0.020 U	
Aroclor 1221	11104-28-2	mg/kg						0.020 U			0.020 U			0.020 U	
Aroclor 1232	11141-16-5	mg/kg						0.020 U			0.020 U			0.020 U	
Aroclor 1242	53469-21-9	mg/kg						0.020 U			0.020 U			0.020 U	
Aroclor 1248	12672-29-6	mg/kg						0.020 U			0.020 U			0.020 U	
Aroclor 1254	11097-69-1	mg/kg						0.048			0.020 U			0.020 U	
Aroclor 1260	11096-82-5	mg/kg						0.020 U			0.090			0.054	
Aroclor 1262	37324-23-5	mg/kg						0.020 U			0.020 U			0.020 U	
Aroclor 1268	11100-14-4	mg/kg						0.020 U			0.020 U			0.020 U	
Total PCB Aroclors (U=0) [4]	T_PCB (U=0)	mg/kg						0.048			0.090			0.054	
Polybrominated Diphenyl Ethers (PBDEs)															
PBDE-003	101-55-3	mg/kg													
Semi-Volatile Organic Compound (SVOCs)															
1-Methylnaphthalene	90-12-0	mg/kg													
2-Methylnaphthalene	91-57-6	mg/kg													
Acenaphthene	83-32-9	mg/kg													
Acenaphthylene	208-96-8	mg/kg													
Anthracene	120-12-7	mg/kg													
Benzo(a)anthracene	56-55-3	mg/kg						1.0 U			1.0 U			1.0 U	
Benzo(a)pyrene	50-32-8	mg/kg						1.0 U			1.0 U			1.0 U	
Benzo(b)fluoranthene	205-99-2	mg/kg						1.0 U			1.0 U			1.0 U	
Benzo(g,h,i)perylene	191-24-2	mg/kg													
Benzo(k)fluoranthene	207-08-9	mg/kg						1.0 U			1.0 U			1.0 U	
Chrysene	218-01-9	mg/kg						1.0 U			1.0 U			1.0 U	
Dibenzo(a,h)anthracene	53-70-3	mg/kg						1.0 U			1.0 U			1.0 U	
Fluoranthene	206-44-0	mg/kg													
Fluorene	86-73-7	mg/kg													
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg						1.0 U			1.0 U			1.0 U	
Naphthalene	91-20-3	mg/kg													

Table 3.3
In Situ Soil Data

		Location Name	A4A-B1	A4A-E1	A4A-N1	A4A-S1	A4A-W1	A4B-B1	A4B-E1	A4B-S1	A4B-E1/S1-Comp	A4B-N1	A4B-W1	A4B-N1/W1-Comp	A4B-N2
		Sample Name	A4A-B1-2	A4A-E1-2	A4A-N1-2	A4A-S1-2	A4A-W1-2	A4B-B1-2	A4B-E1-2	A4B-S1-2	A4B-Comp2	A4B-N1-3	A4B-W1-2	A4B-Comp1	A4B-N2-2
		Sample Date	7/2/2018	7/2/2018	7/2/2018	7/2/2018	7/2/2018	6/19/2018	6/19/2018	6/19/2018	6/19/2018	7/3/2018	6/19/2018	6/19/2018	6/25/2018
		Sample Depth	2 ft	2 ft	2 ft	2 ft	2 ft	2 ft	2 ft	2 ft	2 ft	3 ft	2 ft	2 ft	2 ft
Analyte	**CAS No.**	**Unit**													
Semi-Volatile Organic Compound (SVOCs) (cont.)															
Phenanthrene	85-01-8	mg/kg													
Pyrene	129-00-0	mg/kg													
Total Naphthalenes (U=0) (4)	T_Napth (U=0)	mg/kg													
cPAHs (MTCA TEQ-ZeroND) (6,7)	BaPEq (U=0)	mg/kg						1.0 U			1.0 U			1.0 U	
cPAHs (MTCA TEQ-HalfND) (5,8)	BaPEq (U=1/2)	mg/kg						1.0 U			1.0 U			1.0 U	
Total HPAH (U=0) (4)	T_HPAH (U=0)	mg/kg													
Total LPAH (U=0) (4)	T_LPAH (U=0)	mg/kg													
Total PAH (U=0) (4)	T_PAH (U=0)	mg/kg													
2,3,4,6-Tetrachlorophenol	58-90-2	mg/kg													
2,4,5-Trichlorophenol	95-95-4	mg/kg													
2,4,6-Trichlorophenol	88-06-2	mg/kg													
2,4-Dichlorophenol	120-83-2	mg/kg													
2,4-Dimethylphenol	105-67-9	mg/kg													
2,4-Dinitrophenol	51-28-5	mg/kg													
2,6-Dichlorophenol	87-65-0	mg/kg													
2-Chlorophenol	95-57-8	mg/kg													
2-Methylphenol	95-48-7	mg/kg													
2-Nitrophenol	88-75-5	mg/kg													
3- & 4-Methylphenol	15831-10-4	mg/kg													
4,6-Dinitro-o-cresol	534-52-1	mg/kg													
4-Chloro-3-methylphenol	59-50-7	mg/kg													
4-Methylphenol	106-44-5	mg/kg													
4-Nitrophenol	100-02-7	mg/kg													
Pentachlorophenol	87-86-5	mg/kg													
Phenol	108-95-2	mg/kg													
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg													
Butyl benzyl phthalate	85-68-7	mg/kg													
Di-n-butyl phthalate	84-74-2	mg/kg													
Di-n-octyl phthalate	117-84-0	mg/kg													
Diethylphthalate	84-66-2	mg/kg													
Dimethyl phthalate	131-11-3	mg/kg													
2-Chloronaphthalene	91-58-7	mg/kg													
Aniline	62-53-3	mg/kg													
Azobenzene	103-33-3	mg/kg													
Benzoic acid	65-85-0	mg/kg													
Benzyl alcohol	100-51-6	mg/kg													
Bis(2-chloroethoxy)methane	111-91-1	mg/kg													
Bis-chloroisopropyl ether	108-60-1	mg/kg													
Carbazole	86-74-8	mg/kg													
Dibenzofuran	132-64-9	mg/kg													
Hexachlorobenzene	118-74-1	mg/kg													
Hexachlorobutadiene	87-68-3	mg/kg													
Hexachlorocyclopentadiene	77-47-4	mg/kg													
Isophorone	78-59-1	mg/kg													
N-Nitrosodimethylamine	62-75-9	mg/kg													
N-Nitroso-di-n-propylamine	621-64-7	mg/kg													
N-Nitrosodiphenylamine	86-30-6	mg/kg													

Table 3.3
In Situ Soil Data

		Location Name	A4A-B1	A4A-E1	A4A-N1	A4A-S1	A4A-W1	A4B-B1	A4B-E1	A4B-S1	A4B-E1/S1-Comp	A4B-N1	A4B-W1	A4B-N1/W1-Comp	A4B-N2
		Sample Name	A4A-B1-2	A4A-E1-2	A4A-N1-2	A4A-S1-2	A4A-W1-2	A4B-B1-2	A4B-E1-2	A4B-S1-2	A4B-Comp2	A4B-N1-3	A4B-W1-2	A4B-Comp1	A4B-N2-2
		Sample Date	7/2/2018	7/2/2018	7/2/2018	7/2/2018	7/2/2018	6/19/2018	6/19/2018	6/19/2018	6/19/2018	7/3/2018	6/19/2018	6/19/2018	6/25/2018
		Sample Depth	2 ft	2 ft	2 ft	2 ft	2 ft	2 ft	2 ft	2 ft	2 ft	3 ft	2 ft	2 ft	2 ft
Analyte	**CAS No.**	**Unit**													
Volatile Organic Compound (VOCs)															
Benzene	71-43-2	mg/kg													
Ethylbenzene	100-41-4	mg/kg													
Toluene	108-88-3	mg/kg													
Xylene (meta & para)	108-38-3/106-42-3	mg/kg													
Xylene (ortho)	95-47-6	mg/kg													
Xylene (total)	1330-20-7	mg/kg													
Chloroethane	75-00-3	mg/kg													
cis-1,2-Dichloroethene	156-59-2	mg/kg													
Tetrachloroethene	127-18-4	mg/kg													
trans-1,2-Dichloroethene	156-60-5	mg/kg													
Trichloroethene	79-01-6	mg/kg													
Vinyl chloride	75-01-4	mg/kg													
1,1,1,2-Tetrachloroethane	630-20-6	mg/kg													
1,1,1-Trichloroethane	71-55-6	mg/kg													
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg													
1,1,2-Trichloroethane	79-00-5	mg/kg													
1,1-Dichloroethane	75-34-3	mg/kg													
1,1-Dichloroethene	75-35-4	mg/kg													
1,1-Dichloropropene	563-58-6	mg/kg													
1,2,3-Trichlorobenzene	87-61-6	mg/kg													
1,2,3-Trichloropropane	96-18-4	mg/kg													
1,2,4-Trichlorobenzene	120-82-1	mg/kg													
1,2,4-Trimethylbenzene	95-63-6	mg/kg													
1,2-Dibromo-3-chloropropane	96-12-8	mg/kg													
1,2-Dibromoethane	106-93-4	mg/kg													
1,2-Dichlorobenzene	95-50-1	mg/kg													
1,2-Dichloroethane	107-06-2	mg/kg													
1,2-Dichloropropane	78-87-5	mg/kg													
1,3,5-Trimethylbenzene	108-67-8	mg/kg													
1,3-Dichlorobenzene	541-73-1	mg/kg													
1,3-Dichloropropane	142-28-9	mg/kg													
1,4-Dichlorobenzene	106-46-7	mg/kg													
2,2-Dichloropropane	594-20-7	mg/kg													
2,4-Dinitrotoluene	121-14-2	mg/kg													
2,6-Dinitrotoluene	606-20-2	mg/kg													
2-Chlorotoluene	95-49-8	mg/kg													
2-Hexanone	591-78-6	mg/kg													
2-Nitroaniline	88-74-4	mg/kg													
3,3'-Dichlorobenzidine	91-94-1	mg/kg													
3-Nitroaniline	99-09-2	mg/kg													
4-Chloroaniline	106-47-8	mg/kg													
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg													
4-Chlorotoluene	106-43-4	mg/kg													
4-Nitroaniline	100-01-6	mg/kg													
Acetone	67-64-1	mg/kg													
Bis(2-chloroethyl)ether	111-44-4	mg/kg													
Bis(2-chloroisopropyl)ether	39638-32-9	mg/kg													
Bromobenzene	108-86-1	mg/kg													

Table 3.3
In Situ Soil Data

		Location Name	A4A-B1	A4A-E1	A4A-N1	A4A-S1	A4A-W1	A4B-B1	A4B-E1	A4B-S1	A4B-E1/S1-Comp	A4B-N1	A4B-W1	A4B-N1/W1-Comp	A4B-N2
		Sample Name	A4A-B1-2	A4A-E1-2	A4A-N1-2	A4A-S1-2	A4A-W1-2	A4B-B1-2	A4B-E1-2	A4B-S1-2	A4B-Comp2	A4B-N1-3	A4B-W1-2	A4B-Comp1	A4B-N2-2
		Sample Date	7/2/2018	7/2/2018	7/2/2018	7/2/2018	7/2/2018	6/19/2018	6/19/2018	6/19/2018	6/19/2018	7/3/2018	6/19/2018	6/19/2018	6/25/2018
		Sample Depth	2 ft	2 ft	2 ft	2 ft	2 ft	2 ft	2 ft	2 ft	2 ft	3 ft	2 ft	2 ft	2 ft
Analyte	**CAS No.**	**Unit**													
Volatile Organic Compound (VOCs) (cont.)															
Bromochloromethane	74-97-5	mg/kg													
Bromodichloromethane	75-27-4	mg/kg													
Bromoform	75-25-2	mg/kg													
Bromomethane	74-83-9	mg/kg													
Carbon tetrachloride	56-23-5	mg/kg													
Chlorobenzene	108-90-7	mg/kg													
Chloroform	67-66-3	mg/kg													
Chloromethane	74-87-3	mg/kg													
cis-1,3-Dichloropropene	10061-01-5	mg/kg													
Cymene	99-87-6	mg/kg													
Dibromochloromethane	124-48-1	mg/kg													
Dibromomethane	74-95-3	mg/kg													
Dichlorodifluoromethane	75-71-8	mg/kg													
Hexachloroethane	67-72-1	mg/kg													
Isopropylbenzene	98-82-8	mg/kg													
Methyl ethyl ketone	78-93-3	mg/kg													
Methyl isobutyl ketone	108-10-1	mg/kg													
Methylene chloride	75-09-2	mg/kg													
Methyl-tert-butyl ether	1634-04-4	mg/kg													
n-Hexane	110-54-3	mg/kg													
Nitrobenzene	98-95-3	mg/kg													
n-Propylbenzene	103-65-1	mg/kg													
Pyridine	110-86-1	mg/kg													
sec-Butylbenzene	135-98-8	mg/kg													
Styrene	100-42-5	mg/kg													
tert-Butylbenzene	98-06-6	mg/kg													
trans-1,3-Dichloropropene	10061-02-6	mg/kg													
Trichlorofluoromethane	75-69-4	mg/kg													

Notes:

Blank cells are intentional

All results are rounded to two significant figures.

1 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

2 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

3 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.

4 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

5 Result reported by HCID Analysis

6 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Table 708-2 of WAC 173-340-900.

7 Calculation was performed using only detected cPAH concentrations.

8 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

Abbreviations:

CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbon
ft Feet
mg/kg Milligrams per kilogram
MTCA Model Toxics Control Act
PAH Polycyclic aromatic hydrocarbons
PCB Polychlorinated biphenyl
TEQ Toxic equivalency

Qualifiers:

J Analyte was detected; concentration is an estimate.
U Analyte was not detected at the associated reporting limit.
UJ Analyte was not detected at the associated reporting limit, which is an estimate.

Table 3.3
In Situ Soil Data

		Location Name	A4C-B1	A4C-E1	A4C-W1	A4C-W1/E1-Comp	A4C-N1	A4C-S1	A4C-N1/S1-Comp	A5A-B1	A5A-E1		A5A-W1	A5A-E1/W1-Comp	A5A-N1
		Sample Name	**A4C-B1-2.5**	**A4C-E1-1.5**	**A4C-W1-2**	**A4C-Comp2**	**A4C-N1-2**	**A4C-S1-2**	**A4C-Comp1**	**A5A-B1-6**	**A5A-E1-2**	**A5A-E1-6**	**A5A-W1-2**	**A5A-Comp2**	**A5A-N1-2**
		Sample Date	**6/19/2018**	**6/19/2018**	**6/19/2018**	**6/19/2018**	**7/2/2018**	**6/19/2018**	**6/19/2018**	**6/19/2018**	**6/21/2018**	**6/19/2018**	**6/21/2018**	**6/21/2018**	**6/21/2018**
		Sample Depth	**2.5 ft**	**1.5 ft**	**2 ft**	**1.5-2 ft**	**2 ft**	**2 ft**	**0.5-2 ft**	**6 ft**	**2 ft**	**6 ft**	**2 ft**	**2 ft**	**2 ft**
Analyte	**CAS No.**	**Unit**													
Total Petroleum Hydrocarbons (TPHs)															
Gasoline-range organics	GRO	mg/kg													
Diesel-range organics	DRO	mg/kg	50 U			50 U			330	50 U		50 U		50 U	
Oil-range organics	ORO	mg/kg	250 U			250 U			880	250 U		250 U		250 U	
Total DRO & ORO [4]	T_DRO&ORO (U=0)	mg/kg	250 U			250 U			1,200	250 U		250 U		250 U	
Gasoline [5]	86290-81-5	mg/kg													
Diesel [5]	Dies	mg/kg													
Heavy Oil [5]	Oil_Heavy	mg/kg													
Metals															
Arsenic	7440-38-2	mg/kg	4.4	11	7.2		9.0	12				1.4			
Barium	7440-39-3	mg/kg													
Cadmium	7440-43-9	mg/kg	1.0 U	1.0 U	1.0 U		1.0 U	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U		1.0 U
Chromium	7440-47-3	mg/kg	9.6	14	12			15				7.9			
Chromium(VI)	18540-29-9	mg/kg													
Copper	7440-50-8	mg/kg													
Lead	7439-92-1	mg/kg	3.0	210	86			150				1.6			
Mercury	7439-97-6	mg/kg	1.0 U	1.0 U	1.0 U			1.0 U				1.0 U			
Selenium	7782-49-2	mg/kg													
Silver	7440-22-4	mg/kg													
Polychlorinated Biphenyls															
Aroclor 1016	12674-11-2	mg/kg	0.020 U			0.020 U			0.020 U			0.020 U		0.020 U	
Aroclor 1221	11104-28-2	mg/kg	0.020 U			0.020 U			0.020 U			0.020 U		0.020 U	
Aroclor 1232	11141-16-5	mg/kg	0.020 U			0.020 U			0.020 U			0.020 U		0.020 U	
Aroclor 1242	53469-21-9	mg/kg	0.020 U			0.020 U			0.020 U			0.020 U		0.020 U	
Aroclor 1248	12672-29-6	mg/kg	0.020 U			0.020 U			0.020 U			0.020 U		0.020 U	
Aroclor 1254	11097-69-1	mg/kg	0.020 U			0.020 U			0.020 U			0.020 U		0.020 U	
Aroclor 1260	11096-82-5	mg/kg	0.020 U			0.020 U			0.57			0.020 U		0.020 U	
Aroclor 1262	37324-23-5	mg/kg	0.020 U			0.020 U			0.020 U			0.020 U		0.020 U	
Aroclor 1268	11100-14-4	mg/kg	0.020 U			0.020 U			0.020 U			0.020 U		0.020 U	
Total PCB Aroclors (U=0) [4]	T_PCB (U=0)	mg/kg	0.020 U			0.020 U			0.57			0.020 U		0.020 U	
Polybrominated Diphenyl Ethers (PBDEs)															
PBDE-003	101-55-3	mg/kg													
Semi-Volatile Organic Compound (SVOCs)															
1-Methylnaphthalene	90-12-0	mg/kg													
2-Methylnaphthalene	91-57-6	mg/kg													
Acenaphthene	83-32-9	mg/kg													
Acenaphthylene	208-96-8	mg/kg													
Anthracene	120-12-7	mg/kg													
Benzo(a)anthracene	56-55-3	mg/kg	0.010 U			0.031	0.99	0.10 U	0.65	0.010 U		0.010 U		0.014	
Benzo(a)pyrene	50-32-8	mg/kg	0.010 U			**0.047**	**1.1**	**0.11**	**0.88**	0.010 U		0.010 U		**0.018**	
Benzo(b)fluoranthene	205-99-2	mg/kg	0.010 U			0.064	1.1	0.16	1.5	0.010 U		0.010 U		0.027	
Benzo(g,h,i)perylene	191-24-2	mg/kg													
Benzo(k)fluoranthene	207-08-9	mg/kg	0.010 U			0.024	0.41	0.10 U	0.39	0.010 U		0.010 U		0.010 U	
Chrysene	218-01-9	mg/kg	0.010 U			0.051	1.1	0.15	0.77	0.010 U		0.010 U		0.018	
Dibenzo(a,h)anthracene	53-70-3	mg/kg	0.010 U			0.010 U	0.13	0.10 U	0.10 U	0.010 U		0.010 U		0.010 U	
Fluoranthene	206-44-0	mg/kg													
Fluorene	86-73-7	mg/kg													
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg	0.010 U			0.019	0.59	0.10 U	0.37	0.010 U		0.010 U		0.010 U	
Naphthalene	91-20-3	mg/kg													

Table 3.3
In Situ Soil Data

		Location Name	A4C-B1	A4C-E1	A4C-W1	A4C-W1/E1-Comp	A4C-N1	A4C-S1	A4C-N1/S1-Comp	A5A-B1	A5A-E1		A5A-W1	A5A-E1/W1-Comp	A5A-N1
		Sample Name	A4C-B1-2.5	A4C-E1-1.5	A4C-W1-2	A4C-Comp2	A4C-N1-2	A4C-S1-2	A4C-Comp1	A5A-B1-6	A5A-E1-2	A5A-E1-6	A5A-W1-2	A5A-Comp2	A5A-N1-2
		Sample Date	6/19/2018	6/19/2018	6/19/2018	6/19/2018	7/2/2018	6/19/2018	6/19/2018	6/19/2018	6/21/2018	6/19/2018	6/21/2018	6/21/2018	6/21/2018
		Sample Depth	2.5 ft	1.5 ft	2 ft	1.5-2 ft	2 ft	2 ft	0.5-2 ft	6 ft	2 ft	6 ft	2 ft	2 ft	2 ft
Analyte	**CAS No.**	**Unit**													
Semi-Volatile Organic Compound (SVOCs) (cont.)															
Phenanthrene	85-01-8	mg/kg													
Pyrene	129-00-0	mg/kg													
Total Naphthalenes (U=0) [(4)]	T_Napth (U=0)	mg/kg													
cPAHs (MTCA TEQ-ZeroND) [(6,7)]	BaPEq (U=0)	mg/kg	0.010 U			**0.061**	**1.4**	**0.13**	**1.2**	0.010 U		0.010 U		**0.022**	
cPAHs (MTCA TEQ-HalfND) [(5,8)]	BaPEq (U=1/2)	mg/kg	0.010 U			**0.062**	**1.4**	**0.15**	**1.2**	0.010 U		0.010 U		**0.024**	
Total HPAH (U=0) [(4)]	T_HPAH (U=0)	mg/kg													
Total LPAH (U=0) [(4)]	T_LPAH (U=0)	mg/kg													
Total PAH (U=0) [(4)]	T_PAH (U=0)	mg/kg													
2,3,4,6-Tetrachlorophenol	58-90-2	mg/kg													
2,4,5-Trichlorophenol	95-95-4	mg/kg													
2,4,6-Trichlorophenol	88-06-2	mg/kg													
2,4-Dichlorophenol	120-83-2	mg/kg													
2,4-Dimethylphenol	105-67-9	mg/kg													
2,4-Dinitrophenol	51-28-5	mg/kg													
2,6-Dichlorophenol	87-65-0	mg/kg													
2-Chlorophenol	95-57-8	mg/kg													
2-Methylphenol	95-48-7	mg/kg													
2-Nitrophenol	88-75-5	mg/kg													
3- & 4-Methylphenol	15831-10-4	mg/kg													
4,6-Dinitro-o-cresol	534-52-1	mg/kg													
4-Chloro-3-methylphenol	59-50-7	mg/kg													
4-Methylphenol	106-44-5	mg/kg													
4-Nitrophenol	100-02-7	mg/kg													
Pentachlorophenol	87-86-5	mg/kg													
Phenol	108-95-2	mg/kg													
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg													
Butyl benzyl phthalate	85-68-7	mg/kg													
Di-n-butyl phthalate	84-74-2	mg/kg													
Di-n-octyl phthalate	117-84-0	mg/kg													
Diethylphthalate	84-66-2	mg/kg													
Dimethyl phthalate	131-11-3	mg/kg													
2-Chloronaphthalene	91-58-7	mg/kg													
Aniline	62-53-3	mg/kg													
Azobenzene	103-33-3	mg/kg													
Benzoic acid	65-85-0	mg/kg													
Benzyl alcohol	100-51-6	mg/kg													
Bis(2-chloroethoxy)methane	111-91-1	mg/kg													
Bis-chloroisopropyl ether	108-60-1	mg/kg													
Carbazole	86-74-8	mg/kg													
Dibenzofuran	132-64-9	mg/kg													
Hexachlorobenzene	118-74-1	mg/kg													
Hexachlorobutadiene	87-68-3	mg/kg													
Hexachlorocyclopentadiene	77-47-4	mg/kg													
Isophorone	78-59-1	mg/kg													
N-Nitrosodimethylamine	62-75-9	mg/kg													
N-Nitroso-di-n-propylamine	621-64-7	mg/kg													
N-Nitrosodiphenylamine	86-30-6	mg/kg													

Table 3.3
In Situ Soil Data

		Location Name	A4C-B1	A4C-E1	A4C-W1	A4C-W1/E1-Comp	A4C-N1	A4C-S1	A4C-N1/S1-Comp	A5A-B1	A5A-E1		A5A-W1	A5A-E1/W1-Comp	A5A-N1
		Sample Name	A4C-B1-2.5	A4C-E1-1.5	A4C-W1-2	A4C-Comp2	A4C-N1-2	A4C-S1-2	A4C-Comp1	A5A-B1-6	A5A-E1-2	A5A-E1-6	A5A-W1-2	A5A-Comp2	A5A-N1-2
		Sample Date	6/19/2018	6/19/2018	6/19/2018	6/19/2018	7/2/2018	6/19/2018	6/19/2018	6/19/2018	6/21/2018	6/19/2018	6/21/2018	6/21/2018	6/21/2018
		Sample Depth	2.5 ft	1.5 ft	2 ft	1.5-2 ft	2 ft	2 ft	0.5-2 ft	6 ft	2 ft	6 ft	2 ft	2 ft	2 ft
Analyte	**CAS No.**	**Unit**													
Volatile Organic Compound (VOCs)															
Benzene	71-43-2	mg/kg													
Ethylbenzene	100-41-4	mg/kg													
Toluene	108-88-3	mg/kg													
Xylene (meta & para)	108-38-3/106-42-3	mg/kg													
Xylene (ortho)	95-47-6	mg/kg													
Xylene (total)	1330-20-7	mg/kg													
Chloroethane	75-00-3	mg/kg													
cis-1,2-Dichloroethene	156-59-2	mg/kg													
Tetrachloroethene	127-18-4	mg/kg								0.025 U	0.025 U				0.025 U
trans-1,2-Dichloroethene	156-60-5	mg/kg													
Trichloroethene	79-01-6	mg/kg								0.020 U	0.020 U				0.020 U
Vinyl chloride	75-01-4	mg/kg													
1,1,1,2-Tetrachloroethane	630-20-6	mg/kg													
1,1,1-Trichloroethane	71-55-6	mg/kg													
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg													
1,1,2-Trichloroethane	79-00-5	mg/kg													
1,1-Dichloroethane	75-34-3	mg/kg													
1,1-Dichloroethene	75-35-4	mg/kg													
1,1-Dichloropropene	563-58-6	mg/kg													
1,2,3-Trichlorobenzene	87-61-6	mg/kg													
1,2,3-Trichloropropane	96-18-4	mg/kg													
1,2,4-Trichlorobenzene	120-82-1	mg/kg													
1,2,4-Trimethylbenzene	95-63-6	mg/kg													
1,2-Dibromo-3-chloropropane	96-12-8	mg/kg													
1,2-Dibromoethane	106-93-4	mg/kg													
1,2-Dichlorobenzene	95-50-1	mg/kg													
1,2-Dichloroethane	107-06-2	mg/kg													
1,2-Dichloropropane	78-87-5	mg/kg													
1,3,5-Trimethylbenzene	108-67-8	mg/kg													
1,3-Dichlorobenzene	541-73-1	mg/kg													
1,3-Dichloropropane	142-28-9	mg/kg													
1,4-Dichlorobenzene	106-46-7	mg/kg													
2,2-Dichloropropane	594-20-7	mg/kg													
2,4-Dinitrotoluene	121-14-2	mg/kg													
2,6-Dinitrotoluene	606-20-2	mg/kg													
2-Chlorotoluene	95-49-8	mg/kg													
2-Hexanone	591-78-6	mg/kg													
2-Nitroaniline	88-74-4	mg/kg													
3,3'-Dichlorobenzidine	91-94-1	mg/kg													
3-Nitroaniline	99-09-2	mg/kg													
4-Chloroaniline	106-47-8	mg/kg													
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg													
4-Chlorotoluene	106-43-4	mg/kg													
4-Nitroaniline	100-01-6	mg/kg													
Acetone	67-64-1	mg/kg													
Bis(2-chloroethyl)ether	111-44-4	mg/kg													
Bis(2-chloroisopropyl)ether	39638-32-9	mg/kg													
Bromobenzene	108-86-1	mg/kg													

Table 3.3
In Situ Soil Data

		Location Name	A4C-B1	A4C-E1	A4C-W1	A4C-W1/E1-Comp	A4C-N1	A4C-S1	A4C-N1/S1-Comp	A5A-B1	A5A-E1		A5A-W1	A5A-E1/W1-Comp	A5A-N1
		Sample Name	A4C-B1-2.5	A4C-E1-1.5	A4C-W1-2	A4C-Comp2	A4C-N1-2	A4C-S1-2	A4C-Comp1	A5A-B1-6	A5A-E1-2	A5A-E1-6	A5A-W1-2	A5A-Comp2	A5A-N1-2
		Sample Date	6/19/2018	6/19/2018	6/19/2018	6/19/2018	7/2/2018	6/19/2018	6/19/2018	6/19/2018	6/21/2018	6/19/2018	6/21/2018	6/21/2018	6/21/2018
		Sample Depth	2.5 ft	1.5 ft	2 ft	1.5-2 ft	2 ft	2 ft	0.5-2 ft	6 ft	2 ft	6 ft	2 ft	2 ft	2 ft
Analyte	**CAS No.**	**Unit**													
Volatile Organic Compound (VOCs) (cont.)															
Bromochloromethane	74-97-5	mg/kg													
Bromodichloromethane	75-27-4	mg/kg													
Bromoform	75-25-2	mg/kg													
Bromomethane	74-83-9	mg/kg													
Carbon tetrachloride	56-23-5	mg/kg													
Chlorobenzene	108-90-7	mg/kg													
Chloroform	67-66-3	mg/kg													
Chloromethane	74-87-3	mg/kg													
cis-1,3-Dichloropropene	10061-01-5	mg/kg													
Cymene	99-87-6	mg/kg													
Dibromochloromethane	124-48-1	mg/kg													
Dibromomethane	74-95-3	mg/kg													
Dichlorodifluoromethane	75-71-8	mg/kg													
Hexachloroethane	67-72-1	mg/kg													
Isopropylbenzene	98-82-8	mg/kg													
Methyl ethyl ketone	78-93-3	mg/kg													
Methyl isobutyl ketone	108-10-1	mg/kg													
Methylene chloride	75-09-2	mg/kg													
Methyl-tert-butyl ether	1634-04-4	mg/kg													
n-Hexane	110-54-3	mg/kg													
Nitrobenzene	98-95-3	mg/kg													
n-Propylbenzene	103-65-1	mg/kg													
Pyridine	110-86-1	mg/kg													
sec-Butylbenzene	135-98-8	mg/kg													
Styrene	100-42-5	mg/kg													
tert-Butylbenzene	98-06-6	mg/kg													
trans-1,3-Dichloropropene	10061-02-6	mg/kg													
Trichlorofluoromethane	75-69-4	mg/kg													

Notes:

Blank cells are intentional
All results are rounded to two significant figures.
1 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.
2 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.
3 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.
4 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.
5 Result reported by HCID Analysis
6 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Table 708-2 of WAC 173-340-900.
7 Calculation was performed using only detected cPAH concentrations.
8 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

Abbreviations:

CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbon
ft Feet
mg/kg Milligrams per kilogram
MTCA Model Toxics Control Act
PAH Polycyclic aromatic hydrocarbons
PCB Polychlorinated biphenyl
TEQ Toxic equivalency

Qualifiers:

J Analyte was detected; concentration is an estimate.
U Analyte was not detected at the associated reporting limit.
UJ Analyte was not detected at the associated reporting limit, which is an estimate.

Table 3.3
In Situ Soil Data

		Location Name	A5A-S1	A5A-N1/S1-Comp	A5A-W3	A5A-W4	A5A-W5	A5A-W7	A5A-W9	A5A-W10	A5A-W14	A5A-W15	A5A-W17	A5A-W18	A5A-W19
		Sample Name	A5A-S1-2	A5A-Comp1	A5A-W3-2	A5A-W4-8	A5A-W5-8	A5A-W7-9	A5A-W9-9	A5A-W10-9	A5A-W14-10	A5A-W15-10	A5A-W17-9	A5A-W18-9	A5A-W19-9
		Sample Date	6/21/2018	6/21/2018	6/20/2018	7/3/2018	7/3/2018	7/3/2018	7/3/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/11/2018	7/11/2018
		Sample Depth	2 ft	2 ft	2 ft	8 ft	8 ft	9 ft	9 ft	9 ft	10 ft	10 ft	9 ft	9 ft	9 ft
Analyte	**CAS No.**	**Unit**													
Total Petroleum Hydrocarbons (TPHs)															
Gasoline-range organics	GRO	mg/kg													
Diesel-range organics	DRO	mg/kg		50 U	64 (1)	50 U	50 U	380 (1)	50 U	50 U	50 U	50 U	50 U	50 U	50 U
Oil-range organics	ORO	mg/kg		250 U	400	250 U	250 U	2,100	250 U	250 U	250 U	250 U	250 U	250 U	250 U
Total DRO & ORO (4)	T_DRO&ORO (U=0)	mg/kg		250 U	460	250 U	250 U	2,500	250 U	250 U	250 U	250 U	250 U	250 U	250 U
Gasoline (5)	86290-81-5	mg/kg													
Diesel (5)	Dies	mg/kg													
Heavy Oil (5)	Oil_Heavy	mg/kg													
Metals															
Arsenic	7440-38-2	mg/kg													
Barium	7440-39-3	mg/kg													
Cadmium	7440-43-9	mg/kg	1.0 U		1.9										
Chromium	7440-47-3	mg/kg													
Chromium(VI)	18540-29-9	mg/kg													
Copper	7440-50-8	mg/kg													
Lead	7439-92-1	mg/kg													
Mercury	7439-97-6	mg/kg													
Selenium	7782-49-2	mg/kg													
Silver	7440-22-4	mg/kg													
Polychlorinated Biphenyls															
Aroclor 1016	12674-11-2	mg/kg		0.020 U	0.020 U										
Aroclor 1221	11104-28-2	mg/kg		0.020 U	0.020 U										
Aroclor 1232	11141-16-5	mg/kg		0.020 U	0.020 U										
Aroclor 1242	53469-21-9	mg/kg		0.020 U	0.020 U										
Aroclor 1248	12672-29-6	mg/kg		0.020 U	0.020 U										
Aroclor 1254	11097-69-1	mg/kg		0.020 U	0.24										
Aroclor 1260	11096-82-5	mg/kg		0.020 U	0.020 U										
Aroclor 1262	37324-23-5	mg/kg		0.020 U	0.020 U										
Aroclor 1268	11100-14-4	mg/kg		0.020 U	0.020 U										
Total PCB Aroclors (U=0) (4)	T_PCB (U=0)	mg/kg		0.020 U	0.24										
Polybrominated Diphenyl Ethers (PBDEs)															
PBDE-003	101-55-3	mg/kg													
Semi-Volatile Organic Compound (SVOCs)															
1-Methylnaphthalene	90-12-0	mg/kg													
2-Methylnaphthalene	91-57-6	mg/kg													
Acenaphthene	83-32-9	mg/kg													
Acenaphthylene	208-96-8	mg/kg													
Anthracene	120-12-7	mg/kg													
Benzo(a)anthracene	56-55-3	mg/kg		0.10 U	0.19										
Benzo(a)pyrene	50-32-8	mg/kg		0.10 U	**0.22**										
Benzo(b)fluoranthene	205-99-2	mg/kg		0.10 U	0.36										
Benzo(g,h,i)perylene	191-24-2	mg/kg													
Benzo(k)fluoranthene	207-08-9	mg/kg		0.10 U	0.11										
Chrysene	218-01-9	mg/kg		0.10 U	0.25										
Dibenzo(a,h)anthracene	53-70-3	mg/kg		0.10 U	0.10 U										
Fluoranthene	206-44-0	mg/kg													
Fluorene	86-73-7	mg/kg													
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg		0.10 U	0.11										
Naphthalene	91-20-3	mg/kg													

Table 3.3
In Situ Soil Data

		Location Name	A5A-S1	A5A-N1/S1-Comp	A5A-W3	A5A-W4	A5A-W5	A5A-W7	A5A-W9	A5A-W10	A5A-W14	A5A-W15	A5A-W17	A5A-W18	A5A-W19
		Sample Name	A5A-S1-2	A5A-Comp1	A5A-W3-2	A5A-W4-8	A5A-W5-8	A5A-W7-9	A5A-W9-9	A5A-W10-9	A5A-W14-10	A5A-W15-10	A5A-W17-9	A5A-W18-9	A5A-W19-9
		Sample Date	6/21/2018	6/21/2018	6/20/2018	7/3/2018	7/3/2018	7/3/2018	7/3/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/11/2018	7/11/2018
		Sample Depth	2 ft	2 ft	2 ft	8 ft	8 ft	9 ft	9 ft	9 ft	10 ft	10 ft	9 ft	9 ft	9 ft
Analyte	**CAS No.**	**Unit**													
Semi-Volatile Organic Compound (SVOCs) (cont.)															
Phenanthrene	85-01-8	mg/kg													
Pyrene	129-00-0	mg/kg													
Total Naphthalenes (U=0) (4)	T_Napth (U=0)	mg/kg													
cPAHs (MTCA TEQ-ZeroND) (6,7)	BaPEq (U=0)	mg/kg		0.10 U	**0.30**										
cPAHs (MTCA TEQ-HalfND) (5,8)	BaPEq (U=1/2)	mg/kg		0.10 U	**0.30**										
Total HPAH (U=0) (4)	T_HPAH (U=0)	mg/kg													
Total LPAH (U=0) (4)	T_LPAH (U=0)	mg/kg													
Total PAH (U=0) (4)	T_PAH (U=0)	mg/kg													
2,3,4,6-Tetrachlorophenol	58-90-2	mg/kg													
2,4,5-Trichlorophenol	95-95-4	mg/kg													
2,4,6-Trichlorophenol	88-06-2	mg/kg													
2,4-Dichlorophenol	120-83-2	mg/kg													
2,4-Dimethylphenol	105-67-9	mg/kg													
2,4-Dinitrophenol	51-28-5	mg/kg													
2,6-Dichlorophenol	87-65-0	mg/kg													
2-Chlorophenol	95-57-8	mg/kg													
2-Methylphenol	95-48-7	mg/kg													
2-Nitrophenol	88-75-5	mg/kg													
3- & 4-Methylphenol	15831-10-4	mg/kg													
4,6-Dinitro-o-cresol	534-52-1	mg/kg													
4-Chloro-3-methylphenol	59-50-7	mg/kg													
4-Methylphenol	106-44-5	mg/kg													
4-Nitrophenol	100-02-7	mg/kg													
Pentachlorophenol	87-86-5	mg/kg													
Phenol	108-95-2	mg/kg													
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg													
Butyl benzyl phthalate	85-68-7	mg/kg													
Di-n-butyl phthalate	84-74-2	mg/kg													
Di-n-octyl phthalate	117-84-0	mg/kg													
Diethylphthalate	84-66-2	mg/kg													
Dimethyl phthalate	131-11-3	mg/kg													
2-Chloronaphthalene	91-58-7	mg/kg													
Aniline	62-53-3	mg/kg													
Azobenzene	103-33-3	mg/kg													
Benzoic acid	65-85-0	mg/kg													
Benzyl alcohol	100-51-6	mg/kg													
Bis(2-chloroethoxy)methane	111-91-1	mg/kg													
Bis-chloroisopropyl ether	108-60-1	mg/kg													
Carbazole	86-74-8	mg/kg													
Dibenzofuran	132-64-9	mg/kg													
Hexachlorobenzene	118-74-1	mg/kg													
Hexachlorobutadiene	87-68-3	mg/kg													
Hexachlorocyclopentadiene	77-47-4	mg/kg													
Isophorone	78-59-1	mg/kg													
N-Nitrosodimethylamine	62-75-9	mg/kg													
N-Nitroso-di-n-propylamine	621-64-7	mg/kg													
N-Nitrosodiphenylamine	86-30-6	mg/kg													

Table 3.3
In Situ Soil Data

		Location Name	A5A-S1	A5A-N1/S1-Comp	A5A-W3	A5A-W4	A5A-W5	A5A-W7	A5A-W9	A5A-W10	A5A-W14	A5A-W15	A5A-W17	A5A-W18	A5A-W19
		Sample Name	A5A-S1-2	A5A-Comp1	A5A-W3-2	A5A-W4-8	A5A-W5-8	A5A-W7-9	A5A-W9-9	A5A-W10-9	A5A-W14-10	A5A-W15-10	A5A-W17-9	A5A-W18-9	A5A-W19-9
		Sample Date	6/21/2018	6/21/2018	6/20/2018	7/3/2018	7/3/2018	7/3/2018	7/3/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/11/2018	7/11/2018
		Sample Depth	2 ft	2 ft	2 ft	8 ft	8 ft	9 ft	9 ft	9 ft	10 ft	10 ft	9 ft	9 ft	9 ft
Analyte	**CAS No.**	**Unit**													
Volatile Organic Compound (VOCs)															
Benzene	71-43-2	mg/kg													
Ethylbenzene	100-41-4	mg/kg													
Toluene	108-88-3	mg/kg													
Xylene (meta & para)	108-38-3/106-42-3	mg/kg													
Xylene (ortho)	95-47-6	mg/kg													
Xylene (total)	1330-20-7	mg/kg													
Chloroethane	75-00-3	mg/kg													
cis-1,2-Dichloroethene	156-59-2	mg/kg													
Tetrachloroethene	127-18-4	mg/kg													
trans-1,2-Dichloroethene	156-60-5	mg/kg													
Trichloroethene	79-01-6	mg/kg													
Vinyl chloride	75-01-4	mg/kg													
1,1,1,2-Tetrachloroethane	630-20-6	mg/kg													
1,1,1-Trichloroethane	71-55-6	mg/kg													
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg													
1,1,2-Trichloroethane	79-00-5	mg/kg													
1,1-Dichloroethane	75-34-3	mg/kg													
1,1-Dichloroethene	75-35-4	mg/kg													
1,1-Dichloropropene	563-58-6	mg/kg													
1,2,3-Trichlorobenzene	87-61-6	mg/kg													
1,2,3-Trichloropropane	96-18-4	mg/kg													
1,2,4-Trichlorobenzene	120-82-1	mg/kg													
1,2,4-Trimethylbenzene	95-63-6	mg/kg													
1,2-Dibromo-3-chloropropane	96-12-8	mg/kg													
1,2-Dibromoethane	106-93-4	mg/kg													
1,2-Dichlorobenzene	95-50-1	mg/kg													
1,2-Dichloroethane	107-06-2	mg/kg													
1,2-Dichloropropane	78-87-5	mg/kg													
1,3,5-Trimethylbenzene	108-67-8	mg/kg													
1,3-Dichlorobenzene	541-73-1	mg/kg													
1,3-Dichloropropane	142-28-9	mg/kg													
1,4-Dichlorobenzene	106-46-7	mg/kg													
2,2-Dichloropropane	594-20-7	mg/kg													
2,4-Dinitrotoluene	121-14-2	mg/kg													
2,6-Dinitrotoluene	606-20-2	mg/kg													
2-Chlorotoluene	95-49-8	mg/kg													
2-Hexanone	591-78-6	mg/kg													
2-Nitroaniline	88-74-4	mg/kg													
3,3'-Dichlorobenzidine	91-94-1	mg/kg													
3-Nitroaniline	99-09-2	mg/kg													
4-Chloroaniline	106-47-8	mg/kg													
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg													
4-Chlorotoluene	106-43-4	mg/kg													
4-Nitroaniline	100-01-6	mg/kg													
Acetone	67-64-1	mg/kg													
Bis(2-chloroethyl)ether	111-44-4	mg/kg													
Bis(2-chloroisopropyl)ether	39638-32-9	mg/kg													
Bromobenzene	108-86-1	mg/kg													

Table 3.3
In Situ Soil Data

		Location Name	A5A-S1	A5A-N1/S1-Comp	A5A-W3	A5A-W4	A5A-W5	A5A-W7	A5A-W9	A5A-W10	A5A-W14	A5A-W15	A5A-W17	A5A-W18	A5A-W19
		Sample Name	A5A-S1-2	A5A-Comp1	A5A-W3-2	A5A-W4-8	A5A-W5-8	A5A-W7-9	A5A-W9-9	A5A-W10-9	A5A-W14-10	A5A-W15-10	A5A-W17-9	A5A-W18-9	A5A-W19-9
		Sample Date	6/21/2018	6/21/2018	6/20/2018	7/3/2018	7/3/2018	7/3/2018	7/3/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/11/2018	7/11/2018
		Sample Depth	2 ft	2 ft	2 ft	8 ft	8 ft	9 ft	9 ft	9 ft	10 ft	10 ft	9 ft	9 ft	9 ft
Analyte	**CAS No.**	**Unit**													
Volatile Organic Compound (VOCs) (cont.)															
Bromochloromethane	74-97-5	mg/kg													
Bromodichloromethane	75-27-4	mg/kg													
Bromoform	75-25-2	mg/kg													
Bromomethane	74-83-9	mg/kg													
Carbon tetrachloride	56-23-5	mg/kg													
Chlorobenzene	108-90-7	mg/kg													
Chloroform	67-66-3	mg/kg													
Chloromethane	74-87-3	mg/kg													
cis-1,3-Dichloropropene	10061-01-5	mg/kg													
Cymene	99-87-6	mg/kg													
Dibromochloromethane	124-48-1	mg/kg													
Dibromomethane	74-95-3	mg/kg													
Dichlorodifluoromethane	75-71-8	mg/kg													
Hexachloroethane	67-72-1	mg/kg													
Isopropylbenzene	98-82-8	mg/kg													
Methyl ethyl ketone	78-93-3	mg/kg													
Methyl isobutyl ketone	108-10-1	mg/kg													
Methylene chloride	75-09-2	mg/kg													
Methyl-tert-butyl ether	1634-04-4	mg/kg													
n-Hexane	110-54-3	mg/kg													
Nitrobenzene	98-95-3	mg/kg													
n-Propylbenzene	103-65-1	mg/kg													
Pyridine	110-86-1	mg/kg													
sec-Butylbenzene	135-98-8	mg/kg													
Styrene	100-42-5	mg/kg													
tert-Butylbenzene	98-06-6	mg/kg													
trans-1,3-Dichloropropene	10061-02-6	mg/kg													
Trichlorofluoromethane	75-69-4	mg/kg													

Notes:

Blank cells are intentional

All results are rounded to two significant figures.

1 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

2 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

3 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.

4 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

5 Result reported by HCID Analysis

6 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Table 708-2 of WAC 173-340-900.

7 Calculation was performed using only detected cPAH concentrations.

8 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

Abbreviations:

CAS Chemical Abstracts Service

cPAH Carcinogenic polycyclic aromatic hydrocarbon

ft Feet

mg/kg Milligrams per kilogram

MTCA Model Toxics Control Act

PAH Polycyclic aromatic hydrocarbons

PCB Polychlorinated biphenyl

TEQ Toxic equivalency

Qualifiers:

J Analyte was detected; concentration is an estimate.

U Analyte was not detected at the associated reporting limit.

UJ Analyte was not detected at the associated reporting limit, which is an estimate.

Table 3.3
In Situ Soil Data

		Location Name	A5A-W20	A5A-W21	A5A-W22	A5A-W23	A5A-W25	A5A-W27	A5A-W29	A5A-W31	A5A-W32	A5A-W33	A5A-W35	A5A-W36	A5A-W38	A6A-B1
		Sample Name	A5A-W20-9	A5A-W21-9	A5A-W22-9	A5A-W23-7	A5A-W25-7	A5A-W27-7	A5A-W29-7	A5A-W31-7	A5A-W32-9	A5A-W33-7	A5A-W35-9	A5A-W36-7	A5A-W38-9	A6A-B1-1.5
		Sample Date	7/11/2018	7/11/2018	7/11/2018	7/12/2018	7/12/2018	7/12/2018	7/12/2018	7/12/2018	7/12/2018	7/12/2018	7/12/2018	7/12/2018	7/12/2018	6/15/2018
		Sample Depth	9 ft	9 ft	9 ft	7 ft	7 ft	7 ft	7 ft	7 ft	9 ft	7 ft	9 ft	7 ft	9 ft	1.5 ft
Analyte	**CAS No.**	**Unit**														
Total Petroleum Hydrocarbons (TPHs)																
Gasoline-range organics	GRO	mg/kg														
Diesel-range organics	DRO	mg/kg	50 U	50 U	50 U	50 U	50 U	87	1,700 (1)	5,200 (1)	50 U	800 (1)	50 U	50 U	50 U	
Oil-range organics	ORO	mg/kg	250 U	250 U	250 U	250 U	250 U	670	12,000	26,000	250 U	4,400	250 U	250 U	250 U	
Total DRO & ORO (4)	T_DRO&ORO (U=0)	mg/kg	250 U	250 U	250 U	250 U	250 U	760	14,000	31,000	250 U	5,200	250 U	250 U	250 U	
Gasoline (5)	86290-81-5	mg/kg														
Diesel (5)	Dies	mg/kg														
Heavy Oil (5)	Oil_Heavy	mg/kg														
Metals																
Arsenic	7440-38-2	mg/kg														5.8
Barium	7440-39-3	mg/kg														
Cadmium	7440-43-9	mg/kg														1.0 U
Chromium	7440-47-3	mg/kg														8.6
Chromium(VI)	18540-29-9	mg/kg														
Copper	7440-50-8	mg/kg														
Lead	7439-92-1	mg/kg														5.5
Mercury	7439-97-6	mg/kg														1.0 U
Selenium	7782-49-2	mg/kg														
Silver	7440-22-4	mg/kg														
Polychlorinated Biphenyls																
Aroclor 1016	12674-11-2	mg/kg														
Aroclor 1221	11104-28-2	mg/kg														
Aroclor 1232	11141-16-5	mg/kg														
Aroclor 1242	53469-21-9	mg/kg														
Aroclor 1248	12672-29-6	mg/kg														
Aroclor 1254	11097-69-1	mg/kg														
Aroclor 1260	11096-82-5	mg/kg														
Aroclor 1262	37324-23-5	mg/kg														
Aroclor 1268	11100-14-4	mg/kg														
Total PCB Aroclors (U=0) (4)	T_PCB (U=0)	mg/kg														
Polybrominated Diphenyl Ethers (PBDEs)																
PBDE-003	101-55-3	mg/kg														
Semi-Volatile Organic Compound (SVOCs)																
1-Methylnaphthalene	90-12-0	mg/kg														
2-Methylnaphthalene	91-57-6	mg/kg														
Acenaphthene	83-32-9	mg/kg														
Acenaphthylene	208-96-8	mg/kg														
Anthracene	120-12-7	mg/kg														
Benzo(a)anthracene	56-55-3	mg/kg														
Benzo(a)pyrene	50-32-8	mg/kg														
Benzo(b)fluoranthene	205-99-2	mg/kg														
Benzo(g,h,i)perylene	191-24-2	mg/kg														
Benzo(k)fluoranthene	207-08-9	mg/kg														
Chrysene	218-01-9	mg/kg														
Dibenzo(a,h)anthracene	53-70-3	mg/kg														
Fluoranthene	206-44-0	mg/kg														
Fluorene	86-73-7	mg/kg														
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg														
Naphthalene	91-20-3	mg/kg														

Table 3.3
In Situ Soil Data

		Location Name	A5A-W20	A5A-W21	A5A-W22	A5A-W23	A5A-W25	A5A-W27	A5A-W29	A5A-W31	A5A-W32	A5A-W33	A5A-W35	A5A-W36	A5A-W38	A6A-B1
		Sample Name	A5A-W20-9	A5A-W21-9	A5A-W22-9	A5A-W23-7	A5A-W25-7	A5A-W27-7	A5A-W29-7	A5A-W31-7	A5A-W32-9	A5A-W33-7	A5A-W35-9	A5A-W36-7	A5A-W38-9	A6A-B1-1.5
		Sample Date	7/11/2018	7/11/2018	7/11/2018	7/12/2018	7/12/2018	7/12/2018	7/12/2018	7/12/2018	7/12/2018	7/12/2018	7/12/2018	7/12/2018	7/12/2018	6/15/2018
		Sample Depth	9 ft	9 ft	9 ft	7 ft	7 ft	7 ft	7 ft	7 ft	9 ft	7 ft	9 ft	7 ft	9 ft	1.5 ft
Analyte	**CAS No.**	**Unit**														
Semi-Volatile Organic Compound (SVOCs) (cont.)																
Phenanthrene	85-01-8	mg/kg														
Pyrene	129-00-0	mg/kg														
Total Naphthalenes (U=0) (4)	T_Napth (U=0)	mg/kg														
cPAHs (MTCA TEQ-ZeroND) (6,7)	BaPEq (U=0)	mg/kg														
cPAHs (MTCA TEQ-HalfND) (5,8)	BaPEq (U=1/2)	mg/kg														
Total HPAH (U=0) (4)	T_HPAH (U=0)	mg/kg														
Total LPAH (U=0) (4)	T_LPAH (U=0)	mg/kg														
Total PAH (U=0) (4)	T_PAH (U=0)	mg/kg														
2,3,4,6-Tetrachlorophenol	58-90-2	mg/kg														
2,4,5-Trichlorophenol	95-95-4	mg/kg														
2,4,6-Trichlorophenol	88-06-2	mg/kg														
2,4-Dichlorophenol	120-83-2	mg/kg														
2,4-Dimethylphenol	105-67-9	mg/kg														
2,4-Dinitrophenol	51-28-5	mg/kg														
2,6-Dichlorophenol	87-65-0	mg/kg														
2-Chlorophenol	95-57-8	mg/kg														
2-Methylphenol	95-48-7	mg/kg														
2-Nitrophenol	88-75-5	mg/kg														
3- & 4-Methylphenol	15831-10-4	mg/kg														
4,6-Dinitro-o-cresol	534-52-1	mg/kg														
4-Chloro-3-methylphenol	59-50-7	mg/kg														
4-Methylphenol	106-44-5	mg/kg														
4-Nitrophenol	100-02-7	mg/kg														
Pentachlorophenol	87-86-5	mg/kg														
Phenol	108-95-2	mg/kg														
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg														
Butyl benzyl phthalate	85-68-7	mg/kg														
Di-n-butyl phthalate	84-74-2	mg/kg														
Di-n-octyl phthalate	117-84-0	mg/kg														
Diethylphthalate	84-66-2	mg/kg														
Dimethyl phthalate	131-11-3	mg/kg														
2-Chloronaphthalene	91-58-7	mg/kg														
Aniline	62-53-3	mg/kg														
Azobenzene	103-33-3	mg/kg														
Benzoic acid	65-85-0	mg/kg														
Benzyl alcohol	100-51-6	mg/kg														
Bis(2-chloroethoxy)methane	111-91-1	mg/kg														
Bis-chloroisopropyl ether	108-60-1	mg/kg														
Carbazole	86-74-8	mg/kg														
Dibenzofuran	132-64-9	mg/kg														
Hexachlorobenzene	118-74-1	mg/kg														
Hexachlorobutadiene	87-68-3	mg/kg														
Hexachlorocyclopentadiene	77-47-4	mg/kg														
Isophorone	78-59-1	mg/kg														
N-Nitrosodimethylamine	62-75-9	mg/kg														
N-Nitroso-di-n-propylamine	621-64-7	mg/kg														
N-Nitrosodiphenylamine	86-30-6	mg/kg														

Table 3.3
In Situ Soil Data

		Location Name	A5A-W20	A5A-W21	A5A-W22	A5A-W23	A5A-W25	A5A-W27	A5A-W29	A5A-W31	A5A-W32	A5A-W33	A5A-W35	A5A-W36	A5A-W38	A6A-B1
		Sample Name	A5A-W20-9	A5A-W21-9	A5A-W22-9	A5A-W23-7	A5A-W25-7	A5A-W27-7	A5A-W29-7	A5A-W31-7	A5A-W32-9	A5A-W33-7	A5A-W35-9	A5A-W36-7	A5A-W38-9	A6A-B1-1.5
		Sample Date	7/11/2018	7/11/2018	7/11/2018	7/12/2018	7/12/2018	7/12/2018	7/12/2018	7/12/2018	7/12/2018	7/12/2018	7/12/2018	7/12/2018	7/12/2018	6/15/2018
		Sample Depth	9 ft	9 ft	9 ft	7 ft	7 ft	7 ft	7 ft	7 ft	9 ft	7 ft	9 ft	7 ft	9 ft	1.5 ft
Analyte	**CAS No.**	**Unit**														
Volatile Organic Compound (VOCs)																
Benzene	71-43-2	mg/kg														
Ethylbenzene	100-41-4	mg/kg														
Toluene	108-88-3	mg/kg														
Xylene (meta & para)	108-38-3/106-42-3	mg/kg														
Xylene (ortho)	95-47-6	mg/kg														
Xylene (total)	1330-20-7	mg/kg														
Chloroethane	75-00-3	mg/kg														
cis-1,2-Dichloroethene	156-59-2	mg/kg														
Tetrachloroethene	127-18-4	mg/kg														
trans-1,2-Dichloroethene	156-60-5	mg/kg														
Trichloroethene	79-01-6	mg/kg														
Vinyl chloride	75-01-4	mg/kg														
1,1,1,2-Tetrachloroethane	630-20-6	mg/kg														
1,1,1-Trichloroethane	71-55-6	mg/kg														
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg														
1,1,2-Trichloroethane	79-00-5	mg/kg														
1,1-Dichloroethane	75-34-3	mg/kg														
1,1-Dichloroethene	75-35-4	mg/kg														
1,1-Dichloropropene	563-58-6	mg/kg														
1,2,3-Trichlorobenzene	87-61-6	mg/kg														
1,2,3-Trichloropropane	96-18-4	mg/kg														
1,2,4-Trichlorobenzene	120-82-1	mg/kg														
1,2,4-Trimethylbenzene	95-63-6	mg/kg														
1,2-Dibromo-3-chloropropane	96-12-8	mg/kg														
1,2-Dibromoethane	106-93-4	mg/kg														
1,2-Dichlorobenzene	95-50-1	mg/kg														
1,2-Dichloroethane	107-06-2	mg/kg														
1,2-Dichloropropane	78-87-5	mg/kg														
1,3,5-Trimethylbenzene	108-67-8	mg/kg														
1,3-Dichlorobenzene	541-73-1	mg/kg														
1,3-Dichloropropane	142-28-9	mg/kg														
1,4-Dichlorobenzene	106-46-7	mg/kg														
2,2-Dichloropropane	594-20-7	mg/kg														
2,4-Dinitrotoluene	121-14-2	mg/kg														
2,6-Dinitrotoluene	606-20-2	mg/kg														
2-Chlorotoluene	95-49-8	mg/kg														
2-Hexanone	591-78-6	mg/kg														
2-Nitroaniline	88-74-4	mg/kg														
3,3'-Dichlorobenzidine	91-94-1	mg/kg														
3-Nitroaniline	99-09-2	mg/kg														
4-Chloroaniline	106-47-8	mg/kg														
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg														
4-Chlorotoluene	106-43-4	mg/kg														
4-Nitroaniline	100-01-6	mg/kg														
Acetone	67-64-1	mg/kg														
Bis(2-chloroethyl)ether	111-44-4	mg/kg														
Bis(2-chloroisopropyl)ether	39638-32-9	mg/kg														
Bromobenzene	108-86-1	mg/kg														

Table 3.3
In Situ Soil Data

		Location Name	A5A-W20	A5A-W21	A5A-W22	A5A-W23	A5A-W25	A5A-W27	A5A-W29	A5A-W31	A5A-W32	A5A-W33	A5A-W35	A5A-W36	A5A-W38	A6A-B1
		Sample Name	A5A-W20-9	A5A-W21-9	A5A-W22-9	A5A-W23-7	A5A-W25-7	A5A-W27-7	A5A-W29-7	A5A-W31-7	A5A-W32-9	A5A-W33-7	A5A-W35-9	A5A-W36-7	A5A-W38-9	A6A-B1-1.5
		Sample Date	7/11/2018	7/11/2018	7/11/2018	7/12/2018	7/12/2018	7/12/2018	7/12/2018	7/12/2018	7/12/2018	7/12/2018	7/12/2018	7/12/2018	7/12/2018	6/15/2018
		Sample Depth	9 ft	9 ft	9 ft	7 ft	7 ft	7 ft	7 ft	7 ft	9 ft	7 ft	9 ft	7 ft	9 ft	1.5 ft
Analyte	**CAS No.**	**Unit**														
Volatile Organic Compound (VOCs) (cont.)																
Bromochloromethane	74-97-5	mg/kg														
Bromodichloromethane	75-27-4	mg/kg														
Bromoform	75-25-2	mg/kg														
Bromomethane	74-83-9	mg/kg														
Carbon tetrachloride	56-23-5	mg/kg														
Chlorobenzene	108-90-7	mg/kg														
Chloroform	67-66-3	mg/kg														
Chloromethane	74-87-3	mg/kg														
cis-1,3-Dichloropropene	10061-01-5	mg/kg														
Cymene	99-87-6	mg/kg														
Dibromochloromethane	124-48-1	mg/kg														
Dibromomethane	74-95-3	mg/kg														
Dichlorodifluoromethane	75-71-8	mg/kg														
Hexachloroethane	67-72-1	mg/kg														
Isopropylbenzene	98-82-8	mg/kg														
Methyl ethyl ketone	78-93-3	mg/kg														
Methyl isobutyl ketone	108-10-1	mg/kg														
Methylene chloride	75-09-2	mg/kg														
Methyl-tert-butyl ether	1634-04-4	mg/kg														
n-Hexane	110-54-3	mg/kg														
Nitrobenzene	98-95-3	mg/kg														
n-Propylbenzene	103-65-1	mg/kg														
Pyridine	110-86-1	mg/kg														
sec-Butylbenzene	135-98-8	mg/kg														
Styrene	100-42-5	mg/kg														
tert-Butylbenzene	98-06-6	mg/kg														
trans-1,3-Dichloropropene	10061-02-6	mg/kg														
Trichlorofluoromethane	75-69-4	mg/kg														

Notes:

Blank cells are intentional

All results are rounded to two significant figures.

1 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

2 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

3 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.

4 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

5 Result reported by HCID Analysis

6 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Table 708-2 of WAC 173-340-900.

7 Calculation was performed using only detected cPAH concentrations.

8 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

Abbreviations:

CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbon
ft Feet
mg/kg Milligrams per kilogram
MTCA Model Toxics Control Act
PAH Polycyclic aromatic hydrocarbons
PCB Polychlorinated biphenyl
TEQ Toxic equivalency

Qualifiers:

J Analyte was detected; concentration is an estimate.
U Analyte was not detected at the associated reporting limit.
UJ Analyte was not detected at the associated reporting limit, which is an estimate.

Table 3.3
In Situ Soil Data

		Location Name	A6A-E2	A6A-B1/E2-Comp	A6A-B2	A6A-E3	A6A-E3/B2-Comp	A6A-B3	A6A-B4	A6A-E1	A6A-S1	A6A-S1/E1-Comp	A6A-N1	A6A-N2	A6A-N1/N2-Comp
		Sample Name	A6A-E2-0.5	A6A-Comp2	A6A-B2-0.5	A6A-E3-0.5	A6A-Comp3	A6A-B3-3	A6A-B4-2.5	A6A-E1-0.5	A6A-S1-2	A6A-Comp1	A6A-N1-2	A6A-N2-3	A6A-Comp4
		Sample Date	6/15/2018	6/15/2018	6/15/2018	6/19/2018	6/19/2018	7/6/2018	6/29/2018	6/15/2018	6/15/2018	6/15/2018	6/21/2018	6/21/2018	6/21/2018
		Sample Depth	0.5 ft	0.5-1.5 ft	0.5 ft	0.5 ft	0.5 ft	3 ft	2.5 ft	0.5 ft	2 ft	0.5-2 ft	2 ft	3 ft	2-3 ft
Analyte	**CAS No.**	**Unit**													
Total Petroleum Hydrocarbons (TPHs)															
Gasoline-range organics	GRO	mg/kg			5.0 U										
Diesel-range organics	DRO	mg/kg		50 U			50 U		50 U			50 U			50 U
Oil-range organics	ORO	mg/kg		250 U			250 U		250 U			250 U			250 U
Total DRO & ORO [4]	T_DRO&ORO (U=0)	mg/kg		250 U			250 U		250 U			250 U			250 U
Gasoline [5]	86290-81-5	mg/kg													
Diesel [5]	Dies	mg/kg													
Heavy Oil [5]	Oil_Heavy	mg/kg													
Metals															
Arsenic	7440-38-2	mg/kg	6.2		9.6	7.0		2.1	2.3	6.3	4.1		4.3	2.1	
Barium	7440-39-3	mg/kg													
Cadmium	7440-43-9	mg/kg	1.6		1.0 U	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U		1.0 U	1.0 U	
Chromium	7440-47-3	mg/kg	11		13	11			7.1	11	7.9		8.5	8.8	
Chromium(VI)	18540-29-9	mg/kg													
Copper	7440-50-8	mg/kg													
Lead	7439-92-1	mg/kg	35		260	110			3.6	57	5.8		5.9	3.9	
Mercury	7439-97-6	mg/kg	1.0 U		1.0 U	1.0 U			1.0 U	1.0 U	1.0 U		1.0 U	1.0 U	
Selenium	7782-49-2	mg/kg													
Silver	7440-22-4	mg/kg													
Polychlorinated Biphenyls															
Aroclor 1016	12674-11-2	mg/kg		0.020 U			0.020 U		0.020 U			0.020 U			0.020 U
Aroclor 1221	11104-28-2	mg/kg		0.020 U			0.020 U		0.020 U			0.020 U			0.020 U
Aroclor 1232	11141-16-5	mg/kg		0.020 U			0.020 U		0.020 U			0.020 U			0.020 U
Aroclor 1242	53469-21-9	mg/kg		0.020 U			0.020 U		0.020 U			0.020 U			0.020 U
Aroclor 1248	12672-29-6	mg/kg		0.020 U			0.020 U		0.020 U			0.020 U			0.020 U
Aroclor 1254	11097-69-1	mg/kg		0.020 U			0.39		0.020 U			0.020 U			0.020 U
Aroclor 1260	11096-82-5	mg/kg		0.020 U			0.020 U		0.020 U			0.020 U			0.020 U
Aroclor 1262	37324-23-5	mg/kg		0.020 U			0.020 U		0.020 U			0.020 U			0.020 U
Aroclor 1268	11100-14-4	mg/kg		0.020 U			0.020 U		0.020 U			0.020 U			0.020 U
Total PCB Aroclors (U=0) [4]	T_PCB (U=0)	mg/kg		0.020 U			0.39		0.020 U			0.020 U			0.020 U
Polybrominated Diphenyl Ethers (PBDEs)															
PBDE-003	101-55-3	mg/kg			0.50 U										
Semi-Volatile Organic Compound (SVOCs)															
1-Methylnaphthalene	90-12-0	mg/kg			0.10 U										
2-Methylnaphthalene	91-57-6	mg/kg			0.10 U										
Acenaphthene	83-32-9	mg/kg			0.10 U										
Acenaphthylene	208-96-8	mg/kg			0.10 U										
Anthracene	120-12-7	mg/kg			0.10 U										
Benzo(a)anthracene	56-55-3	mg/kg		0.012	0.10 U		0.10 U		0.010 U			0.010 U			0.010 U
Benzo(a)pyrene	50-32-8	mg/kg		**0.015**	0.10 U		**0.10**		0.010 U			**0.012**			0.010 U
Benzo(b)fluoranthene	205-99-2	mg/kg		0.018	0.13		0.12		0.010 U			0.015			0.010 U
Benzo(g,h,i)perylene	191-24-2	mg/kg			0.10 U										
Benzo(k)fluoranthene	207-08-9	mg/kg		0.010 U	0.10 U		0.10 U		0.010 U			0.010 U			0.010 U
Chrysene	218-01-9	mg/kg		0.015	0.11		0.11		0.010 U			0.014			0.010 U
Dibenzo(a,h)anthracene	53-70-3	mg/kg		0.010 U	0.10 U		0.10 U		0.010 U			0.010 U			0.010 U
Fluoranthene	206-44-0	mg/kg			**0.19**										
Fluorene	86-73-7	mg/kg			0.10 U										
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg		0.010 U	0.10 U		0.10 U		0.010 U			0.010 U			0.010 U
Naphthalene	91-20-3	mg/kg			0.10 U										

Table 3.3
In Situ Soil Data

		Location Name	A6A-E2	A6A-B1/E2-Comp	A6A-B2	A6A-E3	A6A-E3/B2-Comp	A6A-B3	A6A-B4	A6A-E1	A6A-S1	A6A-S1/E1-Comp	A6A-N1	A6A-N2	A6A-N1/N2-Comp
		Sample Name	A6A-E2-0.5	A6A-Comp2	A6A-B2-0.5	A6A-E3-0.5	A6A-Comp3	A6A-B3-3	A6A-B4-2.5	A6A-E1-0.5	A6A-S1-2	A6A-Comp1	A6A-N1-2	A6A-N2-3	A6A-Comp4
		Sample Date	6/15/2018	6/15/2018	6/15/2018	6/19/2018	6/19/2018	7/6/2018	6/29/2018	6/15/2018	6/15/2018	6/15/2018	6/21/2018	6/21/2018	6/21/2018
		Sample Depth	0.5 ft	0.5-1.5 ft	0.5 ft	0.5 ft	0.5 ft	3 ft	2.5 ft	0.5 ft	2 ft	0.5-2 ft	2 ft	3 ft	2-3 ft
Analyte	**CAS No.**	**Unit**													
Semi-Volatile Organic Compound (SVOCs) (cont.)															
Phenanthrene	85-01-8	mg/kg			0.10										
Pyrene	129-00-0	mg/kg			**0.24**										
Total Naphthalenes (U=0) (4)	T_Napth (U=0)	mg/kg			0.10 U										
cPAHs (MTCA TEQ-ZeroND) (6,7)	BaPEq (U=0)	mg/kg		**0.018**	**0.014**		**0.11**		0.010 U			**0.014**			0.010 U
cPAHs (MTCA TEQ-HalfND) (5,8)	BaPEq (U=1/2)	mg/kg		**0.020**	**0.084**		**0.13**		0.010 U			**0.016**			0.010 U
Total HPAH (U=0) (4)	T_HPAH (U=0)	mg/kg			0.67										
Total LPAH (U=0) (4)	T_LPAH (U=0)	mg/kg			0.10										
Total PAH (U=0) (4)	T_PAH (U=0)	mg/kg			0.77										
2,3,4,6-Tetrachlorophenol	58-90-2	mg/kg													
2,4,5-Trichlorophenol	95-95-4	mg/kg			5.0 U										
2,4,6-Trichlorophenol	88-06-2	mg/kg			5.0 U										
2,4-Dichlorophenol	120-83-2	mg/kg			5.0 U										
2,4-Dimethylphenol	105-67-9	mg/kg			5.0 U										
2,4-Dinitrophenol	51-28-5	mg/kg			15 U										
2,6-Dichlorophenol	87-65-0	mg/kg													
2-Chlorophenol	95-57-8	mg/kg			5.0 U										
2-Methylphenol	95-48-7	mg/kg			5.0 U										
2-Nitrophenol	88-75-5	mg/kg			5.0 U										
3- & 4-Methylphenol	15831-10-4	mg/kg			10 U										
4,6-Dinitro-o-cresol	534-52-1	mg/kg			15 U										
4-Chloro-3-methylphenol	59-50-7	mg/kg			5.0 U										
4-Methylphenol	106-44-5	mg/kg													
4-Nitrophenol	100-02-7	mg/kg			15 U										
Pentachlorophenol	87-86-5	mg/kg			2.5 U										
Phenol	108-95-2	mg/kg			5.0 U										
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg			8.0 U										
Butyl benzyl phthalate	85-68-7	mg/kg			5.0 U										
Di-n-butyl phthalate	84-74-2	mg/kg			5.0 U										
Di-n-octyl phthalate	117-84-0	mg/kg			5.0 U										
Diethylphthalate	84-66-2	mg/kg			5.0 U										
Dimethyl phthalate	131-11-3	mg/kg			5.0 U										
2-Chloronaphthalene	91-58-7	mg/kg			0.50 U										
Aniline	62-53-3	mg/kg													
Azobenzene	103-33-3	mg/kg													
Benzoic acid	65-85-0	mg/kg			25 U										
Benzyl alcohol	100-51-6	mg/kg			5.0 U										
Bis(2-chloroethoxy)methane	111-91-1	mg/kg			0.50 U										
Bis-chloroisopropyl ether	108-60-1	mg/kg			0.50 U										
Carbazole	86-74-8	mg/kg			0.50 U										
Dibenzofuran	132-64-9	mg/kg			0.50 U										
Hexachlorobenzene	118-74-1	mg/kg			0.50 U										
Hexachlorobutadiene	87-68-3	mg/kg			0.50 U										
Hexachlorocyclopentadiene	77-47-4	mg/kg			1.5 U										
Isophorone	78-59-1	mg/kg			0.50 U										
N-Nitrosodimethylamine	62-75-9	mg/kg													
N-Nitroso-di-n-propylamine	621-64-7	mg/kg			0.50 U										
N-Nitrosodiphenylamine	86-30-6	mg/kg			0.50 U										

Table 3.3
In Situ Soil Data

		Location Name	A6A-E2	A6A-B1/E2-Comp	A6A-B2	A6A-E3	A6A-E3/B2-Comp	A6A-B3	A6A-B4	A6A-E1	A6A-S1	A6A-S1/E1-Comp	A6A-N1	A6A-N2	A6A-N1/N2-Comp
		Sample Name	A6A-E2-0.5	A6A-Comp2	A6A-B2-0.5	A6A-E3-0.5	A6A-Comp3	A6A-B3-3	A6A-B4-2.5	A6A-E1-0.5	A6A-S1-2	A6A-Comp1	A6A-N1-2	A6A-N2-3	A6A-Comp4
		Sample Date	6/15/2018	6/15/2018	6/15/2018	6/19/2018	6/19/2018	7/6/2018	6/29/2018	6/15/2018	6/15/2018	6/15/2018	6/21/2018	6/21/2018	6/21/2018
		Sample Depth	0.5 ft	0.5-1.5 ft	0.5 ft	0.5 ft	0.5 ft	3 ft	2.5 ft	0.5 ft	2 ft	0.5-2 ft	2 ft	3 ft	2-3 ft
Analyte	**CAS No.**	**Unit**													
Volatile Organic Compound (VOCs)															
Benzene	71-43-2	mg/kg			0.020 U										
Ethylbenzene	100-41-4	mg/kg			0.020 U										
Toluene	108-88-3	mg/kg			0.020 U										
Xylene (meta & para)	108-38-3/106-42-3	mg/kg													
Xylene (ortho)	95-47-6	mg/kg													
Xylene (total)	1330-20-7	mg/kg			0.060 U										
Chloroethane	75-00-3	mg/kg													
cis-1,2-Dichloroethene	156-59-2	mg/kg													
Tetrachloroethene	127-18-4	mg/kg													
trans-1,2-Dichloroethene	156-60-5	mg/kg													
Trichloroethene	79-01-6	mg/kg													
Vinyl chloride	75-01-4	mg/kg													
1,1,1,2-Tetrachloroethane	630-20-6	mg/kg													
1,1,1-Trichloroethane	71-55-6	mg/kg													
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg													
1,1,2-Trichloroethane	79-00-5	mg/kg													
1,1-Dichloroethane	75-34-3	mg/kg													
1,1-Dichloroethene	75-35-4	mg/kg													
1,1-Dichloropropene	563-58-6	mg/kg													
1,2,3-Trichlorobenzene	87-61-6	mg/kg													
1,2,3-Trichloropropane	96-18-4	mg/kg													
1,2,4-Trichlorobenzene	120-82-1	mg/kg			0.50 U										
1,2,4-Trimethylbenzene	95-63-6	mg/kg													
1,2-Dibromo-3-chloropropane	96-12-8	mg/kg													
1,2-Dibromoethane	106-93-4	mg/kg													
1,2-Dichlorobenzene	95-50-1	mg/kg			0.50 U										
1,2-Dichloroethane	107-06-2	mg/kg													
1,2-Dichloropropane	78-87-5	mg/kg													
1,3,5-Trimethylbenzene	108-67-8	mg/kg													
1,3-Dichlorobenzene	541-73-1	mg/kg			0.50 U										
1,3-Dichloropropane	142-28-9	mg/kg													
1,4-Dichlorobenzene	106-46-7	mg/kg			0.50 U										
2,2-Dichloropropane	594-20-7	mg/kg													
2,4-Dinitrotoluene	121-14-2	mg/kg			2.5 U										
2,6-Dinitrotoluene	606-20-2	mg/kg			2.5 UJ										
2-Chlorotoluene	95-49-8	mg/kg													
2-Hexanone	591-78-6	mg/kg													
2-Nitroaniline	88-74-4	mg/kg			2.5 U										
3,3'-Dichlorobenzidine	91-94-1	mg/kg													
3-Nitroaniline	99-09-2	mg/kg			50 U										
4-Chloroaniline	106-47-8	mg/kg			50 U										
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg			0.50 U										
4-Chlorotoluene	106-43-4	mg/kg													
4-Nitroaniline	100-01-6	mg/kg			50 U										
Acetone	67-64-1	mg/kg													
Bis(2-chloroethyl)ether	111-44-4	mg/kg			0.50 U										
Bis(2-chloroisopropyl)ether	39638-32-9	mg/kg													
Bromobenzene	108-86-1	mg/kg													

Table 3.3
In Situ Soil Data

Location Name			A6A-E2	A6A-B1/E2-Comp	A6A-B2	A6A-E3	A6A-E3/B2-Comp	A6A-B3	A6A-B4	A6A-E1	A6A-S1	A6A-S1/E1-Comp	A6A-N1	A6A-N2	A6A-N1/N2-Comp
Sample Name			A6A-E2-0.5	A6A-Comp2	A6A-B2-0.5	A6A-E3-0.5	A6A-Comp3	A6A-B3-3	A6A-B4-2.5	A6A-E1-0.5	A6A-S1-2	A6A-Comp1	A6A-N1-2	A6A-N2-3	A6A-Comp4
Sample Date			6/15/2018	6/15/2018	6/15/2018	6/19/2018	6/19/2018	7/6/2018	6/29/2018	6/15/2018	6/15/2018	6/15/2018	6/21/2018	6/21/2018	6/21/2018
Sample Depth			0.5 ft	0.5-1.5 ft	0.5 ft	0.5 ft	0.5 ft	3 ft	2.5 ft	0.5 ft	2 ft	0.5-2 ft	2 ft	3 ft	2-3 ft
Analyte	**CAS No.**	**Unit**													
Volatile Organic Compound (VOCs) (cont.)															
Bromochloromethane	74-97-5	mg/kg													
Bromodichloromethane	75-27-4	mg/kg													
Bromoform	75-25-2	mg/kg													
Bromomethane	74-83-9	mg/kg													
Carbon tetrachloride	56-23-5	mg/kg													
Chlorobenzene	108-90-7	mg/kg													
Chloroform	67-66-3	mg/kg													
Chloromethane	74-87-3	mg/kg													
cis-1,3-Dichloropropene	10061-01-5	mg/kg													
Cymene	99-87-6	mg/kg													
Dibromochloromethane	124-48-1	mg/kg													
Dibromomethane	74-95-3	mg/kg													
Dichlorodifluoromethane	75-71-8	mg/kg													
Hexachloroethane	67-72-1	mg/kg			0.50 U										
Isopropylbenzene	98-82-8	mg/kg													
Methyl ethyl ketone	78-93-3	mg/kg													
Methyl isobutyl ketone	108-10-1	mg/kg													
Methylene chloride	75-09-2	mg/kg													
Methyl-tert-butyl ether	1634-04-4	mg/kg													
n-Hexane	110-54-3	mg/kg													
Nitrobenzene	98-95-3	mg/kg			0.50 U										
n-Propylbenzene	103-65-1	mg/kg													
Pyridine	110-86-1	mg/kg													
sec-Butylbenzene	135-98-8	mg/kg													
Styrene	100-42-5	mg/kg													
tert-Butylbenzene	98-06-6	mg/kg													
trans-1,3-Dichloropropene	10061-02-6	mg/kg													
Trichlorofluoromethane	75-69-4	mg/kg													

Notes:

Blank cells are intentional

All results are rounded to two significant figures.

1 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

2 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

3 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.

4 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

5 Result reported by HCID Analysis

6 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Table 708-2 of WAC 173-340-900.

7 Calculation was performed using only detected cPAH concentrations.

8 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

Abbreviations:

CAS Chemical Abstracts Service

cPAH Carcinogenic polycyclic aromatic hydrocarbon

ft Feet

mg/kg Milligrams per kilogram

MTCA Model Toxics Control Act

PAH Polycyclic aromatic hydrocarbons

PCB Polychlorinated biphenyl

TEQ Toxic equivalency

Qualifiers:

J Analyte was detected; concentration is an estimate.

U Analyte was not detected at the associated reporting limit.

UJ Analyte was not detected at the associated reporting limit, which is an estimate.

Table 3.3
In Situ Soil Data

		Location Name	A6A-S2	A6A-W1	A6A-S2/W1-Comp	A6A-W1/S1-Comp	A6B-B1	A6B-E1	A6B-N1	A6B-N1/E1-Comp	A6B-S1	A6B-W1	A6B-S1/W1-Comp	A6C-B1	
		Sample Name	A6A-S2-0.5	A6A-W1-0.5	A6AC-Comp1	A6AC-Comp2	A6B-B1-2	A6B-E1-2	A6B-N1-2	A6B-Comp2	A6B-S1-2	A6B-W1-1	A6B-Comp1	A6C-B1-0.5	A6C-B1-0.5-R
		Sample Date	6/19/2018	6/19/2018	6/19/2018	6/19/2018	6/14/2018	6/14/2018	6/14/2018	6/14/2018	6/14/2018	6/14/2018	6/14/2018	6/15/2018	7/2/2018
		Sample Depth	0.5 ft	0.5 ft	0.5 ft	0.5 ft	2 ft	2 ft	2 ft	2 ft	2 ft	1 ft	1-2 ft	0.5 ft	0.5 ft
Analyte	**CAS No.**	**Unit**													
Total Petroleum Hydrocarbons (TPHs)															
Gasoline-range organics	GRO	mg/kg					5.0 U								
Diesel-range organics	DRO	mg/kg			50 U	50 U	50 U			50 U			50 U		
Oil-range organics	ORO	mg/kg			250 U	250 U	250 U			250 U			250 U		
Total DRO & ORO (4)	T_DRO&ORO (U=0)	mg/kg			250 U	250 U	250 U			250 U			250 U		
Gasoline (5)	86290-81-5	mg/kg													
Diesel (5)	Dies	mg/kg													
Heavy Oil (5)	Oil_Heavy	mg/kg													
Metals															
Arsenic	7440-38-2	mg/kg	8.4	9.1			6.3	3.8	3.2		5.1	7.1		12	
Barium	7440-39-3	mg/kg													
Cadmium	7440-43-9	mg/kg	1.0 U	1.0 U			1.0 U	1.0 U	1.0 U		1.0 U	1.0 U		1.1	
Chromium	7440-47-3	mg/kg	11	13			9.6	7.6	9.0		8.4	9.8		20	
Chromium(VI)	18540-29-9	mg/kg													
Copper	7440-50-8	mg/kg													
Lead	7439-92-1	mg/kg	19	60			13	3.2	4.4		5.6	7.1		630	
Mercury	7439-97-6	mg/kg	1.0 U	1.0 U			1.0 U	1.0 U	1.0 U		1.0 U	1.0 U		1.0 U	
Selenium	7782-49-2	mg/kg													
Silver	7440-22-4	mg/kg													
Polychlorinated Biphenyls															
Aroclor 1016	12674-11-2	mg/kg			0.020 U	0.020 U	0.020 U			0.020 U			0.020 U		
Aroclor 1221	11104-28-2	mg/kg			0.020 U	0.020 U	0.020 U			0.020 U			0.020 U		
Aroclor 1232	11141-16-5	mg/kg			0.020 U	0.020 U	0.020 U			0.020 U			0.020 U		
Aroclor 1242	53469-21-9	mg/kg			0.020 U	0.020 U	0.020 U			0.020 U			0.020 U		
Aroclor 1248	12672-29-6	mg/kg			0.020 U	0.020 U	0.020 U			0.020 U			0.020 U		
Aroclor 1254	11097-69-1	mg/kg			0.084	0.034	0.020 U			0.020 U			0.020 U		
Aroclor 1260	11096-82-5	mg/kg			0.020 U	0.020 U	0.020 U			0.020 U			0.020 U		
Aroclor 1262	37324-23-5	mg/kg			0.020 U	0.020 U	0.020 U			0.020 U			0.020 U		
Aroclor 1268	11100-14-4	mg/kg			0.020 U	0.020 U	0.020 U			0.020 U			0.020 U		
Total PCB Aroclors (U=0) (4)	T_PCB (U=0)	mg/kg			0.084	0.034	0.020 U			0.020 U			0.020 U		
Polybrominated Diphenyl Ethers (PBDEs)															
PBDE-003	101-55-3	mg/kg					0.010 U								
Semi-Volatile Organic Compound (SVOCs)															
1-Methylnaphthalene	90-12-0	mg/kg					0.0020 U								
2-Methylnaphthalene	91-57-6	mg/kg					0.0020 U								
Acenaphthene	83-32-9	mg/kg					0.0020 U								
Acenaphthylene	208-96-8	mg/kg					0.0020 U								
Anthracene	120-12-7	mg/kg					0.0020 U								
Benzo(a)anthracene	56-55-3	mg/kg			0.10 U	0.057	0.0020 U			0.010 U			0.010 U		0.10 U
Benzo(a)pyrene	50-32-8	mg/kg			**0.15**	**0.077**	0.0020 U			0.010 U			0.010 U		**0.18**
Benzo(b)fluoranthene	205-99-2	mg/kg			0.18	0.10	0.0023			0.010 U			0.010 U		0.22
Benzo(g,h,i)perylene	191-24-2	mg/kg					0.0020 U								
Benzo(k)fluoranthene	207-08-9	mg/kg			0.10 U	0.035	0.0020 U			0.010 U			0.010 U		0.10 U
Chrysene	218-01-9	mg/kg			0.13	0.075	0.0020 U			0.010 U			0.010 U		0.12
Dibenzo(a,h)anthracene	53-70-3	mg/kg			0.10 U	0.011	0.0020 U			0.010 U			0.010 U		0.10 U
Fluoranthene	206-44-0	mg/kg					0.0025								
Fluorene	86-73-7	mg/kg					0.0020 U								
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg			0.10 U	0.032	0.0020 U			0.010 U			0.010 U		0.10 U
Naphthalene	91-20-3	mg/kg					0.0020 U								

Table 3.3
In Situ Soil Data

		Location Name	A6A-S2	A6A-W1	A6A-S2/W1-Comp	A6A-W1/S1-Comp	A6B-B1	A6B-E1	A6B-N1	A6B-N1/E1-Comp	A6B-S1	A6B-W1	A6B-S1/W1-Comp	A6C-B1	
		Sample Name	A6A-S2-0.5	A6A-W1-0.5	A6AC-Comp1	A6AC-Comp2	A6B-B1-2	A6B-E1-2	A6B-N1-2	A6B-Comp2	A6B-S1-2	A6B-W1-1	A6B-Comp1	A6C-B1-0.5	A6C-B1-0.5-R
		Sample Date	6/19/2018	6/19/2018	6/19/2018	6/19/2018	6/14/2018	6/14/2018	6/14/2018	6/14/2018	6/14/2018	6/14/2018	6/14/2018	6/15/2018	7/2/2018
		Sample Depth	0.5 ft	0.5 ft	0.5 ft	0.5 ft	2 ft	2 ft	2 ft	2 ft	2 ft	1 ft	1-2 ft	0.5 ft	0.5 ft
Analyte	**CAS No.**	**Unit**													
Semi-Volatile Organic Compound (SVOCs) (cont.)															
Phenanthrene	85-01-8	mg/kg					0.0020 U								
Pyrene	129-00-0	mg/kg					0.0030								
Total Naphthalenes (U=0) (4)	T_Napth (U=0)	mg/kg					0.0020 U								
cPAHs (MTCA TEQ-ZeroND) (6,7)	BaPEq (U=0)	mg/kg			**0.17**	**0.10**	**0.00023**			0.010 U			0.010 U		**0.20**
cPAHs (MTCA TEQ-HalfND) (5,8)	BaPEq (U=1/2)	mg/kg			**0.19**	**0.10**	**0.0016**			0.010 U			0.010 U		**0.22**
Total HPAH (U=0) (4)	T_HPAH (U=0)	mg/kg					0.0078								
Total LPAH (U=0) (4)	T_LPAH (U=0)	mg/kg					0.0020 U								
Total PAH (U=0) (4)	T_PAH (U=0)	mg/kg					0.0078								
2,3,4,6-Tetrachlorophenol	58-90-2	mg/kg													
2,4,5-Trichlorophenol	95-95-4	mg/kg					0.10 U								
2,4,6-Trichlorophenol	88-06-2	mg/kg					0.10 U								
2,4-Dichlorophenol	120-83-2	mg/kg					0.10 U								
2,4-Dimethylphenol	105-67-9	mg/kg					0.10 U								
2,4-Dinitrophenol	51-28-5	mg/kg					0.30 U								
2,6-Dichlorophenol	87-65-0	mg/kg													
2-Chlorophenol	95-57-8	mg/kg					0.10 U								
2-Methylphenol	95-48-7	mg/kg					0.10 U								
2-Nitrophenol	88-75-5	mg/kg					0.10 U								
3- & 4-Methylphenol	15831-10-4	mg/kg					0.20 U								
4,6-Dinitro-o-cresol	534-52-1	mg/kg					0.30 U								
4-Chloro-3-methylphenol	59-50-7	mg/kg					0.10 U								
4-Methylphenol	106-44-5	mg/kg													
4-Nitrophenol	100-02-7	mg/kg					0.30 U								
Pentachlorophenol	87-86-5	mg/kg					0.050 U								
Phenol	108-95-2	mg/kg					0.10 U								
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg					0.16 U								
Butyl benzyl phthalate	85-68-7	mg/kg					0.10 U								
Di-n-butyl phthalate	84-74-2	mg/kg					0.10 U								
Di-n-octyl phthalate	117-84-0	mg/kg					0.10 U								
Diethylphthalate	84-66-2	mg/kg					0.10 U								
Dimethyl phthalate	131-11-3	mg/kg					0.10 U								
2-Chloronaphthalene	91-58-7	mg/kg					0.010 U								
Aniline	62-53-3	mg/kg													
Azobenzene	103-33-3	mg/kg													
Benzoic acid	65-85-0	mg/kg					0.50 U								
Benzyl alcohol	100-51-6	mg/kg					0.10 U								
Bis(2-chloroethoxy)methane	111-91-1	mg/kg					0.010 U								
Bis-chloroisopropyl ether	108-60-1	mg/kg					0.010 U								
Carbazole	86-74-8	mg/kg					0.010 U								
Dibenzofuran	132-64-9	mg/kg					0.010 U								
Hexachlorobenzene	118-74-1	mg/kg					0.010 U								
Hexachlorobutadiene	87-68-3	mg/kg					0.010 U								
Hexachlorocyclopentadiene	77-47-4	mg/kg					0.030 U								
Isophorone	78-59-1	mg/kg					0.010 U								
N-Nitrosodimethylamine	62-75-9	mg/kg													
N-Nitroso-di-n-propylamine	621-64-7	mg/kg					0.010 U								
N-Nitrosodiphenylamine	86-30-6	mg/kg					0.010 U								

Table 3.3
In Situ Soil Data

		Location Name	A6A-S2	A6A-W1	A6A-S2/W1-Comp	A6A-W1/S1-Comp	A6B-B1	A6B-E1	A6B-N1	A6B-N1/E1-Comp	A6B-S1	A6B-W1	A6B-S1/W1-Comp	A6C-B1	
		Sample Name	A6A-S2-0.5	A6A-W1-0.5	A6AC-Comp1	A6AC-Comp2	A6B-B1-2	A6B-E1-2	A6B-N1-2	A6B-Comp2	A6B-S1-2	A6B-W1-1	A6B-Comp1	A6C-B1-0.5	A6C-B1-0.5-R
		Sample Date	6/19/2018	6/19/2018	6/19/2018	6/19/2018	6/14/2018	6/14/2018	6/14/2018	6/14/2018	6/14/2018	6/14/2018	6/14/2018	6/15/2018	7/2/2018
		Sample Depth	0.5 ft	0.5 ft	0.5 ft	0.5 ft	2 ft	2 ft	2 ft	2 ft	2 ft	1 ft	1-2 ft	0.5 ft	0.5 ft
Analyte	**CAS No.**	**Unit**													
Volatile Organic Compound (VOCs)															
Benzene	71-43-2	mg/kg					0.020 U								
Ethylbenzene	100-41-4	mg/kg					0.020 U								
Toluene	108-88-3	mg/kg					0.020 U								
Xylene (meta & para)	108-38-3/106-42-3	mg/kg													
Xylene (ortho)	95-47-6	mg/kg													
Xylene (total)	1330-20-7	mg/kg					0.060 U								
Chloroethane	75-00-3	mg/kg													
cis-1,2-Dichloroethene	156-59-2	mg/kg													
Tetrachloroethene	127-18-4	mg/kg													
trans-1,2-Dichloroethene	156-60-5	mg/kg													
Trichloroethene	79-01-6	mg/kg													
Vinyl chloride	75-01-4	mg/kg													
1,1,1,2-Tetrachloroethane	630-20-6	mg/kg													
1,1,1-Trichloroethane	71-55-6	mg/kg													
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg													
1,1,2-Trichloroethane	79-00-5	mg/kg													
1,1-Dichloroethane	75-34-3	mg/kg													
1,1-Dichloroethene	75-35-4	mg/kg													
1,1-Dichloropropene	563-58-6	mg/kg													
1,2,3-Trichlorobenzene	87-61-6	mg/kg													
1,2,3-Trichloropropane	96-18-4	mg/kg													
1,2,4-Trichlorobenzene	120-82-1	mg/kg					0.010 U								
1,2,4-Trimethylbenzene	95-63-6	mg/kg													
1,2-Dibromo-3-chloropropane	96-12-8	mg/kg													
1,2-Dibromoethane	106-93-4	mg/kg													
1,2-Dichlorobenzene	95-50-1	mg/kg					0.010 U								
1,2-Dichloroethane	107-06-2	mg/kg													
1,2-Dichloropropane	78-87-5	mg/kg													
1,3,5-Trimethylbenzene	108-67-8	mg/kg													
1,3-Dichlorobenzene	541-73-1	mg/kg					0.010 U								
1,3-Dichloropropane	142-28-9	mg/kg													
1,4-Dichlorobenzene	106-46-7	mg/kg					0.010 U								
2,2-Dichloropropane	594-20-7	mg/kg													
2,4-Dinitrotoluene	121-14-2	mg/kg					0.050 U								
2,6-Dinitrotoluene	606-20-2	mg/kg					0.050 UJ								
2-Chlorotoluene	95-49-8	mg/kg													
2-Hexanone	591-78-6	mg/kg													
2-Nitroaniline	88-74-4	mg/kg					0.050 U								
3,3'-Dichlorobenzidine	91-94-1	mg/kg													
3-Nitroaniline	99-09-2	mg/kg					1.0 U								
4-Chloroaniline	106-47-8	mg/kg					1.0 U								
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg					0.010 U								
4-Chlorotoluene	106-43-4	mg/kg													
4-Nitroaniline	100-01-6	mg/kg					1.0 U								
Acetone	67-64-1	mg/kg													
Bis(2-chloroethyl)ether	111-44-4	mg/kg					0.010 U								
Bis(2-chloroisopropyl)ether	39638-32-9	mg/kg													
Bromobenzene	108-86-1	mg/kg													

Table 3.3
In Situ Soil Data

		Location Name	A6A-S2	A6A-W1	A6A-S2/W1-Comp	A6A-W1/S1-Comp	A6B-B1	A6B-E1	A6B-N1	A6B-N1/E1-Comp	A6B-S1	A6B-W1	A6B-S1/W1-Comp	A6C-B1	
		Sample Name	A6A-S2-0.5	A6A-W1-0.5	A6AC-Comp1	A6AC-Comp2	A6B-B1-2	A6B-E1-2	A6B-N1-2	A6B-Comp2	A6B-S1-2	A6B-W1-1	A6B-Comp1	A6C-B1-0.5	A6C-B1-0.5-R
		Sample Date	6/19/2018	6/19/2018	6/19/2018	6/19/2018	6/14/2018	6/14/2018	6/14/2018	6/14/2018	6/14/2018	6/14/2018	6/14/2018	6/15/2018	7/2/2018
		Sample Depth	0.5 ft	0.5 ft	0.5 ft	0.5 ft	2 ft	2 ft	2 ft	2 ft	2 ft	1 ft	1-2 ft	0.5 ft	0.5 ft
Analyte	CAS No.	Unit													
Volatile Organic Compound (VOCs) (cont.)															
Bromochloromethane	74-97-5	mg/kg													
Bromodichloromethane	75-27-4	mg/kg													
Bromoform	75-25-2	mg/kg													
Bromomethane	74-83-9	mg/kg													
Carbon tetrachloride	56-23-5	mg/kg													
Chlorobenzene	108-90-7	mg/kg													
Chloroform	67-66-3	mg/kg													
Chloromethane	74-87-3	mg/kg													
cis-1,3-Dichloropropene	10061-01-5	mg/kg													
Cymene	99-87-6	mg/kg													
Dibromochloromethane	124-48-1	mg/kg													
Dibromomethane	74-95-3	mg/kg													
Dichlorodifluoromethane	75-71-8	mg/kg													
Hexachloroethane	67-72-1	mg/kg					0.010 U								
Isopropylbenzene	98-82-8	mg/kg													
Methyl ethyl ketone	78-93-3	mg/kg													
Methyl isobutyl ketone	108-10-1	mg/kg													
Methylene chloride	75-09-2	mg/kg													
Methyl-tert-butyl ether	1634-04-4	mg/kg													
n-Hexane	110-54-3	mg/kg													
Nitrobenzene	98-95-3	mg/kg					0.010 U								
n-Propylbenzene	103-65-1	mg/kg													
Pyridine	110-86-1	mg/kg													
sec-Butylbenzene	135-98-8	mg/kg													
Styrene	100-42-5	mg/kg													
tert-Butylbenzene	98-06-6	mg/kg													
trans-1,3-Dichloropropene	10061-02-6	mg/kg													
Trichlorofluoromethane	75-69-4	mg/kg													

Notes:

Blank cells are intentional

All results are rounded to two significant figures.

1 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

2 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

3 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.

4 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

5 Result reported by HCID Analysis

6 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Table 708-2 of WAC 173-340-900.

7 Calculation was performed using only detected cPAH concentrations.

8 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

Abbreviations:

CAS Chemical Abstracts Service

cPAH Carcinogenic polycyclic aromatic hydrocarbon

ft Feet

mg/kg Milligrams per kilogram

MTCA Model Toxics Control Act

PAH Polycyclic aromatic hydrocarbons

PCB Polychlorinated biphenyl

TEQ Toxic equivalency

Qualifiers:

J Analyte was detected; concentration is an estimate.

U Analyte was not detected at the associated reporting limit.

UJ Analyte was not detected at the associated reporting limit, which is an estimate.

Table 3.3
In Situ Soil Data

		Location Name	A6C-N1		A6C-N1/B1-Comp	A6C-S1	A6C-W1	EY-SP1	EY-SP3	EY-SP6	FT1-B1-12	FT1-NS-6.5	FT1-WS-6.5	FT2-B1-12	FT2-B2-12	FT2-SS1-6.5
		Sample Name	A6C-N1-0.5	A6C-N1-0.5-R	A6C-Comp1	A6C-S1-0.5	A6C-W1-2	EY-SP1	EY-SP3	EY-SP6	FT1-B1-12	FT1-NS-6.5	FT1-WS-6.5	FT2-B1-12	FT2-B2-12	FT2-SS1-6.5
		Sample Date	6/15/2018	7/2/2018	6/15/2018	6/15/2018	7/2/2018	6/27/2018	6/29/2018	7/6/2018	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017
		Sample Depth	0.5 ft	0.5 ft	0.5 ft	0.5 ft	2 ft				12 ft	6.5 ft	6.5 ft	12 ft	12 ft	6.5 ft
Analyte	**CAS No.**	**Unit**														
Total Petroleum Hydrocarbons (TPHs)																
Gasoline-range organics	GRO	mg/kg														
Diesel-range organics	DRO	mg/kg			50 U			560	340							
Oil-range organics	ORO	mg/kg			410			250 U	250 U							
Total DRO & ORO [(4)]	T_DRO&ORO (U=0)	mg/kg			410			560	340							
Gasoline [(5)]	86290-81-5	mg/kg									20 U	20 U	20 U	20 U	20 U	20 U
Diesel [(5)]	Dies	mg/kg									50 U	50 U	50 U	50 U	50 U	50 U
Heavy Oil [(5)]	Oil_Heavy	mg/kg									250 U	250 U	250 U	250 U	250 U	250 U
Metals																
Arsenic	7440-38-2	mg/kg	15			18	11			5.7						
Barium	7440-39-3	mg/kg														
Cadmium	7440-43-9	mg/kg	1.0 U			1.2	1.0 U			1.0 U						
Chromium	7440-47-3	mg/kg	18			16										
Chromium(VI)	18540-29-9	mg/kg														
Copper	7440-50-8	mg/kg														
Lead	7439-92-1	mg/kg	450			410				7.2						
Mercury	7439-97-6	mg/kg	1.0 U			1.0 U										
Selenium	7782-49-2	mg/kg														
Silver	7440-22-4	mg/kg														
Polychlorinated Biphenyls																
Aroclor 1016	12674-11-2	mg/kg			0.020 U											
Aroclor 1221	11104-28-2	mg/kg			0.020 U											
Aroclor 1232	11141-16-5	mg/kg			0.020 U											
Aroclor 1242	53469-21-9	mg/kg			0.020 U											
Aroclor 1248	12672-29-6	mg/kg			0.020 U											
Aroclor 1254	11097-69-1	mg/kg			0.020 U											
Aroclor 1260	11096-82-5	mg/kg			0.042											
Aroclor 1262	37324-23-5	mg/kg			0.020 U											
Aroclor 1268	11100-14-4	mg/kg			0.020 U											
Total PCB Aroclors (U=0) [(4)]	T_PCB (U=0)	mg/kg			0.042											
Polybrominated Diphenyl Ethers (PBDEs)																
PBDE-003	101-55-3	mg/kg														
Semi-Volatile Organic Compound (SVOCs)																
1-Methylnaphthalene	90-12-0	mg/kg														
2-Methylnaphthalene	91-57-6	mg/kg														
Acenaphthene	83-32-9	mg/kg														
Acenaphthylene	208-96-8	mg/kg														
Anthracene	120-12-7	mg/kg														
Benzo(a)anthracene	56-55-3	mg/kg		0.10 U	1.0 U											
Benzo(a)pyrene	50-32-8	mg/kg		**0.11**	**1.2**											
Benzo(b)fluoranthene	205-99-2	mg/kg		0.15	1.2											
Benzo(g,h,i)perylene	191-24-2	mg/kg														
Benzo(k)fluoranthene	207-08-9	mg/kg		0.10 U	1.0 U											
Chrysene	218-01-9	mg/kg		0.11	1.1											
Dibenzo(a,h)anthracene	53-70-3	mg/kg		0.10 U	1.0 U											
Fluoranthene	206-44-0	mg/kg														
Fluorene	86-73-7	mg/kg														
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg		0.10 U	1.0 U											
Naphthalene	91-20-3	mg/kg														

Table 3.3
In Situ Soil Data

		Location Name	A6C-N1		A6C-N1/B1-Comp	A6C-S1	A6C-W1	EY-SP1	EY-SP3	EY-SP6	FT1-B1-12	FT1-NS-6.5	FT1-WS-6.5	FT2-B1-12	FT2-B2-12	FT2-SS1-6.5
		Sample Name	A6C-N1-0.5	A6C-N1-0.5-R	A6C-Comp1	A6C-S1-0.5	A6C-W1-2	EY-SP1	EY-SP3	EY-SP6	FT1-B1-12	FT1-NS-6.5	FT1-WS-6.5	FT2-B1-12	FT2-B2-12	FT2-SS1-6.5
		Sample Date	6/15/2018	7/2/2018	6/15/2018	6/15/2018	7/2/2018	6/27/2018	6/29/2018	7/6/2018	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017
		Sample Depth	0.5 ft	0.5 ft	0.5 ft	0.5 ft	2 ft				12 ft	6.5 ft	6.5 ft	12 ft	12 ft	6.5 ft
Analyte	**CAS No.**	**Unit**														
Semi-Volatile Organic Compound (SVOCs) (cont.)																
Phenanthrene	85-01-8	mg/kg														
Pyrene	129-00-0	mg/kg														
Total Naphthalenes (U=0) [4]	T_Napth (U=0)	mg/kg														
cPAHs (MTCA TEQ-ZeroND) [6,7]	BaPEq (U=0)	mg/kg		**0.13**	**1.3**											
cPAHs (MTCA TEQ-HalfND) [5,8]	BaPEq (U=1/2)	mg/kg		**0.15**	**1.5**											
Total HPAH (U=0) [4]	T_HPAH (U=0)	mg/kg														
Total LPAH (U=0) [4]	T_LPAH (U=0)	mg/kg														
Total PAH (U=0) [4]	T_PAH (U=0)	mg/kg														
2,3,4,6-Tetrachlorophenol	58-90-2	mg/kg														
2,4,5-Trichlorophenol	95-95-4	mg/kg														
2,4,6-Trichlorophenol	88-06-2	mg/kg														
2,4-Dichlorophenol	120-83-2	mg/kg														
2,4-Dimethylphenol	105-67-9	mg/kg														
2,4-Dinitrophenol	51-28-5	mg/kg														
2,6-Dichlorophenol	87-65-0	mg/kg														
2-Chlorophenol	95-57-8	mg/kg														
2-Methylphenol	95-48-7	mg/kg														
2-Nitrophenol	88-75-5	mg/kg														
3- & 4-Methylphenol	15831-10-4	mg/kg														
4,6-Dinitro-o-cresol	534-52-1	mg/kg														
4-Chloro-3-methylphenol	59-50-7	mg/kg														
4-Methylphenol	106-44-5	mg/kg														
4-Nitrophenol	100-02-7	mg/kg														
Pentachlorophenol	87-86-5	mg/kg														
Phenol	108-95-2	mg/kg														
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg														
Butyl benzyl phthalate	85-68-7	mg/kg														
Di-n-butyl phthalate	84-74-2	mg/kg														
Di-n-octyl phthalate	117-84-0	mg/kg														
Diethylphthalate	84-66-2	mg/kg														
Dimethyl phthalate	131-11-3	mg/kg														
2-Chloronaphthalene	91-58-7	mg/kg														
Aniline	62-53-3	mg/kg														
Azobenzene	103-33-3	mg/kg														
Benzoic acid	65-85-0	mg/kg														
Benzyl alcohol	100-51-6	mg/kg														
Bis(2-chloroethoxy)methane	111-91-1	mg/kg														
Bis-chloroisopropyl ether	108-60-1	mg/kg														
Carbazole	86-74-8	mg/kg														
Dibenzofuran	132-64-9	mg/kg														
Hexachlorobenzene	118-74-1	mg/kg														
Hexachlorobutadiene	87-68-3	mg/kg														
Hexachlorocyclopentadiene	77-47-4	mg/kg														
Isophorone	78-59-1	mg/kg														
N-Nitrosodimethylamine	62-75-9	mg/kg														
N-Nitroso-di-n-propylamine	621-64-7	mg/kg														
N-Nitrosodiphenylamine	86-30-6	mg/kg														

Table 3.3
In Situ Soil Data

		Location Name	A6C-N1		A6C-N1/B1-Comp	A6C-S1	A6C-W1	EY-SP1	EY-SP3	EY-SP6	FT1-B1-12	FT1-NS-6.5	FT1-WS-6.5	FT2-B1-12	FT2-B2-12	FT2-SS1-6.5
		Sample Name	A6C-N1-0.5	A6C-N1-0.5-R	A6C-Comp1	A6C-S1-0.5	A6C-W1-2	EY-SP1	EY-SP3	EY-SP6	FT1-B1-12	FT1-NS-6.5	FT1-WS-6.5	FT2-B1-12	FT2-B2-12	FT2-SS1-6.5
		Sample Date	6/15/2018	7/2/2018	6/15/2018	6/15/2018	7/2/2018	6/27/2018	6/29/2018	7/6/2018	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017
		Sample Depth	0.5 ft	0.5 ft	0.5 ft	0.5 ft	2 ft				12 ft	6.5 ft	6.5 ft	12 ft	12 ft	6.5 ft
Analyte	**CAS No.**	**Unit**														
Volatile Organic Compound (VOCs)																
Benzene	71-43-2	mg/kg									0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U
Ethylbenzene	100-41-4	mg/kg									0.041	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U
Toluene	108-88-3	mg/kg									0.067	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U
Xylene (meta & para)	108-38-3/106-42-3	mg/kg														
Xylene (ortho)	95-47-6	mg/kg														
Xylene (total)	1330-20-7	mg/kg									0.31	0.060 U	0.060 U	0.060 U	0.060 U	0.060 U
Chloroethane	75-00-3	mg/kg														
cis-1,2-Dichloroethene	156-59-2	mg/kg														
Tetrachloroethene	127-18-4	mg/kg														
trans-1,2-Dichloroethene	156-60-5	mg/kg														
Trichloroethene	79-01-6	mg/kg														
Vinyl chloride	75-01-4	mg/kg														
1,1,1,2-Tetrachloroethane	630-20-6	mg/kg														
1,1,1-Trichloroethane	71-55-6	mg/kg														
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg														
1,1,2-Trichloroethane	79-00-5	mg/kg														
1,1-Dichloroethane	75-34-3	mg/kg														
1,1-Dichloroethene	75-35-4	mg/kg														
1,1-Dichloropropene	563-58-6	mg/kg														
1,2,3-Trichlorobenzene	87-61-6	mg/kg														
1,2,3-Trichloropropane	96-18-4	mg/kg														
1,2,4-Trichlorobenzene	120-82-1	mg/kg														
1,2,4-Trimethylbenzene	95-63-6	mg/kg														
1,2-Dibromo-3-chloropropane	96-12-8	mg/kg														
1,2-Dibromoethane	106-93-4	mg/kg														
1,2-Dichlorobenzene	95-50-1	mg/kg														
1,2-Dichloroethane	107-06-2	mg/kg														
1,2-Dichloropropane	78-87-5	mg/kg														
1,3,5-Trimethylbenzene	108-67-8	mg/kg														
1,3-Dichlorobenzene	541-73-1	mg/kg														
1,3-Dichloropropane	142-28-9	mg/kg														
1,4-Dichlorobenzene	106-46-7	mg/kg														
2,2-Dichloropropane	594-20-7	mg/kg														
2,4-Dinitrotoluene	121-14-2	mg/kg														
2,6-Dinitrotoluene	606-20-2	mg/kg														
2-Chlorotoluene	95-49-8	mg/kg														
2-Hexanone	591-78-6	mg/kg														
2-Nitroaniline	88-74-4	mg/kg														
3,3'-Dichlorobenzidine	91-94-1	mg/kg														
3-Nitroaniline	99-09-2	mg/kg														
4-Chloroaniline	106-47-8	mg/kg														
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg														
4-Chlorotoluene	106-43-4	mg/kg														
4-Nitroaniline	100-01-6	mg/kg														
Acetone	67-64-1	mg/kg														
Bis(2-chloroethyl)ether	111-44-4	mg/kg														
Bis(2-chloroisopropyl)ether	39638-32-9	mg/kg														
Bromobenzene	108-86-1	mg/kg														

Table 3.3
In Situ Soil Data

		Location Name	A6C-N1		A6C-N1/B1-Comp	A6C-S1	A6C-W1	EY-SP1	EY-SP3	EY-SP6	FT1-B1-12	FT1-NS-6.5	FT1-WS-6.5	FT2-B1-12	FT2-B2-12	FT2-SS1-6.5
		Sample Name	A6C-N1-0.5	A6C-N1-0.5-R	A6C-Comp1	A6C-S1-0.5	A6C-W1-2	EY-SP1	EY-SP3	EY-SP6	FT1-B1-12	FT1-NS-6.5	FT1-WS-6.5	FT2-B1-12	FT2-B2-12	FT2-SS1-6.5
		Sample Date	6/15/2018	7/2/2018	6/15/2018	6/15/2018	7/2/2018	6/27/2018	6/29/2018	7/6/2018	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017
		Sample Depth	0.5 ft	0.5 ft	0.5 ft	0.5 ft	2 ft				12 ft	6.5 ft	6.5 ft	12 ft	12 ft	6.5 ft
Analyte	**CAS No.**	**Unit**														
Volatile Organic Compound (VOCs) (cont.)																
Bromochloromethane	74-97-5	mg/kg														
Bromodichloromethane	75-27-4	mg/kg														
Bromoform	75-25-2	mg/kg														
Bromomethane	74-83-9	mg/kg														
Carbon tetrachloride	56-23-5	mg/kg														
Chlorobenzene	108-90-7	mg/kg														
Chloroform	67-66-3	mg/kg														
Chloromethane	74-87-3	mg/kg														
cis-1,3-Dichloropropene	10061-01-5	mg/kg														
Cymene	99-87-6	mg/kg														
Dibromochloromethane	124-48-1	mg/kg														
Dibromomethane	74-95-3	mg/kg														
Dichlorodifluoromethane	75-71-8	mg/kg														
Hexachloroethane	67-72-1	mg/kg														
Isopropylbenzene	98-82-8	mg/kg														
Methyl ethyl ketone	78-93-3	mg/kg														
Methyl isobutyl ketone	108-10-1	mg/kg														
Methylene chloride	75-09-2	mg/kg														
Methyl-tert-butyl ether	1634-04-4	mg/kg														
n-Hexane	110-54-3	mg/kg														
Nitrobenzene	98-95-3	mg/kg														
n-Propylbenzene	103-65-1	mg/kg														
Pyridine	110-86-1	mg/kg														
sec-Butylbenzene	135-98-8	mg/kg														
Styrene	100-42-5	mg/kg														
tert-Butylbenzene	98-06-6	mg/kg														
trans-1,3-Dichloropropene	10061-02-6	mg/kg														
Trichlorofluoromethane	75-69-4	mg/kg														

Notes:

Blank cells are intentional

All results are rounded to two significant figures.

1 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.
2 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.
3 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.
4 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.
5 Result reported by HCID Analysis
6 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Table 708-2 of WAC 173-340-900.
7 Calculation was performed using only detected cPAH concentrations.
8 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

Abbreviations:

CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbon
ft Feet
mg/kg Milligrams per kilogram
MTCA Model Toxics Control Act
PAH Polycyclic aromatic hydrocarbons
PCB Polychlorinated biphenyl
TEQ Toxic equivalency

Qualifiers:

J Analyte was detected; concentration is an estimate.
U Analyte was not detected at the associated reporting limit.
UJ Analyte was not detected at the associated reporting limit, which is an estimate.

Table 3.3
In Situ Soil Data

		Location Name	FT2-SS2-6.5	FT2-WS-6.5	FT3-B1-12	FT3-ES-12	FT3-ES-4	FT3-ES-6.5	FT3-SS-6.5	FT4-B1-12	FT4-B2-12	FT4-ES-6.5	FT4-NS1-6.5	FT4-NS2-6.5	HA-02	MW-03R
		Sample Name	FT2-SS2-6.5	FT2-WS-6.5	FT3-B1-12	FT3-ES-12	FT3-ES-4	FT3-ES-6.5	FT3-SS-6.5	FT4-B1-12	FT4-B2-12	FT4-E5-6.5	FT4-NS1-6.5	FT4-NS2-6.5	HA-02-0.75	MW3R-2
		Sample Date	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/28/2017	4/28/2017	4/28/2017	4/28/2017	4/28/2017	1/12/2004	3/9/2016
		Sample Depth	6.5 ft	6.5 ft	12 ft	12 ft	4 ft	6.5 ft	6.5 ft	12 ft	12 ft	6.5 ft	6.5 ft	6.5 ft	0.75 ft	2 ft
Analyte	**CAS No.**	**Unit**														
Total Petroleum Hydrocarbons (TPHs)																
Gasoline-range organics	GRO	mg/kg		2.0 U		2.0 U	2.0 U	2.0 U								
Diesel-range organics	DRO	mg/kg		50 U		50 U	320	50 U								740 (1)
Oil-range organics	ORO	mg/kg		250 U		250 U	250 U	250 U								8,900
Total DRO & ORO (4)	T_DRO&ORO (U=0)	mg/kg		250 U		250 U	320	250 U								9,600
Gasoline (5)	86290-81-5	mg/kg	20 U		20 U				20 U	20 U	20 U	20 U	20 U	20 U		
Diesel (5)	Dies	mg/kg	50 U		50 U				50 U	50 U	50 U	50 U	50 U	50 U		
Heavy Oil (5)	Oil_Heavy	mg/kg	250 U		250 U				250 U	250 U	250 U	250 U	250 U	250 U		
Metals																
Arsenic	7440-38-2	mg/kg						2.9								2.1
Barium	7440-39-3	mg/kg						25								27
Cadmium	7440-43-9	mg/kg						1.0 U								1.0 U
Chromium	7440-47-3	mg/kg						6.0								8.6
Chromium(VI)	18540-29-9	mg/kg														
Copper	7440-50-8	mg/kg														
Lead	7439-92-1	mg/kg						2.1								7.3
Mercury	7439-97-6	mg/kg						1.0 U								1.0 U
Selenium	7782-49-2	mg/kg						1.0 U								1.0 U
Silver	7440-22-4	mg/kg						1.0 U								1.0 U
Polychlorinated Biphenyls																
Aroclor 1016	12674-11-2	mg/kg														0.020 U
Aroclor 1221	11104-28-2	mg/kg														0.020 U
Aroclor 1232	11141-16-5	mg/kg														0.020 U
Aroclor 1242	53469-21-9	mg/kg														0.020 U
Aroclor 1248	12672-29-6	mg/kg														0.020 U
Aroclor 1254	11097-69-1	mg/kg														0.020 U
Aroclor 1260	11096-82-5	mg/kg														0.020 U
Aroclor 1262	37324-23-5	mg/kg														0.020 U
Aroclor 1268	11100-14-4	mg/kg														0.020 U
Total PCB Aroclors (U=0) (4)	T_PCB (U=0)	mg/kg														0.020 U
Polybrominated Diphenyl Ethers (PBDEs)																
PBDE-003	101-55-3	mg/kg														
Semi-Volatile Organic Compound (SVOCs)																
1-Methylnaphthalene	90-12-0	mg/kg														
2-Methylnaphthalene	91-57-6	mg/kg														
Acenaphthene	83-32-9	mg/kg														
Acenaphthylene	208-96-8	mg/kg														
Anthracene	120-12-7	mg/kg														
Benzo(a)anthracene	56-55-3	mg/kg														0.50 U
Benzo(a)pyrene	50-32-8	mg/kg														0.50 U
Benzo(b)fluoranthene	205-99-2	mg/kg														0.50 U
Benzo(g,h,i)perylene	191-24-2	mg/kg														
Benzo(k)fluoranthene	207-08-9	mg/kg														0.50 U
Chrysene	218-01-9	mg/kg														0.50 U
Dibenzo(a,h)anthracene	53-70-3	mg/kg														0.50 U
Fluoranthene	206-44-0	mg/kg														
Fluorene	86-73-7	mg/kg														
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg														0.50 U
Naphthalene	91-20-3	mg/kg														0.050 U

Table 3.3
In Situ Soil Data

		Location Name	FT2-SS2-6.5	FT2-WS-6.5	FT3-B1-12	FT3-ES-12	FT3-ES-4	FT3-ES-6.5	FT3-SS-6.5	FT4-B1-12	FT4-B2-12	FT4-ES-6.5	FT4-NS1-6.5	FT4-NS2-6.5	HA-02	MW-03R
		Sample Name	FT2-SS2-6.5	FT2-WS-6.5	FT3-B1-12	FT3-ES-12	FT3-ES-4	FT3-ES-6.5	FT3-SS-6.5	FT4-B1-12	FT4-B2-12	FT4-E5-6.5	FT4-NS1-6.5	FT4-NS2-6.5	HA-02-0.75	MW3R-2
		Sample Date	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/28/2017	4/28/2017	4/28/2017	4/28/2017	4/28/2017	1/12/2004	3/9/2016
		Sample Depth	6.5 ft	6.5 ft	12 ft	12 ft	4 ft	6.5 ft	6.5 ft	12 ft	12 ft	6.5 ft	6.5 ft	6.5 ft	0.75 ft	2 ft
Analyte	**CAS No.**	**Unit**														
Semi-Volatile Organic Compound (SVOCs) (cont.)																
Phenanthrene	85-01-8	mg/kg														
Pyrene	129-00-0	mg/kg														
Total Naphthalenes (U=0) (4)	T_Napth (U=0)	mg/kg														
cPAHs (MTCA TEQ-ZeroND) (6,7)	BaPEq (U=0)	mg/kg														0.50 U
cPAHs (MTCA TEQ-HalfND) (5,8)	BaPEq (U=1/2)	mg/kg														0.50 U
Total HPAH (U=0) (4)	T_HPAH (U=0)	mg/kg														
Total LPAH (U=0) (4)	T_LPAH (U=0)	mg/kg														
Total PAH (U=0) (4)	T_PAH (U=0)	mg/kg														
2,3,4,6-Tetrachlorophenol	58-90-2	mg/kg														
2,4,5-Trichlorophenol	95-95-4	mg/kg														
2,4,6-Trichlorophenol	88-06-2	mg/kg														
2,4-Dichlorophenol	120-83-2	mg/kg														
2,4-Dimethylphenol	105-67-9	mg/kg														
2,4-Dinitrophenol	51-28-5	mg/kg														
2,6-Dichlorophenol	87-65-0	mg/kg														
2-Chlorophenol	95-57-8	mg/kg														
2-Methylphenol	95-48-7	mg/kg														
2-Nitrophenol	88-75-5	mg/kg														
3- & 4-Methylphenol	15831-10-4	mg/kg														
4,6-Dinitro-o-cresol	534-52-1	mg/kg														
4-Chloro-3-methylphenol	59-50-7	mg/kg														
4-Methylphenol	106-44-5	mg/kg														
4-Nitrophenol	100-02-7	mg/kg														
Pentachlorophenol	87-86-5	mg/kg														
Phenol	108-95-2	mg/kg														
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg														
Butyl benzyl phthalate	85-68-7	mg/kg														
Di-n-butyl phthalate	84-74-2	mg/kg														
Di-n-octyl phthalate	117-84-0	mg/kg														
Diethylphthalate	84-66-2	mg/kg														
Dimethyl phthalate	131-11-3	mg/kg														
2-Chloronaphthalene	91-58-7	mg/kg														
Aniline	62-53-3	mg/kg														
Azobenzene	103-33-3	mg/kg														
Benzoic acid	65-85-0	mg/kg														
Benzyl alcohol	100-51-6	mg/kg														
Bis(2-chloroethoxy)methane	111-91-1	mg/kg														
Bis-chloroisopropyl ether	108-60-1	mg/kg														
Carbazole	86-74-8	mg/kg														
Dibenzofuran	132-64-9	mg/kg														
Hexachlorobenzene	118-74-1	mg/kg														
Hexachlorobutadiene	87-68-3	mg/kg													0.010 U	0.25 U
Hexachlorocyclopentadiene	77-47-4	mg/kg														
Isophorone	78-59-1	mg/kg														
N-Nitrosodimethylamine	62-75-9	mg/kg														
N-Nitroso-di-n-propylamine	621-64-7	mg/kg														
N-Nitrosodiphenylamine	86-30-6	mg/kg														

Table 3.3
In Situ Soil Data

		Location Name	FT2-SS2-6.5	FT2-WS-6.5	FT3-B1-12	FT3-ES-12	FT3-ES-4	FT3-ES-6.5	FT3-SS-6.5	FT4-B1-12	FT4-B2-12	FT4-ES-6.5	FT4-NS1-6.5	FT4-NS2-6.5	HA-02	MW-03R
		Sample Name	FT2-SS2-6.5	FT2-WS-6.5	FT3-B1-12	FT3-ES-12	FT3-ES-4	FT3-ES-6.5	FT3-SS-6.5	FT4-B1-12	FT4-B2-12	FT4-E5-6.5	FT4-NS1-6.5	FT4-NS2-6.5	HA-02-0.75	MW3R-2
		Sample Date	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/28/2017	4/28/2017	4/28/2017	4/28/2017	4/28/2017	1/12/2004	3/9/2016
		Sample Depth	6.5 ft	6.5 ft	12 ft	12 ft	4 ft	6.5 ft	6.5 ft	12 ft	12 ft	6.5 ft	6.5 ft	6.5 ft	0.75 ft	2 ft
Analyte	**CAS No.**	**Unit**														
Volatile Organic Compound (VOCs)																
Benzene	71-43-2	mg/kg	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U		0.030 U
Ethylbenzene	100-41-4	mg/kg	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U		0.050 U
Toluene	108-88-3	mg/kg	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U		0.050 U
Xylene (meta & para)	108-38-3/106-42-3	mg/kg														0.10 U
Xylene (ortho)	95-47-6	mg/kg														0.050 U
Xylene (total)	1330-20-7	mg/kg	0.060 U	0.060 U	0.060 U	0.060 U	0.060 U	0.060 U	0.060 U	0.060 U	0.060 U	0.060 U	0.060 U	0.060 U		0.10 U
Chloroethane	75-00-3	mg/kg													0.010 U	0.50 U
cis-1,2-Dichloroethene	156-59-2	mg/kg													0.010 U	0.050 U
Tetrachloroethene	127-18-4	mg/kg													0.010 U	0.025 U
trans-1,2-Dichloroethene	156-60-5	mg/kg													0.010 U	0.050 U
Trichloroethene	79-01-6	mg/kg													0.010 U	0.020 U
Vinyl chloride	75-01-4	mg/kg													0.010 U	0.050 U
1,1,1,2-Tetrachloroethane	630-20-6	mg/kg														0.050 U
1,1,1-Trichloroethane	71-55-6	mg/kg													0.010 U	0.050 U
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg													0.010 U	0.050 U
1,1,2-Trichloroethane	79-00-5	mg/kg													0.010 U	0.050 U
1,1-Dichloroethane	75-34-3	mg/kg													0.010 U	0.050 U
1,1-Dichloroethene	75-35-4	mg/kg													0.010 U	0.050 U
1,1-Dichloropropene	563-58-6	mg/kg													0.010 U	0.050 U
1,2,3-Trichlorobenzene	87-61-6	mg/kg													0.010 U	0.25 U
1,2,3-Trichloropropane	96-18-4	mg/kg													0.010 U	0.050 U
1,2,4-Trichlorobenzene	120-82-1	mg/kg													0.010 U	0.25 U
1,2,4-Trimethylbenzene	95-63-6	mg/kg														0.050 U
1,2-Dibromo-3-chloropropane	96-12-8	mg/kg													0.050 U	0.50 U
1,2-Dibromoethane	106-93-4	mg/kg													0.0050 U	0.050 U
1,2-Dichlorobenzene	95-50-1	mg/kg													0.010 U	0.050 U
1,2-Dichloroethane	107-06-2	mg/kg													0.010 U	0.050 U
1,2-Dichloropropane	78-87-5	mg/kg													0.010 U	0.050 U
1,3,5-Trimethylbenzene	108-67-8	mg/kg														0.050 U
1,3-Dichlorobenzene	541-73-1	mg/kg													0.010 U	0.050 U
1,3-Dichloropropane	142-28-9	mg/kg													0.010 U	0.050 U
1,4-Dichlorobenzene	106-46-7	mg/kg													0.010 U	0.050 U
2,2-Dichloropropane	594-20-7	mg/kg													0.010 U	0.050 U
2,4-Dinitrotoluene	121-14-2	mg/kg														
2,6-Dinitrotoluene	606-20-2	mg/kg														
2-Chlorotoluene	95-49-8	mg/kg													0.010 U	0.050 U
2-Hexanone	591-78-6	mg/kg														0.50 U
2-Nitroaniline	88-74-4	mg/kg														
3,3'-Dichlorobenzidine	91-94-1	mg/kg														
3-Nitroaniline	99-09-2	mg/kg														
4-Chloroaniline	106-47-8	mg/kg														
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg														
4-Chlorotoluene	106-43-4	mg/kg													0.010 U	0.050 U
4-Nitroaniline	100-01-6	mg/kg														
Acetone	67-64-1	mg/kg														0.50 U
Bis(2-chloroethyl)ether	111-44-4	mg/kg														
Bis(2-chloroisopropyl)ether	39638-32-9	mg/kg														
Bromobenzene	108-86-1	mg/kg													0.010 U	0.050 U

Table 3.3
In Situ Soil Data

		Location Name	FT2-SS2-6.5	FT2-WS-6.5	FT3-B1-12	FT3-ES-12	FT3-ES-4	FT3-ES-6.5	FT3-SS-6.5	FT4-B1-12	FT4-B2-12	FT4-ES-6.5	FT4-NS1-6.5	FT4-NS2-6.5	HA-02	MW-03R
		Sample Name	FT2-SS2-6.5	FT2-WS-6.5	FT3-B1-12	FT3-ES-12	FT3-ES-4	FT3-ES-6.5	FT3-SS-6.5	FT4-B1-12	FT4-B2-12	FT4-E5-6.5	FT4-NS1-6.5	FT4-NS2-6.5	HA-02-0.75	MW3R-2
		Sample Date	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/28/2017	4/28/2017	4/28/2017	4/28/2017	4/28/2017	1/12/2004	3/9/2016
		Sample Depth	6.5 ft	6.5 ft	12 ft	12 ft	4 ft	6.5 ft	6.5 ft	12 ft	12 ft	6.5 ft	6.5 ft	6.5 ft	0.75 ft	2 ft
Analyte	**CAS No.**	**Unit**														
Volatile Organic Compound (VOCs) (cont.)																
Bromochloromethane	74-97-5	mg/kg													0.010 U	
Bromodichloromethane	75-27-4	mg/kg													0.010 U	0.050 U
Bromoform	75-25-2	mg/kg													0.010 U	0.050 U
Bromomethane	74-83-9	mg/kg													0.010 U	0.50 U
Carbon tetrachloride	56-23-5	mg/kg													0.010 U	0.050 U
Chlorobenzene	108-90-7	mg/kg													0.010 U	0.050 U
Chloroform	67-66-3	mg/kg													0.010 U	0.050 U
Chloromethane	74-87-3	mg/kg													0.010 U	0.50 U
cis-1,3-Dichloropropene	10061-01-5	mg/kg													0.010 U	0.050 U
Cymene	99-87-6	mg/kg														0.050 U
Dibromochloromethane	124-48-1	mg/kg													0.010 U	0.050 U
Dibromomethane	74-95-3	mg/kg													0.010 U	0.050 U
Dichlorodifluoromethane	75-71-8	mg/kg													0.010 U	0.50 U
Hexachloroethane	67-72-1	mg/kg														
Isopropylbenzene	98-82-8	mg/kg														0.050 U
Methyl ethyl ketone	78-93-3	mg/kg														0.50 U
Methyl isobutyl ketone	108-10-1	mg/kg														0.50 U
Methylene chloride	75-09-2	mg/kg													0.010 U	0.50 U
Methyl-tert-butyl ether	1634-04-4	mg/kg														0.050 U
n-Hexane	110-54-3	mg/kg														0.25 U
Nitrobenzene	98-95-3	mg/kg														
n-Propylbenzene	103-65-1	mg/kg														0.050 U
Pyridine	110-86-1	mg/kg														
sec-Butylbenzene	135-98-8	mg/kg														0.050 U
Styrene	100-42-5	mg/kg														0.050 U
tert-Butylbenzene	98-06-6	mg/kg														0.050 U
trans-1,3-Dichloropropene	10061-02-6	mg/kg													0.010 U	0.050 U
Trichlorofluoromethane	75-69-4	mg/kg													0.010 U	0.50 U

Notes:

Blank cells are intentional

All results are rounded to two significant figures.

1 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

2 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

3 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.

4 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

5 Result reported by HCID Analysis

6 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Table 708-2 of WAC 173-340-900.

7 Calculation was performed using only detected cPAH concentrations.

8 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

Abbreviations:

CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbon
ft Feet
mg/kg Milligrams per kilogram
MTCA Model Toxics Control Act
PAH Polycyclic aromatic hydrocarbons
PCB Polychlorinated biphenyl
TEQ Toxic equivalency

Qualifiers:

J Analyte was detected; concentration is an estimate.
U Analyte was not detected at the associated reporting limit.
UJ Analyte was not detected at the associated reporting limit, which is an estimate.

Table 3.3
In Situ Soil Data

		Location Name	MW-07	MW-08	MW-09	MW-10	MW-11	MW-12	P1	P2	P3	P4	P6		P7	P8	P9
		Sample Name	MW7-5	MW8-3	MW9-2.5	MW10-2.5	P17-10	MW12-2.5	P1-4	P2-4	P3-5	P4-8	P6-5	P6-8	P7-1	P8-3.5	P9-9.5
		Sample Date	3/8/2016	3/9/2016	3/8/2016	3/8/2016	3/9/2016	3/8/2016	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015
		Sample Depth	5 ft	3 ft	2.5 ft	2.5 ft	10 ft	2.5 ft	4 ft	4 ft	5 ft	8 ft	5 ft	8 ft	1 ft	3.5 ft	9.5 ft
Analyte	**CAS No.**	**Unit**															
Total Petroleum Hydrocarbons (TPHs)																	
Gasoline-range organics	GRO	mg/kg										2.0 U				2.0 U	2.0 U
Diesel-range organics	DRO	mg/kg	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	210 (2)	50 U	1,900 (3)	50 U	50 U
Oil-range organics	ORO	mg/kg	250 U	250 U	250 U	250 U	250 U	250 U	250 U	250 U	250 U	250 U	250 U	250 U	14,000	250 U	250 U
Total DRO & ORO (4)	T_DRO&ORO (U=0)	mg/kg	250 U	250 U	250 U	250 U	250 U	250 U	250 U	250 U	250 U	250 U	210	250 U	16,000	250 U	250 U
Gasoline (5)	86290-81-5	mg/kg															
Diesel (5)	Dies	mg/kg															
Heavy Oil (5)	Oil_Heavy	mg/kg															
Metals																	
Arsenic	7440-38-2	mg/kg	1.8	4.9	6.8	2.0					2.5		6.8		2.0	5.4	
Barium	7440-39-3	mg/kg		26		14					44		50		23	54	
Cadmium	7440-43-9	mg/kg	1.0 U	1.0 U	1.0 U	1.0 U					1.0 U		1.0 U		1.0 U	1.0 U	
Chromium	7440-47-3	mg/kg		7.0		6.1					7.2		9.4		19	7.2	
Chromium(VI)	18540-29-9	mg/kg															
Copper	7440-50-8	mg/kg															
Lead	7439-92-1	mg/kg	2.1	47	37	4.0					3.4		96		19	34	
Mercury	7439-97-6	mg/kg		1.0 U		1.0 U					1.0 U		1.0 U		1.0 U	1.0 U	
Selenium	7782-49-2	mg/kg		1.0 U		1.0 U					1.0 U		1.0 U		1.0 U	1.0 U	
Silver	7440-22-4	mg/kg		1.0 U		1.0 U					1.0 U		1.0 U		1.0 U	1.0 U	
Polychlorinated Biphenyls																	
Aroclor 1016	12674-11-2	mg/kg		0.020 U	0.020 U	0.020 U			0.020 U	0.020 U	0.020 U		0.020 U		0.020 U	0.020 U	
Aroclor 1221	11104-28-2	mg/kg		0.020 U	0.020 U	0.020 U			0.020 U	0.020 U	0.020 U		0.020 U		0.020 U	0.020 U	
Aroclor 1232	11141-16-5	mg/kg		0.020 U	0.020 U	0.020 U			0.020 U	0.020 U	0.020 U		0.020 U		0.020 U	0.020 U	
Aroclor 1242	53469-21-9	mg/kg		0.020 U	0.020 U	0.020 U			0.020 U	0.020 U	0.020 U		0.020 U		0.020 U	0.020 U	
Aroclor 1248	12672-29-6	mg/kg		0.020 U	0.020 U	0.020 U			0.020 U	0.020 U	0.020 U		0.020 U		0.045	0.020 U	
Aroclor 1254	11097-69-1	mg/kg		0.020 U	0.18	0.020 U			0.020 U	0.020 U	0.020 U		0.020 U		0.031	0.020 U	
Aroclor 1260	11096-82-5	mg/kg		0.020 U	0.020 U	0.020 U			0.020 U	0.020 U	0.020 U		0.020 U		0.020 U	0.020 U	
Aroclor 1262	37324-23-5	mg/kg		0.020 U	0.020 U	0.020 U			0.020 U	0.020 U	0.020 U		0.020 U		0.020 U		
Aroclor 1268	11100-14-4	mg/kg		0.020 U	0.020 U	0.020 U			0.020 U	0.020 U	0.020 U		0.020 U		0.020 U		
Total PCB Aroclors (U=0) (4)	T_PCB (U=0)	mg/kg		0.020 U	0.18	0.020 U			0.020 U	0.020 U	0.020 U		0.020 U		0.076	0.020 U	
Polybrominated Diphenyl Ethers (PBDEs)																	
PBDE-003	101-55-3	mg/kg											0.10 U				
Semi-Volatile Organic Compound (SVOCs)																	
1-Methylnaphthalene	90-12-0	mg/kg															
2-Methylnaphthalene	91-57-6	mg/kg											**0.13**				
Acenaphthene	83-32-9	mg/kg											0.10 U				
Acenaphthylene	208-96-8	mg/kg											0.10 U				
Anthracene	120-12-7	mg/kg											0.10 U				
Benzo(a)anthracene	56-55-3	mg/kg		0.013									0.12				
Benzo(a)pyrene	50-32-8	mg/kg		**0.018**									**0.15**				
Benzo(b)fluoranthene	205-99-2	mg/kg		0.026									0.20				
Benzo(g,h,i)perylene	191-24-2	mg/kg											0.10				
Benzo(k)fluoranthene	207-08-9	mg/kg		0.010 U									0.10 U				
Chrysene	218-01-9	mg/kg		0.020									0.17				
Dibenzo(a,h)anthracene	53-70-3	mg/kg		0.010 U									0.10 U				
Fluoranthene	206-44-0	mg/kg											**0.39**				
Fluorene	86-73-7	mg/kg											**0.10**				
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg		0.010 U									0.11				
Naphthalene	91-20-3	mg/kg			0.050 U	0.050 U							**0.13**		0.050 U		

Table 3.3
In Situ Soil Data

		Location Name	MW-07	MW-08	MW-09	MW-10	MW-11	MW-12	P1	P2	P3	P4	P6		P7	P8	P9
		Sample Name	**MW7-5**	**MW8-3**	**MW9-2.5**	**MW10-2.5**	**P17-10**	**MW12-2.5**	**P1-4**	**P2-4**	**P3-5**	**P4-8**	**P6-5**	**P6-8**	**P7-1**	**P8-3.5**	**P9-9.5**
		Sample Date	**3/8/2016**	**3/9/2016**	**3/8/2016**	**3/8/2016**	**3/9/2016**	**3/8/2016**	**4/21/2015**	**4/21/2015**	**4/21/2015**	**4/21/2015**	**4/21/2015**	**4/21/2015**	**4/21/2015**	**4/21/2015**	**4/21/2015**
		Sample Depth	**5 ft**	**3 ft**	**2.5 ft**	**2.5 ft**	**10 ft**	**2.5 ft**	**4 ft**	**4 ft**	**5 ft**	**8 ft**	**5 ft**	**8 ft**	**1 ft**	**3.5 ft**	**9.5 ft**
Analyte	**CAS No.**	**Unit**															
Semi-Volatile Organic Compound (SVOCs) (cont.)																	
Phenanthrene	85-01-8	mg/kg											0.39				
Pyrene	129-00-0	mg/kg											**0.35**				
Total Naphthalenes (U=0) (4)	T_Napth (U=0)	mg/kg															
cPAHs (MTCA TEQ-ZeroND) (6,7)	BaPEq (U=0)	mg/kg		**0.022**									**0.19**				
cPAHs (MTCA TEQ-HalfND) (5,8)	BaPEq (U=1/2)	mg/kg		**0.024**									**0.20**				
Total HPAH (U=0) (4)	T_HPAH (U=0)	mg/kg											1.6				
Total LPAH (U=0) (4)	T_LPAH (U=0)	mg/kg											0.62				
Total PAH (U=0) (4)	T_PAH (U=0)	mg/kg											2.2				
2,3,4,6-Tetrachlorophenol	58-90-2	mg/kg															
2,4,5-Trichlorophenol	95-95-4	mg/kg											1.0 U				
2,4,6-Trichlorophenol	88-06-2	mg/kg											1.0 U				
2,4-Dichlorophenol	120-83-2	mg/kg											1.0 U				
2,4-Dimethylphenol	105-67-9	mg/kg											1.0 U				
2,4-Dinitrophenol	51-28-5	mg/kg											3.0 U				
2,6-Dichlorophenol	87-65-0	mg/kg															
2-Chlorophenol	95-57-8	mg/kg											1.0 U				
2-Methylphenol	95-48-7	mg/kg											1.0 U				
2-Nitrophenol	88-75-5	mg/kg											1.0 U				
3- & 4-Methylphenol	15831-10-4	mg/kg											2.0 U				
4,6-Dinitro-o-cresol	534-52-1	mg/kg											3.0 U				
4-Chloro-3-methylphenol	59-50-7	mg/kg											1.0 U				
4-Methylphenol	106-44-5	mg/kg															
4-Nitrophenol	100-02-7	mg/kg											3.0 U				
Pentachlorophenol	87-86-5	mg/kg											1.0 U				
Phenol	108-95-2	mg/kg											1.0 U				
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg											1.6 U				
Butyl benzyl phthalate	85-68-7	mg/kg											1.0 U				
Di-n-butyl phthalate	84-74-2	mg/kg											1.0 U				
Di-n-octyl phthalate	117-84-0	mg/kg											1.0 U				
Diethylphthalate	84-66-2	mg/kg											1.0 U				
Dimethyl phthalate	131-11-3	mg/kg											1.0 U				
2-Chloronaphthalene	91-58-7	mg/kg											0.10 U				
Aniline	62-53-3	mg/kg															
Azobenzene	103-33-3	mg/kg															
Benzoic acid	65-85-0	mg/kg											5.0 U				
Benzyl alcohol	100-51-6	mg/kg											1.0 U				
Bis(2-chloroethoxy)methane	111-91-1	mg/kg											0.10 U				
Bis-chloroisopropyl ether	108-60-1	mg/kg															
Carbazole	86-74-8	mg/kg											1.0 U				
Dibenzofuran	132-64-9	mg/kg											0.10 U				
Hexachlorobenzene	118-74-1	mg/kg											0.10 U				
Hexachlorobutadiene	87-68-3	mg/kg			0.25 U	0.25 U							0.10 U		0.25 U		
Hexachlorocyclopentadiene	77-47-4	mg/kg											0.30 U				
Isophorone	78-59-1	mg/kg											0.10 U				
N-Nitrosodimethylamine	62-75-9	mg/kg															
N-Nitroso-di-n-propylamine	621-64-7	mg/kg											0.10 U				
N-Nitrosodiphenylamine	86-30-6	mg/kg											0.10 U				

Table 3.3
In Situ Soil Data

		Location Name	MW-07	MW-08	MW-09	MW-10	MW-11	MW-12	P1	P2	P3	P4	P6		P7	P8	P9
		Sample Name	MW7-5	MW8-3	MW9-2.5	MW10-2.5	P17-10	MW12-2.5	P1-4	P2-4	P3-5	P4-8	P6-5	P6-8	P7-1	P8-3.5	P9-9.5
		Sample Date	3/8/2016	3/9/2016	3/8/2016	3/8/2016	3/9/2016	3/8/2016	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015
		Sample Depth	5 ft	3 ft	2.5 ft	2.5 ft	10 ft	2.5 ft	4 ft	4 ft	5 ft	8 ft	5 ft	8 ft	1 ft	3.5 ft	9.5 ft
Analyte	**CAS No.**	**Unit**															
Volatile Organic Compound (VOCs)																	
Benzene	71-43-2	mg/kg			0.030 U	0.030 U						0.020 U	0.030 U		0.030 U	0.020 U	0.020 U
Ethylbenzene	100-41-4	mg/kg			0.050 U	0.050 U						0.020 U	0.050 U		0.050 U	0.020 U	0.020 U
Toluene	108-88-3	mg/kg			0.050 U	0.050 U						0.020 U	0.050 U		0.050 U	0.020 U	0.020 U
Xylene (meta & para)	108-38-3/106-42-3	mg/kg			0.10 U	0.10 U							0.10 U		0.10 U		
Xylene (ortho)	95-47-6	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
Xylene (total)	1330-20-7	mg/kg			0.10 U	0.10 U						0.060 U	0.10 U		0.10 U	0.060 U	0.060 U
Chloroethane	75-00-3	mg/kg			0.50 U	0.50 U							0.50 U		0.50 U		
cis-1,2-Dichloroethene	156-59-2	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
Tetrachloroethene	127-18-4	mg/kg			0.025 U	0.025 U							0.025 U		0.025 U		
trans-1,2-Dichloroethene	156-60-5	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
Trichloroethene	79-01-6	mg/kg			0.020 U	0.020 U							0.020 U		0.020 U		
Vinyl chloride	75-01-4	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
1,1,1,2-Tetrachloroethane	630-20-6	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
1,1,1-Trichloroethane	71-55-6	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
1,1,2-Trichloroethane	79-00-5	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
1,1-Dichloroethane	75-34-3	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
1,1-Dichloroethene	75-35-4	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
1,1-Dichloropropene	563-58-6	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
1,2,3-Trichlorobenzene	87-61-6	mg/kg			0.25 U	0.25 U							0.25 U		0.25 U		
1,2,3-Trichloropropane	96-18-4	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
1,2,4-Trichlorobenzene	120-82-1	mg/kg			0.25 U	0.25 U							0.25 U		0.25 U		
1,2,4-Trimethylbenzene	95-63-6	mg/kg			0.050 U	0.050 U							0.055		0.050 U		
1,2-Dibromo-3-chloropropane	96-12-8	mg/kg			0.50 U	0.50 U							0.50 U		0.50 U		
1,2-Dibromoethane	106-93-4	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
1,2-Dichlorobenzene	95-50-1	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
1,2-Dichloroethane	107-06-2	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
1,2-Dichloropropane	78-87-5	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
1,3,5-Trimethylbenzene	108-67-8	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
1,3-Dichlorobenzene	541-73-1	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
1,3-Dichloropropane	142-28-9	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
1,4-Dichlorobenzene	106-46-7	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
2,2-Dichloropropane	594-20-7	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
2,4-Dinitrotoluene	121-14-2	mg/kg											0.50 U				
2,6-Dinitrotoluene	606-20-2	mg/kg											0.50 U				
2-Chlorotoluene	95-49-8	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
2-Hexanone	591-78-6	mg/kg			0.50 U	0.50 U							0.50 U		0.50 U		
2-Nitroaniline	88-74-4	mg/kg											0.50 U				
3,3'-Dichlorobenzidine	91-94-1	mg/kg															
3-Nitroaniline	99-09-2	mg/kg											10 U				
4-Chloroaniline	106-47-8	mg/kg											10 UJ				
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg											0.10 U				
4-Chlorotoluene	106-43-4	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
4-Nitroaniline	100-01-6	mg/kg											10 U				
Acetone	67-64-1	mg/kg			0.50 U	0.50 U							0.50 U		0.50 U		
Bis(2-chloroethyl)ether	111-44-4	mg/kg											0.10 U				
Bis(2-chloroisopropyl)ether	39638-32-9	mg/kg											0.10 U				
Bromobenzene	108-86-1	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		

Table 3.3
In Situ Soil Data

		Location Name	MW-07	MW-08	MW-09	MW-10	MW-11	MW-12	P1	P2	P3	P4	P6		P7	P8	P9
		Sample Name	MW7-5	MW8-3	MW9-2.5	MW10-2.5	P17-10	MW12-2.5	P1-4	P2-4	P3-5	P4-8	P6-5	P6-8	P7-1	P8-3.5	P9-9.5
		Sample Date	3/8/2016	3/9/2016	3/8/2016	3/8/2016	3/9/2016	3/8/2016	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015
		Sample Depth	5 ft	3 ft	2.5 ft	2.5 ft	10 ft	2.5 ft	4 ft	4 ft	5 ft	8 ft	5 ft	8 ft	1 ft	3.5 ft	9.5 ft
Analyte	**CAS No.**	**Unit**															
Volatile Organic Compound (VOCs) (cont.)																	
Bromochloromethane	74-97-5	mg/kg															
Bromodichloromethane	75-27-4	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
Bromoform	75-25-2	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
Bromomethane	74-83-9	mg/kg			0.50 U	0.50 U							0.50 U		0.50 U		
Carbon tetrachloride	56-23-5	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
Chlorobenzene	108-90-7	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
Chloroform	67-66-3	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
Chloromethane	74-87-3	mg/kg			0.50 U	0.50 U							0.50 U		0.50 U		
cis-1,3-Dichloropropene	10061-01-5	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
Cymene	99-87-6	mg/kg			0.050 U	0.050 U							0.23		0.050 U		
Dibromochloromethane	124-48-1	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
Dibromomethane	74-95-3	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
Dichlorodifluoromethane	75-71-8	mg/kg			0.50 U	0.50 U							0.50 U		0.50 U		
Hexachloroethane	67-72-1	mg/kg											0.10 U				
Isopropylbenzene	98-82-8	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
Methyl ethyl ketone	78-93-3	mg/kg			0.50 U	0.50 U							0.50 U		0.50 U		
Methyl isobutyl ketone	108-10-1	mg/kg			0.50 U	0.50 U							0.50 U		0.50 U		
Methylene chloride	75-09-2	mg/kg			0.50 U	0.50 U							0.50 U		0.50 U		
Methyl-tert-butyl ether	1634-04-4	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
n-Hexane	110-54-3	mg/kg			0.25 U	0.25 U											
Nitrobenzene	98-95-3	mg/kg											0.10 U				
n-Propylbenzene	103-65-1	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
Pyridine	110-86-1	mg/kg															
sec-Butylbenzene	135-98-8	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
Styrene	100-42-5	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
tert-Butylbenzene	98-06-6	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
trans-1,3-Dichloropropene	10061-02-6	mg/kg			0.050 U	0.050 U							0.050 U		0.050 U		
Trichlorofluoromethane	75-69-4	mg/kg			0.50 U	0.50 U							0.50 U		0.50 U		

Notes:

Blank cells are intentional
All results are rounded to two significant figures.
1 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.
2 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.
3 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.
4 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.
5 Result reported by HCID Analysis
6 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Table 708-2 of WAC 173-340-900.
7 Calculation was performed using only detected cPAH concentrations.
8 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

Abbreviations:

CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbon
ft Feet
mg/kg Milligrams per kilogram
MTCA Model Toxics Control Act
PAH Polycyclic aromatic hydrocarbons
PCB Polychlorinated biphenyl
TEQ Toxic equivalency

Qualifiers:

J Analyte was detected; concentration is an estimate.
U Analyte was not detected at the associated reporting limit.
UJ Analyte was not detected at the associated reporting limit, which is an estimate.

Table 3.3
In Situ Soil Data

		Location Name	P12	P13	P15	P18		P19		PP1-1	PP2-1	PP3-1	PP4-1	RT-B2	RT-B3	RT-ES2	RT-NS2
		Sample Name	P12-2	P13-5	P15-6	P18-2.5	P18-7.5	P19-4	P19-8	PP1-1	PP2-1	PP3-1	PP4-1	RT-B2-9.5	RT-B3-9.5	RT-ES2-3.5	RT-NS2-3.5
		Sample Date	4/21/2015	4/21/2015	3/9/2016	3/8/2016	3/8/2016	3/8/2016	3/8/2016	4/27/2017	4/27/2017	4/27/2017	4/27/2017	6/27/2018	6/27/2018	6/27/2018	6/27/2018
		Sample Depth	2 ft	5 ft	6 ft	2.5 ft	7.5 ft	4 ft	8 ft	1 ft	1 ft	1 ft	1 ft	9.5 ft	9.5 ft	3.5 ft	3.5 ft
Analyte	**CAS No.**	**Unit**															
Total Petroleum Hydrocarbons (TPHs)																	
Gasoline-range organics	GRO	mg/kg			2.0 UJ												
Diesel-range organics	DRO	mg/kg	50 U	50 U	50 U		50 U		50 U					50 U	50 U	50 U	50 U
Oil-range organics	ORO	mg/kg	250 U	250 U	250 U		250 U		250 U					250 U	250 U	250 U	250 U
Total DRO & ORO [4]	T_DRO&ORO (U=0)	mg/kg	250 U	250 U	250 U		250 U		250 U					250 U	250 U	250 U	250 U
Gasoline [5]	86290-81-5	mg/kg								20 U	20 U	20 U	20 U				
Diesel [5]	Dies	mg/kg								50 U	50 U	50 U	50 U				
Heavy Oil [5]	Oil_Heavy	mg/kg								250 U	250 U	250 U	250 U				
Metals																	
Arsenic	7440-38-2	mg/kg	9.0	1.4		5.6		3.1								3.0	6.9
Barium	7440-39-3	mg/kg	220	14		35											
Cadmium	7440-43-9	mg/kg	1.0 U	1.0 U		1.0 U		1.0 U								1.0 U	1.0 U
Chromium	7440-47-3	mg/kg	8.1	4.7		9.9											
Chromium(VI)	18540-29-9	mg/kg															
Copper	7440-50-8	mg/kg															
Lead	7439-92-1	mg/kg	480	3.3		3.2		2.4								2.1	5.7
Mercury	7439-97-6	mg/kg	1.0 U	1.0 U		1.0 U											
Selenium	7782-49-2	mg/kg	1.0 U	1.0 U		1.0 U											
Silver	7440-22-4	mg/kg	1.0 U	1.0 U		1.0 U											
Polychlorinated Biphenyls																	
Aroclor 1016	12674-11-2	mg/kg	0.020 U	0.020 U													
Aroclor 1221	11104-28-2	mg/kg	0.020 U	0.020 U													
Aroclor 1232	11141-16-5	mg/kg	0.020 U	0.020 U													
Aroclor 1242	53469-21-9	mg/kg	0.020 U	0.020 U													
Aroclor 1248	12672-29-6	mg/kg	0.020 U	0.020 U													
Aroclor 1254	11097-69-1	mg/kg	0.020 U	0.020 U													
Aroclor 1260	11096-82-5	mg/kg	0.020 U	0.020 U													
Aroclor 1262	37324-23-5	mg/kg	0.022	0.020 U													
Aroclor 1268	11100-14-4	mg/kg	0.020 U	0.020 U													
Total PCB Aroclors (U=0) [4]	T_PCB (U=0)	mg/kg	0.022	0.020 U													
Polybrominated Diphenyl Ethers (PBDEs)																	
PBDE-003	101-55-3	mg/kg															
Semi-Volatile Organic Compound (SVOCs)																	
1-Methylnaphthalene	90-12-0	mg/kg															
2-Methylnaphthalene	91-57-6	mg/kg															
Acenaphthene	83-32-9	mg/kg															
Acenaphthylene	208-96-8	mg/kg															
Anthracene	120-12-7	mg/kg															
Benzo(a)anthracene	56-55-3	mg/kg															
Benzo(a)pyrene	50-32-8	mg/kg															
Benzo(b)fluoranthene	205-99-2	mg/kg															
Benzo(g,h,i)perylene	191-24-2	mg/kg															
Benzo(k)fluoranthene	207-08-9	mg/kg															
Chrysene	218-01-9	mg/kg															
Dibenzo(a,h)anthracene	53-70-3	mg/kg															
Fluoranthene	206-44-0	mg/kg															
Fluorene	86-73-7	mg/kg															
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg															
Naphthalene	91-20-3	mg/kg	0.050 U	0.050 U		0.050 U											

Table 3.3
In Situ Soil Data

		Location Name	P12	P13	P15	P18		P19		PP1-1	PP2-1	PP3-1	PP4-1	RT-B2	RT-B3	RT-ES2	RT-NS2
		Sample Name	P12-2	P13-5	P15-6	P18-2.5	P18-7.5	P19-4	P19-8	PP1-1	PP2-1	PP3-1	PP4-1	RT-B2-9.5	RT-B3-9.5	RT-ES2-3.5	RT-NS2-3.5
		Sample Date	4/21/2015	4/21/2015	3/9/2016	3/8/2016	3/8/2016	3/8/2016	3/8/2016	4/27/2017	4/27/2017	4/27/2017	4/27/2017	6/27/2018	6/27/2018	6/27/2018	6/27/2018
		Sample Depth	2 ft	5 ft	6 ft	2.5 ft	7.5 ft	4 ft	8 ft	1 ft	1 ft	1 ft	1 ft	9.5 ft	9.5 ft	3.5 ft	3.5 ft
Analyte	**CAS No.**	**Unit**															
Semi-Volatile Organic Compound (SVOCs) (cont.)																	
Phenanthrene	85-01-8	mg/kg															
Pyrene	129-00-0	mg/kg															
Total Naphthalenes (U=0) (4)	T_Napth (U=0)	mg/kg															
cPAHs (MTCA TEQ-ZeroND) (6,7)	BaPEq (U=0)	mg/kg															
cPAHs (MTCA TEQ-HalfND) (5,8)	BaPEq (U=1/2)	mg/kg															
Total HPAH (U=0) (4)	T_HPAH (U=0)	mg/kg															
Total LPAH (U=0) (4)	T_LPAH (U=0)	mg/kg															
Total PAH (U=0) (4)	T_PAH (U=0)	mg/kg															
2,3,4,6-Tetrachlorophenol	58-90-2	mg/kg															
2,4,5-Trichlorophenol	95-95-4	mg/kg															
2,4,6-Trichlorophenol	88-06-2	mg/kg															
2,4-Dichlorophenol	120-83-2	mg/kg															
2,4-Dimethylphenol	105-67-9	mg/kg															
2,4-Dinitrophenol	51-28-5	mg/kg															
2,6-Dichlorophenol	87-65-0	mg/kg															
2-Chlorophenol	95-57-8	mg/kg															
2-Methylphenol	95-48-7	mg/kg															
2-Nitrophenol	88-75-5	mg/kg															
3- & 4-Methylphenol	15831-10-4	mg/kg															
4,6-Dinitro-o-cresol	534-52-1	mg/kg															
4-Chloro-3-methylphenol	59-50-7	mg/kg															
4-Methylphenol	106-44-5	mg/kg															
4-Nitrophenol	100-02-7	mg/kg															
Pentachlorophenol	87-86-5	mg/kg															
Phenol	108-95-2	mg/kg															
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg															
Butyl benzyl phthalate	85-68-7	mg/kg															
Di-n-butyl phthalate	84-74-2	mg/kg															
Di-n-octyl phthalate	117-84-0	mg/kg															
Diethylphthalate	84-66-2	mg/kg															
Dimethyl phthalate	131-11-3	mg/kg															
2-Chloronaphthalene	91-58-7	mg/kg															
Aniline	62-53-3	mg/kg															
Azobenzene	103-33-3	mg/kg															
Benzoic acid	65-85-0	mg/kg															
Benzyl alcohol	100-51-6	mg/kg															
Bis(2-chloroethoxy)methane	111-91-1	mg/kg															
Bis-chloroisopropyl ether	108-60-1	mg/kg															
Carbazole	86-74-8	mg/kg															
Dibenzofuran	132-64-9	mg/kg															
Hexachlorobenzene	118-74-1	mg/kg															
Hexachlorobutadiene	87-68-3	mg/kg	0.25 U	0.25 U		0.25 U											
Hexachlorocyclopentadiene	77-47-4	mg/kg															
Isophorone	78-59-1	mg/kg															
N-Nitrosodimethylamine	62-75-9	mg/kg															
N-Nitroso-di-n-propylamine	621-64-7	mg/kg															
N-Nitrosodiphenylamine	86-30-6	mg/kg															

Table 3.3
In Situ Soil Data

		Location Name	P12	P13	P15	P18		P19		PP1-1	PP2-1	PP3-1	PP4-1	RT-B2	RT-B3	RT-ES2	RT-NS2
		Sample Name	P12-2	P13-5	P15-6	P18-2.5	P18-7.5	P19-4	P19-8	PP1-1	PP2-1	PP3-1	PP4-1	RT-B2-9.5	RT-B3-9.5	RT-ES2-3.5	RT-NS2-3.5
		Sample Date	4/21/2015	4/21/2015	3/9/2016	3/8/2016	3/8/2016	3/8/2016	3/8/2016	4/27/2017	4/27/2017	4/27/2017	4/27/2017	6/27/2018	6/27/2018	6/27/2018	6/27/2018
		Sample Depth	2 ft	5 ft	6 ft	2.5 ft	7.5 ft	4 ft	8 ft	1 ft	1 ft	1 ft	1 ft	9.5 ft	9.5 ft	3.5 ft	3.5 ft
Analyte	**CAS No.**	**Unit**															
Volatile Organic Compound (VOCs)																	
Benzene	71-43-2	mg/kg	0.030 U	0.030 U	0.020 UJ	0.030 U				0.020 U	0.020 U	0.020 U	0.020 U				
Ethylbenzene	100-41-4	mg/kg	0.050 U	0.050 U	0.020 UJ	0.050 U				0.020 U	0.020 U	0.020 U	0.020 U				
Toluene	108-88-3	mg/kg	0.050 U	0.050 U	0.020 UJ	0.050 U				0.020 U	0.020 U	0.020 U	0.020 U				
Xylene (meta & para)	108-38-3/106-42-3	mg/kg	0.10 U	0.10 U		0.10 U											
Xylene (ortho)	95-47-6	mg/kg	0.050 U	0.050 U		0.050 U											
Xylene (total)	1330-20-7	mg/kg	0.10 U	0.10 U	0.060 UJ	0.10 U				0.060 U	0.060 U	0.060 U	0.060 U				
Chloroethane	75-00-3	mg/kg	0.50 U	0.50 U		0.50 U											
cis-1,2-Dichloroethene	156-59-2	mg/kg	0.050 U	0.050 U		0.050 U											
Tetrachloroethene	127-18-4	mg/kg	0.025 U	0.025 U		0.025 U											
trans-1,2-Dichloroethene	156-60-5	mg/kg	0.050 U	0.050 U		0.050 U											
Trichloroethene	79-01-6	mg/kg	0.020 U	0.020 U		0.020 U											
Vinyl chloride	75-01-4	mg/kg	0.050 U	0.050 U		0.050 U											
1,1,1,2-Tetrachloroethane	630-20-6	mg/kg	0.050 U	0.050 U		0.050 U											
1,1,1-Trichloroethane	71-55-6	mg/kg	0.050 U	0.050 U		0.050 U											
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg	0.050 U	0.050 U		0.050 U											
1,1,2-Trichloroethane	79-00-5	mg/kg	0.050 U	0.050 U		0.050 U											
1,1-Dichloroethane	75-34-3	mg/kg	0.050 U	0.050 U		0.050 U											
1,1-Dichloroethene	75-35-4	mg/kg	0.050 U	0.050 U		0.050 U											
1,1-Dichloropropene	563-58-6	mg/kg	0.050 U	0.050 U		0.050 U											
1,2,3-Trichlorobenzene	87-61-6	mg/kg	0.25 U	0.25 U		0.25 U											
1,2,3-Trichloropropane	96-18-4	mg/kg	0.050 U	0.050 U		0.050 U											
1,2,4-Trichlorobenzene	120-82-1	mg/kg	0.25 U	0.25 U		0.25 U											
1,2,4-Trimethylbenzene	95-63-6	mg/kg	0.050 U	0.050 U		0.050 U											
1,2-Dibromo-3-chloropropane	96-12-8	mg/kg	0.50 U	0.50 U		0.50 U											
1,2-Dibromoethane	106-93-4	mg/kg	0.050 U	0.050 U		0.050 U											
1,2-Dichlorobenzene	95-50-1	mg/kg	0.050 U	0.050 U		0.050 U											
1,2-Dichloroethane	107-06-2	mg/kg	0.050 U	0.050 U		0.050 U											
1,2-Dichloropropane	78-87-5	mg/kg	0.050 U	0.050 U		0.050 U											
1,3,5-Trimethylbenzene	108-67-8	mg/kg	0.050 U	0.050 U		0.050 U											
1,3-Dichlorobenzene	541-73-1	mg/kg	0.050 U	0.050 U		0.050 U											
1,3-Dichloropropane	142-28-9	mg/kg	0.050 U	0.050 U		0.050 U											
1,4-Dichlorobenzene	106-46-7	mg/kg	0.050 U	0.050 U		0.050 U											
2,2-Dichloropropane	594-20-7	mg/kg	0.050 U	0.050 U		0.050 U											
2,4-Dinitrotoluene	121-14-2	mg/kg															
2,6-Dinitrotoluene	606-20-2	mg/kg															
2-Chlorotoluene	95-49-8	mg/kg	0.050 U	0.050 U		0.050 U											
2-Hexanone	591-78-6	mg/kg	0.50 U	0.50 U		0.50 U											
2-Nitroaniline	88-74-4	mg/kg															
3,3'-Dichlorobenzidine	91-94-1	mg/kg															
3-Nitroaniline	99-09-2	mg/kg															
4-Chloroaniline	106-47-8	mg/kg															
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg															
4-Chlorotoluene	106-43-4	mg/kg	0.050 U	0.050 U		0.050 U											
4-Nitroaniline	100-01-6	mg/kg															
Acetone	67-64-1	mg/kg	0.50 U	0.50 U		0.50 U											
Bis(2-chloroethyl)ether	111-44-4	mg/kg															
Bis(2-chloroisopropyl)ether	39638-32-9	mg/kg															
Bromobenzene	108-86-1	mg/kg	0.050 U	0.050 U		0.050 U											

Table 3.3
In Situ Soil Data

		Location Name	P12	P13	P15	P18		P19		PP1-1	PP2-1	PP3-1	PP4-1	RT-B2	RT-B3	RT-ES2	RT-NS2
		Sample Name	P12-2	P13-5	P15-6	P18-2.5	P18-7.5	P19-4	P19-8	PP1-1	PP2-1	PP3-1	PP4-1	RT-B2-9.5	RT-B3-9.5	RT-ES2-3.5	RT-NS2-3.5
		Sample Date	4/21/2015	4/21/2015	3/9/2016	3/8/2016	3/8/2016	3/8/2016	3/8/2016	4/27/2017	4/27/2017	4/27/2017	4/27/2017	6/27/2018	6/27/2018	6/27/2018	6/27/2018
		Sample Depth	2 ft	5 ft	6 ft	2.5 ft	7.5 ft	4 ft	8 ft	1 ft	1 ft	1 ft	1 ft	9.5 ft	9.5 ft	3.5 ft	3.5 ft
Analyte	**CAS No.**	**Unit**															
Volatile Organic Compound (VOCs) (cont.)																	
Bromochloromethane	74-97-5	mg/kg															
Bromodichloromethane	75-27-4	mg/kg	0.050 U	0.050 U		0.050 U											
Bromoform	75-25-2	mg/kg	0.050 U	0.050 U		0.050 U											
Bromomethane	74-83-9	mg/kg	0.50 U	0.50 U		0.50 U											
Carbon tetrachloride	56-23-5	mg/kg	0.050 U	0.050 U		0.050 U											
Chlorobenzene	108-90-7	mg/kg	0.050 U	0.050 U		0.050 U											
Chloroform	67-66-3	mg/kg	0.050 U	0.050 U		0.050 U											
Chloromethane	74-87-3	mg/kg	0.50 U	0.50 U		0.50 U											
cis-1,3-Dichloropropene	10061-01-5	mg/kg	0.050 U	0.050 U		0.050 U											
Cymene	99-87-6	mg/kg	0.050 U	0.050 U		0.050 U											
Dibromochloromethane	124-48-1	mg/kg	0.050 U	0.050 U		0.050 U											
Dibromomethane	74-95-3	mg/kg	0.050 U	0.050 U		0.050 U											
Dichlorodifluoromethane	75-71-8	mg/kg	0.50 U	0.50 U		0.50 U											
Hexachloroethane	67-72-1	mg/kg															
Isopropylbenzene	98-82-8	mg/kg	0.050 U	0.050 U		0.050 U											
Methyl ethyl ketone	78-93-3	mg/kg	0.50 U	0.50 U		0.50 U											
Methyl isobutyl ketone	108-10-1	mg/kg	0.50 U	0.50 U		0.50 U											
Methylene chloride	75-09-2	mg/kg	0.50 U	0.50 U		0.50 U											
Methyl-tert-butyl ether	1634-04-4	mg/kg	0.050 U	0.050 U		0.050 U											
n-Hexane	110-54-3	mg/kg				0.25 U											
Nitrobenzene	98-95-3	mg/kg															
n-Propylbenzene	103-65-1	mg/kg	0.050 U	0.050 U		0.050 U											
Pyridine	110-86-1	mg/kg															
sec-Butylbenzene	135-98-8	mg/kg	0.050 U	0.050 U		0.050 U											
Styrene	100-42-5	mg/kg	0.050 U	0.050 U		0.050 U											
tert-Butylbenzene	98-06-6	mg/kg	0.050 U	0.050 U		0.050 U											
trans-1,3-Dichloropropene	10061-02-6	mg/kg	0.050 U	0.050 U		0.050 U											
Trichlorofluoromethane	75-69-4	mg/kg	0.50 U	0.50 U		0.50 U											

Notes:

Blank cells are intentional

All results are rounded to two significant figures.

1 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

2 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

3 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.

4 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

5 Result reported by HCID Analysis

6 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Table 708-2 of WAC 173-340-900.

7 Calculation was performed using only detected cPAH concentrations.

8 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

Abbreviations:

CAS Chemical Abstracts Service

cPAH Carcinogenic polycyclic aromatic hydrocarbon

ft Feet

mg/kg Milligrams per kilogram

MTCA Model Toxics Control Act

PAH Polycyclic aromatic hydrocarbons

PCB Polychlorinated biphenyl

TEQ Toxic equivalency

Qualifiers:

J Analyte was detected; concentration is an estimate.

U Analyte was not detected at the associated reporting limit.

UJ Analyte was not detected at the associated reporting limit, which is an estimate.

Table 3.3
In Situ Soil Data

		Location Name	RT-SS2	RT-WS2	SB-02	SB-04	SB-05	SB-06	SB-08	SB-11	SB-12	SB-14	TP1-B1	TP1-E1	TP1-W1
		Sample Name	**RT-SS2-3.5**	**RT-WS2-3.5**	**SB-02-6-6.5**	**SB-04-3-4**	**SB-05-3-4**	**SB-06-5-6**	**SB-08-8-8.5**	**SB-11-3-4**	**SB-12-6.5-7.5**	**SB-14-7-8**	**TP1-B1-1.5**	**TP1-E1-1**	**TP1-W1-1**
		Sample Date	**6/27/2018**	**6/27/2018**	**12/4/2003**	**12/4/2003**	**12/4/2003**	**12/4/2003**	**12/4/2003**	**12/4/2003**	**12/4/2003**	**12/12/2003**	**6/27/2018**	**6/27/2018**	**6/27/2018**
		Sample Depth	**3.5 ft**	**3.5 ft**	**6-6.5 ft**	**3-4 ft**	**3-4 ft**	**5-6 ft**	**8-8.5 ft**	**3-4 ft**	**6.5-7.5 ft**	**7-8 ft**	**1.5 ft**	**1 ft**	**1 ft**
Analyte	**CAS No.**	**Unit**													
Total Petroleum Hydrocarbons (TPHs)															
Gasoline-range organics	GRO	mg/kg			3.0 U	3.0 U			3.0 U		3.0 U	3.0 U			
Diesel-range organics	DRO	mg/kg	50 U	50 U	25 U	41 (3)			25 U		25 U	25 U			
Oil-range organics	ORO	mg/kg	250 U	250 U	50 U	570			50 U		50 U	50 U			
Total DRO & ORO (4)	T_DRO&ORO (U=0)	mg/kg	250 U	250 U	50 U	610			50 U		50 U	50 U			
Gasoline (5)	86290-81-5	mg/kg													
Diesel (5)	Dies	mg/kg													
Heavy Oil (5)	Oil_Heavy	mg/kg													
Metals															
Arsenic	7440-38-2	mg/kg	3.7	5.6		3.7 U				4.9 U			8.7	8.4	8.6
Barium	7440-39-3	mg/kg				64				62					
Cadmium	7440-43-9	mg/kg	1.0 U	1.0 U		0.46 U				0.61 U			1.0 U	1.0 U	1.0 U
Chromium	7440-47-3	mg/kg				15				13					
Chromium(VI)	18540-29-9	mg/kg													
Copper	7440-50-8	mg/kg													
Lead	7439-92-1	mg/kg	2.7	3.4	4.2 U	38				110			160	220	210
Mercury	7439-97-6	mg/kg				0.070				0.10					
Selenium	7782-49-2	mg/kg				3.7 U				4.9 U					
Silver	7440-22-4	mg/kg				2.8 U				3.7 U					
Polychlorinated Biphenyls															
Aroclor 1016	12674-11-2	mg/kg				0.10 U									
Aroclor 1221	11104-28-2	mg/kg				0.10 U									
Aroclor 1232	11141-16-5	mg/kg				0.10 U									
Aroclor 1242	53469-21-9	mg/kg				0.10 U									
Aroclor 1248	12672-29-6	mg/kg				0.10 U									
Aroclor 1254	11097-69-1	mg/kg				0.10 U									
Aroclor 1260	11096-82-5	mg/kg				0.10 U									
Aroclor 1262	37324-23-5	mg/kg													
Aroclor 1268	11100-14-4	mg/kg													
Total PCB Aroclors (U=0) (4)	T_PCB (U=0)	mg/kg				0.10 U									
Polybrominated Diphenyl Ethers (PBDEs)															
PBDE-003	101-55-3	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Semi-Volatile Organic Compound (SVOCs)															
1-Methylnaphthalene	90-12-0	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
2-Methylnaphthalene	91-57-6	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Acenaphthene	83-32-9	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Acenaphthylene	208-96-8	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Anthracene	120-12-7	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Benzo(a)anthracene	56-55-3	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Benzo(a)pyrene	50-32-8	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Benzo(b)fluoranthene	205-99-2	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Benzo(g,h,i)perylene	191-24-2	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Benzo(k)fluoranthene	207-08-9	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Chrysene	218-01-9	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Dibenzo(a,h)anthracene	53-70-3	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Fluoranthene	206-44-0	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Fluorene	86-73-7	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Naphthalene	91-20-3	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					

Table 3.3
In Situ Soil Data

		Location Name	RT-SS2	RT-WS2	SB-02	SB-04	SB-05	SB-06	SB-08	SB-11	SB-12	SB-14	TP1-B1	TP1-E1	TP1-W1
		Sample Name	RT-SS2-3.5	RT-WS2-3.5	SB-02-6-6.5	SB-04-3-4	SB-05-3-4	SB-06-5-6	SB-08-8-8.5	SB-11-3-4	SB-12-6.5-7.5	SB-14-7-8	TP1-B1-1.5	TP1-E1-1	TP1-W1-1
		Sample Date	6/27/2018	6/27/2018	12/4/2003	12/4/2003	12/4/2003	12/4/2003	12/4/2003	12/4/2003	12/4/2003	12/12/2003	6/27/2018	6/27/2018	6/27/2018
		Sample Depth	3.5 ft	3.5 ft	6-6.5 ft	3-4 ft	3-4 ft	5-6 ft	8-8.5 ft	3-4 ft	6.5-7.5 ft	7-8 ft	1.5 ft	1 ft	1 ft
Analyte	**CAS No.**	**Unit**													
Semi-Volatile Organic Compound (SVOCs) (cont.)															
Phenanthrene	85-01-8	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Pyrene	129-00-0	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Total Naphthalenes (U=0) (4)	T_Napth (U=0)	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
cPAHs (MTCA TEQ-ZeroND) (6,7)	BaPEq (U=0)	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
cPAHs (MTCA TEQ-HalfND) (5,8)	BaPEq (U=1/2)	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Total HPAH (U=0) (4)	T_HPAH (U=0)	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Total LPAH (U=0) (4)	T_LPAH (U=0)	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Total PAH (U=0) (4)	T_PAH (U=0)	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
2,3,4,6-Tetrachlorophenol	58-90-2	mg/kg				1.5 U	0.25 U	0.25 U		0.25 U					
2,4,5-Trichlorophenol	95-95-4	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
2,4,6-Trichlorophenol	88-06-2	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
2,4-Dichlorophenol	120-83-2	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
2,4-Dimethylphenol	105-67-9	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
2,4-Dinitrophenol	51-28-5	mg/kg				3.0 U	0.50 U	0.50 U		0.50 U					
2,6-Dichlorophenol	87-65-0	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
2-Chlorophenol	95-57-8	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
2-Methylphenol	95-48-7	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
2-Nitrophenol	88-75-5	mg/kg				1.5 U	0.25 U	0.25 U		0.25 U					
3- & 4-Methylphenol	15831-10-4	mg/kg													
4,6-Dinitro-o-cresol	534-52-1	mg/kg				3.0 U	0.50 U	0.50 U		0.50 U					
4-Chloro-3-methylphenol	59-50-7	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
4-Methylphenol	106-44-5	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
4-Nitrophenol	100-02-7	mg/kg				3.0 U	0.50 U	0.50 U		0.50 U					
Pentachlorophenol	87-86-5	mg/kg				3.0 U	0.50 U	0.50 U		0.50 U					
Phenol	108-95-2	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg				1.0 U	0.13 U	0.13 U		0.13 U					
Butyl benzyl phthalate	85-68-7	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Di-n-butyl phthalate	84-74-2	mg/kg				1.0 U	0.13 U	0.13 U		0.13 U					
Di-n-octyl phthalate	117-84-0	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Diethylphthalate	84-66-2	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Dimethyl phthalate	131-11-3	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
2-Chloronaphthalene	91-58-7	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Aniline	62-53-3	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Azobenzene	103-33-3	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Benzoic acid	65-85-0	mg/kg				6.0 U	1.0 U	1.0 U		1.0 U					
Benzyl alcohol	100-51-6	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Bis(2-chloroethoxy)methane	111-91-1	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Bis-chloroisopropyl ether	108-60-1	mg/kg													
Carbazole	86-74-8	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Dibenzofuran	132-64-9	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Hexachlorobenzene	118-74-1	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Hexachlorobutadiene	87-68-3	mg/kg			0.010 U	0.60 U	0.10 U	0.10 U		0.10 U					
Hexachlorocyclopentadiene	77-47-4	mg/kg				3.0 U	0.50 U	0.50 U		0.50 U					
Isophorone	78-59-1	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
N-Nitrosodimethylamine	62-75-9	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
N-Nitroso-di-n-propylamine	621-64-7	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
N-Nitrosodiphenylamine	86-30-6	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					

Table 3.3
In Situ Soil Data

Location Name			RT-SS2	RT-WS2	SB-02	SB-04	SB-05	SB-06	SB-08	SB-11	SB-12	SB-14	TP1-B1	TP1-E1	TP1-W1
Sample Name			RT-SS2-3.5	RT-WS2-3.5	SB-02-6-6.5	SB-04-3-4	SB-05-3-4	SB-06-5-6	SB-08-8-8.5	SB-11-3-4	SB-12-6.5-7.5	SB-14-7-8	TP1-B1-1.5	TP1-E1-1	TP1-W1-1
Sample Date			6/27/2018	6/27/2018	12/4/2003	12/4/2003	12/4/2003	12/4/2003	12/4/2003	12/4/2003	12/4/2003	12/12/2003	6/27/2018	6/27/2018	6/27/2018
Sample Depth			3.5 ft	3.5 ft	6-6.5 ft	3-4 ft	3-4 ft	5-6 ft	8-8.5 ft	3-4 ft	6.5-7.5 ft	7-8 ft	1.5 ft	1 ft	1 ft
Analyte	**CAS No.**	**Unit**													
Volatile Organic Compound (VOCs)															
Benzene	71-43-2	mg/kg			0.030 U	0.030 U			0.030 U		0.030 U	0.030 U			
Ethylbenzene	100-41-4	mg/kg			0.050 U	0.050 U			0.050 U		0.050 U	0.050 U			
Toluene	108-88-3	mg/kg			0.050 U	0.050 U			0.050 U		0.050 U	0.050 U			
Xylene (meta & para)	108-38-3/106-42-3	mg/kg													
Xylene (ortho)	95-47-6	mg/kg													
Xylene (total)	1330-20-7	mg/kg			0.20 U	0.20 U			0.20 U		0.20 U	0.20 U			
Chloroethane	75-00-3	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					
cis-1,2-Dichloroethene	156-59-2	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					
Tetrachloroethene	127-18-4	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					
trans-1,2-Dichloroethene	156-60-5	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					
Trichloroethene	79-01-6	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					
Vinyl chloride	75-01-4	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					
1,1,1,2-Tetrachloroethane	630-20-6	mg/kg													
1,1,1-Trichloroethane	71-55-6	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					
1,1,2-Trichloroethane	79-00-5	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					
1,1-Dichloroethane	75-34-3	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					
1,1-Dichloroethene	75-35-4	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					
1,1-Dichloropropene	563-58-6	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					
1,2,3-Trichlorobenzene	87-61-6	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					
1,2,3-Trichloropropane	96-18-4	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					
1,2,4-Trichlorobenzene	120-82-1	mg/kg			0.010 U	0.60 U	0.010 U	0.010 U		0.010 U					
1,2,4-Trimethylbenzene	95-63-6	mg/kg													
1,2-Dibromo-3-chloropropane	96-12-8	mg/kg			0.050 U		0.050 U	0.050 U		0.050 U					
1,2-Dibromoethane	106-93-4	mg/kg			0.0050 U		0.0050 U	0.0050 U		0.0050 U					
1,2-Dichlorobenzene	95-50-1	mg/kg			0.010 U	0.60 U	0.010 U	0.010 U		0.010 U					
1,2-Dichloroethane	107-06-2	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					
1,2-Dichloropropane	78-87-5	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					
1,3,5-Trimethylbenzene	108-67-8	mg/kg													
1,3-Dichlorobenzene	541-73-1	mg/kg			0.010 U	0.60 U	0.010 U	0.010 U		0.010 U					
1,3-Dichloropropane	142-28-9	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					
1,4-Dichlorobenzene	106-46-7	mg/kg			0.010 U	0.60 U	0.010 U	0.010 U		0.010 U					
2,2-Dichloropropane	594-20-7	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					
2,4-Dinitrotoluene	121-14-2	mg/kg				1.5 U	0.25 U	0.25 U		0.25 U					
2,6-Dinitrotoluene	606-20-2	mg/kg				1.5 U	0.25 U	0.25 U		0.25 U					
2-Chlorotoluene	95-49-8	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					
2-Hexanone	591-78-6	mg/kg													
2-Nitroaniline	88-74-4	mg/kg				1.5 U	0.25 U	0.25 U		0.25 U					
3,3'-Dichlorobenzidine	91-94-1	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
3-Nitroaniline	99-09-2	mg/kg				1.5 U	0.25 U	0.25 U		0.25 U					
4-Chloroaniline	106-47-8	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
4-Chlorotoluene	106-43-4	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					
4-Nitroaniline	100-01-6	mg/kg				0.25 U	0.25 U	0.25 U		0.25 U					
Acetone	67-64-1	mg/kg													
Bis(2-chloroethyl)ether	111-44-4	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Bis(2-chloroisopropyl)ether	39638-32-9	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Bromobenzene	108-86-1	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					

Table 3.3
In Situ Soil Data

		Location Name	RT-SS2	RT-WS2	SB-02	SB-04	SB-05	SB-06	SB-08	SB-11	SB-12	SB-14	TP1-B1	TP1-E1	TP1-W1
		Sample Name	RT-SS2-3.5	RT-WS2-3.5	SB-02-6-6.5	SB-04-3-4	SB-05-3-4	SB-06-5-6	SB-08-8-8.5	SB-11-3-4	SB-12-6.5-7.5	SB-14-7-8	TP1-B1-1.5	TP1-E1-1	TP1-W1-1
		Sample Date	6/27/2018	6/27/2018	12/4/2003	12/4/2003	12/4/2003	12/4/2003	12/4/2003	12/4/2003	12/4/2003	12/12/2003	6/27/2018	6/27/2018	6/27/2018
		Sample Depth	3.5 ft	3.5 ft	6-6.5 ft	3-4 ft	3-4 ft	5-6 ft	8-8.5 ft	3-4 ft	6.5-7.5 ft	7-8 ft	1.5 ft	1 ft	1 ft
Analyte	**CAS No.**	**Unit**													
Volatile Organic Compound (VOCs) (cont.)															
Bromochloromethane	74-97-5	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					
Bromodichloromethane	75-27-4	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					
Bromoform	75-25-2	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					
Bromomethane	74-83-9	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					
Carbon tetrachloride	56-23-5	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					
Chlorobenzene	108-90-7	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					
Chloroform	67-66-3	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					
Chloromethane	74-87-3	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					
cis-1,3-Dichloropropene	10061-01-5	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					
Cymene	99-87-6	mg/kg													
Dibromochloromethane	124-48-1	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					
Dibromomethane	74-95-3	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					
Dichlorodifluoromethane	75-71-8	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					
Hexachloroethane	67-72-1	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
Isopropylbenzene	98-82-8	mg/kg													
Methyl ethyl ketone	78-93-3	mg/kg													
Methyl isobutyl ketone	108-10-1	mg/kg													
Methylene chloride	75-09-2	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					
Methyl-tert-butyl ether	1634-04-4	mg/kg													
n-Hexane	110-54-3	mg/kg													
Nitrobenzene	98-95-3	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
n-Propylbenzene	103-65-1	mg/kg													
Pyridine	110-86-1	mg/kg				0.60 U	0.10 U	0.10 U		0.10 U					
sec-Butylbenzene	135-98-8	mg/kg													
Styrene	100-42-5	mg/kg													
tert-Butylbenzene	98-06-6	mg/kg													
trans-1,3-Dichloropropene	10061-02-6	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					
Trichlorofluoromethane	75-69-4	mg/kg			0.010 U		0.010 U	0.010 U		0.010 U					

Notes:

Blank cells are intentional

All results are rounded to two significant figures.

1 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

2 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

3 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.

4 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

5 Result reported by HCID Analysis

6 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Table 708-2 of WAC 173-340-900.

7 Calculation was performed using only detected cPAH concentrations.

8 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

Abbreviations:

CAS Chemical Abstracts Service

cPAH Carcinogenic polycyclic aromatic hydrocarbon

ft Feet

mg/kg Milligrams per kilogram

MTCA Model Toxics Control Act

PAH Polycyclic aromatic hydrocarbons

PCB Polychlorinated biphenyl

TEQ Toxic equivalency

Qualifiers:

J Analyte was detected; concentration is an estimate.

U Analyte was not detected at the associated reporting limit.

UJ Analyte was not detected at the associated reporting limit, which is an estimate.

Table 3.3
In Situ Soil Data

		Location Name	TP2				TP3				TP4				TP5-B1	TP5-B2
		Sample Name	TP2-1	TP2-2	TP2-3	TP2-4	TP3-1	TP3-2	TP3-3	TP3-4	TP4-1	TP4-2	TP4-3	TP4-4	TP5-B1-5	TP5-B2-5
		Sample Date	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	6/27/2018	6/27/2018
		Sample Depth	1 ft	2 ft	3 ft	4 ft	1 ft	2 ft	3 ft	4 ft	1 ft	2 ft	3 ft	4 ft	5 ft	5 ft
Analyte	**CAS No.**	**Unit**														
Total Petroleum Hydrocarbons (TPHs)																
Gasoline-range organics	GRO	mg/kg														
Diesel-range organics	DRO	mg/kg														
Oil-range organics	ORO	mg/kg														
Total DRO & ORO (4)	T_DRO&ORO (U=0)	mg/kg														
Gasoline (5)	86290-81-5	mg/kg														
Diesel (5)	Dies	mg/kg														
Heavy Oil (5)	Oil_Heavy	mg/kg														
Metals																
Arsenic	7440-38-2	mg/kg	7.5	4.2		3.6	15	18		2.7	6.8	6.9	5.6		5.9	12
Barium	7440-39-3	mg/kg														
Cadmium	7440-43-9	mg/kg	1.0 U	1.0 U	1.0 U	1.0 U	2.0	1.4	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chromium	7440-47-3	mg/kg	11				32					10				
Chromium(VI)	18540-29-9	mg/kg					0.52 U									
Copper	7440-50-8	mg/kg														
Lead	7439-92-1	mg/kg		93	20		2.6	320	540		3.6	15	25	5.2	6.8	130
Mercury	7439-97-6	mg/kg														
Selenium	7782-49-2	mg/kg														
Silver	7440-22-4	mg/kg														
Polychlorinated Biphenyls																
Aroclor 1016	12674-11-2	mg/kg														
Aroclor 1221	11104-28-2	mg/kg														
Aroclor 1232	11141-16-5	mg/kg														
Aroclor 1242	53469-21-9	mg/kg														
Aroclor 1248	12672-29-6	mg/kg														
Aroclor 1254	11097-69-1	mg/kg														
Aroclor 1260	11096-82-5	mg/kg														
Aroclor 1262	37324-23-5	mg/kg														
Aroclor 1268	11100-14-4	mg/kg														
Total PCB Aroclors (U=0) (4)	T_PCB (U=0)	mg/kg														
Polybrominated Diphenyl Ethers (PBDEs)																
PBDE-003	101-55-3	mg/kg														
Semi-Volatile Organic Compound (SVOCs)																
1-Methylnaphthalene	90-12-0	mg/kg														
2-Methylnaphthalene	91-57-6	mg/kg														
Acenaphthene	83-32-9	mg/kg														
Acenaphthylene	208-96-8	mg/kg														
Anthracene	120-12-7	mg/kg														
Benzo(a)anthracene	56-55-3	mg/kg														
Benzo(a)pyrene	50-32-8	mg/kg														
Benzo(b)fluoranthene	205-99-2	mg/kg														
Benzo(g,h,i)perylene	191-24-2	mg/kg														
Benzo(k)fluoranthene	207-08-9	mg/kg														
Chrysene	218-01-9	mg/kg														
Dibenzo(a,h)anthracene	53-70-3	mg/kg														
Fluoranthene	206-44-0	mg/kg														
Fluorene	86-73-7	mg/kg														
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg														
Naphthalene	91-20-3	mg/kg	0.050 U													

Table 3.3
In Situ Soil Data

		Location Name	TP2				TP3				TP4				TP5-B1	TP5-B2
		Sample Name	TP2-1	TP2-2	TP2-3	TP2-4	TP3-1	TP3-2	TP3-3	TP3-4	TP4-1	TP4-2	TP4-3	TP4-4	TP5-B1-5	TP5-B2-5
		Sample Date	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	6/27/2018	6/27/2018
		Sample Depth	1 ft	2 ft	3 ft	4 ft	1 ft	2 ft	3 ft	4 ft	1 ft	2 ft	3 ft	4 ft	5 ft	5 ft
Analyte	**CAS No.**	**Unit**														
Semi-Volatile Organic Compound (SVOCs) (cont.)																
Phenanthrene	85-01-8	mg/kg														
Pyrene	129-00-0	mg/kg														
Total Naphthalenes (U=0) (4)	T_Napth (U=0)	mg/kg														
cPAHs (MTCA TEQ-ZeroND) (6,7)	BaPEq (U=0)	mg/kg														
cPAHs (MTCA TEQ-HalfND) (5,8)	BaPEq (U=1/2)	mg/kg														
Total HPAH (U=0) (4)	T_HPAH (U=0)	mg/kg														
Total LPAH (U=0) (4)	T_LPAH (U=0)	mg/kg														
Total PAH (U=0) (4)	T_PAH (U=0)	mg/kg														
2,3,4,6-Tetrachlorophenol	58-90-2	mg/kg														
2,4,5-Trichlorophenol	95-95-4	mg/kg														
2,4,6-Trichlorophenol	88-06-2	mg/kg														
2,4-Dichlorophenol	120-83-2	mg/kg														
2,4-Dimethylphenol	105-67-9	mg/kg														
2,4-Dinitrophenol	51-28-5	mg/kg														
2,6-Dichlorophenol	87-65-0	mg/kg														
2-Chlorophenol	95-57-8	mg/kg														
2-Methylphenol	95-48-7	mg/kg														
2-Nitrophenol	88-75-5	mg/kg														
3- & 4-Methylphenol	15831-10-4	mg/kg														
4,6-Dinitro-o-cresol	534-52-1	mg/kg														
4-Chloro-3-methylphenol	59-50-7	mg/kg														
4-Methylphenol	106-44-5	mg/kg														
4-Nitrophenol	100-02-7	mg/kg														
Pentachlorophenol	87-86-5	mg/kg														
Phenol	108-95-2	mg/kg														
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg														
Butyl benzyl phthalate	85-68-7	mg/kg														
Di-n-butyl phthalate	84-74-2	mg/kg														
Di-n-octyl phthalate	117-84-0	mg/kg														
Diethylphthalate	84-66-2	mg/kg														
Dimethyl phthalate	131-11-3	mg/kg														
2-Chloronaphthalene	91-58-7	mg/kg														
Aniline	62-53-3	mg/kg														
Azobenzene	103-33-3	mg/kg														
Benzoic acid	65-85-0	mg/kg														
Benzyl alcohol	100-51-6	mg/kg														
Bis(2-chloroethoxy)methane	111-91-1	mg/kg														
Bis-chloroisopropyl ether	108-60-1	mg/kg														
Carbazole	86-74-8	mg/kg														
Dibenzofuran	132-64-9	mg/kg														
Hexachlorobenzene	118-74-1	mg/kg														
Hexachlorobutadiene	87-68-3	mg/kg														
Hexachlorocyclopentadiene	77-47-4	mg/kg														
Isophorone	78-59-1	mg/kg														
N-Nitrosodimethylamine	62-75-9	mg/kg														
N-Nitroso-di-n-propylamine	621-64-7	mg/kg														
N-Nitrosodiphenylamine	86-30-6	mg/kg														

Table 3.3
In Situ Soil Data

		Location Name	TP2				TP3				TP4				TP5-B1	TP5-B2
		Sample Name	TP2-1	TP2-2	TP2-3	TP2-4	TP3-1	TP3-2	TP3-3	TP3-4	TP4-1	TP4-2	TP4-3	TP4-4	TP5-B1-5	TP5-B2-5
		Sample Date	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	6/27/2018	6/27/2018
		Sample Depth	1 ft	2 ft	3 ft	4 ft	1 ft	2 ft	3 ft	4 ft	1 ft	2 ft	3 ft	4 ft	5 ft	5 ft
Analyte	**CAS No.**	**Unit**														
Volatile Organic Compound (VOCs)																
Benzene	71-43-2	mg/kg														
Ethylbenzene	100-41-4	mg/kg														
Toluene	108-88-3	mg/kg														
Xylene (meta & para)	108-38-3/106-42-3	mg/kg														
Xylene (ortho)	95-47-6	mg/kg														
Xylene (total)	1330-20-7	mg/kg														
Chloroethane	75-00-3	mg/kg														
cis-1,2-Dichloroethene	156-59-2	mg/kg														
Tetrachloroethene	127-18-4	mg/kg														
trans-1,2-Dichloroethene	156-60-5	mg/kg														
Trichloroethene	79-01-6	mg/kg														
Vinyl chloride	75-01-4	mg/kg														
1,1,1,2-Tetrachloroethane	630-20-6	mg/kg														
1,1,1-Trichloroethane	71-55-6	mg/kg														
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg														
1,1,2-Trichloroethane	79-00-5	mg/kg														
1,1-Dichloroethane	75-34-3	mg/kg														
1,1-Dichloroethene	75-35-4	mg/kg														
1,1-Dichloropropene	563-58-6	mg/kg														
1,2,3-Trichlorobenzene	87-61-6	mg/kg														
1,2,3-Trichloropropane	96-18-4	mg/kg														
1,2,4-Trichlorobenzene	120-82-1	mg/kg														
1,2,4-Trimethylbenzene	95-63-6	mg/kg														
1,2-Dibromo-3-chloropropane	96-12-8	mg/kg														
1,2-Dibromoethane	106-93-4	mg/kg														
1,2-Dichlorobenzene	95-50-1	mg/kg														
1,2-Dichloroethane	107-06-2	mg/kg														
1,2-Dichloropropane	78-87-5	mg/kg														
1,3,5-Trimethylbenzene	108-67-8	mg/kg														
1,3-Dichlorobenzene	541-73-1	mg/kg														
1,3-Dichloropropane	142-28-9	mg/kg														
1,4-Dichlorobenzene	106-46-7	mg/kg														
2,2-Dichloropropane	594-20-7	mg/kg														
2,4-Dinitrotoluene	121-14-2	mg/kg														
2,6-Dinitrotoluene	606-20-2	mg/kg														
2-Chlorotoluene	95-49-8	mg/kg														
2-Hexanone	591-78-6	mg/kg														
2-Nitroaniline	88-74-4	mg/kg														
3,3'-Dichlorobenzidine	91-94-1	mg/kg														
3-Nitroaniline	99-09-2	mg/kg														
4-Chloroaniline	106-47-8	mg/kg														
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg														
4-Chlorotoluene	106-43-4	mg/kg														
4-Nitroaniline	100-01-6	mg/kg														
Acetone	67-64-1	mg/kg														
Bis(2-chloroethyl)ether	111-44-4	mg/kg														
Bis(2-chloroisopropyl)ether	39638-32-9	mg/kg														
Bromobenzene	108-86-1	mg/kg														

Table 3.3
In Situ Soil Data

		Location Name	TP2				TP3				TP4				TP5-B1	TP5-B2
		Sample Name	TP2-1	TP2-2	TP2-3	TP2-4	TP3-1	TP3-2	TP3-3	TP3-4	TP4-1	TP4-2	TP4-3	TP4-4	TP5-B1-5	TP5-B2-5
		Sample Date	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	6/27/2018	6/27/2018
		Sample Depth	1 ft	2 ft	3 ft	4 ft	1 ft	2 ft	3 ft	4 ft	1 ft	2 ft	3 ft	4 ft	5 ft	5 ft
Analyte	CAS No.	Unit														
Volatile Organic Compound (VOCs) (cont.)																
Bromochloromethane	74-97-5	mg/kg														
Bromodichloromethane	75-27-4	mg/kg														
Bromoform	75-25-2	mg/kg														
Bromomethane	74-83-9	mg/kg														
Carbon tetrachloride	56-23-5	mg/kg														
Chlorobenzene	108-90-7	mg/kg														
Chloroform	67-66-3	mg/kg														
Chloromethane	74-87-3	mg/kg														
cis-1,3-Dichloropropene	10061-01-5	mg/kg														
Cymene	99-87-6	mg/kg														
Dibromochloromethane	124-48-1	mg/kg														
Dibromomethane	74-95-3	mg/kg														
Dichlorodifluoromethane	75-71-8	mg/kg														
Hexachloroethane	67-72-1	mg/kg														
Isopropylbenzene	98-82-8	mg/kg														
Methyl ethyl ketone	78-93-3	mg/kg														
Methyl isobutyl ketone	108-10-1	mg/kg														
Methylene chloride	75-09-2	mg/kg														
Methyl-tert-butyl ether	1634-04-4	mg/kg														
n-Hexane	110-54-3	mg/kg														
Nitrobenzene	98-95-3	mg/kg														
n-Propylbenzene	103-65-1	mg/kg														
Pyridine	110-86-1	mg/kg														
sec-Butylbenzene	135-98-8	mg/kg														
Styrene	100-42-5	mg/kg														
tert-Butylbenzene	98-06-6	mg/kg														
trans-1,3-Dichloropropene	10061-02-6	mg/kg														
Trichlorofluoromethane	75-69-4	mg/kg														

Notes:

Blank cells are intentional

All results are rounded to two significant figures.

1 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

2 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

3 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.

4 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

5 Result reported by HCID Analysis

6 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Table 708-2 of WAC 173-340-900.

7 Calculation was performed using only detected cPAH concentrations.

8 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

Abbreviations:

CAS Chemical Abstracts Service

cPAH Carcinogenic polycyclic aromatic hydrocarbon

ft Feet

mg/kg Milligrams per kilogram

MTCA Model Toxics Control Act

PAH Polycyclic aromatic hydrocarbons

PCB Polychlorinated biphenyl

TEQ Toxic equivalency

Qualifiers:

J Analyte was detected; concentration is an estimate.

U Analyte was not detected at the associated reporting limit.

UJ Analyte was not detected at the associated reporting limit, which is an estimate.

Table 3.3
In Situ Soil Data

		Location Name	TP5-B3	TP5-B4	TP5-E1	TP5-E2	TP5-E3	TP5-E4	TP5-N1	TP5-N3	TP5-N4	TP5-N5	TP5-S1	TP5-S2	TP5-W1	TP5-W2
		Sample Name	TP5-B3-5	TP5-B4-3.5	TP5-E1-5	TP5-E2-5	TP5-E3-3	TP5-E4-2.5	TP5-N1-3	TP5-N3-3	TP5-N4-2.5	TP5-N5-3	TP5-S1-5	TP5-S2-5	TP5-W1-5	TP5-W2-5
		Sample Date	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018
		Sample Depth	5 ft	3.5 ft	5 ft	5 ft	3 ft	2.5 ft	3 ft	3 ft	2.5 ft	3 ft	5 ft	5 ft	5 ft	5 ft
Analyte	**CAS No.**	**Unit**														
Total Petroleum Hydrocarbons (TPHs)																
Gasoline-range organics	GRO	mg/kg														
Diesel-range organics	DRO	mg/kg														
Oil-range organics	ORO	mg/kg														
Total DRO & ORO (4)	T_DRO&ORO (U=0)	mg/kg														
Gasoline (5)	86290-81-5	mg/kg														
Diesel (5)	Dies	mg/kg														
Heavy Oil (5)	Oil_Heavy	mg/kg														
Metals																
Arsenic	7440-38-2	mg/kg	4.4	4.3	2.8	3.7	6.1	6.2	5.2	5.6	5.4	3.9	1.6	2.3	4.8	4.3
Barium	7440-39-3	mg/kg														
Cadmium	7440-43-9	mg/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chromium	7440-47-3	mg/kg														
Chromium(VI)	18540-29-9	mg/kg														
Copper	7440-50-8	mg/kg														
Lead	7439-92-1	mg/kg														
Mercury	7439-97-6	mg/kg														
Selenium	7782-49-2	mg/kg														
Silver	7440-22-4	mg/kg														
Polychlorinated Biphenyls																
Aroclor 1016	12674-11-2	mg/kg														
Aroclor 1221	11104-28-2	mg/kg														
Aroclor 1232	11141-16-5	mg/kg														
Aroclor 1242	53469-21-9	mg/kg														
Aroclor 1248	12672-29-6	mg/kg														
Aroclor 1254	11097-69-1	mg/kg														
Aroclor 1260	11096-82-5	mg/kg														
Aroclor 1262	37324-23-5	mg/kg														
Aroclor 1268	11100-14-4	mg/kg														
Total PCB Aroclors (U=0) (4)	T_PCB (U=0)	mg/kg														
Polybrominated Diphenyl Ethers (PBDEs)																
PBDE-003	101-55-3	mg/kg														
Semi-Volatile Organic Compound (SVOCs)																
1-Methylnaphthalene	90-12-0	mg/kg														
2-Methylnaphthalene	91-57-6	mg/kg														
Acenaphthene	83-32-9	mg/kg														
Acenaphthylene	208-96-8	mg/kg														
Anthracene	120-12-7	mg/kg														
Benzo(a)anthracene	56-55-3	mg/kg														
Benzo(a)pyrene	50-32-8	mg/kg														
Benzo(b)fluoranthene	205-99-2	mg/kg														
Benzo(g,h,i)perylene	191-24-2	mg/kg														
Benzo(k)fluoranthene	207-08-9	mg/kg														
Chrysene	218-01-9	mg/kg														
Dibenzo(a,h)anthracene	53-70-3	mg/kg														
Fluoranthene	206-44-0	mg/kg														
Fluorene	86-73-7	mg/kg														
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg														
Naphthalene	91-20-3	mg/kg														

Table 3.3
In Situ Soil Data

Analyte	CAS No.	Unit	TP5-B3	TP5-B4	TP5-E1	TP5-E2	TP5-E3	TP5-E4	TP5-N1	TP5-N3	TP5-N4	TP5-N5	TP5-S1	TP5-S2	TP5-W1	TP5-W2
		Location Name	TP5-B3	TP5-B4	TP5-E1	TP5-E2	TP5-E3	TP5-E4	TP5-N1	TP5-N3	TP5-N4	TP5-N5	TP5-S1	TP5-S2	TP5-W1	TP5-W2
		Sample Name	TP5-B3-5	TP5-B4-3.5	TP5-E1-5	TP5-E2-5	TP5-E3-3	TP5-E4-2.5	TP5-N1-3	TP5-N3-3	TP5-N4-2.5	TP5-N5-3	TP5-S1-5	TP5-S2-5	TP5-W1-5	TP5-W2-5
		Sample Date	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018
		Sample Depth	5 ft	3.5 ft	5 ft	5 ft	3 ft	2.5 ft	3 ft	3 ft	2.5 ft	3 ft	5 ft	5 ft	5 ft	5 ft
Analyte	**CAS No.**	**Unit**														
Semi-Volatile Organic Compound (SVOCs) (cont.)																
Phenanthrene	85-01-8	mg/kg														
Pyrene	129-00-0	mg/kg														
Total Naphthalenes (U=0) (4)	T_Napth (U=0)	mg/kg														
cPAHs (MTCA TEQ-ZeroND) (6,7)	BaPEq (U=0)	mg/kg														
cPAHs (MTCA TEQ-HalfND) (5,8)	BaPEq (U=1/2)	mg/kg														
Total HPAH (U=0) (4)	T_HPAH (U=0)	mg/kg														
Total LPAH (U=0) (4)	T_LPAH (U=0)	mg/kg														
Total PAH (U=0) (4)	T_PAH (U=0)	mg/kg														
2,3,4,6-Tetrachlorophenol	58-90-2	mg/kg														
2,4,5-Trichlorophenol	95-95-4	mg/kg														
2,4,6-Trichlorophenol	88-06-2	mg/kg														
2,4-Dichlorophenol	120-83-2	mg/kg														
2,4-Dimethylphenol	105-67-9	mg/kg														
2,4-Dinitrophenol	51-28-5	mg/kg														
2,6-Dichlorophenol	87-65-0	mg/kg														
2-Chlorophenol	95-57-8	mg/kg														
2-Methylphenol	95-48-7	mg/kg														
2-Nitrophenol	88-75-5	mg/kg														
3- & 4-Methylphenol	15831-10-4	mg/kg														
4,6-Dinitro-o-cresol	534-52-1	mg/kg														
4-Chloro-3-methylphenol	59-50-7	mg/kg														
4-Methylphenol	106-44-5	mg/kg														
4-Nitrophenol	100-02-7	mg/kg														
Pentachlorophenol	87-86-5	mg/kg														
Phenol	108-95-2	mg/kg														
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg														
Butyl benzyl phthalate	85-68-7	mg/kg														
Di-n-butyl phthalate	84-74-2	mg/kg														
Di-n-octyl phthalate	117-84-0	mg/kg														
Diethylphthalate	84-66-2	mg/kg														
Dimethyl phthalate	131-11-3	mg/kg														
2-Chloronaphthalene	91-58-7	mg/kg														
Aniline	62-53-3	mg/kg														
Azobenzene	103-33-3	mg/kg														
Benzoic acid	65-85-0	mg/kg														
Benzyl alcohol	100-51-6	mg/kg														
Bis(2-chloroethoxy)methane	111-91-1	mg/kg														
Bis-chloroisopropyl ether	108-60-1	mg/kg														
Carbazole	86-74-8	mg/kg														
Dibenzofuran	132-64-9	mg/kg														
Hexachlorobenzene	118-74-1	mg/kg														
Hexachlorobutadiene	87-68-3	mg/kg														
Hexachlorocyclopentadiene	77-47-4	mg/kg														
Isophorone	78-59-1	mg/kg														
N-Nitrosodimethylamine	62-75-9	mg/kg														
N-Nitroso-di-n-propylamine	621-64-7	mg/kg														
N-Nitrosodiphenylamine	86-30-6	mg/kg														

Table 3.3
In Situ Soil Data

		Location Name	TP5-B3	TP5-B4	TP5-E1	TP5-E2	TP5-E3	TP5-E4	TP5-N1	TP5-N3	TP5-N4	TP5-N5	TP5-S1	TP5-S2	TP5-W1	TP5-W2
		Sample Name	TP5-B3-5	TP5-B4-3.5	TP5-E1-5	TP5-E2-5	TP5-E3-3	TP5-E4-2.5	TP5-N1-3	TP5-N3-3	TP5-N4-2.5	TP5-N5-3	TP5-S1-5	TP5-S2-5	TP5-W1-5	TP5-W2-5
		Sample Date	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018
		Sample Depth	5 ft	3.5 ft	5 ft	5 ft	3 ft	2.5 ft	3 ft	3 ft	2.5 ft	3 ft	5 ft	5 ft	5 ft	5 ft
Analyte	**CAS No.**	**Unit**														
Volatile Organic Compound (VOCs)																
Benzene	71-43-2	mg/kg														
Ethylbenzene	100-41-4	mg/kg														
Toluene	108-88-3	mg/kg														
Xylene (meta & para)	108-38-3/106-42-3	mg/kg														
Xylene (ortho)	95-47-6	mg/kg														
Xylene (total)	1330-20-7	mg/kg														
Chloroethane	75-00-3	mg/kg														
cis-1,2-Dichloroethene	156-59-2	mg/kg														
Tetrachloroethene	127-18-4	mg/kg														
trans-1,2-Dichloroethene	156-60-5	mg/kg														
Trichloroethene	79-01-6	mg/kg														
Vinyl chloride	75-01-4	mg/kg														
1,1,1,2-Tetrachloroethane	630-20-6	mg/kg														
1,1,1-Trichloroethane	71-55-6	mg/kg														
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg														
1,1,2-Trichloroethane	79-00-5	mg/kg														
1,1-Dichloroethane	75-34-3	mg/kg														
1,1-Dichloroethene	75-35-4	mg/kg														
1,1-Dichloropropene	563-58-6	mg/kg														
1,2,3-Trichlorobenzene	87-61-6	mg/kg														
1,2,3-Trichloropropane	96-18-4	mg/kg														
1,2,4-Trichlorobenzene	120-82-1	mg/kg														
1,2,4-Trimethylbenzene	95-63-6	mg/kg														
1,2-Dibromo-3-chloropropane	96-12-8	mg/kg														
1,2-Dibromoethane	106-93-4	mg/kg														
1,2-Dichlorobenzene	95-50-1	mg/kg														
1,2-Dichloroethane	107-06-2	mg/kg														
1,2-Dichloropropane	78-87-5	mg/kg														
1,3,5-Trimethylbenzene	108-67-8	mg/kg														
1,3-Dichlorobenzene	541-73-1	mg/kg														
1,3-Dichloropropane	142-28-9	mg/kg														
1,4-Dichlorobenzene	106-46-7	mg/kg														
2,2-Dichloropropane	594-20-7	mg/kg														
2,4-Dinitrotoluene	121-14-2	mg/kg														
2,6-Dinitrotoluene	606-20-2	mg/kg														
2-Chlorotoluene	95-49-8	mg/kg														
2-Hexanone	591-78-6	mg/kg														
2-Nitroaniline	88-74-4	mg/kg														
3,3'-Dichlorobenzidine	91-94-1	mg/kg														
3-Nitroaniline	99-09-2	mg/kg														
4-Chloroaniline	106-47-8	mg/kg														
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg														
4-Chlorotoluene	106-43-4	mg/kg														
4-Nitroaniline	100-01-6	mg/kg														
Acetone	67-64-1	mg/kg														
Bis(2-chloroethyl)ether	111-44-4	mg/kg														
Bis(2-chloroisopropyl)ether	39638-32-9	mg/kg														
Bromobenzene	108-86-1	mg/kg														

Table 3.3
In Situ Soil Data

		Location Name	TP5-B3	TP5-B4	TP5-E1	TP5-E2	TP5-E3	TP5-E4	TP5-N1	TP5-N3	TP5-N4	TP5-N5	TP5-S1	TP5-S2	TP5-W1	TP5-W2
		Sample Name	TP5-B3-5	TP5-B4-3.5	TP5-E1-5	TP5-E2-5	TP5-E3-3	TP5-E4-2.5	TP5-N1-3	TP5-N3-3	TP5-N4-2.5	TP5-N5-3	TP5-S1-5	TP5-S2-5	TP5-W1-5	TP5-W2-5
		Sample Date	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018
		Sample Depth	5 ft	3.5 ft	5 ft	5 ft	3 ft	2.5 ft	3 ft	3 ft	2.5 ft	3 ft	5 ft	5 ft	5 ft	5 ft
Analyte	**CAS No.**	**Unit**														
Volatile Organic Compound (VOCs) (cont.)																
Bromochloromethane	74-97-5	mg/kg														
Bromodichloromethane	75-27-4	mg/kg														
Bromoform	75-25-2	mg/kg														
Bromomethane	74-83-9	mg/kg														
Carbon tetrachloride	56-23-5	mg/kg														
Chlorobenzene	108-90-7	mg/kg														
Chloroform	67-66-3	mg/kg														
Chloromethane	74-87-3	mg/kg														
cis-1,3-Dichloropropene	10061-01-5	mg/kg														
Cymene	99-87-6	mg/kg														
Dibromochloromethane	124-48-1	mg/kg														
Dibromomethane	74-95-3	mg/kg														
Dichlorodifluoromethane	75-71-8	mg/kg														
Hexachloroethane	67-72-1	mg/kg														
Isopropylbenzene	98-82-8	mg/kg														
Methyl ethyl ketone	78-93-3	mg/kg														
Methyl isobutyl ketone	108-10-1	mg/kg														
Methylene chloride	75-09-2	mg/kg														
Methyl-tert-butyl ether	1634-04-4	mg/kg														
n-Hexane	110-54-3	mg/kg														
Nitrobenzene	98-95-3	mg/kg														
n-Propylbenzene	103-65-1	mg/kg														
Pyridine	110-86-1	mg/kg														
sec-Butylbenzene	135-98-8	mg/kg														
Styrene	100-42-5	mg/kg														
tert-Butylbenzene	98-06-6	mg/kg														
trans-1,3-Dichloropropene	10061-02-6	mg/kg														
Trichlorofluoromethane	75-69-4	mg/kg														

Notes:

Blank cells are intentional

All results are rounded to two significant figures.

1 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

2 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

3 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.

4 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

5 Result reported by HCID Analysis

6 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Table 708-2 of WAC 173-340-900.

7 Calculation was performed using only detected cPAH concentrations.

8 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

Abbreviations:

CAS Chemical Abstracts Service

cPAH Carcinogenic polycyclic aromatic hydrocarbon

ft Feet

mg/kg Milligrams per kilogram

MTCA Model Toxics Control Act

PAH Polycyclic aromatic hydrocarbons

PCB Polychlorinated biphenyl

TEQ Toxic equivalency

Qualifiers:

J Analyte was detected; concentration is an estimate.

U Analyte was not detected at the associated reporting limit.

UJ Analyte was not detected at the associated reporting limit, which is an estimate.

Table 3.3
In Situ Soil Data

		Location Name	TP5-W3	TP5-W4	TP6				TP7-B1	TP7-B2	TP7-B3	TP7-B4	TP7-E1	TP7-E2	TP7-E3	TP7-E4
		Sample Name	TP5-W3-2.5	TP5-W4-3	TP6-1	TP6-2	TP6-3	TP6-4	TP7-B1-5	TP7-B2-5	TP7-B3-5	TP7-B4-5	TP7-E1-2.5	TP7-E2-3	TP7-E3-2.5	TP7-E4-2.5
		Sample Date	7/10/2018	7/10/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	7/10/2018
		Sample Depth	2.5 ft	3 ft	1 ft	2 ft	3 ft	4 ft	5 ft	5 ft	5 ft	5 ft	2.5 ft	3 ft	2.5 ft	2.5 ft
Analyte	**CAS No.**	**Unit**														
Total Petroleum Hydrocarbons (TPHs)																
Gasoline-range organics	GRO	mg/kg														
Diesel-range organics	DRO	mg/kg														
Oil-range organics	ORO	mg/kg														
Total DRO & ORO (4)	T_DRO&ORO (U=0)	mg/kg														
Gasoline (5)	86290-81-5	mg/kg														
Diesel (5)	Dies	mg/kg														
Heavy Oil (5)	Oil_Heavy	mg/kg														
Metals																
Arsenic	7440-38-2	mg/kg	5.1	7.2	1.7	5.1		4.1	8.6	1.6	3.3	2.8	97	83	10	7.1
Barium	7440-39-3	mg/kg														
Cadmium	7440-43-9	mg/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.1	1.1	1.7	1.0 U
Chromium	7440-47-3	mg/kg			5.1											
Chromium(VI)	18540-29-9	mg/kg														
Copper	7440-50-8	mg/kg														
Lead	7439-92-1	mg/kg			4.2	1.7	3.9		11	1.2	1.7	2.1	160	110	59	
Mercury	7439-97-6	mg/kg														
Selenium	7782-49-2	mg/kg														
Silver	7440-22-4	mg/kg														
Polychlorinated Biphenyls																
Aroclor 1016	12674-11-2	mg/kg														
Aroclor 1221	11104-28-2	mg/kg														
Aroclor 1232	11141-16-5	mg/kg														
Aroclor 1242	53469-21-9	mg/kg														
Aroclor 1248	12672-29-6	mg/kg														
Aroclor 1254	11097-69-1	mg/kg														
Aroclor 1260	11096-82-5	mg/kg														
Aroclor 1262	37324-23-5	mg/kg														
Aroclor 1268	11100-14-4	mg/kg														
Total PCB Aroclors (U=0) (4)	T_PCB (U=0)	mg/kg														
Polybrominated Diphenyl Ethers (PBDEs)																
PBDE-003	101-55-3	mg/kg														
Semi-Volatile Organic Compound (SVOCs)																
1-Methylnaphthalene	90-12-0	mg/kg														
2-Methylnaphthalene	91-57-6	mg/kg														
Acenaphthene	83-32-9	mg/kg														
Acenaphthylene	208-96-8	mg/kg														
Anthracene	120-12-7	mg/kg														
Benzo(a)anthracene	56-55-3	mg/kg														
Benzo(a)pyrene	50-32-8	mg/kg														
Benzo(b)fluoranthene	205-99-2	mg/kg														
Benzo(g,h,i)perylene	191-24-2	mg/kg														
Benzo(k)fluoranthene	207-08-9	mg/kg														
Chrysene	218-01-9	mg/kg														
Dibenzo(a,h)anthracene	53-70-3	mg/kg														
Fluoranthene	206-44-0	mg/kg														
Fluorene	86-73-7	mg/kg														
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg														
Naphthalene	91-20-3	mg/kg														

Table 3.3
In Situ Soil Data

		Location Name	TP5-W3	TP5-W4	TP6				TP7-B1	TP7-B2	TP7-B3	TP7-B4	TP7-E1	TP7-E2	TP7-E3	TP7-E4
		Sample Name	TP5-W3-2.5	TP5-W4-3	TP6-1	TP6-2	TP6-3	TP6-4	TP7-B1-5	TP7-B2-5	TP7-B3-5	TP7-B4-5	TP7-E1-2.5	TP7-E2-3	TP7-E3-2.5	TP7-E4-2.5
		Sample Date	7/10/2018	7/10/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	7/10/2018
		Sample Depth	2.5 ft	3 ft	1 ft	2 ft	3 ft	4 ft	5 ft	5 ft	5 ft	5 ft	2.5 ft	3 ft	2.5 ft	2.5 ft
Analyte	**CAS No.**	**Unit**														
Semi-Volatile Organic Compound (SVOCs) (cont.)																
Phenanthrene	85-01-8	mg/kg														
Pyrene	129-00-0	mg/kg														
Total Naphthalenes (U=0) (4)	T_Napth (U=0)	mg/kg														
cPAHs (MTCA TEQ-ZeroND) (6,7)	BaPEq (U=0)	mg/kg														
cPAHs (MTCA TEQ-HalfND) (5,8)	BaPEq (U=1/2)	mg/kg														
Total HPAH (U=0) (4)	T_HPAH (U=0)	mg/kg														
Total LPAH (U=0) (4)	T_LPAH (U=0)	mg/kg														
Total PAH (U=0) (4)	T_PAH (U=0)	mg/kg														
2,3,4,6-Tetrachlorophenol	58-90-2	mg/kg														
2,4,5-Trichlorophenol	95-95-4	mg/kg														
2,4,6-Trichlorophenol	88-06-2	mg/kg														
2,4-Dichlorophenol	120-83-2	mg/kg														
2,4-Dimethylphenol	105-67-9	mg/kg														
2,4-Dinitrophenol	51-28-5	mg/kg														
2,6-Dichlorophenol	87-65-0	mg/kg														
2-Chlorophenol	95-57-8	mg/kg														
2-Methylphenol	95-48-7	mg/kg														
2-Nitrophenol	88-75-5	mg/kg														
3- & 4-Methylphenol	15831-10-4	mg/kg														
4,6-Dinitro-o-cresol	534-52-1	mg/kg														
4-Chloro-3-methylphenol	59-50-7	mg/kg														
4-Methylphenol	106-44-5	mg/kg														
4-Nitrophenol	100-02-7	mg/kg														
Pentachlorophenol	87-86-5	mg/kg														
Phenol	108-95-2	mg/kg														
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg														
Butyl benzyl phthalate	85-68-7	mg/kg														
Di-n-butyl phthalate	84-74-2	mg/kg														
Di-n-octyl phthalate	117-84-0	mg/kg														
Diethylphthalate	84-66-2	mg/kg														
Dimethyl phthalate	131-11-3	mg/kg														
2-Chloronaphthalene	91-58-7	mg/kg														
Aniline	62-53-3	mg/kg														
Azobenzene	103-33-3	mg/kg														
Benzoic acid	65-85-0	mg/kg														
Benzyl alcohol	100-51-6	mg/kg														
Bis(2-chloroethoxy)methane	111-91-1	mg/kg														
Bis-chloroisopropyl ether	108-60-1	mg/kg														
Carbazole	86-74-8	mg/kg														
Dibenzofuran	132-64-9	mg/kg														
Hexachlorobenzene	118-74-1	mg/kg														
Hexachlorobutadiene	87-68-3	mg/kg														
Hexachlorocyclopentadiene	77-47-4	mg/kg														
Isophorone	78-59-1	mg/kg														
N-Nitrosodimethylamine	62-75-9	mg/kg														
N-Nitroso-di-n-propylamine	621-64-7	mg/kg														
N-Nitrosodiphenylamine	86-30-6	mg/kg														

Table 3.3
In Situ Soil Data

Location Name			TP5-W3	TP5-W4	TP6				TP7-B1	TP7-B2	TP7-B3	TP7-B4	TP7-E1	TP7-E2	TP7-E3	TP7-E4
Sample Name			TP5-W3-2.5	TP5-W4-3	TP6-1	TP6-2	TP6-3	TP6-4	TP7-B1-5	TP7-B2-5	TP7-B3-5	TP7-B4-5	TP7-E1-2.5	TP7-E2-3	TP7-E3-2.5	TP7-E4-2.5
Sample Date			7/10/2018	7/10/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	7/10/2018
Sample Depth			2.5 ft	3 ft	1 ft	2 ft	3 ft	4 ft	5 ft	5 ft	5 ft	5 ft	2.5 ft	3 ft	2.5 ft	2.5 ft
Analyte	**CAS No.**	**Unit**														
Volatile Organic Compound (VOCs)																
Benzene	71-43-2	mg/kg														
Ethylbenzene	100-41-4	mg/kg														
Toluene	108-88-3	mg/kg														
Xylene (meta & para)	108-38-3/106-42-3	mg/kg														
Xylene (ortho)	95-47-6	mg/kg														
Xylene (total)	1330-20-7	mg/kg														
Chloroethane	75-00-3	mg/kg														
cis-1,2-Dichloroethene	156-59-2	mg/kg														
Tetrachloroethene	127-18-4	mg/kg														
trans-1,2-Dichloroethene	156-60-5	mg/kg														
Trichloroethene	79-01-6	mg/kg														
Vinyl chloride	75-01-4	mg/kg														
1,1,1,2-Tetrachloroethane	630-20-6	mg/kg														
1,1,1-Trichloroethane	71-55-6	mg/kg														
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg														
1,1,2-Trichloroethane	79-00-5	mg/kg														
1,1-Dichloroethane	75-34-3	mg/kg														
1,1-Dichloroethene	75-35-4	mg/kg														
1,1-Dichloropropene	563-58-6	mg/kg														
1,2,3-Trichlorobenzene	87-61-6	mg/kg														
1,2,3-Trichloropropane	96-18-4	mg/kg														
1,2,4-Trichlorobenzene	120-82-1	mg/kg														
1,2,4-Trimethylbenzene	95-63-6	mg/kg														
1,2-Dibromo-3-chloropropane	96-12-8	mg/kg														
1,2-Dibromoethane	106-93-4	mg/kg														
1,2-Dichlorobenzene	95-50-1	mg/kg														
1,2-Dichloroethane	107-06-2	mg/kg														
1,2-Dichloropropane	78-87-5	mg/kg														
1,3,5-Trimethylbenzene	108-67-8	mg/kg														
1,3-Dichlorobenzene	541-73-1	mg/kg														
1,3-Dichloropropane	142-28-9	mg/kg														
1,4-Dichlorobenzene	106-46-7	mg/kg														
2,2-Dichloropropane	594-20-7	mg/kg														
2,4-Dinitrotoluene	121-14-2	mg/kg														
2,6-Dinitrotoluene	606-20-2	mg/kg														
2-Chlorotoluene	95-49-8	mg/kg														
2-Hexanone	591-78-6	mg/kg														
2-Nitroaniline	88-74-4	mg/kg														
3,3'-Dichlorobenzidine	91-94-1	mg/kg														
3-Nitroaniline	99-09-2	mg/kg														
4-Chloroaniline	106-47-8	mg/kg														
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg														
4-Chlorotoluene	106-43-4	mg/kg														
4-Nitroaniline	100-01-6	mg/kg														
Acetone	67-64-1	mg/kg														
Bis(2-chloroethyl)ether	111-44-4	mg/kg														
Bis(2-chloroisopropyl)ether	39638-32-9	mg/kg														
Bromobenzene	108-86-1	mg/kg														

Table 3.3
In Situ Soil Data

		Location Name	TP5-W3	TP5-W4	TP6				TP7-B1	TP7-B2	TP7-B3	TP7-B4	TP7-E1	TP7-E2	TP7-E3	TP7-E4
		Sample Name	TP5-W3-2.5	TP5-W4-3	TP6-1	TP6-2	TP6-3	TP6-4	TP7-B1-5	TP7-B2-5	TP7-B3-5	TP7-B4-5	TP7-E1-2.5	TP7-E2-3	TP7-E3-2.5	TP7-E4-2.5
		Sample Date	7/10/2018	7/10/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	7/10/2018
		Sample Depth	2.5 ft	3 ft	1 ft	2 ft	3 ft	4 ft	5 ft	5 ft	5 ft	5 ft	2.5 ft	3 ft	2.5 ft	2.5 ft
Analyte	**CAS No.**	**Unit**														
Volatile Organic Compound (VOCs) (cont.)																
Bromochloromethane	74-97-5	mg/kg														
Bromodichloromethane	75-27-4	mg/kg														
Bromoform	75-25-2	mg/kg														
Bromomethane	74-83-9	mg/kg														
Carbon tetrachloride	56-23-5	mg/kg														
Chlorobenzene	108-90-7	mg/kg														
Chloroform	67-66-3	mg/kg														
Chloromethane	74-87-3	mg/kg														
cis-1,3-Dichloropropene	10061-01-5	mg/kg														
Cymene	99-87-6	mg/kg														
Dibromochloromethane	124-48-1	mg/kg														
Dibromomethane	74-95-3	mg/kg														
Dichlorodifluoromethane	75-71-8	mg/kg														
Hexachloroethane	67-72-1	mg/kg														
Isopropylbenzene	98-82-8	mg/kg														
Methyl ethyl ketone	78-93-3	mg/kg														
Methyl isobutyl ketone	108-10-1	mg/kg														
Methylene chloride	75-09-2	mg/kg														
Methyl-tert-butyl ether	1634-04-4	mg/kg														
n-Hexane	110-54-3	mg/kg														
Nitrobenzene	98-95-3	mg/kg														
n-Propylbenzene	103-65-1	mg/kg														
Pyridine	110-86-1	mg/kg														
sec-Butylbenzene	135-98-8	mg/kg														
Styrene	100-42-5	mg/kg														
tert-Butylbenzene	98-06-6	mg/kg														
trans-1,3-Dichloropropene	10061-02-6	mg/kg														
Trichlorofluoromethane	75-69-4	mg/kg														

Notes:

Blank cells are intentional

All results are rounded to two significant figures.

1 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

2 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

3 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.

4 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

5 Result reported by HCID Analysis

6 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Table 708-2 of WAC 173-340-900.

7 Calculation was performed using only detected cPAH concentrations.

8 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

Abbreviations:

CAS Chemical Abstracts Service

cPAH Carcinogenic polycyclic aromatic hydrocarbon

ft Feet

mg/kg Milligrams per kilogram

MTCA Model Toxics Control Act

PAH Polycyclic aromatic hydrocarbons

PCB Polychlorinated biphenyl

TEQ Toxic equivalency

Qualifiers:

J Analyte was detected; concentration is an estimate.

U Analyte was not detected at the associated reporting limit.

UJ Analyte was not detected at the associated reporting limit, which is an estimate.

Table 3.3
In Situ Soil Data

		Location Name	TP7-E5	TP7-E6	TP7-N1	TP7-N2	TP7-N3	TP7-S1	TP7-S2	TP7-S3	TP7-W1	TP7-W2	TP7-W3	TP7-W4	TP7-W5
		Sample Name	TP7-E5-3	TP7-E6-2.5	TP7-N1-5	TP7-N2-5	TP7-N3-5	TP7-S1-3	TP7-S2-2.5	TP7-S3-3	TP7-W1-3	TP7-W2-5	TP7-W3-3	TP7-W4-2.5	TP7-W5-3
		Sample Date	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018
		Sample Depth	3 ft	2.5 ft	5 ft	5 ft	5 ft	3 ft	2.5 ft	3 ft	3 ft	5 ft	3 ft	2.5 ft	3 ft
Analyte	**CAS No.**	**Unit**													
Total Petroleum Hydrocarbons (TPHs)															
Gasoline-range organics	GRO	mg/kg													
Diesel-range organics	DRO	mg/kg													
Oil-range organics	ORO	mg/kg													
Total DRO & ORO (4)	T_DRO&ORO (U=0)	mg/kg													
Gasoline (5)	86290-81-5	mg/kg													
Diesel (5)	Dies	mg/kg													
Heavy Oil (5)	Oil_Heavy	mg/kg													
Metals															
Arsenic	7440-38-2	mg/kg	7.5	7.6	1.4	2.0	2.1	9.6	16	5.3	19	2.6	6.0	5.7	7.2
Barium	7440-39-3	mg/kg													
Cadmium	7440-43-9	mg/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chromium	7440-47-3	mg/kg													
Chromium(VI)	18540-29-9	mg/kg													
Copper	7440-50-8	mg/kg													
Lead	7439-92-1	mg/kg						19	17	4.0	47				
Mercury	7439-97-6	mg/kg													
Selenium	7782-49-2	mg/kg													
Silver	7440-22-4	mg/kg													
Polychlorinated Biphenyls															
Aroclor 1016	12674-11-2	mg/kg													
Aroclor 1221	11104-28-2	mg/kg													
Aroclor 1232	11141-16-5	mg/kg													
Aroclor 1242	53469-21-9	mg/kg													
Aroclor 1248	12672-29-6	mg/kg													
Aroclor 1254	11097-69-1	mg/kg													
Aroclor 1260	11096-82-5	mg/kg													
Aroclor 1262	37324-23-5	mg/kg													
Aroclor 1268	11100-14-4	mg/kg													
Total PCB Aroclors (U=0) (4)	T_PCB (U=0)	mg/kg													
Polybrominated Diphenyl Ethers (PBDEs)															
PBDE-003	101-55-3	mg/kg													
Semi-Volatile Organic Compound (SVOCs)															
1-Methylnaphthalene	90-12-0	mg/kg													
2-Methylnaphthalene	91-57-6	mg/kg													
Acenaphthene	83-32-9	mg/kg													
Acenaphthylene	208-96-8	mg/kg													
Anthracene	120-12-7	mg/kg													
Benzo(a)anthracene	56-55-3	mg/kg													
Benzo(a)pyrene	50-32-8	mg/kg													
Benzo(b)fluoranthene	205-99-2	mg/kg													
Benzo(g,h,i)perylene	191-24-2	mg/kg													
Benzo(k)fluoranthene	207-08-9	mg/kg													
Chrysene	218-01-9	mg/kg													
Dibenzo(a,h)anthracene	53-70-3	mg/kg													
Fluoranthene	206-44-0	mg/kg													
Fluorene	86-73-7	mg/kg													
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg													
Naphthalene	91-20-3	mg/kg													

Table 3.3
In Situ Soil Data

		Location Name	TP7-E5	TP7-E6	TP7-N1	TP7-N2	TP7-N3	TP7-S1	TP7-S2	TP7-S3	TP7-W1	TP7-W2	TP7-W3	TP7-W4	TP7-W5
		Sample Name	TP7-E5-3	TP7-E6-2.5	TP7-N1-5	TP7-N2-5	TP7-N3-5	TP7-S1-3	TP7-S2-2.5	TP7-S3-3	TP7-W1-3	TP7-W2-5	TP7-W3-3	TP7-W4-2.5	TP7-W5-3
		Sample Date	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018
		Sample Depth	3 ft	2.5 ft	5 ft	5 ft	5 ft	3 ft	2.5 ft	3 ft	3 ft	5 ft	3 ft	2.5 ft	3 ft
Analyte	**CAS No.**	**Unit**													
Semi-Volatile Organic Compound (SVOCs) (cont.)															
Phenanthrene	85-01-8	mg/kg													
Pyrene	129-00-0	mg/kg													
Total Naphthalenes (U=0) (4)	T_Napth (U=0)	mg/kg													
cPAHs (MTCA TEQ-ZeroND) (6,7)	BaPEq (U=0)	mg/kg													
cPAHs (MTCA TEQ-HalfND) (5,8)	BaPEq (U=1/2)	mg/kg													
Total HPAH (U=0) (4)	T_HPAH (U=0)	mg/kg													
Total LPAH (U=0) (4)	T_LPAH (U=0)	mg/kg													
Total PAH (U=0) (4)	T_PAH (U=0)	mg/kg													
2,3,4,6-Tetrachlorophenol	58-90-2	mg/kg													
2,4,5-Trichlorophenol	95-95-4	mg/kg													
2,4,6-Trichlorophenol	88-06-2	mg/kg													
2,4-Dichlorophenol	120-83-2	mg/kg													
2,4-Dimethylphenol	105-67-9	mg/kg													
2,4-Dinitrophenol	51-28-5	mg/kg													
2,6-Dichlorophenol	87-65-0	mg/kg													
2-Chlorophenol	95-57-8	mg/kg													
2-Methylphenol	95-48-7	mg/kg													
2-Nitrophenol	88-75-5	mg/kg													
3- & 4-Methylphenol	15831-10-4	mg/kg													
4,6-Dinitro-o-cresol	534-52-1	mg/kg													
4-Chloro-3-methylphenol	59-50-7	mg/kg													
4-Methylphenol	106-44-5	mg/kg													
4-Nitrophenol	100-02-7	mg/kg													
Pentachlorophenol	87-86-5	mg/kg													
Phenol	108-95-2	mg/kg													
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg													
Butyl benzyl phthalate	85-68-7	mg/kg													
Di-n-butyl phthalate	84-74-2	mg/kg													
Di-n-octyl phthalate	117-84-0	mg/kg													
Diethylphthalate	84-66-2	mg/kg													
Dimethyl phthalate	131-11-3	mg/kg													
2-Chloronaphthalene	91-58-7	mg/kg													
Aniline	62-53-3	mg/kg													
Azobenzene	103-33-3	mg/kg													
Benzoic acid	65-85-0	mg/kg													
Benzyl alcohol	100-51-6	mg/kg													
Bis(2-chloroethoxy)methane	111-91-1	mg/kg													
Bis-chloroisopropyl ether	108-60-1	mg/kg													
Carbazole	86-74-8	mg/kg													
Dibenzofuran	132-64-9	mg/kg													
Hexachlorobenzene	118-74-1	mg/kg													
Hexachlorobutadiene	87-68-3	mg/kg													
Hexachlorocyclopentadiene	77-47-4	mg/kg													
Isophorone	78-59-1	mg/kg													
N-Nitrosodimethylamine	62-75-9	mg/kg													
N-Nitroso-di-n-propylamine	621-64-7	mg/kg													
N-Nitrosodiphenylamine	86-30-6	mg/kg													

Table 3.3
In Situ Soil Data

		Location Name	TP7-E5	TP7-E6	TP7-N1	TP7-N2	TP7-N3	TP7-S1	TP7-S2	TP7-S3	TP7-W1	TP7-W2	TP7-W3	TP7-W4	TP7-W5
		Sample Name	TP7-E5-3	TP7-E6-2.5	TP7-N1-5	TP7-N2-5	TP7-N3-5	TP7-S1-3	TP7-S2-2.5	TP7-S3-3	TP7-W1-3	TP7-W2-5	TP7-W3-3	TP7-W4-2.5	TP7-W5-3
		Sample Date	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018
		Sample Depth	3 ft	2.5 ft	5 ft	5 ft	5 ft	3 ft	2.5 ft	3 ft	3 ft	5 ft	3 ft	2.5 ft	3 ft
Analyte	**CAS No.**	**Unit**													
Volatile Organic Compound (VOCs)															
Benzene	71-43-2	mg/kg													
Ethylbenzene	100-41-4	mg/kg													
Toluene	108-88-3	mg/kg													
Xylene (meta & para)	108-38-3/106-42-3	mg/kg													
Xylene (ortho)	95-47-6	mg/kg													
Xylene (total)	1330-20-7	mg/kg													
Chloroethane	75-00-3	mg/kg													
cis-1,2-Dichloroethene	156-59-2	mg/kg													
Tetrachloroethene	127-18-4	mg/kg													
trans-1,2-Dichloroethene	156-60-5	mg/kg													
Trichloroethene	79-01-6	mg/kg													
Vinyl chloride	75-01-4	mg/kg													
1,1,1,2-Tetrachloroethane	630-20-6	mg/kg													
1,1,1-Trichloroethane	71-55-6	mg/kg													
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg													
1,1,2-Trichloroethane	79-00-5	mg/kg													
1,1-Dichloroethane	75-34-3	mg/kg													
1,1-Dichloroethene	75-35-4	mg/kg													
1,1-Dichloropropene	563-58-6	mg/kg													
1,2,3-Trichlorobenzene	87-61-6	mg/kg													
1,2,3-Trichloropropane	96-18-4	mg/kg													
1,2,4-Trichlorobenzene	120-82-1	mg/kg													
1,2,4-Trimethylbenzene	95-63-6	mg/kg													
1,2-Dibromo-3-chloropropane	96-12-8	mg/kg													
1,2-Dibromoethane	106-93-4	mg/kg													
1,2-Dichlorobenzene	95-50-1	mg/kg													
1,2-Dichloroethane	107-06-2	mg/kg													
1,2-Dichloropropane	78-87-5	mg/kg													
1,3,5-Trimethylbenzene	108-67-8	mg/kg													
1,3-Dichlorobenzene	541-73-1	mg/kg													
1,3-Dichloropropane	142-28-9	mg/kg													
1,4-Dichlorobenzene	106-46-7	mg/kg													
2,2-Dichloropropane	594-20-7	mg/kg													
2,4-Dinitrotoluene	121-14-2	mg/kg													
2,6-Dinitrotoluene	606-20-2	mg/kg													
2-Chlorotoluene	95-49-8	mg/kg													
2-Hexanone	591-78-6	mg/kg													
2-Nitroaniline	88-74-4	mg/kg													
3,3'-Dichlorobenzidine	91-94-1	mg/kg													
3-Nitroaniline	99-09-2	mg/kg													
4-Chloroaniline	106-47-8	mg/kg													
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg													
4-Chlorotoluene	106-43-4	mg/kg													
4-Nitroaniline	100-01-6	mg/kg													
Acetone	67-64-1	mg/kg													
Bis(2-chloroethyl)ether	111-44-4	mg/kg													
Bis(2-chloroisopropyl)ether	39638-32-9	mg/kg													
Bromobenzene	108-86-1	mg/kg													

Table 3.3
In Situ Soil Data

		Location Name	TP7-E5	TP7-E6	TP7-N1	TP7-N2	TP7-N3	TP7-S1	TP7-S2	TP7-S3	TP7-W1	TP7-W2	TP7-W3	TP7-W4	TP7-W5
		Sample Name	TP7-E5-3	TP7-E6-2.5	TP7-N1-5	TP7-N2-5	TP7-N3-5	TP7-S1-3	TP7-S2-2.5	TP7-S3-3	TP7-W1-3	TP7-W2-5	TP7-W3-3	TP7-W4-2.5	TP7-W5-3
		Sample Date	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018
		Sample Depth	3 ft	2.5 ft	5 ft	5 ft	5 ft	3 ft	2.5 ft	3 ft	3 ft	5 ft	3 ft	2.5 ft	3 ft
Analyte	**CAS No.**	**Unit**													
Volatile Organic Compound (VOCs) (cont.)															
Bromochloromethane	74-97-5	mg/kg													
Bromodichloromethane	75-27-4	mg/kg													
Bromoform	75-25-2	mg/kg													
Bromomethane	74-83-9	mg/kg													
Carbon tetrachloride	56-23-5	mg/kg													
Chlorobenzene	108-90-7	mg/kg													
Chloroform	67-66-3	mg/kg													
Chloromethane	74-87-3	mg/kg													
cis-1,3-Dichloropropene	10061-01-5	mg/kg													
Cymene	99-87-6	mg/kg													
Dibromochloromethane	124-48-1	mg/kg													
Dibromomethane	74-95-3	mg/kg													
Dichlorodifluoromethane	75-71-8	mg/kg													
Hexachloroethane	67-72-1	mg/kg													
Isopropylbenzene	98-82-8	mg/kg													
Methyl ethyl ketone	78-93-3	mg/kg													
Methyl isobutyl ketone	108-10-1	mg/kg													
Methylene chloride	75-09-2	mg/kg													
Methyl-tert-butyl ether	1634-04-4	mg/kg													
n-Hexane	110-54-3	mg/kg													
Nitrobenzene	98-95-3	mg/kg													
n-Propylbenzene	103-65-1	mg/kg													
Pyridine	110-86-1	mg/kg													
sec-Butylbenzene	135-98-8	mg/kg													
Styrene	100-42-5	mg/kg													
tert-Butylbenzene	98-06-6	mg/kg													
trans-1,3-Dichloropropene	10061-02-6	mg/kg													
Trichlorofluoromethane	75-69-4	mg/kg													

Notes:

Blank cells are intentional

All results are rounded to two significant figures.

1 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.
2 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.
3 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.
4 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.
5 Result reported by HCID Analysis
6 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Table 708-2 of WAC 173-340-900.
7 Calculation was performed using only detected cPAH concentrations.
8 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

Abbreviations:

CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbon
ft Feet
mg/kg Milligrams per kilogram
MTCA Model Toxics Control Act
PAH Polycyclic aromatic hydrocarbons
PCB Polychlorinated biphenyl
TEQ Toxic equivalency

Qualifiers:

J Analyte was detected; concentration is an estimate.
U Analyte was not detected at the associated reporting limit.
UJ Analyte was not detected at the associated reporting limit, which is an estimate.

Table 3.3
In Situ Soil Data

		Location Name	TP8				TP9				TP10-B1	TP10-E1	TP10-W1	TP11-B1	TP11-E1	TP11-W1	WH-RBank
		Sample Name	TP8-1	TP8-2	TP8-3	TP8-4	TP9-1	TP9-2	TP9-3	TP9-4	TP10-B1-5	TP10-E1-2.5	TP10-W1-2.5	TP11-B1-5	TP11-E1-2.5	TP11-W1-2.5	WH-RBank
		Sample Date	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	7/6/2018	7/6/2018	7/6/2018	7/6/2018	7/6/2018	7/6/2018	7/18/2018
		Sample Depth	1 ft	2 ft	3 ft	4 ft	1 ft	2 ft	3 ft	4 ft	5 ft	2.5 ft	2.5 ft	5 ft	2.5 ft	2.5 ft	1.5-4.5 ft
Analyte	**CAS No.**	**Unit**															
Total Petroleum Hydrocarbons (TPHs)																	
Gasoline-range organics	GRO	mg/kg															
Diesel-range organics	DRO	mg/kg															
Oil-range organics	ORO	mg/kg															
Total DRO & ORO (4)	T_DRO&ORO (U=0)	mg/kg															
Gasoline (5)	86290-81-5	mg/kg															
Diesel (5)	Dies	mg/kg															
Heavy Oil (5)	Oil_Heavy	mg/kg															
Metals																	
Arsenic	7440-38-2	mg/kg	9.6	6.0	6.1		9.8	6.6		5.1	6.8	7.0	9.5	6.5	5.7	5.9	7.0
Barium	7440-39-3	mg/kg															
Cadmium	7440-43-9	mg/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	47
Chromium	7440-47-3	mg/kg		10			9.1										
Chromium(VI)	18540-29-9	mg/kg															
Copper	7440-50-8	mg/kg															14,000
Lead	7439-92-1	mg/kg		30	8.8	5.8		92	11								2,400
Mercury	7439-97-6	mg/kg															
Selenium	7782-49-2	mg/kg															
Silver	7440-22-4	mg/kg															
Polychlorinated Biphenyls																	
Aroclor 1016	12674-11-2	mg/kg															
Aroclor 1221	11104-28-2	mg/kg															
Aroclor 1232	11141-16-5	mg/kg															
Aroclor 1242	53469-21-9	mg/kg															
Aroclor 1248	12672-29-6	mg/kg															
Aroclor 1254	11097-69-1	mg/kg															
Aroclor 1260	11096-82-5	mg/kg															
Aroclor 1262	37324-23-5	mg/kg															
Aroclor 1268	11100-14-4	mg/kg															
Total PCB Aroclors (U=0) (4)	T_PCB (U=0)	mg/kg															
Polybrominated Diphenyl Ethers (PBDEs)																	
PBDE-003	101-55-3	mg/kg															
Semi-Volatile Organic Compound (SVOCs)																	
1-Methylnaphthalene	90-12-0	mg/kg															
2-Methylnaphthalene	91-57-6	mg/kg															
Acenaphthene	83-32-9	mg/kg															
Acenaphthylene	208-96-8	mg/kg															
Anthracene	120-12-7	mg/kg															
Benzo(a)anthracene	56-55-3	mg/kg															
Benzo(a)pyrene	50-32-8	mg/kg															
Benzo(b)fluoranthene	205-99-2	mg/kg															
Benzo(g,h,i)perylene	191-24-2	mg/kg															
Benzo(k)fluoranthene	207-08-9	mg/kg															
Chrysene	218-01-9	mg/kg															
Dibenzo(a,h)anthracene	53-70-3	mg/kg															
Fluoranthene	206-44-0	mg/kg															
Fluorene	86-73-7	mg/kg															
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg															
Naphthalene	91-20-3	mg/kg															

Table 3.3
In Situ Soil Data

		Location Name	TP8				TP9				TP10-B1	TP10-E1	TP10-W1	TP11-B1	TP11-E1	TP11-W1	WH-RBank
		Sample Name	TP8-1	TP8-2	TP8-3	TP8-4	TP9-1	TP9-2	TP9-3	TP9-4	TP10-B1-5	TP10-E1-2.5	TP10-W1-2.5	TP11-B1-5	TP11-E1-2.5	TP11-W1-2.5	WH-RBank
		Sample Date	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	7/6/2018	7/6/2018	7/6/2018	7/6/2018	7/6/2018	7/6/2018	7/18/2018
		Sample Depth	1 ft	2 ft	3 ft	4 ft	1 ft	2 ft	3 ft	4 ft	5 ft	2.5 ft	2.5 ft	5 ft	2.5 ft	2.5 ft	1.5-4.5 ft
Analyte	**CAS No.**	**Unit**															
Semi-Volatile Organic Compound (SVOCs) (cont.)																	
Phenanthrene	85-01-8	mg/kg															
Pyrene	129-00-0	mg/kg															
Total Naphthalenes (U=0) (4)	T_Napth (U=0)	mg/kg															
cPAHs (MTCA TEQ-ZeroND) (6,7)	BaPEq (U=0)	mg/kg															
cPAHs (MTCA TEQ-HalfND) (5,8)	BaPEq (U=1/2)	mg/kg															
Total HPAH (U=0) (4)	T_HPAH (U=0)	mg/kg															
Total LPAH (U=0) (4)	T_LPAH (U=0)	mg/kg															
Total PAH (U=0) (4)	T_PAH (U=0)	mg/kg															
2,3,4,6-Tetrachlorophenol	58-90-2	mg/kg															
2,4,5-Trichlorophenol	95-95-4	mg/kg															
2,4,6-Trichlorophenol	88-06-2	mg/kg															
2,4-Dichlorophenol	120-83-2	mg/kg															
2,4-Dimethylphenol	105-67-9	mg/kg															
2,4-Dinitrophenol	51-28-5	mg/kg															
2,6-Dichlorophenol	87-65-0	mg/kg															
2-Chlorophenol	95-57-8	mg/kg															
2-Methylphenol	95-48-7	mg/kg															
2-Nitrophenol	88-75-5	mg/kg															
3- & 4-Methylphenol	15831-10-4	mg/kg															
4,6-Dinitro-o-cresol	534-52-1	mg/kg															
4-Chloro-3-methylphenol	59-50-7	mg/kg															
4-Methylphenol	106-44-5	mg/kg															
4-Nitrophenol	100-02-7	mg/kg															
Pentachlorophenol	87-86-5	mg/kg															
Phenol	108-95-2	mg/kg															
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg															
Butyl benzyl phthalate	85-68-7	mg/kg															
Di-n-butyl phthalate	84-74-2	mg/kg															
Di-n-octyl phthalate	117-84-0	mg/kg															
Diethylphthalate	84-66-2	mg/kg															
Dimethyl phthalate	131-11-3	mg/kg															
2-Chloronaphthalene	91-58-7	mg/kg															
Aniline	62-53-3	mg/kg															
Azobenzene	103-33-3	mg/kg															
Benzoic acid	65-85-0	mg/kg															
Benzyl alcohol	100-51-6	mg/kg															
Bis(2-chloroethoxy)methane	111-91-1	mg/kg															
Bis-chloroisopropyl ether	108-60-1	mg/kg															
Carbazole	86-74-8	mg/kg															
Dibenzofuran	132-64-9	mg/kg															
Hexachlorobenzene	118-74-1	mg/kg															
Hexachlorobutadiene	87-68-3	mg/kg															
Hexachlorocyclopentadiene	77-47-4	mg/kg															
Isophorone	78-59-1	mg/kg															
N-Nitrosodimethylamine	62-75-9	mg/kg															
N-Nitroso-di-n-propylamine	621-64-7	mg/kg															
N-Nitrosodiphenylamine	86-30-6	mg/kg															

Table 3.3
In Situ Soil Data

		Location Name	TP8				TP9				TP10-B1	TP10-E1	TP10-W1	TP11-B1	TP11-E1	TP11-W1	WH-RBank
		Sample Name	TP8-1	TP8-2	TP8-3	TP8-4	TP9-1	TP9-2	TP9-3	TP9-4	TP10-B1-5	TP10-E1-2.5	TP10-W1-2.5	TP11-B1-5	TP11-E1-2.5	TP11-W1-2.5	WH-RBank
		Sample Date	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	7/6/2018	7/6/2018	7/6/2018	7/6/2018	7/6/2018	7/6/2018	7/18/2018
		Sample Depth	1 ft	2 ft	3 ft	4 ft	1 ft	2 ft	3 ft	4 ft	5 ft	2.5 ft	2.5 ft	5 ft	2.5 ft	2.5 ft	1.5-4.5 ft
Analyte	**CAS No.**	**Unit**															
Volatile Organic Compound (VOCs)																	
Benzene	71-43-2	mg/kg															
Ethylbenzene	100-41-4	mg/kg															
Toluene	108-88-3	mg/kg															
Xylene (meta & para)	108-38-3/106-42-3	mg/kg															
Xylene (ortho)	95-47-6	mg/kg															
Xylene (total)	1330-20-7	mg/kg															
Chloroethane	75-00-3	mg/kg															
cis-1,2-Dichloroethene	156-59-2	mg/kg															
Tetrachloroethene	127-18-4	mg/kg															
trans-1,2-Dichloroethene	156-60-5	mg/kg															
Trichloroethene	79-01-6	mg/kg															
Vinyl chloride	75-01-4	mg/kg															
1,1,1,2-Tetrachloroethane	630-20-6	mg/kg															
1,1,1-Trichloroethane	71-55-6	mg/kg															
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg															
1,1,2-Trichloroethane	79-00-5	mg/kg															
1,1-Dichloroethane	75-34-3	mg/kg															
1,1-Dichloroethene	75-35-4	mg/kg															
1,1-Dichloropropene	563-58-6	mg/kg															
1,2,3-Trichlorobenzene	87-61-6	mg/kg															
1,2,3-Trichloropropane	96-18-4	mg/kg															
1,2,4-Trichlorobenzene	120-82-1	mg/kg															
1,2,4-Trimethylbenzene	95-63-6	mg/kg															
1,2-Dibromo-3-chloropropane	96-12-8	mg/kg															
1,2-Dibromoethane	106-93-4	mg/kg															
1,2-Dichlorobenzene	95-50-1	mg/kg															
1,2-Dichloroethane	107-06-2	mg/kg															
1,2-Dichloropropane	78-87-5	mg/kg															
1,3,5-Trimethylbenzene	108-67-8	mg/kg															
1,3-Dichlorobenzene	541-73-1	mg/kg															
1,3-Dichloropropane	142-28-9	mg/kg															
1,4-Dichlorobenzene	106-46-7	mg/kg															
2,2-Dichloropropane	594-20-7	mg/kg															
2,4-Dinitrotoluene	121-14-2	mg/kg															
2,6-Dinitrotoluene	606-20-2	mg/kg															
2-Chlorotoluene	95-49-8	mg/kg															
2-Hexanone	591-78-6	mg/kg															
2-Nitroaniline	88-74-4	mg/kg															
3,3'-Dichlorobenzidine	91-94-1	mg/kg															
3-Nitroaniline	99-09-2	mg/kg															
4-Chloroaniline	106-47-8	mg/kg															
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg															
4-Chlorotoluene	106-43-4	mg/kg															
4-Nitroaniline	100-01-6	mg/kg															
Acetone	67-64-1	mg/kg															
Bis(2-chloroethyl)ether	111-44-4	mg/kg															
Bis(2-chloroisopropyl)ether	39638-32-9	mg/kg															
Bromobenzene	108-86-1	mg/kg															

Table 3.3
In Situ Soil Data

		Location Name	TP8				TP9				TP10-B1	TP10-E1	TP10-W1	TP11-B1	TP11-E1	TP11-W1	WH-RBank
		Sample Name	TP8-1	TP8-2	TP8-3	TP8-4	TP9-1	TP9-2	TP9-3	TP9-4	TP10-B1-5	TP10-E1-2.5	TP10-W1-2.5	TP11-B1-5	TP11-E1-2.5	TP11-W1-2.5	WH-RBank
		Sample Date	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	7/6/2018	7/6/2018	7/6/2018	7/6/2018	7/6/2018	7/6/2018	7/18/2018
		Sample Depth	1 ft	2 ft	3 ft	4 ft	1 ft	2 ft	3 ft	4 ft	5 ft	2.5 ft	2.5 ft	5 ft	2.5 ft	2.5 ft	1.5-4.5 ft
Analyte	**CAS No.**	**Unit**															
Volatile Organic Compound (VOCs) (cont.)																	
Bromochloromethane	74-97-5	mg/kg															
Bromodichloromethane	75-27-4	mg/kg															
Bromoform	75-25-2	mg/kg															
Bromomethane	74-83-9	mg/kg															
Carbon tetrachloride	56-23-5	mg/kg															
Chlorobenzene	108-90-7	mg/kg															
Chloroform	67-66-3	mg/kg															
Chloromethane	74-87-3	mg/kg															
cis-1,3-Dichloropropene	10061-01-5	mg/kg															
Cymene	99-87-6	mg/kg															
Dibromochloromethane	124-48-1	mg/kg															
Dibromomethane	74-95-3	mg/kg															
Dichlorodifluoromethane	75-71-8	mg/kg															
Hexachloroethane	67-72-1	mg/kg															
Isopropylbenzene	98-82-8	mg/kg															
Methyl ethyl ketone	78-93-3	mg/kg															
Methyl isobutyl ketone	108-10-1	mg/kg															
Methylene chloride	75-09-2	mg/kg															
Methyl-tert-butyl ether	1634-04-4	mg/kg															
n-Hexane	110-54-3	mg/kg															
Nitrobenzene	98-95-3	mg/kg															
n-Propylbenzene	103-65-1	mg/kg															
Pyridine	110-86-1	mg/kg															
sec-Butylbenzene	135-98-8	mg/kg															
Styrene	100-42-5	mg/kg															
tert-Butylbenzene	98-06-6	mg/kg															
trans-1,3-Dichloropropene	10061-02-6	mg/kg															
Trichlorofluoromethane	75-69-4	mg/kg															

Notes:

Blank cells are intentional

All results are rounded to two significant figures.

1 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

2 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

3 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.

4 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

5 Result reported by HCID Analysis

6 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Table 708-2 of WAC 173-340-900.

7 Calculation was performed using only detected cPAH concentrations.

8 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

Abbreviations:

CAS Chemical Abstracts Service

cPAH Carcinogenic polycyclic aromatic hydrocarbon

ft Feet

mg/kg Milligrams per kilogram

MTCA Model Toxics Control Act

PAH Polycyclic aromatic hydrocarbons

PCB Polychlorinated biphenyl

TEQ Toxic equivalency

Qualifiers:

J Analyte was detected; concentration is an estimate.

U Analyte was not detected at the associated reporting limit.

UJ Analyte was not detected at the associated reporting limit, which is an estimate.

Table 3.4
Excavated Soil Data

		Location Name	A1A-B2		A1A-B4	A1A-B6	A1A-B16	A1A-B17	A1A-B18	A1A-E1	A1A-E2	A1A-E3	A1A-N1	A1A-N2	A1A-N4	A1A-S3	A1A-T1-B1	A1A-T2-B1
		Sample Name	A1A-B2-3	A1A-B2-3-R	A1A-B4-3	A1A-B6-5	A1A-B16-5	A1A-B17-6	A1A-B18-9	A1A-E1-1.5	A1A-E2-1.5	A1A-E3-2	A1A-N1-1.5	A1A-N2-1.5	A1A-N4-2	A1A-S3-2	A1A-T1-B1-7	A1A-T2-B1-9
		Sample Date	6/27/2018	6/29/2018	6/27/2018	7/5/2018	7/5/2018	7/6/2018	7/9/2018	7/2/2018	6/27/2018	7/5/2018	6/27/2018	6/27/2018	7/5/2018	7/5/2018	7/11/2018	7/18/2018
		Sample Depth	3 ft	3 ft	3 ft	5 ft	5 ft	6 ft	9 ft	1.5 ft	1.5 ft	2 ft	1.5 ft	1.5 ft	2 ft	2 ft	7 ft	9 ft
Analyte	**CAS No.**	**Unit**																
Total Petroleum Hydrocarbons (TPHs)																		
Gasoline-range organics	GRO	mg/kg	5.0 UJ	5.0 U			220	180	110								22	360
Diesel-range organics	DRO	mg/kg	50 U		92 (1)		920		50 U		50 U		50 U	50 U			50 U	230 (1)
Oil-range organics	ORO	mg/kg	250 U		250 U		1,000		250 U		510		250 U	250 U			250 U	250 U
Total DRO & ORO (4)	T_DRO&ORO (U=0)	mg/kg	250 U		92		1,900		250 U		510		250 U	250 U			250 U	230
Diesel (5)	Dies	mg/kg																50 U
Heavy Oil (5)	Oil_Heavy	mg/kg																250 U
Metals																		
Arsenic	7440-38-2	mg/kg	59		14	2.6		2.1	4.5	6.8	25	16	27	52	250	15		
Barium	7440-39-3	mg/kg																
Cadmium	7440-43-9	mg/kg	1.0		2.1	2.8		1.0 U	1.0 U	7.0	26	27	6.9	8.0	5.3	4.7		
Chromium	7440-47-3	mg/kg																
Chromium(VI)	18540-29-9	mg/kg																
Lead	7439-92-1	mg/kg	130		340	3.8		1.7	5.0	510	5,700	4,900	1,200	1,000	800	870		
Mercury	7439-97-6	mg/kg																
Selenium	7782-49-2	mg/kg																
Silver	7440-22-4	mg/kg																
Polychlorinated Biphenyls (PCBs)																		
Aroclor 1016	12674-11-2	mg/kg																
Aroclor 1221	11104-28-2	mg/kg																
Aroclor 1232	11141-16-5	mg/kg																
Aroclor 1242	53469-21-9	mg/kg																
Aroclor 1248	12672-29-6	mg/kg																
Aroclor 1254	11097-69-1	mg/kg																
Aroclor 1260	11096-82-5	mg/kg																
Aroclor 1262	37324-23-5	mg/kg																
Aroclor 1268	11100-14-4	mg/kg																
Total PCB Aroclors (U=0) (4)	T_PCB (U=0)	mg/kg																
Polybrominated Diphenyl Ethers (PBDEs)																		
PBDE-003	101-55-3	mg/kg																
Semi-Volatile Organic Compound (SVOCs)																		
1-Methylnaphthalene	90-12-0	mg/kg																0.36
2-Methylnaphthalene	91-57-6	mg/kg																0.45
Acenaphthene	83-32-9	mg/kg																
Acenaphthylene	208-96-8	mg/kg																
Anthracene	120-12-7	mg/kg																
Benzo(a)anthracene	56-55-3	mg/kg																0.10 U
Benzo(a)pyrene	50-32-8	mg/kg																0.10 U
Benzo(b)fluoranthene	205-99-2	mg/kg																0.10 U
Benzo(g,h,i)perylene	191-24-2	mg/kg																
Benzo(k)fluoranthene	207-08-9	mg/kg																0.10 U
Chrysene	218-01-9	mg/kg																0.10 U
Dibenzo(a,h)anthracene	53-70-3	mg/kg																0.10 U
Fluoranthene	206-44-0	mg/kg																
Fluorene	86-73-7	mg/kg																
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg																0.10 U
Naphthalene	91-20-3	mg/kg																0.10 U
Phenanthrene	85-01-8	mg/kg																
Pyrene	129-00-0	mg/kg																

Table 3.4
Excavated Soil Data

Location Name			A1A-B2		A1A-B4	A1A-B6	A1A-B16	A1A-B17	A1A-B18	A1A-E1	A1A-E2	A1A-E3	A1A-N1	A1A-N2	A1A-N4	A1A-S3	A1A-T1-B1	A1A-T2-B1
Sample Name			A1A-B2-3	A1A-B2-3-R	A1A-B4-3	A1A-B6-5	A1A-B16-5	A1A-B17-6	A1A-B18-9	A1A-E1-1.5	A1A-E2-1.5	A1A-E3-2	A1A-N1-1.5	A1A-N2-1.5	A1A-N4-2	A1A-S3-2	A1A-T1-B1-7	A1A-T2-B1-9
Sample Date			6/27/2018	6/29/2018	6/27/2018	7/5/2018	7/5/2018	7/6/2018	7/9/2018	7/2/2018	6/27/2018	7/5/2018	6/27/2018	6/27/2018	7/5/2018	7/5/2018	7/11/2018	7/18/2018
Sample Depth			3 ft	3 ft	3 ft	5 ft	5 ft	6 ft	9 ft	1.5 ft	1.5 ft	2 ft	1.5 ft	1.5 ft	2 ft	2 ft	7 ft	9 ft
Analyte	**CAS No.**	**Unit**																
Semi-Volatile Organic Compound (SVOCs) (cont.)																		
Total Naphthalenes (U=0) (4)	T_Napth (U=0)	mg/kg																0.81
cPAHs (MTCA TEQ-ZeroND) (7,8)	BaPEq (U=0)	mg/kg																0.10 U
cPAHs (MTCA TEQ-HalfND) (7,9)	BaPEq (U=1/2)	mg/kg																0.10 U
Total HPAH (U=0) (4)	T_HPAH (U=0)	mg/kg																
Total LPAH (U=0) (4)	T_LPAH (U=0)	mg/kg																
Total PAH (U=0) (4)	T_PAH (U=0)	mg/kg																
2,3,4,6-Tetrachlorophenol	58-90-2	mg/kg																
2,4,5-Trichlorophenol	95-95-4	mg/kg																
2,4,6-Trichlorophenol	88-06-2	mg/kg																
2,4-Dichlorophenol	120-83-2	mg/kg																
2,4-Dimethylphenol	105-67-9	mg/kg																
2,4-Dinitrophenol	51-28-5	mg/kg																
2,6-Dichlorophenol	87-65-0	mg/kg																
2-Chlorophenol	95-57-8	mg/kg																
2-Methylphenol	95-48-7	mg/kg																
2-Nitrophenol	88-75-5	mg/kg																
3- & 4-Methylphenol	15831-10-4	mg/kg																
4,6-Dinitro-o-cresol	534-52-1	mg/kg																
4-Chloro-3-methylphenol	59-50-7	mg/kg																
4-Methylphenol	106-44-5	mg/kg																
4-Nitrophenol	100-02-7	mg/kg																
Pentachlorophenol	87-86-5	mg/kg																
Phenol	108-95-2	mg/kg																
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg																
Butyl benzyl phthalate	85-68-7	mg/kg																
Di-n-butyl phthalate	84-74-2	mg/kg																
Di-n-octyl phthalate	117-84-0	mg/kg																
Diethylphthalate	84-66-2	mg/kg																
Dimethyl phthalate	131-11-3	mg/kg																
2-Chloronaphthalene	91-58-7	mg/kg																
Aniline	62-53-3	mg/kg																
Azobenzene	103-33-3	mg/kg																
Benzoic acid	65-85-0	mg/kg																
Benzyl alcohol	100-51-6	mg/kg																
Bis(2-chloroethoxy)methane	111-91-1	mg/kg																
Carbazole	86-74-8	mg/kg																
Dibenzofuran	132-64-9	mg/kg																
Hexachlorobenzene	118-74-1	mg/kg																
Hexachlorobutadiene	87-68-3	mg/kg																
Hexachlorocyclopentadiene	77-47-4	mg/kg																
Isophorone	78-59-1	mg/kg																
N-Nitrosodimethylamine	62-75-9	mg/kg																
N-Nitroso-di-n-propylamine	621-64-7	mg/kg																
N-Nitrosodiphenylamine	86-30-6	mg/kg																

Table 3.4
Excavated Soil Data

		Location Name	A1A-B2		A1A-B4	A1A-B6	A1A-B16	A1A-B17	A1A-B18	A1A-E1	A1A-E2	A1A-E3	A1A-N1	A1A-N2	A1A-N4	A1A-S3	A1A-T1-B1	A1A-T2-B1
		Sample Name	A1A-B2-3	A1A-B2-3-R	A1A-B4-3	A1A-B6-5	A1A-B16-5	A1A-B17-6	A1A-B18-9	A1A-E1-1.5	A1A-E2-1.5	A1A-E3-2	A1A-N1-1.5	A1A-N2-1.5	A1A-N4-2	A1A-S3-2	A1A-T1-B1-7	A1A-T2-B1-9
		Sample Date	6/27/2018	6/29/2018	6/27/2018	7/5/2018	7/5/2018	7/6/2018	7/9/2018	7/2/2018	6/27/2018	7/5/2018	6/27/2018	6/27/2018	7/5/2018	7/5/2018	7/11/2018	7/18/2018
		Sample Depth	3 ft	3 ft	3 ft	5 ft	5 ft	6 ft	9 ft	1.5 ft	1.5 ft	2 ft	1.5 ft	1.5 ft	2 ft	2 ft	7 ft	9 ft
Analyte	**CAS No.**	**Unit**																
Volatile Organic Compound (VOCs)																		
Benzene	71-43-2	mg/kg	0.020 UJ				0.020 U	0.020 UJ	0.020 U								0.020 U	0.20 U
Ethylbenzene	100-41-4	mg/kg	0.020 UJ				0.19	0.16	0.88								0.020 U	2.2
Toluene	108-88-3	mg/kg	0.020 UJ				0.10 U	0.10 U	0.020 U								0.020 U	0.20 U
Xylene (meta & para)	108-38-3/106-42-3	mg/kg																
Xylene (ortho)	95-47-6	mg/kg																
Xylene (total)	1330-20-7	mg/kg	0.060 UJ				0.59	0.30 U	0.49								0.060 U	1.4
Chloroethane	75-00-3	mg/kg																
cis-1,2-Dichloroethene	156-59-2	mg/kg																
Tetrachloroethene	127-18-4	mg/kg																
trans-1,2-Dichloroethene	156-60-5	mg/kg																
Trichloroethene	79-01-6	mg/kg																
Vinyl chloride	75-01-4	mg/kg																
1,1,1,2-Tetrachloroethane	630-20-6	mg/kg																
1,1,1-Trichloroethane	71-55-6	mg/kg																
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg																
1,1,2-Trichloroethane	79-00-5	mg/kg																
1,1-Dichloroethane	75-34-3	mg/kg																
1,1-Dichloroethene	75-35-4	mg/kg																
1,1-Dichloropropene	563-58-6	mg/kg																
1,2,3-Trichlorobenzene	87-61-6	mg/kg																
1,2,3-Trichloropropane	96-18-4	mg/kg																
1,2,4-Trichlorobenzene	120-82-1	mg/kg																
1,2,4-Trimethylbenzene	95-63-6	mg/kg																
1,2-Dibromo-3-chloropropane	96-12-8	mg/kg																
1,2-Dibromoethane	106-93-4	mg/kg																
1,2-Dichlorobenzene	95-50-1	mg/kg																
1,2-Dichloroethane	107-06-2	mg/kg																
1,2-Dichloropropane	78-87-5	mg/kg																
1,3,5-Trimethylbenzene	108-67-8	mg/kg																
1,3-Dichlorobenzene	541-73-1	mg/kg																
1,3-Dichloropropane	142-28-9	mg/kg																
1,4-Dichlorobenzene	106-46-7	mg/kg																
2,2-Dichloropropane	594-20-7	mg/kg																
2,4-Dinitrotoluene	121-14-2	mg/kg																
2,6-Dinitrotoluene	606-20-2	mg/kg																
2-Chlorotoluene	95-49-8	mg/kg																
2-Hexanone	591-78-6	mg/kg																
2-Nitroaniline	88-74-4	mg/kg																
3,3'-Dichlorobenzidine	91-94-1	mg/kg																
3-Nitroaniline	99-09-2	mg/kg																
4-Chloroaniline	106-47-8	mg/kg																
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg																
4-Chlorotoluene	106-43-4	mg/kg																
4-Nitroaniline	100-01-6	mg/kg																
Acetone	67-64-1	mg/kg																
Bis(2-chloroethyl)ether	111-44-4	mg/kg																
Bis(2-chloroisopropyl)ether	39638-32-9	mg/kg																
Bromobenzene	108-86-1	mg/kg																

Table 3.4
Excavated Soil Data

Location Name			A1A-B2		A1A-B4	A1A-B6	A1A-B16	A1A-B17	A1A-B18	A1A-E1	A1A-E2	A1A-E3	A1A-N1	A1A-N2	A1A-N4	A1A-S3	A1A-T1-B1	A1A-T2-B1
Sample Name			A1A-B2-3	A1A-B2-3-R	A1A-B4-3	A1A-B6-5	A1A-B16-5	A1A-B17-6	A1A-B18-9	A1A-E1-1.5	A1A-E2-1.5	A1A-E3-2	A1A-N1-1.5	A1A-N2-1.5	A1A-N4-2	A1A-S3-2	A1A-T1-B1-7	A1A-T2-B1-9
Sample Date			6/27/2018	6/29/2018	6/27/2018	7/5/2018	7/5/2018	7/6/2018	7/9/2018	7/2/2018	6/27/2018	7/5/2018	6/27/2018	6/27/2018	7/5/2018	7/5/2018	7/11/2018	7/18/2018
Sample Depth			3 ft	3 ft	3 ft	5 ft	5 ft	6 ft	9 ft	1.5 ft	1.5 ft	2 ft	1.5 ft	1.5 ft	2 ft	2 ft	7 ft	9 ft
Analyte	**CAS No.**	**Unit**																
Volatile Organic Compound (VOCs) (cont.)																		
Bromochloromethane	74-97-5	mg/kg																
Bromodichloromethane	75-27-4	mg/kg																
Bromoform	75-25-2	mg/kg																
Bromomethane	74-83-9	mg/kg																
Carbon tetrachloride	56-23-5	mg/kg																
Chlorobenzene	108-90-7	mg/kg																
Chloroform	67-66-3	mg/kg																
Chloromethane	74-87-3	mg/kg																
cis-1,3-Dichloropropene	10061-01-5	mg/kg																
Cymene	99-87-6	mg/kg																
Dibromochloromethane	124-48-1	mg/kg																
Dibromomethane	74-95-3	mg/kg																
Dichlorodifluoromethane	75-71-8	mg/kg																
Hexachloroethane	67-72-1	mg/kg																
Isopropylbenzene	98-82-8	mg/kg																
Methyl ethyl ketone	78-93-3	mg/kg																
Methyl isobutyl ketone	108-10-1	mg/kg																
Methylene chloride	75-09-2	mg/kg																
Methyl-tert-butyl ether	1634-04-4	mg/kg																
Nitrobenzene	98-95-3	mg/kg																
n-Hexane	110-54-3	mg/kg																
n-Propylbenzene	103-65-1	mg/kg																
Pyridine	110-86-1	mg/kg																
sec-Butylbenzene	135-98-8	mg/kg																
Styrene	100-42-5	mg/kg																
tert-Butylbenzene	98-06-6	mg/kg																
trans-1,3-Dichloropropene	10061-02-6	mg/kg																
Trichlorofluoromethane	75-69-4	mg/kg																

Notes:

Blank cells are intentional.
All results are rounded to two significant figures.
italics Non-detect result exceeds PSL.
1 Preliminary Screening Level as established in Table X.X
1 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.
2 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.
3 The laboratory noted the chromatograms resemble a mixture of diesel and residual range products.
4 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.
5 Result reported by HCID Analysis.
6 The laboratory noted that analysis for PCB shows peaks which closely resemble Aroclors but pattern and restention time are not close enough for identification.
7 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Table 708-2 of WAC 173-340-900.
8 Calculation was performed using only detected cPAH concentrations.
9 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

Abbreviations:

CAS Chemical Abstracts Service Number
cPAH Carcinogenic polycyclic aromatic hydrocarbon
ft Feet
mg/kg Milligrams per kilogram
MTCA Model Toxics Control Act
PAH Polycyclic aromatic hydrocarbon
TEQ Toxic equivalency

Qualifiers:

J Analyte was detected; concentration is an estimate.
U Analyte was not detected at the associated reporting limit.
UJ Analyte was not detected at the associated reporting limit, which is an estimate.

Table 3.4
Excavated Soil Data

		Location Name	A1A-T2-E1	A1A-T2-N1	A1A-T2-S2	A1A-T2-W2	A1A-W1		A1A-W2		A3A-E1	A3A-E1/W1-Comp	A3A-S1	A3A-W1	A3B-E1	A3B-S1
		Sample Name	A1A-T2-E1-7.5	A1A-T2-N1-7.5	A1A-T2-S2-10	A1A-T2-W2-10	A1A-W1-2	A1A-W1-2-R	A1A-W2-0.5	A1A-W2-2	A3A-E1-0.5	A3A-Comp1	A3A-S1-0.5	A3A-W1-0.5	A3B-E1-0.5	A3B-S1-0.5
		Sample Date	7/18/2018	7/18/2018	7/18/2018	7/18/2018	6/27/2018	6/29/2018	6/27/2018	6/27/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018
		Sample Depth	7.5 ft	7.5 ft	10 ft	10 ft	2 ft	2 ft	0.5 ft	2 ft	0.5 ft	0.5 ft	0.5 ft	0.5 ft	0.5 ft	0.5 ft
Analyte	**CAS No.**	**Unit**														
Total Petroleum Hydrocarbons (TPHs)																
Gasoline-range organics	GRO	mg/kg	130 J		50 J	150 J	5.0 UJ	5.0 U								
Diesel-range organics	DRO	mg/kg	110 (1)	50 U	50 U	50 U	50 U		50 U	140 (1)		2,700			320 (1)	
Oil-range organics	ORO	mg/kg	250 U	250 U	250 U	250 U	250 U		250 U	670		3,100			1,600	
Total DRO & ORO (4)	T_DRO&ORO (U=0)	mg/kg	110	250 U	250 U	250 U	250 U		250 U	810		5,800			1,900	
Diesel (5)	Dies	mg/kg														
Heavy Oil (5)	Oil_Heavy	mg/kg														
Metals																
Arsenic	7440-38-2	mg/kg					6.5		7.6	79	20		31	18	37	32
Barium	7440-39-3	mg/kg														
Cadmium	7440-43-9	mg/kg					4.0		1.0 U	1.4	1.0 U		1.0 U	1.0 U	1.0 U	1.1
Chromium	7440-47-3	mg/kg									15		2.8	80	25	5.1
Chromium(VI)	18540-29-9	mg/kg														
Lead	7439-92-1	mg/kg					240		13	340	27		5.6	98	40	16
Mercury	7439-97-6	mg/kg									1.0 U		1.0 U	1.0 U	1.0 U	1.0 U
Selenium	7782-49-2	mg/kg														
Silver	7440-22-4	mg/kg														
Polychlorinated Biphenyls (PCBs)																
Aroclor 1016	12674-11-2	mg/kg										0.020 U				
Aroclor 1221	11104-28-2	mg/kg										0.020 U				
Aroclor 1232	11141-16-5	mg/kg										0.020 U				
Aroclor 1242	53469-21-9	mg/kg										0.020 U				
Aroclor 1248	12672-29-6	mg/kg										0.020 U				
Aroclor 1254	11097-69-1	mg/kg										0.026				
Aroclor 1260	11096-82-5	mg/kg										0.020 U				
Aroclor 1262	37324-23-5	mg/kg										0.020 U				
Aroclor 1268	11100-14-4	mg/kg										0.020 U				
Total PCB Aroclors (U=0) (4)	T_PCB (U=0)	mg/kg										0.026				
Polybrominated Diphenyl Ethers (PBDEs)																
PBDE-003	101-55-3	mg/kg														
Semi-Volatile Organic Compound (SVOCs)																
1-Methylnaphthalene	90-12-0	mg/kg														
2-Methylnaphthalene	91-57-6	mg/kg														
Acenaphthene	83-32-9	mg/kg														
Acenaphthylene	208-96-8	mg/kg														
Anthracene	120-12-7	mg/kg														
Benzo(a)anthracene	56-55-3	mg/kg									0.50 U	1.0 U		1.0 U		
Benzo(a)pyrene	50-32-8	mg/kg									0.50 U	1.0 U		1.0 U		
Benzo(b)fluoranthene	205-99-2	mg/kg									0.50 U	1.0 U		1.6		
Benzo(g,h,i)perylene	191-24-2	mg/kg														
Benzo(k)fluoranthene	207-08-9	mg/kg									0.50 U	1.0 U		1.0 U		
Chrysene	218-01-9	mg/kg									0.50 U	1.0 U		1.0 U		
Dibenzo(a,h)anthracene	53-70-3	mg/kg									0.50 U	1.0 U		1.0 U		
Fluoranthene	206-44-0	mg/kg														
Fluorene	86-73-7	mg/kg														
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg									0.50 U	1.0 U		1.0 U		
Naphthalene	91-20-3	mg/kg	0.050 UJ													
Phenanthrene	85-01-8	mg/kg														
Pyrene	129-00-0	mg/kg														

Table 3.4
Excavated Soil Data

		Location Name	A1A-T2-E1	A1A-T2-N1	A1A-T2-S2	A1A-T2-W2	A1A-W1		A1A-W2		A3A-E1	A3A-E1/W1-Comp	A3A-S1	A3A-W1	A3B-E1	A3B-S1
		Sample Name	A1A-T2-E1-7.5	A1A-T2-N1-7.5	A1A-T2-S2-10	A1A-T2-W2-10	A1A-W1-2	A1A-W1-2-R	A1A-W2-0.5	A1A-W2-2	A3A-E1-0.5	A3A-Comp1	A3A-S1-0.5	A3A-W1-0.5	A3B-E1-0.5	A3B-S1-0.5
		Sample Date	7/18/2018	7/18/2018	7/18/2018	7/18/2018	6/27/2018	6/29/2018	6/27/2018	6/27/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018
		Sample Depth	7.5 ft	7.5 ft	10 ft	10 ft	2 ft	2 ft	0.5 ft	2 ft	0.5 ft	0.5 ft	0.5 ft	0.5 ft	0.5 ft	0.5 ft
Analyte	**CAS No.**	**Unit**														
Semi-Volatile Organic Compound (SVOCs) (cont.)																
Total Naphthalenes (U=0) [4]	T_Napth (U=0)	mg/kg														
cPAHs (MTCA TEQ-ZeroND) [7,8]	BaPEq (U=0)	mg/kg									0.50 U	1.0 U		0.16		
cPAHs (MTCA TEQ-HalfND) [7,9]	BaPEq (U=1/2)	mg/kg									0.50 U	1.0 U		0.87		
Total HPAH (U=0) [4]	T_HPAH (U=0)	mg/kg														
Total LPAH (U=0) [4]	T_LPAH (U=0)	mg/kg														
Total PAH (U=0) [4]	T_PAH (U=0)	mg/kg														
2,3,4,6-Tetrachlorophenol	58-90-2	mg/kg														
2,4,5-Trichlorophenol	95-95-4	mg/kg														
2,4,6-Trichlorophenol	88-06-2	mg/kg														
2,4-Dichlorophenol	120-83-2	mg/kg														
2,4-Dimethylphenol	105-67-9	mg/kg														
2,4-Dinitrophenol	51-28-5	mg/kg														
2,6-Dichlorophenol	87-65-0	mg/kg														
2-Chlorophenol	95-57-8	mg/kg														
2-Methylphenol	95-48-7	mg/kg														
2-Nitrophenol	88-75-5	mg/kg														
3- & 4-Methylphenol	15831-10-4	mg/kg														
4,6-Dinitro-o-cresol	534-52-1	mg/kg														
4-Chloro-3-methylphenol	59-50-7	mg/kg														
4-Methylphenol	106-44-5	mg/kg														
4-Nitrophenol	100-02-7	mg/kg														
Pentachlorophenol	87-86-5	mg/kg														
Phenol	108-95-2	mg/kg														
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg														
Butyl benzyl phthalate	85-68-7	mg/kg														
Di-n-butyl phthalate	84-74-2	mg/kg														
Di-n-octyl phthalate	117-84-0	mg/kg														
Diethylphthalate	84-66-2	mg/kg														
Dimethyl phthalate	131-11-3	mg/kg														
2-Chloronaphthalene	91-58-7	mg/kg														
Aniline	62-53-3	mg/kg														
Azobenzene	103-33-3	mg/kg														
Benzoic acid	65-85-0	mg/kg														
Benzyl alcohol	100-51-6	mg/kg														
Bis(2-chloroethoxy)methane	111-91-1	mg/kg														
Carbazole	86-74-8	mg/kg														
Dibenzofuran	132-64-9	mg/kg														
Hexachlorobenzene	118-74-1	mg/kg														
Hexachlorobutadiene	87-68-3	mg/kg	0.25 UJ													
Hexachlorocyclopentadiene	77-47-4	mg/kg														
Isophorone	78-59-1	mg/kg														
N-Nitrosodimethylamine	62-75-9	mg/kg														
N-Nitroso-di-n-propylamine	621-64-7	mg/kg														
N-Nitrosodiphenylamine	86-30-6	mg/kg														

Table 3.4
Excavated Soil Data

		Location Name	A1A-T2-E1	A1A-T2-N1	A1A-T2-S2	A1A-T2-W2	A1A-W1		A1A-W2		A3A-E1	A3A-E1/W1-Comp	A3A-S1	A3A-W1	A3B-E1	A3B-S1
		Sample Name	A1A-T2-E1-7.5	A1A-T2-N1-7.5	A1A-T2-S2-10	A1A-T2-W2-10	A1A-W1-2	A1A-W1-2-R	A1A-W2-0.5	A1A-W2-2	A3A-E1-0.5	A3A-Comp1	A3A-S1-0.5	A3A-W1-0.5	A3B-E1-0.5	A3B-S1-0.5
		Sample Date	7/18/2018	7/18/2018	7/18/2018	7/18/2018	6/27/2018	6/29/2018	6/27/2018	6/27/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018
		Sample Depth	7.5 ft	7.5 ft	10 ft	10 ft	2 ft	2 ft	0.5 ft	2 ft	0.5 ft	0.5 ft	0.5 ft	0.5 ft	0.5 ft	0.5 ft
Analyte	**CAS No.**	**Unit**														
Volatile Organic Compound (VOCs)																
Benzene	71-43-2	mg/kg	0.030 UJ		0.020 UJ	0.020 UJ	0.020 UJ									
Ethylbenzene	100-41-4	mg/kg	0.050 UJ		0.25 J	1.1 J	0.020 UJ									
Toluene	108-88-3	mg/kg	0.050 UJ		0.020 UJ	0.10 UJ	0.020 UJ									
Xylene (meta & para)	108-38-3/106-42-3	mg/kg	0.10 UJ													
Xylene (ortho)	95-47-6	mg/kg	0.050 UJ													
Xylene (total)	1330-20-7	mg/kg	0.10 UJ		0.51 J	0.79 J	0.060 UJ									
Chloroethane	75-00-3	mg/kg	0.50 UJ													
cis-1,2-Dichloroethene	156-59-2	mg/kg	0.050 UJ													
Tetrachloroethene	127-18-4	mg/kg	0.025 UJ													
trans-1,2-Dichloroethene	156-60-5	mg/kg	0.050 UJ													
Trichloroethene	79-01-6	mg/kg	0.020 UJ													
Vinyl chloride	75-01-4	mg/kg	0.050 UJ													
1,1,1,2-Tetrachloroethane	630-20-6	mg/kg	0.050 UJ													
1,1,1-Trichloroethane	71-55-6	mg/kg	0.050 UJ													
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg	0.050 UJ													
1,1,2-Trichloroethane	79-00-5	mg/kg	0.050 UJ													
1,1-Dichloroethane	75-34-3	mg/kg	0.050 UJ													
1,1-Dichloroethene	75-35-4	mg/kg	0.050 UJ													
1,1-Dichloropropene	563-58-6	mg/kg	0.050 UJ													
1,2,3-Trichlorobenzene	87-61-6	mg/kg	0.25 UJ													
1,2,3-Trichloropropane	96-18-4	mg/kg	0.050 UJ													
1,2,4-Trichlorobenzene	120-82-1	mg/kg	0.25 UJ													
1,2,4-Trimethylbenzene	95-63-6	mg/kg	0.050 UJ													
1,2-Dibromo-3-chloropropane	96-12-8	mg/kg	0.50 UJ													
1,2-Dibromoethane	106-93-4	mg/kg	0.050 UJ													
1,2-Dichlorobenzene	95-50-1	mg/kg	0.050 UJ													
1,2-Dichloroethane	107-06-2	mg/kg	0.050 UJ													
1,2-Dichloropropane	78-87-5	mg/kg	0.050 UJ													
1,3,5-Trimethylbenzene	108-67-8	mg/kg	0.050 UJ													
1,3-Dichlorobenzene	541-73-1	mg/kg	0.050 UJ													
1,3-Dichloropropane	142-28-9	mg/kg	0.050 UJ													
1,4-Dichlorobenzene	106-46-7	mg/kg	0.050 UJ													
2,2-Dichloropropane	594-20-7	mg/kg	0.050 UJ													
2,4-Dinitrotoluene	121-14-2	mg/kg														
2,6-Dinitrotoluene	606-20-2	mg/kg														
2-Chlorotoluene	95-49-8	mg/kg	0.050 UJ													
2-Hexanone	591-78-6	mg/kg	0.50 UJ													
2-Nitroaniline	88-74-4	mg/kg														
3,3'-Dichlorobenzidine	91-94-1	mg/kg														
3-Nitroaniline	99-09-2	mg/kg														
4-Chloroaniline	106-47-8	mg/kg														
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg														
4-Chlorotoluene	106-43-4	mg/kg	0.050 UJ													
4-Nitroaniline	100-01-6	mg/kg														
Acetone	67-64-1	mg/kg	0.50 UJ													
Bis(2-chloroethyl)ether	111-44-4	mg/kg														
Bis(2-chloroisopropyl)ether	39638-32-9	mg/kg														
Bromobenzene	108-86-1	mg/kg	0.050 UJ													

Table 3.4
Excavated Soil Data

		Location Name	A1A-T2-E1	A1A-T2-N1	A1A-T2-S2	A1A-T2-W2	A1A-W1		A1A-W2		A3A-E1	A3A-E1/W1-Comp	A3A-S1	A3A-W1	A3B-E1	A3B-S1
		Sample Name	A1A-T2-E1-7.5	A1A-T2-N1-7.5	A1A-T2-S2-10	A1A-T2-W2-10	A1A-W1-2	A1A-W1-2-R	A1A-W2-0.5	A1A-W2-2	A3A-E1-0.5	A3A-Comp1	A3A-S1-0.5	A3A-W1-0.5	A3B-E1-0.5	A3B-S1-0.5
		Sample Date	7/18/2018	7/18/2018	7/18/2018	7/18/2018	6/27/2018	6/29/2018	6/27/2018	6/27/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018
		Sample Depth	7.5 ft	7.5 ft	10 ft	10 ft	2 ft	2 ft	0.5 ft	2 ft	0.5 ft	0.5 ft	0.5 ft	0.5 ft	0.5 ft	0.5 ft
Analyte	**CAS No.**	**Unit**														
Volatile Organic Compound (VOCs) (cont.)																
Bromochloromethane	74-97-5	mg/kg														
Bromodichloromethane	75-27-4	mg/kg	0.050 UJ													
Bromoform	75-25-2	mg/kg	0.050 UJ													
Bromomethane	74-83-9	mg/kg	0.50 UJ													
Carbon tetrachloride	56-23-5	mg/kg	0.050 UJ													
Chlorobenzene	108-90-7	mg/kg	0.050 UJ													
Chloroform	67-66-3	mg/kg	0.050 UJ													
Chloromethane	74-87-3	mg/kg	0.50 UJ													
cis-1,3-Dichloropropene	10061-01-5	mg/kg	0.050 UJ													
Cymene	99-87-6	mg/kg	0.050 UJ													
Dibromochloromethane	124-48-1	mg/kg	0.050 UJ													
Dibromomethane	74-95-3	mg/kg	0.050 UJ													
Dichlorodifluoromethane	75-71-8	mg/kg	0.50 UJ													
Hexachloroethane	67-72-1	mg/kg														
Isopropylbenzene	98-82-8	mg/kg	0.050 UJ													
Methyl ethyl ketone	78-93-3	mg/kg	0.50 UJ													
Methyl isobutyl ketone	108-10-1	mg/kg	0.50 UJ													
Methylene chloride	75-09-2	mg/kg	0.50 UJ													
Methyl-tert-butyl ether	1634-04-4	mg/kg	0.050 UJ													
Nitrobenzene	98-95-3	mg/kg														
n-Hexane	110-54-3	mg/kg	0.25 UJ													
n-Propylbenzene	103-65-1	mg/kg	0.050 UJ													
Pyridine	110-86-1	mg/kg														
sec-Butylbenzene	135-98-8	mg/kg	0.050 UJ													
Styrene	100-42-5	mg/kg	0.050 UJ													
tert-Butylbenzene	98-06-6	mg/kg	0.050 UJ													
trans-1,3-Dichloropropene	10061-02-6	mg/kg	0.050 UJ													
Trichlorofluoromethane	75-69-4	mg/kg	0.50 UJ													

Notes:

Blank cells are intentional.

All results are rounded to two significant figures.

italics Non-detect result exceeds PSL.

1 Preliminary Screening Level as established in Table X.X

1 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

2 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

3 The laboratory noted the chromatograms resemble a mixture of diesel and residual range products.

4 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

5 Result reported by HCID Analysis.

6 The laboratory noted that analysis for PCB shows peaks which closely resemble Aroclors but pattern and restention time are not close enough for identification.

7 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Table 708-2 of WAC 173-340-900.

8 Calculation was performed using only detected cPAH concentrations.

9 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

Abbreviations:

CAS Chemical Abstracts Service Number

cPAH Carcinogenic polycyclic aromatic hydrocarbon

ft Feet

mg/kg Milligrams per kilogram

MTCA Model Toxics Control Act

PAH Polycyclic aromatic hydrocarbon

TEQ Toxic equivalency

Qualifiers:

J Analyte was detected; concentration is an estimate.

U Analyte was not detected at the associated reporting limit.

UJ Analyte was not detected at the associated reporting limit, which is an estimate.

Table 3.4
Excavated Soil Data

		Location Name	A3B-W1	A3B-W1/E1-Comp	A4A-B1	A4B-N1	A4C-N1	A5A-N2	A6A-B3	A6C-W1	EY-SP2	EY-SP4	EY-SP5	EY-SP7	EY-SP8	FTSP1	FTSP2
		Sample Name	A3B-W1-0.5	A3B-Comp2	A4A-B1-0.5	A4B-N1-2	A4C-N1-0.5	A5A-N2-4	A6A-B3-1	A6C-W1-0.5	EY-SP2	EY-SP4	EY-SP5	EY-SP7	EY-SP8	FTSP1	FTSP2
		Sample Date	6/20/2018	6/20/2018	6/19/2018	6/19/2018	6/19/2018	6/27/2018	6/25/2018	6/19/2018	6/27/2018	6/29/2018	6/29/2018	7/6/2018	7/6/2018	4/27/2017	4/27/2017
		Sample Depth	0.5 ft	0.5 ft	0.5 ft	2 ft	0.5 ft	4 ft	1 ft	0.5 ft							
Analyte	**CAS No.**	**Unit**															
Total Petroleum Hydrocarbons (TPHs)																	
Gasoline-range organics	GRO	mg/kg														12	2.0 U
Diesel-range organics	DRO	mg/kg	510 (1)	330 (1)	4,600 (1)			7,900 (1)	110 (1)							50 U	66
Oil-range organics	ORO	mg/kg	3,000	1,900	12,000			36,000	710							250 U	250 U
Total DRO & ORO (4)	T_DRO&ORO (U=0)	mg/kg	3,500	2,200	17,000			44,000	820							250 U	66
Diesel (5)	Dies	mg/kg															
Heavy Oil (5)	Oil_Heavy	mg/kg															
Metals																	
Arsenic	7440-38-2	mg/kg	31		3.6	10	33		44	21	36	71	36	63	170		
Barium	7440-39-3	mg/kg															
Cadmium	7440-43-9	mg/kg	1.0 U		1.0 U	3.3	1.3	1.0 U	1.3	2.0	6.8	5.6	3.8	1.0 U	1.3		
Chromium	7440-47-3	mg/kg	2.9		24	35	260		43	17							
Chromium(VI)	18540-29-9	mg/kg															
Lead	7439-92-1	mg/kg	8.8		22	290	270		340	520	140	220	160	110	270		
Mercury	7439-97-6	mg/kg	1.0 U		1.0 U	1.0 U	1.0 U		1.0 U	1.0 U							
Selenium	7782-49-2	mg/kg															
Silver	7440-22-4	mg/kg															
Polychlorinated Biphenyls (PCBs)																	
Aroclor 1016	12674-11-2	mg/kg		0.020 U	0.020 U			0.020 U	0.020 U								
Aroclor 1221	11104-28-2	mg/kg		0.020 U	0.020 U			0.020 U	0.020 U								
Aroclor 1232	11141-16-5	mg/kg		0.020 U	0.020 U			0.020 U	0.020 U								
Aroclor 1242	53469-21-9	mg/kg		0.020 U	0.18			0.020 U	0.020 U								
Aroclor 1248	12672-29-6	mg/kg		0.020 U	0.020 U			0.020 U	0.020 U								
Aroclor 1254	11097-69-1	mg/kg		0.020 U	0.020 U			0.020 U	0.020 U								
Aroclor 1260	11096-82-5	mg/kg		0.079	0.020 U			0.020 U	0.11								
Aroclor 1262	37324-23-5	mg/kg		0.038	0.020 U			0.020 U	0.020 U								
Aroclor 1268	11100-14-4	mg/kg		0.020 U	0.020 U			0.020 U	0.020 U								
Total PCB Aroclors (U=0) (4)	T_PCB (U=0)	mg/kg		0.12	0.18			0.020 U	0.11								
Polybrominated Diphenyl Ethers (PBDEs)																	
PBDE-003	101-55-3	mg/kg															
Semi-Volatile Organic Compound (SVOCs)																	
1-Methylnaphthalene	90-12-0	mg/kg															
2-Methylnaphthalene	91-57-6	mg/kg															
Acenaphthene	83-32-9	mg/kg															
Acenaphthylene	208-96-8	mg/kg															
Anthracene	120-12-7	mg/kg															
Benzo(a)anthracene	56-55-3	mg/kg		0.50 U	1.0 U		1.3	1.0 U	0.25								
Benzo(a)pyrene	50-32-8	mg/kg		0.50 U	1.0 U		1.5	1.0 U	0.29								
Benzo(b)fluoranthene	205-99-2	mg/kg		0.50 U	1.0 U		2.0	1.0 U	0.43								
Benzo(g,h,i)perylene	191-24-2	mg/kg															
Benzo(k)fluoranthene	207-08-9	mg/kg		0.50 U	1.0 U		1.0 U	1.0 U	0.13								
Chrysene	218-01-9	mg/kg		0.50 U	1.0 U		1.5	1.0 U	0.29								
Dibenzo(a,h)anthracene	53-70-3	mg/kg		0.50 U	1.0 U		1.0 U	1.0 U	0.10 U								
Fluoranthene	206-44-0	mg/kg															
Fluorene	86-73-7	mg/kg															
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg		0.50 U	1.0 U		1.4	1.0 U	0.23								
Naphthalene	91-20-3	mg/kg															
Phenanthrene	85-01-8	mg/kg															
Pyrene	129-00-0	mg/kg															

Table 3.4
Excavated Soil Data

		Location Name	**A3B-W1**	**A3B-W1/E1-Comp**	**A4A-B1**	**A4B-N1**	**A4C-N1**	**A5A-N2**	**A6A-B3**	**A6C-W1**	**EY-SP2**	**EY-SP4**	**EY-SP5**	**EY-SP7**	**EY-SP8**	**FTSP1**	**FTSP2**
		Sample Name	**A3B-W1-0.5**	**A3B-Comp2**	**A4A-B1-0.5**	**A4B-N1-2**	**A4C-N1-0.5**	**A5A-N2-4**	**A6A-B3-1**	**A6C-W1-0.5**	**EY-SP2**	**EY-SP4**	**EY-SP5**	**EY-SP7**	**EY-SP8**	**FTSP1**	**FTSP2**
		Sample Date	**6/20/2018**	**6/20/2018**	**6/19/2018**	**6/19/2018**	**6/19/2018**	**6/27/2018**	**6/25/2018**	**6/19/2018**	**6/27/2018**	**6/29/2018**	**6/29/2018**	**7/6/2018**	**7/6/2018**	**4/27/2017**	**4/27/2017**
		Sample Depth	**0.5 ft**	**0.5 ft**	**0.5 ft**	**2 ft**	**0.5 ft**	**4 ft**	**1 ft**	**0.5 ft**							
Analyte	**CAS No.**	**Unit**															
Semi-Volatile Organic Compound (SVOCs) (cont.)																	
Total Naphthalenes (U=0) (4)	T_Napth (U=0)	mg/kg															
cPAHs (MTCA TEQ-ZeroND) (7,8)	BaPEq (U=0)	mg/kg		0.50 U	1.0 U		2.0	1.0 U	0.40								
cPAHs (MTCA TEQ-HalfND) (7,9)	BaPEq (U=1/2)	mg/kg		0.50 U	1.0 U		2.1	1.0 U	0.40								
Total HPAH (U=0) (4)	T_HPAH (U=0)	mg/kg															
Total LPAH (U=0) (4)	T_LPAH (U=0)	mg/kg															
Total PAH (U=0) (4)	T_PAH (U=0)	mg/kg															
2,3,4,6-Tetrachlorophenol	58-90-2	mg/kg															
2,4,5-Trichlorophenol	95-95-4	mg/kg															
2,4,6-Trichlorophenol	88-06-2	mg/kg															
2,4-Dichlorophenol	120-83-2	mg/kg															
2,4-Dimethylphenol	105-67-9	mg/kg															
2,4-Dinitrophenol	51-28-5	mg/kg															
2,6-Dichlorophenol	87-65-0	mg/kg															
2-Chlorophenol	95-57-8	mg/kg															
2-Methylphenol	95-48-7	mg/kg															
2-Nitrophenol	88-75-5	mg/kg															
3- & 4-Methylphenol	15831-10-4	mg/kg															
4,6-Dinitro-o-cresol	534-52-1	mg/kg															
4-Chloro-3-methylphenol	59-50-7	mg/kg															
4-Methylphenol	106-44-5	mg/kg															
4-Nitrophenol	100-02-7	mg/kg															
Pentachlorophenol	87-86-5	mg/kg															
Phenol	108-95-2	mg/kg															
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg															
Butyl benzyl phthalate	85-68-7	mg/kg															
Di-n-butyl phthalate	84-74-2	mg/kg															
Di-n-octyl phthalate	117-84-0	mg/kg															
Diethylphthalate	84-66-2	mg/kg															
Dimethyl phthalate	131-11-3	mg/kg															
2-Chloronaphthalene	91-58-7	mg/kg															
Aniline	62-53-3	mg/kg															
Azobenzene	103-33-3	mg/kg															
Benzoic acid	65-85-0	mg/kg															
Benzyl alcohol	100-51-6	mg/kg															
Bis(2-chloroethoxy)methane	111-91-1	mg/kg															
Carbazole	86-74-8	mg/kg															
Dibenzofuran	132-64-9	mg/kg															
Hexachlorobenzene	118-74-1	mg/kg															
Hexachlorobutadiene	87-68-3	mg/kg															
Hexachlorocyclopentadiene	77-47-4	mg/kg															
Isophorone	78-59-1	mg/kg															
N-Nitrosodimethylamine	62-75-9	mg/kg															
N-Nitroso-di-n-propylamine	621-64-7	mg/kg															
N-Nitrosodiphenylamine	86-30-6	mg/kg															

Table 3.4
Excavated Soil Data

		Location Name	A3B-W1	A3B-W1/E1-Comp	A4A-B1	A4B-N1	A4C-N1	A5A-N2	A6A-B3	A6C-W1	EY-SP2	EY-SP4	EY-SP5	EY-SP7	EY-SP8	FTSP1	FTSP2
		Sample Name	A3B-W1-0.5	A3B-Comp2	A4A-B1-0.5	A4B-N1-2	A4C-N1-0.5	A5A-N2-4	A6A-B3-1	A6C-W1-0.5	EY-SP2	EY-SP4	EY-SP5	EY-SP7	EY-SP8	FTSP1	FTSP2
		Sample Date	6/20/2018	6/20/2018	6/19/2018	6/19/2018	6/19/2018	6/27/2018	6/25/2018	6/19/2018	6/27/2018	6/29/2018	6/29/2018	7/6/2018	7/6/2018	4/27/2017	4/27/2017
		Sample Depth	0.5 ft	0.5 ft	0.5 ft	2 ft	0.5 ft	4 ft	1 ft	0.5 ft							
Analyte	CAS No.	Unit															
Volatile Organic Compound (VOCs)																	
Benzene	71-43-2	mg/kg														0.020 U	0.020 U
Ethylbenzene	100-41-4	mg/kg														0.037	0.020 U
Toluene	108-88-3	mg/kg														0.077	0.020 U
Xylene (meta & para)	108-38-3/106-42-3	mg/kg															
Xylene (ortho)	95-47-6	mg/kg															
Xylene (total)	1330-20-7	mg/kg														0.28	0.060 U
Chloroethane	75-00-3	mg/kg															
cis-1,2-Dichloroethene	156-59-2	mg/kg															
Tetrachloroethene	127-18-4	mg/kg						0.025 U									
trans-1,2-Dichloroethene	156-60-5	mg/kg															
Trichloroethene	79-01-6	mg/kg						0.020 U									
Vinyl chloride	75-01-4	mg/kg															
1,1,1,2-Tetrachloroethane	630-20-6	mg/kg															
1,1,1-Trichloroethane	71-55-6	mg/kg															
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg															
1,1,2-Trichloroethane	79-00-5	mg/kg															
1,1-Dichloroethane	75-34-3	mg/kg															
1,1-Dichloroethene	75-35-4	mg/kg															
1,1-Dichloropropene	563-58-6	mg/kg															
1,2,3-Trichlorobenzene	87-61-6	mg/kg															
1,2,3-Trichloropropane	96-18-4	mg/kg															
1,2,4-Trichlorobenzene	120-82-1	mg/kg															
1,2,4-Trimethylbenzene	95-63-6	mg/kg															
1,2-Dibromo-3-chloropropane	96-12-8	mg/kg															
1,2-Dibromoethane	106-93-4	mg/kg															
1,2-Dichlorobenzene	95-50-1	mg/kg															
1,2-Dichloroethane	107-06-2	mg/kg															
1,2-Dichloropropane	78-87-5	mg/kg															
1,3,5-Trimethylbenzene	108-67-8	mg/kg															
1,3-Dichlorobenzene	541-73-1	mg/kg															
1,3-Dichloropropane	142-28-9	mg/kg															
1,4-Dichlorobenzene	106-46-7	mg/kg															
2,2-Dichloropropane	594-20-7	mg/kg															
2,4-Dinitrotoluene	121-14-2	mg/kg															
2,6-Dinitrotoluene	606-20-2	mg/kg															
2-Chlorotoluene	95-49-8	mg/kg															
2-Hexanone	591-78-6	mg/kg															
2-Nitroaniline	88-74-4	mg/kg															
3,3'-Dichlorobenzidine	91-94-1	mg/kg															
3-Nitroaniline	99-09-2	mg/kg															
4-Chloroaniline	106-47-8	mg/kg															
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg															
4-Chlorotoluene	106-43-4	mg/kg															
4-Nitroaniline	100-01-6	mg/kg															
Acetone	67-64-1	mg/kg															
Bis(2-chloroethyl)ether	111-44-4	mg/kg															
Bis(2-chloroisopropyl)ether	39638-32-9	mg/kg															
Bromobenzene	108-86-1	mg/kg															

Table 3.4
Excavated Soil Data

		Location Name	A3B-W1	A3B-W1/E1-Comp	A4A-B1	A4B-N1	A4C-N1	A5A-N2	A6A-B3	A6C-W1	EY-SP2	EY-SP4	EY-SP5	EY-SP7	EY-SP8	FTSP1	FTSP2
		Sample Name	A3B-W1-0.5	A3B-Comp2	A4A-B1-0.5	A4B-N1-2	A4C-N1-0.5	A5A-N2-4	A6A-B3-1	A6C-W1-0.5	EY-SP2	EY-SP4	EY-SP5	EY-SP7	EY-SP8	FTSP1	FTSP2
		Sample Date	6/20/2018	6/20/2018	6/19/2018	6/19/2018	6/19/2018	6/27/2018	6/25/2018	6/19/2018	6/27/2018	6/29/2018	6/29/2018	7/6/2018	7/6/2018	4/27/2017	4/27/2017
		Sample Depth	0.5 ft	0.5 ft	0.5 ft	2 ft	0.5 ft	4 ft	1 ft	0.5 ft							
Analyte	**CAS No.**	**Unit**															
Volatile Organic Compound (VOCs) (cont.)																	
Bromochloromethane	74-97-5	mg/kg															
Bromodichloromethane	75-27-4	mg/kg															
Bromoform	75-25-2	mg/kg															
Bromomethane	74-83-9	mg/kg															
Carbon tetrachloride	56-23-5	mg/kg															
Chlorobenzene	108-90-7	mg/kg															
Chloroform	67-66-3	mg/kg															
Chloromethane	74-87-3	mg/kg															
cis-1,3-Dichloropropene	10061-01-5	mg/kg															
Cymene	99-87-6	mg/kg															
Dibromochloromethane	124-48-1	mg/kg															
Dibromomethane	74-95-3	mg/kg															
Dichlorodifluoromethane	75-71-8	mg/kg															
Hexachloroethane	67-72-1	mg/kg															
Isopropylbenzene	98-82-8	mg/kg															
Methyl ethyl ketone	78-93-3	mg/kg															
Methyl isobutyl ketone	108-10-1	mg/kg															
Methylene chloride	75-09-2	mg/kg															
Methyl-tert-butyl ether	1634-04-4	mg/kg															
Nitrobenzene	98-95-3	mg/kg															
n-Hexane	110-54-3	mg/kg															
n-Propylbenzene	103-65-1	mg/kg															
Pyridine	110-86-1	mg/kg															
sec-Butylbenzene	135-98-8	mg/kg															
Styrene	100-42-5	mg/kg															
tert-Butylbenzene	98-06-6	mg/kg															
trans-1,3-Dichloropropene	10061-02-6	mg/kg															
Trichlorofluoromethane	75-69-4	mg/kg															

Notes:
Blank cells are intentional.
All results are rounded to two significant figures.
italics Non-detect result exceeds PSL.
1 Preliminary Screening Level as established in Table X.X
1 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.
2 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.
3 The laboratory noted the chromatograms resemble a mixture of diesel and residual range products.
4 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.
5 Result reported by HCID Analysis.
6 The laboratory noted that analysis for PCB shows peaks which closely resemble Aroclors but pattern and restention time are not close enough for identification.
7 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Table 708-2 of WAC 173-340-900.
8 Calculation was performed using only detected cPAH concentrations.
9 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

Abbreviations:
CAS Chemical Abstracts Service Number
cPAH Carcinogenic polycyclic aromatic hydrocarbon
ft Feet
mg/kg Milligrams per kilogram
MTCA Model Toxics Control Act
PAH Polycyclic aromatic hydrocarbon
TEQ Toxic equivalency

Qualifiers:
J Analyte was detected; concentration is an estimate.
U Analyte was not detected at the associated reporting limit.
UJ Analyte was not detected at the associated reporting limit, which is an estimate.

Table 3.4
Excavated Soil Data

		Location Name	HA-01	MW-11		P2	P3	P5	P6		P7	P8		P13		P14		P15	
		Sample Name	**HA-01-0.75**	**P17-3**	**P17-5**	**P2-1**	**P3-1**	**P5-2**	**P6-0**	**P6-SF**	**P7-7**	**P8-0**	**P8-1**	**P13-0**	**P13-SF**	**P14-2**	**P14-4**	**P15-2**	**P15-4**
		Sample Date	**1/12/2004**	**3/9/2016**	**3/9/2016**	**4/21/2015**	**4/21/2015**	**4/21/2015**	**4/21/2015**	**4/21/2015**	**4/21/2015**	**4/21/2015**	**4/21/2015**	**4/21/2015**	**4/24/2015**	**3/9/2016**	**3/9/2016**	**3/9/2016**	**3/9/2016**
		Sample Depth	**0.75 ft**	**3 ft**	**5 ft**	**1 ft**	**1 ft**	**2 ft**	**0 ft**		**7 ft**	**0 ft**	**1 ft**	**0 ft**		**2 ft**	**4 ft**	**2 ft**	**4 ft**
Analyte	**CAS No.**	**Unit**																	
Total Petroleum Hydrocarbons (TPHs)																			
Gasoline-range organics	GRO	mg/kg			2.0 U			4.0				41 J						2.0 U	
Diesel-range organics	DRO	mg/kg		78 [1]	50 U	150 [2]	1,700 [2]	330 [2]	17,000 [2]	5,300 [3]	50 U	3,200 [3]		6,000 [3]	13,000 [1]	50 U		270 [1]	
Oil-range organics	ORO	mg/kg		2,200	250 U	3,000	35,000	2,900	100,000	10,000 [3]	250 U	7,900 [3]		18,000 [3]	45,000	250 U		1,200 [1]	
Total DRO & ORO [4]	T_DRO&ORO (U=0)	mg/kg		2,300	250 U	3,200	37,000	3,200	120,000	15,000	250 U	11,000		24,000	58,000	250 U		1,500	
Diesel [5]	Dies	mg/kg																	
Heavy Oil [5]	Oil_Heavy	mg/kg																	
Metals																			
Arsenic	7440-38-2	mg/kg		110	2.4		15	13	10 U	10		6.7	6.1	13		6.7		16	
Barium	7440-39-3	mg/kg					30	160	56	150		85	120	77					
Cadmium	7440-43-9	mg/kg		2.9			1.0 U	17	10 U	8.8		4.4	1.0 U	2.0		21		9.8	
Chromium	7440-47-3	mg/kg					6.7	120	73	180		45	7.5	43					
Chromium(VI)	18540-29-9	mg/kg						0.59 U											
Lead	7439-92-1	mg/kg		540	1.9		28	4,100	250	610		340	170	110		2,000	480	1,200	170
Mercury	7439-97-6	mg/kg					1.0 U	1.0 U	10 U	1.5		1.0 U	1.0 U	1.0 U					
Selenium	7782-49-2	mg/kg					1.0 U	1.0 U	10 U	1.0 U		1.0 U	1.0 U	1.0 U					
Silver	7440-22-4	mg/kg					1.0 U	12	10 U	1.0 U		1.0 U	1.0 U	1.0 U					
Polychlorinated Biphenyls (PCBs)																			
Aroclor 1016	12674-11-2	mg/kg	0.10 U			0.020 U	0.020 U		0.20 U	2.9			0.20 U	0.20 U	0.20 U				
Aroclor 1221	11104-28-2	mg/kg	0.10 U			0.020 U	0.020 U		0.20 U	0.20 U			0.20 U	0.20 U	0.20 U				
Aroclor 1232	11141-16-5	mg/kg	0.10 U			0.020 U	0.020 U		0.20 U	0.20 U			0.20 U	0.20 U	0.20 U				
Aroclor 1242	53469-21-9	mg/kg	0.10 U			0.020 U	0.020 U		0.20 U	0.20 U			0.20 U	0.20 U	0.34				
Aroclor 1248	12672-29-6	mg/kg	0.10 U			0.020 U	0.020 U		0.53	2.9			0.20 U	0.20 U	0.20 U				
Aroclor 1254	11097-69-1	mg/kg	0.20			0.020 U	0.020 U		0.47	0.93			0.20 U	0.20 U	0.20 U				
Aroclor 1260	11096-82-5	mg/kg	0.10 U			0.028	0.020 U		0.20 U	0.20 U			0.20 U	0.20 U	0.20 U				
Aroclor 1262	37324-23-5	mg/kg				0.020 U	0.020 U		0.20 U	0.20 U			0.20 U	0.20 U					
Aroclor 1268	11100-14-4	mg/kg				0.020 U	0.020 U		0.20 U	0.20 U			0.20 U	0.20 U					
Total PCB Aroclors (U=0) [4]	T_PCB (U=0)	mg/kg	0.20			0.028	0.020 U		1.0	6.7			0.20 U	0.20 U	0.34				
Polybrominated Diphenyl Ethers (PBDEs)																			
PBDE-003	101-55-3	mg/kg							2.5 U										
Semi-Volatile Organic Compound (SVOCs)																			
1-Methylnaphthalene	90-12-0	mg/kg																	
2-Methylnaphthalene	91-57-6	mg/kg							2.5 U										
Acenaphthene	83-32-9	mg/kg							2.5 U										
Acenaphthylene	208-96-8	mg/kg							2.5 U										
Anthracene	120-12-7	mg/kg							2.5 U										
Benzo(a)anthracene	56-55-3	mg/kg							2.5 U										
Benzo(a)pyrene	50-32-8	mg/kg							2.5 U										
Benzo(b)fluoranthene	205-99-2	mg/kg							2.5 U										
Benzo(g,h,i)perylene	191-24-2	mg/kg							2.5 U										
Benzo(k)fluoranthene	207-08-9	mg/kg							2.5 U										
Chrysene	218-01-9	mg/kg							2.5 U										
Dibenzo(a,h)anthracene	53-70-3	mg/kg							2.5 U										
Fluoranthene	206-44-0	mg/kg							2.5 U										
Fluorene	86-73-7	mg/kg							2.5 U										
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg							2.5 U										
Naphthalene	91-20-3	mg/kg					0.050 U		2.5 U	0.050 U				0.93	0.050 U				
Phenanthrene	85-01-8	mg/kg							2.5 U										
Pyrene	129-00-0	mg/kg							2.5 U										

Table 3.4
Excavated Soil Data

		Location Name	HA-01	MW-11		P2	P3	P5	P6		P7	P8		P13		P14		P15	
		Sample Name	HA-01-0.75	P17-3	P17-5	P2-1	P3-1	P5-2	P6-0	P6-SF	P7-7	P8-0	P8-1	P13-0	P13-SF	P14-2	P14-4	P15-2	P15-4
		Sample Date	1/12/2004	3/9/2016	3/9/2016	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/24/2015	3/9/2016	3/9/2016	3/9/2016	3/9/2016
		Sample Depth	0.75 ft	3 ft	5 ft	1 ft	1 ft	2 ft	0 ft		7 ft	0 ft	1 ft	0 ft		2 ft	4 ft	2 ft	4 ft
Analyte	**CAS No.**	**Unit**																	
Semi-Volatile Organic Compound (SVOCs) (cont.)																			
Total Naphthalenes (U=0) [4]	T_Napth (U=0)	mg/kg																	
cPAHs (MTCA TEQ-ZeroND) [7,8]	BaPEq (U=0)	mg/kg							2.5 U										
cPAHs (MTCA TEQ-HalfND) [7,9]	BaPEq (U=1/2)	mg/kg							2.5 U										
Total HPAH (U=0) [4]	T_HPAH (U=0)	mg/kg							2.5 U										
Total LPAH (U=0) [4]	T_LPAH (U=0)	mg/kg							2.5 U										
Total PAH (U=0) [4]	T_PAH (U=0)	mg/kg							2.5 U										
2,3,4,6-Tetrachlorophenol	58-90-2	mg/kg																	
2,4,5-Trichlorophenol	95-95-4	mg/kg							25 U										
2,4,6-Trichlorophenol	88-06-2	mg/kg							25 U										
2,4-Dichlorophenol	120-83-2	mg/kg							25 U										
2,4-Dimethylphenol	105-67-9	mg/kg							25 U										
2,4-Dinitrophenol	51-28-5	mg/kg							75 U										
2,6-Dichlorophenol	87-65-0	mg/kg																	
2-Chlorophenol	95-57-8	mg/kg							25 U										
2-Methylphenol	95-48-7	mg/kg							25 U										
2-Nitrophenol	88-75-5	mg/kg							25 U										
3- & 4-Methylphenol	15831-10-4	mg/kg							50 U										
4,6-Dinitro-o-cresol	534-52-1	mg/kg							75 U										
4-Chloro-3-methylphenol	59-50-7	mg/kg							25 U										
4-Methylphenol	106-44-5	mg/kg																	
4-Nitrophenol	100-02-7	mg/kg							75 U										
Pentachlorophenol	87-86-5	mg/kg							25 U										
Phenol	108-95-2	mg/kg							25 U										
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg							40 U										
Butyl benzyl phthalate	85-68-7	mg/kg							25 U										
Di-n-butyl phthalate	84-74-2	mg/kg							25 U										
Di-n-octyl phthalate	117-84-0	mg/kg							25 U										
Diethylphthalate	84-66-2	mg/kg							25 U										
Dimethyl phthalate	131-11-3	mg/kg							25 U										
2-Chloronaphthalene	91-58-7	mg/kg							2.5 U										
Aniline	62-53-3	mg/kg																	
Azobenzene	103-33-3	mg/kg																	
Benzoic acid	65-85-0	mg/kg							120 U										
Benzyl alcohol	100-51-6	mg/kg							25 U										
Bis(2-chloroethoxy)methane	111-91-1	mg/kg							2.5 U										
Carbazole	86-74-8	mg/kg							25 U										
Dibenzofuran	132-64-9	mg/kg							2.5 U										
Hexachlorobenzene	118-74-1	mg/kg							2.5 U										
Hexachlorobutadiene	87-68-3	mg/kg					0.25 U		2.5 U	0.25 U				0.25 U	0.25 U				
Hexachlorocyclopentadiene	77-47-4	mg/kg							7.5 U										
Isophorone	78-59-1	mg/kg							2.5 U										
N-Nitrosodimethylamine	62-75-9	mg/kg																	
N-Nitroso-di-n-propylamine	621-64-7	mg/kg							2.5 U										
N-Nitrosodiphenylamine	86-30-6	mg/kg							2.5 U										

Table 3.4
Excavated Soil Data

		Location Name	HA-01	MW-11		P2	P3	P5	P6		P7	P8		P13		P14		P15	
		Sample Name	HA-01-0.75	P17-3	P17-5	P2-1	P3-1	P5-2	P6-0	P6-SF	P7-7	P8-0	P8-1	P13-0	P13-SF	P14-2	P14-4	P15-2	P15-4
		Sample Date	1/12/2004	3/9/2016	3/9/2016	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/24/2015	3/9/2016	3/9/2016	3/9/2016	3/9/2016
		Sample Depth	0.75 ft	3 ft	5 ft	1 ft	1 ft	2 ft	0 ft		7 ft	0 ft	1 ft	0 ft		2 ft	4 ft	2 ft	4 ft
Analyte	**CAS No.**	**Unit**																	
Volatile Organic Compound (VOCs)																			
Benzene	71-43-2	mg/kg			0.020 U		0.030 U	0.020 U	0.030 U	0.030 U		0.020 UJ		0.030 U	0.030 U			0.020 U	
Ethylbenzene	100-41-4	mg/kg			0.020 U		0.050 U	0.020 U	0.050 U	0.050 U		0.10 J		0.24	0.050 U			0.020 U	
Toluene	108-88-3	mg/kg			0.020 U		0.050 U	0.069	0.050 U	0.050 U		0.020 UJ		0.050 U	0.050 U			0.020 U	
Xylene (meta & para)	108-38-3/106-42-3	mg/kg					0.10 U		0.10 U	0.10 U				0.68	0.10 U				
Xylene (ortho)	95-47-6	mg/kg					0.050 U		0.098	0.050 U				0.23	0.050 U				
Xylene (total)	1330-20-7	mg/kg			0.060 U		0.10 U	0.060 U	0.098	0.10 U		0.22 J		0.91	0.10 U			0.060 U	
Chloroethane	75-00-3	mg/kg					0.50 U		0.50 U	0.50 U				0.50 U	0.50 U				
cis-1,2-Dichloroethene	156-59-2	mg/kg					0.050 U		1.6	0.050 U				0.050 U	0.050 U				
Tetrachloroethene	127-18-4	mg/kg					0.025 U		0.15	0.025 U				0.025 U	0.025 U				
trans-1,2-Dichloroethene	156-60-5	mg/kg					0.050 U		0.050 U	0.050 U				0.050 U	0.050 U				
Trichloroethene	79-01-6	mg/kg					0.020 U		0.044	0.020 U				0.020 U	0.020 U				
Vinyl chloride	75-01-4	mg/kg					0.050 U		0.072	0.050 U				0.050 U	0.050 U				
1,1,1,2-Tetrachloroethane	630-20-6	mg/kg					0.050 U		0.050 U	0.050 U				0.050 U	0.050 U				
1,1,1-Trichloroethane	71-55-6	mg/kg					0.050 U		0.050 U	0.050 U				0.050 U	0.050 U				
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg					0.050 U		0.050 U	0.050 U				0.050 U	0.050 U				
1,1,2-Trichloroethane	79-00-5	mg/kg					0.050 U		0.050 U	0.050 U				0.050 U	0.050 U				
1,1-Dichloroethane	75-34-3	mg/kg					0.050 U		0.050 U	0.050 U				0.050 U	0.050 U				
1,1-Dichloroethene	75-35-4	mg/kg					0.050 U		0.050 U	0.050 U				0.050 U	0.081				
1,1-Dichloropropene	563-58-6	mg/kg					0.050 U		0.050 U	0.050 U				0.050 U	0.050 U				
1,2,3-Trichlorobenzene	87-61-6	mg/kg					0.25 U		0.25 U	0.25 U				0.25 U	0.25 U				
1,2,3-Trichloropropane	96-18-4	mg/kg					0.050 U		0.050 U	0.050 U				0.050 U	0.050 U				
1,2,4-Trichlorobenzene	120-82-1	mg/kg					0.25 U		0.25 U	0.25 U				0.25 U	0.25 U				
1,2,4-Trimethylbenzene	95-63-6	mg/kg					0.050 U		0.12	0.050 U				2.5	0.050 U				
1,2-Dibromo-3-chloropropane	96-12-8	mg/kg					0.50 U		0.50 U	0.50 U				0.50 U	0.50 U				
1,2-Dibromoethane	106-93-4	mg/kg					0.050 U		0.050 U	0.050 U				0.050 U	0.050 U				
1,2-Dichlorobenzene	95-50-1	mg/kg					0.050 U		0.050 U	0.050 U				0.050 U	0.050 U				
1,2-Dichloroethane	107-06-2	mg/kg					0.050 U		0.050 U	0.050 U				0.050 U	0.050 U				
1,2-Dichloropropane	78-87-5	mg/kg					0.050 U		0.050 U	0.050 U				0.050 U	0.050 U				
1,3,5-Trimethylbenzene	108-67-8	mg/kg					0.050 U		0.056	0.050 U				1.3	0.050 U				
1,3-Dichlorobenzene	541-73-1	mg/kg					0.050 U		0.050 U	0.050 U				0.050 U	0.050 U				
1,3-Dichloropropane	142-28-9	mg/kg					0.050 U		0.050 U	0.050 U				0.050 U	0.050 U				
1,4-Dichlorobenzene	106-46-7	mg/kg					0.050 U		0.050 U	0.050 U				0.050 U	0.050 U				
2,2-Dichloropropane	594-20-7	mg/kg					0.050 U		0.050 U	0.050 U				0.050 U	0.050 U				
2,4-Dinitrotoluene	121-14-2	mg/kg							12 U										
2,6-Dinitrotoluene	606-20-2	mg/kg							12 U										
2-Chlorotoluene	95-49-8	mg/kg					0.050 U		0.050 U	0.050 U				0.050 U	0.050 U				
2-Hexanone	591-78-6	mg/kg					0.50 U		0.50 U	0.50 U				0.50 U	0.50 U				
2-Nitroaniline	88-74-4	mg/kg							12 U										
3,3'-Dichlorobenzidine	91-94-1	mg/kg																	
3-Nitroaniline	99-09-2	mg/kg							250 U										
4-Chloroaniline	106-47-8	mg/kg							250 UJ										
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg							2.5 U										
4-Chlorotoluene	106-43-4	mg/kg					0.050 U		0.050 U	0.050 U				0.050 U	0.050 U				
4-Nitroaniline	100-01-6	mg/kg							250 U										
Acetone	67-64-1	mg/kg					0.50 U		0.50 U	0.50 U				0.50 U	0.50 U				
Bis(2-chloroethyl)ether	111-44-4	mg/kg							2.5 U										
Bis(2-chloroisopropyl)ether	39638-32-9	mg/kg							2.5 U										
Bromobenzene	108-86-1	mg/kg					0.050 U		0.050 U	0.050 U				0.050 U	0.050 U				

Table 3.4
Excavated Soil Data

		Location Name	HA-01	MW-11		P2	P3	P5	P6		P7	P8		P13		P14		P15	
		Sample Name	HA-01-0.75	P17-3	P17-5	P2-1	P3-1	P5-2	P6-0	P6-SF	P7-7	P8-0	P8-1	P13-0	P13-SF	P14-2	P14-4	P15-2	P15-4
		Sample Date	1/12/2004	3/9/2016	3/9/2016	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/24/2015	3/9/2016	3/9/2016	3/9/2016	3/9/2016
		Sample Depth	0.75 ft	3 ft	5 ft	1 ft	1 ft	2 ft	0 ft		7 ft	0 ft	1 ft	0 ft		2 ft	4 ft	2 ft	4 ft
Analyte	**CAS No.**	**Unit**																	
Volatile Organic Compound (VOCs) (cont.)																			
Bromochloromethane	74-97-5	mg/kg																	
Bromodichloromethane	75-27-4	mg/kg					0.050 U		0.050 U	0.050 U				0.050 U	0.050 U				
Bromoform	75-25-2	mg/kg					0.050 U		0.050 U	0.050 U				0.050 U	0.050 U				
Bromomethane	74-83-9	mg/kg					0.50 U		0.50 U	0.50 U				0.50 U	0.50 U				
Carbon tetrachloride	56-23-5	mg/kg					0.050 U		0.050 U	0.050 U				0.050 U	0.050 U				
Chlorobenzene	108-90-7	mg/kg					0.050 U		0.050 U	0.050 U				0.050 U	0.050 U				
Chloroform	67-66-3	mg/kg					0.050 U		0.050 U	0.050 U				0.050 U	0.050 U				
Chloromethane	74-87-3	mg/kg					0.50 U		0.50 U	0.50 U				0.50 U	0.50 U				
cis-1,3-Dichloropropene	10061-01-5	mg/kg					0.050 U		0.050 U	0.050 U				0.050 U	0.050 U				
Cymene	99-87-6	mg/kg					0.050 U		0.050 U	0.050 U				0.37	0.050 U				
Dibromochloromethane	124-48-1	mg/kg					0.050 U		0.050 U	0.050 U				0.050 U	0.050 U				
Dibromomethane	74-95-3	mg/kg					0.050 U		0.050 U	0.050 U				0.050 U	0.050 U				
Dichlorodifluoromethane	75-71-8	mg/kg					0.50 U		0.50 U	0.50 U				0.50 U	0.50 U				
Hexachloroethane	67-72-1	mg/kg							2.5 U										
Isopropylbenzene	98-82-8	mg/kg					0.050 U		0.050 U	0.050 U				0.25	0.050 U				
Methyl ethyl ketone	78-93-3	mg/kg					0.50 U		0.50 U	0.50 U				0.50 U	0.50 U				
Methyl isobutyl ketone	108-10-1	mg/kg					0.50 U		0.50 U	0.50 U				0.50 U	0.50 U				
Methylene chloride	75-09-2	mg/kg					0.50 U		0.50 U	0.50 U				0.50 U	0.50 U				
Methyl-tert-butyl ether	1634-04-4	mg/kg					0.050 U		0.050 U	0.050 U				0.050 U	0.050 U				
Nitrobenzene	98-95-3	mg/kg							2.5 U										
n-Hexane	110-54-3	mg/kg																	
n-Propylbenzene	103-65-1	mg/kg					0.050 U		0.050 U	0.050 U				0.55	0.050 U				
Pyridine	110-86-1	mg/kg																	
sec-Butylbenzene	135-98-8	mg/kg					0.050 U		0.050 U	0.050 U				0.35	0.050 U				
Styrene	100-42-5	mg/kg					0.050 U		0.050 U	0.050 U				0.050 U	0.050 U				
tert-Butylbenzene	98-06-6	mg/kg					0.050 U		0.050 U	0.050 U				0.050 U	0.050 U				
trans-1,3-Dichloropropene	10061-02-6	mg/kg					0.050 U		0.050 U	0.050 U				0.050 U	0.050 U				
Trichlorofluoromethane	75-69-4	mg/kg					0.50 U		0.50 U	0.50 U				0.50 U	0.99				

Notes:

Blank cells are intentional.
All results are rounded to two significant figures.
italics Non-detect result exceeds PSL.
1 Preliminary Screening Level as established in Table X.X
1 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.
2 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.
3 The laboratory noted the chromatograms resemble a mixture of diesel and residual range products.
4 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.
5 Result reported by HCID Analysis.
6 The laboratory noted that analysis for PCB shows peaks which closely resemble Aroclors but pattern and restention time are not close enough for identification.
7 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Table 708-2 of WAC 173-340-900.
8 Calculation was performed using only detected cPAH concentrations.
9 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

Abbreviations:

CAS Chemical Abstracts Service Number
cPAH Carcinogenic polycyclic aromatic hydrocarbon
ft Feet
mg/kg Milligrams per kilogram
MTCA Model Toxics Control Act
PAH Polycyclic aromatic hydrocarbon
TEQ Toxic equivalency

Qualifiers:

J Analyte was detected; concentration is an estimate.
U Analyte was not detected at the associated reporting limit.
UJ Analyte was not detected at the associated reporting limit, which is an estimate.

Table 3.4
Excavated Soil Data

		Location Name	P16		RT-B1-8	RT-ES-3.5	RT-NS-3.5	RT-SP1	RT-SP2	RT-SS-3.5	RT-WS-3.5	SB-08	TP1				TP1-N1	TP1-S1
		Sample Name	P16-2	P16-4	RT-B1-8	RT-ES-3.5	RT-NS-3.5	RT-SP1	RT-SP2	RT-SS-3.5	RT-WS-3.5	SB-08-3-4	TP1-1	TP1-2	TP1-3	TP1-4	TP1-N1-1	TP1-S1-1
		Sample Date	3/9/2016	3/9/2016	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017	12/4/2003	5/22/2018	5/22/2018	5/22/2018	5/22/2018	6/27/2018	6/27/2018
		Sample Depth	2 ft	4 ft	8 ft	3.5 ft	3.5 ft			3.5 ft	3.5 ft	3-4 ft	1 ft	2 ft	3 ft	4 ft	1 ft	1 ft
Analyte	**CAS No.**	**Unit**																
Total Petroleum Hydrocarbons (TPHs)																		
Gasoline-range organics	GRO	mg/kg																
Diesel-range organics	DRO	mg/kg	50 U		6,000	250	6,500	50 U	900	50 U	50 U							
Oil-range organics	ORO	mg/kg	250 U		250 U	250 U	440 [1]	250 U	250 U	250 U	250 U							
Total DRO & ORO [4]	T_DRO&ORO (U=0)	mg/kg	250 U		6,000	250	6,900	250 U	900	250 U	250 U							
Diesel [5]	Dies	mg/kg																
Heavy Oil [5]	Oil_Heavy	mg/kg																
Metals																		
Arsenic	7440-38-2	mg/kg	6.1									4.3 U	27	4.3	2.7		6.6	7.4
Barium	7440-39-3	mg/kg										66						
Cadmium	7440-43-9	mg/kg	7.8									9.6	4.7	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chromium	7440-47-3	mg/kg										79	48	9.0	6.7			
Chromium(VI)	18540-29-9	mg/kg										5.0 U						
Lead	7439-92-1	mg/kg	1,700	290								51	3.3	390	4.7	2.0	60	82
Mercury	7439-97-6	mg/kg										0.67						
Selenium	7782-49-2	mg/kg										4.3 U						
Silver	7440-22-4	mg/kg										3.2 U						
Polychlorinated Biphenyls (PCBs)																		
Aroclor 1016	12674-11-2	mg/kg										0.20 U [6]						
Aroclor 1221	11104-28-2	mg/kg										0.20 U [6]						
Aroclor 1232	11141-16-5	mg/kg										0.20 U [6]						
Aroclor 1242	53469-21-9	mg/kg										0.20 U [6]						
Aroclor 1248	12672-29-6	mg/kg										0.20 U [6]						
Aroclor 1254	11097-69-1	mg/kg										0.20 U [6]						
Aroclor 1260	11096-82-5	mg/kg										0.20 U [6]						
Aroclor 1262	37324-23-5	mg/kg																
Aroclor 1268	11100-14-4	mg/kg																
Total PCB Aroclors (U=0) [4]	T_PCB (U=0)	mg/kg										0.20 U						
Polybrominated Diphenyl Ethers (PBDEs)																		
PBDE-003	101-55-3	mg/kg										0.10 U						
Semi-Volatile Organic Compound (SVOCs)																		
1-Methylnaphthalene	90-12-0	mg/kg										0.10 U						
2-Methylnaphthalene	91-57-6	mg/kg										0.10 U						
Acenaphthene	83-32-9	mg/kg										0.10 U						
Acenaphthylene	208-96-8	mg/kg										0.10 U						
Anthracene	120-12-7	mg/kg										0.10 U						
Benzo(a)anthracene	56-55-3	mg/kg										0.10 U						
Benzo(a)pyrene	50-32-8	mg/kg										0.10 U						
Benzo(b)fluoranthene	205-99-2	mg/kg										0.10 U						
Benzo(g,h,i)perylene	191-24-2	mg/kg										0.10 U						
Benzo(k)fluoranthene	207-08-9	mg/kg										0.10 U						
Chrysene	218-01-9	mg/kg										0.10 U						
Dibenzo(a,h)anthracene	53-70-3	mg/kg										0.10 U						
Fluoranthene	206-44-0	mg/kg										0.10 U						
Fluorene	86-73-7	mg/kg										0.10 U						
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg										0.10 U						
Naphthalene	91-20-3	mg/kg										0.10 U						
Phenanthrene	85-01-8	mg/kg										0.10 U						
Pyrene	129-00-0	mg/kg										0.10 U						

Table 3.4
Excavated Soil Data

		Location Name	P16		RT-B1-8	RT-ES-3.5	RT-NS-3.5	RT-SP1	RT-SP2	RT-SS-3.5	RT-WS-3.5	SB-08	TP1				TP1-N1	TP1-S1
		Sample Name	P16-2	P16-4	RT-B1-8	RT-ES-3.5	RT-NS-3.5	RT-SP1	RT-SP2	RT-SS-3.5	RT-WS-3.5	SB-08-3-4	TP1-1	TP1-2	TP1-3	TP1-4	TP1-N1-1	TP1-S1-1
		Sample Date	3/9/2016	3/9/2016	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017	12/4/2003	5/22/2018	5/22/2018	5/22/2018	5/22/2018	6/27/2018	6/27/2018
		Sample Depth	2 ft	4 ft	8 ft	3.5 ft	3.5 ft			3.5 ft	3.5 ft	3-4 ft	1 ft	2 ft	3 ft	4 ft	1 ft	1 ft
Analyte	**CAS No.**	**Unit**																
Semi-Volatile Organic Compound (SVOCs) (cont.)																		
Total Naphthalenes (U=0) (4)	T_Napth (U=0)	mg/kg										0.10 U						
cPAHs (MTCA TEQ-ZeroND) (7,8)	BaPEq (U=0)	mg/kg										0.10 U						
cPAHs (MTCA TEQ-HalfND) (7,9)	BaPEq (U=1/2)	mg/kg										0.10 U						
Total HPAH (U=0) (4)	T_HPAH (U=0)	mg/kg										0.10 U						
Total LPAH (U=0) (4)	T_LPAH (U=0)	mg/kg										0.10 U						
Total PAH (U=0) (4)	T_PAH (U=0)	mg/kg										0.10 U						
2,3,4,6-Tetrachlorophenol	58-90-2	mg/kg										0.25 U						
2,4,5-Trichlorophenol	95-95-4	mg/kg										0.10 U						
2,4,6-Trichlorophenol	88-06-2	mg/kg										0.10 U						
2,4-Dichlorophenol	120-83-2	mg/kg										0.10 U						
2,4-Dimethylphenol	105-67-9	mg/kg										0.10 U						
2,4-Dinitrophenol	51-28-5	mg/kg										0.50 U						
2,6-Dichlorophenol	87-65-0	mg/kg										0.10 U						
2-Chlorophenol	95-57-8	mg/kg										0.10 U						
2-Methylphenol	95-48-7	mg/kg										0.10 U						
2-Nitrophenol	88-75-5	mg/kg										0.25 U						
3- & 4-Methylphenol	15831-10-4	mg/kg																
4,6-Dinitro-o-cresol	534-52-1	mg/kg										0.50 U						
4-Chloro-3-methylphenol	59-50-7	mg/kg										0.10 U						
4-Methylphenol	106-44-5	mg/kg										0.10 U						
4-Nitrophenol	100-02-7	mg/kg										0.50 U						
Pentachlorophenol	87-86-5	mg/kg										0.50 U						
Phenol	108-95-2	mg/kg										0.10 U						
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg										0.83						
Butyl benzyl phthalate	85-68-7	mg/kg										0.10 U						
Di-n-butyl phthalate	84-74-2	mg/kg										0.13 U						
Di-n-octyl phthalate	117-84-0	mg/kg										0.10 U						
Diethylphthalate	84-66-2	mg/kg										0.10 U						
Dimethyl phthalate	131-11-3	mg/kg										0.10 U						
2-Chloronaphthalene	91-58-7	mg/kg										0.10 U						
Aniline	62-53-3	mg/kg										0.10 U						
Azobenzene	103-33-3	mg/kg										0.10 U						
Benzoic acid	65-85-0	mg/kg										1.0 U						
Benzyl alcohol	100-51-6	mg/kg										0.10 U						
Bis(2-chloroethoxy)methane	111-91-1	mg/kg										0.10 U						
Carbazole	86-74-8	mg/kg										0.10 U						
Dibenzofuran	132-64-9	mg/kg										0.10 U						
Hexachlorobenzene	118-74-1	mg/kg										0.10 U						
Hexachlorobutadiene	87-68-3	mg/kg										0.10 U						
Hexachlorocyclopentadiene	77-47-4	mg/kg										0.50 U						
Isophorone	78-59-1	mg/kg										0.10 U						
N-Nitrosodimethylamine	62-75-9	mg/kg										0.10 U						
N-Nitroso-di-n-propylamine	621-64-7	mg/kg										0.10 U						
N-Nitrosodiphenylamine	86-30-6	mg/kg										0.10 U						

Table 3.4
Excavated Soil Data

		Location Name	P16		RT-B1-8	RT-ES-3.5	RT-NS-3.5	RT-SP1	RT-SP2	RT-SS-3.5	RT-WS-3.5	SB-08	TP1				TP1-N1	TP1-S1
		Sample Name	P16-2	P16-4	RT-B1-8	RT-ES-3.5	RT-NS-3.5	RT-SP1	RT-SP2	RT-SS-3.5	RT-WS-3.5	SB-08-3-4	TP1-1	TP1-2	TP1-3	TP1-4	TP1-N1-1	TP1-S1-1
		Sample Date	3/9/2016	3/9/2016	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017	12/4/2003	5/22/2018	5/22/2018	5/22/2018	5/22/2018	6/27/2018	6/27/2018
		Sample Depth	2 ft	4 ft	8 ft	3.5 ft	3.5 ft			3.5 ft	3.5 ft	3-4 ft	1 ft	2 ft	3 ft	4 ft	1 ft	1 ft
Analyte	**CAS No.**	**Unit**																
Volatile Organic Compound (VOCs)																		
Benzene	71-43-2	mg/kg																
Ethylbenzene	100-41-4	mg/kg																
Toluene	108-88-3	mg/kg																
Xylene (meta & para)	108-38-3/106-42-3	mg/kg																
Xylene (ortho)	95-47-6	mg/kg																
Xylene (total)	1330-20-7	mg/kg																
Chloroethane	75-00-3	mg/kg																
cis-1,2-Dichloroethene	156-59-2	mg/kg																
Tetrachloroethene	127-18-4	mg/kg																
trans-1,2-Dichloroethene	156-60-5	mg/kg																
Trichloroethene	79-01-6	mg/kg																
Vinyl chloride	75-01-4	mg/kg																
1,1,1,2-Tetrachloroethane	630-20-6	mg/kg																
1,1,1-Trichloroethane	71-55-6	mg/kg																
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg																
1,1,2-Trichloroethane	79-00-5	mg/kg																
1,1-Dichloroethane	75-34-3	mg/kg																
1,1-Dichloroethene	75-35-4	mg/kg																
1,1-Dichloropropene	563-58-6	mg/kg																
1,2,3-Trichlorobenzene	87-61-6	mg/kg																
1,2,3-Trichloropropane	96-18-4	mg/kg																
1,2,4-Trichlorobenzene	120-82-1	mg/kg										0.10 U						
1,2,4-Trimethylbenzene	95-63-6	mg/kg																
1,2-Dibromo-3-chloropropane	96-12-8	mg/kg																
1,2-Dibromoethane	106-93-4	mg/kg																
1,2-Dichlorobenzene	95-50-1	mg/kg										0.10 U						
1,2-Dichloroethane	107-06-2	mg/kg																
1,2-Dichloropropane	78-87-5	mg/kg																
1,3,5-Trimethylbenzene	108-67-8	mg/kg																
1,3-Dichlorobenzene	541-73-1	mg/kg										0.10 U						
1,3-Dichloropropane	142-28-9	mg/kg																
1,4-Dichlorobenzene	106-46-7	mg/kg										0.10 U						
2,2-Dichloropropane	594-20-7	mg/kg																
2,4-Dinitrotoluene	121-14-2	mg/kg										0.25 U						
2,6-Dinitrotoluene	606-20-2	mg/kg										0.25 U						
2-Chlorotoluene	95-49-8	mg/kg																
2-Hexanone	591-78-6	mg/kg																
2-Nitroaniline	88-74-4	mg/kg										0.25 U						
3,3'-Dichlorobenzidine	91-94-1	mg/kg										0.10 U						
3-Nitroaniline	99-09-2	mg/kg										0.25 U						
4-Chloroaniline	106-47-8	mg/kg										0.10 U						
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg										0.10 U						
4-Chlorotoluene	106-43-4	mg/kg																
4-Nitroaniline	100-01-6	mg/kg										0.25 U						
Acetone	67-64-1	mg/kg																
Bis(2-chloroethyl)ether	111-44-4	mg/kg										0.10 U						
Bis(2-chloroisopropyl)ether	39638-32-9	mg/kg										0.10 U						
Bromobenzene	108-86-1	mg/kg																

Table 3.4
Excavated Soil Data

		Location Name	P16		RT-B1-8	RT-ES-3.5	RT-NS-3.5	RT-SP1	RT-SP2	RT-SS-3.5	RT-WS-3.5	SB-08	TP1				TP1-N1	TP1-S1
		Sample Name	P16-2	P16-4	RT-B1-8	RT-ES-3.5	RT-NS-3.5	RT-SP1	RT-SP2	RT-SS-3.5	RT-WS-3.5	SB-08-3-4	TP1-1	TP1-2	TP1-3	TP1-4	TP1-N1-1	TP1-S1-1
		Sample Date	3/9/2016	3/9/2016	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017	12/4/2003	5/22/2018	5/22/2018	5/22/2018	5/22/2018	6/27/2018	6/27/2018
		Sample Depth	2 ft	4 ft	8 ft	3.5 ft	3.5 ft			3.5 ft	3.5 ft	3-4 ft	1 ft	2 ft	3 ft	4 ft	1 ft	1 ft
Analyte	**CAS No.**	**Unit**																
Volatile Organic Compound (VOCs) (cont.)																		
Bromochloromethane	74-97-5	mg/kg																
Bromodichloromethane	75-27-4	mg/kg																
Bromoform	75-25-2	mg/kg																
Bromomethane	74-83-9	mg/kg																
Carbon tetrachloride	56-23-5	mg/kg																
Chlorobenzene	108-90-7	mg/kg																
Chloroform	67-66-3	mg/kg																
Chloromethane	74-87-3	mg/kg																
cis-1,3-Dichloropropene	10061-01-5	mg/kg																
Cymene	99-87-6	mg/kg																
Dibromochloromethane	124-48-1	mg/kg																
Dibromomethane	74-95-3	mg/kg																
Dichlorodifluoromethane	75-71-8	mg/kg																
Hexachloroethane	67-72-1	mg/kg										0.10 U						
Isopropylbenzene	98-82-8	mg/kg																
Methyl ethyl ketone	78-93-3	mg/kg																
Methyl isobutyl ketone	108-10-1	mg/kg																
Methylene chloride	75-09-2	mg/kg																
Methyl-tert-butyl ether	1634-04-4	mg/kg																
Nitrobenzene	98-95-3	mg/kg										0.10 U						
n-Hexane	110-54-3	mg/kg																
n-Propylbenzene	103-65-1	mg/kg																
Pyridine	110-86-1	mg/kg										0.10 U						
sec-Butylbenzene	135-98-8	mg/kg																
Styrene	100-42-5	mg/kg																
tert-Butylbenzene	98-06-6	mg/kg																
trans-1,3-Dichloropropene	10061-02-6	mg/kg																
Trichlorofluoromethane	75-69-4	mg/kg																

Notes:

Blank cells are intentional.
All results are rounded to two significant figures.
italics Non-detect result exceeds PSL.
1 Preliminary Screening Level as established in Table X.X
1 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.
2 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.
3 The laboratory noted the chromatograms resemble a mixture of diesel and residual range products.
4 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.
5 Result reported by HCID Analysis.
6 The laboratory noted that analysis for PCB shows peaks which closely resemble Aroclors but pattern and restention time are not close enough for identification.
7 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Table 708-2 of WAC 173-340-900.
8 Calculation was performed using only detected cPAH concentrations.
9 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

Abbreviations:

CAS Chemical Abstracts Service Number
cPAH Carcinogenic polycyclic aromatic hydrocarbon
ft Feet
mg/kg Milligrams per kilogram
MTCA Model Toxics Control Act
PAH Polycyclic aromatic hydrocarbon
TEQ Toxic equivalency

Qualifiers:

J Analyte was detected; concentration is an estimate.
U Analyte was not detected at the associated reporting limit.
UJ Analyte was not detected at the associated reporting limit, which is an estimate.

Table 3.4
Excavated Soil Data

		Location Name	TP5			TP5-E1	TP5-E2	TP5-N1	TP5-N2	TP5-S1	TP5-S2	TP5-W1	TP5-W2	TP7		TP7-N1	TP7-N2	TP7-N3	TP7-W2
		Sample Name	TP5-1	TP5-3	TP5-4	TP5-E1-3	TP5-E2-2.5	TP5-N1-2.5	TP5-N2-3	TP5-S1-3	TP5-S2-2.5	TP5-W1-2.5	TP5-W2-3	TP7-1	TP7-5	TP7-N1-3	TP7-N2-2.5	TP7-N3-3	TP7-W2-2.5
		Sample Date	5/22/2018	5/22/2018	5/22/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	5/22/2018	5/22/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018
		Sample Depth	1 ft	3 ft	4 ft	3 ft	2.5 ft	2.5 ft	3 ft	3 ft	2.5 ft	2.5 ft	3 ft	1 ft	5 ft	3 ft	2.5 ft	3 ft	2.5 ft
Analyte	**CAS No.**	**Unit**																	
Total Petroleum Hydrocarbons (TPHs)																			
Gasoline-range organics	GRO	mg/kg																	
Diesel-range organics	DRO	mg/kg																	
Oil-range organics	ORO	mg/kg																	
Total DRO & ORO (4)	T_DRO&ORO (U=0)	mg/kg																	
Diesel (5)	Dies	mg/kg																	
Heavy Oil (5)	Oil_Heavy	mg/kg																	
Metals																			
Arsenic	7440-38-2	mg/kg	83	790	5.5	110	50	79	19	25	5.4	27	62	4.5		12	29	6.6	25
Barium	7440-39-3	mg/kg																	
Cadmium	7440-43-9	mg/kg	5.5	10 U	1.0 U	8.8	9.4	1.0 U	1.1	3.0	8.9	4.1	1.0 U	9.7	1.0 U	7.1	5.0	9.7	1.0
Chromium	7440-47-3	mg/kg		98															
Chromium(VI)	18540-29-9	mg/kg		0.59 U															
Lead	7439-92-1	mg/kg		230	990	200	150	100	53	380	61	110	100	3.0	39	49	71	55	37
Mercury	7439-97-6	mg/kg																	
Selenium	7782-49-2	mg/kg																	
Silver	7440-22-4	mg/kg																	
Polychlorinated Biphenyls (PCBs)																			
Aroclor 1016	12674-11-2	mg/kg																	
Aroclor 1221	11104-28-2	mg/kg																	
Aroclor 1232	11141-16-5	mg/kg																	
Aroclor 1242	53469-21-9	mg/kg																	
Aroclor 1248	12672-29-6	mg/kg																	
Aroclor 1254	11097-69-1	mg/kg																	
Aroclor 1260	11096-82-5	mg/kg																	
Aroclor 1262	37324-23-5	mg/kg																	
Aroclor 1268	11100-14-4	mg/kg																	
Total PCB Aroclors (U=0) (4)	T_PCB (U=0)	mg/kg																	
Polybrominated Diphenyl Ethers (PBDEs)																			
PBDE-003	101-55-3	mg/kg																	
Semi-Volatile Organic Compound (SVOCs)																			
1-Methylnaphthalene	90-12-0	mg/kg																	
2-Methylnaphthalene	91-57-6	mg/kg																	
Acenaphthene	83-32-9	mg/kg																	
Acenaphthylene	208-96-8	mg/kg																	
Anthracene	120-12-7	mg/kg																	
Benzo(a)anthracene	56-55-3	mg/kg																	
Benzo(a)pyrene	50-32-8	mg/kg																	
Benzo(b)fluoranthene	205-99-2	mg/kg																	
Benzo(g,h,i)perylene	191-24-2	mg/kg																	
Benzo(k)fluoranthene	207-08-9	mg/kg																	
Chrysene	218-01-9	mg/kg																	
Dibenzo(a,h)anthracene	53-70-3	mg/kg																	
Fluoranthene	206-44-0	mg/kg																	
Fluorene	86-73-7	mg/kg																	
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg																	
Naphthalene	91-20-3	mg/kg																	
Phenanthrene	85-01-8	mg/kg																	
Pyrene	129-00-0	mg/kg																	

Table 3.4
Excavated Soil Data

		Location Name	TP5			TP5-E1	TP5-E2	TP5-N1	TP5-N2	TP5-S1	TP5-S2	TP5-W1	TP5-W2	TP7		TP7-N1	TP7-N2	TP7-N3	TP7-W2
		Sample Name	**TP5-1**	**TP5-3**	**TP5-4**	**TP5-E1-3**	**TP5-E2-2.5**	**TP5-N1-2.5**	**TP5-N2-3**	**TP5-S1-3**	**TP5-S2-2.5**	**TP5-W1-2.5**	**TP5-W2-3**	**TP7-1**	**TP7-5**	**TP7-N1-3**	**TP7-N2-2.5**	**TP7-N3-3**	**TP7-W2-2.5**
		Sample Date	**5/22/2018**	**5/22/2018**	**5/22/2018**	**6/27/2018**	**6/27/2018**	**6/27/2018**	**6/27/2018**	**6/27/2018**	**6/27/2018**	**6/27/2018**	**6/27/2018**	**5/22/2018**	**5/22/2018**	**6/27/2018**	**6/27/2018**	**6/27/2018**	**6/27/2018**
		Sample Depth	**1 ft**	**3 ft**	**4 ft**	**3 ft**	**2.5 ft**	**2.5 ft**	**3 ft**	**3 ft**	**2.5 ft**	**2.5 ft**	**3 ft**	**1 ft**	**5 ft**	**3 ft**	**2.5 ft**	**3 ft**	**2.5 ft**
Analyte	**CAS No.**	**Unit**																	
Semi-Volatile Organic Compound (SVOCs) (cont.)																			
Total Naphthalenes (U=0) (4)	T_Napth (U=0)	mg/kg																	
cPAHs (MTCA TEQ-ZeroND) (7,8)	BaPEq (U=0)	mg/kg																	
cPAHs (MTCA TEQ-HalfND) (7,9)	BaPEq (U=1/2)	mg/kg																	
Total HPAH (U=0) (4)	T_HPAH (U=0)	mg/kg																	
Total LPAH (U=0) (4)	T_LPAH (U=0)	mg/kg																	
Total PAH (U=0) (4)	T_PAH (U=0)	mg/kg																	
2,3,4,6-Tetrachlorophenol	58-90-2	mg/kg																	
2,4,5-Trichlorophenol	95-95-4	mg/kg																	
2,4,6-Trichlorophenol	88-06-2	mg/kg																	
2,4-Dichlorophenol	120-83-2	mg/kg																	
2,4-Dimethylphenol	105-67-9	mg/kg																	
2,4-Dinitrophenol	51-28-5	mg/kg																	
2,6-Dichlorophenol	87-65-0	mg/kg																	
2-Chlorophenol	95-57-8	mg/kg																	
2-Methylphenol	95-48-7	mg/kg																	
2-Nitrophenol	88-75-5	mg/kg																	
3- & 4-Methylphenol	15831-10-4	mg/kg																	
4,6-Dinitro-o-cresol	534-52-1	mg/kg																	
4-Chloro-3-methylphenol	59-50-7	mg/kg																	
4-Methylphenol	106-44-5	mg/kg																	
4-Nitrophenol	100-02-7	mg/kg																	
Pentachlorophenol	87-86-5	mg/kg																	
Phenol	108-95-2	mg/kg																	
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg																	
Butyl benzyl phthalate	85-68-7	mg/kg																	
Di-n-butyl phthalate	84-74-2	mg/kg																	
Di-n-octyl phthalate	117-84-0	mg/kg																	
Diethylphthalate	84-66-2	mg/kg																	
Dimethyl phthalate	131-11-3	mg/kg																	
2-Chloronaphthalene	91-58-7	mg/kg																	
Aniline	62-53-3	mg/kg																	
Azobenzene	103-33-3	mg/kg																	
Benzoic acid	65-85-0	mg/kg																	
Benzyl alcohol	100-51-6	mg/kg																	
Bis(2-chloroethoxy)methane	111-91-1	mg/kg																	
Carbazole	86-74-8	mg/kg																	
Dibenzofuran	132-64-9	mg/kg																	
Hexachlorobenzene	118-74-1	mg/kg																	
Hexachlorobutadiene	87-68-3	mg/kg																	
Hexachlorocyclopentadiene	77-47-4	mg/kg																	
Isophorone	78-59-1	mg/kg																	
N-Nitrosodimethylamine	62-75-9	mg/kg																	
N-Nitroso-di-n-propylamine	621-64-7	mg/kg																	
N-Nitrosodiphenylamine	86-30-6	mg/kg																	

Table 3.4
Excavated Soil Data

Location Name			TP5			TP5-E1	TP5-E2	TP5-N1	TP5-N2	TP5-S1	TP5-S2	TP5-W1	TP5-W2	TP7		TP7-N1	TP7-N2	TP7-N3	TP7-W2
Sample Name			TP5-1	TP5-3	TP5-4	TP5-E1-3	TP5-E2-2.5	TP5-N1-2.5	TP5-N2-3	TP5-S1-3	TP5-S2-2.5	TP5-W1-2.5	TP5-W2-3	TP7-1	TP7-5	TP7-N1-3	TP7-N2-2.5	TP7-N3-3	TP7-W2-2.5
Sample Date			5/22/2018	5/22/2018	5/22/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	5/22/2018	5/22/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018
Sample Depth			1 ft	3 ft	4 ft	3 ft	2.5 ft	2.5 ft	3 ft	3 ft	2.5 ft	2.5 ft	3 ft	1 ft	5 ft	3 ft	2.5 ft	3 ft	2.5 ft
Analyte	**CAS No.**	**Unit**																	
Volatile Organic Compound (VOCs)																			
Benzene	71-43-2	mg/kg																	
Ethylbenzene	100-41-4	mg/kg																	
Toluene	108-88-3	mg/kg																	
Xylene (meta & para)	108-38-3/106-42-3	mg/kg																	
Xylene (ortho)	95-47-6	mg/kg																	
Xylene (total)	1330-20-7	mg/kg																	
Chloroethane	75-00-3	mg/kg																	
cis-1,2-Dichloroethene	156-59-2	mg/kg																	
Tetrachloroethene	127-18-4	mg/kg																	
trans-1,2-Dichloroethene	156-60-5	mg/kg																	
Trichloroethene	79-01-6	mg/kg																	
Vinyl chloride	75-01-4	mg/kg																	
1,1,1,2-Tetrachloroethane	630-20-6	mg/kg																	
1,1,1-Trichloroethane	71-55-6	mg/kg																	
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg																	
1,1,2-Trichloroethane	79-00-5	mg/kg																	
1,1-Dichloroethane	75-34-3	mg/kg																	
1,1-Dichloroethene	75-35-4	mg/kg																	
1,1-Dichloropropene	563-58-6	mg/kg																	
1,2,3-Trichlorobenzene	87-61-6	mg/kg																	
1,2,3-Trichloropropane	96-18-4	mg/kg																	
1,2,4-Trichlorobenzene	120-82-1	mg/kg																	
1,2,4-Trimethylbenzene	95-63-6	mg/kg																	
1,2-Dibromo-3-chloropropane	96-12-8	mg/kg																	
1,2-Dibromoethane	106-93-4	mg/kg																	
1,2-Dichlorobenzene	95-50-1	mg/kg																	
1,2-Dichloroethane	107-06-2	mg/kg																	
1,2-Dichloropropane	78-87-5	mg/kg																	
1,3,5-Trimethylbenzene	108-67-8	mg/kg																	
1,3-Dichlorobenzene	541-73-1	mg/kg																	
1,3-Dichloropropane	142-28-9	mg/kg																	
1,4-Dichlorobenzene	106-46-7	mg/kg																	
2,2-Dichloropropane	594-20-7	mg/kg																	
2,4-Dinitrotoluene	121-14-2	mg/kg																	
2,6-Dinitrotoluene	606-20-2	mg/kg																	
2-Chlorotoluene	95-49-8	mg/kg																	
2-Hexanone	591-78-6	mg/kg																	
2-Nitroaniline	88-74-4	mg/kg																	
3,3'-Dichlorobenzidine	91-94-1	mg/kg																	
3-Nitroaniline	99-09-2	mg/kg																	
4-Chloroaniline	106-47-8	mg/kg																	
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg																	
4-Chlorotoluene	106-43-4	mg/kg																	
4-Nitroaniline	100-01-6	mg/kg																	
Acetone	67-64-1	mg/kg																	
Bis(2-chloroethyl)ether	111-44-4	mg/kg																	
Bis(2-chloroisopropyl)ether	39638-32-9	mg/kg																	
Bromobenzene	108-86-1	mg/kg																	

Table 3.4
Excavated Soil Data

		Location Name	TP5			TP5-E1	TP5-E2	TP5-N1	TP5-N2	TP5-S1	TP5-S2	TP5-W1	TP5-W2	TP7		TP7-N1	TP7-N2	TP7-N3	TP7-W2
		Sample Name	**TP5-1**	**TP5-3**	**TP5-4**	**TP5-E1-3**	**TP5-E2-2.5**	**TP5-N1-2.5**	**TP5-N2-3**	**TP5-S1-3**	**TP5-S2-2.5**	**TP5-W1-2.5**	**TP5-W2-3**	**TP7-1**	**TP7-5**	**TP7-N1-3**	**TP7-N2-2.5**	**TP7-N3-3**	**TP7-W2-2.5**
		Sample Date	**5/22/2018**	**5/22/2018**	**5/22/2018**	**6/27/2018**	**6/27/2018**	**6/27/2018**	**6/27/2018**	**6/27/2018**	**6/27/2018**	**6/27/2018**	**6/27/2018**	**5/22/2018**	**5/22/2018**	**6/27/2018**	**6/27/2018**	**6/27/2018**	**6/27/2018**
		Sample Depth	**1 ft**	**3 ft**	**4 ft**	**3 ft**	**2.5 ft**	**2.5 ft**	**3 ft**	**3 ft**	**2.5 ft**	**2.5 ft**	**3 ft**	**1 ft**	**5 ft**	**3 ft**	**2.5 ft**	**3 ft**	**2.5 ft**
Analyte	**CAS No.**	**Unit**																	
Volatile Organic Compound (VOCs) (cont.)																			
Bromochloromethane	74-97-5	mg/kg																	
Bromodichloromethane	75-27-4	mg/kg																	
Bromoform	75-25-2	mg/kg																	
Bromomethane	74-83-9	mg/kg																	
Carbon tetrachloride	56-23-5	mg/kg																	
Chlorobenzene	108-90-7	mg/kg																	
Chloroform	67-66-3	mg/kg																	
Chloromethane	74-87-3	mg/kg																	
cis-1,3-Dichloropropene	10061-01-5	mg/kg																	
Cymene	99-87-6	mg/kg																	
Dibromochloromethane	124-48-1	mg/kg																	
Dibromomethane	74-95-3	mg/kg																	
Dichlorodifluoromethane	75-71-8	mg/kg																	
Hexachloroethane	67-72-1	mg/kg																	
Isopropylbenzene	98-82-8	mg/kg																	
Methyl ethyl ketone	78-93-3	mg/kg																	
Methyl isobutyl ketone	108-10-1	mg/kg																	
Methylene chloride	75-09-2	mg/kg																	
Methyl-tert-butyl ether	1634-04-4	mg/kg																	
Nitrobenzene	98-95-3	mg/kg																	
n-Hexane	110-54-3	mg/kg																	
n-Propylbenzene	103-65-1	mg/kg																	
Pyridine	110-86-1	mg/kg																	
sec-Butylbenzene	135-98-8	mg/kg																	
Styrene	100-42-5	mg/kg																	
tert-Butylbenzene	98-06-6	mg/kg																	
trans-1,3-Dichloropropene	10061-02-6	mg/kg																	
Trichlorofluoromethane	75-69-4	mg/kg																	

Notes:

Blank cells are intentional.
All results are rounded to two significant figures.
italics Non-detect result exceeds PSL.
1 Preliminary Screening Level as established in Table X.X
1 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.
2 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.
3 The laboratory noted the chromatograms resemble a mixture of diesel and residual range products.
4 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.
5 Result reported by HCID Analysis.
6 The laboratory noted that analysis for PCB shows peaks which closely resemble Aroclors but pattern and restention time are not close enough for identification.
7 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Table 708-2 of WAC 173-340-900.
8 Calculation was performed using only detected cPAH concentrations.
9 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

Abbreviations:

CAS Chemical Abstracts Service Number
cPAH Carcinogenic polycyclic aromatic hydrocarbon
ft Feet
mg/kg Milligrams per kilogram
MTCA Model Toxics Control Act
PAH Polycyclic aromatic hydrocarbon
TEQ Toxic equivalency

Qualifiers:

J Analyte was detected; concentration is an estimate.
U Analyte was not detected at the associated reporting limit.
UJ Analyte was not detected at the associated reporting limit, which is an estimate.

Table 5.1
Groundwater Preliminary Screening Levels [1,2]

Analyte	CAS No.	Protection of Drinking Water	Protection of Surface Water	Protection of Sediment	Protection of Indoor Air	Natural Background	Most Stringent PSL	Most Stringent PSL Basis
Total Petroleum Hydrocarbons (TPHs)								
Gasoline-range organics, fresh	TPHG	800	800	--	--	--	800	Protect Drinking Water
Gasoline-range organics, weathered	TPHGW	1,000	1,000	--	--	--	1,000	Protect Drinking Water
Diesel-range organics, fresh	TPHD	500	50	--	--	--	50	Protect Surface Water
Diesel-range organics, weathered	TPHDW	500	500	--	--	--	500	Protect Drinking Water
Oil-range organics	TPHO	500	500	--	--	--	500	Protect Drinking Water
Stoddard solvent	TPHSS	--	--	--	--	--	--	--
Total DRO + ORO	TPHDO	500	500	--	--	--	500	Protect Drinking Water
Metals								
Aluminum	7429-90-5	16,000	--	--	--	--	16,000	Protect Drinking Water
Antimony	7440-36-0	6.0	90	--	--	--	6.0	Protect Drinking Water
Arsenic	7440-38-2	0.58	0.14	220	--	8.0	8.0	Natural Background
Barium	7440-39-3	2,000	200	930,000	--	--	200	Protect Surface Water
Beryllium	7440-41-7	4.0	76	4.9	--	--	4.0	Protect Drinking Water
Cadmium	7440-43-9	5.0	7.9	1.2	--	--	1.2	Protect Sediment
Chromium, total	7440-47-3	100	--	--	--	--	100	Protect Drinking Water
Chromium, trivalent	16065-83-1	24,000	27	85	--	--	27	Protect Surface Water
Chromium, hexavalent	18540-29-9	0.046	0.36	78	--	--	0.046	Protect Drinking Water
Cobalt	7440-48-4	4.8	--	--	--	--	4.8	Protect Drinking Water
Copper	7440-50-8	640	3.1	14	--	--	3.1	Protect Surface Water
Iron	7439-89-6	300	--	--	--	--	300	Protect Drinking Water
Lead	7439-92-1	15	5.6	19	--	--	5.6	Protect Surface Water
Manganese	7439-96-5	50	100	--	--	--	50	Protect Drinking Water
Mercury, inorganic	7439-97-6	2.0	0.025	2.0	1.1	--	0.025	Protect Surface Water
Methylmercury	16056-34-1	1.6	--	--	--	--	1.6	Protect Drinking Water
Molybdenum	7439-98-7	80	--	--	--	--	80	Protect Drinking Water
Nickel	7440-02-0	100	8.2	2,600	--	--	8.2	Protect Surface Water
Selenium	7782-49-2	50	71	430,000	--	--	50	Protect Drinking Water
Silver	7440-22-4	80	1.9	55	--	--	1.9	Protect Surface Water
Thallium	7440-28-0	0.16	0.062	25	--	--	0.062	Protect Surface Water
Tin	7440-31-5	9,600	--	--	--	--	9,600	Protect Drinking Water
Vanadium	7440-62-2	140	--	--	--	--	140	Protect Drinking Water
Zinc	7440-66-6	4,800	81	770	--	--	81	Protect Surface Water
Polychlorinted Biphenyls (PCBs)								
Total PCB Aroclors	1336-36-3	0.22	0.0000070	0.086	--	--	0.0000070	Protect Surface Water
Total PCB congeners	PCBCON	0.22	0.0000070	0.0013	--	--	0.0000070	Protect Surface Water
Dioxins/Furans								
Total dioxin/furan TEQ	DFTEQ	0.00000034	0.000000028	0.00000042	--	--	0.000000028	Protect Surface Water

Table 5.1

Groundwater Preliminary Screening Levels (1,2)

Analyte	CAS No.	Protection of Drinking Water	Protection of Surface Water	Protection of Sediment	Protection of Indoor Air	Natural Background	Most Stringent PSL	Most Stringent PSL Basis
Semi-Volatile Organic Compounds (SVOCs) and Polycyclic Aromatic Hydrocarbons (PAHs)								
Acenaphthene	83-32-9	480	30	5.3	--	--	5.3	Protect Sediment
Acenaphthylene	208-96-8	--	--	--	--	--	--	--
Anthracene	120-12-7	2,400	100	2.1	--	--	2.1	Protect Sediment
Benzo(a)anthracene	56-55-3	--	0.00016	0.19	--	--	0.00016	Protect Surface Water
Benzo(b)fluoranthene	205-99-2	--	0.00016	--	--	--	0.00016	Protect Surface Water
Benzo(k)fluoranthene	207-08-9	--	0.0016	--	--	--	0.0016	Protect Surface Water
Total benzofluoranthenes	TBFLUO	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	191-24-2	--	--	--	--	--	--	--
Benzo(a)pyrene	50-32-8	0.20	0.000016	0.087	--	--	0.000016	Protect Surface Water
Chrysene	218-01-9	--	0.016	0.40	--	--	0.016	Protect Surface Water
Dibenz(a,h)anthracene	53-70-3	--	0.000016	0.0068	--	--	0.000016	Protect Surface Water
Dibenzofuran	132-64-9	8.0	--	3.1	--	--	3.1	Protect Sediment
Fluoranthene	206-44-0	640	6.0	1.8	--	--	1.8	Protect Sediment
Fluorene	86-73-7	320	10	3.7	--	--	3.7	Protect Sediment
Indeno(1,2,3-c,d)pyrene	193-39-5	--	0.00016	0.016	--	--	0.00016	Protect Surface Water
Methyl isopropyl phenanthrene	483-65-8	--	--	--	--	--	--	--
1-Methylnaphthalene	90-12-0	1.5	--	800	--	--	1.5	Protect Drinking Water
2-Methylnaphthalene	91-57-6	32	--	14	--	--	14	Protect Sediment
naphthalene	91-20-3	160	1.4	90	8.9	--	1.4	Protect Surface Water
Phenanthrene	85-01-8	--	--	--	--	--	--	--
Pyrene	129-00-0	240	8.0	2.0	--	--	2.0	Protect Sediment
Total cPAH TEQ	CPAHTEQ	0.023	0.0097	0.032	--	--	0.0097	Protect Surface Water
Other Semi-Volatile Organic Compounds								
Acetaldehyde	75-07-0	--	--	--	0.030	--	0.030	Protect Indoor Air
Aniline	62-53-3	15	--	120,000	--	--	15	Protect Drinking Water
Azobenzene	103-33-3	0.40	--	--	--	--	0.40	Protect Drinking Water
Benzidine	92-87-5	0.00010	0.000023	0.088	--	--	0.000023	Protect Surface Water
Benzoic acid	65-85-0	64,000	--	590	--	--	590	Protect Sediment
Benzyl alcohol	100-51-6	1,600	--	56	--	--	56	Protect Sediment
Bis(2-chloroethoxy)methane	111-91-1	--	--	--	--	--	--	--
Bis(2-chloroethyl)ether	111-44-4	0.040	0.060	590	--	--	0.040	Protect Drinking Water
Bis(chloromethyl)ether	542-88-1	0.00020	0.017	7.6	--	--	0.00020	Protect Drinking Water
Bis(2-chloro-1-methylethyl)ether	108-60-1	320	900	3,700,000	--	--	320	Protect Drinking Water
2,6-Bis(1,1-dimethylethyl) phenol	128-39-2	--	--	--	--	--	--	--
Bis(2-ethylhexyl) phthalate	117-81-7	6.0	0.046	0.62	--	--	0.046	Protect Surface Water
4-Bromophenyl phenyl ether	101-55-3	--	--	--	--	--	--	--
Butyl benzyl phthalate	85-68-7	46	0.013	0.24	--	--	0.013	Protect Surface Water
Butyl diphenyl phosphate	2752-95-6	--	--	--	--	--	--	--
Carbazole	86-74-8	--	--	--	--	--	--	--
4-Chloroaniline	106-47-8	0.44	--	2,400	--	--	0.44	Protect Drinking Water
4-Chloro-3-methylphenol	59-50-7	--	36	--	--	--	36	Protect Surface Water

Table 5.1

Groundwater Preliminary Screening Levels [1,2]

Analyte	CAS No.	Protection of Drinking Water	Protection of Surface Water	Protection of Sediment	Protection of Indoor Air	Natural Background	Most Stringent PSL	Most Stringent PSL Basis
Other Semi-Volatile Organic Compounds (cont.)								
2-Chloronaphthalene	91-58-7	640	100	330,000	--	--	100	Protect Surface Water
2-Chlorophenol	95-57-8	40	17	3,500	--	--	17	Protect Surface Water
4-Chlorophenyl phenyl ether	7005-72-3	--	--	--	--	--	--	--
Dibutyl phthalate	84-74-2	1,600	8.0	46	--	--	8.0	Protect Surface Water
Dibutyl phenyl phosphate	2528-36-1	--	--	--	--	--	--	--
1,2-Dichlorobenzene	95-50-1	600	800	4.5	2,500	--	4.5	Protect Sediment
1,3-Dichlorobenzene	541-73-1	--	2.0	--	--	--	2.0	Protect Surface Water
1,4-Dichlorobenzene	106-46-7	75	60	8.9	5.0	--	5.0	Protect Indoor Air
3,3'-Dichlorobenzidine	91-94-1	0.19	0.0033	440	--	--	0.0033	Protect Surface Water
2,4-Dichlorophenol	120-83-2	48	10	8,200	--	--	10	Protect Surface Water
Diethyl phthalate	84-66-2	13,000	200	93	--	--	93	Protect Sediment
Dimethyl phthalate	131-11-3	--	600	59	--	--	59	Protect Sediment
2,4-Dimethylphenol	105-67-9	320	97	2.9	--	--	2.9	Protect Sediment
4,6-Dinitro-2-methylphenol	534-52-1	--	7.0	--	--	--	7.0	Protect Surface Water
2,4-Dinitrophenol	51-28-5	32	100	650,000	--	--	32	Protect Drinking Water
2,4-Dinitrotoluene	121-14-2	0.28	0.18	370	--	--	0.18	Protect Surface Water
2,6-Dinitrotoluene	606-20-2	0.058	--	75	--	--	0.058	Protect Drinking Water
Di-n-octyl phthalate	117-84-0	160	--	2.3	--	--	2.3	Protect Sediment
1,4-Dioxane	123-91-1	0.44	--	20,000	--	--	0.44	Protect Drinking Water
1,2-Diphenylhydrazine	122-66-7	0.11	0.020	56	--	--	0.020	Protect Surface Water
Hexachlorobenzene	118-74-1	0.27	0.0000050	0.014	0.24	--	0.0000050	Protect Surface Water
Hexachlorobutadiene	87-68-3	0.56	0.010	0.66	0.64	--	0.010	Protect Surface Water
Hexachlorocyclopentadiene	77-47-4	48	1.0	44,000	4.2	--	1.0	Protect Surface Water
Hexachloroethane	67-72-1	1.1	0.020	7,600	3.8	--	0.020	Protect Surface Water
Isophorone	78-59-1	92	110	750,000	--	--	92	Protect Drinking Water
2-Methoxynaphthalene	93-04-9	--	--	--	--	--	--	--
2-Methylphenol	95-48-7	800	--	11	--	--	11	Protect Sediment
4-Methylphenol	106-44-5	1,600	--	110	--	--	110	Protect Sediment
2-Nitroaniline	88-74-4	160	--	740,000	--	--	160	Protect Drinking Water
3-Nitroaniline	99-09-2	--	--	--	--	--	--	--
4-Nitroaniline	100-01-6	4.4	--	110,000	--	--	4.4	Protect Drinking Water
Nitrobenzene	98-95-3	16	100	140,000	--	--	16	Protect Drinking Water
2-Nitrophenol	88-75-5	--	--	--	--	--	--	--
4-Nitrophenol	100-02-7	--	--	--	--	--	--	--
n-Nitrosodimethylamine	62-75-9	0.00023	0.34	8.8	--	--	0.00023	Protect Drinking Water
n-Nitrosodiphenylamine	86-30-6	18	0.69	0.55	--	--	0.55	Protect Sediment
n-Nitrosodi-n-propylamine	621-64-7	0.013	0.058	32	--	--	0.013	Protect Drinking Water
Pentachlorophenol	87-86-5	1.0	0.0020	0.88	--	--	0.0020	Protect Surface Water
Phenol	108-95-2	4,800	70,000	100	--	--	100	Protect Sediment
Pyridine	110-86-1	8.0	--	100,000	--	--	8.0	Protect Drinking Water

Table 5.1
Groundwater Preliminary Screening Levels (1,2)

Analyte	CAS No.	Protection of Drinking Water	Protection of Surface Water	Protection of Sediment	Protection of Indoor Air	Natural Background	Most Stringent PSL	Most Stringent PSL Basis
Other Semi-Volatile Organic Compounds (cont.)								
2,3,4,5-Tetrachlorophenol	4901-51-3	--	--	--	--	--	--	--
2,3,4,6-Tetrachlorophenol	58-90-2	480	--	--	--	--	480	Protect Drinking Water
1,2,4-Trichlorobenzene	120-82-1	15	--	0.96	39	--	0.96	Protect Sediment
2,4,5-Trichlorophenol	95-95-4	1,600	0.037	67,000	--	--	0.037	Protect Surface Water
2,4,6-Trichlorophenol	88-06-2	8.0	600	910	--	--	8.0	Protect Drinking Water
Volatile Organic Compounds (VOCs)								
Acetone	67-64-1	7,200	--	340,000,000	--	--	7,200	Protect Drinking Water
Acrolein	107-02-8	4.0	1.1	200,000	2.9	--	1.1	Protect Surface Water
Acrylonitrile	107-13-1	0.081	0.028	7,100	12	--	0.028	Protect Surface Water
Benzaldehyde	100-52-7	11	--	900,000	--	--	11	Protect Drinking Water
Benzene	71-43-2	5.0	1.6	30,000	2.4	--	1.6	Protect Surface Water
Bromobenzene	108-86-1	64	--	390,000	630	--	64	Protect Drinking Water
Bromochloromethane	74-97-5	--	--	--	--	--	--	--
Bromoethane	74-96-4	--	--	--	--	--	--	--
Bromoform	75-25-2	55	12	120,000	220	--	12	Protect Surface Water
Bromomethane	74-83-9	11	270	440,000	11	--	11	Protect Indoor Air
2-Butoxyethanol	111-76-2	800	--	37,000,000	--	--	800	Protect Drinking Water
n-Butylbenzene	104-51-8	400	--	420,000	--	--	400	Protect Drinking Water
sec-Butylbenzene	135-98-8	800	--	940,000	--	--	800	Protect Drinking Water
tert-Butylbenzene	98-06-6	800	--	1,200,000	--	--	800	Protect Drinking Water
Carbon disulfide	75-15-0	800	--	24,000,000	840	--	800	Protect Drinking Water
Carbon tetrachloride	56-23-5	5.0	0.35	12,000	0.62	--	0.35	Protect Surface Water
Chlorobenzene	108-90-7	100	200	1,000,000	350	--	100	Protect Drinking Water
Chloroethane	75-00-3	--	--	--	15,000	--	15,000	Protect Indoor Air
2-Chloroethyl vinyl ether	110-75-8	--	--	--	--	--	--	--
Chloroform	67-66-3	14	150	58,000	1.2	--	1.2	Protect Indoor Air
Chloromethane	74-87-3	--	--	--	150	--	150	Protect Indoor Air
3-Chloro-1-propene	107-05-1	2.1	--	100,000	--	--	2.1	Protect Drinking Water
2-Chlorotoluene	95-49-8	160	--	620,000	--	--	160	Protect Drinking Water
4-Chlorotoluene	106-43-4	160	--	630,000	--	--	160	Protect Drinking Water
Dibromochloromethane	124-48-1	5.2	2.2	29,000	--	--	2.2	Protect Surface Water
1,2-Dibromo-3-chloropropane	96-12-8	0.14	--	250	0.042	--	0.042	Protect Indoor Air
Dibromomethane	74-95-3	80	--	1,400,000	86	--	80	Protect Drinking Water
Dichlorobromomethane	75-27-4	7.1	2.8	39,000	1.4	--	1.4	Protect Indoor Air
trans-1,4-Dichloro-2-butene	110-57-6	--	--	--	--	--	--	--
Dichlorodifluoromethane	75-71-8	1,600	--	34,000,000	4.2	--	4.2	Protect Indoor Air
1,1-Dichloroethane	75-34-3	7.7	--	320,000	11	--	7.7	Protect Drinking Water
1,2-Dichloroethane	107-06-2	4.8	73	24,000	3.5	--	3.5	Protect Indoor Air
1,1-Dichloroethylene	75-35-4	7.0	4,000	6,600,000	130	--	7.0	Protect Drinking Water
cis-1,2-Dichloroethylene	156-59-2	16	--	360,000	--	--	16	Protect Drinking Water
trans-1,2-Dichloroethylene	156-60-5	100	1,000	3,700,000	77	--	77	Protect Indoor Air

Table 5.1
Groundwater Preliminary Screening Levels (1,2)

Analyte	CAS No.	Protection of Drinking Water	Protection of Surface Water	Protection of Sediment	Protection of Indoor Air	Natural Background	Most Stringent PSL	Most Stringent PSL Basis
Volatile Organic Compounds (VOCs) (cont.)								
1,2-Dichloroethylene (mixed isomers)	540-59-0	72	--	1,700,000	--	--	72	Protect Drinking Water
1,2-Dichloropropane	78-87-5	5.0	3.1	53,000	10	--	3.1	Protect Surface Water
1,3-Dichloropropane	142-28-9	160	--	2,500,000	--	--	160	Protect Drinking Water
2,2-Dichloropropane	594-20-7	--	--	--	--	--	--	--
1,1-Dichloropropene	563-58-6	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	10061-01-5	0.44	1.2	26,000	--	--	0.44	Protect Drinking Water
trans-1,3-Dichloropropene	10061-02-6	0.44	1.2	26,000	--	--	0.44	Protect Drinking Water
Ethane	74-84-0	--	--	--	--	--	--	--
Ethylbenzene	100-41-4	700	21	5,400,000	2,800	--	21	Protect Surface Water
Ethylene	74-85-1	0.037	--	2,800	0.054	--	0.037	Protect Drinking Water
Ethyl ether	60-29-7	1,600	--	62,000,000	--	--	1,600	Protect Drinking Water
Ethylene dibromide	106-93-4	0.050	--	790	0.30	--	0.050	Protect Drinking Water
Formaldehyde	50-00-0	2.1	--	220,000	--	--	2.1	Protect Drinking Water
n-Hexane	110-54-3	480	--	220,000	4.1	--	4.1	Protect Indoor Air
2-Hexanone	591-78-6	40	--	2,000,000	7,300	--	40	Protect Drinking Water
Isopropylbenzene	98-82-8	800	--	1,800,000	910	--	800	Protect Drinking Water
4-Isopropyltoluene	99-87-6	--	--	--	--	--	--	--
Methane	74-82-8	--	--	--	--	--	--	--
Methyl ethyl ketone	78-93-3	4,800	--	210,000,000	1,700,000	--	4,800	Protect Drinking Water
Methyl iodide	74-88-4	--	--	--	--	--	--	--
Methyl isobutyl ketone	108-10-1	640	--	23,000,000	470,000	--	640	Protect Drinking Water
Methyl tert-butyl ether	1634-04-4	24	--	2,000,000	800	--	24	Protect Drinking Water
Methylene chloride	75-09-2	5.0	100	360,000	780	--	5.0	Protect Drinking Water
2-Pentanone	107-87-9	--	--	--	--	--	--	--
n-Propylbenzene	103-65-1	800	--	1,500,000	2,300	--	800	Protect Drinking Water
Styrene	100-42-5	100	--	2,700,000	8,200	--	100	Protect Drinking Water
1,1,1,2-Tetrachloroethane	630-20-6	1.7	--	50,000	7.1	--	1.7	Protect Drinking Water
1,1,2,2-Tetrachloroethane	79-34-5	0.22	0.30	6,900	5.9	--	0.22	Protect Drinking Water
Tetrachloroethylene	127-18-4	5.0	2.9	250,000	25	--	2.9	Protect Surface Water
Toluene	108-88-3	640	100	6,000,000	15,000	--	100	Protect Surface Water
1,2,3-Trichlorobenzene	87-61-6	6.4	--	7,300	--	--	6.4	Protect Drinking Water
1,1,1-Trichloroethane	71-55-6	200	50,000	150,000,000	5,400	--	200	Protect Drinking Water
1,1,2-Trichloroethane	79-00-5	3.0	0.90	25,000	5.1	--	0.90	Protect Surface Water
Trichloroethylene	79-01-6	4.0	0.70	5,100	1.4	--	0.70	Protect Surface Water
Trichlorofluoroethane	27154-33-2	--	--	--	--	--	--	--
Trichlorofluoromethane	75-69-4	2,400	--	51,000,000	120	--	120	Protect Indoor Air
1,2,3-Trichloropropane	96-18-4	0.00038	--	6.8	--	--	0.00038	Protect Drinking Water
Trichlorotrifluoroethane	76-13-1	240,000	--	1,700,000,000	170	--	170	Protect Indoor Air
1,2,3-Trimethylbenzene	526-73-8	80	--	190,000	410	--	80	Protect Drinking Water
1,2,4-Trimethylbenzene	95-63-6	80	--	200,000	240	--	80	Protect Drinking Water
1,3,5-Trimethylbenzene	108-67-8	80	--	200,000	170	--	80	Protect Drinking Water

Table 5.1
Groundwater Preliminary Screening Levels (1,2)

Analyte	CAS No.	Protection of Drinking Water	Protection of Surface Water	Protection of Sediment	Protection of Indoor Air	Natural Background	Most Stringent PSL	Most Stringent PSL Basis
Volatile Organic Compounds (VOCs)(cont.)								
Vinyl acetate	108-05-4	8,000	--	340,000,000	7,800	--	7,800	Protect Indoor Air
Vinyl chloride	75-01-4	0.29	0.18	1,900	0.33	--	0.18	Protect Surface Water
m-Xylene	108-38-3	--	--	--	--	--	--	--
m,p-Xylene	179601-23-1	--	--	--	--	--	--	--
o-Xylene	95-47-6	--	--	--	--	--	--	--
Total xylenes	1330-20-7	1,600	110	9,700,000	320	--	110	Protect Surface Water
Pesticides								
Aldrin	309-00-2	0.0026	0.000000041	0.00011	6.3	--	0.000000041	Protect Surface Water
alpha-BHC	319-84-6	0.014	0.000048	6.2	--	--	0.000048	Protect Surface Water
beta-BHC	319-85-7	0.049	0.0014	18	--	--	0.0014	Protect Surface Water
delta-BHC	319-86-8	--	--	--	--	--	--	--
gamma-BHC	58-89-9	0.20	0.13	46	--	--	0.13	Protect Surface Water
Carbaryl	63-25-2	1,600	--	--	--	--	1,600	Protect Drinking Water
cis-Chlordane	5103-71-9	0.13	0.00036	0.00010	--	--	0.00010	Protect Sediment
trans-Chlordane	5103-74-2	0.13	0.00036	0.00010	--	--	0.00010	Protect Sediment
Chlordane	57-74-9	1.3	0.000022	--	--	--	0.000022	Protect Surface Water
Chlorpyrifos	2921-88-2	16	0.0056	1,400	--	--	0.0056	Protect Surface Water
4,4'-DDD	72-54-8	0.36	0.0000079	7.9	--	--	0.0000079	Protect Surface Water
4,4'-DDE	72-55-9	0.13	0.00000088	3.8	--	--	0.00000088	Protect Surface Water
4,4'-DDT	50-29-3	0.26	0.0000012	0.0000078	--	--	0.0000012	Protect Surface Water
Total DDD	M	0.36	0.0010	7.9	--	--	0.0010	Protect Surface Water
Total DDE	N	0.13	0.0010	3.8	--	--	0.0010	Protect Surface Water
Total DDT	O	0.26	0.0010	--	--	--	0.0010	Protect Surface Water
Diazinon	333-41-5	11	--	2,400	--	--	11	Protect Drinking Water
Dieldrin	60-57-1	0.0055	0.0000012	0.00021	--	--	0.0000012	Protect Surface Water
Endosulfan I	959-98-8	48	0.0087	9,300	--	--	0.0087	Protect Surface Water
Endosulfan II	33213-65-9	48	0.0087	9,300	--	--	0.0087	Protect Surface Water
Endosulfan sulfate	1031-07-8	96	10	6,400	--	--	10	Protect Surface Water
Endrin	72-20-8	2.0	0.0020	290	--	--	0.0020	Protect Surface Water
Endrin aldehyde	7421-93-4	--	0.035	--	--	--	0.035	Protect Surface Water
Endrin ketone	53494-70-5	--	--	--	--	--	--	--
Heptachlor	76-44-8	0.097	0.00000034	0.00055	0.51	--	0.00000034	Protect Surface Water
Heptachlor epoxide	1024-57-3	0.048	0.0000024	--	--	--	0.0000024	Protect Surface Water
Malathion	121-75-5	320	0.10	3,300,000	--	--	0.10	Protect Surface Water
Methoxychlor	72-43-5	40	0.020	660	--	--	0.020	Protect Surface Water
Mirex	2385-85-5	0.0024	0.0010	0.011	0.015	--	0.0010	Protect Surface Water
Nonachlor	3734-49-4	--	--	--	--	--	--	--
Toxaphene	8001-35-2	0.80	0.000032	0.66	--	--	0.000032	Protect Surface Water

Notes:

-- Not available.

1 All PSLs are derived from the Lower Duwamish Waterway Preliminary Cleanup Level Workbook (Ecology 2022).

2 Concentrations are presented in µg/L. Criteria have been rounded to two significant digits.

Abbreviations:

BHC Benzenehexachloride
CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbon
DDD Dichlorodiphenyldichloroethane
DDE Dichlorodiphenyldichloroethylene
DDT Dichlorodiphenyltrichloroethane
DRO Diesel-range organics
µg/L Micrograms per liter
ORO Oil-range organics
PSL Preliminary screening level
TEQ Toxic equivalent

Table 5.2
Soil Preliminary Screening Levels (1,2)

Analyte	CAS No.	Protection of Direct Contact	Protection of Leaching to Groundwater	Protection of Erosion to Sediment	Site-Specific TEE Unrestricted	Natural Background Ecology (Ecology 1994 and 2010)	Most Stringent PSL	Basis for Most Stringent PSL
Total Petroleum Hydrocarbons (TPHs)								
Gasoline-range organics (3)	TPHG	1,500	30	--	120	--	30	Protect Drinking Water Saturated Zone
Gasoline-range organics, weathered	TPHGW	1,500	100	--	120	--	100	Protect Drinking Water Saturated Zone
Diesel-range organics	TPHD	--	2,000	--	260	--	260	Site-Specific TEE Unrestricted
Diesel-range organics, weathered	TPHDW	--	2,000	--	260	--	260	Site-Specific TEE Unrestricted
Oil-range organics	TPHO	--	2,000	--	260	--	260	Site-Specific TEE Unrestricted
Stoddard solvent	TPHSS	--	--	--	--	--	--	--
Total DRO + ORO	TPHDO	--	2,000	--	260	--	260	Site-Specific TEE Unrestricted
Metals								
Aluminum	7429-90-5	80,000	24,000	240,000	50	33,000	33,000	Natural Background
Antimony	7440-36-0	32	0.27	97	5.0	--	0.27	Protect Drinking Water Saturated Zone
Arsenic	7440-38-2	0.67	0.0041	7.0	7.0	7.3	7.3	Natural Background
Barium	7440-39-3	16,000	8.3	49,000	100	--	8.3	Protect Surface Water via Ground Water Saturated Zone
Beryllium	7440-41-7	160	3.2	490	10	0.61	3.2	Protect Drinking Water Saturated Zone
Cadmium	7440-43-9	80	0.0083	5.1	4.0	0.77	0.77	Natural Background
Chromium, total	7440-47-3	--	--	260	42	48	48	Nautral Background
Chromium, trivalent	16065-83-1	120,000	27	370,000	--	--	27	Protect Surface Water via Ground Water Saturated Zone
Chromium, hexavalent	18540-29-9	0.38	0.00089	1.1	--	--	0.00089	Protect Drinking Water Saturated Zone
Cobalt	7440-48-4	24	0.22	73	20	--	0.22	Protect Drinking Water Saturated Zone
Copper	7440-50-8	3,200	0.069	390	50	36	36	Natural Background
Iron	7439-89-6	56,000	7.6	170,000	--	36,000	36,000	Natural Background
Lead	7439-92-1	250	56	450	50	24	50	Protect Surface Water via Ground Water Saturated Zone
Manganese	7439-96-5	3,700	3.3	11,000	1,100	1,100	1,100	Natural Background
Mercury, inorganic	7439-97-6	24	0.0013	0.41	0.10	0.070	0.070	Natural Background
Methylmercury	16056-34-1	8.0	11	24	0.40	--	0.40	Site-Specific TEE Unrestricted
Molybdenum	7439-98-7	400	1.6	1,200	2.0	--	1.6	Protect Drinking Water Saturated Zone
Nickel	7440-02-0	1,600	0.54	4,900	30	48	48	Natural Background
Selenium	7782-49-2	400	0.26	1,200	0.30	--	0.26	Protect Drinking Water Saturated Zone
Silver	7440-22-4	400	0.016	6.1	2.0	--	0.016	Protect Surface Water via Ground Water Saturated Zone
Thallium	7440-28-0	0.80	0.0044	2.4	1.0	--	0.0044	Protect Surface Water via Ground Water Saturated Zone
Tin	7440-31-5	48,000	2,400	150,000	50	--	50	Site-Specific TEE Unrestricted
Vanadium	7440-62-2	720	140	2,200	2.0	--	2.0	Site-Specific TEE Unrestricted
Zinc	7440-66-6	24,000	5.0	410	86	85	85	Natural Background
Polychlorinated Biphenyls (PCBs)								
Total PCB Aroclors	1336-36-3	1.0	0.00000055	0.13	0.65	--	0.00000055	Protect Surface Water via Ground Water Saturated Zone
Total PCB congeners	PCBCON	1.0	0.00000055	0.0020	0.65	--	0.00000055	Protect Surface Water via Ground Water Saturated Zone
Dioxins/Furans								
Total dioxin/furan TEQ	DFTEQ	0.000013	0.0000000069	0.0000020	--	0.0000052	0.0000052	Natural Background

Table 5.2
Soil Preliminary Screening Levels (1,2)

Analyte	CAS No.	Protection of Direct Contact	Protection of Leaching to Groundwater	Protection of Erosion to Sediment	Site-Specific TEE Unrestricted	Natural Background Ecology (Ecology 1994 and 2010)	Most Stringent PSL	Basis for Most Stringent PSL
Semivolatile Organic Compounds (SVOCs) /Polycyclic Aromatic Hydrocarbons (PAHs)								
Acenaphthene	83-32-9	4,800	0.028	0.50	20	--	0.028	Protect Sediment via Ground Water Saturated Zone
Acenaphthylene	208-96-8	--	--	1.3	--	--	1.3	Protect Sediment via Erosion
Anthracene	120-12-7	24,000	0.051	0.96	--	--	0.051	Protect Sediment via Ground Water Saturated Zone
Benzo(a)anthracene	56-55-3	--	--	--	--	--	--	--
Benzo(b)fluoranthene	205-99-2	--	--	--	--	--	--	--
Total benzofluoranthenes	BANTH	--	--	3.2	--	--	3.2	Protect Sediment via Erosion
Benzo(g,h,i)perylene	191-24-2	--	--	0.67	--	--	0.67	Protect Sediment via Erosion
Benzo(a)pyrene	50-32-8	0.19	0.000016	1.6	12	--	0.000016	Protect Surface Water via Ground Water Saturated Zone
Benzo(k)fluoranthene	207-08-9	--	--	--	--	--	--	--
Chrysene	218-01-9	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	53-70-3	--	--	--	--	--	--	--
Dibenzofuran	132-64-9	80	0.029	0.54	--	--	0.029	Protect Sediment via Ground Water Saturated Zone
Fluoranthene	206-44-0	3,200	0.090	1.7	--	--	0.090	Protect Sediment via Ground Water Saturated Zone
Fluorene	86-73-7	3,200	0.029	0.54	30	--	0.029	Protect Sediment via Ground Water Saturated Zone
Indeno(1,2,3-c,d)pyrene	193-39-5	--	--	--	--	--	--	--
Methyl isopropyl phenanthrene	483-65-8	--	--	--	--	--	--	--
1-Methylnaphthalene	90-12-0	34	0.0042	39	--	--	0.0042	Protect Drinking Water Saturated Zone
2-Methylnaphthalene	91-57-6	320	0.039	0.67	--	--	0.039	Protect Sediment via Ground Water Saturated Zone
Naphthalene	91-20-3	1,600	0.0021	2.1	--	--	0.0021	Protect Surface Water via Ground Water Saturated Zone
Phenanthrene	85-01-8	--	--	1.5	--	--	1.5	Protect Sediment via Erosion
Pyrene	129-00-0	2,400	0.14	2.6	--	--	0.14	Protect Sediment via Ground Water Saturated Zone
Total LPAHs	LPAH	--	--	5.2	--	--	5.2	Protect Sediment via Erosion
Total HPAHs	HPAH	--	--	12	--	--	12	Protect Sediment via Erosion
Total PAHs	TPAH	--	--	--	--	--	--	--
Total cPAH TEQ	CPAHTEQ	0.19	0.000016	0.59	--	--	0.000016	Protect Surface Water via Ground Water Saturated Zone
Other Semivolatile Organic Compounds								
Acetaldehyde	75-07-0	--	--	--	--	--	--	--
Aniline	62-53-3	180	0.0055	230	--	--	0.0055	Protect Drinking Water Saturated Zone
Azobenzene	103-33-3	9.1	--	12	--	--	9.1	Direct Contact Unrestricted
Benzidine	92-87-5	0.00082	0.000000034	0.0020	--	--	0.000000034	Protect Surface Water via Ground Water Saturated Zone
Benzoic acid	65-85-0	320,000	0.17	0.65	--	--	0.17	Protect Sediment via Ground Water Saturated Zone
Benzyl alcohol	100-51-6	8,000	0.017	0.057	--	--	0.017	Protect Sediment via Ground Water Saturated Zone
Bis(2-chloroethoxy)methane	111-91-1	--	--	--	--	--	--	--
Bis(2-chloroethyl)ether	111-44-4	0.91	0.000014	1.2	--	--	0.000014	Protect Drinking Water Saturated Zone
Bis(chloromethyl)ether	542-88-1	0.0045	--	0.0060	--	--	0.0045	Direct Contact Unrestricted
Bis(2-chloro-1-methylethyl)ether	108-60-1	3,200	0.12	8,000	--	--	0.12	Protect Drinking Water Saturated Zone
2,6-Bis(1,1-dimethylethyl) phenol	128-39-2	--	--	--	--	--	--	--
Bis(2-ethylhexyl) phthalate	117-81-7	71	0.0051	1.3	--	--	0.0051	Protect Surface Water via Ground Water Saturated Zone
4-Bromophenyl phenyl ether	101-55-3	--	--	--	--	--	--	--

Table 5.2

Soil Preliminary Screening Levels [1,2]

Analyte	CAS No.	Protection of Direct Contact	Protection of Leaching to Groundwater	Protection of Erosion to Sediment	Site-Specific TEE Unrestricted	Natural Background Ecology (Ecology 1994 and 2010)	Most Stringent PSL	Basis for Most Stringent PSL
Other Semivolatile Organic Compounds (cont.)								
Butyl benzyl phthalate	85-68-7	530	0.00018	0.063	--	--	0.00018	Protect Surface Water via Ground Water Saturated Zone
Butyl diphenyl phosphate	2752-95-6	--	--	--	--	--	--	--
Carbazole	86-74-8	--	--	--	--	--	--	--
4-Chloroaniline	106-47-8	5.0	0.00017	6.6	--	--	0.00017	Protect Drinking Water Saturated Zone
4-Chloro-3-methylphenol	59-50-7	--	0.028	--	--	--	0.028	Protect Surface Water via Ground Water Saturated Zone
2-Chloronaphthalene	91-58-7	6,400	0.28	16,000	--	--	0.28	Protect Surface Water via Ground Water Saturated Zone
2-Chlorophenol	95-57-8	400	0.011	1,000	--	--	0.011	Protect Surface Water via Ground Water Saturated Zone
4-Chlorophenyl phenyl ether	7005-72-3	--	--	--	--	--	--	--
Dibutyl phthalate	84-74-2	8,000	0.015	1.4	200	--	0.015	Protect Surface Water via Ground Water Saturated Zone
Dibutyl phenyl phosphate	2528-36-1	--	--	--	--	--	--	--
1,2-Dichlorobenzene	95-50-1	7,200	0.0030	0.035	--	--	0.0030	Protect Sediment via Ground Water Saturated Zone
1,4-Dichlorobenzene	106-46-7	190	0.0081	0.11	20	--	0.0081	Protect Sediment via Ground Water Saturated Zone
3,3'-Dichlorobenzidine	91-94-1	2.2	0.0000020	2.9	--	--	0.0000020	Protect Surface Water via Ground Water Saturated Zone
2,4-Dichlorophenol	120-83-2	240	0.0043	600	--	--	0.0043	Protect Surface Water via Ground Water Saturated Zone
1,3-Dichlorobenzene	541-73-1	--	0.0013	--	--	--	0.0013	Protect Surface Water via Ground Water Saturated Zone
Diethyl phthalate	84-66-2	64,000	0.034	0.20	100	--	0.034	Protect Sediment via Ground Water Saturated Zone
Dimethyl phthalate	131-11-3	--	0.019	0.071	200	--	0.019	Protect Sediment via Ground Water Saturated Zone
2,4-Dimethylphenol	105-67-9	1,600	0.0023	0.029	--	--	0.0023	Protect Sediment via Ground Water Saturated Zone
1,2-Dinitrobenzene	528-29-0	8.0	--	20	--	--	8.0	Direct Contact Unrestricted
1,3-Dinitrobenzene	99-65-0	8.0	--	20	--	--	8.0	Direct Contact Unrestricted
1,4-Dinitrobenzene	100-25-4	8.0	--	20	--	--	8.0	Direct Contact Unrestricted
4,6-Dinitro-2-methylphenol	534-52-1	--	0.0073	--	--	--	0.0073	Protect Surface Water via Ground Water Saturated Zone
2,4-Dinitrophenol	51-28-5	160	0.0092	400	20	--	0.0092	Protect Drinking Water Saturated Zone
2,4-Dinitrotoluene	121-14-2	3.2	0.00016	4.3	--	--	0.00016	Protect Surface Water via Ground Water Saturated Zone
2,6-Dinitrotoluene	606-20-2	0.67	0.000051	0.88	--	--	0.000051	Protect Drinking Water Saturated Zone
Di-n-octyl phthalate	117-84-0	800	0.33	6.2	--	--	0.33	Protect Sediment via Ground Water Saturated Zone
1,4-Dioxane	123-91-1	10	0.00013	13	--	--	0.00013	Protect Drinking Water Saturated Zone
1,2-Diphenylhydrazine	122-66-7	1.3	0.000036	1.7	--	--	0.000036	Protect Surface Water via Ground Water Saturated Zone
Hexachlorobenzene	118-74-1	0.63	0.00000040	0.022	17	--	0.00000040	Protect Surface Water via Ground Water Saturated Zone
Hexachlorobutadiene	87-68-3	13	0.000011	0.011	--	--	0.000011	Protect Surface Water via Ground Water Saturated Zone
Hexachlorocyclopentadiene	77-47-4	480	0.0017	1,200	10	--	0.0017	Protect Surface Water via Ground Water Saturated Zone
Hexachloroethane	67-72-1	25	0.0000097	33	--	--	0.0000097	Protect Surface Water via Ground Water Saturated Zone
Isophorone	78-59-1	1,100	0.032	1,400	--	--	0.032	Protect Drinking Water Saturated Zone
2-Methoxynaphthalene	93-04-9	--	--	--	--	--	--	--
2-Methylphenol (o-cresol)	95-48-7	4,000	0.0064	0.069	--	--	0.0064	Protect Sediment via Ground Water Saturated Zone
3-Methylphenol (m-cresol)	108-39-4	4,000	--	10,000	--	--	4,000	Direct Contact Unrestricted
4-Methylphenol (p-cresol)	106-44-5	8,000	0.062	0.67	--	--	0.062	Protect Sediment via Ground Water Saturated Zone
2-Nitroaniline	88-74-4	800	0.064	2,000	--	--	0.064	Protect Drinking Water Saturated Zone

Table 5.2
Soil Preliminary Screening Levels [1,2]

Analyte	CAS No.	Protection of Direct Contact	Protection of Leaching to Groundwater	Protection of Erosion to Sediment	Site-Specific TEE Unrestricted	Natural Background Ecology (Ecology 1994 and 2010)	Most Stringent PSL	Basis for Most Stringent PSL
Other Semivolatile Organic Compounds (cont.)								
3-Nitroaniline	99-09-2	--	--	--	--	--	--	--
4-Nitroaniline	100-01-6	50	0.0013	66	--	--	0.0013	Protect Drinking Water Saturated Zone
Nitrobenzene	98-95-3	160	0.0065	400	40	--	0.0065	Protect Drinking Water Saturated Zone
2-Nitrophenol	88-75-5	--	--	--	--	--	--	--
4-Nitrophenol	100-02-7	--	--	--	7.0	--	7.0	Site-Specific TEE Unrestricted
n-Nitrosodimethylamine	62-75-9	0.0037	0.000000071	0.0092	--	--	0.000000071	Protect Drinking Water Saturated Zone
n-Nitrosodiphenylamine	86-30-6	200	0.0016	0.028	20	--	0.0016	Protect Sediment via Ground Water Saturated Zone
n-Nitrosodi-n-propylamine	621-64-7	0.14	0.0000070	0.19	--	--	0.0000070	Protect Drinking Water Saturated Zone
Pentachlorophenol	87-86-5	2.5	0.0000018	0.36	3.0	--	0.0000018	Protect Surface Water via Ground Water Saturated Zone
Phenol	108-95-2	24,000	0.048	0.42	30	--	0.048	Protect Sediment via Ground Water Saturated Zone
Pyridine	110-86-1	80	0.0029	200	--	--	0.0029	Protect Drinking Water Saturated Zone
2,3,4,5-Tetrachlorophenol	4901-51-3	--	--	--	--	--	--	--
2,3,4,6-Tetrachlorophenol	58-90-2	2,400	--	6,000	--	--	2,400	Direct Contact Unrestricted
1,2,4-Trichlorobenzene	120-82-1	34	0.0019	0.031	20	--	0.0019	Protect Sediment via Ground Water Saturated Zone
2,4,5-Trichlorophenol	95-95-4	8,000	0.000070	20,000	4.0	--	0.000070	Protect Surface Water via Ground Water Saturated Zone
2,4,6-Trichlorophenol	88-06-2	80	0.0053	120	10	--	0.0053	Protect Drinking Water Saturated Zone
Volatile Organic Compounds								
Acetone	67-64-1	72,000	2.1	220,000	--	--	2.1	Protect Drinking Water Saturated Zone
Acrolein	107-02-8	40	0.00032	120	--	--	0.00032	Protect Surface Water via Ground Water Saturated Zone
Acrylonitrile	107-13-1	1.9	0.0000083	5.4	--	--	0.0000083	Protect Surface Water via Ground Water Saturated Zone
Benzaldehyde	100-52-7	250	0.0033	730	--	--	0.0033	Protect Drinking Water Saturated Zone
Benzene	71-43-2	18	0.00056	53	--	--	0.00056	Protect Surface Water via Ground Water Saturated Zone
Bromochloromethane	74-97-5	--	--	--	--	--	--	--
Bromoethane	74-96-4	--	--	--	--	--	--	--
Bromoform	75-25-2	130	0.0050	370	--	--	0.0050	Protect Surface Water via Ground Water Saturated Zone
Bromobenzene	108-86-1	640	0.033	1,900	--	--	0.033	Protect Drinking Water Saturated Zone
Bromomethane	74-83-9	110	0.0033	340	--	--	0.0033	Protect Drinking Water Saturated Zone
2-Butoxyethanol	111-76-2	8,000	0.23	24,000	--	--	0.23	Protect Drinking Water Saturated Zone
n-Butylbenzene	104-51-8	4,000	0.71	12,000	--	--	0.71	Protect Drinking Water Saturated Zone
sec-Butylbenzene	135-98-8	8,000	1.3	24,000	--	--	1.3	Protect Drinking Water Saturated Zone
tert-Butylbenzene	98-06-6	8,000	1.0	24,000	--	--	1.0	Protect Drinking Water Saturated Zone
Carbon disulfide	75-15-0	8,000	0.25	24,000	--	--	0.25	Protect Drinking Water Saturated Zone
Carbon tetrachloride	56-23-5	14	0.00015	42	--	--	0.00015	Protect Surface Water via Ground Water Saturated Zone
Chlorobenzene	108-90-7	1,600	0.051	4,900	40	--	0.051	Protect Drinking Water Saturated Zone
Chloroethane	75-00-3	--	--	--	--	--	--	--
2-Chloroethyl vinyl ether	110-75-8	--	--	--	--	--	--	--
Chloroform	67-66-3	32	0.0048	94	--	--	0.0048	Protect Drinking Water Saturated Zone
Chloromethane	74-87-3	--	--	--	--	--	--	--

Table 5.2

Soil Preliminary Screening Levels (1,2)

Analyte	CAS No.	Protection of Direct Contact	Protection of Leaching to Groundwater	Protection of Erosion to Sediment	Site-Specific TEE Unrestricted	Natural Background Ecology (Ecology 1994 and 2010)	Most Stringent PSL	Basis for Most Stringent PSL
Volatile Organic Compounds (cont.)								
3-Chloro-1-propene	107-05-1	48	0.00068	140	--	--	0.00068	Protect Drinking Water Saturated Zone
2-Chlorotoluene	95-49-8	1,600	0.11	4,900	--	--	0.11	Protect Drinking Water Saturated Zone
4-Chlorotoluene	106-43-4	1,600	0.11	4,900	--	--	0.11	Protect Drinking Water Saturated Zone
Dibromochloromethane	124-48-1	12	0.00070	35	--	--	0.00070	Protect Surface Water via Ground Water Saturated Zone
1,2-Dibromo-3-chloropropane	96-12-8	0.23	0.000056	0.71	--	--	0.000056	Protect Drinking Water Saturated Zone
Dibromomethane	74-95-3	800	0.028	2,400	--	--	0.028	Protect Drinking Water Saturated Zone
Dichlorobromomethane	75-27-4	16	0.00089	47	--	--	0.00089	Protect Surface Water via Ground Water Saturated Zone
trans-1,4-Dichloro-2-butene	110-57-6	--	--	--	--	--	--	--
Dichlorodifluoromethane	75-71-8	16,000	0.53	49,000	--	--	0.53	Protect Drinking Water Saturated Zone
1,1-Dichloroethane	75-34-3	180	0.0026	510	--	--	0.0026	Protect Drinking Water Saturated Zone
1,2-Dichloroethane	107-06-2	11	0.0016	32	--	--	0.0016	Protect Drinking Water Saturated Zone
1,1-Dichloroethylene	75-35-4	4,000	0.0025	12,000	--	--	0.0025	Protect Drinking Water Saturated Zone
cis-1,2-Dichloroethylene	156-59-2	160	0.0052	490	--	--	0.0052	Protect Drinking Water Saturated Zone
trans-1,2-Dichloroethylene	156-60-5	1,600	0.032	4,900	--	--	0.032	Protect Drinking Water Saturated Zone
1,2-Dichloroethylene (mixed isomers)	540-59-0	720	0.023	2,200	--	--	0.023	Protect Drinking Water Saturated Zone
1,2-Dichloropropane	78-87-5	27	0.0010	79	700	--	0.0010	Protect Surface Water via Ground Water Saturated Zone
1,3-Dichloropropane	142-28-9	1,600	0.057	4,900	--	--	0.057	Protect Drinking Water Saturated Zone
2,2-Dichloropropane	594-20-7	--	--	--	--	--	--	--
1,1-Dichloropropene	563-58-6	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	10061-01-5	10	0.00014	29	--	--	0.00014	Protect Drinking Water Saturated Zone
trans-1,3-Dichloropropene	10061-02-6	10	0.00014	29	--	--	0.00014	Protect Drinking Water Saturated Zone
Ethane	74-84-0	--	--	--	--	--	--	--
Ethylbenzene	100-41-4	8,000	0.010	24,000	--	--	0.010	Protect Surface Water via Ground Water Saturated Zone
Ethylene oxide	74-85-1	0.60	0.000011	1.8	--	--	0.000011	Protect Drinking Water Saturated Zone
Ethyl ether	60-29-7	16,000	0.47	49,000	--	--	0.47	Protect Drinking Water Saturated Zone
Ethylene dibromide	106-93-4	0.50	0.000018	1.5	--	--	0.000018	Protect Drinking Water Saturated Zone
Formaldehyde	50-00-0	48	0.00060	140	--	--	0.00060	Protect Drinking Water Saturated Zone
n-Hexane	110-54-3	4,800	1.8	15,000	--	--	1.8	Protect Drinking Water Saturated Zone
2-Hexanone	591-78-6	400	0.012	1,200	--	--	0.012	Protect Drinking Water Saturated Zone
Isopropylbenzene	98-82-8	8,000	0.79	24,000	--	--	0.79	Protect Drinking Water Saturated Zone
4-Isopropyltoluene	99-87-6	--	--	--	--	--	--	--
Methane	74-82-8	--	--	--	--	--	--	--
Methyl ethyl ketone	78-93-3	48,000	1.4	150,000	--	--	1.4	Protect Drinking Water Saturated Zone
Methyl iodide	74-88-4	--	--	--	--	--	--	--
Methyl isobutyl ketone	108-10-1	6,400	0.19	19,000	--	--	0.19	Protect Drinking Water Saturated Zone
Methyl tert-butyl ether	1634-04-4	560	0.0072	1,600	--	--	0.0072	Protect Drinking Water Saturated Zone
Methylene chloride	75-09-2	94	0.0015	290	--	--	0.0015	Protect Drinking Water Saturated Zone
2-Pentanone	107-87-9	--	--	--	--	--	--	--

Table 5.2

Soil Preliminary Screening Levels [1,2]

Analyte	CAS No.	Protection of Direct Contact	Protection of Leaching to Groundwater	Protection of Erosion to Sediment	Site-Specific TEE Unrestricted	Natural Background Ecology (Ecology 1994 and 2010)	Most Stringent PSL	Basis for Most Stringent PSL
Volatile Organic Compounds (cont.)								
n-Propylbenzene	103-65-1	8,000	0.88	24,000	--	--	0.88	Protect Drinking Water Saturated Zone
Styrene	100-42-5	16,000	0.12	49,000	300	--	0.12	Protect Drinking Water Saturated Zone
1,1,1,2-Tetrachloroethane	630-20-6	38	0.00063	110	--	--	0.00063	Protect Drinking Water Saturated Zone
1,1,2,2-Tetrachloroethane	79-34-5	5.0	0.000080	15	--	--	0.000080	Protect Drinking Water Saturated Zone
Tetrachloroethylene	127-18-4	480	0.0016	1,400	--	--	0.0016	Protect Surface Water via Ground Water Saturated Zone
Toluene	108-88-3	6,400	0.044	19,000	200	--	0.044	Protect Surface Water via Ground Water Saturated Zone
1,2,3-Trichlorobenzene	87-61-6	64	0.011	190	20	--	0.011	Protect Drinking Water Saturated Zone
1,1,1-Trichloroethane	71-55-6	160,000	0.084	490,000	--	--	0.084	Protect Drinking Water Saturated Zone
1,1,2-Trichloroethane	79-00-5	18	0.00033	51	--	--	0.00033	Protect Surface Water via Ground Water Saturated Zone
Trichloroethylene	79-01-6	12	0.00027	12	--	--	0.00027	Protect Surface Water via Ground Water Saturated Zone
Trichlorofluoroethane	27154-33-2	--	--	--	--	--	--	--
Trichlorofluoromethane	75-69-4	24,000	0.79	73,000	--	--	0.79	Protect Drinking Water Saturated Zone
1,2,3-Trichloropropane	96-18-4	0.0063	0.00000015	0.019	--	--	0.00000015	Protect Drinking Water Saturated Zone
Trichlorotrifluoroethane	76-13-1	2,400,000	120	7,300,000	--	--	120	Protect Drinking Water Saturated Zone
1,2,3-Trimethylbenzene	526-73-8	800	0.073	2,400	--	--	0.073	Protect Drinking Water Saturated Zone
1,2,4-Trimethylbenzene	95-63-6	800	0.072	2,400	--	--	0.072	Protect Drinking Water Saturated Zone
1,3,5-Trimethylbenzene	108-67-8	800	0.071	2,400	--	--	0.071	Protect Drinking Water Saturated Zone
Vinyl acetate	108-05-4	80,000	2.3	240,000	--	--	2.3	Protect Drinking Water Saturated Zone
Vinyl chloride	75-01-4	0.67	0.000056	1.9	--	--	0.000056	Protect Surface Water via Ground Water Saturated Zone
Total xylenes	1330-20-7	16,000	0.055	49,000	--	--	0.055	Protect Surface Water via Ground Water Saturated Zone
Pesticides								
Carbaryl	63-25-2	8,000	0.0010	--	--	--	0.0010	Protect Surface Water via Ground Water Saturated Zone

Notes:

-- Not available.
1 All PSLs are derived from the Lower Duwamish Waterway Preliminary Cleanup Level Workbook (Ecology 2022).
2 Concentrations are presented in mg/kg. Criteria have been rounded to two significant digits.
3 PSLs for gasoline-range organics assume the presence of benzene.

Abbreviations:

CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbon
DRO Diesel-range organics
HPAH High molecular weight polycyclic aromatic hydrocarbon
LPAH Low molecular weight polycyclic aromatic hydrocarbon
mg/kg Milligrams per kilogram
ORO Oil-range organics
PSL Preliminary screening level
TEE Terrestrial Ecological Evaluation
TEQ Toxic equivalent

Table 5.3

Sediment Preliminary Screening Levels [1,2]

Analyte	CAS No.	SMS Lower Tier Marine Benthic SCO Dry Weight [3]	SMS Lower Tier Marine Benthic SCO OC Normalized [3]	SMS Lower Tier Marine Benthic LAET Dry Weight [3]	SMS Lower Tier Human Health Direct Contact SCO	Bioaccumulative	Lower Tier Risk-Based Concentration for Bioaccumulatives SCO	RAO 1 CUL Human Seafood Consumption LDW-Wide 0-10 cm [4]	RAO 2 CUL Human Direct Contact LDW-Wide 0-10 cm [4]	RAO 2 CUL Human Direct Contact Clamming Areas 0-45 cm [4]	RAO 2 CUL Human Direct Contact Beaches 0-45 cm [4]
Polychlorinted Biphenyls (PCBs)											
Total PCB Aroclors	1336-36-3	--	12	0.13	0.54	Yes	0.012	--	1.3	0.50	1.7
Total PCB congeners	--	--	--	--	0.54	Yes	0.0020	0.0020	1.3	0.50	1.7
Total PCB TEQ	--	--	--	--	0.000023	Yes	0.00000070	--	--	--	--
Dioxins/Furans											
Total dioxin/furan TEQ	--	--	--	--	0.000023	Yes	0.0000050	0.0000020	0.000037	0.000013	0.000028
2,3,7,8-TCDD	1746-01-6	--	--	--	0.000023	Yes	PQL	--	--	--	--
Total chlorinated dioxins	--	--	--	--	--	No	--	--	--	--	--
Total chlorinated furans	--	--	--	--	--	No	--	--	--	--	--
Metals											
Aluminum	7429-90-5	--	--	--	240,000	No	--	--	--	--	--
Antimony	7440-36-0	--	--	--	97	No	--	--	--	--	--
Arsenic	7440-38-2	57	--	57	1.4	Yes	7.0	--	7.0	7.0	7.0
Barium	7440-39-3	--	--	--	49,000	No	--	--	--	--	--
Beryllium	7440-41-7	--	--	--	490	No	--	--	--	--	--
Cadmium	7440-43-9	5.1	--	5.1	220	No	--	--	--	--	--
Chromium, total	7440-47-3	260	--	260	--	No	--	--	--	--	--
Chromium, trivalent	16065-83-1	--	--	--	370,000	No	--	--	--	--	--
Chromium, hexavalent	18540-29-9	--	--	--	1.1	No	--	--	--	--	--
Cobalt	7440-48-4	--	--	--	73	No	--	--	--	--	--
Copper	7440-50-8	390	--	390	9,700	No	--	--	--	--	--
Iron	7439-89-6	--	--	--	170,000	No	--	--	--	--	--
Lead	7439-92-1	450	--	450	--	No	--	--	--	--	--
Manganese	7439-96-5	--	--	--	11,000	No	--	--	--	--	--
Mercury, inorganic	7439-97-6	0.41	--	0.41	--	Yes	0.20	--	--	--	--
Methylmercury	16056-34-1	--	--	--	24	No	--	--	--	--	--
Molybdenum	7439-98-7	--	--	--	1,200	No	--	--	--	--	--
Nickel	7440-02-0	--	--	--	4,900	No	--	--	--	--	--
Selenium	7782-49-2	--	--	--	1,200	No	--	--	--	--	--
Silver	7440-22-4	6.1	--	6.1	1,200	No	--	--	--	--	--
Thallium	7440-28-0	--	--	--	2.4	No	--	--	--	--	--
Tin	7440-31-5	--	--	--	150,000	No	--	--	--	--	--
Vanadium	7440-62-2	--	--	--	2,200	No	--	--	--	--	--
Zinc	7440-66-6	410	--	410	73,000	No	--	--	--	--	--
Metals - Butyltins											
Monobutyltin	78763-54-9	--	--	--	--	No	--	--	--	--	--
Dibutyltin	1002-53-5	--	--	--	--	No	--	--	--	--	--
Tributyltin oxide	36643-28-4	--	--	--	60	Yes	0.0021	--	--	--	--
Tetrabutyltin	1461-25-2	--	--	--	--	No	--	--	--	--	--
Semivolatile Organic Compounds (SVOCs) and Polycyclic Aromatic Hydrocarbons (PAHs)											
Acenaphthene	83-32-9	--	16	0.50	11,000	No	--	--	--	--	--
Acenaphthylene	208-96-8	--	66	1.3	--	No	--	--	--	--	--
Anthracene	120-12-7	--	220	0.96	57,000	No	--	--	--	--	--
Benzo(a)anthracene	56-55-3	--	110	1.3	--	No	--	--	--	--	--
Benzo(b)fluoranthene	205-99-2	--	--	--	--	No	--	--	--	--	--
Benzo(k)fluoranthene	207-08-9	--	--	--	--	No	--	--	--	--	--
Total benzofluoranthenes	--	--	230	3.2	--	No	--	--	--	--	--
Benzo(g,h,i)perylene	191-24-2	--	31	0.67	--	No	--	--	--	--	--
Benzo(a)pyrene	50-32-8	--	99	1.6	0.32	No	--	--	--	--	--
Chrysene	218-01-9	--	110	1.4	--	No	--	--	--	--	--

Table 5.3
Sediment Preliminary Screening Levels [1,2]

Analyte	CAS No.	RAO 3 CUL Benthic Invertebrates [5]	RAO 4 CUL Ecological LDW-Wide 0-10 cm [4]	PQL [6]	Lower Tier Natural Background [7]	Target Sediment Concentration Minimum ROD CUL + SMS Lower Tier SCO	Basis for Most Stringent PSL
Polychlorinted Biphenyls (PCBs)							
Total PCB Aroclors	1336-36-3	0.13	0.13	0.012	--	0.13	LDW ROD RAO 4 CUL Ecological LDW-Wide 0-10 cm
Total PCB congeners	--	0.13	0.13	--	0.0020	0.0020	LDW ROD RAO 1 CUL Human Seafood Consumption
Total PCB TEQ	--	--	--	0.00000070	0.00000020	0.00000070	PQL
Dioxins/Furans							
Total dioxin/furan TEQ	--	--	--	0.0000050	0.0000020	0.0000020	LDW ROD RAO 1 CUL Human Seafood Consumption
2,3,7,8-TCDD	1746-01-6	--	--	--	--	0.000023	SMS Lower Tier Human Health Direct Contact SCO [8]
Total chlorinated dioxins	--	--	--	--	--	--	--
Total chlorinated furans	--	--	--	--	--	--	--
Metals							
Aluminum	7429-90-5	--	--	--	--	240,000	SMS Lower Tier Human Health Direct Contact SCO
Antimony	7440-36-0	--	--	0.50	--	97	SMS Lower Tier Human Health Direct Contact SCO
Arsenic	7440-38-2	57	--	0.30	7.0	7.0	Natural Background
Barium	7440-39-3	--	--	--	--	49,000	SMS Lower Tier Human Health Direct Contact SCO
Beryllium	7440-41-7	--	--	--	--	490	SMS Lower Tier Human Health Direct Contact SCO
Cadmium	7440-43-9	5.1	--	0.070	0.80	5.1	LDW ROD RAO 3 CUL Benthic Invertebrates
Chromium, total	7440-47-3	260	--	0.20	62	260	LDW ROD RAO 3 CUL Benthic Invertebrates
Chromium, trivalent	16065-83-1	--	--	--	--	370,000	SMS Lower Tier Human Health Direct Contact SCO
Chromium, hexavalent	18540-29-9	--	--	--	--	1.1	SMS Lower Tier Human Health Direct Contact SCO
Cobalt	7440-48-4	--	--	--	--	73	SMS Lower Tier Human Health Direct Contact SCO
Copper	7440-50-8	390	--	0.10	45	390	LDW ROD RAO 3 CUL Benthic Invertebrates
Iron	7439-89-6	--	--	--	--	170,000	SMS Lower Tier Human Health Direct Contact SCO
Lead	7439-92-1	450	--	0.10	21	450	LDW ROD RAO 3 CUL Benthic Invertebrates
Manganese	7439-96-5	--	--	--	--	11,000	SMS Lower Tier Human Health Direct Contact SCO
Mercury, inorganic	7439-97-6	0.41	--	0.020	0.20	0.41	LDW ROD RAO 3 CUL Benthic Invertebrates
Methylmercury	16056-34-1	--	--	--	--	24	SMS Lower Tier Human Health Direct Contact SCO
Molybdenum	7439-98-7	--	--	--	--	1,200	SMS Lower Tier Human Health Direct Contact SCO
Nickel	7440-02-0	--	--	0.20	50	4,900	SMS Lower Tier Human Health Direct Contact SCO
Selenium	7782-49-2	--	--	0.10	--	1,200	SMS Lower Tier Human Health Direct Contact SCO
Silver	7440-22-4	6.1	--	0.10	0.24	6.1	LDW ROD RAO 3 CUL Benthic Invertebrates
Thallium	7440-28-0	--	--	--	--	2.4	SMS Lower Tier Human Health Direct Contact SCO
Tin	7440-31-5	--	--	--	--	150,000	SMS Lower Tier Human Health Direct Contact SCO
Vanadium	7440-62-2	--	--	--	--	2,200	SMS Lower Tier Human Health Direct Contact SCO
Zinc	7440-66-6	410	--	1.0	93	410	LDW ROD RAO 3 CUL Benthic Invertebrates
Metals - Butyltins							
Monobutyltin	78763-54-9	--	--	--	--	--	--
Dibutyltin	1002-53-5	--	--	--	--	--	--
Tributyltin oxide	36643-28-4	--	--	0.0021	--	0.0021	Lower Tier Risk-Based Concentration for Bioaccumulatives SCO
Tetrabutyltin	1461-25-2	--	--	--	--	--	--
Semivolatile Organic Compounds (SVOCs) and Polycyclic Aromatic Hydrocarbons (PAHs)							
Acenaphthene	83-32-9	0.50	--	0.0050	--	0.50	LDW ROD RAO 3 CUL Benthic Invertebrates
Acenaphthylene	208-96-8	--	--	0.0050	--	1.3	SMS Lower Tier Marine Benthic LAET Dry Weight
Anthracene	120-12-7	0.96	--	0.0050	--	0.96	LDW ROD RAO 3 CUL Benthic Invertebrates
Benzo(a)anthracene	56-55-3	1.3	--	0.0090	--	1.3	LDW ROD RAO 3 CUL Benthic Invertebrates
Benzo(b)fluoranthene	205-99-2	--	--	0.0090	--	--	--
Benzo(k)fluoranthene	207-08-9	--	--	0.0090	--	--	--
Total benzofluoranthenes	--	3.2	--	0.012	--	3.2	LDW ROD RAO 3 CUL Benthic Invertebrates
Benzo(g,h,i)perylene	191-24-2	0.67	--	0.0050	--	0.67	LDW ROD RAO 3 CUL Benthic Invertebrates
Benzo(a)pyrene	50-32-8	1.6	--	0.0090	--	1.6	LDW ROD RAO 3 CUL Benthic Invertebrates
Chrysene	218-01-9	1.4	--	0.0090	--	1.4	LDW ROD RAO 3 CUL Benthic Invertebrates

Table 5.3
Sediment Preliminary Screening Levels (1,2)

Analyte	CAS No.	SMS Lower Tier Marine Benthic SCO Dry Weight (3)	SMS Lower Tier Marine Benthic SCO OC Normalized (3)	SMS Lower Tier Marine Benthic LAET Dry Weight (3)	SMS Lower Tier Human Health Direct Contact SCO	Bioaccumulative	Lower Tier Risk-Based Concentration for Bioaccumulatives SCO	RAO 1 CUL Human Seafood Consumption LDW-Wide 0-10 cm (4)	RAO 2 CUL Human Direct Contact LDW-Wide 0-10 cm (4)	RAO 2 CUL Human Direct Contact Clamming Areas 0-45 cm (4)	RAO 2 CUL Human Direct Contact Beaches 0-45 cm (4)
Semivolatile Organic Compounds (SVOCs) and Polycyclic Aromatic Hydrocarbons (PAHs) (cont.)											
Dibenz(a,h)anthracene	53-70-3	--	12	0.23	--	No	--	--	--	--	--
Dibenzofuran	132-64-9	--	15	0.54	240	No	--	--	--	--	--
Fluoranthene	206-44-0	--	160	1.7	7,600	No	--	--	--	--	--
Fluorene	86-73-7	--	23	0.54	7,600	No	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	193-39-5	--	34	0.60	--	No	--	--	--	--	--
Methyl isopropyl phenanthrene	483-65-8	--	--	--	--	No	--	--	--	--	--
1-Methylnaphthalene	90-12-0	--	--	--	39	No	--	--	--	--	--
2-Methylnaphthalene	91-57-6	--	38	0.67	760	No	--	--	--	--	--
Naphthalene	91-20-3	--	99	2.1	3,800	No	--	--	--	--	--
Phenanthrene	85-01-8	--	100	1.5	--	No	--	--	--	--	--
Pyrene	129-00-0	--	1,000	2.6	5,700	No	--	--	--	--	--
Total LPAHs	--	--	370	5.2	--	No	--	--	--	--	--
Total HPAHs	--	--	960	12	--	No	--	--	--	--	--
Total PAHs	--	--	--	--	--	No	--	--	--	--	--
Total cPAH TEQ	--	--	--	--	0.32	Yes	0.0090	--	2.8	1.1	0.59
Other Semivolatile Organic Compounds											
Aniline	62-53-3	--	--	--	230	No	--	--	--	--	--
Azobenzene	103-33-3	--	--	--	12	No	--	--	--	--	--
Benzidine	92-87-5	--	--	--	0.0020	No	--	--	--	--	--
Benzoic acid	65-85-0	0.65	--	0.65	800,000	No	--	--	--	--	--
Benzyl alcohol	100-51-6	0.057	--	0.057	20,000	No	--	--	--	--	--
Bis(2-chloroethoxy)methane	111-91-1	--	--	--	600	No	--	--	--	--	--
Bis(2-chloroethyl)ether	111-44-4	--	--	--	2.7	No	--	--	--	--	--
Bis(chloromethyl)ether	542-88-1	--	--	--	0.0060	No	--	--	--	--	--
Bis(2-chloro-1-methylethyl)ether	108-60-1	--	--	--	19	No	--	--	--	--	--
2,6-Bis(1,1-dimethylethyl) phenol	128-39-2	--	--	--	--	No	--	--	--	--	--
Bis(2-ethylhexyl) phthalate	117-81-7	--	47	1.3	94	No	--	--	--	--	--
4-Bromophenyl phenyl ether	101-55-3	--	--	--	--	No	--	--	--	--	--
Butyl benzyl phthalate	85-68-7	--	4.9	0.063	700	No	--	--	--	--	--
Butyl diphenyl phosphate	2752-95-6	--	--	--	--	No	--	--	--	--	--
Carbazole	86-74-8	--	--	--	--	No	--	--	--	--	--
4-Chloroaniline	106-47-8	--	--	--	6.6	No	--	--	--	--	--
4-Chloro-3-methylphenol	59-50-7	--	--	--	20,000	No	--	--	--	--	--
2-Chloronaphthalene	91-58-7	--	--	--	16,000	No	--	--	--	--	--
2-Chlorophenol	95-57-8	--	--	--	1,200	No	--	--	--	--	--
4-Chlorophenyl phenyl ether	7005-72-3	--	--	--	--	No	--	--	--	--	--
Dibutyl phthalate	84-74-2	--	220	1.4	20,000	No	--	--	--	--	--
Dibutyl phenyl phosphate	2528-36-1	--	--	--	--	No	--	--	--	--	--
1,2-Dichlorobenzene	95-50-1	--	2.3	0.035	18,000	No	--	--	--	--	--
1,3-Dichlorobenzene	541-73-1	--	--	--	--	No	--	--	--	--	--
1,4-Dichlorobenzene	106-46-7	--	3.1	0.11	240	No	--	--	--	--	--
3,3'-Dichlorobenzidine	91-94-1	--	--	--	2.9	No	--	--	--	--	--
2,4-Dichlorophenol	120-83-2	--	--	--	600	No	--	--	--	--	--
Di(2-ethylhexyl)adipate	103-23-1	--	--	--	1,100	No	--	--	--	--	--
Diethyl phthalate	84-66-2	--	61	0.20	160,000	No	--	--	--	--	--
Dimethyl phthalate	131-11-3	--	53	0.071	--	No	--	--	--	--	--
2,4-Dimethylphenol	105-67-9	0.029	--	0.029	4,000	No	--	--	--	--	--
1,2-Dinitrobenzene	528-29-0	--	--	--	20	No	--	--	--	--	--
1,3-Dinitrobenzene	99-65-0	--	--	--	20	No	--	--	--	--	--

Table 5.3
Sediment Preliminary Screening Levels [1,2]

Analyte	CAS No.	RAO 3 CUL Benthic Invertebrates [5]	RAO 4 CUL Ecological LDW-Wide 0-10 cm [4]	PQL [6]	Lower Tier Natural Background [7]	Target Sediment Concentration Minimum ROD CUL + SMS Lower Tier SCO	Basis for Most Stringent PSL
Semivolatile Organic Compounds (SVOCs) and Polycyclic Aromatic Hydrocarbons (PAHs) (cont.)							
Dibenz(a,h)anthracene	53-70-3	0.23	--	0.0090	--	0.23	LDW ROD RAO 3 CUL Benthic Invertebrates
Dibenzofuran	132-64-9	0.54	--	0.068	--	0.54	LDW ROD RAO 3 CUL Benthic Invertebrates
Fluoranthene	206-44-0	1.7	--	0.0050	--	1.7	LDW ROD RAO 3 CUL Benthic Invertebrates
Fluorene	86-73-7	0.54	--	0.0050	--	0.54	LDW ROD RAO 3 CUL Benthic Invertebrates
Indeno(1,2,3-cd)pyrene	193-39-5	0.60	--	0.0090	--	0.60	LDW ROD RAO 3 CUL Benthic Invertebrates
Methyl isopropyl phenanthrene	483-65-8	--	--	--	--	--	--
1-Methylnaphthalene	90-12-0	--	--	--	--	39	SMS Lower Tier Human Health Direct Contact SCO
2-Methylnaphthalene	91-57-6	0.67	--	0.0070	--	0.67	LDW ROD RAO 3 CUL Benthic Invertebrates
Naphthalene	91-20-3	2.1	--	0.0060	--	2.1	LDW ROD RAO 3 CUL Benthic Invertebrates
Phenanthrene	85-01-8	1.5	--	0.0050	--	1.5	LDW ROD RAO 3 CUL Benthic Invertebrates
Pyrene	129-00-0	2.6	--	0.0050	--	2.6	LDW ROD RAO 3 CUL Benthic Invertebrates
Total LPAHs	--	5.2	--	--	--	5.2	LDW ROD RAO 3 CUL Benthic Invertebrates
Total HPAHs	--	12	--	--	--	12	LDW ROD RAO 3 CUL Benthic Invertebrates
Total PAHs	--	--	--	--	--	--	--
Total cPAH TEQ	--	--	--	0.0090	0.0090	0.59	LDW ROD RAO 2 CUL Human Direct Contact Beaches 0-45 cm
Other Semivolatile Organic Compounds							
Aniline	62-53-3	--	--	--	--	230	SMS Lower Tier Human Health Direct Contact SCO
Azobenzene	103-33-3	--	--	--	--	12	SMS Lower Tier Human Health Direct Contact SCO
Benzidine	92-87-5	--	--	--	--	0.0020	SMS Lower Tier Human Health Direct Contact SCO
Benzoic acid	65-85-0	0.65	--	0.50	--	0.65	LDW ROD RAO 3 CUL Benthic Invertebrates
Benzyl alcohol	100-51-6	0.057	--	0.14	--	0.057	LDW ROD RAO 3 CUL Benthic Invertebrates
Bis(2-chloroethoxy)methane	111-91-1	--	--	--	--	600	SMS Lower Tier Human Health Direct Contact SCO
Bis(2-chloroethyl)ether	111-44-4	--	--	--	--	2.7	SMS Lower Tier Human Health Direct Contact SCO
Bis(chloromethyl)ether	542-88-1	--	--	--	--	0.0060	SMS Lower Tier Human Health Direct Contact SCO
Bis(2-chloro-1-methylethyl)ether	108-60-1	--	--	--	--	19	SMS Lower Tier Human Health Direct Contact SCO
2,6-Bis(1,1-dimethylethyl) phenol	128-39-2	--	--	--	--	--	--
Bis(2-ethylhexyl) phthalate	117-81-7	1.3	--	0.12	--	1.3	LDW ROD RAO 3 CUL Benthic Invertebrates
4-Bromophenyl phenyl ether	101-55-3	--	--	--	--	--	--
Butyl benzyl phthalate	85-68-7	0.063	--	0.081	--	0.063	LDW ROD RAO 3 CUL Benthic Invertebrates
Butyl diphenyl phosphate	2752-95-6	--	--	--	--	--	--
Carbazole	86-74-8	--	--	--	--	--	--
4-Chloroaniline	106-47-8	--	--	--	--	6.6	SMS Lower Tier Human Health Direct Contact SCO
4-Chloro-3-methylphenol	59-50-7	--	--	--	--	20,000	SMS Lower Tier Human Health Direct Contact SCO
2-Chloronaphthalene	91-58-7	--	--	--	--	16,000	SMS Lower Tier Human Health Direct Contact SCO
2-Chlorophenol	95-57-8	--	--	--	--	1,200	SMS Lower Tier Human Health Direct Contact SCO
4-Chlorophenyl phenyl ether	7005-72-3	--	--	--	--	--	--
Dibutyl phthalate	84-74-2	--	--	0.076	--	1.4	SMS Lower Tier Marine Benthic LAET Dry Weight
Dibutyl phenyl phosphate	2528-36-1	--	--	--	--	--	--
1,2-Dichlorobenzene	95-50-1	0.035	--	0.068	--	0.035	LDW ROD RAO 3 CUL Benthic Invertebrates
1,3-Dichlorobenzene	541-73-1	--	--	0.068	--	--	--
1,4-Dichlorobenzene	106-46-7	0.11	--	0.068	--	0.11	LDW ROD RAO 3 CUL Benthic Invertebrates
3,3'-Dichlorobenzidine	91-94-1	--	--	--	--	2.9	SMS Lower Tier Human Health Direct Contact SCO
2,4-Dichlorophenol	120-83-2	--	--	--	--	600	SMS Lower Tier Human Health Direct Contact SCO
Di(2-ethylhexyl)adipate	103-23-1	--	--	--	--	1,100	SMS Lower Tier Human Health Direct Contact SCO
Diethyl phthalate	84-66-2	--	--	0.093	--	0.20	SMS Lower Tier Marine Benthic LAET Dry Weight
Dimethyl phthalate	131-11-3	0.071	--	0.066	--	0.071	LDW ROD RAO 3 CUL Benthic Invertebrates
2,4-Dimethylphenol	105-67-9	0.029	--	0.21	--	0.029	LDW ROD RAO 3 CUL Benthic Invertebrates
1,2-Dinitrobenzene	528-29-0	1.0	--	--	--	20	SMS Lower Tier Human Health Direct Contact SCO
1,3-Dinitrobenzene	99-65-0	2.0	--	--	--	20	SMS Lower Tier Human Health Direct Contact SCO

Table 5.3

Sediment Preliminary Screening Levels (1,2)

Analyte	CAS No.	SMS Lower Tier Marine Benthic SCO Dry Weight (3)	SMS Lower Tier Marine Benthic SCO OC Normalized (3)	SMS Lower Tier Marine Benthic LAET Dry Weight (3)	SMS Lower Tier Human Health Direct Contact SCO	Bioaccumulative	Lower Tier Risk-Based Concentration for Bioaccumulatives SCO	RAO 1 CUL Human Seafood Consumption LDW-Wide 0-10 cm (4)	RAO 2 CUL Human Direct Contact LDW-Wide 0-10 cm (4)	RAO 2 CUL Human Direct Contact Clamming Areas 0-45 cm (4)	RAO 2 CUL Human Direct Contact Beaches 0-45 cm (4)
Other Semivolatile Organic Compounds (cont.)											
1,4-Dinitrobenzene	100-25-4	--	--	--	20	No	--	--	--	--	--
4,6-Dinitro-2-methylphenol (DNOC)	534-52-1	--	--	--	16	No	--	--	--	--	--
2,4-Dinitrophenol	51-28-5	--	--	--	400	No	--	--	--	--	--
2,4-Dinitrotoluene	121-14-2	--	--	--	4.3	No	--	--	--	--	--
2,6-Dinitrotoluene	606-20-2	--	--	--	0.88	No	--	--	--	--	--
Di-n-octyl phthalate	117-84-0	--	58	6.2	2,000	No	--	--	--	--	--
1,4-Dioxane	123-91-1	--	--	--	13	No	--	--	--	--	--
1,2-Diphenylhydrazine	122-66-7	--	--	--	1.7	No	--	--	--	--	--
Hexachlorobenzene	118-74-1	--	0.38	0.022	1.8	Yes	0.0010	--	--	--	--
Hexachlorobutadiene	87-68-3	--	3.9	0.011	17	No	--	--	--	--	--
Hexachlorocyclopentadiene	77-47-4	--	--	--	1,500	No	--	--	--	--	--
Hexachloroethane	67-72-1	--	--	--	33	No	--	--	--	--	--
Isophorone	78-59-1	--	--	--	1,400	No	--	--	--	--	--
2-Methoxynaphthalene	93-04-9	--	--	--	--	No	--	--	--	--	--
2-Methylphenol (o-cresol)	95-48-7	0.063	--	0.063	10,000	No	--	--	--	--	--
3-Methylphenol (m-cresol)	108-39-4	--	--	--	10,000	No	--	--	--	--	--
4-Methylphenol (p-cresol)	106-44-5	0.67	--	0.67	20,000	No	--	--	--	--	--
2-Nitroaniline	88-74-4	--	--	--	2,000	No	--	--	--	--	--
3-Nitroaniline	99-09-2	--	--	--	--	No	--	--	--	--	--
4-Nitroaniline	100-01-6	--	--	--	66	No	--	--	--	--	--
Nitrobenzene	98-95-3	--	--	--	400	No	--	--	--	--	--
2-Nitrophenol	88-75-5	--	--	--	--	No	--	--	--	--	--
4-Nitrophenol	100-02-7	--	--	--	--	No	--	--	--	--	--
n-Nitrosodimethylamine	62-75-9	--	--	--	0.011	No	--	--	--	--	--
n-Nitrosodiphenylamine	86-30-6	--	11	0.028	270	No	--	--	--	--	--
n-Nitrosodi-n-propylamine	621-64-7	--	--	--	0.19	No	--	--	--	--	--
Pentachlorophenol	87-86-5	0.36	--	0.36	1.0	Yes	0.36	--	--	--	--
Phenol	108-95-2	0.42	--	0.42	60,000	No	--	--	--	--	--
Pyridine	110-86-1	--	--	--	200	No	--	--	--	--	--
2,3,4,5-Tetrachlorophenol	4901-51-3	--	--	--	--	No	--	--	--	--	--
2,3,4,6-Tetrachlorophenol	58-90-2	--	--	--	6,000	No	--	--	--	--	--
1,2,4-Trichlorobenzene	120-82-1	--	0.81	0.031	46	No	--	--	--	--	--
2,4,5-Trichlorophenol	95-95-4	--	--	--	20,000	No	--	--	--	--	--
2,4,6-Trichlorophenol	88-06-2	--	--	--	120	No	--	--	--	--	--
Pesticides											
Aldrin	309-00-2	--	--	--	0.17	Yes	0.00010	--	--	--	--
alpha-BHC	319-84-6	--	--	--	0.21	No	--	--	--	--	--
beta-BHC	319-85-7	--	--	--	0.73	No	--	--	--	--	--
delta-BHC	319-86-8	--	--	--	--	No	--	--	--	--	--
gamma-BHC	58-89-9	--	--	--	1.2	No	--	--	--	--	--
cis-Chlordane	5103-71-9	--	--	--	100	Yes	0.00010	--	--	--	--
trans-Chlordane	5103-74-2	--	--	--	100	Yes	0.00010	--	--	--	--
Chlordane	57-74-9	--	--	--	5.6	Yes	PQL	--	--	--	--
Chlorpyrifos	2921-88-2	--	--	--	200	No	--	--	--	--	--
4,4'-DDD	72-54-8	--	--	--	5.5	No	--	--	--	--	--
4,4'-DDE	72-55-9	--	--	--	8.6	No	--	--	--	--	--
4,4'-DDT	50-29-3	--	--	--	6.3	Yes	0.00010	--	--	--	--

Table 5.3
Sediment Preliminary Screening Levels [1,2]

Analyte	CAS No.	RAO 3 CUL Benthic Invertebrates [5]	RAO 4 CUL Ecological LDW-Wide 0-10 cm [4]	PQL [6]	Lower Tier Natural Background [7]	Target Sediment Concentration Minimum ROD CUL + SMS Lower Tier SCO	Basis for Most Stringent PSL
Other Semivolatile Organic Compounds (cont.)							
1,4-Dinitrobenzene	100-25-4	3.0	--	--	--	20	SMS Lower Tier Human Health Direct Contact SCO
4,6-Dinitro-2-methylphenol (DNOC)	534-52-1	--	--	--	--	16	SMS Lower Tier Human Health Direct Contact SCO
2,4-Dinitrophenol	51-28-5	--	--	--	--	400	SMS Lower Tier Human Health Direct Contact SCO
2,4-Dinitrotoluene	121-14-2	--	--	--	--	4.3	SMS Lower Tier Human Health Direct Contact SCO
2,6-Dinitrotoluene	606-20-2	--	--	--	--	0.88	SMS Lower Tier Human Health Direct Contact SCO
Di-n-octyl phthalate	117-84-0	--	--	0.14	--	6.2	SMS Lower Tier Marine Benthic LAET Dry Weight
1,4-Dioxane	123-91-1	--	--	--	--	13	SMS Lower Tier Human Health Direct Contact SCO
1,2-Diphenylhydrazine	122-66-7	--	--	--	--	1.7	SMS Lower Tier Human Health Direct Contact SCO
Hexachlorobenzene	118-74-1	0.022	--	0.0010	--	0.022	LDW ROD RAO 3 CUL Benthic Invertebrates
Hexachlorobutadiene	87-68-3	--	--	0.00030	--	0.011	SMS Lower Tier Marine Benthic LAET Dry Weight
Hexachlorocyclopentadiene	77-47-4	--	--	--	--	1,500	SMS Lower Tier Human Health Direct Contact SCO
Hexachloroethane	67-72-1	--	--	0.0010	--	33	SMS Lower Tier Human Health Direct Contact SCO
Isophorone	78-59-1	--	--	--	--	1,400	SMS Lower Tier Human Health Direct Contact SCO
2-Methoxynaphthalene	93-04-9	--	--	--	--	--	--
2-Methylphenol (o-cresol)	95-48-7	--	--	0.069	--	0.069	PQL
3-Methylphenol (m-cresol)	108-39-4	--	--	0.18	--	10,000	SMS Lower Tier Human Health Direct Contact SCO
4-Methylphenol (p-cresol)	106-44-5	0.67	--	0.015	--	0.67	LDW ROD RAO 3 CUL Benthic Invertebrates
2-Nitroaniline	88-74-4	--	--	--	--	2,000	SMS Lower Tier Human Health Direct Contact SCO
3-Nitroaniline	99-09-2	--	--	--	--	--	--
4-Nitroaniline	100-01-6	--	--	--	--	66	SMS Lower Tier Human Health Direct Contact SCO
Nitrobenzene	98-95-3	--	--	--	--	400	SMS Lower Tier Human Health Direct Contact SCO
2-Nitrophenol	88-75-5	--	--	--	--	--	--
4-Nitrophenol	100-02-7	--	--	--	--	--	--
n-Nitrosodimethylamine	62-75-9	--	--	--	--	0.011	SMS Lower Tier Human Health Direct Contact SCO
n-Nitrosodiphenylamine	86-30-6	0.028	--	0.068	--	0.028	LDW ROD RAO 3 CUL Benthic Invertebrates
n-Nitrosodi-n-propylamine	621-64-7	--	--	--	--	0.19	SMS Lower Tier Human Health Direct Contact SCO
Pentachlorophenol	87-86-5	0.36	--	0.36	--	0.36	LDW ROD RAO 3 CUL Benthic Invertebrates
Phenol	108-95-2	0.42	--	0.072	--	0.42	LDW ROD RAO 3 CUL Benthic Invertebrates
Pyridine	110-86-1	--	--	--	--	200	SMS Lower Tier Human Health Direct Contact SCO
2,3,4,5-Tetrachlorophenol	4901-51-3	--	--	--	--	--	--
2,3,4,6-Tetrachlorophenol	58-90-2	--	--	--	--	6,000	SMS Lower Tier Human Health Direct Contact SCO
1,2,4-Trichlorobenzene	120-82-1	0.031	--	0.068	--	0.031	LDW ROD RAO 3 CUL Benthic Invertebrates
2,4,5-Trichlorophenol	95-95-4	--	--	--	--	20,000	SMS Lower Tier Human Health Direct Contact SCO
2,4,6-Trichlorophenol	88-06-2	--	--	--	--	120	SMS Lower Tier Human Health Direct Contact SCO
Pesticides							
Aldrin	309-00-2	--	--	0.00010	--	0.00010	PQL
alpha-BHC	319-84-6	--	--	--	--	0.21	SMS Lower Tier Human Health Direct Contact SCO
beta-BHC	319-85-7	--	--	--	--	0.73	SMS Lower Tier Human Health Direct Contact SCO
delta-BHC	319-86-8	--	--	--	--	--	--
gamma-BHC	58-89-9	--	--	0.00010	--	1.2	SMS Lower Tier Human Health Direct Contact SCO
cis-Chlordane	5103-71-9	--	--	0.00010	--	0.00010	PQL
trans-Chlordane	5103-74-2	--	--	0.00010	--	0.00010	PQL
Chlordane	57-74-9	--	--	--	--	5.6	SMS Lower Tier Human Health Direct Contact SCO [8]
Chlorpyrifos	2921-88-2	--	--	--	--	200	SMS Lower Tier Human Health Direct Contact SCO
4,4'-DDD	72-54-8	--	--	0.00010	--	5.5	SMS Lower Tier Human Health Direct Contact SCO
4,4'-DDE	72-55-9	--	--	0.00010	--	8.6	SMS Lower Tier Human Health Direct Contact SCO
4,4'-DDT	50-29-3	--	--	0.00010	--	0.00010	PQL

Table 5.3
Sediment Preliminary Screening Levels [1,2]

Analyte	CAS No.	SMS Lower Tier Marine Benthic SCO Dry Weight [3]	SMS Lower Tier Marine Benthic SCO OC Normalized [3]	SMS Lower Tier Marine Benthic LAET Dry Weight [3]	SMS Lower Tier Human Health Direct Contact SCO	Bioaccumulative	Lower Tier Risk-Based Concentration for Bioaccumulatives SCO	RAO 1 CUL Human Seafood Consumption LDW-Wide 0-10 cm [4]	RAO 2 CUL Human Direct Contact LDW-Wide 0-10 cm [4]	RAO 2 CUL Human Direct Contact Clamming Areas 0-45 cm [4]	RAO 2 CUL Human Direct Contact Beaches 0-45 cm [4]
Pesticides (cont.)											
Total DDD	--	--	--	--	5.5	No	--	--	--	--	--
Total DDE	--	--	--	--	8.6	No	--	--	--	--	--
Total DDT	--	--	--	--	6.3	Yes	PQL	--	--	--	--
Diazinon	333-41-5	--	--	--	140	No	--	--	--	--	--
Dieldrin	60-57-1	--	--	--	0.083	Yes	0.00010	--	--	--	--
Endosulfan I	959-98-8	--	--	--	--	No	--	--	--	--	--
Endosulfan II	33213-65-9	--	--	--	--	No	--	--	--	--	--
Endosulfan sulfate	1031-07-8	--	--	--	1,200	No	--	--	--	--	--
Endrin	72-20-8	--	--	--	60	No	--	--	--	--	--
Endrin aldehyde	7421-93-4	--	--	--	--	No	--	--	--	--	--
Endrin ketone	53494-70-5	--	--	--	--	No	--	--	--	--	--
Heptachlor	76-44-8	--	--	--	0.65	Yes	0.00010	--	--	--	--
Heptachlor epoxide	1024-57-3	--	--	--	0.32	Yes	PQL	--	--	--	--
Lindane	58-89-9	--	--	--	1.8	No	--	--	--	--	--
Malathion	121-75-5	--	--	--	4,000	No	--	--	--	--	--
Methoxychlor	72-43-5	--	--	--	1000	No	--	--	--	--	--
Mirex	2385-85-5	--	--	--	0.16	No	--	--	--	--	--
Nonachlor	3734-49-4	--	--	--	--	No	--	--	--	--	--
Toxaphene	8001-35-2	--	--	--	1.2	No	--	--	--	--	--

Notes:

-- Not available.
1 All PSLs are derived from the Lower Duwamish Waterway Preliminary Cleanup Level Workbook (Ecology 2022).
2 Concentrations are presented in mg/kg dry weight unless otherwise stated. Criteria have been rounded to two significant digits.
3 SCUM Table 8-1
4 LDW ROD Table 19
5 LDW ROD Table 20
6 SCUM Tables 11-1, D-1
7 LDW ROD Table 3 SCUM Table 10-1
8 Lower Duwamish Waterway Preliminary Cleanup Level Workbook defaults to the practical quantitation limit for this analyte; the lowest available numerical criterion (for protection of human health) has been selected as the basis for the PSL.

Abbreviations:

CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbon
CUL Cleanup level
HPAH High molecular weight polycyclic aromatic hydrocarbon
LDW Lower Duwamish Waterway
LPAH Low molecular weight polycyclic aromatic hydrocarbon
mg/kg Milligrams per kilogram
PSL Preliminary screening level
RAO Remedial action objective
ROD Record of Decision
SCO Soil cleanup objective
SCUM Sediment Cleanup User's Manual
SMS Sediment Management Standards
TEQ Toxic equivalent

Table 5.3

Sediment Preliminary Screening Levels [1,2]

Analyte	CAS No.	RAO 3 CUL Benthic Invertebrates [5]	RAO 4 CUL Ecological LDW-Wide 0-10 cm [4]	PQL [6]	Lower Tier Natural Background [7]	Target Sediment Concentration Minimum ROD CUL + SMS Lower Tier SCO	Basis for Most Stringent PSL
Pesticides (cont.)							
Total DDD	--	--	--	--	--	5.5	SMS Lower Tier Human Health Direct Contact SCO
Total DDE	--	--	--	--	--	8.6	SMS Lower Tier Human Health Direct Contact SCO
Total DDT	--	--	--	--	--	6.3	SMS Lower Tier Human Health Direct Contact SCO [8]
Diazinon	333-41-5	--	--	--	--	140	SMS Lower Tier Human Health Direct Contact SCO
Dieldrin	60-57-1	--	--	0.00010	--	0.00010	PQL
Endosulfan I	959-98-8	--	--	--	--	--	--
Endosulfan II	33213-65-9	--	--	--	--	--	--
Endosulfan sulfate	1031-07-8	--	--	--	--	1,200	SMS Lower Tier Human Health Direct Contact SCO
Endrin	72-20-8	--	--	--	--	60	SMS Lower Tier Human Health Direct Contact SCO
Endrin aldehyde	7421-93-4	--	--	--	--	--	--
Endrin ketone	53494-70-5	--	--	--	--	--	--
Heptachlor	76-44-8	--	--	0.00010	--	0.00010	PQL
Heptachlor epoxide	1024-57-3	--	--	--	--	0.32	SMS Lower Tier Human Health Direct Contact SCO [8]
Lindane	58-89-9	--	--	0.10	--	1.8	SMS Lower Tier Human Health Direct Contact SCO
Malathion	121-75-5	--	--	--	--	4,000	SMS Lower Tier Human Health Direct Contact SCO
Methoxychlor	72-43-5	--	--	--	--	1000	SMS Lower Tier Human Health Direct Contact SCO
Mirex	2385-85-5	--	--	--	--	0.16	SMS Lower Tier Human Health Direct Contact SCO
Nonachlor	3734-49-4	--	--	0.00010	--	--	--
Toxaphene	8001-35-2	--	--	--	--	1.2	SMS Lower Tier Human Health Direct Contact SCO

Notes:

-- Not available.
1 All PSLs are derived from the Lower Duwamish Waterway Preliminary Cleanup Level Workbook (Ecology 2022).
2 Concentrations are presented in mg/kg dry weight unless otherwise stated. Criteria have been rounded to two significant digits.
3 SCUM Table 8-1
4 LDW ROD Table 19
5 LDW ROD Table 20
6 SCUM Tables 11-1, D-1
7 LDW ROD Table 3 SCUM Table 10-1
8 Lower Duwamish Waterway Preliminary Cleanup Level Workbook defaults to the practical quantitation limit for this analyte; the lowest available numerical criterion (for protection of human health) has been selected as the basis for the PSL.

Abbreviations:

CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbon
CUL Cleanup level
HPAH High molecular weight polycyclic aromatic hydrocarbon
LDW Lower Duwamish Waterway
LPAH Low molecular weight polycyclic aromatic hydrocarbon
mg/kg Milligrams per kilogram
PSL Preliminary screening level
RAO Remedial action objective
ROD Record of Decision
SCO Soil cleanup objective
SCUM Sediment Cleanup User's Manual
SMS Sediment Management Standards
TEQ Toxic equivalent

Table 5.4
Summary Statistics for Monitoring Well Groundwater Samples

				Information about Detects						Information about Detected Exceedances				Information about Non-Detects				Information about Non-Detect Exceedances			
Analytes	CAS No.	Unit	Number of Results	Number of Detects	Percent of Detects	Minimum Detected Value	Maximum Detected Value	Location Of Maximum Detect	Date of Maximum Detect	Preliminary Screening Level	Number of Detects Exceeding Criteria	Percent of Detects Exceeding Criteria	Exceedance Factor (1)	Number of Non-Detects	Percent of Non-Detects	Minimum Non-Detect Value (2)	Maximum Non-Detect Value (2)	Preliminary Screening Level	Number of Non-Detects Exceeding Criteria	Percent of Non-Detects Exceeding Criteria	Exceedance Factor (1)
Conventio'--ls																					
Total Organic Carbon	TOC	mg/L	4	4	100%	3.59	16.1	MW-08	4/8/2016	--	--	--	--	None	None	0.5	2.5	--	--	--	--
Total Petroleum Hydrocarbons (TPHs)																					
Gasoline-range organics	GRO	µg/L	5	None	None	None	None	None	None	800	None	None	None	5	100%	50	100	800	None	None	None
Diesel-range organics	DRO	µg/L	15	9	60%	270	1,600	MW-12	4/8/2016	50	9	60%	32	6	40%	50	130	50	2	13%	2.6
Oil-range organics	ORO	µg/L	15	6	40%	270	1,200	MW-01	4/23/2015	500	4	27%	2.4	9	60%	250	250	500	None	None	None
Total DRO & ORO	T_DRO&ORO (U=0)	µg/L	15	9	60%	270	2,200	MW-12	4/8/2016	500	7	47%	4.4	6	40%	250	250	500	None	None	None
Metals																					
Arsenic	7440-38-2	µg/L	25	22	88%	1	12	MW-04	12/16/2003	8	5	20%	1.5	3	12%	5	25	8	1	4%	3.1
Barium	7440-39-3	µg/L	13	9	69%	2	70	MW-03	12/16/2003	200	None	None	None	4	31%	20	200	200	None	None	None
Cadmium	7440-43-9	µg/L	25	None	None	None	None	None	None	1.2	None	None	None	25	100%	1	40	1.2	5	20%	33
Chromium	7440-47-3	µg/L	13	3	23%	1.1	1.3	MW-10	4/8/2016	100	None	None	None	10	77%	1	560	100	1	8%	5.6
Lead	7439-92-1	µg/L	25	2	8%	4	170	MW-03	4/23/2015	5.6	1	4%	30	23	92%	1	3	5.6	None	None	None
Mercury	7439-97-6	µg/L	13	None	None	None	None	None	None	0.025	None	None	None	13	100%	0.2	1	0.025	13	100%	40
Selenium	7782-49-2	µg/L	13	8	62%	1.3	7.4	MW-11	4/8/2016	50	None	None	None	5	38%	40	320	50	2	15%	6.4
Silver	7440-22-4	µg/L	13	None	None	None	None	None	None	1.9	None	None	None	13	100%	1	240	1.9	5	38%	130
Polychlorinated Biphenyls (PCBs)																					
Aroclor 1016	12674-11-2	µg/L	8	None	None	None	None	None	None	--	--	--	--	8	100%	0.1	0.1	--	--	--	--
Aroclor 1221	11104-28-2	µg/L	8	None	None	None	None	None	None	--	--	--	--	8	100%	0.1	0.1	--	--	--	--
Aroclor 1232	11141-16-5	µg/L	8	None	None	None	None	None	None	--	--	--	--	8	100%	0.1	0.1	--	--	--	--
Aroclor 1242	53469-21-9	µg/L	8	None	None	None	None	None	None	--	--	--	--	8	100%	0.1	0.1	--	--	--	--
Aroclor 1248	12672-29-6	µg/L	8	None	None	None	None	None	None	--	--	--	--	8	100%	0.1	0.1	--	--	--	--
Aroclor 1254	11097-69-1	µg/L	8	None	None	None	None	None	None	--	--	--	--	8	100%	0.1	0.1	--	--	--	--
Aroclor 1260	11096-82-5	µg/L	8	None	None	None	None	None	None	--	--	--	--	8	100%	0.1	0.1	--	--	--	--
Aroclor 1262	37324-23-5	µg/L	5	None	None	None	None	None	None	--	--	--	--	5	100%	0.1	0.1	--	--	--	--
Aroclor 1268	11100-14-4	µg/L	5	None	None	None	None	None	None	--	--	--	--	5	100%	0.1	0.1	--	--	--	--
Total PCB Aroclors (U=0)	T_PCB (U=0)	µg/L	8	None	None	None	None	None	None	0.000007	None	None	None	8	100%	0.1	0.1	0.000007	8	100%	14,000
Polybrominated Diphenyl Ethers (PBDEs)																					
PBDE-003	101-55-3	µg/L	4	None	None	None	None	None	None	--	--	--	--	4	100%	2	2	--	--	--	--
Pesticides																					
Hexachlorocyclopentadiene	77-47-4	µg/L	4	None	None	None	None	None	None	1	None	None	None	4	100%	10	10	1	4	100%	10
Hexachlorobenzene	118-74-1	µg/L	4	None	None	None	None	None	None	0.000005	None	None	None	4	100%	2	2	0.000005	4	100%	400,000
Semivolatile Organic Compounds (SVOCs) - Polycyclic Aromatic Hydrocarbons (PAHs)																					
1-Methylnaphthalene	90-12-0	µg/L	4	None	None	None	None	None	None	1.5	None	None	None	4	100%	2	2	1.5	4	100%	1.3
2-Methylnaphthalene	91-57-6	µg/L	4	None	None	None	None	None	None	14	None	None	None	4	100%	2	2	14	None	None	None
Acenaphthene	83-32-9	µg/L	4	None	None	None	None	None	None	5.3	None	None	None	4	100%	2	2	5.3	None	None	None
Acenaphthylene	208-96-8	µg/L	4	None	None	None	None	None	None	--	--	--	--	4	100%	2	2	--	--	--	--
Anthracene	120-12-7	µg/L	4	None	None	None	None	None	None	2.1	None	None	None	4	100%	2	2	2.1	None	None	None
Benzo(a)anthracene	56-55-3	µg/L	6	None	None	None	None	None	None	0.00016	None	None	None	6	100%	0.06	2	0.00016	6	100%	13,000
Benzo(a)pyrene	50-32-8	µg/L	6	None	None	None	None	None	None	0.000016	None	None	None	6	100%	0.06	2	0.000016	6	100%	130,000
Benzo(b)fluoranthene	205-99-2	µg/L	6	None	None	None	None	None	None	0.00016	None	None	None	6	100%	0.06	2	0.00016	6	100%	13,000
Benzo(g,h,i)perylene	191-24-2	µg/L	4	None	None	None	None	None	None	--	--	--	--	4	100%	2	2	--	--	--	--
Benzo(k)fluoranthene	207-08-9	µg/L	6	None	None	None	None	None	None	0.0016	None	None	None	6	100%	0.06	2	0.0016	6	100%	1,300
Chrysene	218-01-9	µg/L	6	None	None	None	None	None	None	0.016	None	None	None	6	100%	0.06	2	0.016	6	100%	130
Dibenzo(a,h)anthracene	53-70-3	µg/L	6	None	None	None	None	None	None	0.000016	None	None	None	6	100%	0.06	2	0.000016	6	100%	130,000
Fluoranthene	206-44-0	µg/L	4	None	None	None	None	None	None	1.8	None	None	None	4	100%	2	2	1.8	4	100%	1.1
Fluorene	86-73-7	µg/L	4	None	None	None	None	None	None	3.7	None	None	None	4	100%	2	2	3.7	None	None	None
Indeno(1,2,3-c,d)pyrene	193-39-5	µg/L	6	None	None	None	None	None	None	0.00016	None	None	None	6	100%	0.06	2	0.00016	6	100%	13,000
Naphthalene	91-20-3	µg/L	16	None	None	None	None	None	None	1.4	None	None	None	16	100%	1	2	1.4	7	44%	1.4
Phenanthrene	85-01-8	µg/L	4	None	None	None	None	None	None	--	--	--	--	4	100%	2	2	--	--	--	--
Pyrene	129-00-0	µg/L	4	None	None	None	None	None	None	2	None	None	None	4	100%	2	2	2	None	None	None
Total naphthalenes	T_Napth (U=0)	µg/L	4	None	None	None	None	None	None	--	--	--	--	4	100%	2	2	--	--	--	--
cPAHs (MTCA TEQ-HalfND)	BaPEq (U=1/2)	µg/L	6	None	None	None	None	None	None	0.000016	None	None	None	6	100%	0.06	2	0.000016	6	100%	125,000
cPAHs (MTCA TEQ-ZeroND)	BaPEq (U=0)	µg/L	6	None	None	None	None	None	None	0.000016	None	None	None	6	100%	0.06	2	0.000016	6	100%	125,000

Table 5.4
Summary Statistics for Monitoring Well Groundwater Samples

				Information about Detects						Information about Detected Exceedances				Information about Non-Detects				Information about Non-Detect Exceedances			
Analytes	CAS No.	Unit	Number of Results	Number of Detects	Percent of Detects	Minimum Detected Value	Maximum Detected Value	Location Of Maximum Detect	Date of Maximum Detect	Preliminary Screening Level	Number of Detects Exceeding Criteria	Percent of Detects Exceeding Criteria	Exceedance Factor (1)	Number of Non-Detects	Percent of Non-Detects	Minimum Non-Detect Value (2)	Maximum Non-Detect Value (2)	Preliminary Screening Level	Number of Non-Detects Exceeding Criteria	Percent of Non-Detects Exceeding Criteria	Exceedance Factor (1)
Semivolatile Organic Compounds (SVOCs) /Polycyclic Aromatic Hydrocarbons (PAHs) (cont.)																					
Total HPAH (U=0)	T_HPAH (U=0)	µg/L	4	None	None	None	None	None	None	--	--	--	--	4	100%	2	2	--	--	--	--
Total LPAH (U=0)	T_LPAH (U=0)	µg/L	4	None	None	None	None	None	None	--	--	--	--	4	100%	2	2	--	--	--	--
Total PAH (U=0)	T_PAH (U=0)	µg/L	4	None	None	None	None	None	None	--	--	--	--	4	100%	2	2	--	--	--	--
Semivolatile Organic Compounds (SVOCs) : Phenols																					
2,3,4,6-Tetrachlorophenol	58-90-2	µg/L	4	None	None	None	None	None	None	480	None	None	None	4	100%	5	5	480	None	None	None
2,4,5-Trichlorophenol	95-95-4	µg/L	4	None	None	None	None	None	None	0.037	None	None	None	4	100%	2	2	0.037	4	100%	54
2,4,6-Trichlorophenol	88-06-2	µg/L	4	None	None	None	None	None	None	8	None	None	None	4	100%	2	2	8	None	None	None
2,4-Dichlorophenol	120-83-2	µg/L	4	None	None	None	None	None	None	10	None	None	None	4	100%	2	2	10	None	None	None
2,4-Dimethylphenol	105-67-9	µg/L	4	None	None	None	None	None	None	2.9	None	None	None	4	100%	2	2	2.9	None	None	None
2,4-Dinitrophenol	51-28-5	µg/L	4	None	None	None	None	None	None	32	None	None	None	4	100%	10	10	32	None	None	None
2,6-Dichlorophenol	87-65-0	µg/L	4	None	None	None	None	None	None	--	--	--	--	4	100%	2	2	--	--	--	--
2-Chlorophenol	95-57-8	µg/L	4	None	None	None	None	None	None	17	None	None	None	4	100%	2	2	17	None	None	None
2-Methylphenol	95-48-7	µg/L	4	None	None	None	None	None	None	11	None	None	None	4	100%	2	2	11	None	None	None
2-Nitrophenol	88-75-5	µg/L	4	None	None	None	None	None	None	--	--	--	--	4	100%	5	5	--	--	--	--
4,6-Dinitro-o-cresol	534-52-1	µg/L	4	None	None	None	None	None	None	1.3	None	None	None	4	100%	10	10	1.3	10	100%	7.7
4-Chloro-3-methylphenol	59-50-7	µg/L	4	None	None	None	None	None	None	36	None	None	None	4	100%	2	2	36	None	None	None
4-Methylphenol	106-44-5	µg/L	4	None	None	None	None	None	None	110	None	None	None	4	100%	2	2	110	None	None	None
4-Nitrophenol	100-02-7	µg/L	4	None	None	None	None	None	None	--	--	--	--	4	100%	10	10	--	--	--	--
Pentachlorophenol	87-86-5	µg/L	4	None	None	None	None	None	None	0.002	None	None	None	4	100%	10	10	0.002	4	100%	5,000
Phenol	108-95-2	µg/L	4	None	None	None	None	None	None	100	None	None	None	4	100%	2	2	100	None	None	None
Semivolatile Organic Compounds (SVOCs): Phthalates																					
Bis(2-ethylhexyl)phthalate	117-81-7	µg/L	4	None	None	None	None	None	None	0.046	None	None	None	4	100%	3	3	0.046	4	100%	65
Butyl benzyl phthalate	85-68-7	µg/L	4	None	None	None	None	None	None	0.013	None	None	None	4	100%	2	2	0.013	4	100%	150
Di-n-butyl phthalate	84-74-2	µg/L	4	1	25%	5	5	MW-05	12/16/2003	8	None	None	None	3	75%	3	3	8	None	None	None
Di-n-octyl phthalate	117-84-0	µg/L	4	None	None	None	None	None	None	2.3	None	None	None	4	100%	2	2	2.3	None	None	None
Diethylphthalate	84-66-2	µg/L	4	4	100%	3	12	MW-01 MW-05	12/16/2003 12/16/2003	93	None	None	None	None	None	--	--	93	None	None	None
Dimethyl phthalate	131-11-3	µg/L	4	None	None	None	None	None	None	59	None	None	None	4	100%	2	2	59	None	None	None
Semivolatile Organic Compounds (SVOCs): Other																					
2-Chloronaphthalene	91-58-7	µg/L	4	None	None	None	None	None	None	100	None	None	None	4	100%	2	2	100	None	None	None
Acrylonitrile	107-13-1	µg/L	3	None	None	None	None	None	None	0.028	None	None	None	3	100%	10	10	0.028	3	100%	360
Aniline	62-53-3	µg/L	4	None	None	None	None	None	None	15	None	None	None	4	100%	2	2	15	None	None	None
Azobenzene	103-33-3	µg/L	4	None	None	None	None	None	None	0.40	None	None	None	4	100%	2	2	0.40	4	100%	2.5
Benzoic acid	65-85-0	µg/L	4	None	None	None	None	None	None	590	None	None	None	4	100%	20	20	590	None	None	None
Benzyl alcohol	100-51-6	µg/L	4	1	25%	4	4	MW-05	12/16/2003	56	None	None	None	3	75%	2	2	56	None	None	None
Bis(2-chloroethoxy)methane	111-91-1	µg/L	4	None	None	None	None	None	None	48	None	None	None	4	100%	2	2	48	None	None	None
Carbazole	86-74-8	µg/L	4	None	None	None	None	None	None	--	--	--	--	4	100%	2	2	--	--	--	--
Dibenzofuran	132-64-9	µg/L	4	None	None	None	None	None	None	3.1	None	None	None	4	100%	2	2	3.1	None	None	None
Hexachlorobutadiene	87-68-3	µg/L	18	None	None	None	None	None	None	0.01	None	None	None	18	100%	1	2	0.01	18	100%	200
Isophorone	78-59-1	µg/L	4	1	25%	3	3	MW-05	12/16/2003	92	None	None	None	3	75%	2	2	92	None	None	None
N-Nitrosodimethylamine	62-75-9	µg/L	4	None	None	None	None	None	None	0.00023	None	None	None	4	100%	2	2	0.00023	4	100%	8,700
N-Nitroso-di-n-propylamine	621-64-7	µg/L	4	None	None	None	None	None	None	0.013	None	None	None	4	100%	2	2	0.013	4	100%	150
N-Nitrosodiphenylamine	86-30-6	µg/L	4	None	None	None	None	None	None	0.55	None	None	None	4	100%	2	2	0.55	4	100%	3.6
Volatile Organic Compounds (VOCs): BTEX																					
Benzene	71-43-2	µg/L	13	None	None	None	None	None	None	1.6	None	None	None	13	100%	0.35	2	1.6	3	23%	1.3
Ethylbenzene	100-41-4	µg/L	13	None	None	None	None	None	None	21	None	None	None	13	100%	1	2	21	None	None	None
Toluene	108-88-3	µg/L	13	1	8%	3	3	MW-03	12/16/2003	100	None	None	None	12	92%	1	2	100	None	None	None
Xylene (meta & para)	108-38-3/106-42-3	µg/L	12	None	None	None	None	None	None	--	--	--	--	12	100%	2	4	--	--	--	--
Xylene (ortho)	95-47-6	µg/L	12	None	None	None	None	None	None	--	--	--	--	12	100%	1	2	--	--	--	--
Xylene (total)	1330-20-7	µg/L	13	None	None	None	None	None	None	110	None	None	None	13	100%	2	4	110	None	None	None

Table 5.4
Summary Statistics for Monitoring Well Groundwater Samples

				Information about Detects						Information about Detected Exceedances				Information about Non-Detects				Information about Non-Detect Exceedances			
Analytes	CAS No.	Unit	Number of Results	Number of Detects	Percent of Detects	Minimum Detected Value	Maximum Detected Value	Location Of Maximum Detect	Date of Maximum Detect	Preliminary Screening Level	Number of Detects Exceeding Criteria	Percent of Detects Exceeding Criteria	Exceedance Factor (1)	Number of Non-Detects	Percent of Non-Detects	Minimum Non-Detect Value (2)	Maximum Non-Detect Value (2)	Preliminary Screening Level	Number of Non-Detects Exceeding Criteria	Percent of Non-Detects Exceeding Criteria	Exceedance Factor (1)
Volatile Organic Compounds (VOCs): cVOCs																					
Chloroethane	75-00-3	µg/L	14	None	None	None	None	None	None	15,000	None	None	None	14	100%	1	2	15,000	None	None	None
cis-1,2-Dichloroethene	156-59-2	µg/L	14	None	None	None	None	None	None	16	None	None	None	14	100%	1	2	16	None	None	None
trans-1,2-Dichloroethene	156-60-5	µg/L	14	None	None	None	None	None	None	77	None	None	None	14	100%	1	2	77	None	None	None
Vinyl chloride	75-01-4	µg/L	14	3	21%	0.3	0.46	MW-10	4/8/2016	0.18	3	21%	2.6	11	79%	0.2	2	0.18	11	79%	11
Tetrachloroethene	127-18-4	µg/L	14	5	36%	7.7	16	MW-05	12/16/2003	2.9	5	36%	5.5	9	64%	1	2	2.9	None	None	None
Trichloroethene	79-01-6	µg/L	14	2	14%	2	2	MW-05	12/16/2003	0.7	2	14%	2.9	12	86%	1	2	0.7	12	86%	2.9
Trichloroethene	79-01-6	µg/L	14	2	14%	2	2	MW-07	4/8/2016	0.7	2	14%	2.9	12	86%	1	2	0.7	12	86%	2.9
Volatile Organic Compounds (VOCs): Other																					
1,1,1,2-Tetrachloroethane	630-20-6	µg/L	12	None	None	None	None	None	None	1.7	None	None	None	12	100%	1	2	1.7	3	25%	1.2
1,1,1-Trichloroethane	71-55-6	µg/L	14	None	None	None	None	None	None	200	None	None	None	14	100%	1	2	200	None	None	None
1,1,2,2-Tetrachloroethane	79-34-5	µg/L	14	None	None	None	None	None	None	0.22	None	None	None	14	100%	1	2	0.22	14	100%	9.1
1,1,2-Trichloroethane	79-00-5	µg/L	14	None	None	None	None	None	None	0.9	None	None	None	14	100%	1	2	0.9	14	100%	2.2
1,1-Dichloroethane	75-34-3	µg/L	14	None	None	None	None	None	None	7.7	None	None	None	14	100%	1	2	7.7	None	None	None
1,1-Dichloroethene	75-35-4	µg/L	14	None	None	None	None	None	None	7	None	None	None	14	100%	1	2	7	None	None	None
1,1-Dichloropropene	563-58-6	µg/L	14	None	None	None	None	None	None	--	--	--	--	14	100%	1	2	--	--	--	--
1,2,3-Trichlorobenzene	87-61-6	µg/L	14	None	None	None	None	None	None	6.4	None	None	None	14	100%	1	2	6.4	None	None	None
1,2,3-Trichloropropane	96-18-4	µg/L	14	None	None	None	None	None	None	0.00038	None	None	None	14	100%	1	2	0.00038	14	100%	5,300
1,2,4-Trichlorobenzene	120-82-1	µg/L	18	None	None	None	None	None	None	0.96	None	None	None	18	100%	1	2	0.96	18	100%	2.1
1,2,4-Trimethylbenzene	95-63-6	µg/L	12	None	None	None	None	None	None	80	None	None	None	12	100%	1	2	80	None	None	None
1,2-Dibromo-3-chloropropane	96-12-8	µg/L	14	None	None	None	None	None	None	0.042	None	None	None	14	100%	10	10	0.042	14	100%	240
1,2-Dibromoethane	106-93-4	µg/L	14	None	None	None	None	None	None	0.05	None	None	None	14	100%	1	2	0.05	14	100%	40
1,2-Dichlorobenzene	95-50-1	µg/L	18	None	None	None	None	None	None	4.5	None	None	None	18	100%	1	2	4.5	None	None	None
1,2-Dichloroethane	107-06-2	µg/L	14	None	None	None	None	None	None	3.5	None	None	None	14	100%	1	2	3.5	None	None	None
1,2-Dichloropropane	78-87-5	µg/L	14	None	None	None	None	None	None	3.1	None	None	None	14	100%	1	2	3.1	None	None	None
1,3,5-Trimethylbenzene	108-67-8	µg/L	12	None	None	None	None	None	None	80	None	None	None	12	100%	1	2	80	None	None	None
1,3-Dichlorobenzene	541-73-1	µg/L	18	None	None	None	None	None	None	2	None	None	None	18	100%	1	2	2	None	None	None
1,3-Dichloropropane	142-28-9	µg/L	14	None	None	None	None	None	None	160	None	None	None	14	100%	1	2	160	None	None	None
1,4-Dichlorobenzene	106-46-7	µg/L	18	None	None	None	None	None	None	5.0	None	None	None	18	100%	1	2	5.0	None	None	None
2,2-Dichloropropane	594-20-7	µg/L	14	None	None	None	None	None	None	--	--	--	--	14	100%	1	2	--	--	--	--
2,4-Dinitrotoluene	121-14-2	µg/L	4	None	None	None	None	None	None	0.18	None	None	None	4	100%	5	5	0.18	4	100%	28
2,6-Dinitrotoluene	606-20-2	µg/L	4	None	None	None	None	None	None	0.058	None	None	None	4	100%	5	5	0.058	5	100%	86
2-Chlorotoluene	95-49-8	µg/L	14	None	None	None	None	None	None	160	None	None	None	14	100%	1	2	160	None	None	None
2-Hexanone	591-78-6	µg/L	12	None	None	None	None	None	None	40	None	None	None	12	100%	10	10	40	None	None	None
2-Nitroaniline	88-74-4	µg/L	4	None	None	None	None	None	None	160	None	None	None	4	100%	5	5	160	None	None	None
3,3'-Dichlorobenzidine	91-94-1	µg/L	4	None	None	None	None	None	None	0.0033	None	None	None	4	100%	2	2	0.0033	4	100%	610
3-Nitroaniline	99-09-2	µg/L	4	None	None	None	None	None	None	--	--	--	--	4	100%	5	5	--	--	--	--
4-Chloroaniline	106-47-8	µg/L	4	None	None	None	None	None	None	0.44	None	None	None	4	100%	2	2	0.44	4	100%	4.5
4-Chlorophenyl phenyl ether	7005-72-3	µg/L	4	None	None	None	None	None	None	--	--	--	--	4	100%	2	2	--	--	--	--
4-Chlorotoluene	106-43-4	µg/L	14	None	None	None	None	None	None	160	None	None	None	14	100%	1	2	160	None	None	None
4-Nitroaniline	100-01-6	µg/L	4	None	None	None	None	None	None	4.4	None	None	None	4	100%	5	5	4.4	4	100%	1.1
Acetone	67-64-1	µg/L	12	1	8%	30	30	MW-02	12/16/2003	7,200	None	None	None	11	92%	10	25	7,200	None	None	None
Bis(2-chloroethyl)ether	111-44-4	µg/L	4	None	None	None	None	None	None	0.04	None	None	None	4	100%	2	2	0.04	4	100%	50
Bis(2-chloroisopropyl)ether	39638-32-9	µg/L	4	None	None	None	None	None	None	--	--	--	--	4	100%	2	2	--	--	--	--
Bromobenzene	108-86-1	µg/L	14	None	None	None	None	None	None	64	None	None	None	14	100%	1	2	64	None	None	None
Bromochloromethane	74-97-5	µg/L	5	None	None	None	None	None	None	--	--	--	--	5	100%	2	2	--	--	--	--
Bromodichloromethane	75-27-4	µg/L	14	None	None	None	None	None	None	1.4	None	None	None	14	100%	1	2	1.4	5	36%	1.4
Bromoform	75-25-2	µg/L	14	None	None	None	None	None	None	12	None	None	None	14	100%	1	2	12	None	None	None
Bromomethane	74-83-9	µg/L	14	None	None	None	None	None	None	11	None	None	None	14	100%	1	2	11	None	None	None
Carbon tetrachloride	56-23-5	µg/L	14	None	None	None	None	None	None	0.35	None	None	None	14	100%	1	2	0.35	14	100%	5.7
Chlorobenzene	108-90-7	µg/L	14	None	None	None	None	None	None	100	None	None	None	14	100%	1	2	100	None	None	None
Chloroform	67-66-3	µg/L	14	None	None	None	None	None	None	1.2	None	None	None	14	100%	1	2	1.2	5	36%	1.7
Chloromethane	74-87-3	µg/L	14	None	None	None	None	None	None	150	None	None	None	14	100%	2	10	150	None	None	None
cis-1,3-Dichloropropene	10061-01-5	µg/L	14	None	None	None	None	None	None	0.44	None	None	None	14	100%	1	2	0.44	14	100%	4.5

Table 5.4
Summary Statistics for Monitoring Well Groundwater Samples

				Information about Detects						Information about Detected Exceedances				Information about Non-Detects				Information about Non-Detect Exceedances			
Analytes	CAS No.	Unit	Number of Results	Number of Detects	Percent of Detects	Minimum Detected Value	Maximum Detected Value	Location Of Maximum Detect	Date of Maximum Detect	Preliminary Screening Level	Number of Detects Exceeding Criteria	Percent of Detects Exceeding Criteria	Exceedance Factor (1)	Number of Non-Detects	Percent of Non-Detects	Minimum Non-Detect Value (2)	Maximum Non-Detect Value (2)	Preliminary Screening Level	Number of Non-Detects Exceeding Criteria	Percent of Non-Detects Exceeding Criteria	Exceedance Factor (1)
Volatile Organic Compounds (VOCs): Other (cont.)																					
Cymene	99-87-6	µg/L	12	None	None	None	None	None	None	--	--	--	--	12	100%	1	2	--	--	--	--
Dibromochloromethane	124-48-1	µg/L	14	None	None	None	None	None	None	2.2	None	None	None	14	100%	1	2	2.2	None	None	None
Dibromomethane	74-95-3	µg/L	14	None	None	None	None	None	None	80	None	None	None	14	100%	1	2	80	None	None	None
Dichlorodifluoromethane	75-71-8	µg/L	14	None	None	None	None	None	None	4.2	None	None	None	14	100%	1	2	4.2	None	None	None
Hexachloroethane	67-72-1	µg/L	4	None	None	None	None	None	None	0.02	None	None	None	4	100%	2	2	0.02	4	100%	100
Isopropylbenzene	98-82-8	µg/L	12	None	None	None	None	None	None	800	None	None	None	12	100%	1	2	800	None	None	None
Methyl ethyl ketone	78-93-3	µg/L	12	3	25%	12	52	MW-02	12/16/2003	4,800	None	None	None	9	75%	10	10	4,800	None	None	None
Methyl isobutyl ketone	108-10-1	µg/L	12	None	None	None	None	None	None	640	None	None	None	12	100%	10	10	640	None	None	None
Methylene chloride	75-09-2	µg/L	14	None	None	None	None	None	None	5	None	None	None	14	100%	5	5	5	None	None	None
Methyl-tert-butyl ether	1634-04-4	µg/L	9	None	None	None	None	None	None	24	None	None	None	9	100%	1	2	24	None	None	None
n-Butylbenzene	104-51-8	µg/L	3	None	None	None	None	None	None	400	None	None	None	3	100%	2	2	400	None	None	None
n-Hexane	110-54-3	µg/L	6	None	None	None	None	None	None	4.1	None	None	None	6	100%	1	1	4.1	None	None	None
Nitrobenzene	98-95-3	µg/L	4	None	None	None	None	None	None	16	None	None	None	4	100%	2	2	16	None	None	None
n-Propylbenzene	103-65-1	µg/L	12	None	None	None	None	None	None	800	None	None	None	12	100%	1	2	800	None	None	None
Pyridine	110-86-1	µg/L	4	None	None	None	None	None	None	8	None	None	None	4	100%	4	4	8	None	None	None
sec-Butylbenzene	135-98-8	µg/L	12	None	None	None	None	None	None	800	None	None	None	12	100%	1	2	800	None	None	None
Styrene	100-42-5	µg/L	12	None	None	None	None	None	None	100	None	None	None	12	100%	1	2	100	None	None	None
tert-Butylbenzene	98-06-6	µg/L	12	None	None	None	None	None	None	800	None	None	None	12	100%	1	2	800	None	None	None
trans-1,3-Dichloropropene	10061-02-6	µg/L	14	None	None	None	None	None	None	0.44	None	None	None	14	100%	1	2	0.44	14	100%	4.5
Trichlorofluoromethane	75-69-4	µg/L	14	None	None	None	None	None	None	120	None	None	None	14	100%	1	2	120	None	None	None

Notes:

-- Criterion not established
1 Exceedance factor rounded to two significant figures.
2 For analytes where all results were detected, reporting limit information is provided when available.

Abbreviations:

BTEX Benzene, toluene, ethylbenzene, and xylenes
CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbon
cVOC Chlorinated volatile organic compound
DRO Diesel-range organics
HPAH High molecular weight polycyclic aromatic hydrocarbon
LPAH Low molecular weight polycyclic aromatic hydrocarbon
µg/L Micrograms per liter
mg/L Milligrams per liter
MTCA Model Toxics Control Act
ND Non-detect
ORO Oil-range organics
PAH Polycyclic aromatic hydrocarbon
TEQ Toxic equivalent

Table 5.5
Summary Statistics for Groundwater Reconnaissance Samples

				Information about Detects						Information about Detected Exceedances				Information about Non-Detects				Information about Non-Detect Exceedances			
Analytes	CAS No.	Unit	Number of Results	Number of Detects	Percent of Detects	Minimum Detected Value	Maximum Detected Value	Location of Maximum Detect	Date of Maximum Detect	Preliminary Screening Level	Number of Detects Exceeding Criteria	Percent of Detects Exceeding Criteria	Exceedance Factor (1)	Number of Non-Detects	Percent of Non-Detects	Minimum Non-Detect Value (2)	Maximum Non-Detect Value (2)	Preliminary Screening Level	Number of Non-Detects Exceeding Criteria	Percent of Non-Detects Exceeding Criteria	Exceedance Factor (1)
Metals																					
Arsenic	7440-38-2	µg/L	1	1	100%	11	11	A1A-S6	7/9/2018	8	1	100%	1.4	None	None	1	1	8	None	None	None
Cadmium	7440-43-9	µg/L	1	None	None	None	None	None	None	1.2	None	None	None	1	100%	1	1	1.2	None	None	None
Lead	7439-92-1	µg/L	1	None	None	None	None	None	None	5.6	None	None	None	1	100%	1	1	5.6	None	None	None
Semivolatile Organic Compounds: Polycyclic Aromatic Hydrocarbons (PAHs)																					
Naphthalene	91-20-3	µg/L	4	None	None	None	None	None	None	1.4	None	None	None	4	100%	1	1	1.4	None	None	None
Semivolatile Organic Compounds: Other																					
Hexachlorobutadiene	87-68-3	µg/L	4	None	None	None	None	None	None	0.01	None	None	None	4	100%	1	1	0.01	4	100%	100
Total Petroleum Hydrocarbons (TPHs)																					
Gasoline-range organics	GRO	µg/L	5	1	20%	210	210	P3	4/21/2015	800	None	None	None	4	80%	100	100	800	None	None	None
Diesel-range organics	DRO	µg/L	7	6	86%	190	1,900	P3	4/21/2015	50	6	86%	38	1	14%	50	50	50	None	None	None
Oil-range organics	ORO	µg/L	7	5	71%	280	600	P5	4/21/2015	500	2	29%	1.2	2	29%	250	250	500	None	None	None
Total DRO & ORO	T_DRO&ORO (U=0)	µg/L	7	6	86%	190	2,500	P3	4/21/2015	500	5	71%	5.0	1	14%	250	250	500	None	None	None
Volatile Organic Compounds: BTEX																					
Benzene	71-43-2	µg/L	6	None	None	None	None	None	None	1.6	None	None	None	6	100%	0.35	1	1.6	None	None	None
Ethylbenzene	100-41-4	µg/L	6	None	None	None	None	None	None	21	None	None	None	6	100%	1	1	21	None	None	None
Toluene	108-88-3	µg/L	6	1	17%	11	11	P5	4/21/2015	100	None	None	None	5	83%	1	1	100	None	None	None
Xylene (meta & para)	108-38-3/106-42-3	µg/L	4	None	None	None	None	None	None	--	--	--	--	4	100%	2	2	--	--	--	--
Xylene (ortho)	95-47-6	µg/L	4	None	None	None	None	None	None	--	--	--	--	4	100%	1	1	--	--	--	--
Xylene (total)	1330-20-7	µg/L	6	None	None	None	None	None	None	110	None	None	None	6	100%	2	3	110	None	None	None
Volatile Organic Compounds: cVOCs																					
Chloroethane	75-00-3	µg/L	4	None	None	None	None	None	None	15,000	None	None	None	4	100%	1	1	15,000	None	None	None
cis-1,2-Dichloroethene	156-59-2	µg/L	4	2	50%	1.9	5.3	P13	4/21/2015	16	None	None	None	2	50%	1	1	16	None	None	None
trans-1,2-Dichloroethene	156-60-5	µg/L	4	None	None	None	None	None	None	77	None	None	None	4	100%	1	1	77	None	None	None
Vinyl chloride	75-01-4	µg/L	4	None	None	None	None	None	None	0.18	None	None	None	4	100%	0.2	0.2	0.18	4	100%	1.1
Tetrachloroethene	127-18-4	µg/L	4	None	None	None	None	None	None	2.9	None	None	None	4	100%	1	1	2.9	None	None	None
Trichloroethene	79-01-6	µg/L	4	None	None	None	None	None	None	0.7	None	None	None	4	100%	1	1	0.7	4	100%	1.4
Volatile Organic Compounds: Other																					
1,1,1,2-Tetrachloroethane	630-20-6	µg/L	4	None	None	None	None	None	None	1.7	None	None	None	4	100%	1	1	1.7	None	None	None
1,1,1-Trichloroethane	71-55-6	µg/L	4	None	None	None	None	None	None	200	None	None	None	4	100%	1	1	200	None	None	None
1,1,2,2-Tetrachloroethane	79-34-5	µg/L	4	None	None	None	None	None	None	0.22	None	None	None	4	100%	1	1	0.22	4	100%	4.5
1,1,2-Trichloroethane	79-00-5	µg/L	4	None	None	None	None	None	None	0.9	None	None	None	4	100%	1	1	0.9	4	100%	1.1
1,1-Dichloroethane	75-34-3	µg/L	4	None	None	None	None	None	None	7.7	None	None	None	4	100%	1	1	7.7	None	None	None
1,1-Dichloroethene	75-35-4	µg/L	4	None	None	None	None	None	None	7	None	None	None	4	100%	1	1	7	None	None	None
1,1-Dichloropropene	563-58-6	µg/L	4	None	None	None	None	None	None	--	--	--	--	4	100%	1	1	--	--	--	--
1,2,3-Trichlorobenzene	87-61-6	µg/L	4	None	None	None	None	None	None	6.4	None	None	None	4	100%	1	1	6.4	None	None	None
1,2,3-Trichloropropane	96-18-4	µg/L	4	None	None	None	None	None	None	0.00038	None	None	None	4	100%	1	1	0.00038	4	100%	2,600
1,2,4-Trichlorobenzene	120-82-1	µg/L	4	None	None	None	None	None	None	0.96	None	None	None	4	100%	1	1	0.96	4	100%	1
1,2,4-Trimethylbenzene	95-63-6	µg/L	4	1	25%	1.9	1.9	P13	4/21/2015	80	None	None	None	3	75%	1	1	80	None	None	None
1,2-Dibromo-3-chloropropane	96-12-8	µg/L	4	None	None	None	None	None	None	0.042	None	None	None	4	100%	10	10	0.042	4	100%	240
1,2-Dibromoethane	106-93-4	µg/L	4	None	None	None	None	None	None	0.05	None	None	None	4	100%	1	1	0.05	4	100%	20
1,2-Dichlorobenzene	95-50-1	µg/L	4	None	None	None	None	None	None	4.5	None	None	None	4	100%	1	1	4.5	None	None	None
1,2-Dichloroethane	107-06-2	µg/L	4	None	None	None	None	None	None	3.5	None	None	None	4	100%	1	1	3.5	None	None	None
1,2-Dichloropropane	78-87-5	µg/L	4	None	None	None	None	None	None	3.1	None	None	None	4	100%	1	1	3.1	None	None	None
1,3,5-Trimethylbenzene	108-67-8	µg/L	4	None	None	None	None	None	None	80	None	None	None	4	100%	1	1	80	None	None	None
1,3-Dichlorobenzene	541-73-1	µg/L	4	1	25%	1.1	1.1	P6	4/21/2015	2	None	None	None	3	75%	1	1	2	None	None	None
1,3-Dichloropropane	142-28-9	µg/L	4	None	None	None	None	None	None	160	None	None	None	4	100%	1	1	160	None	None	None
1,4-Dichlorobenzene	106-46-7	µg/L	4	None	None	None	None	None	None	5.0	None	None	None	4	100%	1	1	5.0	None	None	None
2,2-Dichloropropane	594-20-7	µg/L	4	None	None	None	None	None	None	--	--	--	--	4	100%	1	1	--	--	--	--
2-Chlorotoluene	95-49-8	µg/L	4	None	None	None	None	None	None	160	None	None	None	4	100%	1	1	160	None	None	None
2-Hexanone	591-78-6	µg/L	4	None	None	None	None	None	None	40	None	None	None	4	100%	10	10	40	None	None	None
4-Chlorotoluene	106-43-4	µg/L	4	None	None	None	None	None	None	160	None	None	None	4	100%	1	1	160	None	None	None

Table 5.5
Summary Statistics for Groundwater Reconnaissance Samples

				Information about Detects						Information about Detected Exceedances				Information about Non-Detects				Information about Non-Detect Exceedances			
Analytes	CAS No.	Unit	Number of Results	Number of Detects	Percent of Detects	Minimum Detected Value	Maximum Detected Value	Location of Maximum Detect	Date of Maximum Detect	Preliminary Screening Level	Number of Detects Exceeding Criteria	Percent of Detects Exceeding Criteria	Exceedance Factor (1)	Number of Non-Detects	Percent of Non-Detects	Minimum Non-Detect Value (2)	Maximum Non-Detect Value (2)	Preliminary Screening Level	Number of Non-Detects Exceeding Criteria	Percent of Non-Detects Exceeding Criteria	Exceedance Factor (1)
Volatile Organic Compounds: Other (cont.)																					
Acetone	67-64-1	µg/L	4	None	None	None	None	None	None	7,200	None	None	None	4	100%	10	50	7,200	None	None	None
Bromobenzene	108-86-1	µg/L	4	None	None	None	None	None	None	64	None	None	None	4	100%	1	1	64	None	None	None
Bromodichloromethane	75-27-4	µg/L	4	None	None	None	None	None	None	1.4	None	None	None	4	100%	1	1	1.4	None	None	None
Bromoform	75-25-2	µg/L	4	None	None	None	None	None	None	12	None	None	None	4	100%	1	1	12	None	None	None
Bromomethane	74-83-9	µg/L	4	None	None	None	None	None	None	11	None	None	None	4	100%	1	1	11	None	None	None
Carbon tetrachloride	56-23-5	µg/L	4	None	None	None	None	None	None	0.35	None	None	None	4	100%	1	1	0.35	4	100%	2.9
Chlorobenzene	108-90-7	µg/L	4	None	None	None	None	None	None	100	None	None	None	4	100%	1	1	100	None	None	None
Chloroform	67-66-3	µg/L	4	None	None	None	None	None	None	1.2	None	None	None	4	100%	1	1	1.2	None	None	None
Chloromethane	74-87-3	µg/L	4	None	None	None	None	None	None	150	None	None	None	4	100%	10	10	150	None	None	None
cis-1,3-Dichloropropene	10061-01-5	µg/L	4	None	None	None	None	None	None	0.44	None	None	None	4	100%	1	1	0.44	4	100%	2.3
Cymene	99-87-6	µg/L	4	None	None	None	None	None	None	--	--	--	--	4	100%	1	1	--	--	--	--
Dibromochloromethane	124-48-1	µg/L	4	None	None	None	None	None	None	2.2	None	None	None	4	100%	1	1	2.2	None	None	None
Dibromomethane	74-95-3	µg/L	4	None	None	None	None	None	None	80	None	None	None	4	100%	1	1	80	None	None	None
Dichlorodifluoromethane	75-71-8	µg/L	4	None	None	None	None	None	None	4.2	None	None	None	4	100%	1	1	4.2	None	None	None
Isopropylbenzene	98-82-8	µg/L	4	None	None	None	None	None	None	800	None	None	None	4	100%	1	1	800	None	None	None
Methyl ethyl ketone	78-93-3	µg/L	4	None	None	None	None	None	None	4,800	None	None	None	4	100%	10	10	4,800	None	None	None
Methyl isobutyl ketone	108-10-1	µg/L	4	None	None	None	None	None	None	640	None	None	None	4	100%	10	10	640	None	None	None
Methylene chloride	75-09-2	µg/L	4	None	None	None	None	None	None	5	None	None	None	4	100%	5	5	5	None	None	None
Methyl-tert-butyl ether	1634-04-4	µg/L	4	None	None	None	None	None	None	24	None	None	None	4	100%	1	1	24	None	None	None
n-Hexane	110-54-3	µg/L	2	None	None	None	None	None	None	4.1	None	None	None	2	100%	1	1	4.1	None	None	None
n-Propylbenzene	103-65-1	µg/L	4	None	None	None	None	None	None	800	None	None	None	4	100%	1	1	800	None	None	None
sec-Butylbenzene	135-98-8	µg/L	4	None	None	None	None	None	None	800	None	None	None	4	100%	1	1	800	None	None	None
Styrene	100-42-5	µg/L	4	None	None	None	None	None	None	100	None	None	None	4	100%	1	1	100	None	None	None
tert-Butylbenzene	98-06-6	µg/L	4	None	None	None	None	None	None	800	None	None	None	4	100%	1	1	800	None	None	None
trans-1,3-Dichloropropene	10061-02-6	µg/L	4	None	None	None	None	None	None	0.44	None	None	None	4	100%	1	1	0.44	4	100%	2.3
Trichlorofluoromethane	75-69-4	µg/L	4	None	None	None	None	None	None	120	None	None	None	4	100%	1	1	120	None	None	None

Notes:

-- Criterion not established

1 Exceedance factor rounded to two significant figures.

2 For analytes where all results were detected, reporting limit information is provided when available.

Abbreviations:

BTEX Benzene, toluene, ethylbenzene, and xylenes
CAS Chemical Abstracts Service
cVOC Chlorinated volatile organic compound
DRO Diesel-range organics
ND Non-detect
ORO Oil-range organics

Table 5.6
Summary Statistics for In Situ Soil

				Information About Detects							Information About Detected Exceedances				Information About Non-detects				Information About Non-detect Exceedances			
Analytes	CAS No.	Unit	Number of Results	Number of Detects	Percent of Detects	Minimum Detected Value	Maximum Detected Value	Locaton Of Maximum Detect	Date of Maximum Detect	Depth of Maximum Detect (ft bgs)	Preliminary Screening Level	Number of Detects Exceeding Criteria	Percent of Detects Exceeding Criteria	Exceedance Factor (1)	Number of Non-detects	Percent of Non-detects	Minimum Non-detect Value (2)	Maximum Non-detect Value (2)	Preliminary Screening Level	Number of Non-detects Exceeding Criteria	Percent of Non-detects Exceeding Criteria	Exceedance Factor (1)
Total Petroleum Hydrocarbons (TPHs)																						
Gasoline-range organics	GRO	mg/kg	25	5	20%	12	54	A1A-S5	7/6/2018	2	30	2	40%	1.8	20	80%	2	5	30	None	None	None
Diesel-range organics	DRO	mg/kg	116	22	19%	41	5,200	A5A-W31	7/12/2018	7	260	12	55%	20	94	81%	25	50	260	None	None	None
Oil-range organics	ORO	mg/kg	116	19	16%	280	26,000	A5A-W31	7/12/2018	7	260	19	100%	100	97	84%	50	250	260	None	None	None
Total DRO & ORO	T_DRO&ORO (U=0)	mg/kg	116	25	22%	66	31,000	A5A-W31	7/12/2018	7	260	23	92%	120	91	78%	50	250	260	None	None	None
Total Petroleum Hydrocarbons (TPHs)-by HCID																						
Gasoline	86290-81-5	mg/kg	18	None	None	None	None	None	None	None	30	None	None	None	18	100%	20	20	30	None	None	None
Diesel	Dies	mg/kg	18	None	None	None	None	None	None	None	260	None	None	None	18	100%	50	50	260	None	None	None
Heavy oil	Oil_Heavy	mg/kg	18	None	None	None	None	None	None	None	260	None	None	None	18	100%	250	250	260	None	None	None
Metals																						
Arsenic	7440-38-2	mg/kg	158	156	99%	1.4	97	TP7-E1	6/27/2018	2.5	7.3	44	28%	13	2	1.3%	3.7	4.9	7.3	None	None	None
Barium	7440-39-3	mg/kg	13	13	100%	14	220	P12	4/21/2015	2	8.3	13	100%	27	None	None	None	None	8.3	None	None	None
Cadmium	7440-43-9	mg/kg	171	18	11%	1.1	47	WH-RBank	7/18/2018	1.5-4.5	0.77	18	100%	61	153	89%	0.46	1	0.77	151	99%	1.3
Chromium	7440-47-3	mg/kg	57	57	100%	4.7	44	A3B-N1	6/20/2018	0.5	48	None	None	None	None	None	None	None	48	None	None	None
Chromium(VI)	18540-29-9	mg/kg	1	None	None	None	None	None	None	None	0.00089	None	None	None	1	100%	0.52	0.52	0.00089	1	100%	590
Copper	7440-50-8	mg/kg	1	1	100%	14,000	14,000	WH-RBank	7/18/2018	1.5-4.5	36	1	100%	390	None	None	None	None	36	None	None	None
Lead	7439-92-1	mg/kg	116	115	99%	1.2	2,400	WH-RBank	7/18/2018	1.5-4.5	50	37	32%	48	1	0.86%	4.2	4.2	50	None	None	None
Mercury	7439-97-6	mg/kg	51	2	3.9%	0.07	0.1	SB-11	12/4/2003	3-4	0.070	1	50%	1.4	49	96%	1	1	0.070	49	100%	14
Selenium	7782-49-2	mg/kg	13	None	None	None	None	None	None	None	0.26	None	None	None	13	100%	1	4.9	0.26	13	100%	19
Silver	7440-22-4	mg/kg	13	None	None	None	None	None	None	None	0.016	None	None	None	13	100%	1	3.7	0.016	13	100%	230
Polychlorinated Biphenyls (PCBs)																						
Aroclor 1016	12674-11-2	mg/kg	41	None	None	None	None	None	None	None	--	--	--	--	41	100%	0.02	0.1	--	--	--	--
Aroclor 1221	11104-28-2	mg/kg	41	None	None	None	None	None	None	None	--	--	--	--	41	100%	0.02	0.1	--	--	--	--
Aroclor 1232	11141-16-5	mg/kg	41	None	None	None	None	None	None	None	--	--	--	--	41	100%	0.02	0.1	--	--	--	--
Aroclor 1242	53469-21-9	mg/kg	41	None	None	None	None	None	None	None	--	--	--	--	41	100%	0.02	0.1	--	--	--	--
Aroclor 1248	12672-29-6	mg/kg	41	1	2.4%	0.045	0.045	P7	4/21/2015	1	--	--	--	--	40	98%	0.02	0.1	--	--	--	--
Aroclor 1254	11097-69-1	mg/kg	41	7	17%	0.031	0.39	A6A-E3/B2-Comp	6/19/2018	0.5	--	--	--	--	34	83%	0.02	0.1	--	--	--	--
Aroclor 1260	11096-82-5	mg/kg	41	5	12%	0.042	0.57	A4C-N1/S1-Comp	6/19/2018	0.5-2	--	--	--	--	36	88%	0.02	0.1	--	--	--	--
Aroclor 1262	37324-23-5	mg/kg	39	1	2.6%	0.022	0.022	P12	4/21/2015	2	--	--	--	--	38	97%	0.02	0.02	--	--	--	--
Aroclor 1268	11100-14-4	mg/kg	39	None	None	None	None	None	None	None	--	--	--	--	39	100%	0.02	0.02	--	--	--	--
Total PCB Aroclors (U=0)	T_PCB (U=0)	mg/kg	41	13	32%	0.022	0.57	A4C-N1/S1-Comp	6/19/2018	0.5-2	0.00000055	13	100%	1,000,000	28	68%	0.02	0.1	0.00000055	28	100%	180,000
Polybrominated Diphenyl Ethers (PBDEs)																						
PBDE-003	101-55-3	mg/kg	7	None	None	None	None	None	None	None	--	--	--	--	7	100%	0.01	0.6	--	--	--	--
Pesticides																						
Hexachlorocyclopentadiene	77-47-4	mg/kg	7	None	None	None	None	None	None	None	0.0017	None	None	None	7	100%	0.03	3	0.0017	7	100%	1,800
Hexachlorobenzene	118-74-1	mg/kg	7	None	None	None	None	None	None	None	0.00000040	None	None	None	7	100%	0.01	0.6	0.00000040	7	100%	1,500,000
Semivolatile Organic Compounds (SVOCs) - Polycyclic Aromatic Hydrocarbons (PAHs)																						
1-Methylnaphthalene	90-12-0	mg/kg	7	1	14%	0.15	0.15	A1A-T2-B3	7/18/2018	16	0.0042	1	100%	35	6	86%	0.002	0.6	0.0042	5	83%	140
2-Methylnaphthalene	91-57-6	mg/kg	8	1	13%	0.13	0.13	P6	4/21/2015	5	0.039	1	100%	3.3	7	88%	0.002	0.6	0.039	5	71%	15
Acenaphthene	83-32-9	mg/kg	7	None	None	None	None	None	None	None	0.028	None	None	None	7	100%	0.002	0.6	0.028	6	86%	22
Acenaphthylene	208-96-8	mg/kg	7	None	None	None	None	None	None	None	1.3	None	None	None	7	100%	0.002	0.6	1.3	None	None	None
Anthracene	120-12-7	mg/kg	7	None	None	None	None	None	None	None	0.051	None	None	None	7	100%	0.002	0.6	0.051	6	86%	12
Benzo(a)anthracene	56-55-3	mg/kg	46	12	26%	0.012	0.99	A4C-N1	7/2/2018	2	--	--	--	--	34	74%	0.002	1	--	--	--	--
Benzo(a)pyrene	50-32-8	mg/kg	46	19	41%	0.012	1.2	A6C-N1/B1-Comp	6/15/2018	0.5	0.000016	19	100%	77,000	27	59%	0.002	1	0.000016	27	100%	64,000
Benzo(b)fluoranthene	205-99-2	mg/kg	46	22	48%	0.0023	1.5	A4C-N1/S1-Comp	6/19/2018	0.5-2	--	--	--	--	24	52%	0.01	1	--	--	--	--
Benzo(g,h,i)perylene	191-24-2	mg/kg	7	1	14%	0.1	0.1	P6	4/21/2015	5	0.67	None	None	None	6	86%	0.002	0.6	0.67	None	None	None
Benzo(k)fluoranthene	207-08-9	mg/kg	46	7	15%	0.024	0.41	A4C-N1	7/2/2018	2	--	--	--	--	39	85%	0.002	1	--	--	--	--
Chrysene	218-01-9	mg/kg	46	20	43%	0.014	1.1	A6C-N1/B1-Comp	6/15/2018	0.5	--	--	--	--	26	57%	0.002	1	--	--	--	--
Dibenzo(a,h)anthracene	53-70-3	mg/kg	46	2	4%	0.011	0.13	A4C-N1	7/2/2018	2	--	--	--	--	44	96%	0.002	1	--	--	--	--
Fluoranthene	206-44-0	mg/kg	7	3	43%	0.0025	0.39	P6	4/21/2015	5	0.090	2	67%	4.3	4	57%	0.1	0.6	0.090	4	100%	6.7
Fluorene	86-73-7	mg/kg	7	1	14%	0.1	0.1	P6	4/21/2015	5	0.029	1	100%	3.4	6	86%	0.002	0.6	0.029	5	83%	20
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg	46	9	20%	0.01	0.59	A4C-N1	7/2/2018	2	--	--	--	--	37	80%	0.002	1	--	--	--	--
Naphthalene	91-20-3	mg/kg	18	3	17%	0.028	0.13	P6	4/21/2015	5	0.0021	3	100%	63	15	83%	0.002	0.6	0.0021	14	93%	290
Phenanthrene	85-01-8	mg/kg	7	2	29%	0.1	0.39	P6	4/21/2015	5	1.5	None	None	None	5	71%	0.002	0.6	1.5	None	None	None
Pyrene	129-00-0	mg/kg	7	3	43%	0.003	0.35	P6	4/21/2015	5	0.14	2	67%	2.5	4	57%	0.1	0.6	0.14	1	25%	4.4
Total naphthalenes	T_Napth (U=0)	mg/kg	7	1	14%	0.18	0.18	A1A-T2-B3	7/18/2018	16	--	--	--	--	6	86%	0.002	0.6	--	--	--	--
cPAHs (MTCA TEQ-HalfND)	BaPEq (U=1/2)	mg/kg	46	22	48%	0.0016	1.5	A6C-N1/B1-Comp	6/15/2018	0.5	0.000016	22	100%	97,000	24	52%	0.01	1	0.000016	24	100%	64,000
cPAHs (MTCA TEQ-ZeroND)	BaPEq (U=0)	mg/kg	46	22	48%	0.00023	1.4	A4C-N1	7/2/2018	2	0.000016	22	100%	90,000	24	52%	0.01	1	0.000016	24	100%	64,000

Table 5.6
Summary Statistics for In Situ Soil

				Information About Detects							Information About Detected Exceedances				Information About Non-detects				Information About Non-detect Exceedances			
Analytes	CAS No.	Unit	Number of Results	Number of Detects	Percent of Detects	Minimum Detected Value	Maximum Detected Value	Locaton Of Maximum Detect	Date of Maximum Detect	Depth of Maximum Detect (ft bgs)	Preliminary Screening Level	Number of Detects Exceeding Criteria	Percent of Detects Exceeding Criteria	Exceedance Factor (1)	Number of Non-detects	Percent of Non-detects	Minimum Non-detect Value (2)	Maximum Non-detect Value (2)	Preliminary Screening Level	Number of Non-detects Exceeding Criteria	Percent of Non-detects Exceeding Criteria	Exceedance Factor (1)
Semivolatile Organic Compounds (SVOCs) - Polycyclic Aromatic Hydrocarbons (PAHs)(cont.)																						
Total HPAH (U=0)	T_HPAH (U=0)	mg/kg	7	3	43%	0.0078	1.6	P6	4/21/2015	5	12	None	None	None	4	57%	0.1	0.6	12	None	None	None
Total LPAH (U=0)	T_LPAH (U=0)	mg/kg	7	2	29%	0.1	0.62	P6	4/21/2015	5	5.2	None	None	None	5	71%	0.002	0.6	5.2	None	None	None
Total PAH (U=0)	T_PAH (U=0)	mg/kg	7	3	43%	0.0078	2.2	P6	4/21/2015	5	--	--	--	--	4	57%	0.1	0.6	--	--	--	--
Semivolatile Organic Compounds (SVOCs) -Phenols																						
2,3,4,6-Tetrachlorophenol	58-90-2	mg/kg	4	None	None	None	None	None	None	None	2,400	None	None	None	4	100%	0.25	1.5	2,400	None	None	None
2,4,5-Trichlorophenol	95-95-4	mg/kg	7	None	None	None	None	None	None	None	1.1	None	None	None	7	100%	0.1	5	1.1	1	14%	4.5
2,4,6-Trichlorophenol	88-06-2	mg/kg	7	None	None	None	None	None	None	None	0.00019	None	None	None	7	100%	0.1	5	0.00019	7	100%	26,000
2,4-Dichlorophenol	120-83-2	mg/kg	7	None	None	None	None	None	None	None	0.0043	None	None	None	7	100%	0.1	5	0.0043	7	100%	1,200
2,4-Dimethylphenol	105-67-9	mg/kg	7	None	None	None	None	None	None	None	0.0023	None	None	None	7	100%	0.1	5	0.0023	7	100%	2,200
2,4-Dinitrophenol	51-28-5	mg/kg	7	None	None	None	None	None	None	None	0.0092	None	None	None	7	100%	0.3	15	0.0092	7	100%	1,600
2,6-Dichlorophenol	87-65-0	mg/kg	4	None	None	None	None	None	None	None	--	--	--	--	4	100%	0.1	0.6	--	--	--	--
2-Chlorophenol	95-57-8	mg/kg	7	None	None	None	None	None	None	None	0.011	None	None	None	7	100%	0.1	5	0.011	7	100%	440
2-Methylphenol	95-48-7	mg/kg	7	None	None	None	None	None	None	None	0.0064	None	None	None	7	100%	0.1	5	0.0064	7	100%	790
2-Nitrophenol	88-75-5	mg/kg	7	None	None	None	None	None	None	None	--	--	--	--	7	100%	0.1	5	--	--	--	--
3- & 4-Methylphenol	15831-10-4	mg/kg	3	None	None	None	None	None	None	None	0.062	None	None	None	3	100%	0.2	10	0.062	3	100%	160
4,6-Dinitro-o-cresol	534-52-1	mg/kg	7	None	None	None	None	None	None	None	0.0013	None	None	None	7	100%	0.3	15	0.0013	7	100%	12,000
4-Chloro-3-methylphenol	59-50-7	mg/kg	7	None	None	None	None	None	None	None	0.028	None	None	None	7	100%	0.1	5	0.028	7	100%	180
4-Methylphenol	106-44-5	mg/kg	4	None	None	None	None	None	None	None	0.062	None	None	None	4	100%	0.1	0.6	0.062	4	100%	9.6
4-Nitrophenol	100-02-7	mg/kg	7	None	None	None	None	None	None	None	7.0	None	None	None	7	100%	0.3	15	7.0	1	14%	2.1
Pentachlorophenol	87-86-5	mg/kg	7	None	None	None	None	None	None	None	0.0000018	None	None	None	7	100%	0.05	3	0.0000018	7	100%	1,700,000
Phenol	108-95-2	mg/kg	7	None	None	None	None	None	None	None	0.048	None	None	None	7	100%	0.1	5	0.048	7	100%	100
Semivolatile Organic Compounds (SVOCs) -Phthalates																						
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	7	None	None	None	None	None	None	None	0.0051	None	None	None	7	100%	0.13	8	0.0051	7	100%	1,600
Butyl benzyl phthalate	85-68-7	mg/kg	7	None	None	None	None	None	None	None	0.00018	None	None	None	7	100%	0.1	5	0.00018	7	100%	27,000
Di-n-butyl phthalate	84-74-2	mg/kg	7	None	None	None	None	None	None	None	0.015	None	None	None	7	100%	0.1	5	0.015	7	100%	340
Di-n-octyl phthalate	117-84-0	mg/kg	7	None	None	None	None	None	None	None	0.33	None	None	None	7	100%	0.1	5	0.33	3	43%	15
Diethylphthalate	84-66-2	mg/kg	7	None	None	None	None	None	None	None	0.034	None	None	None	7	100%	0.1	5	0.034	7	100%	150
Dimethyl phthalate	131-11-3	mg/kg	7	None	None	None	None	None	None	None	0.019	None	None	None	7	100%	0.1	5	0.019	7	100%	270
Semivolatile Organic Compounds (SVOCs) -Other																						
2-Chloronaphthalene	91-58-7	mg/kg	7	None	None	None	None	None	None	None	0.28	None	None	None	7	100%	0.01	0.6	0.28	2	29%	2.2
Aniline	62-53-3	mg/kg	4	None	None	None	None	None	None	None	0.0055	None	None	None	4	100%	0.1	0.6	0.0055	4	100%	110
Azobenzene	103-33-3	mg/kg	4	None	None	None	None	None	None	None	9.1	None	None	None	4	100%	0.1	0.6	9.1	None	None	None
Benzoic acid	65-85-0	mg/kg	7	None	None	None	None	None	None	None	0.17	None	None	None	7	100%	0.5	25	0.17	7	100%	150
Benzyl alcohol	100-51-6	mg/kg	7	None	None	None	None	None	None	None	0.017	None	None	None	7	100%	0.1	5	0.017	7	100%	290
Bis(2-chloroethoxy)methane	111-91-1	mg/kg	7	None	None	None	None	None	None	None	0.014	None	None	None	7	100%	0.01	0.6	0.014	6	86%	43
Bis-chloroisopropyl ether	108-60-1	mg/kg	2	None	None	None	None	None	None	None	0.00023	None	None	None	2	100%	0.01	0.5	0.00023	2	100%	2,200
Carbazole	86-74-8	mg/kg	7	None	None	None	None	None	None	None	--	--	--	--	7	100%	0.01	1	--	--	--	--
Dibenzofuran	132-64-9	mg/kg	7	None	None	None	None	None	None	None	0.029	None	None	None	7	100%	0.01	0.6	0.029	6	86%	21
Hexachlorobutadiene	87-68-3	mg/kg	21	None	None	None	None	None	None	None	0.000011	None	None	None	21	100%	0.01	0.6	0.000011	21	100%	53,000
Isophorone	78-59-1	mg/kg	7	None	None	None	None	None	None	None	0.032	None	None	None	7	100%	0.01	0.6	0.032	6	86%	19
N-Nitrosodimethylamine	62-75-9	mg/kg	4	None	None	None	None	None	None	None	0.000000071	None	None	None	4	100%	0.1	0.6	0.000000071	4	100%	8,400,000
N-Nitroso-di-n-propylamine	621-64-7	mg/kg	7	None	None	None	None	None	None	None	0.0000070	None	None	None	7	100%	0.01	0.6	0.0000070	7	100%	85,000
N-Nitrosodiphenylamine	86-30-6	mg/kg	7	None	None	None	None	None	None	None	0.0016	None	None	None	7	100%	0.01	0.6	0.0016	7	100%	370
Volatile Organic Compounds (VOCs) - BTEX																						
Benzene	71-43-2	mg/kg	51	None	None	None	None	None	None	None	0.00056	None	None	None	51	100%	0.02	0.03	0.00056	51	100%	54
Ethylbenzene	100-41-4	mg/kg	51	5	10%	0.037	0.36	A1A-T2-N2	7/18/2018	10	0.010	5	100%	35	46	90%	0.02	0.05	0.010	46	100%	4.9
Toluene	108-88-3	mg/kg	51	3	5.9%	0.067	0.18	A1A-T2-B3	7/18/2018	16	0.044	3	100%	4.1	48	94%	0.02	0.05	0.044	14	29%	1.1
Xylene (meta & para)	108-38-3/106-42-3	mg/kg	9	None	None	None	None	None	None	None	--	--	--	--	9	100%	0.1	0.1	--	--	--	--
Xylene (ortho)	95-47-6	mg/kg	9	None	None	None	None	None	None	None	--	--	--	--	9	100%	0.05	0.05	--	--	--	--
Xylene (total)	1330-20-7	mg/kg	51	4	7.8%	0.21	0.31	FT1-B1-12	4/27/2017	12	0.055	4	100%	5.6	47	92%	0.06	0.2	0.055	47	100%	3.6
Volatile Organic Compounds (VOCs) - cVOCs																						
Chloroethane	75-00-3	mg/kg	14	None	None	None	None	None	None	None	--	--	--	--	14	100%	0.01	0.5	--	--	--	--
cis-1,2-Dichloroethene	156-59-2	mg/kg	14	None	None	None	None	None	None	None	0.0052	None	None	None	14	100%	0.01	0.05	0.0052	14	100%	9.6
Tetrachloroethene	127-18-4	mg/kg	17	None	None	None	None	None	None	None	0.0016	None	None	None	17	100%	0.01	0.025	0.0016	17	100%	16
trans-1,2-Dichloroethene	156-60-5	mg/kg	14	None	None	None	None	None	None	None	0.032	None	None	None	14	100%	0.01	0.05	0.032	9	64%	1.5
Trichloroethene	79-01-6	mg/kg	17	None	None	None	None	None	None	None	0.00027	None	None	None	17	100%	0.01	0.02	0.00027	17	100%	75
Vinyl chloride	75-01-4	mg/kg	14	None	None	None	None	None	None	None	0.000056	None	None	None	14	100%	0.01	0.05	0.000056	14	100%	900

Table 5.6
Summary Statistics for In Situ Soil

				Information About Detects							Information About Detected Exceedances				Information About Non-detects				Information About Non-detect Exceedances			
Analytes	CAS No.	Unit	Number of Results	Number of Detects	Percent of Detects	Minimum Detected Value	Maximum Detected Value	Locaton Of Maximum Detect	Date of Maximum Detect	Depth of Maximum Detect (ft bgs)	Preliminary Screening Level	Number of Detects Exceeding Criteria	Percent of Detects Exceeding Criteria	Exceedance Factor [1]	Number of Non-detects	Percent of Non-detects	Minimum Non-detect Value [2]	Maximum Non-detect Value [2]	Preliminary Screening Level	Number of Non-detects Exceeding Criteria	Percent of Non-detects Exceeding Criteria	Exceedance Factor [1]
Volatile Organic Compounds (VOCs) - Other																						
1,1,1,2-Tetrachloroethane	630-20-6	mg/kg	9	None	None	None	None	None	None	None	0.00063	None	None	None	9	100%	0.05	0.05	0.00063	9	100%	80
1,1,1-Trichloroethane	71-55-6	mg/kg	14	None	None	None	None	None	None	None	0.084	None	None	None	14	100%	0.01	0.05	0.084	None	None	None
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg	14	None	None	None	None	None	None	None	0.000080	None	None	None	14	100%	0.01	0.05	0.000080	14	100%	630
1,1,2-Trichloroethane	79-00-5	mg/kg	14	None	None	None	None	None	None	None	0.00033	None	None	None	14	100%	0.01	0.05	0.00033	14	100%	150
1,1-Dichloroethane	75-34-3	mg/kg	14	None	None	None	None	None	None	None	0.0026	None	None	None	14	100%	0.01	0.05	0.0026	14	100%	19
1,1-Dichloroethene	75-35-4	mg/kg	14	None	None	None	None	None	None	None	0.0025	None	None	None	14	100%	0.01	0.05	0.0025	14	100%	20
1,1-Dichloropropene	563-58-6	mg/kg	14	None	None	None	None	None	None	None	--	--	--	--	14	100%	0.01	0.05	--	--	--	--
1,2,3-Trichlorobenzene	87-61-6	mg/kg	14	None	None	None	None	None	None	None	0.011	None	None	None	14	100%	0.01	0.25	0.011	9	64%	23
1,2,3-Trichloropropane	96-18-4	mg/kg	14	None	None	None	None	None	None	None	0.00000015	None	None	None	14	100%	0.01	0.05	0.00000015	14	100%	330,000
1,2,4-Trichlorobenzene	120-82-1	mg/kg	21	None	None	None	None	None	None	None	0.000072	None	None	None	21	100%	0.01	0.6	0.000072	21	100%	8,300
1,2,4-Trimethylbenzene	95-63-6	mg/kg	9	1	11%	0.055	0.055	P6	4/21/2015	5	0.072	None	None	None	8	89%	0.05	0.05	0.072	None	None	None
1,2-Dibromo-3-chloropropane	96-12-8	mg/kg	14	None	None	None	None	None	None	None	0.000056	None	None	None	14	100%	0.05	0.5	0.000056	14	100%	8,900
1,2-Dibromoethane	106-93-4	mg/kg	14	None	None	None	None	None	None	None	0.000018	None	None	None	14	100%	0.005	0.05	0.000018	14	100%	2,800
1,2-Dichlorobenzene	95-50-1	mg/kg	21	None	None	None	None	None	None	None	0.0030	None	None	None	21	100%	0.01	0.6	0.0030	21	100%	200
1,2-Dichloroethane	107-06-2	mg/kg	14	None	None	None	None	None	None	None	0.0016	None	None	None	14	100%	0.01	0.05	0.0016	14	100%	32
1,2-Dichloropropane	78-87-5	mg/kg	14	None	None	None	None	None	None	None	0.0010	None	None	None	14	100%	0.01	0.05	0.0010	14	100%	48
1,3,5-Trimethylbenzene	108-67-8	mg/kg	9	None	None	None	None	None	None	None	0.071	None	None	None	9	100%	0.05	0.05	0.071	None	None	None
1,3-Dichlorobenzene	541-73-1	mg/kg	21	None	None	None	None	None	None	None	0.0013	None	None	None	21	100%	0.01	0.6	0.0013	21	100%	450
1,3-Dichloropropane	142-28-9	mg/kg	14	None	None	None	None	None	None	None	0.057	None	None	None	14	100%	0.01	0.05	0.057	None	None	None
1,4-Dichlorobenzene	106-46-7	mg/kg	21	None	None	None	None	None	None	None	0.0081	None	None	None	21	100%	0.01	0.6	0.0081	21	100%	74
2,2-Dichloropropane	594-20-7	mg/kg	14	None	None	None	None	None	None	None	--	--	--	--	14	100%	0.01	0.05	--	--	--	--
2,4-Dinitrotoluene	121-14-2	mg/kg	7	None	None	None	None	None	None	None	0.00016	None	None	None	7	100%	0.05	2.5	0.00016	7	100%	16,000
2,6-Dinitrotoluene	606-20-2	mg/kg	7	None	None	None	None	None	None	None	0.000051	None	None	None	7	100%	0.05	2.5	0.000051	7	100%	49,000
2-Chlorotoluene	95-49-8	mg/kg	14	None	None	None	None	None	None	None	0.11	None	None	None	14	100%	0.01	0.05	0.11	None	None	None
2-Hexanone	591-78-6	mg/kg	9	None	None	None	None	None	None	None	0.012	None	None	None	9	100%	0.5	0.5	0.012	9	100%	41
2-Nitroaniline	88-74-4	mg/kg	7	None	None	None	None	None	None	None	0.064	None	None	None	7	100%	0.05	2.5	0.064	6	86%	39
3,3'-Dichlorobenzidine	91-94-1	mg/kg	4	None	None	None	None	None	None	None	0.0000020	None	None	None	4	100%	0.1	0.6	0.0000020	4	100%	300,000
3-Nitroaniline	99-09-2	mg/kg	7	None	None	None	None	None	None	None	--	--	--	--	7	100%	0.25	50	--	--	--	--
4-Chloroaniline	106-47-8	mg/kg	7	None	None	None	None	None	None	None	0.00017	None	None	None	7	100%	0.1	50	0.00017	7	100%	290,000
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg	7	None	None	None	None	None	None	None	--	--	--	--	7	100%	0.01	0.6	--	--	--	--
4-Chlorotoluene	106-43-4	mg/kg	14	None	None	None	None	None	None	None	0.11	None	None	None	14	100%	0.01	0.05	0.11	None	None	None
4-Nitroaniline	100-01-6	mg/kg	7	None	None	None	None	None	None	None	0.0013	None	None	None	7	100%	0.25	50	0.0013	7	100%	40,000
Acetone	67-64-1	mg/kg	9	None	None	None	None	None	None	None	2.1	None	None	None	9	100%	0.5	0.5	2.1	None	None	None
Bis(2-chloroethyl)ether	111-44-4	mg/kg	7	None	None	None	None	None	None	None	0.000014	None	None	None	7	100%	0.01	0.6	0.000014	7	100%	42,000
Bis(2-chloroisopropyl)ether	39638-32-9	mg/kg	5	None	None	None	None	None	None	None	--	--	--	--	5	100%	0.1	0.6	--	--	--	--
Bromobenzene	108-86-1	mg/kg	14	None	None	None	None	None	None	None	0.033	None	None	None	14	100%	0.01	0.05	0.033	9	64%	1.5
Bromochloromethane	74-97-5	mg/kg	5	None	None	None	None	None	None	None	--	--	--	--	5	100%	0.01	0.01	--	--	--	--
Bromodichloromethane	75-27-4	mg/kg	14	None	None	None	None	None	None	None	0.00089	None	None	None	14	100%	0.01	0.05	0.00089	14	100%	56
Bromoform	75-25-2	mg/kg	14	None	None	None	None	None	None	None	0.0050	None	None	None	14	100%	0.01	0.05	0.0050	14	100%	10
Bromomethane	74-83-9	mg/kg	14	None	None	None	None	None	None	None	0.0033	None	None	None	14	100%	0.01	0.5	0.0033	14	100%	150
Carbon tetrachloride	56-23-5	mg/kg	14	None	None	None	None	None	None	None	0.00015	None	None	None	14	100%	0.01	0.05	0.00015	14	100%	330
Chlorobenzene	108-90-7	mg/kg	14	None	None	None	None	None	None	None	0.051	None	None	None	14	100%	0.01	0.05	0.051	None	None	None
Chloroform	67-66-3	mg/kg	14	None	None	None	None	None	None	None	0.0048	None	None	None	14	100%	0.01	0.05	0.0048	14	100%	10
Chloromethane	74-87-3	mg/kg	14	None	None	None	None	None	None	None	--	--	--	--	14	100%	0.01	0.5	--	--	--	--
cis-1,3-Dichloropropene	10061-01-5	mg/kg	14	None	None	None	None	None	None	None	0.00014	None	None	None	14	100%	0.01	0.05	0.00014	14	100%	360
Cymene	99-87-6	mg/kg	9	1	11%	0.23	0.23	P6	4/21/2015	5	--	--	--	--	8	89%	0.05	0.05	--	--	--	--
Dibromochloromethane	124-48-1	mg/kg	14	None	None	None	None	None	None	None	0.00070	None	None	None	14	100%	0.01	0.05	0.00070	14	100%	71
Dibromomethane	74-95-3	mg/kg	14	None	None	None	None	None	None	None	0.028	None	None	None	14	100%	0.01	0.05	0.028	9	64%	1.8
Dichlorodifluoromethane	75-71-8	mg/kg	14	None	None	None	None	None	None	None	0.53	None	None	None	14	100%	0.01	0.5	0.53	None	None	None
Hexachloroethane	67-72-1	mg/kg	7	None	None	None	None	None	None	None	0.0000097	None	None	None	7	100%	0.01	0.6	0.0000097	7	100%	62,000
Isopropylbenzene	98-82-8	mg/kg	9	None	None	None	None	None	None	None	0.79	None	None	None	9	100%	0.05	0.05	0.79	None	None	None
Methyl ethyl ketone	78-93-3	mg/kg	9	None	None	None	None	None	None	None	1.4	None	None	None	9	100%	0.5	0.5	1.4	None	None	None
Methyl isobutyl ketone	108-10-1	mg/kg	9	None	None	None	None	None	None	None	0.19	None	None	None	9	100%	0.5	0.5	0.19	9	100%	2.6
Methylene chloride	75-09-2	mg/kg	14	None	None	None	None	None	None	None	0.0015	None	None	None	14	100%	0.01	0.5	0.0015	14	100%	340
Methyl-tert-butyl ether	1634-04-4	mg/kg	9	None	None	None	None	None	None	None	0.0072	None	None	None	9	100%	0.05	0.05	0.0072	9	100%	6.9
n-Hexane	110-54-3	mg/kg	5	None	None	None	None	None	None	None	1.8	None	None	None	5	100%	0.25	0.25	1.8	None	None	None
Nitrobenzene	98-95-3	mg/kg	7	None	None	None	None	None	None	None	0.0065	None	None	None	7	100%	0.01	0.6	0.0065	7	100%	92

Table 5.6
Summary Statistics for In Situ Soil

Analytes	CAS No.	Unit	Number of Results	Information About Detects: Number of Detects	Percent of Detects	Minimum Detected Value	Maximum Detected Value	Locaton Of Maximum Detect	Date of Maximum Detect	Depth of Maximum Detect (ft bgs)	Information About Detected Exceedances: Preliminary Screening Level	Number of Detects Exceeding Criteria	Percent of Detects Exceeding Criteria	Exceedance Factor (1)	Information About Non-detects: Number of Non-detects	Percent of Non-detects	Minimum Non-detect Value (2)	Maximum Non-detect Value (2)	Information About Non-detect Exceedances: Preliminary Screening Level	Number of Non-detects Exceeding Criteria	Percent of Non-detects Exceeding Criteria	Exceedance Factor (1)
Volatile Organic Compounds (VOCs) - Other (cont.)																						
n-Propylbenzene	103-65-1	mg/kg	9	None	None	None	None	None	None	None	0.88	None	None	None	9	100%	0.05	0.05	0.88	None	None	None
Pyridine	110-86-1	mg/kg	4	None	None	None	None	None	None	None	0.0029	None	None	None	4	100%	0.1	0.6	0.0029	4	100%	210
sec-Butylbenzene	135-98-8	mg/kg	9	None	None	None	None	None	None	None	1.3	None	None	None	9	100%	0.05	0.05	1.3	None	None	None
Styrene	100-42-5	mg/kg	9	None	None	None	None	None	None	None	0.12	None	None	None	9	100%	0.05	0.05	0.12	None	None	None
tert-Butylbenzene	98-06-6	mg/kg	9	None	None	None	None	None	None	None	1.0	None	None	None	9	100%	0.05	0.05	1.0	None	None	None
trans-1,3-Dichloropropene	10061-02-6	mg/kg	14	None	None	None	None	None	None	None	0.00014	None	None	None	14	100%	0.01	0.05	0.00014	14	100%	360
Trichlorofluoromethane	75-69-4	mg/kg	14	None	None	None	None	None	None	None	0.79	None	None	None	14	100%	0.01	0.5	0.79	None	None	None

Notes:

The dataset does not include soil TCLP results or "trip blank" soil samples.

-- Criterion not established

1 Exceedance factor rounded to two significant figures.

2 For analytes where all results were detected, reporting limit information is provided when available.

Abbreviations:

bgs Below ground surface
BTEX Benzene, toluene, ethylbenzene and xylene
CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbon
DRO Diesel-range organics
ft Feet
HPAH High molecular weight polycyclic aromatic hydrocarbon
mg/kg Milligrams per kilogram
LPAH Low molecular weight polycyclic aromatic hydrocarbon
ORO Oil-range organics
TEQ Toxic equivalent

Table 5.7
Summary Statistics for Excavated Soil

				Information About Detects							Information About Detected Exceedances				Information About Non-detects				Information About Non-detect Exceedances			
Analytes	CAS No.	Unit	Number of Results	Number of Detects	Percent of Detects	Minimum Detected Value	Maximum Detected Value	Location Of Maximum Detect	Date of Maximum Detect	Depth of Maximum Detect (ft bgs)	Preliminary Screening Level	Number of Detects Exceeding Criteria	Percent of Detects Exceeding Criteria	Exceedance Factor (1)	Number of Non-detects	Percent of Non-detects	Minimum Non-detect Value (2)	Maximum Non-detect Value (2)	Preliminary Screening Level	Number of Non-detects Exceeding Criteria	Percent of Non-detects Exceeding Criteria	Exceedance Factor (1)
Total Petroleum Hydrocarbons (TPHs)																						
Gasoline-range organics	GRO	mg/kg	16	10	63%	4.0	360	A1A-T2-B1	7/18/2018	9	30	8	50%	12	6	38%	2.0	5.0	30	None	None	None
Diesel-range organics	DRO	mg/kg	42	25	60%	78	17,000	P6	4/21/2015	0	260	17	40%	65	17	40%	50	50	260	None	None	None
Oil-range organics	ORO	mg/kg	42	21	50%	440	100,000	P6	4/21/2015	0	260	21	50%	380	21	50%	250	250	260	None	None	None
Total DRO & ORO	T_DRO&ORO (U=0)	mg/kg	42	26	62%	92	120,000	P6	4/21/2015	0	260	22	52%	460	16	38%	250	250	260	None	None	None
Total Petroleum Hydrocarbons (TPHs)-by HCID																						
Diesel	Dies	mg/kg	1	None	None	None	None	None	None	None	260	None	None	None	1	100%	50	50	260	None	None	None
Heavy oil	Oil_Heavy	mg/kg	1	None	None	None	None	None	None	None	260	None	None	None	1	100%	250	250	260	None	None	None
Metals																						
Arsenic	7440-38-2	mg/kg	65	63	97%	2.1	790	TP5	5/22/2018	3	7.3	45	69%	110	2	3.1%	4.3	10	7.3	1	1.5%	1.4
Barium	7440-39-3	mg/kg	8	8	100%	30	160	P5	4/21/2015	2	8.3	8	100%	19	None	None	None	None	8.3	None	None	None
Cadmium	7440-43-9	mg/kg	67	43	64%	1.0	27	A1A-E3	7/5/2018	2	0.77	43	64%	35	24	36%	1.0	10	0.77	24	36%	13
Chromium	7440-47-3	mg/kg	23	23	100%	2.8	260	A4C-N1	6/19/2018	0.5	48	7	30%	5.4	None	None	None	None	48	None	None	None
Chromium(VI)	18540-29-9	mg/kg	3	None	None	None	None	None	None	None	0.00089	None	None	None	3	100%	0.59	5.0	0.00089	3	100%	5,600
Lead	7439-92-1	mg/kg	69	69	100%	1.7	5,700	A1A-E2	6/27/2018	1.5	50	50	72%	110	None	None	None	None	50	None	None	None
Mercury	7439-97-6	mg/kg	19	2	11%	0.67	1.5	P6	4/21/2015	--	0.070	2	11%	21	17	89%	1.0	10	0.070	17	89%	140
Selenium	7782-49-2	mg/kg	8	None	None	None	None	None	None	None	0.26	None	None	None	8	100%	1.0	10	0.26	8	100%	38
Silver	7440-22-4	mg/kg	8	1	13%	12	12	P5	4/21/2015	2	0.016	1	13%	740	7	88%	1.0	10	0.016	7	88%	610
Polychlorinated Biphenyls (PCBs)																						
Aroclor 1016	12674-11-2	mg/kg	14	1	7.1%	2.9	2.9	P6	4/21/2015	--	--	--	--	--	12	92%	0.020	0.20	--	--	--	--
Aroclor 1221	11104-28-2	mg/kg	14	None	None	None	None	None	None	None	--	--	--	--	13	100%	0.020	0.20	--	--	--	--
Aroclor 1232	11141-16-5	mg/kg	14	None	None	None	None	None	None	None	--	--	--	--	13	100%	0.020	0.20	--	--	--	--
Aroclor 1242	53469-21-9	mg/kg	14	2	14%	0.18	0.34	P13	4/24/2015	--	--	--	--	--	11	85%	0.020	0.20	--	--	--	--
Aroclor 1248	12672-29-6	mg/kg	14	2	14%	0.53	2.9	P6	4/21/2015	--	--	--	--	--	11	85%	0.020	0.20	--	--	--	--
Aroclor 1254	11097-69-1	mg/kg	14	4	29%	0.026	0.93	P6	4/21/2015	--	--	--	--	--	10	77%	0.020	0.20	--	--	--	--
Aroclor 1260	11096-82-5	mg/kg	14	3	21%	0.028	0.11	A6A-B3	6/25/2018	1	--	--	--	--	10	77%	0.020	0.20	--	--	--	--
Aroclor 1262	37324-23-5	mg/kg	11	1	9.1%	0.038	0.038	A3B-W1/E1-Comp	6/20/2018	0.5	--	--	--	--	10	91%	0.020	0.20	--	--	--	--
Aroclor 1268	11100-14-4	mg/kg	11	None	None	None	None	None	None	None	--	--	--	--	11	100%	0.020	0.20	--	--	--	--
Total PCB Aroclors (U=0)	T_PCB (U=0)	mg/kg	14	9	64%	0.026	6.7	P6	4/21/2015	-	0.00000055	9	64%	12,000,000	5	36%	0.020	0.20	0.00000055	5	36%	360,000
Polybrominated Diphenyl Ethers (PBDEs)																						
PBDE-003	101-55-3	mg/kg	2	None	None	None	None	None	None	None	--	--	--	--	2	100%	0.10	2.5	--	--	--	--
Pesticides																						
Hexachlorocyclopentadiene	77-47-4	mg/kg	2	None	None	None	None	None	None	None	0.0017	None	None	None	2	100%	0.50	7.5	0.0017	2	100%	4,400
Hexachlorobenzene	118-74-1	mg/kg	2	None	None	None	None	None	None	None	0.00000040	None	None	None	2	100%	0.10	2.5	0.00000040	2	100%	6,200,000
Semivolatile Organic Compounds (SVOCs) - Polycyclic Aromatic Hydrocarbons (PAHs)																						
1-Methylnaphthalene	90-12-0	mg/kg	2	1	50%	0.36	0.36	A1A-T2-B1	7/18/2018	9	0.0042	1	50%	85	1	50%	0.10	0.10	0.0042	1	50%	24
2-Methylnaphthalene	91-57-6	mg/kg	3	1	33%	0.45	0.45	A1A-T2-B1	7/18/2018	9	0.039	1	33%	12	2	67%	0.10	2.5	0.039	2	67%	64
Acenaphthene	83-32-9	mg/kg	2	None	None	None	None	None	None	None	0.028	None	None	None	2	100%	0.10	2.5	0.028	2	100%	90
Acenaphthylene	208-96-8	mg/kg	2	None	None	None	None	None	None	None	1.3	None	None	None	2	100%	0.10	2.5	1.3	1	50%	1.9
Anthracene	120-12-7	mg/kg	2	None	None	None	None	None	None	None	0.051	None	None	None	2	100%	0.10	2.5	0.051	2	100%	49
Benzo(a)anthracene	56-55-3	mg/kg	11	2	18%	0.25	1.3	A4C-N1	6/19/2018	0.5	--	--	--	--	9	82%	0.10	2.5	--	--	--	--
Benzo(a)pyrene	50-32-8	mg/kg	11	2	18%	0.29	1.5	A4C-N1	6/19/2018	0.5	0.000016	2	18%	97,000	9	82%	0.10	2.5	0.000016	9	82%	160,000
Benzo(b)fluoranthene	205-99-2	mg/kg	11	3	27%	0.43	2.0	A4C-N1	6/19/2018	0.5	--	--	--	--	8	73%	0.10	2.5	--	--	--	--
Benzo(g,h,i)perylene	191-24-2	mg/kg	2	None	None	None	None	None	None	None	0.67	None	None	None	2	100%	0.10	2.5	0.67	1	50%	3.7
Benzo(k)fluoranthene	207-08-9	mg/kg	11	1	9.1%	0.13	0.13	A6A-B3	6/25/2018	1	--	--	--	--	10	91%	0.10	2.5	--	--	--	--
Chrysene	218-01-9	mg/kg	11	2	18%	0.29	1.5	A4C-N1	6/19/2018	0.5	--	--	--	--	9	82%	0.10	2.5	--	--	--	--
Dibenzo(a,h)anthracene	53-70-3	mg/kg	11	None	None	None	None	None	None	None	--	--	--	--	11	100%	0.10	2.5	--	--	--	--
Fluoranthene	206-44-0	mg/kg	2	None	None	None	None	None	None	None	0.090	None	None	None	2	100%	0.10	2.5	0.090	2	100%	28
Fluorene	86-73-7	mg/kg	2	None	None	None	None	None	None	None	0.029	None	None	None	2	100%	0.10	2.5	0.029	2	100%	85
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg	11	2	18%	0.23	1.4	A4C-N1	6/19/2018	0.5	--	--	--	--	9	82%	0.10	2.5	--	--	--	--
Naphthalene	91-20-3	mg/kg	9	2	22%	0.075	0.93	P13	4/21/2015	0	0.0021	2	22%	450	7	78%	0.050	2.5	0.0021	7	78%	1,200
Phenanthrene	85-01-8	mg/kg	2	None	None	None	None	None	None	None	1.5	None	None	None	2	100%	0.10	2.5	1.5	1	50%	1.7
Pyrene	129-00-0	mg/kg	2	None	None	None	None	None	None	None	0.14	None	None	None	2	100%	0.10	2.5	0.14	1	50%	18
Total naphthalenes	T_Napth (U=0)	mg/kg	2	1	50%	0.81	0.81	A1A-T2-B1	7/18/2018	9	--	--	--	--	1	50%	0.10	0.10	--	--	--	--
cPAHs (MTCA TEQ-HalfND)	BaPEq (U=1/2)	mg/kg	11	3	27%	0.40	2.1	A4C-N1	6/19/2018	0.5	0.000016	3	27%	140,000	8	73%	0.10	2.5	0.000016	8	73%	160,000
cPAHs (MTCA TEQ-ZeroND)	BaPEq (U=0)	mg/kg	11	3	27%	0.16	2.0	A4C-N1	6/19/2018	0.5	0.000016	3	27%	130,000	8	73%	0.10	2.5	0.000016	8	73%	160,000

Table 5.7
Summary Statistics for Excavated Soil

				Information About Detects							Information About Detected Exceedances				Information About Non-detects				Information About Non-detect Exceedances			
Analytes	CAS No.	Unit	Number of Results	Number of Detects	Percent of Detects	Minimum Detected Value	Maximum Detected Value	Location Of Maximum Detect	Date of Maximum Detect	Depth of Maximum Detect (ft bgs)	Preliminary Screening Level	Number of Detects Exceeding Criteria	Percent of Detects Exceeding Criteria	Exceedance Factor (1)	Number of Non-detects	Percent of Non-detects	Minimum Non-detect Value (2)	Maximum Non-detect Value (2)	Preliminary Screening Level	Number of Non-detects Exceeding Criteria	Percent of Non-detects Exceeding Criteria	Exceedance Factor (1)
Semivolatile Organic Compounds (SVOCs) - Polycyclic Aromatic Hydrocarbons (PAHs)(cont.)																						
Total HPAH (U=0)	T_HPAH (U=0)	mg/kg	2	None	None	None	None	None	None	None	12	None	None	None	2	100%	0.10	2.5	12	None	None	None
Total LPAH (U=0)	T_LPAH (U=0)	mg/kg	2	None	None	None	None	None	None	None	5.2	None	None	None	2	100%	0.10	2.5	5.2	None	None	None
Total PAH (U=0)	T_PAH (U=0)	mg/kg	2	None	None	None	None	None	None	None	--	--	--	--	2	100%	0.10	2.5	--	--	--	--
Semivolatile Organic Compounds (SVOCs)-Phenols																						
2,3,4,6-Tetrachlorophenol	58-90-2	mg/kg	1	None	None	None	None	None	None	None	2,400	None	None	None	1	100%	0.25	0.25	2,400	None	None	None
2,4,5-Trichlorophenol	95-95-4	mg/kg	2	None	None	None	None	None	None	None	1.1	None	None	None	2	100%	0.10	25	1.1	1	50%	360,000
2,4,6-Trichlorophenol	88-06-2	mg/kg	2	None	None	None	None	None	None	None	0.00019	None	None	None	2	100%	0.10	25	0.00019	2	100%	23
2,4-Dichlorophenol	120-83-2	mg/kg	2	None	None	None	None	None	None	None	0.0043	None	None	None	2	100%	0.10	25	0.0043	2	100%	5,800
2,4-Dimethylphenol	105-67-9	mg/kg	2	None	None	None	None	None	None	None	0.0023	None	None	None	2	100%	0.10	25	0.0023	2	100%	11,000
2,4-Dinitrophenol	51-28-5	mg/kg	2	None	None	None	None	None	None	None	0.0092	None	None	None	2	100%	0.50	75	0.0092	2	100%	8,200
2,6-Dichlorophenol	87-65-0	mg/kg	1	None	None	None	None	None	None	None	--	--	--	--	1	100%	0.10	0.10	--	--	--	--
2-Chlorophenol	95-57-8	mg/kg	2	None	None	None	None	None	None	None	0.011	None	None	None	2	100%	0.10	25	0.011	2	100%	2,200
2-Methylphenol	95-48-7	mg/kg	2	None	None	None	None	None	None	None	0.0064	None	None	None	2	100%	0.10	25	0.0064	2	100%	3,900
2-Nitrophenol	88-75-5	mg/kg	2	None	None	None	None	None	None	None	--	--	--	--	2	100%	0.25	25	--	--	--	--
3- & 4-Methylphenol	15831-10-4	mg/kg	1	None	None	None	None	None	None	None	0.062	None	None	None	1	100%	50	50	0.062	1	100%	810
4,6-Dinitro-o-cresol	534-52-1	mg/kg	2	None	None	None	None	None	None	None	0.0013	None	None	None	2	100%	0.50	75	0.0013	2	100%	58,000
4-Chloro-3-methylphenol	59-50-7	mg/kg	2	None	None	None	None	None	None	None	0.028	None	None	None	2	100%	0.10	25	0.028	2	100%	890
4-Methylphenol	106-44-5	mg/kg	1	None	None	None	None	None	None	None	0.062	None	None	None	1	100%	0.10	0.10	0.062	1	100%	1.6
4-Nitrophenol	100-02-7	mg/kg	2	None	None	None	None	None	None	None	7.0	None	None	None	2	100%	0.50	75	7.0	1	50%	11
Pentachlorophenol	87-86-5	mg/kg	2	None	None	None	None	None	None	None	0.0000018	None	None	None	2	100%	0.50	25	0.0000018	2	100%	14,000,000
Phenol	108-95-2	mg/kg	2	None	None	None	None	None	None	None	0.048	None	None	None	2	100%	0.10	25	0.048	2	100%	520
Semivolatile Organic Compounds (SVOCs)-Phthalates																						
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	2	1	50%	0.83	0.83	SB-08	12/4/2003	3-4	0.0051	1	50%	160	1	50%	40	40	0.0051	1	50%	7,800
Butyl benzyl phthalate	85-68-7	mg/kg	2	None	None	None	None	None	None	None	0.00018	None	None	None	2	100%	0.10	25	0.00018	2	100%	140,000
Di-n-butyl phthalate	84-74-2	mg/kg	2	None	None	None	None	None	None	None	0.015	None	None	None	2	100%	0.13	25	0.015	2	100%	1,700
Di-n-octyl phthalate	117-84-0	mg/kg	2	None	None	None	None	None	None	None	0.33	None	None	None	2	100%	0.10	25	0.33	1	50%	76
Diethylphthalate	84-66-2	mg/kg	2	None	None	None	None	None	None	None	0.034	None	None	None	2	100%	0.10	25	0.034	2	100%	730
Dimethyl phthalate	131-11-3	mg/kg	2	None	None	None	None	None	None	None	0.019	None	None	None	2	100%	0.10	25	0.019	2	100%	1,300
Semivolatile Organic Compounds (SVOCs)-Other																						
2-Chloronaphthalene	91-58-7	mg/kg	2	None	None	None	None	None	None	None	0.28	None	None	None	2	100%	0.10	2.5	0.28	1	50%	9.0
Aniline	62-53-3	mg/kg	1	None	None	None	None	None	None	None	0.0055	None	None	None	1	100%	0.10	0.10	0.0055	1	100%	18
Azobenzene	103-33-3	mg/kg	1	None	None	None	None	None	None	None	9.1	None	None	None	1	100%	0.10	0.10	9.1	None	None	None
Benzoic acid	65-85-0	mg/kg	2	None	None	None	None	None	None	None	0.17	None	None	None	2	100%	1.0	120	0.17	2	100%	710
Benzyl alcohol	100-51-6	mg/kg	2	None	None	None	None	None	None	None	0.017	None	None	None	2	100%	0.10	25	0.017	2	100%	1,400
Bis(2-chloroethoxy)methane	111-91-1	mg/kg	2	None	None	None	None	None	None	None	0.014	None	None	None	2	100%	0.10	2.5	0.014	2	100%	170
Carbazole	86-74-8	mg/kg	2	None	None	None	None	None	None	None	--	--	--	--	2	100%	0.10	25	--	--	--	--
Dibenzofuran	132-64-9	mg/kg	2	None	None	None	None	None	None	None	0.029	None	None	None	2	100%	0.10	2.5	0.029	2	100%	86
Hexachlorobutadiene	87-68-3	mg/kg	8	None	None	None	None	None	None	None	0.000011	None	None	None	8	100%	0.10	2.5	0.000011	8	100%	220,000
Isophorone	78-59-1	mg/kg	2	None	None	None	None	None	None	None	0.032	None	None	None	2	100%	0.10	2.5	0.032	2	100%	77
N-Nitrosodimethylamine	62-75-9	mg/kg	1	None	None	None	None	None	None	None	0.000000071	None	None	None	1	100%	0.10	0.10	0.000000071	1	100%	1,400,000
N-Nitroso-di-n-propylamine	621-64-7	mg/kg	2	None	None	None	None	None	None	None	0.0000070	None	None	None	2	100%	0.10	2.5	0.0000070	2	100%	360,000
N-Nitrosodiphenylamine	86-30-6	mg/kg	2	None	None	None	None	None	None	None	0.0016	None	None	None	2	100%	0.10	2.5	0.0016	2	100%	1,500
VOCs-BTEX																						
Benzene	71-43-2	mg/kg	19	None	None	None	None	None	None	None	0.00056	None	None	None	19	100%	0.020	0.20	0.00056	19	100%	360
Ethylbenzene	100-41-4	mg/kg	19	8	42%	0.10	2.2	A1A-T2-B1	7/18/2018	9	0.010	8	42%	210	11	58%	0.020	0.050	0.010	11	58%	4.9
Toluene	108-88-3	mg/kg	19	1	5.3%	0.069	0.069	P5	4/21/2015	2	0.044	1	5%	1.6	18	95%	0.020	0.20	0.044	10	53%	4.6
Xylene (meta & para)	108-38-3/106-42-3	mg/kg	6	1	17%	0.68	0.68	P13	4/21/2015	0	--	--	--	--	5	83%	0.10	0.10	--	--	--	--
Xylene (ortho)	95-47-6	mg/kg	6	2	33%	0.098	0.23	P13	4/21/2015	0	--	--	--	--	4	67%	0.050	0.050	--	--	--	--
Xylene (total)	1330-20-7	mg/kg	19	8	42%	0.098	1.4	A1A-T2-B1	7/18/2018	9	0.055	8	42%	25	11	58%	0.060	0.30	0.055	11	58%	5.4
VOCs-cVOCs																						
Chloroethane	75-00-3	mg/kg	6	None	None	None	None	None	None	None	--	--	--	--	6	100%	0.50	0.50	--	--	--	--
cis-1,2-Dichloroethene	156-59-2	mg/kg	6	1	17%	1.6	1.6	P6	4/21/2015	0	0.0052	1	17%	310	5	83%	0.050	0.050	0.0052	5	83%	9.6
Tetrachloroethene	127-18-4	mg/kg	7	1	14%	0.15	0.15	P6	4/21/2015	0	0.0016	1	14%	94	6	86%	0.025	0.025	0.0016	6	86%	16
trans-1,2-Dichloroethene	156-60-5	mg/kg	6	None	None	None	None	None	None	None	0.032	None	None	None	6	100%	0.050	0.050	0.032	6	100%	1.5
Trichloroethene	79-01-6	mg/kg	7	1	14%	0.044	0.044	P6	4/21/2015	0	0.00027	1	14%	170	6	86%	0.020	0.020	0.00027	6	86%	75
Vinyl chloride	75-01-4	mg/kg	6	1	17%	0.072	0.072	P6	4/21/2015	0	0.000056	1	17%	1,300	5	83%	0.050	0.050	0.000056	5	83%	900

Table 5.7
Summary Statistics for Excavated Soil

				Information About Detects							Information About Detected Exceedances				Information About Non-detects				Information About Non-detect Exceedances			
Analytes	CAS No.	Unit	Number of Results	Number of Detects	Percent of Detects	Minimum Detected Value	Maximum Detected Value	Location Of Maximum Detect	Date of Maximum Detect	Depth of Maximum Detect (ft bgs)	Preliminary Screening Level	Number of Detects Exceeding Criteria	Percent of Detects Exceeding Criteria	Exceedance Factor (1)	Number of Non-detects	Percent of Non-detects	Minimum Non-detect Value (2)	Maximum Non-detect Value (2)	Preliminary Screening Level	Number of Non-detects Exceeding Criteria	Percent of Non-detects Exceeding Criteria	Exceedance Factor (1)
Volatile Organic Compounds (VOCs)-Other																						
1,1,1,2-Tetrachloroethane	630-20-6	mg/kg	6	None	None	None	None	None	None	None	0.00063	None	None	None	6	100%	0.050	0.050	0.00063	6	100%	80
1,1,1-Trichloroethane	71-55-6	mg/kg	6	None	None	None	None	None	None	None	0.084	None	None	None	6	100%	0.050	0.050	0.084	None	None	None
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg	6	None	None	None	None	None	None	None	0.000080	None	None	None	6	100%	0.050	0.050	0.000080	6	100%	630
1,1,2-Trichloroethane	79-00-5	mg/kg	6	None	None	None	None	None	None	None	0.00033	None	None	None	6	100%	0.050	0.050	0.00033	6	100%	150
1,1-Dichloroethane	75-34-3	mg/kg	6	None	None	None	None	None	None	None	0.0026	None	None	None	6	100%	0.050	0.050	0.0026	6	100%	19
1,1-Dichloroethene	75-35-4	mg/kg	6	1	14%	0.081	0.081	P13	4/24/2015	-	0.0025	1	17%	33	5	83%	0.050	0.050	0.0025	5	83%	20
1,1-Dichloropropene	563-58-6	mg/kg	6	None	None	None	None	None	None	None	--	--	--	--	6	100%	0.050	0.050	--	--	--	--
1,2,3-Trichlorobenzene	87-61-6	mg/kg	6	None	None	None	None	None	None	None	0.011	None	None	None	6	100%	0.25	0.25	0.011	6	100%	23
1,2,3-Trichloropropane	96-18-4	mg/kg	6	None	None	None	None	None	None	None	0.00000015	None	None	None	6	100%	0.050	0.050	0.00000015	6	100%	330,000
1,2,4-Trichlorobenzene	120-82-1	mg/kg	8	None	None	None	None	None	None	None	0.000072	None	None	None	8	100%	0.10	2.5	0.000072	8	100%	35,000
1,2,4-Trimethylbenzene	95-63-6	mg/kg	6	2	33%	0.12	2.5	P13	4/21/2015	0	0.072	2	33%	35	4	67%	0.050	0.050	0.072	None	None	None
1,2-Dibromo-3-chloropropane	96-12-8	mg/kg	6	None	None	None	None	None	None	None	0.000056	None	None	None	6	100%	0.50	0.50	0.000056	6	100%	8,900
1,2-Dibromoethane	106-93-4	mg/kg	6	None	None	None	None	None	None	None	0.000018	None	None	None	6	100%	0.050	0.050	0.000018	6	100%	2,800
1,2-Dichlorobenzene	95-50-1	mg/kg	8	None	None	None	None	None	None	None	0.0030	None	None	None	8	100%	2.5	2.5	0.0030	8	100%	840
1,2-Dichloroethane	107-06-2	mg/kg	6	None	None	None	None	None	None	None	0.0016	None	None	None	6	100%	0.050	0.050	0.0016	6	100%	32
1,2-Dichloropropane	78-87-5	mg/kg	6	None	None	None	None	None	None	None	0.0010	None	None	None	6	100%	0.050	0.050	0.0010	6	100%	48
1,3,5-Trimethylbenzene	108-67-8	mg/kg	6	2	33%	0.056	1.3	P13	4/21/2015	0	0.071	1	17%	18	4	67%	0.050	0.050	0.071	None	None	None
1,3-Dichlorobenzene	541-73-1	mg/kg	8	None	None	None	None	None	None	None	0.0013	None	None	None	8	100%	0.050	2.5	0.0013	8	100%	1,900
1,3-Dichloropropane	142-28-9	mg/kg	6	None	None	None	None	None	None	None	0.057	None	None	None	6	100%	0.050	0.050	0.057	None	None	None
1,4-Dichlorobenzene	106-46-7	mg/kg	8	None	None	None	None	None	None	None	0.0081	None	None	None	8	100%	0.050	2.5	0.0081	8	100%	310
2,2-Dichloropropane	594-20-7	mg/kg	6	None	None	None	None	None	None	None	--	--	--	--	6	100%	0.050	0.050	--	--	--	--
2,4-Dinitrotoluene	121-14-2	mg/kg	2	None	None	None	None	None	None	None	0.00016	None	None	None	2	100%	0.25	12	0.00016	2	100%	77,000
2,6-Dinitrotoluene	606-20-2	mg/kg	2	None	None	None	None	None	None	None	0.000051	None	None	None	2	100%	0.25	12	0.000051	2	100%	240,000
2-Chlorotoluene	95-49-8	mg/kg	6	None	None	None	None	None	None	None	0.11	None	None	None	6	100%	0.050	0.050	0.11	None	None	None
2-Hexanone	591-78-6	mg/kg	6	None	None	None	None	None	None	None	0.012	None	None	None	6	100%	0.50	0.50	0.012	6	100%	41
2-Nitroaniline	88-74-4	mg/kg	2	None	None	None	None	None	None	None	0.064	None	None	None	2	100%	0.25	12	0.064	2	100%	190
3,3'-Dichlorobenzidine	91-94-1	mg/kg	1	None	None	None	None	None	None	None	0.0000020	None	None	None	1	100%	0.10	0.10	0.0000020	1	100%	50,000
3-Nitroaniline	99-09-2	mg/kg	2	None	None	None	None	None	None	None	--	--	--	--	2	100%	0.25	250	--	--	--	--
4-Chloroaniline	106-47-8	mg/kg	2	None	None	None	None	None	None	None	0.00017	None	None	None	2	100%	0.10	250	0.00017	2	100%	1,400,000
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg	2	None	None	None	None	None	None	None	--	--	--	--	2	100%	0.10	2.5	--	--	--	--
4-Chlorotoluene	106-43-4	mg/kg	6	None	None	None	None	None	None	None	0.11	None	None	None	6	100%	0.050	0.050	0.11	None	None	None
4-Nitroaniline	100-01-6	mg/kg	2	None	None	None	None	None	None	None	0.0013	None	None	None	2	100%	0.25	250	0.0013	2	100%	200,000
Acetone	67-64-1	mg/kg	6	None	None	None	None	None	None	None	2.1	None	None	None	6	100%	0.50	0.50	2.1	None	None	None
Bis(2-chloroethyl)ether	111-44-4	mg/kg	2	None	None	None	None	None	None	None	0.000014	None	None	None	2	100%	0.10	2.5	0.000014	2	100%	170,000
Bis(2-chloroisopropyl)ether	39638-32-9	mg/kg	2	None	None	None	None	None	None	None	--	--	--	--	2	100%	0.10	2.5	--	--	--	--
Bromobenzene	108-86-1	mg/kg	6	None	None	None	None	None	None	None	0.033	None	None	None	6	100%	0.050	0.050	0.033	6	100%	1.5
Bromodichloromethane	75-27-4	mg/kg	6	None	None	None	None	None	None	None	0.00089	None	None	None	6	100%	0.050	0.050	0.00089	6	100%	56
Bromoform	75-25-2	mg/kg	6	None	None	None	None	None	None	None	0.0050	None	None	None	6	100%	0.050	0.050	0.0050	6	100%	10
Bromomethane	74-83-9	mg/kg	6	None	None	None	None	None	None	None	0.0033	None	None	None	6	100%	0.50	0.50	0.0033	6	100%	150
Carbon tetrachloride	56-23-5	mg/kg	6	None	None	None	None	None	None	None	0.00015	None	None	None	6	100%	0.050	0.050	0.00015	6	100%	330
Chlorobenzene	108-90-7	mg/kg	6	None	None	None	None	None	None	None	0.051	None	None	None	6	100%	0.050	0.050	0.051	None	None	None
Chloroform	67-66-3	mg/kg	6	None	None	None	None	None	None	None	0.0048	None	None	None	6	100%	0.050	0.050	0.0048	6	100%	10
Chloromethane	74-87-3	mg/kg	6	None	None	None	None	None	None	None	--	--	--	--	6	100%	0.50	0.50	--	--	--	--
cis-1,3-Dichloropropene	10061-01-5	mg/kg	6	None	None	None	None	None	None	None	0.00014	None	None	None	6	100%	0.050	0.050	0.00014	6	100%	360
Cymene	99-87-6	mg/kg	6	1	17%	0.37	0.37	P13	4/21/2015	0	--	--	--	--	5	83%	0.050	0.050	--	--	--	--
Dibromochloromethane	124-48-1	mg/kg	6	None	None	None	None	None	None	None	0.00070	None	None	None	6	100%	0.050	0.050	0.00070	6	100%	71
Dibromomethane	74-95-3	mg/kg	6	None	None	None	None	None	None	None	0.028	None	None	None	6	100%	0.050	0.050	0.028	6	100%	1.8
Dichlorodifluoromethane	75-71-8	mg/kg	6	None	None	None	None	None	None	None	0.53	None	None	None	6	100%	0.50	0.50	0.53	None	None	None
Hexachloroethane	67-72-1	mg/kg	2	None	None	None	None	None	None	None	0.0000097	None	None	None	2	100%	0.10	2.5	0.0000097	2	100%	260,000
Isopropylbenzene	98-82-8	mg/kg	6	1	17%	0.25	0.25	P13	4/21/2015	0	0.79	None	None	None	5	83%	0.050	0.050	0.79	None	None	None
Methyl ethyl ketone	78-93-3	mg/kg	6	None	None	None	None	None	None	None	1.4	None	None	None	6	100%	0.50	0.50	1.4	None	None	None
Methyl isobutyl ketone	108-10-1	mg/kg	6	None	None	None	None	None	None	None	0.19	None	None	None	6	100%	0.50	0.50	0.19	6	100%	2.6
Methylene chloride	75-09-2	mg/kg	6	None	None	None	None	None	None	None	0.0015	None	None	None	6	100%	0.50	0.50	0.0015	6	100%	340
Methyl-tert-butyl ether	1634-04-4	mg/kg	6	None	None	None	None	None	None	None	0.0072	None	None	None	6	100%	0.050	0.050	0.0072	6	100%	6.9
n-Hexane	110-54-3	mg/kg	1	None	None	None	None	None	None	None	1.8	None	None	None	1	100%	0.25	0.25	1.8	None	None	None
Nitrobenzene	98-95-3	mg/kg	2	None	None	None	None	None	None	None	0.0065	None	None	None	2	100%	0.10	2.5	0.0065	2	100%	390
n-Propylbenzene	103-65-1	mg/kg	6	1	17%	0.55	0.55	P13	4/21/2015	0	0.88	None	None	None	5	83%	0.050	0.050	0.88	None	None	None

Table 5.7
Summary Statistics for Excavated Soil

				Information About Detects							Information About Detected Exceedances				Information About Non-detects				Information About Non-detect Exceedances			
Analytes	CAS No.	Unit	Number of Results	Number of Detects	Percent of Detects	Minimum Detected Value	Maximum Detected Value	Location Of Maximum Detect	Date of Maximum Detect	Depth of Maximum Detect (ft bgs)	Preliminary Screening Level	Number of Detects Exceeding Criteria	Percent of Detects Exceeding Criteria	Exceedance Factor (1)	Number of Non-detects	Percent of Non-detects	Minimum Non-detect Value (2)	Maximum Non-detect Value (2)	Preliminary Screening Level	Number of Non-detects Exceeding Criteria	Percent of Non-detects Exceeding Criteria	Exceedance Factor (1)
Volatile Organic Compounds (VOCs)-Other (cont.)																						
Pyridine	110-86-1	mg/kg	1	None	None	None	None	None	None	None	0.0029	None	None	None	1	100%	0.10	0.10	0.0029	1	100%	35
sec-Butylbenzene	135-98-8	mg/kg	6	1	17%	0.35	0.35	P13	4/21/2015	0	1.3	None	None	None	5	83%	0.050	0.050	1.3	None	None	None
Styrene	100-42-5	mg/kg	6	None	None	None	None	None	None	None	0.12	None	None	None	6	100%	0.050	0.050	0.12	None	None	None
tert-Butylbenzene	98-06-6	mg/kg	6	None	None	None	None	None	None	None	1.0	None	None	None	6	100%	0.050	0.050	1.0	None	None	None
trans-1,3-Dichloropropene	10061-02-6	mg/kg	6	None	None	None	None	None	None	None	0.00014	None	None	None	6	100%	0.050	0.050	0.00014	6	100%	360
Trichlorofluoromethane	75-69-4	mg/kg	6	1	17%	0.99	0.99	P13	4/24/2015	--	0.79	1	17%	1.2	5	83%	0.50	0.50	0.79	None	None	None

Notes:

-- Criterion not established

1 Exceedance factor rounded to two significant figures.

2 For analytes where all results were detected, reporting limit information is provided when available.

Abbreviations:

bgs Below ground surface
BTEX Benzene, toluene, ethylbenzene and xylene
CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbon
DRO Diesel-range organics
ft Feet
HPAH High molecular weight polycyclic aromatic hydrocarbon
LPAH Low molecular weight polycyclic aromatic hydrocarbon
mg/kg Milligrams per kilogram
ORO Oil-range organics
TEQ Toxic equivalent

Table 5.8
Historical Operational Contaminants of Interest

Historical Operations (Time Period in Chronological Order)	Historical Operations Details	Potential Contaminants of Interest
Single-family residences (prior to 1930s – approx. 1969)	• Heating oil tanks • 7808 warehouse, the 7814 office (formerly listed as 802 South Kenyon Street) and a residence formerly located on the southeast corner of 8th Avenue South and South Kenyon Street were each heated by oil-burning furnaces (Phase I, RGI 2002) • 1951 aerial shows the Study Area is mostly residential. • 1969 aerial shows the Study Area remains mostly residential • 1993 aerial shows the Study Area is fully industrial/commercial and residences are no longer present.	***Petroleum Releases:*** Storage and handling of heating oil can indicate potential releases associated with multiple COCs. Heating oil is typically associated with heavy oil- or diesel-range organics (ORO or DRO). The following COCs have been commonly associated with heating oil. • **DRO and ORO** • **Polycyclic aromatic hydrocarbons (PAHs; including naphthalenes)**
Shoreline filling and other filling	• refer to Existing Information report Section 3.2 regarding additional photographic documentation of shoreline fill events • 1936 aerial shows a gas station structure appears on the northern corner. An area of apparent fill soil characterized by light-colored bare soil, presumably dredge fill derived from the adjacent LDW, is visible at the northern end of the shoreline. • 1951 aerial shows additional fill (presumed to be dredged material) extends into the LDW at the northern end of the Study Area • 1969 aerial shows shadows along the LDW bank indicate that the bank is artificially steepened and may have structural reinforcement • In 2002 aerial shows a wheelhouse has been added next to the dock.	***Fill Material and Dock Piling:*** Potential shoreline filling and fill material sourced from uplands could contain multiple COCs depending on the origin of fill material. In addition to fill material, dock pilings historically could have been treated with creosote or pentachlorophenol. The following COCs could be present based on the association of filling events and historical dock piling. • **LWD COCs -**Potential shoreline filling using dredged sediments from LDW, associated LDW COCs**.** • **Metals, TPH, Polychlorinated Biphenyls (PCBs), and PAHs** -Fill material originating from upland source could contain ubiquitous urban contaminants. • **Creosote, and Pentachlorophenol -** dock pilings historically have been known to be treated with creosote or pentachlorophenol.
Gasoline service station/battery shop and auto repair shop (1929 – 1961)	• The earliest known commercial/industrial use in the Study Area is a gasoline service station, which operated in the northern corner of the Study Area from 1929 until approximately 1961.	***Petroleum Releases:*** Bulk storage containment and holding of petroleum can indicate potential releases associated with multiple COCs. Lead was a common gasoline additive prior to 1975. As such, lead is a common COC associated with historical petroleum releases. Additionally, heavy oils and waste oils may be associated with auto repair operations. The following COCs have been commonly associated with gasoline stations and auto repair shops: • **GRO** • **DRO and ORO** • **Benzene, toluene, ethylbenzene, and xylenes (BTEX)** • **PAHs (including naphthalenes)** • **Lead** • **PCBs,** • **Chlorinated Volatile Organic Compounds (CVOCs)** Battery storage may additionally be associated with lead-acid batteries and artificially low pH conditions.

Table 5.8
Historical Operational Contaminants of Interest

Historical Operations (Time Period in Chronological Order)	Historical Operations Details	Potential Contaminants of Interest
Boat building/repair operations (various) (early 1980s – mid-2000s)	• Workboats Northwest operations included construction and painting of aluminum-hulled watercraft • Several pad-mounted transformers and pole-mounted transformers in the ROW south of the Property line are assumed to have been conducted during the course of Workboats Northwest operations. • Workboats Northwest may have included fueling and fuel storage utilizing underground storage tanks (USTs) and aboveground storage tanks (ASTs) • Yacht builder North Wind Marine, which performed boat building and painting in the Southern Portion of the Study Area • Rasmussen Wire Rope & Rigging, which manufactured synthetic harnesses.	***Boat Building/Repair:*** Boat building and repair activities have been known to generate various COCs. These activities include paint removal, sandblasting, engine maintenance, bilge water discharge, metal work, and electrical repair. The following COCs are known to be associated with the activities mentioned above: • **Metals** – Cadmium, Chromium, Copper, Zinc, Lead, Mercury • **Tributyltin** – associated with antifouling paints used in the 1970s and 1980s. • **PCBs and lead** – associated with marine paints • **TPH (GRO, DRO, ORO) and BTEX** – associated with fueling and engine maintenance activities. • **PAHs** – associated with creosote-treated lumber
Timber and milled lumber sales by Silver Bay Logging (1996 – 2015)	• Silver Bay Logging operations included transfer of processed logs and milled lumber and included over-water loading/unloading and moorage in the wharf area. • Fueling and fuel storage activities in the Study Area continued during Silver Bay Logging's operations. • Minor fuel, degreaser, paint, and battery storage in shed area in the western portion of the Study Area during Silver Bay Logging's tenure • A drum and lumber storage yard in the southeastern portion of the Study Area	***Timber and Milled Lumber Handling:*** Handling of timber and milled lumber can result in releases of a few COCs to the environment. The following COCs are known to be associated with timber and lumber handling operations. • **Chromated arsenicals** – Arsenic, chromium, and copper are associated with chromated arsenicals that were used as wood preservatives from the 1970s to early 2000s. • **Creosote (PAHs)** – associated with wood preservatives that have been used since the 1948. • **Pentachlorophenol** – associated with pesticides that were commonly used until 1987. • **Lead** – associated with batteries. • **Mercury** – used in various equipment. • **CVOCs** – associated with degreaser activities. • **TPH and BTEX** – associated with fueling and fuel storage activities.
Slug bait packaging by Corry's Slug Bait (approx. 1960 – 1999)	• Corry's Slug Bait, conducted packing and warehouse operations on the parcel south of the S Chicago Street	***Slug Bait Packaging:*** Slug bait packaging is not expected to generate significant releases of MTCA regulated materials. For completeness the active ingredients associated with slug bait are listed below. • **Metaldehyde** - active ingredient in Corry's slug bait. • **Carbaryl** - active ingredient in Corry's slug bait. • **Acetaldehyde**- active ingredient in Corry's slug bait.
Metals recycling by Independent Metals (2006 – 2014)	• Independent Metals was a scrap and recycled metal sorting and handling facility. • Operations included scrap metal loading in a ramp area in the central portion of the Study Area, loading/offloading and moorage in the wharf area, and scrap metal shredding in a warehouse building in the southern portion of the Study Area. • Independent Metals also stored scrap metal in stockpiles, and both fuel and waste oil in ASTs; in various locations within the Study Area	***Metal Recycling:*** Metal recycling is known to generate COCs and can be linked to releases to the environment. Typical metal recycling activities such as shredding and scrapping could be associated with the following COCs. • **Metals** – Heavy metals associated with various metals scrapping and shredding activities. • **PCBs** – associated with shredder residue and evidenced through effluent data. • **CVOCs** – associated with degreaser and cleaners commonly used in the metal manufacturing industry.
Gypsum recycling (currently operating)	• American Gypsum Recycling-2, LLC (American Gypsum), performs recycling of gypsum wallboard • American Gypsum currently maintains two large stockpiles of gypsum and paper waste on paved portions	***Gypsum Recycling:*** Recycling of new unused/damaged gypsum wallboard is not anticipated to generate or release significant contaminants to the environment. However, gypsum dust has the potential to cause unacceptable air quality.
Construction Office (currently operating)	• The southeast portion of the Study Area (East Yard) is leased to Head Construction Co.	Construction Office operations are not expected to generate or release any potential contaminants to the environment. • Office space, no specific potential contaminants

Table 6.1
Data Quality Objectives

DQO No.	Step 1: State the Problem	Step 2: Identify the Goals of the Study	Step 3: Identify Information Inputs	Step 4: Define the Boundaries of the Study	Step 5: Develop the Analytical Approach	Step 6: Specify the Performance or Acceptance Criteria	Step 7: Develop the Plan for Obtaining Data
EXISTING DATASET							
1	**METALS IN GROUNDWATER:** Additional data are needed to determine the source, magnitude, and extent of elevated metals in groundwater, and evaluate geochemical conditions.	Establish a groundwater monitoring well network to define the extent of metals impacts in groundwater exceeding PSLs, and determine whether elevated metals are associated with historical operational areas or sources, sufficient to develop and evaluate Feasibility Study remedial alternatives.	Existing monitoring well metals data show that arsenic exceeded the PSL in the vicinity of the former gas station (MW-04), the storage shed (MW-03) and downgradient of A5A (MW-02, MW-09). Lead was also historically detected at MW-04. Groundwater samples will be collected from additional monitoring wells in the areas surrounding metals impacts.	Well locations with previous PSL exceedances for metals are shown on Figures 6.1 and 6.2.	Groundwater samples will be analyzed for metals which are designated as COIs: arsenic, cadmium, chromium, copper, lead, mercury, silver, and zinc. Groundwater field parameters (ORP, DO, pH, etc.) will be collected to evaluate geochemical conditions.	Field sample acceptance criteria and laboratory result acceptance criteria are described in the SAP/QAPP (Appendix C).	Extent of metals along the eastern shoreline will be assessed through existing monitoring wells MW-05, -07, and -11 and new wells MW-01R, -20, and -21. Extent of metals near former gas station operations will be additionally assessed at new well MW-13. Historical groundwater exceedances of PSLs will be confirmed by sampling MW-03R, -08, -09, and -10. New wells will be installed with screened intervals spanning the expected water table depth across all seasonal and tidal conditions. Sampling protocols and anticipated well screen depths are presented in the SAP/QAPP (Appendix C).
2	**TPH IN GROUNDWATER:** Additional data are needed to characterize the magnitude and extent of elevated GRO, DRO+ORO, and BTEX compounds in groundwater related to known petroleum releases.	Establish a groundwater monitoring well network to define the extent of petroleum impacts in groundwater exceeding PSLs, sufficient to develop and evaluate Feasibility Study remedial alternatives.	Existing monitoring well data for TPH and BTEX show elevated total DRO+ORO concentrations in the vicinity for the former gas station (MW-04 and MW-11), within and downgradient of the storage shed/hydraulic oil storage area used by Silver Bay Logging (MW-03/03R and MW-10), near interim action excavation area A5A (MW-08), and along the shoreline south of the filled bank are (MW-01). Groundwater samples will be collected from additional monitoring wells in the areas surrounding petroleum impacts.	Well locations with previous PSL exceedances for total DRO+ORO are shown on Figure 6.3.	Groundwater samples will be analyzed for GRO, DRO, ORO and BTEX compounds. Samples collected from the vicinity of suspected waste oil storage will additionally be analyzed for PCBs and PAHs consistent with MTCA Table 830-1.	Field sample acceptance criteria and laboratory result acceptance criteria are described in the SAP/QAPP (Appendix C).	Existing monitoring wells MW-03R, -08, -09, -11, and -12 and new monitoring wells W-01R, -13, -14, -20, and -21 will be used to assess petroleum concentrations and bounding the extent. Existing wells MW-08, -09, and -12 and new well MW-20 in and downgradient of the hydraulic oil storage area will additionally be analyzed for PCBs and PAHs. New wells will be installed with screened intervals spanning the expected water table depth across all seasonal and tidal conditions. Sampling protocols and anticipated well screen depths are presented in the SAP/QAPP (Appendix C).

Table 6.1
Data Quality Objectives

DQO No.	Step 1: State the Problem	Step 2: Identify the Goals of the Study	Step 3: Identify Information Inputs	Step 4: Define the Boundaries of the Study	Step 5: Develop the Analytical Approach	Step 6: Specify the Performance or Acceptance Criteria	Step 7: Develop the Plan for Obtaining Data
3	**CVOCS IN GROUNDWATER:** Additional data are needed to determine the source, magnitude and extent of elevated CVOCs in groundwater. PCE sources such as recorded spills or highly contaminated soil have not been discovered at the Site, and elevated PCE has been detected off-Property in the upgradient direction, suggesting a potential off-Site source.	Establish a groundwater monitoring well network to define the extent of CVOCs impacts in groundwater exceeding PSLs, and determine whether elevated CVOCs are associated with historical operational areas or sources, sufficient to develop and evaluate Feasibility Study remedial alternatives.	Existing monitoring well CVOC data show that PCE exceeded the PSL in the southeastern corner (East Yard) of the Site (MW-05, MW-07) and off-property in the upgradient direction (MW-06). Vinyl chloride additionally historically exceeded PSLs in the East Yard (MW-03R, MW-10, and MW-09) and vinyl chloride detection limits were greater than the PSL for all samples in the existing dataset. Groundwater samples will be collected from additional monitoring wells in the areas surrounding CVOC impacts and in the upgradient directions from CVOC impacts.	Well locations with previous PSL exceedances for CVOCs are shown on Figures 6.4 and 6.5.	Samples will be analyzed for CVOCs: PCE, TCE, cis- and trans-1,2-DCE and vinyl chloride.	Field sample acceptance criteria and laboratory result acceptance criteria are described in the SAP/QAPP (Appendix C).	CVOCs will be monitored with MW-05 and MW-07, which had historical groundwater PSL exceedances of PCE. New monitoring wells MW-17, -18, -19, and -20 will be used to laterally bound PCE and other CVOC impacts. A new deeper well (MW-05D) will be installed adjacent to MW-05 and sampled to determine the potential for vertical migration of CVOCs. Soil from the capillary fringe and water table intervals, and any soil intervals with elevated PID readings, will additionally be analyzed for CVOCs from the new upgradient well borings FS-34/MW-17 and FS-35/MW-18 to further investigate potential upgradient soil sources of PCE. CVOCs will be analyzed in soil from deep well boring FS-33/MW-05D to confirm previous investigation findings in which PCE was not identified in soil in the southeast Site corner. All remaining Site wells will be analyzed for CVOCs to determine the extent and identify potential sources of historical VC exceedances and assess groundwater quality relative to CVOCs at the shoreline. Exiting monitoring wells in the upgradient direction in the ROW may be used to evaluate area wide VC conditions, if accessible. New wells will be installed with screened intervals spanning the expected water table depth across all seasonal and tidal conditions except as noted above. Sampling protocols and detailed information regarding anticipated exploration depths are presented in the SAP/QAPP (Appendix C).

Table 6.1
Data Quality Objectives

DQO No.	Step 1: State the Problem	Step 2: Identify the Goals of the Study	Step 3: Identify Information Inputs	Step 4: Define the Boundaries of the Study	Step 5: Develop the Analytical Approach	Step 6: Specify the Performance or Acceptance Criteria	Step 7: Develop the Plan for Obtaining Data
4	**REMEDIAL ACTION AREA SOIL:** Additional data are needed to determine the extent of TPH, and metals left in place following IA excavations	Collect subsurface soil data to delineate the vertical and horizontal extents of TPH and metals exceeding PSLs, sufficient to develop and evaluate Feasibility Study remedial alternatives at the following locations: • south of excavation area A3B footprint • west of excavation area A5A footprint	Existing excavation confirmation sidewall samples (Section 3.2) have been used to identify additional boring locations to delineate the limits of soil exceeding PSLs adjacent to interim action excavation footprints. Additional soil samples will be collected from these borings to characterize TPH and metals adjacent to excavation sidewalls.	Areas of known soil contamination following interim action excavations are shown on Figure 6.6 through 6.8.	To determine the extent of remedial excavations soil samples surrounding A3B will focus on metals (arsenic, cadmium, chromium, copper, lead, mercury, silver, zinc) and soil samples surrounding A5A will focus on total DRO+ORO. Additionally, the two samples with the highest metals for this DQO, will be analyzed for non-volatile COIs including PCBs, PAHs, PCP, and dioxins/furans. Also, any soil with elevated PID screening greater than 10 times background will be analyzed for volatile COIs (VOCs and GRO). Adjacent step-out and step-down samples will be analyzed until the limits of contaminants exceeding PSLs have been determined. Laboratory analyses are described in the SAP/QAPP (Appendix C).	Field sample acceptance criteria and laboratory result acceptance criteria are described in the SAP/QAPP (Appendix C).	Samples will be collected from boring FS-28 located adjacent to the building south of A3B and west of A5A. Soil samples will be immediately analyzed from the approximate 2 to 2.5 feet bgs interval and 7 to 9 feet bgs interval. A contingent step-out boring (FS-29C) will be advanced. Step-out and step-down samples will be archived for step-down analyses, if needed. The proposed sampling plan is described in Section 6.2.1 and the SAP/QAPP (Appendix C). Existing well MW-09 downgradient of the previous excavation will be monitored for TPH. Sampling protocols and detailed information regarding anticipated exploration depths are presented in the SAP/QAPP (Appendix C).

Table 6.1
Data Quality Objectives

DQO No.	Step 1: State the Problem	Step 2: Identify the Goals of the Study	Step 3: Identify Information Inputs	Step 4: Define the Boundaries of the Study	Step 5: Develop the Analytical Approach	Step 6: Specify the Performance or Acceptance Criteria	Step 7: Develop the Plan for Obtaining Data
5	**BANK FILL SOIL:** Additional data are needed to identify the potential composition and extents of stained bank fill soil with elevated metals concentrations in the northern Site corner in the vicinity of the former gasoline/auto repair and battery shop. This DQO is related to DQO #14. <u>The riverbank adjacent to the Site is an armored slope that is within the intertidal sediment zone of the LDW.</u>	Collect subsurface soil data to delineate the vertical and horizontal extents of stained fill soil with associated metals exceeding PSLs, sufficient to develop and evaluate Feasibility Study remedial alternatives. Collect additional geochemical data and field observations to determine potential composition and sources of stained fill. Determine whether the metals-contaminated fill unit contains other COIs, including LDW COCs, at concentrations exceeding PSLs. Visually evaluate/ document bank erosion.	Existing samples WH-RBank, A1As-N5-2.5, A1A-E5-2, and A1A-S7-2.5 define the area with documented metals concentrations exceeding PSLs in the riverbank and adjacent to interim action excavation A1A; the next closest sample locations to the south are MW-03R and MW-10 where stained soil and significantly elevated metals concentrations were not encountered. Aerial photographs from 1959, 1961, and 1969 show fill placement along the riverbank, including in the vicinity of the WH-RBank sample. Additional soil samples will be collected from soil borings within and surrounding the approximate fill area to delineate metals impacts.	Areas of known stained fill soil/significantly elevated metals are shown on Figures 6.6 and 6.7. Fill area boundaries are shown in historical photographs (Appendix A).	Soil samples will be analyzed for metals (arsenic, cadmium, chromium, copper, lead, mercury, zinc) and pH. Additionally, the five samples with the highest metals for this DQO, will be analyzed for TPH-D, PCBs, dioxins/furans and SVOCs. Also, any soil with elevated PID screening greater than 10 times background will be analyzed for volatile COIs (TPH-G and VOCs). If any additional COIs are detected exceeding PSLs, the “clean” samples delineating the lateral and vertical extent of metals contamination will additionally be analyzed for the other COIs that exceeded PSLs to fully delineate the unit of contaminated shoreline fill. Field observations of debris will be noted. Adjacent step-out and step-down samples will be analyzed until the limits of contaminants exceeding PSLs have been determined. Laboratory analyses are described in the SAP/QAPP (Appendix C).	Field sample acceptance criteria and laboratory result acceptance criteria are described in the SAP/QAPP (Appendix C).	Bank fill soils will be visually surveyed, and field screened with X-ray fluorescence (XRF) to determine the extent of the riverbank fill unit containing elevated metals. Soil samples will be collected from borings advanced along the riverbank (FS-01, -02, -03, -26, and -27) as shown on Figure 6.10 to determine the lateral and vertical extents of metals-contaminated bank fill. The final locations will be adjusted in the field based on the results of XRF study to encompass the likely lateral extents of contaminated fill. Lateral step-out borings will be advanced to the west to delineate the landward extent of the shoreline fill area (FS-05, -06, -07, -10, and -11) as shown on Figure 6.10. Soil samples will be immediately analyzed from the approximate 2-3, 3-4 and 4-5 feet bgs intervals equivalent to the depth where stained fill was previously observed in the riverbank and any other intervals where staining is observed. Underlying samples will be archived for step-down analyses, if needed. Sampling protocols and detailed information regarding anticipated exploration depths are presented in the SAP/QAPP (Appendix C).

Table 6.1
Data Quality Objectives

DQO No.	Step 1: State the Problem	Step 2: Identify the Goals of the Study	Step 3: Identify Information Inputs	Step 4: Define the Boundaries of the Study	Step 5: Develop the Analytical Approach	Step 6: Specify the Performance or Acceptance Criteria	Step 7: Develop the Plan for Obtaining Data
HISTORICAL OPERATIONS							
6	**FILL SOIL:** Additional data are needed to characterize the COIs associated with soils placed during historical filling events throughout the Site uplands.	Collect soil data to determine whether fill contains COIs at concentrations that exceed PSLs, and if so the approximate areas of fill soil exceedances, in order to develop and evaluate Feasibility Study remedial alternatives.	Some existing soil boring logs collected prior to Independent Metals operations or outside of areas where interim action excavations were conducted due to impacts from Independent Metals operations indicate the presence of imported fill: HA-01, SB-04, SB-08, SB-13, P1, P4, P12, MW-03R, MW-10, WH-RBank. Laboratory analytical data (for metals, PCBs, VOCs, SVOCs, and/or TPH) are available for fill at these locations except for P4. Elevated metals, TPH and PCB concentrations were detected periodically in fill soil. SVOCs and VOCs were not detected in fill, however the laboratory reporting limits were not sufficiently low for many analytes. Additional representative fill soil samples will be collected to more thoroughly chemically characterize these soils.	The Site and boring locations where fill was observed are shown on Figure 3.1.	Samples will be analyzed for chemicals that were previously detected at elevated concentrations in fill or are likely to be present in fill derived from urban/industrial areas, inclusive of COIs that may be present in dredge fill derived from LDW sediments: • Metals • TPH-G and -D • PCBs • SVOCs • Dioxins/furans • VOCs Also, any soil with elevated PID screening greater than 10 times background will be analyzed for volatile COIs (TPH-G and VOCs).	Field sample acceptance criteria and laboratory result acceptance criteria are described in the SAP/QAPP (Appendix C).	Riverbank fill soils are addressed in DQO-5. Additional borings to characterize fill soil (FS-04, -05, -11, -12, -14, -15, -16, -18, -20, -21, -22, -23, -28, -32, and -33) will be distributed across the Site including along the LDW shoreline to provide representative data about general fill quality. All fill samples will be immediately analyzed (note some already analyzed for DQO-5). Native samples will be archived unless field indications of contamination are observed. Sampling protocols and detailed information regarding anticipated exploration depths are presented in the SAP/QAPP (Appendix C).

Table 6.1
Data Quality Objectives

DQO No.	Step 1: State the Problem	Step 2: Identify the Goals of the Study	Step 3: Identify Information Inputs	Step 4: Define the Boundaries of the Study	Step 5: Develop the Analytical Approach	Step 6: Specify the Performance or Acceptance Criteria	Step 7: Develop the Plan for Obtaining Data
7	**BOAT BUILDING:** Additional data are needed to determine whether historical boat building operations at the Property resulted in releases of contaminants at the Site.	Collect soil and groundwater data for COIs associated with historical boat building operations to determine whether the COIs are present at concentrations that exceed PSLs. If a potential historical release is identified, determine the nature and extent of the resulting contamination sufficient to develop and evaluate Feasibility Study remedial alternatives.	The nature of historical boat building operations and operational areas have been determined from property ownership records, aerial photographs, and records from site visits and interviews with the property owners/operators. An aerial photograph from 1993 shows several historical buildings in the center of the Site that are gone by 2002. Research regarding these industries and processes identified COIs potentially associated with the historical operations. Existing boring SB-11 near former boat building has elevated metals (barium, lead, mercury) at 3-4 feet bgs and was also analyzed for VOCs and SVOCs but with elevated reporting limits. Existing boring P6 had elevated barium, lead and cPAHs at 5 feet bgs. Additional soil and groundwater samples will be collected within the areas of boat building operations.	The Site and historical operational areas are shown on Figure 2.1.	Samples will be analyzed for the COIs potentially associated with boat building • metals (including those potentially contained in sandblast grit) • tributyltin (added to marine paints as an antifouling agent) • PCBs (used in corrosion-resistant paint • chlorinated solvents (used for degreasing) • TPH and PAHs (related to fossil fuel storage and use)	Field sample acceptance criteria and laboratory result acceptance criteria are described in the SAP/QAPP (Appendix C).	Advance FS-16, -17, -18, -19, -21, -23, -24, and -25 borings in the vicinity and outside of the former boat building. Advance contingent borings FS-30C and -31C if floor drains or sumps indicating drainage to the ground surface are encountered within the building. All fill samples and native samples to the capillary fringe will be immediately analyzed. Native soil samples below the water table will be archived pending analysis of shallower samples, unless field indications of contamination are observed. Groundwater samples from monitoring wells within the boat building area (MW-01R, -07, -09, -12, -16, -19, and -20) will also be archived for analysis of tributyltin (TBT), which is the COIs unique to boat building, or other COIs if detected in the soil samples. Sampling protocols and detailed information regarding anticipated exploration depths are presented in the SAP/QAPP (Appendix C).

Table 6.1
Data Quality Objectives

DQO No.	Step 1: State the Problem	Step 2: Identify the Goals of the Study	Step 3: Identify Information Inputs	Step 4: Define the Boundaries of the Study	Step 5: Develop the Analytical Approach	Step 6: Specify the Performance or Acceptance Criteria	Step 7: Develop the Plan for Obtaining Data
8	**TREATED WOOD STORAGE AREA:** Additional data are needed to determine whether historical treated wood storage operations at the Site and other storage shed operations in the vicinity of the treated wood storage area resulted in releases of contaminants at the Site.	Collect soil and groundwater data for COIs associated with historical treated wood operations to determine whether the COIs are present at concentrations that exceed PSLs and, if a potential historical release is identified, determine the nature and extent of the resulting contamination sufficient to develop and evaluate Feasibility Study remedial alternatives.	The nature of historical treated wood storage operations and operational areas have been determined from property ownership records, aerial photographs, and records from site visits and interviews with the property owners/operators. Research regarding wood treatment processes identified COIs potentially associated with the historical operations. Soil and groundwater samples will be collected from the treated wood storage area to characterize these media for contaminants associated with wood treatment.	The Site and historical operational areas are shown on Figure 2.1.	Samples will be analyzed for the COIs potentially associated with wood treatment and other material storage. • PCP • PAHs (i.e., creosote) • Arsenic, chromium, copper, mercury, and lead (contained in chromated arsenicals and batteries/other stored equipment • CVOCs potentially contained in degreasers • TPH and BTEX resulting from fuel storage • If PCP is detected, dioxins/furans will additionally be analyzed in those samples	Field sample acceptance criteria and laboratory result acceptance criteria are described in the SAP/QAPP (Appendix C).	Advance FS-05, -08, -09 and -12 and contingency boring FS-13C in the vicinity of the former treated wood storage area/shed storage area. Fill samples and native soil samples down to the capillary fringe will be analyzed immediately. Native samples below the water table will be archived pending analysis of shallower samples unless field indications of contamination are observed. Volume will be archived for potential dioxin/furan analysis from all intervals. New monitoring well MW-14, to be installed within the former treated wood storage area, will be monitored for COIs detected in soil. Sampling protocols and detailed information regarding anticipated exploration depths are presented in the SAP/QAPP (Appendix C).

Table 6.1
Data Quality Objectives

DQO No.	Step 1: State the Problem	Step 2: Identify the Goals of the Study	Step 3: Identify Information Inputs	Step 4: Define the Boundaries of the Study	Step 5: Develop the Analytical Approach	Step 6: Specify the Performance or Acceptance Criteria	Step 7: Develop the Plan for Obtaining Data
9	**SLUG BAIT HANDLING:** Additional data are needed to determine whether historical slug bait packaging/handling operations at the Property resulted in releases of contaminants to the Site.	Collect soil and groundwater data for COIs associated with historical slug bait handling determine whether the COIs are present at concentrations that exceed PSLs and, if a potential historical release is identified, determine the nature and extent of the resulting contamination sufficient to develop and evaluate Feasibility Study remedial alternatives.	The nature of historical slug bait handling operations has been determined from property ownership records, aerial photographs, and records from site visits and interviews with the property owners/operators. Research regarding the historical formulation identified COIs potentially associated with the historical operations. Soil and groundwater samples will be collected near the former slug bait packaging operations area to characterize these media for contaminants associated with slug bait.	The Site and historical operational areas are shown on Figure 2.1. The interior of the building is not accessible for sampling.	Samples will be analyzed for acetaldehyde and carbaryl, which were identified as the ingredient in the historical slug bait formulation with potential toxicity to receptors at the Site. Regulatory criteria to determine a PSL are available for acetaldehyde and carbaryl. A laboratory has not been identified for metaldehyde, which was also part of the historical slug bait formulation.	Field sample acceptance criteria and laboratory result acceptance criteria are described in the SAP/QAPP (Appendix C).	Advance FS-36 outside the building housing former slug bait operations in the vicinity of the loading dock where spills to the ground surface may have occurred. Advance FS-15 in the vicinity of the personnel entrance of the building. Fill and native soils down to the capillary fringe will be analyzed immediately. Native samples below the water table will be archived pending analysis of shallower samples unless field indications of contamination are observed. Archive samples farther from the loading dock will be collected at FS-16, -17, -28, and -29C for analysis if slug bait COIs exceed PSLs at FS-36 or -15. Existing well MW-09, located downgradient of the former slug bait handling operations, will be monitored for slug bait COIs to determine potential impacts from releases to floor drains inside the building. Additional wells farther downgradient may be sampled if groundwater at MW-09 is impacted by slug bait COIs. Sampling protocols and detailed information regarding anticipated exploration depths are presented in the SAP/QAPP (Appendix C).
CONTAMINANT MIGRATION AND EXPOSURE PATHWAYS							
10	**UPGRADIENT GROUNDWATER:** Additional data are needed to characterize the quality of groundwater flowing into the Site from upgradient	Establish a groundwater monitoring well network at the upgradient Site boundaries with sufficient density to detect any potential upgradient sources of COIs and that is sufficient to identify off site sources for the RI/FS.	Existing upgradient wells include MW-03R, -06, and -10. Additional groundwater monitoring wells will be installed on Site in the upgradient directions to the south and west, and off-Site to the south.	Existing and new well locations are shown on Figure 6.9.	Upgradient groundwater samples will be analyzed for metals, TPH, VOCs, SVOCs, PCBs and dioxins/furans.	Field sample acceptance criteria and laboratory result acceptance criteria are described in the SAP/QAPP (Appendix C).	Upgradient groundwater will be characterized by wells along the western and southern perimeter of the Site, includes existing wells MW-03R, -06, and -10 and new monitoring wells MW-13, -14, -15, -16, -17, and -18.

Table 6.1
Data Quality Objectives

DQO No.	Step 1: State the Problem	Step 2: Identify the Goals of the Study	Step 3: Identify Information Inputs	Step 4: Define the Boundaries of the Study	Step 5: Develop the Analytical Approach	Step 6: Specify the Performance or Acceptance Criteria	Step 7: Develop the Plan for Obtaining Data
11	**GROUNDWATER DISCHARGE TO SURFACE WATER:** Additional data are needed to characterize the quality of groundwater discharging to the LDW.	Establish a groundwater monitoring well network at the shoreline with sufficient density to determine the potential for COIs to impact surface water or sediment quality in the LDW and that is sufficient to develop and evaluate Feasibility Study remedial alternatives. Evaluate the potential for groundwater seeps to impact surface water.	Existing shoreline wells include MW-05, -07, and -11 and historically included MW-01 and -04. Additional groundwater monitoring wells will be installed to gain information about groundwater quality across the shoreline area.	Existing and new well locations are shown on Figure 6.9.	Shoreline groundwater samples will be analyzed for the COIs: metals, TPH, VOCs, SVOCs, PCBs and dioxins/furans. Additionally analyze for TBT, and/or COIs associated with slug bait if indicated by upgradient groundwater results.	Field sample acceptance criteria and laboratory result acceptance criteria are described in the SAP/QAPP (Appendix C).	Discharge to surface groundwater will be characterized with wells along the shoreline, which include existing wells MW-05, -07, and -11, and new monitoring wells MW-01R, -05D, -20, and -21. The presence of seeps will be determined by a visual survey conducted during low tide. Sampling protocols and detailed information regarding anticipated exploration depths are presented in the SAP/QAPP (Appendix C).
12	**CONTAMINANT PARTITIONING:** Additional data are needed to determine the site-specific partitioning of COIs to soil and groundwater.	Collect paired soil and groundwater results for COIs and organic carbon to test, and adjust the default assumptions used for calculation of PSLs protective of the leaching pathway. Collect additional data on alkanes for comparison to toxicity benchmarks and identification of potentially weathered petroleum. Data will be sufficient to develop and evaluate site-specific partitioning coefficients for the RI/FS.	A limited number of soil sample results for metals in the existing dataset have reporting limits sufficiently low to compare to PSLs and groundwater metals results. The analytical sensitivity for other COIs in the existing dataset is not sufficient to assess partitioning. Environmental investigations at other sites in the vicinity may include area-specific partitioning data. Samples of soil and groundwater will be collected from the Site to assess Site-specific partitioning of contaminants.	Existing and new well locations are shown on Figure 6.9.	Soil samples collected from the saturated well screen zone and corresponding groundwater samples will be analyzed for the COIs and total organic carbon. TPH-contaminated samples will be analyzed with silica gel cleanup and extractible petroleum hydrocarbons/volatile petroleum hydrocarbons to determine the concentrations of alkanes present. A literature review of investigation reports for other sites in the vicinity will be conducted to identify additional area-wide partitioning data.	Field sample acceptance criteria and laboratory result acceptance criteria are described in the SAP/QAPP (Appendix C).	Contaminant partitioning will be assessed with soil and groundwater data from new monitoring wells MW-FS-32/01R, FS-08/MW-14, and FS-19/MW-19. Samples will be analyzed immediately from the capillary fringe and water table intervals. Petroleum alkane profiles and toxicity characteristics will be assessed by collecting petroleum fractionation (extractable and volatile petroleum hydrocarbon) analysis from monitoring wells MW-01R, -03R, -08, -09, -11, and -12 where TPH concentrations were elevated in the historical groundwater dataset. Sampling protocols and detailed information regarding anticipated exploration depths are presented in the SAP/QAPP (Appendix C).

Table 6.1
Data Quality Objectives

DQO No.	Step 1: State the Problem	Step 2: Identify the Goals of the Study	Step 3: Identify Information Inputs	Step 4: Define the Boundaries of the Study	Step 5: Develop the Analytical Approach	Step 6: Specify the Performance or Acceptance Criteria	Step 7: Develop the Plan for Obtaining Data
13	**HYDROGEOLOGY:** Additional data are needed to determine the range and magnitude of horizontal flow directions, tidal influence on groundwater flow and hydraulic conductivity of shallow water-bearing zones.	Collect water level measurements across a range of tide conditions to determine site-specific flow directions and horizontal gradients, and collect site-specific hydraulic conductivity measurements, in order to determine likely seepage velocities of groundwater flow toward the LDW. Data will be sufficient to develop and evaluate site-specific groundwater flow conditions for the RI/FS.	Existing hydrogeologic studies conducted on the Site identified horizontal gradients ranging from 0.0060 to 0.21 feet/foot and likely brief tidal reversals near the shoreline during high tides in the LDW. Additional water level data and hydrogeologic testing data will be collected at the Site to supplement the existing hydrogeologic dataset.	The Site and existing well locations are shown on Figure 6.9.	Water levels will be collected using a combination of manual measurements during four quarters of groundwater monitoring. Pressure transducers will be used to collect measurements between monitoring events, and will additionally be used to assess water levels over representative high and low tide cycles. Hydraulic conductivity will be measured by performing slug testing in designated wells.	Hydrogeologic study performance criteria for accuracy and precision are described in the SAP/QAPP (Appendix C).	Site-wide groundwater levels will be collected during high and low tide events. Transducer studies will be performed to determine water level direction and pattern throughout tide cycles; and slug tests will be performed at low tide to determine the range of hydraulic conductivity values of shallow saturated soils. New monitoring wells MW-14, -16, -19, -20, and -21, for which records of all construction details will be available, will be included in a pressure transducer study. MW-05 and MW-05D will also be included in the transducer study to assess vertical gradients at the shallow/deep well pair. Data collection protocols are presented in the SAP/QAPP (Appendix C).

Table 6.1
Data Quality Objectives

DQO No.	Step 1: State the Problem	Step 2: Identify the Goals of the Study	Step 3: Identify Information Inputs	Step 4: Define the Boundaries of the Study	Step 5: Develop the Analytical Approach	Step 6: Specify the Performance or Acceptance Criteria	Step 7: Develop the Plan for Obtaining Data
14	**SEDIMENT QUALITY:** Additional analytical data for SMS chemicals are needed to assess the quality of intertidal and subtidal sediments in the LDW adjacent to the Site relative to COIs associated with the Site. <u>This DQO is related to DQO-5. The riverbank adjacent to the Site is within the intertidal sediment zone of the LDW. The slope conditions appear to be eroding in places.</u> <u>Characterization of potential impacts to LDW sediments directly downstream of the current and historical stormwater outfall pipes at the Site is a component of this DQO.</u>	Collect surface and subsurface sediment samples spatially distributed along the shoreline of the LDW adjacent to the Site, in coordination with LDWG (Windward 2022) sediment Pre-Design Investigation (PDI) sampling and analysis in the middle reach of the Lower Duwamish Waterway (LDW) being done in accordance with the USEPA (2022) AO 5. This DQO is addressed along with groundwater contaminant migration and exposure DQOs because compliance with groundwater PCULs for protection of sediment quality may be demonstrated if sediment concentrations do not exceed target values. This DQO incorporates sampling to assess potential sediment impacts from discharges from current and historical stormwater outfalls.	Existing sediment samples collected within the previous approximate 10 years include those collected during the LDW RI/FS (Figure 6.11). Additionally surface and subsurface samples will be collected by LDWG during PDI sampling in accordance with the PDI QAPP; data from these samples is anticipated to be available during development of the RI/FS. Three surface sediment samples will be collected from intertidal sediments near the Site to supplement the existing data and planned LDWG samples. The sample locations are next to current and historical stormwater outfalls. One sample will be located under the dock structure next to an identified area of fill with elevated metals concentrations.	The existing LDW middle reach (river mile [RM] 1.6 to RM 3.0) sample locations are shown on Figure 6.11. The intertidal sediment area is the focus of this DQO because it is nearest the Site and is depositional, therefore retaining potential contamination migrating from the Site uplands from soil erosion and uncontrolled stormwater, and potentially groundwater discharge. The immediate radius of the end of the three stormwater outfall pipes and downstream of the pipe ends are areas of focus to obtain data regarding potential stormwater-related impacts to sediment.	Samples will be analyzed for the full suite of SMS chemicals including: metals, SVOCs, PAHs, and PCBs. A subset of the Site COIs are also LDW COCs, including metals, PAHs, PCP, PCBs and dioxins/furans and data for these samples will be incorporated into the Site RI/FS dataset. Sediment split samples have been provided to SBL by LDWG for potential TBT analysis. If detected in Site soils, TBT will be analyzed in one or more of the sediment samples. Sediment samples based on the results of soil analysis.	Field sample acceptance criteria and laboratory result acceptance criteria are described in the SAP/QAPP (Appendix C) and in the Lower Duwamish Water Group Predesign Investigation QAPP for AO 5.	The LDWG (2022) PDI QAPP provides detailed information on the sampling analysis plan to obtain surface and subsurface sediment data for the middle reach. Existing sediment investigation data from the LDW adjacent to the Site will be obtained from LDW database sources. Four additional intertidal sediment samples will be obtained at low tide during the Site RI to supplement the LDWG information for sediment characterization and to evaluate contaminant migration from the Site to the intertidal sediment of the LDW. Sampling protocols are presented in the SAP/QAPP (Appendix C).

Abbreviations:

AO 5	Agreed Order 5	PCB	Polychlorinated biphenyl
cm	Centimeters	PCE	Tetrachloroethene
COC	Contaminant of concern	PCP	Pentachlorophenol
COI	Contaminants of Interest	PSL	Preliminary screening level
CVOC	Chlorinated volatile organic compound	SAP/QAPP	Sampling and Analysis Plan/Quality Assurance Project Plan
DQO	Data quality objective	SMS	Washington State Sediment Management Standards (WAC 173-204)
LDW	Lower Duwamish Waterway	TPH	Total petroleum hydrocarbons
PAH	Polycyclic aromatic hydrocarbon	VOC	Volatile organic compound

Table 6.2
Detected Analytes in Groundwater

			Location Name	MW-01		MW-02	MW-03		MW-03R	MW-04	MW-05			MW-06
			Sample Name	MW-01-04232015	MW-01-12162003	MW-02-12162003	MW-03-04232015	MW-03-12162003	MW-03R-04082016	MW-04-12162003	MW-05-04112016	MW-05-04232015	MW-05-12162003	MW-06-04082016
			Sample Date	4/23/2015	12/16/2003	12/16/2003	4/23/2015	12/16/2003	4/8/2016	12/16/2003	4/11/2016	4/23/2015	12/16/2003	4/8/2016
Analyte	**CAS No.**	**Unit**	**PSL (1)**											
Conventionals														
Total Organic Carbon	TOC	mg/L	--						4.9					
Total Metals														
Arsenic	7440-38-2	µg/L	8						2.1		1.6			1.0
Barium	7440-39-3	µg/L	200						23					
Chromium	7440-47-3	µg/L	100						1.0 U					
Lead	7439-92-1	µg/L	5.6						1.0 U		1.0 U			1.0 U
Selenium	7782-49-2	µg/L	50						4.6					
Dissolved Metals														
Arsenic	7440-38-2	µg/L	8		*25 U*	**9.0**	**8.1**	5.0 U	1.8	**12**	1.5	1.6	5.0 U	1.0
Barium	7440-39-3	µg/L	200		200 U	160 U	16	70	22	160 U		2.0	20 U	
Chromium	7440-47-3	µg/L	100		7.0 U	*560 U*	1.2	7.0 U	1.0 U	56 U		1.0 U	7.0 U	
Lead	7439-92-1	µg/L	5.6		3.0 U	3.0 U	**170**	3.0 U	1.0 U	4.0	1.0 U	1.0 U	3.0 U	1.0 U
Selenium	7782-49-2	µg/L	50		40 U	*320 U*	1.3	40 U	4.4	*320 U*		1.7	40 U	
Semi-Volatile Organic Compounds: Phthalates														
Di-n-butyl phthalate	84-74-2	µg/L	8		3.0 U	3.0 U				3.0 U			5.0	
Diethylphthalate	84-66-2	µg/L	93		12	7.0				3.0			12	
Semi-Volatile Organic Compounds: Other														
Benzyl alcohol	100-51-6	µg/L	56		2.0 U	2.0 U				2.0 U			4.0	
Isophorone	78-59-1	µg/L	92		2.0 U	2.0 U				2.0 U			3.0	
Total Petroleum Hydrocarbons														
Gasoline-range organics	GRO	µg/L	800	100 U			100 U	50 U		50 U		100 U		
Diesel-range organics	DRO	µg/L	50	**630** (2)		*130 U*	**270** (2)	*130 U*	**370** (2)	**570** (2)	50 U	50 U		50 U
Oil-range organics	ORO	µg/L	500	**1,200**		250 U	250 U	250 U	270 (2)	250 U	250 U	250 U		250 U
Total DRO & ORO (3)	T_DRO&ORO (U=0)	µg/L	500	**1,800** (2)		250 U	270 (2)	250 U	**640** (2)	**570** (2)	250 U	250 U		250 U
Volatile Organic Compounds: Benzene, Toluene, Ethylbenzene, and Xylenes														
Toluene	108-88-3	µg/L	100	1.0 U		2.0 U	1.0 U	3.0	1.0 U	1.0 U	1.0 U	1.0 U	2.0 U	1.0 U
Volatile Organic Compounds: Chlorinated Volatile Organic Compounds														
cis-1,2-Dichloroethene	156-59-2	µg/L	16	1.0 U	2.0 U	2.0 U	1.0 U	2.0 U	1.0 U	2.0 U	1.0 U	1.0 U	2.0 U	1.0 U
Vinyl chloride	75-01-4	µg/L	0.18	*0.20 U*	*2.0 U*	*2.0 U*	*0.20 U*	*2.0 U*	**0.31**	*2.0 U*	*0.20 U*	*0.20 U*	*2.0 U*	*0.20 U*
Tetrachloroethene	127-18-4	µg/L	2.9	1.0 U	2.0 U	2.0 U	1.0 U	2.0 U	1.0 U	2.0 U	**8.0**	**7.7**	**16**	**14**
Trichloroethene	79-01-6	µg/L	0.7	*1.0 U*	*2.0 U*	*2.0 U*	*1.0 U*	*2.0 U*	*1.0 U*	*2.0 U*	*1.0 U*	*1.0 U*	**2.0**	*1.0 U*
Volatile Organic Compounds: Other														
1,2,4-Trimethylbenzene	95-63-6	µg/L	80	1.0 U		2.0 U	1.0 U	2.0 U	1.0 U		1.0 U	1.0 U	2.0 U	1.0 U
1,3-Dichlorobenzene	541-73-1	µg/L	2	1.0 U	2.0 U	2.0 U	1.0 U	2.0 U	1.0 U	2.0 U	1.0 U	1.0 U	2.0 U	1.0 U
Acetone	67-64-1	µg/L	7,200	10 U		30	10 U	25 U	10 U		10 U	10 U	25 U	10 U
Methyl ethyl ketone	78-93-3	µg/L	4,800	10 U		52	10 U	26	10 U		10 U	10 U	12	10 U

Notes:

Blank cells are intentional.

All results are rounded to two significant figures.

RED/BOLD Detected result exceeds PSL.

Italics Non-detect result exceeds PSL.

1 Preliminary Screening Level as established in Table 5.1.

2 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

3 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

Abbreviations:

CAS Chemical Abstracts Service
DRO Diesel-range organics
GRO Gasoline-range organics
µg/L Micrograms per liter
mg/L Milligrams per liter
ORO Oil-range organics
PSL Preliminary screening level
TOC Total Organic Carbon

Qualifier:

U Analyte was not detected at the associated reporting limit.

Table 6.2
Detected Analytes in Groundwater

			Location Name	MW-07	MW-08	MW-09	MW-10	MW-11	MW-12	A1A-S6	P13	P15	P3	P5	P6	P7	P9
			Sample Name	MW-07-04082016	MW-08-04082016	MW-09-04082016	MW-10-04082016	MW-11-04082016	MW-12-04082016	A1A-G5-1	P13-W	P15-W	P3-W	P5-W	P6-W	P7-W	P9-W
			Sample Date	4/8/2016	4/8/2016	4/8/2016	4/8/2016	4/8/2016	4/8/2016	7/9/2018	4/21/2015	3/9/2016	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015
Analyte	**CAS No.**	**Unit**	**PSL [1]**														
Conventionals																	
Total Organic Carbon	TOC	mg/L	--		16	12		3.6									
Total Metals																	
Arsenic	7440-38-2	µg/L	8	1.6	7.0	**10**	1.9	2.7	5.1								
Barium	7440-39-3	µg/L	200				18	44									
Chromium	7440-47-3	µg/L	100				1.3	1.0 U									
Lead	7439-92-1	µg/L	5.6	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U								
Selenium	7782-49-2	µg/L	50				3.2	7.4									
Dissolved Metals																	
Arsenic	7440-38-2	µg/L	8	1.4	5.1	**10**	1.5	2.2	4.9	**11**							
Barium	7440-39-3	µg/L	200				17	44									
Chromium	7440-47-3	µg/L	100				1.1	1.0 U									
Lead	7439-92-1	µg/L	5.6	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U							
Selenium	7782-49-2	µg/L	50				3.0	7.2									
Semi-Volatile Organic Compounds: Phthalates																	
Di-n-butyl phthalate	84-74-2	µg/L	8														
Diethylphthalate	84-66-2	µg/L	93														
Semi-Volatile Organic Compounds: Other																	
Benzyl alcohol	100-51-6	µg/L	56														
Isophorone	78-59-1	µg/L	92														
Total Petroleum Hydrocarbons																	
Gasoline-range organics	GRO	µg/L	800							100 U		100 U	210	100 U			100 U
Diesel-range organics	DRO	µg/L	50	50 U	**970 [2]**	**440 [2]**	**1,100 [2]**	**360 [2]**	**1,600 [2]**		**800 [2]**	**390 [2]**	**1,900 [2]**	**770 [2]**	**190 [2]**	**710 [2]**	50 U
Oil-range organics	ORO	µg/L	500	250 U	**600 [2]**	250 U	**940 [2]**	400 [2]	**610 [2]**		390 [2]	280 [2]	**560 [2]**	**600 [2]**	250 U	430 [2]	250 U
Total DRO & ORO [3]	T_DRO&ORO (U=0)	µg/L	500	250 U	**1,600 [2]**	440 [2]	**2,000 [2]**	**760 [2]**	**2,200 [2]**		**1,200 [2]**	**670 [2]**	**2,500 [2]**	**1,400 [2]**	190 [2]	**1,100 [2]**	250 U
Volatile Organic Compounds: Benzene, Toluene, Ethylbenzene, and Xylenes																	
Toluene	108-88-3	µg/L	100	1.0 U		1.0 U	1.0 U			1.0 U	1.0 U	1.0 U		11	1.0 U		1.0 U
Volatile Organic Compounds: Chlorinated Volatile Organic Compounds																	
cis-1,2-Dichloroethene	156-59-2	µg/L	16	1.0 U		1.0 U	1.0 U			1.0 U	5.3	1.0 U			1.9		
Vinyl chloride	75-01-4	µg/L	0.18	*0.20 U*		**0.30**	**0.46**			*0.20 U*	*0.20 U*	*0.20 U*			*0.20 U*		
Tetrachloroethene	127-18-4	µg/L	2.9	**12**		1.0 U	1.0 U			1.0 U	1.0 U	1.0 U			1.0 U		
Trichloroethene	79-01-6	µg/L	0.7	**2.0**		*1.0 U*	*1.0 U*			*1.0 U*	*1.0 U*	*1.0 U*			*1.0 U*		
Volatile Organic Compounds: Other																	
1,2,4-Trimethylbenzene	95-63-6	µg/L	80	1.0 U		1.0 U	1.0 U			1.0 U	1.9	1.0 U			1.0 U		
1,3-Dichlorobenzene	541-73-1	µg/L	2	1.0 U		1.0 U	1.0 U			1.0 U	1.0 U	1.0 U			1.1		
Acetone	67-64-1	µg/L	7,200	10 U		10 U	10 U			50 U	10 U	10 U			10 U		
Methyl ethyl ketone	78-93-3	µg/L	4,800	10 U		10 U	10 U			10 U	10 U	10 U			10 U		

Notes:

Blank cells are intentional.

All results are rounded to two significant figures.

RED/BOLD Detected result exceeds PSL.

Italics Non-detect result exceeds PSL.

1 Preliminary Screening Level as established in Table 5.1

2 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

3 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

Abbreviations:

CAS Chemical Abstracts Service

DRO Diesel-range organics

µg/L Micrograms per liter

mg/L Milligrams per liter

ORO Oil-range organics

PSL Preliminary screening level

Qualifier:

U Analyte was not detected at the associated reporting limit.

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	A1A-B5	A1A-B7	A1A-B8	A1A-B9	A1A-B10	A1A-B11	A1A-B12	A1A-B13	A1A-B14	A1A-B15	A1A-B19	A1A-B20	A1A-B21
			Sample Name	A1A-B5-5	A1A-B7-5	A1A-B8-5	A1A-B9-5	A1A-B10-5	A1A-B11-5	A1A-B12-5	A1A-B13-5	A1A-B14-5	A1A-B15-5	A1A-B19-5	A1A-B20-9.5	A1A-B21-7
			Sample Date	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/9/2018	7/12/2018	7/12/2018
			Sample Depth	5 ft	5 ft	5 ft	5 ft	5 ft	5 ft	5 ft	5 ft	5 ft	5 ft	5 ft	9.5 ft	7 ft
Analyte	**CAS No.**	**Unit**	**PSL [(1)]**													
Metals																
Arsenic	7440-38-2	mg/kg	7.3	2.4	2.1	3.1	2.0	4.9	4.5	1.8	1.9	3.1	3.1	2.1	6.1	2.6
Barium	7440-39-3	mg/kg	8.3													
Cadmium	7440-43-9	mg/kg	0.77	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*
Chromium	7440-47-3	mg/kg	48													
Copper	7440-50-8	mg/kg	36													
Lead	7439-92-1	mg/kg	50	1.9	1.3	**140**	17	12	8.5	1.5	3.4	1.9	7.8	1.6	4.5	1.8
Mercury	7439-97-6	mg/kg	0.070													
Silver	7440-22-4	mg/kg	0.016													
Polychlorinated Biphenyls (PCBs)																
Aroclor 1016	12674-11-2	mg/kg	--													
Aroclor 1242	53469-21-9	mg/kg	--													
Aroclor 1248	12672-29-6	mg/kg	--													
Aroclor 1254	11097-69-1	mg/kg	--													
Aroclor 1260	11096-82-5	mg/kg	--													
Aroclor 1262	37324-23-5	mg/kg	--													
Total PCB Aroclors (U=0) [(2)]	T_PCB (U=0)	mg/kg	0.00000055													
Semi-Volatile Organic Compounds: Polycyclic Aromatic Hydrocarbons (PAHs)																
1-Methylnaphthalene	90-12-0	mg/kg	0.0042													
2-Methylnaphthalene	91-57-6	mg/kg	0.039													
Benzo(a)anthracene	56-55-3	mg/kg	--													
Benzo(a)pyrene	50-32-8	mg/kg	0.000016													
Benzo(b)fluoranthene	205-99-2	mg/kg	--													
Benzo(g,h,i)perylene	191-24-2	mg/kg	0.67													
Benzo(k)fluoranthene	207-08-9	mg/kg	--													
Chrysene	218-01-9	mg/kg	--													
Dibenzo(a,h)anthracene	53-70-3	mg/kg	--													
Fluoranthene	206-44-0	mg/kg	0.090													
Fluorene	86-73-7	mg/kg	0.029													
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg	--													
Naphthalene	91-20-3	mg/kg	0.0021													
Phenanthrene	85-01-8	mg/kg	1.5													
Pyrene	129-00-0	mg/kg	0.14													
Total Naphthalenes [(2)]	T_Napth (U=0)	mg/kg	--													
cPAHs (MTCA TEQ-ZeroND) [(3,4)]	BaPEq (U=0)	mg/kg	0.000016													
cPAHs (MTCA TEQ-HalfND) [(3,5)]	BaPEq (U=1/2)	mg/kg	0.000016													
Total HPAH (U=0) [(2)]	T_HPAH (U=0)	mg/kg	12													
Total LPAH (U=0) [(2)]	T_LPAH (U=0)	mg/kg	5.2													
Total PAH (U=0) [(2)]	T_PAH (U=0)	mg/kg	--													
Semi-Volatile Organic Compounds: Phthalates																
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	0.0051													
Total Petroleum Hydrocarbons																
Gasoline-range organics	GRO	mg/kg	30											5.0 U	5.0 U	
Diesel-range organics	DRO	mg/kg	260											50 U	50 U	
Oil-range organics	ORO	mg/kg	260											250 U	250 U	
Total DRO & ORO [(2)]	T_DRO&ORO (U=0)	mg/kg	260											250 U	250 U	

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	A1A-B5	A1A-B7	A1A-B8	A1A-B9	A1A-B10	A1A-B11	A1A-B12	A1A-B13	A1A-B14	A1A-B15	A1A-B19	A1A-B20	A1A-B21
			Sample Name	**A1A-B5-5**	**A1A-B7-5**	**A1A-B8-5**	**A1A-B9-5**	**A1A-B10-5**	**A1A-B11-5**	**A1A-B12-5**	**A1A-B13-5**	**A1A-B14-5**	**A1A-B15-5**	**A1A-B19-5**	**A1A-B20-9.5**	**A1A-B21-7**
			Sample Date	**7/5/2018**	**7/5/2018**	**7/5/2018**	**7/5/2018**	**7/5/2018**	**7/5/2018**	**7/5/2018**	**7/5/2018**	**7/5/2018**	**7/5/2018**	**7/9/2018**	**7/12/2018**	**7/12/2018**
			Sample Depth	**5 ft**	**5 ft**	**5 ft**	**5 ft**	**5 ft**	**5 ft**	**5 ft**	**5 ft**	**5 ft**	**5 ft**	**5 ft**	**9.5 ft**	**7 ft**
Analyte	**CAS No.**	**Unit**	**PSL (1)**													
Volatile Organic Compounds: Benzene, Toluene, Ethylbenzene, and Xylenes																
Ethylbenzene	100-41-4	mg/kg	0.010											*0.020 U*	*0.020 U*	
Toluene	108-88-3	mg/kg	0.044											0.020 U	0.020 U	
Xylene (meta & para)	108-38-3/106-42-3	mg/kg	--													
Xylene (ortho)	95-47-6	mg/kg	--													
Xylene (total)	1330-20-7	mg/kg	0.055											*0.060 U*	*0.060 U*	
Volatile Organic Compounds: Chlorinated Volatile Organic Compounds																
cis-1,2-Dichloroethene	156-59-2	mg/kg	0.0052													
Tetrachloroethene	127-18-4	mg/kg	0.0016													
Trichloroethene	79-01-6	mg/kg	0.00027													
Vinyl chloride	75-01-4	mg/kg	0.000056													
Volatile Organic Compounds: Other																
1,1-Dichloroethene	75-35-4	mg/kg	0.0025													
1,2,4-Trimethylbenzene	95-63-6	mg/kg	0.072													
1,3,5-Trimethylbenzene	108-67-8	mg/kg	0.071													
Cymene	99-87-6	mg/kg	--													
Isopropylbenzene	98-82-8	mg/kg	0.79													
n-Propylbenzene	103-65-1	mg/kg	0.88													
sec-Butylbenzene	135-98-8	mg/kg	1.3													
Trichlorofluoromethane	75-69-4	mg/kg	0.79													

Notes:

Blank cells are intentional.

All results are rounded to two significant figures.

RED/BOLD Detected result exceeds PSL.

Italics Non-detect result exceeds PSL.

1 Preliminary Screening Level as established in Table 5.2.

2 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

3 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic equivalent Factors as presented in Table 708-2 of WAC 173-340-900.

4 Calculation was performed using only detected cPAH concentrations.

5 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

6 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

7 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.

8 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

Abbreviations:

CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbon
DRO Diesel-range organics
ft Feet
GRO Gasoline-range organics
HPAH High molecular weight polycyclic aromatic hydrocarbon
LPAH Low molecular weight polycyclic aromatic hydrocarbon
mg/kg Milligrams per kilogram
MTCA Model Toxics Control Act
ORO Oil-range organics
PSL Preliminary screening level
TEQ Toxic equivalent

Qualifier:

U Analyte was not detected at the associated reporting limit.

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	A1A-E4	A1A-E5	A1A-N3	A1A-N5	A1A-S5	A1A-S6	A1A-S7	A1A-T2-B3	A1A-T2-E2	A1A-T2-N2	A1A-T2-PF	A1A-T2-S1	A1A-T2-W1
			Sample Name	A1A-E4-2	A1A-E5-2	A1A-N3-2	A1A-N5-2.5	A1A-S5-2	A1A-S6-9	A1A-S7-2.5	A1A-T2-B3-16	A1A-T2-E2-10	A1A-T2-N2-10	A1A-T2-PF-3	A1A-T2-S1-7.5	A1A-T2-W1-7.5
			Sample Date	7/6/2018	7/12/2018	7/5/2018	7/12/2018	7/6/2018	7/9/2018	7/12/2018	7/18/2018	7/18/2018	7/18/2018	7/18/2018	7/18/2018	7/18/2018
			Sample Depth	2 ft	2 ft	2 ft	2.5 ft	2 ft	9 ft	2.5 ft	16 ft	10 ft	10 ft	3 ft	7.5 ft	7.5 ft
Analyte	**CAS No.**	**Unit**	**PSL (1)**													
Metals																
Arsenic	7440-38-2	mg/kg	7.3	3.6	**8.3**	**14**	**22**	5.0	3.6	**10**						
Barium	7440-39-3	mg/kg	8.3													
Cadmium	7440-43-9	mg/kg	0.77	*1.0 U*	**8.8**	**1.4**	**7.4**	*1.0 U*	*1.0 U*	**5.0**						
Chromium	7440-47-3	mg/kg	48													
Copper	7440-50-8	mg/kg	36													
Lead	7439-92-1	mg/kg	50	13	**1,100**	**150**	**720**	39	3.4	**390**						
Mercury	7439-97-6	mg/kg	0.070													
Silver	7440-22-4	mg/kg	0.016													
Polychlorinated Biphenyls (PCBs)																
Aroclor 1016	12674-11-2	mg/kg	--													
Aroclor 1242	53469-21-9	mg/kg	--													
Aroclor 1248	12672-29-6	mg/kg	--													
Aroclor 1254	11097-69-1	mg/kg	--													
Aroclor 1260	11096-82-5	mg/kg	--													
Aroclor 1262	37324-23-5	mg/kg	--													
Total PCB Aroclors (U=0) (2)	T_PCB (U=0)	mg/kg	0.00000055													
Semi-Volatile Organic Compounds: Polycyclic Aromatic Hydrocarbons (PAHs)																
1-Methylnaphthalene	90-12-0	mg/kg	0.0042								**0.15**					
2-Methylnaphthalene	91-57-6	mg/kg	0.039								0.010 U					
Benzo(a)anthracene	56-55-3	mg/kg	--								0.010 U					
Benzo(a)pyrene	50-32-8	mg/kg	0.000016								*0.010 U*					
Benzo(b)fluoranthene	205-99-2	mg/kg	--								0.010 U					
Benzo(g,h,i)perylene	191-24-2	mg/kg	0.67													
Benzo(k)fluoranthene	207-08-9	mg/kg	--								0.010 U					
Chrysene	218-01-9	mg/kg	--								0.010 U					
Dibenzo(a,h)anthracene	53-70-3	mg/kg	--								0.010 U					
Fluoranthene	206-44-0	mg/kg	0.090													
Fluorene	86-73-7	mg/kg	0.029													
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg	--								0.010 U					
Naphthalene	91-20-3	mg/kg	0.0021								**0.028**	*0.050 UJ*				
Phenanthrene	85-01-8	mg/kg	1.5													
Pyrene	129-00-0	mg/kg	0.14													
Total Naphthalenes (2)	T_Napth (U=0)	mg/kg	--								0.18					
cPAHs (MTCA TEQ-ZeroND) (3,4)	BaPEq (U=0)	mg/kg	0.000016								*0.010 U*					
cPAHs (MTCA TEQ-HalfND) (3,5)	BaPEq (U=1/2)	mg/kg	0.000016								*0.010 U*					
Total HPAH (U=0) (2)	T_HPAH (U=0)	mg/kg	12													
Total LPAH (U=0) (2)	T_LPAH (U=0)	mg/kg	5.2													
Total PAH (U=0) (2)	T_PAH (U=0)	mg/kg	--													
Semi-Volatile Organic Compounds: Phthalates																
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	0.0051													
Total Petroleum Hydrocarbons																
Gasoline-range organics	GRO	mg/kg	30					**54**	5.0 U		25	27 J	**44 J**			
Diesel-range organics	DRO	mg/kg	260						50 U		50 U	50 U	50 U	50 U	50 U	50 U
Oil-range organics	ORO	mg/kg	260						250 U		250 U	250 U	250 U	250 U	250 U	250 U
Total DRO & ORO (2)	T_DRO&ORO (U=0)	mg/kg	260						250 U		250 U	250 U	250 U	250 U	250 U	250 U

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	A1A-E4	A1A-E5	A1A-N3	A1A-N5	A1A-S5	A1A-S6	A1A-S7	A1A-T2-B3	A1A-T2-E2	A1A-T2-N2	A1A-T2-PF	A1A-T2-S1	A1A-T2-W1
			Sample Name	A1A-E4-2	A1A-E5-2	A1A-N3-2	A1A-N5-2.5	A1A-S5-2	A1A-S6-9	A1A-S7-2.5	A1A-T2-B3-16	A1A-T2-E2-10	A1A-T2-N2-10	A1A-T2-PF-3	A1A-T2-S1-7.5	A1A-T2-W1-7.5
			Sample Date	7/6/2018	7/12/2018	7/5/2018	7/12/2018	7/6/2018	7/9/2018	7/12/2018	7/18/2018	7/18/2018	7/18/2018	7/18/2018	7/18/2018	7/18/2018
			Sample Depth	2 ft	2 ft	2 ft	2.5 ft	2 ft	9 ft	2.5 ft	16 ft	10 ft	10 ft	3 ft	7.5 ft	7.5 ft
Analyte	**CAS No.**	**Unit**	**PSL (1)**													
Volatile Organic Compounds: Benzene, Toluene, Ethylbenzene, and Xylenes																
Ethylbenzene	100-41-4	mg/kg	0.010					**0.044**	*0.020 U*		**0.064**	*0.050 UJ*	**0.36 J**			
Toluene	108-88-3	mg/kg	0.044					0.020 U	0.020 U		**0.18**	*0.050 UJ*	0.020 UJ			
Xylene (meta & para)	108-38-3/106-42-3	mg/kg	--									0.10 UJ				
Xylene (ortho)	95-47-6	mg/kg	--									0.050 UJ				
Xylene (total)	1330-20-7	mg/kg	0.055					*0.060 U*	*0.060 U*		**0.21**	*0.10 UJ*	**0.24 J**			
Volatile Organic Compounds: Chlorinated Volatile Organic Compounds																
cis-1,2-Dichloroethene	156-59-2	mg/kg	0.0052									*0.050 UJ*				
Tetrachloroethene	127-18-4	mg/kg	0.0016									*0.025 UJ*				
Trichloroethene	79-01-6	mg/kg	0.00027									*0.020 UJ*				
Vinyl chloride	75-01-4	mg/kg	0.000056									*0.050 UJ*				
Volatile Organic Compounds: Other																
1,1-Dichloroethene	75-35-4	mg/kg	0.0025									*0.050 UJ*				
1,2,4-Trimethylbenzene	95-63-6	mg/kg	0.072									0.050 UJ				
1,3,5-Trimethylbenzene	108-67-8	mg/kg	0.071									0.050 UJ				
Cymene	99-87-6	mg/kg	--									0.050 UJ				
Isopropylbenzene	98-82-8	mg/kg	0.79									0.050 UJ				
n-Propylbenzene	103-65-1	mg/kg	0.88									0.050 UJ				
sec-Butylbenzene	135-98-8	mg/kg	1.3									0.050 UJ				
Trichlorofluoromethane	75-69-4	mg/kg	0.79									0.50 UJ				

Notes:

Blank cells are intentional.

All results are rounded to two significant figures.

RED/BOLD Detected result exceeds PSL.

Italics Non-detect result exceeds PSL.

1 Preliminary Screening Level as established in Table 5.2.

5 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

6 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic equivalent Factors as presented in Table 708-2 of WAC 173-340-900.

7 Calculation was performed using only detected cPAH concentrations.

8 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

2 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

4 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.

3 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

Abbreviations:

CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbon
DRO Diesel-range organics
ft Feet
GRO Gasoline-range organics
HPAH High molecular weight polycyclic aromatic hydrocarbon
LPAH Low molecular weight polycyclic aromatic hydrocarbon
mg/kg Milligrams per kilogram
MTCA Model Toxics Control Act
ORO Oil-range organics
PSL Preliminary screening level
TEQ Toxic equivalent

Qualifier:

U Analyte was not detected at the associated reporting limit.

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	A1A-W3	A1A-W4	A2A-B1	A2A-N1/W1-Comp	A2A-S1/E1-Comp	A2B-N1/S1-Comp	A3A-B1	A3A-N1/S1-Comp	A3A-E1	A3A-N1	A3A-S1	A3A-W1	A3B-B1
			Sample Name	A1A-W3-2	A1A-W4-2	A2A-B1-2.5	A2A-Comp1	A2A-Comp2	A2B-Comp1	A3A-B1-0.5	A3A-Comp2	A3A-E1-2	A3A-N1-0.5	A3A-S1-2	A3A-W1-2	A3B-B1-0.5
			Sample Date	7/6/2018	7/12/2018	6/20/2018	6/20/2018	6/20/2018	6/21/2018	6/20/2018	6/20/2018	7/2/2018	6/20/2018	7/2/2018	7/2/2018	6/20/2018
			Sample Depth	2 ft	2 ft	2.5 ft	2.5-3 ft	2 ft	2 ft	0.5 ft	0.5 ft	2 ft	0.5 ft	2 ft	2 ft	0.5 ft
Analyte	**CAS No.**	**Unit**	**PSL [1]**													
Metals																
Arsenic	7440-38-2	mg/kg	7.3	**17**	4.6					2.4		5.1	2.4	**7.8**	**12**	**19**
Barium	7440-39-3	mg/kg	8.3													
Cadmium	7440-43-9	mg/kg	0.77	**1.7**	1.0 U				1.0 U	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	**1.1**
Chromium	7440-47-3	mg/kg	48							11			12			33
Copper	7440-50-8	mg/kg	36													
Lead	7439-92-1	mg/kg	50	**270**	18					7.6			13			**65**
Mercury	7439-97-6	mg/kg	0.070							1.0 U			1.0 U			1.0 U
Silver	7440-22-4	mg/kg	0.016													
Polychlorinated Biphenyls (PCBs)																
Aroclor 1016	12674-11-2	mg/kg	--							0.020 U	0.020 U					0.020 U
Aroclor 1242	53469-21-9	mg/kg	--							0.020 U	0.020 U					0.020 U
Aroclor 1248	12672-29-6	mg/kg	--							0.020 U	0.020 U					0.020 U
Aroclor 1254	11097-69-1	mg/kg	--							0.020 U	0.020 U					0.020 U
Aroclor 1260	11096-82-5	mg/kg	--							0.020 U	0.020 U					0.062
Aroclor 1262	37324-23-5	mg/kg	--							0.020 U	0.020 U					0.020 U
Total PCB Aroclors (U=0) [2]	T_PCB (U=0)	mg/kg	0.00000055							0.020 U	0.020 U					**0.062**
Semi-Volatile Organic Compounds: Polycyclic Aromatic Hydrocarbons (PAHs)																
1-Methylnaphthalene	90-12-0	mg/kg	0.0042													
2-Methylnaphthalene	91-57-6	mg/kg	0.039													
Benzo(a)anthracene	56-55-3	mg/kg	--			0.010 U	0.10 U	0.010 U	1.0 U	0.10 U	0.010 U					1.0 U
Benzo(a)pyrene	50-32-8	mg/kg	0.000016			0.010 U	0.10 U	0.010 U	1.0 U	0.10 U	0.010 U					1.0 U
Benzo(b)fluoranthene	205-99-2	mg/kg	--			0.010 U	0.10 U	0.010 U	1.0 U	0.10 U	0.011					1.0 U
Benzo(g,h,i)perylene	191-24-2	mg/kg	0.67													
Benzo(k)fluoranthene	207-08-9	mg/kg	--			0.010 U	0.10 U	0.010 U	1.0 U	0.10 U	0.010 U					1.0 U
Chrysene	218-01-9	mg/kg	--			0.010 U	0.10 U	0.010 U	1.0 U	0.10 U	0.010 U					1.0 U
Dibenzo(a,h)anthracene	53-70-3	mg/kg	--			0.010 U	0.10 U	0.010 U	1.0 U	0.10 U	0.010 U					1.0 U
Fluoranthene	206-44-0	mg/kg	0.090													
Fluorene	86-73-7	mg/kg	0.029													
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg	--			0.010 U	0.10 U	0.010 U	1.0 U	0.10 U	0.010 U					1.0 U
Naphthalene	91-20-3	mg/kg	0.0021													
Phenanthrene	85-01-8	mg/kg	1.5													
Pyrene	129-00-0	mg/kg	0.14													
Total Naphthalenes [2]	T_Napth (U=0)	mg/kg	--													
cPAHs (MTCA TEQ-ZeroND) [3,4]	BaPEq (U=0)	mg/kg	0.000016			0.010 U	0.10 U	0.010 U	1.0 U	0.10 U	**0.0011**					1.0 U
cPAHs (MTCA TEQ-HalfND) [3,5]	BaPEq (U=1/2)	mg/kg	0.000016			0.010 U	0.10 U	0.010 U	1.0 U	0.10 U	**0.0082**					1.0 U
Total HPAH (U=0) [2]	T_HPAH (U=0)	mg/kg	12													
Total LPAH (U=0) [2]	T_LPAH (U=0)	mg/kg	5.2													
Total PAH (U=0) [2]	T_PAH (U=0)	mg/kg	--													
Semi-Volatile Organic Compounds: Phthalates																
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	0.0051													
Total Petroleum Hydrocarbons																
Gasoline-range organics	GRO	mg/kg	30													
Diesel-range organics	DRO	mg/kg	260			50 U	50 U	50 U	96 [6]	50 U	50 U	50 U			50 U	110 [6]
Oil-range organics	ORO	mg/kg	260			250 U	250 U	250 U	**300**	250 U	250 U	250 U			250 U	**540**
Total DRO & ORO [2]	T_DRO&ORO (U=0)	mg/kg	260			250 U	250 U	250 U	**400**	250 U	250 U	250 U			250 U	**650**

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	A1A-W3	A1A-W4	A2A-B1	A2A-N1/W1-Comp	A2A-S1/E1-Comp	A2B-N1/S1-Comp	A3A-B1	A3A-N1/S1-Comp	A3A-E1	A3A-N1	A3A-S1	A3A-W1	A3B-B1
			Sample Name	A1A-W3-2	A1A-W4-2	A2A-B1-2.5	A2A-Comp1	A2A-Comp2	A2B-Comp1	A3A-B1-0.5	A3A-Comp2	A3A-E1-2	A3A-N1-0.5	A3A-S1-2	A3A-W1-2	A3B-B1-0.5
			Sample Date	7/6/2018	7/12/2018	6/20/2018	6/20/2018	6/20/2018	6/21/2018	6/20/2018	6/20/2018	7/2/2018	6/20/2018	7/2/2018	7/2/2018	6/20/2018
			Sample Depth	2 ft	2 ft	2.5 ft	2.5-3 ft	2 ft	2 ft	0.5 ft	0.5 ft	2 ft	0.5 ft	2 ft	2 ft	0.5 ft
Analyte	**CAS No.**	**Unit**	**PSL (1)**													
Volatile Organic Compounds: Benzene, Toluene, Ethylbenzene, and Xylenes																
Ethylbenzene	100-41-4	mg/kg	0.010													
Toluene	108-88-3	mg/kg	0.044													
Xylene (meta & para)	108-38-3/106-42-3	mg/kg	--													
Xylene (ortho)	95-47-6	mg/kg	--													
Xylene (total)	1330-20-7	mg/kg	0.055													
Volatile Organic Compounds: Chlorinated Volatile Organic Compounds																
cis-1,2-Dichloroethene	156-59-2	mg/kg	0.0052													
Tetrachloroethene	127-18-4	mg/kg	0.0016													
Trichloroethene	79-01-6	mg/kg	0.00027													
Vinyl chloride	75-01-4	mg/kg	0.000056													
Volatile Organic Compounds: Other																
1,1-Dichloroethene	75-35-4	mg/kg	0.0025													
1,2,4-Trimethylbenzene	95-63-6	mg/kg	0.072													
1,3,5-Trimethylbenzene	108-67-8	mg/kg	0.071													
Cymene	99-87-6	mg/kg	--													
Isopropylbenzene	98-82-8	mg/kg	0.79													
n-Propylbenzene	103-65-1	mg/kg	0.88													
sec-Butylbenzene	135-98-8	mg/kg	1.3													
Trichlorofluoromethane	75-69-4	mg/kg	0.79													

Notes:

Blank cells are intentional.
All results are rounded to two significant figures.
RED/BOLD Detected result exceeds PSL.
Italics Non-detect result exceeds PSL.
1 Preliminary Screening Level as established in Table 5.2.
5 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.
6 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic equivalent Factors as presented in Table 708-2 of WAC 173-340-900.
7 Calculation was performed using only detected cPAH concentrations.
8 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.
2 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.
4 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.
3 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

Abbreviations:

CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbon
DRO Diesel-range organics
ft Feet
GRO Gasoline-range organics
HPAH High molecular weight polycyclic aromatic hydrocarbon
LPAH Low molecular weight polycyclic aromatic hydrocarbon
mg/kg Milligrams per kilogram
MTCA Model Toxics Control Act
ORO Oil-range organics
PSL Preliminary screening level
TEQ Toxic equivalent

Qualifier:

U Analyte was not detected at the associated reporting limit.

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	A3B-N1/S1-Comp	A3B-E1	A3B-N1	A3B-S1	A3B-W1	A3C-B1	A3C-B2	A3C-N1/S1-Comp	A3C-E1/W1-Comp	A3C-B1/B2-Comp	A3C-E1	A3C-N1	A3C-S1
			Sample Name	A3B-Comp1	A3B-E1-2	A3B-N1-0.5	A3B-S1-2	A3B-W1-2	A3C-B1-1	A3C-B2-1	A3C-Comp1	A3C-Comp2	A3C-Comp3	A3C-E1-0.5	A3C-N1-0.5	A3C-S1-0.5
			Sample Date	6/20/2018	7/5/2018	6/20/2018	7/2/2018	7/2/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018	6/20/2018
			Sample Depth	0.5 ft	2 ft	0.5 ft	2 ft	2 ft	1 ft	1 ft	0.5 ft	0.5-1 ft	1 ft	0.5 ft	0.5 ft	0.5 ft
Analyte	**CAS No.**	**Unit**	**PSL (1)**													
Metals																
Arsenic	7440-38-2	mg/kg	7.3		6.8	9.7	24	7.5	4.8	3.3				4.6	5.1	4.8
Barium	7440-39-3	mg/kg	8.3													
Cadmium	7440-43-9	mg/kg	0.77		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U				1.0 U	1.0 U	1.0 U
Chromium	7440-47-3	mg/kg	48			44			22	20				36	21	26
Copper	7440-50-8	mg/kg	36													
Lead	7439-92-1	mg/kg	50			31			51	34				24	34	43
Mercury	7439-97-6	mg/kg	0.070			1.0 U			1.0 U	1.0 U				1.0 U	1.0 U	1.0 U
Silver	7440-22-4	mg/kg	0.016													
Polychlorinated Biphenyls (PCBs)																
Aroclor 1016	12674-11-2	mg/kg	--	0.020 U							0.020 U	0.020 U	0.020 U			
Aroclor 1242	53469-21-9	mg/kg	--	0.020 U							0.020 U	0.020 U	0.020 U			
Aroclor 1248	12672-29-6	mg/kg	--	0.020 U							0.020 U	0.020 U	0.020 U			
Aroclor 1254	11097-69-1	mg/kg	--	0.020 U							0.020 U	0.020 U	0.020 U			
Aroclor 1260	11096-82-5	mg/kg	--	0.020 U							0.020 U	0.020 U	0.020 U			
Aroclor 1262	37324-23-5	mg/kg	--	0.020 U							0.020 U	0.020 U	0.020 U			
Total PCB Aroclors (U=0) (2)	T_PCB (U=0)	mg/kg	0.00000055	0.020 U							0.020 U	0.020 U	0.020 U			
Semi-Volatile Organic Compounds: Polycyclic Aromatic Hydrocarbons (PAHs)																
1-Methylnaphthalene	90-12-0	mg/kg	0.0042													
2-Methylnaphthalene	91-57-6	mg/kg	0.039													
Benzo(a)anthracene	56-55-3	mg/kg	--	0.50 U							0.038	0.10	0.017			
Benzo(a)pyrene	50-32-8	mg/kg	0.000016	0.50 U							0.033	0.085	0.018			
Benzo(b)fluoranthene	205-99-2	mg/kg	--	0.50 U							0.095	0.11	0.027			
Benzo(g,h,i)perylene	191-24-2	mg/kg	0.67													
Benzo(k)fluoranthene	207-08-9	mg/kg	--	0.50 U							0.030	0.041	0.010 U			
Chrysene	218-01-9	mg/kg	--	0.50 U							0.14	0.11	0.019			
Dibenzo(a,h)anthracene	53-70-3	mg/kg	--	0.50 U							0.010 U	0.010 U	0.010 U			
Fluoranthene	206-44-0	mg/kg	0.090													
Fluorene	86-73-7	mg/kg	0.029													
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg	--	0.50 U							0.020	0.028	0.010			
Naphthalene	91-20-3	mg/kg	0.0021													
Phenanthrene	85-01-8	mg/kg	1.5													
Pyrene	129-00-0	mg/kg	0.14													
Total Naphthalenes (2)	T_Napth (U=0)	mg/kg	--													
cPAHs (MTCA TEQ-ZeroND) (3,4)	BaPEq (U=0)	mg/kg	0.000016	0.50 U							0.053	0.11	0.024			
cPAHs (MTCA TEQ-HalfND) (3,5)	BaPEq (U=1/2)	mg/kg	0.000016	0.50 U							0.053	0.11	0.025			
Total HPAH (U=0) (2)	T_HPAH (U=0)	mg/kg	12													
Total LPAH (U=0) (2)	T_LPAH (U=0)	mg/kg	5.2													
Total PAH (U=0) (2)	T_PAH (U=0)	mg/kg	--													
Semi-Volatile Organic Compounds: Phthalates																
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	0.0051													
Total Petroleum Hydrocarbons																
Gasoline-range organics	GRO	mg/kg	30							5.0 U						
Diesel-range organics	DRO	mg/kg	260	700				50 U			50 U	50 U	50 U			
Oil-range organics	ORO	mg/kg	260	620				250 U			250 U	250 U	250 U			
Total DRO & ORO (2)	T_DRO&ORO (U=0)	mg/kg	260	1,300				250 U			250 U	250 U	250 U			

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	A3B-N1/S1-Comp	A3B-E1	A3B-N1	A3B-S1	A3B-W1	A3C-B1	A3C-B2	A3C-N1/S1-Comp	A3C-E1/W1-Comp	A3C-B1/B2-Comp	A3C-E1	A3C-N1	A3C-S1
			Sample Name	**A3B-Comp1**	**A3B-E1-2**	**A3B-N1-0.5**	**A3B-S1-2**	**A3B-W1-2**	**A3C-B1-1**	**A3C-B2-1**	**A3C-Comp1**	**A3C-Comp2**	**A3C-Comp3**	**A3C-E1-0.5**	**A3C-N1-0.5**	**A3C-S1-0.5**
			Sample Date	**6/20/2018**	**7/5/2018**	**6/20/2018**	**7/2/2018**	**7/2/2018**	**6/20/2018**	**6/20/2018**	**6/20/2018**	**6/20/2018**	**6/20/2018**	**6/20/2018**	**6/20/2018**	**6/20/2018**
			Sample Depth	**0.5 ft**	**2 ft**	**0.5 ft**	**2 ft**	**2 ft**	**1 ft**	**1 ft**	**0.5 ft**	**0.5-1 ft**	**1 ft**	**0.5 ft**	**0.5 ft**	**0.5 ft**
Analyte	**CAS No.**	**Unit**	**PSL [1]**													
Volatile Organic Compounds: Benzene, Toluene, Ethylbenzene, and Xylenes																
Ethylbenzene	100-41-4	mg/kg	0.010							*0.020 U*						
Toluene	108-88-3	mg/kg	0.044							0.020 U						
Xylene (meta & para)	108-38-3/106-42-3	mg/kg	--													
Xylene (ortho)	95-47-6	mg/kg	--													
Xylene (total)	1330-20-7	mg/kg	0.055							*0.060 U*						
Volatile Organic Compounds: Chlorinated Volatile Organic Compounds																
cis-1,2-Dichloroethene	156-59-2	mg/kg	0.0052													
Tetrachloroethene	127-18-4	mg/kg	0.0016													
Trichloroethene	79-01-6	mg/kg	0.00027													
Vinyl chloride	75-01-4	mg/kg	0.000056													
Volatile Organic Compounds: Other																
1,1-Dichloroethene	75-35-4	mg/kg	0.0025													
1,2,4-Trimethylbenzene	95-63-6	mg/kg	0.072													
1,3,5-Trimethylbenzene	108-67-8	mg/kg	0.071													
Cymene	99-87-6	mg/kg	--													
Isopropylbenzene	98-82-8	mg/kg	0.79													
n-Propylbenzene	103-65-1	mg/kg	0.88													
sec-Butylbenzene	135-98-8	mg/kg	1.3													
Trichlorofluoromethane	75-69-4	mg/kg	0.79													

Notes:

Blank cells are intentional.

All results are rounded to two significant figures.

RED/BOLD Detected result exceeds PSL.

Italics Non-detect result exceeds PSL.

1 Preliminary Screening Level as established in Table 5.2.

5 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

6 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic equivalent Factors as presented in Table 708-2 of WAC 173-340-900.

7 Calculation was performed using only detected cPAH concentrations.

8 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

2 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

4 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.

3 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

Abbreviations:

CAS Chemical Abstracts Service

cPAH Carcinogenic polycyclic aromatic hydrocarbon

DRO Diesel-range organics

ft Feet

GRO Gasoline-range organics

HPAH High molecular weight polycyclic aromatic hydrocarbon

LPAH Low molecular weight polycyclic aromatic hydrocarbon

mg/kg Milligrams per kilogram

MTCA Model Toxics Control Act

ORO Oil-range organics

PSL Preliminary screening level

TEQ Toxic equivalent

Qualifier:

U Analyte was not detected at the associated reporting limit.

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	A3C-W1	A4A-B1	A4A-E1	A4A-N1	A4A-S1	A4A-W1	A4B-B1	A4B-N1/W1-Comp	A4B-E1/S1-Comp	A4B-E1	A4B-N1	A4B-N2	A4B-S1
			Sample Name	A3C-W1-1	A4A-B1-2	A4A-E1-2	A4A-N1-2	A4A-S1-2	A4A-W1-2	A4B-B1-2	A4B-Comp1	A4B-Comp2	A4B-E1-2	A4B-N1-3	A4B-N2-2	A4B-S1-2
			Sample Date	6/20/2018	7/2/2018	7/2/2018	7/2/2018	7/2/2018	7/2/2018	6/19/2018	6/19/2018	6/19/2018	6/19/2018	7/3/2018	6/25/2018	6/19/2018
			Sample Depth	1 ft	2 ft	2 ft	2 ft	2 ft	2 ft	2 ft	2 ft	2 ft	2 ft	3 ft	2 ft	2 ft
Analyte	**CAS No.**	**Unit**	**PSL (1)**													
Metals																
Arsenic	7440-38-2	mg/kg	7.3	4.0						4.4			**16**	**9.1**		**9.5**
Barium	7440-39-3	mg/kg	8.3													
Cadmium	7440-43-9	mg/kg	0.77	*1.0 U*						*1.0 U*			**1.1**	**1.3**		*1.0 U*
Chromium	7440-47-3	mg/kg	48	25						17			41			19
Copper	7440-50-8	mg/kg	36													
Lead	7439-92-1	mg/kg	50	30						**160**			**260**			**230**
Mercury	7439-97-6	mg/kg	0.070	*1.0 U*						*1.0 U*			*1.0 U*			*1.0 U*
Silver	7440-22-4	mg/kg	0.016													
Polychlorinated Biphenyls (PCBs)																
Aroclor 1016	12674-11-2	mg/kg	--							0.020 U	0.020 U	0.020 U				
Aroclor 1242	53469-21-9	mg/kg	--							0.020 U	0.020 U	0.020 U				
Aroclor 1248	12672-29-6	mg/kg	--							0.020 U	0.020 U	0.020 U				
Aroclor 1254	11097-69-1	mg/kg	--							0.048	0.020 U	0.020 U				
Aroclor 1260	11096-82-5	mg/kg	--							0.020 U	0.054	0.090				
Aroclor 1262	37324-23-5	mg/kg	--							0.020 U	0.020 U	0.020 U				
Total PCB Aroclors (U=0) (2)	T_PCB (U=0)	mg/kg	0.00000055							**0.048**	**0.054**	**0.090**				
Semi-Volatile Organic Compounds: Polycyclic Aromatic Hydrocarbons (PAHs)																
1-Methylnaphthalene	90-12-0	mg/kg	0.0042													
2-Methylnaphthalene	91-57-6	mg/kg	0.039													
Benzo(a)anthracene	56-55-3	mg/kg	--							1.0 U	1.0 U	1.0 U				
Benzo(a)pyrene	50-32-8	mg/kg	0.000016							*1.0 U*	*1.0 U*	*1.0 U*				
Benzo(b)fluoranthene	205-99-2	mg/kg	--							1.0 U	1.0 U	1.0 U				
Benzo(g,h,i)perylene	191-24-2	mg/kg	0.67													
Benzo(k)fluoranthene	207-08-9	mg/kg	--							1.0 U	1.0 U	1.0 U				
Chrysene	218-01-9	mg/kg	--							1.0 U	1.0 U	1.0 U				
Dibenzo(a,h)anthracene	53-70-3	mg/kg	--							1.0 U	1.0 U	1.0 U				
Fluoranthene	206-44-0	mg/kg	0.090													
Fluorene	86-73-7	mg/kg	0.029													
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg	--							1.0 U	1.0 U	1.0 U				
Naphthalene	91-20-3	mg/kg	0.0021													
Phenanthrene	85-01-8	mg/kg	1.5													
Pyrene	129-00-0	mg/kg	0.14													
Total Naphthalenes (2)	T_Napth (U=0)	mg/kg	--													
cPAHs (MTCA TEQ-ZeroND) (3,4)	BaPEq (U=0)	mg/kg	0.000016							*1.0 U*	*1.0 U*	*1.0 U*				
cPAHs (MTCA TEQ-HalfND) (3,5)	BaPEq (U=1/2)	mg/kg	0.000016							*1.0 U*	*1.0 U*	*1.0 U*				
Total HPAH (U=0) (2)	T_HPAH (U=0)	mg/kg	12													
Total LPAH (U=0) (2)	T_LPAH (U=0)	mg/kg	5.2													
Total PAH (U=0) (2)	T_PAH (U=0)	mg/kg	--													
Semi-Volatile Organic Compounds: Phthalates																
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	0.0051													
Total Petroleum Hydrocarbons																
Gasoline-range organics	GRO	mg/kg	30													
Diesel-range organics	DRO	mg/kg	260		130 (6)	50 U	50 U	170 (6)	50 U	50 U	50 U	62 (6)			50 U	
Oil-range organics	ORO	mg/kg	260		**280**	250 U	250 U	**370**	250 U	**330**	**340**	**390**			250 U	
Total DRO & ORO (2)	T_DRO&ORO (U=0)	mg/kg	260		**410**	250 U	250 U	**540**	250 U	**330**	**340**	**450**			250 U	

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	A3C-W1	A4A-B1	A4A-E1	A4A-N1	A4A-S1	A4A-W1	A4B-B1	A4B-N1/W1-Comp	A4B-E1/S1-Comp	A4B-E1	A4B-N1	A4B-N2	A4B-S1
			Sample Name	A3C-W1-1	A4A-B1-2	A4A-E1-2	A4A-N1-2	A4A-S1-2	A4A-W1-2	A4B-B1-2	A4B-Comp1	A4B-Comp2	A4B-E1-2	A4B-N1-3	A4B-N2-2	A4B-S1-2
			Sample Date	6/20/2018	7/2/2018	7/2/2018	7/2/2018	7/2/2018	7/2/2018	6/19/2018	6/19/2018	6/19/2018	6/19/2018	7/3/2018	6/25/2018	6/19/2018
			Sample Depth	1 ft	2 ft	2 ft	2 ft	2 ft	2 ft	2 ft	2 ft	2 ft	2 ft	3 ft	2 ft	2 ft
Analyte	**CAS No.**	**Unit**	**PSL (1)**													
Volatile Organic Compounds: Benzene, Toluene, Ethylbenzene, and Xylenes																
Ethylbenzene	100-41-4	mg/kg	0.010													
Toluene	108-88-3	mg/kg	0.044													
Xylene (meta & para)	108-38-3/106-42-3	mg/kg	--													
Xylene (ortho)	95-47-6	mg/kg	--													
Xylene (total)	1330-20-7	mg/kg	0.055													
Volatile Organic Compounds: Chlorinated Volatile Organic Compounds																
cis-1,2-Dichloroethene	156-59-2	mg/kg	0.0052													
Tetrachloroethene	127-18-4	mg/kg	0.0016													
Trichloroethene	79-01-6	mg/kg	0.00027													
Vinyl chloride	75-01-4	mg/kg	0.000056													
Volatile Organic Compounds: Other																
1,1-Dichloroethene	75-35-4	mg/kg	0.0025													
1,2,4-Trimethylbenzene	95-63-6	mg/kg	0.072													
1,3,5-Trimethylbenzene	108-67-8	mg/kg	0.071													
Cymene	99-87-6	mg/kg	--													
Isopropylbenzene	98-82-8	mg/kg	0.79													
n-Propylbenzene	103-65-1	mg/kg	0.88													
sec-Butylbenzene	135-98-8	mg/kg	1.3													
Trichlorofluoromethane	75-69-4	mg/kg	0.79													

Notes:

Blank cells are intentional.

All results are rounded to two significant figures.

RED/BOLD Detected result exceeds PSL.

Italics Non-detect result exceeds PSL.

1 Preliminary Screening Level as established in Table 5.2.

2 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

3 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic equivalent Factors as presented in Table 708-2 of WAC 173-340-900.

4 Calculation was performed using only detected cPAH concentrations.

5 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

6 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

7 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.

8 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

Abbreviations:

CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbon
DRO Diesel-range organics
ft Feet
GRO Gasoline-range organics
HPAH High molecular weight polycyclic aromatic hydrocarbon
LPAH Low molecular weight polycyclic aromatic hydrocarbon
mg/kg Milligrams per kilogram
MTCA Model Toxics Control Act
ORO Oil-range organics
PSL Preliminary screening level
TEQ Toxic equivalent

Qualifier:

U Analyte was not detected at the associated reporting limit.

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	A4B-W1	A4C-B1	A4C-N1/S1-Comp	A4C-W1/E1-Comp	A4C-E1	A4C-N1	A4C-S1	A4C-W1	A5A-B1	A5A-N1/S1-Comp	A5A-E1/W1-Comp	A5A-E1	
			Sample Name	A4B-W1-2	A4C-B1-2.5	A4C-Comp1	A4C-Comp2	A4C-E1-1.5	A4C-N1-2	A4C-S1-2	A4C-W1-2	A5A-B1-6	A5A-Comp1	A5A-Comp2	A5A-E1-2	A5A-E1-6
			Sample Date	6/19/2018	6/19/2018	6/19/2018	6/19/2018	6/19/2018	7/2/2018	6/19/2018	6/19/2018	6/19/2018	6/21/2018	6/21/2018	6/21/2018	6/19/2018
			Sample Depth	2 ft	2.5 ft	0.5-2 ft	1.5-2 ft	1.5 ft	2 ft	2 ft	2 ft	6 ft	2 ft	2 ft	2 ft	6 ft
Analyte	**CAS No.**	**Unit**	**PSL [1]**													
Metals																
Arsenic	7440-38-2	mg/kg	7.3	6.4	4.4			**11**	**9.0**	**12**	7.2					1.4
Barium	7440-39-3	mg/kg	8.3													
Cadmium	7440-43-9	mg/kg	0.77	*1.0 U*	*1.0 U*			*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*			*1.0 U*	*1.0 U*
Chromium	7440-47-3	mg/kg	48	19	9.6			14		15	12					7.9
Copper	7440-50-8	mg/kg	36													
Lead	7439-92-1	mg/kg	50	**200**	3.0			**210**		**150**	**86**					1.6
Mercury	7439-97-6	mg/kg	0.070	*1.0 U*	*1.0 U*			*1.0 U*		*1.0 U*	*1.0 U*					*1.0 U*
Silver	7440-22-4	mg/kg	0.016													
Polychlorinated Biphenyls (PCBs)																
Aroclor 1016	12674-11-2	mg/kg	--		0.020 U	0.020 U	0.020 U						0.020 U	0.020 U		0.020 U
Aroclor 1242	53469-21-9	mg/kg	--		0.020 U	0.020 U	0.020 U						0.020 U	0.020 U		0.020 U
Aroclor 1248	12672-29-6	mg/kg	--		0.020 U	0.020 U	0.020 U						0.020 U	0.020 U		0.020 U
Aroclor 1254	11097-69-1	mg/kg	--		0.020 U	0.020 U	0.020 U						0.020 U	0.020 U		0.020 U
Aroclor 1260	11096-82-5	mg/kg	--		0.020 U	0.57	0.020 U						0.020 U	0.020 U		0.020 U
Aroclor 1262	37324-23-5	mg/kg	--		0.020 U	0.020 U	0.020 U						0.020 U	0.020 U		0.020 U
Total PCB Aroclors (U=0) [2]	T_PCB (U=0)	mg/kg	0.00000055		*0.020 U*	**0.57**	*0.020 U*						*0.020 U*	*0.020 U*		*0.020 U*
Semi-Volatile Organic Compounds: Polycyclic Aromatic Hydrocarbons (PAHs)																
1-Methylnaphthalene	90-12-0	mg/kg	0.0042													
2-Methylnaphthalene	91-57-6	mg/kg	0.039													
Benzo(a)anthracene	56-55-3	mg/kg	--		0.010 U	0.65	0.031		0.99	0.10 U		0.010 U	0.10 U	0.014		0.010 U
Benzo(a)pyrene	50-32-8	mg/kg	0.000016		*0.010 U*	**0.88**	**0.047**		**1.1**	**0.11**		*0.010 U*	*0.10 U*	**0.018**		*0.010 U*
Benzo(b)fluoranthene	205-99-2	mg/kg	--		0.010 U	1.5	0.064		1.1	0.16		0.010 U	0.10 U	0.027		0.010 U
Benzo(g,h,i)perylene	191-24-2	mg/kg	0.67													
Benzo(k)fluoranthene	207-08-9	mg/kg	--		0.010 U	0.39	0.024		0.41	0.10 U		0.010 U	0.10 U	0.010 U		0.010 U
Chrysene	218-01-9	mg/kg	--		0.010 U	0.77	0.051		1.1	0.15		0.010 U	0.10 U	0.018		0.010 U
Dibenzo(a,h)anthracene	53-70-3	mg/kg	--		0.010 U	0.10 U	0.010 U		0.13	0.10 U		0.010 U	0.10 U	0.010 U		0.010 U
Fluoranthene	206-44-0	mg/kg	0.090													
Fluorene	86-73-7	mg/kg	0.029													
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg	--		0.010 U	0.37	0.019		0.59	0.10 U		0.010 U	0.10 U	0.010 U		0.010 U
Naphthalene	91-20-3	mg/kg	0.0021													
Phenanthrene	85-01-8	mg/kg	1.5													
Pyrene	129-00-0	mg/kg	0.14													
Total Naphthalenes [2]	T_Napth (U=0)	mg/kg	--													
cPAHs (MTCA TEQ-ZeroND) [3,4]	BaPEq (U=0)	mg/kg	0.000016		*0.010 U*	**1.2**	**0.061**		**1.4**	**0.13**		*0.010 U*	*0.10 U*	**0.022**		*0.010 U*
cPAHs (MTCA TEQ-HalfND) [3,5]	BaPEq (U=1/2)	mg/kg	0.000016		*0.010 U*	**1.2**	**0.062**		**1.4**	**0.15**		*0.010 U*	*0.10 U*	**0.024**		*0.010 U*
Total HPAH (U=0) [2]	T_HPAH (U=0)	mg/kg	12													
Total LPAH (U=0) [2]	T_LPAH (U=0)	mg/kg	5.2													
Total PAH (U=0) [2]	T_PAH (U=0)	mg/kg	--													
Semi-Volatile Organic Compounds: Phthalates																
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	0.0051													
Total Petroleum Hydrocarbons																
Gasoline-range organics	GRO	mg/kg	30													
Diesel-range organics	DRO	mg/kg	260		50 U	**330**	50 U					50 U	50 U	50 U		50 U
Oil-range organics	ORO	mg/kg	260		250 U	**880**	250 U					250 U	250 U	250 U		250 U
Total DRO & ORO [2]	T_DRO&ORO (U=0)	mg/kg	260		250 U	**1,200**	250 U					250 U	250 U	250 U		250 U

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	A4B-W1	A4C-B1	A4C-N1/S1-Comp	A4C-W1/E1-Comp	A4C-E1	A4C-N1	A4C-S1	A4C-W1	A5A-B1	A5A-N1/S1-Comp	A5A-E1/W1-Comp	A5A-E1	
			Sample Name	**A4B-W1-2**	**A4C-B1-2.5**	**A4C-Comp1**	**A4C-Comp2**	**A4C-E1-1.5**	**A4C-N1-2**	**A4C-S1-2**	**A4C-W1-2**	**A5A-B1-6**	**A5A-Comp1**	**A5A-Comp2**	**A5A-E1-2**	**A5A-E1-6**
			Sample Date	**6/19/2018**	**6/19/2018**	**6/19/2018**	**6/19/2018**	**6/19/2018**	**7/2/2018**	**6/19/2018**	**6/19/2018**	**6/19/2018**	**6/21/2018**	**6/21/2018**	**6/21/2018**	**6/19/2018**
			Sample Depth	**2 ft**	**2.5 ft**	**0.5-2 ft**	**1.5-2 ft**	**1.5 ft**	**2 ft**	**2 ft**	**2 ft**	**6 ft**	**2 ft**	**2 ft**	**2 ft**	**6 ft**
Analyte	**CAS No.**	**Unit**	**PSL (1)**													
Volatile Organic Compounds: Benzene, Toluene, Ethylbenzene, and Xylenes																
Ethylbenzene	100-41-4	mg/kg	0.010													
Toluene	108-88-3	mg/kg	0.044													
Xylene (meta & para)	108-38-3/106-42-3	mg/kg	--													
Xylene (ortho)	95-47-6	mg/kg	--													
Xylene (total)	1330-20-7	mg/kg	0.055													
Volatile Organic Compounds: Chlorinated Volatile Organic Compounds																
cis-1,2-Dichloroethene	156-59-2	mg/kg	0.0052													
Tetrachloroethene	127-18-4	mg/kg	0.0016									*0.025 U*			*0.025 U*	
Trichloroethene	79-01-6	mg/kg	0.00027									*0.020 U*			*0.020 U*	
Vinyl chloride	75-01-4	mg/kg	0.000056													
Volatile Organic Compounds: Other																
1,1-Dichloroethene	75-35-4	mg/kg	0.0025													
1,2,4-Trimethylbenzene	95-63-6	mg/kg	0.072													
1,3,5-Trimethylbenzene	108-67-8	mg/kg	0.071													
Cymene	99-87-6	mg/kg	--													
Isopropylbenzene	98-82-8	mg/kg	0.79													
n-Propylbenzene	103-65-1	mg/kg	0.88													
sec-Butylbenzene	135-98-8	mg/kg	1.3													
Trichlorofluoromethane	75-69-4	mg/kg	0.79													

Notes:

Blank cells are intentional.

All results are rounded to two significant figures.

RED/BOLD Detected result exceeds PSL.

Italics Non-detect result exceeds PSL.

1 Preliminary Screening Level as established in Table 5.2.

2 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

3 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic equivalent Factors as presented in Table 708-2 of WAC 173-340-900.

4 Calculation was performed using only detected cPAH concentrations.

5 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

6 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

7 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.

8 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

Abbreviations:

CAS Chemical Abstracts Service

cPAH Carcinogenic polycyclic aromatic hydrocarbon

DRO Diesel-range organics

ft Feet

GRO Gasoline-range organics

HPAH High molecular weight polycyclic aromatic hydrocarbon

LPAH Low molecular weight polycyclic aromatic hydrocarbon

mg/kg Milligrams per kilogram

MTCA Model Toxics Control Act

ORO Oil-range organics

PSL Preliminary screening level

TEQ Toxic equivalent

Qualifier:

U Analyte was not detected at the associated reporting limit.

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	**A5A-N1**	**A5A-S1**	**A5A-W31**	**A5A-W32**	**A5A-W33**	**A5A-W35**	**A5A-W36**	**A5A-W38**	**A6A-B1**	**A6A-B2**	**A6A-B3**	**A6A-B4**	**A6A-S2/W1-Comp**
			Sample Name	**A5A-N1-2**	**A5A-S1-2**	**A5A-W31-7**	**A5A-W32-9**	**A5A-W33-7**	**A5A-W35-9**	**A5A-W36-7**	**A5A-W38-9**	**A6A-B1-1.5**	**A6A-B2-0.5**	**A6A-B3-3**	**A6A-B4-2.5**	**A6AC-Comp1**
			Sample Date	**6/21/2018**	**6/21/2018**	**7/12/2018**	**7/12/2018**	**7/12/2018**	**7/12/2018**	**7/12/2018**	**7/12/2018**	**6/15/2018**	**6/15/2018**	**7/6/2018**	**6/29/2018**	**6/19/2018**
			Sample Depth	**2 ft**	**2 ft**	**7 ft**	**9 ft**	**7 ft**	**9 ft**	**7 ft**	**9 ft**	**1.5 ft**	**0.5 ft**	**3 ft**	**2.5 ft**	**0.5 ft**
Analyte	**CAS No.**	**Unit**	**PSL [1]**													
Metals																
Arsenic	7440-38-2	mg/kg	7.3									5.8	**9.6**	2.1	2.3	
Barium	7440-39-3	mg/kg	8.3													
Cadmium	7440-43-9	mg/kg	0.77	*1.0 U*	*1.0 U*							*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	
Chromium	7440-47-3	mg/kg	48									8.6	13		7.1	
Copper	7440-50-8	mg/kg	36													
Lead	7439-92-1	mg/kg	50									5.5	**260**		3.6	
Mercury	7439-97-6	mg/kg	0.070									*1.0 U*	*1.0 U*		*1.0 U*	
Silver	7440-22-4	mg/kg	0.016													
Polychlorinated Biphenyls (PCBs)																
Aroclor 1016	12674-11-2	mg/kg	--												0.020 U	0.020 U
Aroclor 1242	53469-21-9	mg/kg	--												0.020 U	0.020 U
Aroclor 1248	12672-29-6	mg/kg	--												0.020 U	0.020 U
Aroclor 1254	11097-69-1	mg/kg	--												0.020 U	0.084
Aroclor 1260	11096-82-5	mg/kg	--												0.020 U	0.020 U
Aroclor 1262	37324-23-5	mg/kg	--												0.020 U	0.020 U
Total PCB Aroclors (U=0) [2]	T_PCB (U=0)	mg/kg	0.00000055												*0.020 U*	**0.084**
Semi-Volatile Organic Compounds: Polycyclic Aromatic Hydrocarbons (PAHs)																
1-Methylnaphthalene	90-12-0	mg/kg	0.0042										*0.10 U*			
2-Methylnaphthalene	91-57-6	mg/kg	0.039										*0.10 U*			
Benzo(a)anthracene	56-55-3	mg/kg	--										0.10 U		0.010 U	0.10 U
Benzo(a)pyrene	50-32-8	mg/kg	0.000016										*0.10 U*		*0.010 U*	**0.15**
Benzo(b)fluoranthene	205-99-2	mg/kg	--										0.13		0.010 U	0.18
Benzo(g,h,i)perylene	191-24-2	mg/kg	0.67										0.10 U			
Benzo(k)fluoranthene	207-08-9	mg/kg	--										0.10 U		0.010 U	0.10 U
Chrysene	218-01-9	mg/kg	--										0.11		0.010 U	0.13
Dibenzo(a,h)anthracene	53-70-3	mg/kg	--										0.10 U		0.010 U	0.10 U
Fluoranthene	206-44-0	mg/kg	0.090										**0.19**			
Fluorene	86-73-7	mg/kg	0.029										*0.10 U*			
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg	--										0.10 U		0.010 U	0.10 U
Naphthalene	91-20-3	mg/kg	0.0021										*0.10 U*			
Phenanthrene	85-01-8	mg/kg	1.5										0.10			
Pyrene	129-00-0	mg/kg	0.14										**0.24**			
Total Naphthalenes [2]	T_Napth (U=0)	mg/kg	--										0.10 U			
cPAHs (MTCA TEQ-ZeroND) [3,4]	BaPEq (U=0)	mg/kg	0.000016										**0.014**		*0.010 U*	**0.17**
cPAHs (MTCA TEQ-HalfND) [3,5]	BaPEq (U=1/2)	mg/kg	0.000016										**0.084**		*0.010 U*	**0.19**
Total HPAH (U=0) [2]	T_HPAH (U=0)	mg/kg	12										0.67			
Total LPAH (U=0) [2]	T_LPAH (U=0)	mg/kg	5.2										0.10			
Total PAH (U=0) [2]	T_PAH (U=0)	mg/kg	--										0.77			
Semi-Volatile Organic Compounds: Phthalates																
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	0.0051										*8.0 U*			
Total Petroleum Hydrocarbons																
Gasoline-range organics	GRO	mg/kg	30										5.0 U			
Diesel-range organics	DRO	mg/kg	260			**5,200 [6]**	50 U	**800 [6]**	50 U	50 U	50 U				50 U	50 U
Oil-range organics	ORO	mg/kg	260			**26,000**	250 U	**4,400**	250 U	250 U	250 U				250 U	250 U
Total DRO & ORO [2]	T_DRO&ORO (U=0)	mg/kg	260			**31,000**	250 U	**5,200**	250 U	250 U	250 U				250 U	250 U

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	A5A-N1	A5A-S1	A5A-W31	A5A-W32	A5A-W33	A5A-W35	A5A-W36	A5A-W38	A6A-B1	A6A-B2	A6A-B3	A6A-B4	A6A-S2/W1-Comp
			Sample Name	A5A-N1-2	A5A-S1-2	A5A-W31-7	A5A-W32-9	A5A-W33-7	A5A-W35-9	A5A-W36-7	A5A-W38-9	A6A-B1-1.5	A6A-B2-0.5	A6A-B3-3	A6A-B4-2.5	A6AC-Comp1
			Sample Date	6/21/2018	6/21/2018	7/12/2018	7/12/2018	7/12/2018	7/12/2018	7/12/2018	7/12/2018	6/15/2018	6/15/2018	7/6/2018	6/29/2018	6/19/2018
			Sample Depth	2 ft	2 ft	7 ft	9 ft	7 ft	9 ft	7 ft	9 ft	1.5 ft	0.5 ft	3 ft	2.5 ft	0.5 ft
Analyte	**CAS No.**	**Unit**	**PSL (1)**													
Volatile Organic Compounds: Benzene, Toluene, Ethylbenzene, and Xylenes																
Ethylbenzene	100-41-4	mg/kg	0.010										*0.020 U*			
Toluene	108-88-3	mg/kg	0.044										0.020 U			
Xylene (meta & para)	108-38-3/106-42-3	mg/kg	--													
Xylene (ortho)	95-47-6	mg/kg	--													
Xylene (total)	1330-20-7	mg/kg	0.055										*0.060 U*			
Volatile Organic Compounds: Chlorinated Volatile Organic Compounds																
cis-1,2-Dichloroethene	156-59-2	mg/kg	0.0052													
Tetrachloroethene	127-18-4	mg/kg	0.0016	*0.025 U*												
Trichloroethene	79-01-6	mg/kg	0.00027	*0.020 U*												
Vinyl chloride	75-01-4	mg/kg	0.000056													
Volatile Organic Compounds: Other																
1,1-Dichloroethene	75-35-4	mg/kg	0.0025													
1,2,4-Trimethylbenzene	95-63-6	mg/kg	0.072													
1,3,5-Trimethylbenzene	108-67-8	mg/kg	0.071													
Cymene	99-87-6	mg/kg	--													
Isopropylbenzene	98-82-8	mg/kg	0.79													
n-Propylbenzene	103-65-1	mg/kg	0.88													
sec-Butylbenzene	135-98-8	mg/kg	1.3													
Trichlorofluoromethane	75-69-4	mg/kg	0.79													

Notes:
Blank cells are intentional.
All results are rounded to two significant figures.
RED/BOLD Detected result exceeds PSL.
Italics Non-detect result exceeds PSL.
1 Preliminary Screening Level as established in Table 5.2.
2 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.
3 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic equivalent Factors as presented in Table 708-2 of WAC 173-340-900.
4 Calculation was performed using only detected cPAH concentrations.
5 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.
6 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.
7 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.
8 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

Abbreviations:
CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbon
DRO Diesel-range organics
ft Feet
GRO Gasoline-range organics
HPAH High molecular weight polycyclic aromatic hydrocarbon
LPAH Low molecular weight polycyclic aromatic hydrocarbon
mg/kg Milligrams per kilogram
MTCA Model Toxics Control Act
ORO Oil-range organics
PSL Preliminary screening level
TEQ Toxic equivalent

Qualifier:
U Analyte was not detected at the associated reporting limit.

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	A6A-W1/S1-Comp	A6A-S1/E1-Comp	A6A-B1/E2-Comp	A6A-E3/B2-Comp	A6A-N1/N2-Comp	A6A-E1	A6A-E2	A6A-E3	A6A-N1	A6A-N2	A5A-W1	A5A-W3	A5A-W4
			Sample Name	A6AC-Comp2	A6A-Comp1	A6A-Comp2	A6A-Comp3	A6A-Comp4	A6A-E1-0.5	A6A-E2-0.5	A6A-E3-0.5	A6A-N1-2	A6A-N2-3	A5A-W1-2	A5A-W3-2	A5A-W4-8
			Sample Date	6/19/2018	6/15/2018	6/15/2018	6/19/2018	6/21/2018	6/15/2018	6/15/2018	6/19/2018	6/21/2018	6/21/2018	6/21/2018	6/20/2018	7/3/2018
			Sample Depth	0.5 ft	0.5-2 ft	0.5-1.5 ft	0.5 ft	2-3 ft	0.5 ft	0.5 ft	0.5 ft	2 ft	3 ft	2 ft	2 ft	8 ft
Analyte	**CAS No.**	**Unit**	**PSL [1]**													
Metals																
Arsenic	7440-38-2	mg/kg	7.3						6.3	6.2	7.0	4.3	2.1			
Barium	7440-39-3	mg/kg	8.3													
Cadmium	7440-43-9	mg/kg	0.77						*1.0 U*	**1.6**	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	**1.9**	
Chromium	7440-47-3	mg/kg	48						11	11	11	8.5	8.8			
Copper	7440-50-8	mg/kg	36													
Lead	7439-92-1	mg/kg	50						**57**	35	**110**	5.9	3.9			
Mercury	7439-97-6	mg/kg	0.070						*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*			
Silver	7440-22-4	mg/kg	0.016													
Polychlorinated Biphenyls (PCBs)																
Aroclor 1016	12674-11-2	mg/kg	--	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U							0.020 U	
Aroclor 1242	53469-21-9	mg/kg	--	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U							0.020 U	
Aroclor 1248	12672-29-6	mg/kg	--	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U							0.020 U	
Aroclor 1254	11097-69-1	mg/kg	--	0.034	0.020 U	0.020 U	0.39	0.020 U							0.24	
Aroclor 1260	11096-82-5	mg/kg	--	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U							0.020 U	
Aroclor 1262	37324-23-5	mg/kg	--	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U							0.020 U	
Total PCB Aroclors (U=0) [2]	T_PCB (U=0)	mg/kg	0.00000055	**0.034**	*0.020 U*	*0.020 U*	**0.39**	*0.020 U*							**0.24**	
Semi-Volatile Organic Compounds: Polycyclic Aromatic Hydrocarbons (PAHs)																
1-Methylnaphthalene	90-12-0	mg/kg	0.0042													
2-Methylnaphthalene	91-57-6	mg/kg	0.039													
Benzo(a)anthracene	56-55-3	mg/kg	--	0.057	0.010 U	0.012	0.10 U	0.010 U							0.19	
Benzo(a)pyrene	50-32-8	mg/kg	0.000016	**0.077**	**0.012**	**0.015**	**0.10**	*0.010 U*							**0.22**	
Benzo(b)fluoranthene	205-99-2	mg/kg	--	0.10	0.015	0.018	0.12	0.010 U							0.36	
Benzo(g,h,i)perylene	191-24-2	mg/kg	0.67													
Benzo(k)fluoranthene	207-08-9	mg/kg	--	0.035	0.010 U	0.010 U	0.10 U	0.010 U							0.11	
Chrysene	218-01-9	mg/kg	--	0.075	0.014	0.015	0.11	0.010 U							0.25	
Dibenzo(a,h)anthracene	53-70-3	mg/kg	--	0.011	0.010 U	0.010 U	0.10 U	0.010 U							0.10 U	
Fluoranthene	206-44-0	mg/kg	0.090													
Fluorene	86-73-7	mg/kg	0.029													
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg	--	0.032	0.010 U	0.010 U	0.10 U	0.010 U							0.11	
Naphthalene	91-20-3	mg/kg	0.0021													
Phenanthrene	85-01-8	mg/kg	1.5													
Pyrene	129-00-0	mg/kg	0.14													
Total Naphthalenes [2]	T_Napth (U=0)	mg/kg	--													
cPAHs (MTCA TEQ-ZeroND) [3,4]	BaPEq (U=0)	mg/kg	0.000016	**0.10**	**0.014**	**0.018**	**0.11**	*0.010 U*							**0.30**	
cPAHs (MTCA TEQ-HalfND) [3,5]	BaPEq (U=1/2)	mg/kg	0.000016	**0.10**	**0.016**	**0.020**	**0.13**	*0.010 U*							**0.30**	
Total HPAH (U=0) [2]	T_HPAH (U=0)	mg/kg	12													
Total LPAH (U=0) [2]	T_LPAH (U=0)	mg/kg	5.2													
Total PAH (U=0) [2]	T_PAH (U=0)	mg/kg	--													
Semi-Volatile Organic Compounds: Phthalates																
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	0.0051													
Total Petroleum Hydrocarbons																
Gasoline-range organics	GRO	mg/kg	30													
Diesel-range organics	DRO	mg/kg	260	50 U	50 U	50 U	50 U	50 U							64 [6]	50 U
Oil-range organics	ORO	mg/kg	260	250 U	250 U	250 U	250 U	250 U							**400**	250 U
Total DRO & ORO [2]	T_DRO&ORO (U=0)	mg/kg	260	250 U	250 U	250 U	250 U	250 U							**460**	250 U

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	A6A-W1/S1-Comp	A6A-S1/E1-Comp	A6A-B1/E2-Comp	A6A-E3/B2-Comp	A6A-N1/N2-Comp	A6A-E1	A6A-E2	A6A-E3	A6A-N1	A6A-N2	A5A-W1	A5A-W3	A5A-W4
			Sample Name	A6AC-Comp2	A6A-Comp1	A6A-Comp2	A6A-Comp3	A6A-Comp4	A6A-E1-0.5	A6A-E2-0.5	A6A-E3-0.5	A6A-N1-2	A6A-N2-3	A5A-W1-2	A5A-W3-2	A5A-W4-8
			Sample Date	6/19/2018	6/15/2018	6/15/2018	6/19/2018	6/21/2018	6/15/2018	6/15/2018	6/19/2018	6/21/2018	6/21/2018	6/21/2018	6/20/2018	7/3/2018
			Sample Depth	0.5 ft	0.5-2 ft	0.5-1.5 ft	0.5 ft	2-3 ft	0.5 ft	0.5 ft	0.5 ft	2 ft	3 ft	2 ft	2 ft	8 ft
Analyte	**CAS No.**	**Unit**	**PSL (1)**													
Volatile Organic Compounds: Benzene, Toluene, Ethylbenzene, and Xylenes																
Ethylbenzene	100-41-4	mg/kg	0.010													
Toluene	108-88-3	mg/kg	0.044													
Xylene (meta & para)	108-38-3/106-42-3	mg/kg	--													
Xylene (ortho)	95-47-6	mg/kg	--													
Xylene (total)	1330-20-7	mg/kg	0.055													
Volatile Organic Compounds: Chlorinated Volatile Organic Compounds																
cis-1,2-Dichloroethene	156-59-2	mg/kg	0.0052													
Tetrachloroethene	127-18-4	mg/kg	0.0016													
Trichloroethene	79-01-6	mg/kg	0.00027													
Vinyl chloride	75-01-4	mg/kg	0.000056													
Volatile Organic Compounds: Other																
1,1-Dichloroethene	75-35-4	mg/kg	0.0025													
1,2,4-Trimethylbenzene	95-63-6	mg/kg	0.072													
1,3,5-Trimethylbenzene	108-67-8	mg/kg	0.071													
Cymene	99-87-6	mg/kg	--													
Isopropylbenzene	98-82-8	mg/kg	0.79													
n-Propylbenzene	103-65-1	mg/kg	0.88													
sec-Butylbenzene	135-98-8	mg/kg	1.3													
Trichlorofluoromethane	75-69-4	mg/kg	0.79													

Notes:

Blank cells are intentional.

All results are rounded to two significant figures.

RED/BOLD Detected result exceeds PSL.

Italics Non-detect result exceeds PSL.

1 Preliminary Screening Level as established in Table 5.2.

2 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

3 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic equivalent Factors as presented in Table 708-2 of WAC 173-340-900.

4 Calculation was performed using only detected cPAH concentrations.

5 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

6 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

7 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.

8 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

Abbreviations:

CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbon
DRO Diesel-range organics
ft Feet
GRO Gasoline-range organics
HPAH High molecular weight polycyclic aromatic hydrocarbon
LPAH Low molecular weight polycyclic aromatic hydrocarbon
mg/kg Milligrams per kilogram
MTCA Model Toxics Control Act
ORO Oil-range organics
PSL Preliminary screening level
TEQ Toxic equivalent

Qualifier:

U Analyte was not detected at the associated reporting limit.

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	A5A-W5	A5A-W7	A5A-W9	A5A-W10	A5A-W14	A5A-W15	A5A-W17	A5A-W18	A5A-W19	A5A-W20	A5A-W21	A5A-W22	A5A-W23
			Sample Name	A5A-W5-8	A5A-W7-9	A5A-W9-9	A5A-W10-9	A5A-W14-10	A5A-W15-10	A5A-W17-9	A5A-W18-9	A5A-W19-9	A5A-W20-9	A5A-W21-9	A5A-W22-9	A5A-W23-7
			Sample Date	7/3/2018	7/3/2018	7/3/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/11/2018	7/11/2018	7/11/2018	7/11/2018	7/11/2018	7/12/2018
			Sample Depth	8 ft	9 ft	9 ft	9 ft	10 ft	10 ft	9 ft	9 ft	9 ft	9 ft	9 ft	9 ft	7 ft
Analyte	**CAS No.**	**Unit**	**PSL (1)**													
Metals																
Arsenic	7440-38-2	mg/kg	7.3													
Barium	7440-39-3	mg/kg	8.3													
Cadmium	7440-43-9	mg/kg	0.77													
Chromium	7440-47-3	mg/kg	48													
Copper	7440-50-8	mg/kg	36													
Lead	7439-92-1	mg/kg	50													
Mercury	7439-97-6	mg/kg	0.070													
Silver	7440-22-4	mg/kg	0.016													
Polychlorinated Biphenyls (PCBs)																
Aroclor 1016	12674-11-2	mg/kg	--													
Aroclor 1242	53469-21-9	mg/kg	--													
Aroclor 1248	12672-29-6	mg/kg	--													
Aroclor 1254	11097-69-1	mg/kg	--													
Aroclor 1260	11096-82-5	mg/kg	--													
Aroclor 1262	37324-23-5	mg/kg	--													
Total PCB Aroclors (U=0) (2)	T_PCB (U=0)	mg/kg	0.00000055													
Semi-Volatile Organic Compounds: Polycyclic Aromatic Hydrocarbons (PAHs)																
1-Methylnaphthalene	90-12-0	mg/kg	0.0042													
2-Methylnaphthalene	91-57-6	mg/kg	0.039													
Benzo(a)anthracene	56-55-3	mg/kg	--													
Benzo(a)pyrene	50-32-8	mg/kg	0.000016													
Benzo(b)fluoranthene	205-99-2	mg/kg	--													
Benzo(g,h,i)perylene	191-24-2	mg/kg	0.67													
Benzo(k)fluoranthene	207-08-9	mg/kg	--													
Chrysene	218-01-9	mg/kg	--													
Dibenzo(a,h)anthracene	53-70-3	mg/kg	--													
Fluoranthene	206-44-0	mg/kg	0.090													
Fluorene	86-73-7	mg/kg	0.029													
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg	--													
Naphthalene	91-20-3	mg/kg	0.0021													
Phenanthrene	85-01-8	mg/kg	1.5													
Pyrene	129-00-0	mg/kg	0.14													
Total Naphthalenes (2)	T_Napth (U=0)	mg/kg	--													
cPAHs (MTCA TEQ-ZeroND) (3,4)	BaPEq (U=0)	mg/kg	0.000016													
cPAHs (MTCA TEQ-HalfND) (3,5)	BaPEq (U=1/2)	mg/kg	0.000016													
Total HPAH (U=0) (2)	T_HPAH (U=0)	mg/kg	12													
Total LPAH (U=0) (2)	T_LPAH (U=0)	mg/kg	5.2													
Total PAH (U=0) (2)	T_PAH (U=0)	mg/kg	--													
Semi-Volatile Organic Compounds: Phthalates																
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	0.0051													
Total Petroleum Hydrocarbons																
Gasoline-range organics	GRO	mg/kg	30													
Diesel-range organics	DRO	mg/kg	260	50 U	**380 (6)**	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
Oil-range organics	ORO	mg/kg	260	250 U	**2,100**	250 U	250 U	250 U	250 U	250 U	250 U	250 U	250 U	250 U	250 U	250 U
Total DRO & ORO (2)	T_DRO&ORO (U=0)	mg/kg	260	250 U	**2,500**	250 U	250 U	250 U	250 U	250 U	250 U	250 U	250 U	250 U	250 U	250 U

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	A5A-W5	A5A-W7	A5A-W9	A5A-W10	A5A-W14	A5A-W15	A5A-W17	A5A-W18	A5A-W19	A5A-W20	A5A-W21	A5A-W22	A5A-W23
			Sample Name	A5A-W5-8	A5A-W7-9	A5A-W9-9	A5A-W10-9	A5A-W14-10	A5A-W15-10	A5A-W17-9	A5A-W18-9	A5A-W19-9	A5A-W20-9	A5A-W21-9	A5A-W22-9	A5A-W23-7
			Sample Date	7/3/2018	7/3/2018	7/3/2018	7/5/2018	7/5/2018	7/5/2018	7/5/2018	7/11/2018	7/11/2018	7/11/2018	7/11/2018	7/11/2018	7/12/2018
			Sample Depth	8 ft	9 ft	9 ft	9 ft	10 ft	10 ft	9 ft	9 ft	9 ft	9 ft	9 ft	9 ft	7 ft
Analyte	**CAS No.**	**Unit**	**PSL (1)**													
Volatile Organic Compounds: Benzene, Toluene, Ethylbenzene, and Xylenes																
Ethylbenzene	100-41-4	mg/kg	0.010													
Toluene	108-88-3	mg/kg	0.044													
Xylene (meta & para)	108-38-3/106-42-3	mg/kg	--													
Xylene (ortho)	95-47-6	mg/kg	--													
Xylene (total)	1330-20-7	mg/kg	0.055													
Volatile Organic Compounds: Chlorinated Volatile Organic Compounds																
cis-1,2-Dichloroethene	156-59-2	mg/kg	0.0052													
Tetrachloroethene	127-18-4	mg/kg	0.0016													
Trichloroethene	79-01-6	mg/kg	0.00027													
Vinyl chloride	75-01-4	mg/kg	0.000056													
Volatile Organic Compounds: Other																
1,1-Dichloroethene	75-35-4	mg/kg	0.0025													
1,2,4-Trimethylbenzene	95-63-6	mg/kg	0.072													
1,3,5-Trimethylbenzene	108-67-8	mg/kg	0.071													
Cymene	99-87-6	mg/kg	--													
Isopropylbenzene	98-82-8	mg/kg	0.79													
n-Propylbenzene	103-65-1	mg/kg	0.88													
sec-Butylbenzene	135-98-8	mg/kg	1.3													
Trichlorofluoromethane	75-69-4	mg/kg	0.79													

Notes:

Blank cells are intentional.
All results are rounded to two significant figures.
RED/BOLD Detected result exceeds PSL.
Italics Non-detect result exceeds PSL.
1 Preliminary Screening Level as established in Table 5.2.
2 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.
3 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic equivalent Factors as presented in Table 708-2 of WAC 173-340-900.
4 Calculation was performed using only detected cPAH concentrations.
5 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.
6 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.
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HPAH High molecular weight polycyclic aromatic hydrocarbon
LPAH Low molecular weight polycyclic aromatic hydrocarbon
mg/kg Milligrams per kilogram
MTCA Model Toxics Control Act
ORO Oil-range organics
PSL Preliminary screening level
TEQ Toxic equivalent

Qualifier:

U Analyte was not detected at the associated reporting limit.

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	A5A-W25	A5A-W27	A5A-W29	A6A-S1	A6A-S2	A6A-W1	A6B-B1	A6B-S1/W1-Comp	A6B-N1/E1-Comp	A6B-E1	A6B-N1	A6B-S1	A6B-W1
			Sample Name	A5A-W25-7	A5A-W27-7	A5A-W29-7	A6A-S1-2	A6A-S2-0.5	A6A-W1-0.5	A6B-B1-2	A6B-Comp1	A6B-Comp2	A6B-E1-2	A6B-N1-2	A6B-S1-2	A6B-W1-1
			Sample Date	7/12/2018	7/12/2018	7/12/2018	6/15/2018	6/19/2018	6/19/2018	6/14/2018	6/14/2018	6/14/2018	6/14/2018	6/14/2018	6/14/2018	6/14/2018
			Sample Depth	7 ft	7 ft	7 ft	2 ft	0.5 ft	0.5 ft	2 ft	1-2 ft	2 ft	2 ft	2 ft	2 ft	1 ft
Analyte	**CAS No.**	**Unit**	**PSL** (1)													
Metals																
Arsenic	7440-38-2	mg/kg	7.3				4.1	**8.4**	**9.1**	6.3			3.8	3.2	5.1	7.1
Barium	7440-39-3	mg/kg	8.3													
Cadmium	7440-43-9	mg/kg	0.77				*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*			*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*
Chromium	7440-47-3	mg/kg	48				7.9	11	13	9.6			7.6	9.0	8.4	9.8
Copper	7440-50-8	mg/kg	36													
Lead	7439-92-1	mg/kg	50				5.8	19	**60**	13			3.2	4.4	5.6	7.1
Mercury	7439-97-6	mg/kg	0.070				*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*			*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*
Silver	7440-22-4	mg/kg	0.016													
Polychlorinated Biphenyls (PCBs)																
Aroclor 1016	12674-11-2	mg/kg	--							0.020 U	0.020 U	0.020 U				
Aroclor 1242	53469-21-9	mg/kg	--							0.020 U	0.020 U	0.020 U				
Aroclor 1248	12672-29-6	mg/kg	--							0.020 U	0.020 U	0.020 U				
Aroclor 1254	11097-69-1	mg/kg	--							0.020 U	0.020 U	0.020 U				
Aroclor 1260	11096-82-5	mg/kg	--							0.020 U	0.020 U	0.020 U				
Aroclor 1262	37324-23-5	mg/kg	--							0.020 U	0.020 U	0.020 U				
Total PCB Aroclors (U=0) (2)	T_PCB (U=0)	mg/kg	0.00000055							*0.020 U*	*0.020 U*	*0.020 U*				
Semi-Volatile Organic Compounds: Polycyclic Aromatic Hydrocarbons (PAHs)																
1-Methylnaphthalene	90-12-0	mg/kg	0.0042							0.0020 U						
2-Methylnaphthalene	91-57-6	mg/kg	0.039							0.0020 U						
Benzo(a)anthracene	56-55-3	mg/kg	--							0.0020 U	0.010 U	0.010 U				
Benzo(a)pyrene	50-32-8	mg/kg	0.000016							*0.0020 U*	*0.010 U*	*0.010 U*				
Benzo(b)fluoranthene	205-99-2	mg/kg	--							0.0023	0.010 U	0.010 U				
Benzo(g,h,i)perylene	191-24-2	mg/kg	0.67							0.0020 U						
Benzo(k)fluoranthene	207-08-9	mg/kg	--							0.0020 U	0.010 U	0.010 U				
Chrysene	218-01-9	mg/kg	--							0.0020 U	0.010 U	0.010 U				
Dibenzo(a,h)anthracene	53-70-3	mg/kg	--							0.0020 U	0.010 U	0.010 U				
Fluoranthene	206-44-0	mg/kg	0.090							0.0025						
Fluorene	86-73-7	mg/kg	0.029							0.0020 U						
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg	--							0.0020 U	0.010 U	0.010 U				
Naphthalene	91-20-3	mg/kg	0.0021							0.0020 U						
Phenanthrene	85-01-8	mg/kg	1.5							0.0020 U						
Pyrene	129-00-0	mg/kg	0.14							0.0030						
Total Naphthalenes (2)	T_Napth (U=0)	mg/kg	--							0.0020 U						
cPAHs (MTCA TEQ-ZeroND) (3,4)	BaPEq (U=0)	mg/kg	0.000016							**0.00023**	*0.010 U*	*0.010 U*				
cPAHs (MTCA TEQ-HalfND) (3,5)	BaPEq (U=1/2)	mg/kg	0.000016							**0.0016**	*0.010 U*	*0.010 U*				
Total HPAH (U=0) (2)	T_HPAH (U=0)	mg/kg	12							0.0078						
Total LPAH (U=0) (2)	T_LPAH (U=0)	mg/kg	5.2							0.0020 U						
Total PAH (U=0) (2)	T_PAH (U=0)	mg/kg	--							0.0078						
Semi-Volatile Organic Compounds: Phthalates																
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	0.0051							*0.16 U*						
Total Petroleum Hydrocarbons																
Gasoline-range organics	GRO	mg/kg	30							5.0 U						
Diesel-range organics	DRO	mg/kg	260	50 U	87	**1,700** (6)				50 U	50 U	50 U				
Oil-range organics	ORO	mg/kg	260	250 U	**670**	**12,000**				250 U	250 U	250 U				
Total DRO & ORO (2)	T_DRO&ORO (U=0)	mg/kg	260	250 U	**760**	**14,000**				250 U	250 U	250 U				

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	A5A-W25	A5A-W27	A5A-W29	A6A-S1	A6A-S2	A6A-W1	A6B-B1	A6B-S1/W1-Comp	A6B-N1/E1-Comp	A6B-E1	A6B-N1	A6B-S1	A6B-W1
			Sample Name	A5A-W25-7	A5A-W27-7	A5A-W29-7	A6A-S1-2	A6A-S2-0.5	A6A-W1-0.5	A6B-B1-2	A6B-Comp1	A6B-Comp2	A6B-E1-2	A6B-N1-2	A6B-S1-2	A6B-W1-1
			Sample Date	7/12/2018	7/12/2018	7/12/2018	6/15/2018	6/19/2018	6/19/2018	6/14/2018	6/14/2018	6/14/2018	6/14/2018	6/14/2018	6/14/2018	6/14/2018
			Sample Depth	7 ft	7 ft	7 ft	2 ft	0.5 ft	0.5 ft	2 ft	1-2 ft	2 ft	2 ft	2 ft	2 ft	1 ft
Analyte	**CAS No.**	**Unit**	**PSL (1)**													
Volatile Organic Compounds: Benzene, Toluene, Ethylbenzene, and Xylenes																
Ethylbenzene	100-41-4	mg/kg	0.010							*0.020 U*						
Toluene	108-88-3	mg/kg	0.044							0.020 U						
Xylene (meta & para)	108-38-3/106-42-3	mg/kg	--													
Xylene (ortho)	95-47-6	mg/kg	--													
Xylene (total)	1330-20-7	mg/kg	0.055							*0.060 U*						
Volatile Organic Compounds: Chlorinated Volatile Organic Compounds																
cis-1,2-Dichloroethene	156-59-2	mg/kg	0.0052													
Tetrachloroethene	127-18-4	mg/kg	0.0016													
Trichloroethene	79-01-6	mg/kg	0.00027													
Vinyl chloride	75-01-4	mg/kg	0.000056													
Volatile Organic Compounds: Other																
1,1-Dichloroethene	75-35-4	mg/kg	0.0025													
1,2,4-Trimethylbenzene	95-63-6	mg/kg	0.072													
1,3,5-Trimethylbenzene	108-67-8	mg/kg	0.071													
Cymene	99-87-6	mg/kg	--													
Isopropylbenzene	98-82-8	mg/kg	0.79													
n-Propylbenzene	103-65-1	mg/kg	0.88													
sec-Butylbenzene	135-98-8	mg/kg	1.3													
Trichlorofluoromethane	75-69-4	mg/kg	0.79													

Notes:

Blank cells are intentional.
All results are rounded to two significant figures.
RED/BOLD Detected result exceeds PSL.
Italics Non-detect result exceeds PSL.
1 Preliminary Screening Level as established in Table 5.2.
2 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.
3 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic equivalent Factors as presented in Table 708-2 of WAC 173-340-900.
4 Calculation was performed using only detected cPAH concentrations.
5 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.
6 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.
7 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.
8 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

Abbreviations:

CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbon
DRO Diesel-range organics
ft Feet
GRO Gasoline-range organics
HPAH High molecular weight polycyclic aromatic hydrocarbon
LPAH Low molecular weight polycyclic aromatic hydrocarbon
mg/kg Milligrams per kilogram
MTCA Model Toxics Control Act
ORO Oil-range organics
PSL Preliminary screening level
TEQ Toxic equivalent

Qualifier:

U Analyte was not detected at the associated reporting limit.

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	A6C-B1		A6C-N1/B1-Comp	A6C-N1		A6C-S1	A6C-W1	EY-SP1	EY-SP3	EY-SP6	FT1-B1-12	FT1-NS-6.5	FT1-WS-6.5
			Sample Name	A6C-B1-0.5	A6C-B1-0.5-R	A6C-Comp1	A6C-N1-0.5	A6C-N1-0.5-R	A6C-S1-0.5	A6C-W1-2	EY-SP1	EY-SP3	EY-SP6	FT1-B1-12	FT1-NS-6.5	FT1-WS-6.5
			Sample Date	6/15/2018	7/2/2018	6/15/2018	6/15/2018	7/2/2018	6/15/2018	7/2/2018	6/27/2018	6/29/2018	7/6/2018	4/27/2017	4/27/2017	4/27/2017
			Sample Depth	0.5 ft	0.5 ft	0.5 ft	0.5 ft	0.5 ft	0.5 ft	2 ft				12 ft	6.5 ft	6.5 ft
Analyte	**CAS No.**	**Unit**	**PSL** (1)													
Metals																
Arsenic	7440-38-2	mg/kg	7.3	**12**			**15**		**18**	**11**			5.7			
Barium	7440-39-3	mg/kg	8.3													
Cadmium	7440-43-9	mg/kg	0.77	**1.1**			*1.0 U*		**1.2**	*1.0 U*			*1.0 U*			
Chromium	7440-47-3	mg/kg	48	20			18		16							
Copper	7440-50-8	mg/kg	36													
Lead	7439-92-1	mg/kg	50	**630**			**450**		**410**				7.2			
Mercury	7439-97-6	mg/kg	0.070	*1.0 U*			*1.0 U*		*1.0 U*							
Silver	7440-22-4	mg/kg	0.016													
Polychlorinated Biphenyls (PCBs)																
Aroclor 1016	12674-11-2	mg/kg	--			0.020 U										
Aroclor 1242	53469-21-9	mg/kg	--			0.020 U										
Aroclor 1248	12672-29-6	mg/kg	--			0.020 U										
Aroclor 1254	11097-69-1	mg/kg	--			0.020 U										
Aroclor 1260	11096-82-5	mg/kg	--			0.042										
Aroclor 1262	37324-23-5	mg/kg	--			0.020 U										
Total PCB Aroclors (U=0) (2)	T_PCB (U=0)	mg/kg	0.00000055			**0.042**										
Semi-Volatile Organic Compounds: Polycyclic Aromatic Hydrocarbons (PAHs)																
1-Methylnaphthalene	90-12-0	mg/kg	0.0042													
2-Methylnaphthalene	91-57-6	mg/kg	0.039													
Benzo(a)anthracene	56-55-3	mg/kg	--		0.10 U	1.0 U		0.10 U								
Benzo(a)pyrene	50-32-8	mg/kg	0.000016		**0.18**	**1.2**		**0.11**								
Benzo(b)fluoranthene	205-99-2	mg/kg	--		0.22	1.2		0.15								
Benzo(g,h,i)perylene	191-24-2	mg/kg	0.67													
Benzo(k)fluoranthene	207-08-9	mg/kg	--		0.10 U	1.0 U		0.10 U								
Chrysene	218-01-9	mg/kg	--		0.12	1.1		0.11								
Dibenzo(a,h)anthracene	53-70-3	mg/kg	--		0.10 U	1.0 U		0.10 U								
Fluoranthene	206-44-0	mg/kg	0.090													
Fluorene	86-73-7	mg/kg	0.029													
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg	--		0.10 U	1.0 U		0.10 U								
Naphthalene	91-20-3	mg/kg	0.0021													
Phenanthrene	85-01-8	mg/kg	1.5													
Pyrene	129-00-0	mg/kg	0.14													
Total Naphthalenes (2)	T_Napth (U=0)	mg/kg	--													
cPAHs (MTCA TEQ-ZeroND) (3,4)	BaPEq (U=0)	mg/kg	0.000016		**0.20**	**1.3**		**0.13**								
cPAHs (MTCA TEQ-HalfND) (3,5)	BaPEq (U=1/2)	mg/kg	0.000016		**0.22**	**1.5**		**0.15**								
Total HPAH (U=0) (2)	T_HPAH (U=0)	mg/kg	12													
Total LPAH (U=0) (2)	T_LPAH (U=0)	mg/kg	5.2													
Total PAH (U=0) (2)	T_PAH (U=0)	mg/kg	--													
Semi-Volatile Organic Compounds: Phthalates																
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	0.0051													
Total Petroleum Hydrocarbons																
Gasoline-range organics	GRO	mg/kg	30													
Diesel-range organics	DRO	mg/kg	260			50 U					**560**	**340**				
Oil-range organics	ORO	mg/kg	260			**410**					250 U	250 U				
Total DRO & ORO (2)	T_DRO&ORO (U=0)	mg/kg	260			**410**					**560**	**340**				

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	A6C-B1		A6C-N1/B1-Comp	A6C-N1		A6C-S1	A6C-W1	EY-SP1	EY-SP3	EY-SP6	FT1-B1-12	FT1-NS-6.5	FT1-WS-6.5
			Sample Name	**A6C-B1-0.5**	**A6C-B1-0.5-R**	**A6C-Comp1**	**A6C-N1-0.5**	**A6C-N1-0.5-R**	**A6C-S1-0.5**	**A6C-W1-2**	**EY-SP1**	**EY-SP3**	**EY-SP6**	**FT1-B1-12**	**FT1-NS-6.5**	**FT1-WS-6.5**
			Sample Date	**6/15/2018**	**7/2/2018**	**6/15/2018**	**6/15/2018**	**7/2/2018**	**6/15/2018**	**7/2/2018**	**6/27/2018**	**6/29/2018**	**7/6/2018**	**4/27/2017**	**4/27/2017**	**4/27/2017**
			Sample Depth	**0.5 ft**	**0.5 ft**	**0.5 ft**	**0.5 ft**	**0.5 ft**	**0.5 ft**	**2 ft**				**12 ft**	**6.5 ft**	**6.5 ft**
Analyte	**CAS No.**	**Unit**	**PSL (1)**													
Volatile Organic Compounds: Benzene, Toluene, Ethylbenzene, and Xylenes																
Ethylbenzene	100-41-4	mg/kg	0.010											**0.041**	*0.020 U*	*0.020 U*
Toluene	108-88-3	mg/kg	0.044											**0.067**	0.020 U	0.020 U
Xylene (meta & para)	108-38-3/106-42-3	mg/kg	--													
Xylene (ortho)	95-47-6	mg/kg	--													
Xylene (total)	1330-20-7	mg/kg	0.055											**0.31**	*0.060 U*	*0.060 U*
Volatile Organic Compounds: Chlorinated Volatile Organic Compounds																
cis-1,2-Dichloroethene	156-59-2	mg/kg	0.0052													
Tetrachloroethene	127-18-4	mg/kg	0.0016													
Trichloroethene	79-01-6	mg/kg	0.00027													
Vinyl chloride	75-01-4	mg/kg	0.000056													
Volatile Organic Compounds: Other																
1,1-Dichloroethene	75-35-4	mg/kg	0.0025													
1,2,4-Trimethylbenzene	95-63-6	mg/kg	0.072													
1,3,5-Trimethylbenzene	108-67-8	mg/kg	0.071													
Cymene	99-87-6	mg/kg	--													
Isopropylbenzene	98-82-8	mg/kg	0.79													
n-Propylbenzene	103-65-1	mg/kg	0.88													
sec-Butylbenzene	135-98-8	mg/kg	1.3													
Trichlorofluoromethane	75-69-4	mg/kg	0.79													

Notes:

Blank cells are intentional.

All results are rounded to two significant figures.

RED/BOLD Detected result exceeds PSL.

Italics Non-detect result exceeds PSL.

1 Preliminary Screening Level as established in Table 5.2.

2 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

3 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic equivalent Factors as presented in Table 708-2 of WAC 173-340-900.

4 Calculation was performed using only detected cPAH concentrations.

5 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

6 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

7 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.

8 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

Abbreviations:

CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbon
DRO Diesel-range organics
ft Feet
GRO Gasoline-range organics
HPAH High molecular weight polycyclic aromatic hydrocarbon
LPAH Low molecular weight polycyclic aromatic hydrocarbon
mg/kg Milligrams per kilogram
MTCA Model Toxics Control Act
ORO Oil-range organics
PSL Preliminary screening level
TEQ Toxic equivalent

Qualifier:

U Analyte was not detected at the associated reporting limit.

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	FT2-B1-12	FT2-B2-12	FT2-SS1-6.5	FT2-SS2-6.5	FT2-WS-6.5	FT3-B1-12	FT3-ES-12	FT3-ES-4	FT3-ES-6.5	FT3-SS-6.5	FT4-B1-12	FT4-B2-12	FT4-ES-6.5
			Sample Name	FT2-B1-12	FT2-B2-12	FT2-SS1-6.5	FT2-SS2-6.5	FT2-WS-6.5	FT3-B1-12	FT3-ES-12	FT3-ES-4	FT3-ES-6.5	FT3-SS-6.5	FT4-B1-12	FT4-B2-12	FT4-E5-6.5
			Sample Date	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/27/2017	4/28/2017	4/28/2017	4/28/2017
			Sample Depth	12 ft	12 ft	6.5 ft	6.5 ft	6.5 ft	12 ft	12 ft	4 ft	6.5 ft	6.5 ft	12 ft	12 ft	6.5 ft
Analyte	**CAS No.**	**Unit**	**PSL [1]**													
Metals																
Arsenic	7440-38-2	mg/kg	7.3									2.9				
Barium	7440-39-3	mg/kg	8.3									**25**				
Cadmium	7440-43-9	mg/kg	0.77									*1.0 U*				
Chromium	7440-47-3	mg/kg	48									6.0				
Copper	7440-50-8	mg/kg	36													
Lead	7439-92-1	mg/kg	50									2.1				
Mercury	7439-97-6	mg/kg	0.070									*1.0 U*				
Silver	7440-22-4	mg/kg	0.016									*1.0 U*				
Polychlorinated Biphenyls (PCBs)																
Aroclor 1016	12674-11-2	mg/kg	--													
Aroclor 1242	53469-21-9	mg/kg	--													
Aroclor 1248	12672-29-6	mg/kg	--													
Aroclor 1254	11097-69-1	mg/kg	--													
Aroclor 1260	11096-82-5	mg/kg	--													
Aroclor 1262	37324-23-5	mg/kg	--													
Total PCB Aroclors (U=0) [2]	T_PCB (U=0)	mg/kg	0.00000055													
Semi-Volatile Organic Compounds: Polycyclic Aromatic Hydrocarbons (PAHs)																
1-Methylnaphthalene	90-12-0	mg/kg	0.0042													
2-Methylnaphthalene	91-57-6	mg/kg	0.039													
Benzo(a)anthracene	56-55-3	mg/kg	--													
Benzo(a)pyrene	50-32-8	mg/kg	0.000016													
Benzo(b)fluoranthene	205-99-2	mg/kg	--													
Benzo(g,h,i)perylene	191-24-2	mg/kg	0.67													
Benzo(k)fluoranthene	207-08-9	mg/kg	--													
Chrysene	218-01-9	mg/kg	--													
Dibenzo(a,h)anthracene	53-70-3	mg/kg	--													
Fluoranthene	206-44-0	mg/kg	0.090													
Fluorene	86-73-7	mg/kg	0.029													
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg	--													
Naphthalene	91-20-3	mg/kg	0.0021													
Phenanthrene	85-01-8	mg/kg	1.5													
Pyrene	129-00-0	mg/kg	0.14													
Total Naphthalenes [2]	T_Napth (U=0)	mg/kg	--													
cPAHs (MTCA TEQ-ZeroND) [3,4]	BaPEq (U=0)	mg/kg	0.000016													
cPAHs (MTCA TEQ-HalfND) [3,5]	BaPEq (U=1/2)	mg/kg	0.000016													
Total HPAH (U=0) [2]	T_HPAH (U=0)	mg/kg	12													
Total LPAH (U=0) [2]	T_LPAH (U=0)	mg/kg	5.2													
Total PAH (U=0) [2]	T_PAH (U=0)	mg/kg	--													
Semi-Volatile Organic Compounds: Phthalates																
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	0.0051													
Total Petroleum Hydrocarbons																
Gasoline-range organics	GRO	mg/kg	30					2.0 U		2.0 U	2.0 U	2.0 U				
Diesel-range organics	DRO	mg/kg	260					50 U		50 U	**320**	50 U				
Oil-range organics	ORO	mg/kg	260					250 U		250 U	250 U	250 U				
Total DRO & ORO [2]	T_DRO&ORO (U=0)	mg/kg	260					250 U		250 U	**320**	250 U				

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	FT2-B1-12	FT2-B2-12	FT2-SS1-6.5	FT2-SS2-6.5	FT2-WS-6.5	FT3-B1-12	FT3-ES-12	FT3-ES-4	FT3-ES-6.5	FT3-SS-6.5	FT4-B1-12	FT4-B2-12	FT4-ES-6.5
			Sample Name	**FT2-B1-12**	**FT2-B2-12**	**FT2-SS1-6.5**	**FT2-SS2-6.5**	**FT2-WS-6.5**	**FT3-B1-12**	**FT3-ES-12**	**FT3-ES-4**	**FT3-ES-6.5**	**FT3-SS-6.5**	**FT4-B1-12**	**FT4-B2-12**	**FT4-ES-6.5**
			Sample Date	**4/27/2017**	**4/27/2017**	**4/27/2017**	**4/27/2017**	**4/27/2017**	**4/27/2017**	**4/27/2017**	**4/27/2017**	**4/27/2017**	**4/27/2017**	**4/28/2017**	**4/28/2017**	**4/28/2017**
			Sample Depth	**12 ft**	**12 ft**	**6.5 ft**	**6.5 ft**	**6.5 ft**	**12 ft**	**12 ft**	**4 ft**	**6.5 ft**	**6.5 ft**	**12 ft**	**12 ft**	**6.5 ft**
Analyte	**CAS No.**	**Unit**	**PSL [1]**													
Volatile Organic Compounds: Benzene, Toluene, Ethylbenzene, and Xylenes																
Ethylbenzene	100-41-4	mg/kg	0.010	*0.020 U*	*0.020 U*	*0.020 U*	*0.020 U*	*0.020 U*	*0.020 U*	*0.020 U*	*0.020 U*	*0.020 U*	*0.020 U*	*0.020 U*	*0.020 U*	*0.020 U*
Toluene	108-88-3	mg/kg	0.044	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U
Xylene (meta & para)	108-38-3/106-42-3	mg/kg	--													
Xylene (ortho)	95-47-6	mg/kg	--													
Xylene (total)	1330-20-7	mg/kg	0.055	*0.060 U*	*0.060 U*	*0.060 U*	*0.060 U*	*0.060 U*	*0.060 U*	*0.060 U*	*0.060 U*	*0.060 U*	*0.060 U*	*0.060 U*	*0.060 U*	*0.060 U*
Volatile Organic Compounds: Chlorinated Volatile Organic Compounds																
cis-1,2-Dichloroethene	156-59-2	mg/kg	0.0052													
Tetrachloroethene	127-18-4	mg/kg	0.0016													
Trichloroethene	79-01-6	mg/kg	0.00027													
Vinyl chloride	75-01-4	mg/kg	0.000056													
Volatile Organic Compounds: Other																
1,1-Dichloroethene	75-35-4	mg/kg	0.0025													
1,2,4-Trimethylbenzene	95-63-6	mg/kg	0.072													
1,3,5-Trimethylbenzene	108-67-8	mg/kg	0.071													
Cymene	99-87-6	mg/kg	--													
Isopropylbenzene	98-82-8	mg/kg	0.79													
n-Propylbenzene	103-65-1	mg/kg	0.88													
sec-Butylbenzene	135-98-8	mg/kg	1.3													
Trichlorofluoromethane	75-69-4	mg/kg	0.79													

Notes:

Blank cells are intentional.

All results are rounded to two significant figures.

RED/BOLD Detected result exceeds PSL.

Italics Non-detect result exceeds PSL.

1 Preliminary Screening Level as established in Table 5.2.

2 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

3 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic equivalent Factors as presented in Table 708-2 of WAC 173-340-900.

4 Calculation was performed using only detected cPAH concentrations.

5 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

6 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

7 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.

8 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

Abbreviations:

CAS Chemical Abstracts Service

cPAH Carcinogenic polycyclic aromatic hydrocarbon

DRO Diesel-range organics

ft Feet

GRO Gasoline-range organics

HPAH High molecular weight polycyclic aromatic hydrocarbon

LPAH Low molecular weight polycyclic aromatic hydrocarbon

mg/kg Milligrams per kilogram

MTCA Model Toxics Control Act

ORO Oil-range organics

PSL Preliminary screening level

TEQ Toxic equivalent

Qualifier:

U Analyte was not detected at the associated reporting limit.

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	FT4-NS1-6.5	FT4-NS2-6.5	HA-02	MW-03R	MW-07	MW-08	MW-09	MW-10	MW-12	P1	P2	P3	P4
			Sample Name	FT4-NS1-6.5	FT4-NS2-6.5	HA-02-0.75	MW3R-2	MW7-5	MW8-3	MW9-2.5	MW10-2.5	MW12-2.5	P1-4	P2-4	P3-5	P4-8
			Sample Date	4/28/2017	4/28/2017	1/12/2004	3/9/2016	3/8/2016	3/9/2016	3/8/2016	3/8/2016	3/8/2016	4/21/2015	4/21/2015	4/21/2015	4/21/2015
			Sample Depth	6.5 ft	6.5 ft	0.75 ft	2 ft	5 ft	3 ft	2.5 ft	2.5 ft	2.5 ft	4 ft	4 ft	5 ft	8 ft
Analyte	**CAS No.**	**Unit**	**PSL [1]**													
Metals																
Arsenic	7440-38-2	mg/kg	7.3				2.1	1.8	4.9	6.8	2.0				2.5	
Barium	7440-39-3	mg/kg	8.3				**27**		**26**		**14**				**44**	
Cadmium	7440-43-9	mg/kg	0.77				1.0 U	1.0 U	1.0 U	1.0 U	1.0 U				1.0 U	
Chromium	7440-47-3	mg/kg	48				8.6		7.0		6.1				7.2	
Copper	7440-50-8	mg/kg	36													
Lead	7439-92-1	mg/kg	50				7.3	2.1	47	37	4.0				3.4	
Mercury	7439-97-6	mg/kg	0.070				1.0 U		1.0 U		1.0 U				1.0 U	
Silver	7440-22-4	mg/kg	0.016				1.0 U		1.0 U		1.0 U				1.0 U	
Polychlorinated Biphenyls (PCBs)																
Aroclor 1016	12674-11-2	mg/kg	--				0.020 U		0.020 U	0.020 U	0.020 U		0.020 U	0.020 U	0.020 U	
Aroclor 1242	53469-21-9	mg/kg	--				0.020 U		0.020 U	0.020 U	0.020 U		0.020 U	0.020 U	0.020 U	
Aroclor 1248	12672-29-6	mg/kg	--				0.020 U		0.020 U	0.020 U	0.020 U		0.020 U	0.020 U	0.020 U	
Aroclor 1254	11097-69-1	mg/kg	--				0.020 U		0.020 U	0.18	0.020 U		0.020 U	0.020 U	0.020 U	
Aroclor 1260	11096-82-5	mg/kg	--				0.020 U		0.020 U	0.020 U	0.020 U		0.020 U	0.020 U	0.020 U	
Aroclor 1262	37324-23-5	mg/kg	--				0.020 U		0.020 U	0.020 U	0.020 U		0.020 U	0.020 U	0.020 U	
Total PCB Aroclors (U=0) [2]	T_PCB (U=0)	mg/kg	0.00000055				0.020 U		0.020 U	**0.18**	0.020 U		0.020 U	0.020 U	0.020 U	
Semi-Volatile Organic Compounds: Polycyclic Aromatic Hydrocarbons (PAHs)																
1-Methylnaphthalene	90-12-0	mg/kg	0.0042													
2-Methylnaphthalene	91-57-6	mg/kg	0.039													
Benzo(a)anthracene	56-55-3	mg/kg	--				0.50 U		0.013							
Benzo(a)pyrene	50-32-8	mg/kg	0.000016				0.50 U		**0.018**							
Benzo(b)fluoranthene	205-99-2	mg/kg	--				0.50 U		0.026							
Benzo(g,h,i)perylene	191-24-2	mg/kg	0.67													
Benzo(k)fluoranthene	207-08-9	mg/kg	--				0.50 U		0.010 U							
Chrysene	218-01-9	mg/kg	--				0.50 U		0.020							
Dibenzo(a,h)anthracene	53-70-3	mg/kg	--				0.50 U		0.010 U							
Fluoranthene	206-44-0	mg/kg	0.090													
Fluorene	86-73-7	mg/kg	0.029													
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg	--				0.50 U		0.010 U							
Naphthalene	91-20-3	mg/kg	0.0021				0.050 U			0.050 U	0.050 U					
Phenanthrene	85-01-8	mg/kg	1.5													
Pyrene	129-00-0	mg/kg	0.14													
Total Naphthalenes [2]	T_Napth (U=0)	mg/kg	--													
cPAHs (MTCA TEQ-ZeroND) [3,4]	BaPEq (U=0)	mg/kg	0.000016				0.50 U		**0.022**							
cPAHs (MTCA TEQ-HalfND) [3,5]	BaPEq (U=1/2)	mg/kg	0.000016				0.50 U		**0.024**							
Total HPAH (U=0) [2]	T_HPAH (U=0)	mg/kg	12													
Total LPAH (U=0) [2]	T_LPAH (U=0)	mg/kg	5.2													
Total PAH (U=0) [2]	T_PAH (U=0)	mg/kg	--													
Semi-Volatile Organic Compounds: Phthalates																
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	0.0051													
Total Petroleum Hydrocarbons																
Gasoline-range organics	GRO	mg/kg	30													2.0 U
Diesel-range organics	DRO	mg/kg	260				**740** [6]	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
Oil-range organics	ORO	mg/kg	260				**8,900**	250 U	250 U	250 U	250 U	250 U	250 U	250 U	250 U	250 U
Total DRO & ORO [2]	T_DRO&ORO (U=0)	mg/kg	260				**9,600**	250 U	250 U	250 U	250 U	250 U	250 U	250 U	250 U	250 U

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	FT4-NS1-6.5	FT4-NS2-6.5	HA-02	MW-03R	MW-07	MW-08	MW-09	MW-10	MW-12	P1	P2	P3	P4
			Sample Name	**FT4-NS1-6.5**	**FT4-NS2-6.5**	**HA-02-0.75**	**MW3R-2**	**MW7-5**	**MW8-3**	**MW9-2.5**	**MW10-2.5**	**MW12-2.5**	**P1-4**	**P2-4**	**P3-5**	**P4-8**
			Sample Date	**4/28/2017**	**4/28/2017**	**1/12/2004**	**3/9/2016**	**3/8/2016**	**3/9/2016**	**3/8/2016**	**3/8/2016**	**3/8/2016**	**4/21/2015**	**4/21/2015**	**4/21/2015**	**4/21/2015**
			Sample Depth	**6.5 ft**	**6.5 ft**	**0.75 ft**	**2 ft**	**5 ft**	**3 ft**	**2.5 ft**	**2.5 ft**	**2.5 ft**	**4 ft**	**4 ft**	**5 ft**	**8 ft**
Analyte	**CAS No.**	**Unit**	**PSL (1)**													
Volatile Organic Compounds: Benzene, Toluene, Ethylbenzene, and Xylenes																
Ethylbenzene	100-41-4	mg/kg	0.010	*0.020 U*	*0.020 U*		*0.050 U*			*0.050 U*	*0.050 U*					*0.020 U*
Toluene	108-88-3	mg/kg	0.044	0.020 U	0.020 U		*0.050 U*			*0.050 U*	*0.050 U*					0.020 U
Xylene (meta & para)	108-38-3/106-42-3	mg/kg	--				0.10 U			0.10 U	0.10 U					
Xylene (ortho)	95-47-6	mg/kg	--				0.050 U			0.050 U	0.050 U					
Xylene (total)	1330-20-7	mg/kg	0.055	*0.060 U*	*0.060 U*		*0.10 U*			*0.10 U*	*0.10 U*					*0.060 U*
Volatile Organic Compounds: Chlorinated Volatile Organic Compounds																
cis-1,2-Dichloroethene	156-59-2	mg/kg	0.0052			*0.010 U*	*0.050 U*			*0.050 U*	*0.050 U*					
Tetrachloroethene	127-18-4	mg/kg	0.0016			*0.010 U*	*0.025 U*			*0.025 U*	*0.025 U*					
Trichloroethene	79-01-6	mg/kg	0.00027			*0.010 U*	*0.020 U*			*0.020 U*	*0.020 U*					
Vinyl chloride	75-01-4	mg/kg	0.000056			*0.010 U*	*0.050 U*			*0.050 U*	*0.050 U*					
Volatile Organic Compounds: Other																
1,1-Dichloroethene	75-35-4	mg/kg	0.0025			*0.010 U*	*0.050 U*			*0.050 U*	*0.050 U*					
1,2,4-Trimethylbenzene	95-63-6	mg/kg	0.072				0.050 U			0.050 U	0.050 U					
1,3,5-Trimethylbenzene	108-67-8	mg/kg	0.071				0.050 U			0.050 U	0.050 U					
Cymene	99-87-6	mg/kg	--				0.050 U			0.050 U	0.050 U					
Isopropylbenzene	98-82-8	mg/kg	0.79				0.050 U			0.050 U	0.050 U					
n-Propylbenzene	103-65-1	mg/kg	0.88				0.050 U			0.050 U	0.050 U					
sec-Butylbenzene	135-98-8	mg/kg	1.3				0.050 U			0.050 U	0.050 U					
Trichlorofluoromethane	75-69-4	mg/kg	0.79			0.010 U	0.50 U			0.50 U	0.50 U					

Notes:

Blank cells are intentional.

All results are rounded to two significant figures.

RED/BOLD Detected result exceeds PSL.

Italics Non-detect result exceeds PSL.

1 Preliminary Screening Level as established in Table 5.2.

2 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

3 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic equivalent Factors as presented in Table 708-2 of WAC 173-340-900.

4 Calculation was performed using only detected cPAH concentrations.

5 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

6 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

7 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.

8 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

Abbreviations:

CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbon
DRO Diesel-range organics
ft Feet
GRO Gasoline-range organics
HPAH High molecular weight polycyclic aromatic hydrocarbon
LPAH Low molecular weight polycyclic aromatic hydrocarbon
mg/kg Milligrams per kilogram
MTCA Model Toxics Control Act
ORO Oil-range organics
PSL Preliminary screening level
TEQ Toxic equivalent

Qualifier:

U Analyte was not detected at the associated reporting limit.

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	P6		P7	P8	P9	P12	P13	P15	MW-11	P18		P19	
			Sample Name	P6-5	P6-8	P7-1	P8-3.5	P9-9.5	P12-2	P13-5	P15-6	P17-10	P18-2.5	P18-7.5	P19-4	P19-8
			Sample Date	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015	4/21/2015	3/9/2016	3/9/2016	3/8/2016	3/8/2016	3/8/2016	3/8/2016
			Sample Depth	5 ft	8 ft	1 ft	3.5 ft	9.5 ft	2 ft	5 ft	6 ft	10 ft	2.5 ft	7.5 ft	4 ft	8 ft
Analyte	**CAS No.**	**Unit**	**PSL (1)**													
Metals																
Arsenic	7440-38-2	mg/kg	7.3	6.8		2.0	5.4		**9.0**	1.4			5.6		3.1	
Barium	7440-39-3	mg/kg	8.3	**50**		**23**	**54**		**220**	**14**			**35**			
Cadmium	7440-43-9	mg/kg	0.77	*1.0 U*		*1.0 U*	*1.0 U*		*1.0 U*	*1.0 U*			*1.0 U*		*1.0 U*	
Chromium	7440-47-3	mg/kg	48	9.4		19	7.2		8.1	4.7			9.9			
Copper	7440-50-8	mg/kg	36													
Lead	7439-92-1	mg/kg	50	**96**		19	34		**480**	3.3			3.2		2.4	
Mercury	7439-97-6	mg/kg	0.070	*1.0 U*		*1.0 U*	*1.0 U*		*1.0 U*	*1.0 U*			*1.0 U*			
Silver	7440-22-4	mg/kg	0.016	*1.0 U*		*1.0 U*	*1.0 U*		*1.0 U*	*1.0 U*			*1.0 U*			
Polychlorinated Biphenyls (PCBs)																
Aroclor 1016	12674-11-2	mg/kg	--	0.020 U		0.020 U	0.020 U		0.020 U	0.020 U						
Aroclor 1242	53469-21-9	mg/kg	--	0.020 U		0.020 U	0.020 U		0.020 U	0.020 U						
Aroclor 1248	12672-29-6	mg/kg	--	0.020 U		0.045	0.020 U		0.020 U	0.020 U						
Aroclor 1254	11097-69-1	mg/kg	--	0.020 U		0.031	0.020 U		0.020 U	0.020 U						
Aroclor 1260	11096-82-5	mg/kg	--	0.020 U		0.020 U	0.020 U		0.020 U	0.020 U						
Aroclor 1262	37324-23-5	mg/kg	--	0.020 U		0.020 U			0.022	0.020 U						
Total PCB Aroclors (U=0) (2)	T_PCB (U=0)	mg/kg	0.00000055	*0.020 U*		**0.076**	*0.020 U*		**0.022**	*0.020 U*						
Semi-Volatile Organic Compounds: Polycyclic Aromatic Hydrocarbons (PAHs)																
1-Methylnaphthalene	90-12-0	mg/kg	0.0042													
2-Methylnaphthalene	91-57-6	mg/kg	0.039	**0.13**												
Benzo(a)anthracene	56-55-3	mg/kg	--	0.12												
Benzo(a)pyrene	50-32-8	mg/kg	0.000016	**0.15**												
Benzo(b)fluoranthene	205-99-2	mg/kg	--	0.20												
Benzo(g,h,i)perylene	191-24-2	mg/kg	0.67	0.10												
Benzo(k)fluoranthene	207-08-9	mg/kg	--	0.10 U												
Chrysene	218-01-9	mg/kg	--	0.17												
Dibenzo(a,h)anthracene	53-70-3	mg/kg	--	0.10 U												
Fluoranthene	206-44-0	mg/kg	0.090	**0.39**												
Fluorene	86-73-7	mg/kg	0.029	**0.10**												
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg	--	0.11												
Naphthalene	91-20-3	mg/kg	0.0021	**0.13**		*0.050 U*			*0.050 U*	*0.050 U*			*0.050 U*			
Phenanthrene	85-01-8	mg/kg	1.5	0.39												
Pyrene	129-00-0	mg/kg	0.14	**0.35**												
Total Naphthalenes (2)	T_Napth (U=0)	mg/kg	--													
cPAHs (MTCA TEQ-ZeroND) (3,4)	BaPEq (U=0)	mg/kg	0.000016	**0.19**												
cPAHs (MTCA TEQ-HalfND) (3,5)	BaPEq (U=1/2)	mg/kg	0.000016	**0.20**												
Total HPAH (U=0) (2)	T_HPAH (U=0)	mg/kg	12	1.6												
Total LPAH (U=0) (2)	T_LPAH (U=0)	mg/kg	5.2	0.62												
Total PAH (U=0) (2)	T_PAH (U=0)	mg/kg	--	2.2												
Semi-Volatile Organic Compounds: Phthalates																
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	0.0051	*1.6 U*												
Total Petroleum Hydrocarbons																
Gasoline-range organics	GRO	mg/kg	30				2.0 U	2.0 U			2.0 UJ					
Diesel-range organics	DRO	mg/kg	260	210 (7)	50 U	**1,900 (8)**	50 U	50 U	50 U	50 U	50 U	50 U		50 U		50 U
Oil-range organics	ORO	mg/kg	260	250 U	250 U	**14,000**	250 U	250 U	250 U	250 U	250 U	250 U		250 U		250 U
Total DRO & ORO (2)	T_DRO&ORO (U=0)	mg/kg	260	210	250 U	**16,000**	250 U	250 U	250 U	250 U	250 U	250 U		250 U		250 U

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	P6		P7	P8	P9	P12	P13	P15	MW-11	P18		P19	
			Sample Name	**P6-5**	**P6-8**	**P7-1**	**P8-3.5**	**P9-9.5**	**P12-2**	**P13-5**	**P15-6**	**P17-10**	**P18-2.5**	**P18-7.5**	**P19-4**	**P19-8**
			Sample Date	**4/21/2015**	**4/21/2015**	**4/21/2015**	**4/21/2015**	**4/21/2015**	**4/21/2015**	**4/21/2015**	**3/9/2016**	**3/9/2016**	**3/8/2016**	**3/8/2016**	**3/8/2016**	**3/8/2016**
			Sample Depth	**5 ft**	**8 ft**	**1 ft**	**3.5 ft**	**9.5 ft**	**2 ft**	**5 ft**	**6 ft**	**10 ft**	**2.5 ft**	**7.5 ft**	**4 ft**	**8 ft**
Analyte	**CAS No.**	**Unit**	**PSL (1)**													
Volatile Organic Compounds: Benzene, Toluene, Ethylbenzene, and Xylenes																
Ethylbenzene	100-41-4	mg/kg	0.010	*0.050 U*		*0.050 U*	*0.020 U*	*0.020 U*	*0.050 U*	*0.050 U*	*0.020 UJ*		*0.050 U*			
Toluene	108-88-3	mg/kg	0.044	*0.050 U*		*0.050 U*	0.020 U	0.020 U	*0.050 U*	*0.050 U*	0.020 UJ		*0.050 U*			
Xylene (meta & para)	108-38-3/106-42-3	mg/kg	--	0.10 U		0.10 U			0.10 U	0.10 U			0.10 U			
Xylene (ortho)	95-47-6	mg/kg	--	0.050 U		0.050 U			0.050 U	0.050 U			0.050 U			
Xylene (total)	1330-20-7	mg/kg	0.055	*0.10 U*		*0.10 U*	*0.060 U*	*0.060 U*	*0.10 U*	*0.10 U*	*0.060 UJ*		*0.10 U*			
Volatile Organic Compounds: Chlorinated Volatile Organic Compounds																
cis-1,2-Dichloroethene	156-59-2	mg/kg	0.0052	*0.050 U*		*0.050 U*			*0.050 U*	*0.050 U*			*0.050 U*			
Tetrachloroethene	127-18-4	mg/kg	0.0016	*0.025 U*		*0.025 U*			*0.025 U*	*0.025 U*			*0.025 U*			
Trichloroethene	79-01-6	mg/kg	0.00027	*0.020 U*		*0.020 U*			*0.020 U*	*0.020 U*			*0.020 U*			
Vinyl chloride	75-01-4	mg/kg	0.000056	*0.050 U*		*0.050 U*			*0.050 U*	*0.050 U*			*0.050 U*			
Volatile Organic Compounds: Other																
1,1-Dichloroethene	75-35-4	mg/kg	0.0025	*0.050 U*		*0.050 U*			*0.050 U*	*0.050 U*			*0.050 U*			
1,2,4-Trimethylbenzene	95-63-6	mg/kg	0.072	0.055		0.050 U			0.050 U	0.050 U			0.050 U			
1,3,5-Trimethylbenzene	108-67-8	mg/kg	0.071	0.050 U		0.050 U			0.050 U	0.050 U			0.050 U			
Cymene	99-87-6	mg/kg	--	0.23		0.050 U			0.050 U	0.050 U			0.050 U			
Isopropylbenzene	98-82-8	mg/kg	0.79	0.050 U		0.050 U			0.050 U	0.050 U			0.050 U			
n-Propylbenzene	103-65-1	mg/kg	0.88	0.050 U		0.050 U			0.050 U	0.050 U			0.050 U			
sec-Butylbenzene	135-98-8	mg/kg	1.3	0.050 U		0.050 U			0.050 U	0.050 U			0.050 U			
Trichlorofluoromethane	75-69-4	mg/kg	0.79	0.50 U		0.50 U			0.50 U	0.50 U			0.50 U			

Notes:

Blank cells are intentional.

All results are rounded to two significant figures.

RED/BOLD Detected result exceeds PSL.

Italics Non-detect result exceeds PSL.

1 Preliminary Screening Level as established in Table 5.2.

2 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

3 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic equivalent Factors as presented in Table 708-2 of WAC 173-340-900.

4 Calculation was performed using only detected cPAH concentrations.

5 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

6 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

7 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.

8 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

Abbreviations:

CAS Chemical Abstracts Service

cPAH Carcinogenic polycyclic aromatic hydrocarbon

DRO Diesel-range organics

ft Feet

GRO Gasoline-range organics

HPAH High molecular weight polycyclic aromatic hydrocarbon

LPAH Low molecular weight polycyclic aromatic hydrocarbon

mg/kg Milligrams per kilogram

MTCA Model Toxics Control Act

ORO Oil-range organics

PSL Preliminary screening level

TEQ Toxic equivalent

Qualifier:

U Analyte was not detected at the associated reporting limit.

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	PP1-1	PP2-1	PP3-1	PP4-1	RT-B2	RT-B3	RT-ES2	RT-NS2	RT-SS2	RT-WS2	SB-02	SB-04	SB-05
			Sample Name	PP1-1	PP2-1	PP3-1	PP4-1	RT-B2-9.5	RT-B3-9.5	RT-ES2-3.5	RT-NS2-3.5	RT-SS2-3.5	RT-WS2-3.5	SB-02-6-6.5	SB-04-3-4	SB-05-3-4
			Sample Date	4/27/2017	4/27/2017	4/27/2017	4/27/2017	6/27/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	12/4/2003	12/4/2003	12/4/2003
			Sample Depth	1 ft	1 ft	1 ft	1 ft	9.5 ft	9.5 ft	3.5 ft	3.5 ft	3.5 ft	3.5 ft	6-6.5 ft	3-4 ft	3-4 ft
Analyte	**CAS No.**	**Unit**	**PSL [1]**													
Metals																
Arsenic	7440-38-2	mg/kg	7.3							3.0	6.9	3.7	5.6		3.7 U	
Barium	7440-39-3	mg/kg	8.3												**64**	
Cadmium	7440-43-9	mg/kg	0.77							*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*		0.46 U	
Chromium	7440-47-3	mg/kg	48												15	
Copper	7440-50-8	mg/kg	36													
Lead	7439-92-1	mg/kg	50							2.1	5.7	2.7	3.4	4.2 U	38	
Mercury	7439-97-6	mg/kg	0.070												0.070	
Silver	7440-22-4	mg/kg	0.016												*2.8 U*	
Polychlorinated Biphenyls (PCBs)																
Aroclor 1016	12674-11-2	mg/kg	--												0.10 U	
Aroclor 1242	53469-21-9	mg/kg	--												0.10 U	
Aroclor 1248	12672-29-6	mg/kg	--												0.10 U	
Aroclor 1254	11097-69-1	mg/kg	--												0.10 U	
Aroclor 1260	11096-82-5	mg/kg	--												0.10 U	
Aroclor 1262	37324-23-5	mg/kg	--													
Total PCB Aroclors (U=0) [2]	T_PCB (U=0)	mg/kg	0.00000055												*0.10 U*	
Semi-Volatile Organic Compounds: Polycyclic Aromatic Hydrocarbons (PAHs)																
1-Methylnaphthalene	90-12-0	mg/kg	0.0042												*0.60 U*	*0.10 U*
2-Methylnaphthalene	91-57-6	mg/kg	0.039												*0.60 U*	*0.10 U*
Benzo(a)anthracene	56-55-3	mg/kg	--												0.60 U	0.10 U
Benzo(a)pyrene	50-32-8	mg/kg	0.000016												*0.60 U*	*0.10 U*
Benzo(b)fluoranthene	205-99-2	mg/kg	--												0.60 U	0.10 U
Benzo(g,h,i)perylene	191-24-2	mg/kg	0.67												0.60 U	0.10 U
Benzo(k)fluoranthene	207-08-9	mg/kg	--												0.60 U	0.10 U
Chrysene	218-01-9	mg/kg	--												0.60 U	0.10 U
Dibenzo(a,h)anthracene	53-70-3	mg/kg	--												0.60 U	0.10 U
Fluoranthene	206-44-0	mg/kg	0.090												*0.60 U*	*0.10 U*
Fluorene	86-73-7	mg/kg	0.029												*0.60 U*	*0.10 U*
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg	--												0.60 U	0.10 U
Naphthalene	91-20-3	mg/kg	0.0021												*0.60 U*	*0.10 U*
Phenanthrene	85-01-8	mg/kg	1.5												0.60 U	0.10 U
Pyrene	129-00-0	mg/kg	0.14												*0.60 U*	0.10 U
Total Naphthalenes [2]	T_Napth (U=0)	mg/kg	--												0.60 U	0.10 U
cPAHs (MTCA TEQ-ZeroND) [3,4]	BaPEq (U=0)	mg/kg	0.000016												*0.60 U*	*0.10 U*
cPAHs (MTCA TEQ-HalfND) [3,5]	BaPEq (U=1/2)	mg/kg	0.000016												*0.60 U*	*0.10 U*
Total HPAH (U=0) [2]	T_HPAH (U=0)	mg/kg	12												0.60 U	0.10 U
Total LPAH (U=0) [2]	T_LPAH (U=0)	mg/kg	5.2												0.60 U	0.10 U
Total PAH (U=0) [2]	T_PAH (U=0)	mg/kg	--												0.60 U	0.10 U
Semi-Volatile Organic Compounds: Phthalates																
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	0.0051												*1.0 U*	*0.13 U*
Total Petroleum Hydrocarbons																
Gasoline-range organics	GRO	mg/kg	30											3.0 U	3.0 U	
Diesel-range organics	DRO	mg/kg	260					50 U	50 U	50 U	50 U	50 U	50 U	25 U	41 [6]	
Oil-range organics	ORO	mg/kg	260					250 U	250 U	250 U	250 U	250 U	250 U	50 U	**570**	
Total DRO & ORO [2]	T_DRO&ORO (U=0)	mg/kg	260					250 U	250 U	250 U	250 U	250 U	250 U	50 U	**610**	

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	PP1-1	PP2-1	PP3-1	PP4-1	RT-B2	RT-B3	RT-ES2	RT-NS2	RT-SS2	RT-WS2	SB-02	SB-04	SB-05
			Sample Name	**PP1-1**	**PP2-1**	**PP3-1**	**PP4-1**	**RT-B2-9.5**	**RT-B3-9.5**	**RT-ES2-3.5**	**RT-NS2-3.5**	**RT-SS2-3.5**	**RT-WS2-3.5**	**SB-02-6-6.5**	**SB-04-3-4**	**SB-05-3-4**
			Sample Date	**4/27/2017**	**4/27/2017**	**4/27/2017**	**4/27/2017**	**6/27/2018**	**6/27/2018**	**6/27/2018**	**6/27/2018**	**6/27/2018**	**6/27/2018**	**12/4/2003**	**12/4/2003**	**12/4/2003**
			Sample Depth	**1 ft**	**1 ft**	**1 ft**	**1 ft**	**9.5 ft**	**9.5 ft**	**3.5 ft**	**3.5 ft**	**3.5 ft**	**3.5 ft**	**6-6.5 ft**	**3-4 ft**	**3-4 ft**
Analyte	**CAS No.**	**Unit**	**PSL [1]**													
Volatile Organic Compounds: Benzene, Toluene, Ethylbenzene, and Xylenes																
Ethylbenzene	100-41-4	mg/kg	0.010	*0.020 U*	*0.020 U*	*0.020 U*	*0.020 U*							*0.050 U*	*0.050 U*	
Toluene	108-88-3	mg/kg	0.044	0.020 U	0.020 U	0.020 U	0.020 U							*0.050 U*	*0.050 U*	
Xylene (meta & para)	108-38-3/106-42-3	mg/kg	--													
Xylene (ortho)	95-47-6	mg/kg	--													
Xylene (total)	1330-20-7	mg/kg	0.055	*0.060 U*	*0.060 U*	*0.060 U*	*0.060 U*							*0.20 U*	*0.20 U*	
Volatile Organic Compounds: Chlorinated Volatile Organic Compounds																
cis-1,2-Dichloroethene	156-59-2	mg/kg	0.0052											*0.010 U*		*0.010 U*
Tetrachloroethene	127-18-4	mg/kg	0.0016											*0.010 U*		*0.010 U*
Trichloroethene	79-01-6	mg/kg	0.00027											*0.010 U*		*0.010 U*
Vinyl chloride	75-01-4	mg/kg	0.000056											*0.010 U*		*0.010 U*
Volatile Organic Compounds: Other																
1,1-Dichloroethene	75-35-4	mg/kg	0.0025											*0.010 U*		*0.010 U*
1,2,4-Trimethylbenzene	95-63-6	mg/kg	0.072													
1,3,5-Trimethylbenzene	108-67-8	mg/kg	0.071													
Cymene	99-87-6	mg/kg	--													
Isopropylbenzene	98-82-8	mg/kg	0.79													
n-Propylbenzene	103-65-1	mg/kg	0.88													
sec-Butylbenzene	135-98-8	mg/kg	1.3													
Trichlorofluoromethane	75-69-4	mg/kg	0.79											0.010 U		0.010 U

Notes:

Blank cells are intentional.

All results are rounded to two significant figures.

RED/BOLD Detected result exceeds PSL.

Italics Non-detect result exceeds PSL.

1 Preliminary Screening Level as established in Table 5.2.

2 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

3 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic equivalent Factors as presented in Table 708-2 of WAC 173-340-900.

4 Calculation was performed using only detected cPAH concentrations.

5 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

6 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

7 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.

8 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

Abbreviations:

CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbon
DRO Diesel-range organics
ft Feet
GRO Gasoline-range organics
HPAH High molecular weight polycyclic aromatic hydrocarbon
LPAH Low molecular weight polycyclic aromatic hydrocarbon
mg/kg Milligrams per kilogram
MTCA Model Toxics Control Act
ORO Oil-range organics
PSL Preliminary screening level
TEQ Toxic equivalent

Qualifier:

U Analyte was not detected at the associated reporting limit.

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	SB-06	SB-08	SB-11	SB-12	SB-14	TP1-B1	TP1-E1	TP1-W1	TP2			
			Sample Name	SB-06-5-6	SB-08-8-8.5	SB-11-3-4	SB-12-6.5-7.5	SB-14-7-8	TP1-B1-1.5	TP1-E1-1	TP1-W1-1	TP2-1	TP2-2	TP2-3	TP2-4
			Sample Date	12/4/2003	12/4/2003	12/4/2003	12/4/2003	12/12/2003	6/27/2018	6/27/2018	6/27/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018
			Sample Depth	5-6 ft	8-8.5 ft	3-4 ft	6.5-7.5 ft	7-8 ft	1.5 ft	1 ft	1 ft	1 ft	2 ft	3 ft	4 ft
Analyte	**CAS No.**	**Unit**	**PSL [1]**												
Metals															
Arsenic	7440-38-2	mg/kg	7.3			4.9 U			8.7	8.4	8.6	7.5	4.2		3.6
Barium	7440-39-3	mg/kg	8.3			62									
Cadmium	7440-43-9	mg/kg	0.77			0.61 U			*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*
Chromium	7440-47-3	mg/kg	48			13						11			
Copper	7440-50-8	mg/kg	36												
Lead	7439-92-1	mg/kg	50			110			160	220	210		93	20	
Mercury	7439-97-6	mg/kg	0.070			0.10									
Silver	7440-22-4	mg/kg	0.016			*3.7 U*									
Polychlorinated Biphenyls (PCBs)															
Aroclor 1016	12674-11-2	mg/kg	--												
Aroclor 1242	53469-21-9	mg/kg	--												
Aroclor 1248	12672-29-6	mg/kg	--												
Aroclor 1254	11097-69-1	mg/kg	--												
Aroclor 1260	11096-82-5	mg/kg	--												
Aroclor 1262	37324-23-5	mg/kg	--												
Total PCB Aroclors (U=0) [2]	T_PCB (U=0)	mg/kg	0.00000055												
Semi-Volatile Organic Compounds: Polycyclic Aromatic Hydrocarbons (PAHs)															
1-Methylnaphthalene	90-12-0	mg/kg	0.0042	*0.10 U*		*0.10 U*									
2-Methylnaphthalene	91-57-6	mg/kg	0.039	*0.10 U*		*0.10 U*									
Benzo(a)anthracene	56-55-3	mg/kg	--	0.10 U		0.10 U									
Benzo(a)pyrene	50-32-8	mg/kg	0.000016	*0.10 U*		*0.10 U*									
Benzo(b)fluoranthene	205-99-2	mg/kg	--	0.10 U		0.10 U									
Benzo(g,h,i)perylene	191-24-2	mg/kg	0.67	0.10 U		0.10 U									
Benzo(k)fluoranthene	207-08-9	mg/kg	--	0.10 U		0.10 U									
Chrysene	218-01-9	mg/kg	--	0.10 U		0.10 U									
Dibenzo(a,h)anthracene	53-70-3	mg/kg	--	0.10 U		0.10 U									
Fluoranthene	206-44-0	mg/kg	0.090	*0.10 U*		*0.10 U*									
Fluorene	86-73-7	mg/kg	0.029	*0.10 U*		*0.10 U*									
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg	--	0.10 U		0.10 U									
Naphthalene	91-20-3	mg/kg	0.0021	*0.10 U*		*0.10 U*						*0.050 U*			
Phenanthrene	85-01-8	mg/kg	1.5	0.10 U		0.10 U									
Pyrene	129-00-0	mg/kg	0.14	0.10 U		0.10 U									
Total Naphthalenes [2]	T_Napth (U=0)	mg/kg	--	0.10 U		0.10 U									
cPAHs (MTCA TEQ-ZeroND) [3,4]	BaPEq (U=0)	mg/kg	0.000016	*0.10 U*		*0.10 U*									
cPAHs (MTCA TEQ-HalfND) [3,5]	BaPEq (U=1/2)	mg/kg	0.000016	*0.10 U*		*0.10 U*									
Total HPAH (U=0) [2]	T_HPAH (U=0)	mg/kg	12	0.10 U		0.10 U									
Total LPAH (U=0) [2]	T_LPAH (U=0)	mg/kg	5.2	0.10 U		0.10 U									
Total PAH (U=0) [2]	T_PAH (U=0)	mg/kg	--	0.10 U		0.10 U									
Semi-Volatile Organic Compounds: Phthalates															
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	0.0051	*0.13 U*		*0.13 U*									
Total Petroleum Hydrocarbons															
Gasoline-range organics	GRO	mg/kg	30		3.0 U		3.0 U	3.0 U							
Diesel-range organics	DRO	mg/kg	260		25 U		25 U	25 U							
Oil-range organics	ORO	mg/kg	260		50 U		50 U	50 U							
Total DRO & ORO [2]	T_DRO&ORO (U=0)	mg/kg	260		50 U		50 U	50 U							

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	SB-06	SB-08	SB-11	SB-12	SB-14	TP1-B1	TP1-E1	TP1-W1	TP2			
			Sample Name	SB-06-5-6	SB-08-8-8.5	SB-11-3-4	SB-12-6.5-7.5	SB-14-7-8	TP1-B1-1.5	TP1-E1-1	TP1-W1-1	TP2-1	TP2-2	TP2-3	TP2-4
			Sample Date	12/4/2003	12/4/2003	12/4/2003	12/4/2003	12/12/2003	6/27/2018	6/27/2018	6/27/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018
			Sample Depth	5-6 ft	8-8.5 ft	3-4 ft	6.5-7.5 ft	7-8 ft	1.5 ft	1 ft	1 ft	1 ft	2 ft	3 ft	4 ft
Analyte	**CAS No.**	**Unit**	**PSL [1]**												
Volatile Organic Compounds: Benzene, Toluene, Ethylbenzene, and Xylenes															
Ethylbenzene	100-41-4	mg/kg	0.010		*0.050 U*		*0.050 U*	*0.050 U*							
Toluene	108-88-3	mg/kg	0.044		*0.050 U*		*0.050 U*	*0.050 U*							
Xylene (meta & para)	108-38-3/106-42-3	mg/kg	--												
Xylene (ortho)	95-47-6	mg/kg	--												
Xylene (total)	1330-20-7	mg/kg	0.055		*0.20 U*		*0.20 U*	*0.20 U*							
Volatile Organic Compounds: Chlorinated Volatile Organic Compounds															
cis-1,2-Dichloroethene	156-59-2	mg/kg	0.0052	*0.010 U*		*0.010 U*									
Tetrachloroethene	127-18-4	mg/kg	0.0016	*0.010 U*		*0.010 U*									
Trichloroethene	79-01-6	mg/kg	0.00027	*0.010 U*		*0.010 U*									
Vinyl chloride	75-01-4	mg/kg	0.000056	*0.010 U*		*0.010 U*									
Volatile Organic Compounds: Other															
1,1-Dichloroethene	75-35-4	mg/kg	0.0025	*0.010 U*		*0.010 U*									
1,2,4-Trimethylbenzene	95-63-6	mg/kg	0.072												
1,3,5-Trimethylbenzene	108-67-8	mg/kg	0.071												
Cymene	99-87-6	mg/kg	--												
Isopropylbenzene	98-82-8	mg/kg	0.79												
n-Propylbenzene	103-65-1	mg/kg	0.88												
sec-Butylbenzene	135-98-8	mg/kg	1.3												
Trichlorofluoromethane	75-69-4	mg/kg	0.79	0.010 U		0.010 U									

Notes:

Blank cells are intentional.

All results are rounded to two significant figures.

RED/BOLD Detected result exceeds PSL.

Italics Non-detect result exceeds PSL.

1 Preliminary Screening Level as established in Table 5.2.

2 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

3 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic equivalent Factors as presented in Table 708-2 of WAC 173-340-900.

4 Calculation was performed using only detected cPAH concentrations.

5 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

6 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

7 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.

8 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

Abbreviations:

CAS Chemical Abstracts Service

cPAH Carcinogenic polycyclic aromatic hydrocarbon

DRO Diesel-range organics

ft Feet

GRO Gasoline-range organics

HPAH High molecular weight polycyclic aromatic hydrocarbon

LPAH Low molecular weight polycyclic aromatic hydrocarbon

mg/kg Milligrams per kilogram

MTCA Model Toxics Control Act

ORO Oil-range organics

PSL Preliminary screening level

TEQ Toxic equivalent

Qualifier:

U Analyte was not detected at the associated reporting limit.

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	TP3				TP4				TP5-B1	TP5-B2	TP5-B3	TP5-B4	TP5-E1
			Sample Name	**TP3-1**	**TP3-2**	**TP3-3**	**TP3-4**	**TP4-1**	**TP4-2**	**TP4-3**	**TP4-4**	**TP5-B1-5**	**TP5-B2-5**	**TP5-B3-5**	**TP5-B4-3.5**	**TP5-E1-5**
			Sample Date	**5/22/2018**	**5/22/2018**	**5/22/2018**	**5/22/2018**	**5/22/2018**	**5/22/2018**	**5/22/2018**	**5/22/2018**	**6/27/2018**	**6/27/2018**	**7/10/2018**	**7/10/2018**	**7/10/2018**
			Sample Depth	**1 ft**	**2 ft**	**3 ft**	**4 ft**	**1 ft**	**2 ft**	**3 ft**	**4 ft**	**5 ft**	**5 ft**	**5 ft**	**3.5 ft**	**5 ft**
Analyte	**CAS No.**	**Unit**	**PSL (1)**													
Metals																
Arsenic	7440-38-2	mg/kg	7.3	**15**	**18**		2.7	6.8	6.9	5.6		5.9	**12**	4.4	4.3	2.8
Barium	7440-39-3	mg/kg	8.3													
Cadmium	7440-43-9	mg/kg	0.77	**2.0**	**1.4**	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*
Chromium	7440-47-3	mg/kg	48	32					10							
Copper	7440-50-8	mg/kg	36													
Lead	7439-92-1	mg/kg	50	2.6	**320**	**540**		3.6	15	25	5.2	6.8	**130**			
Mercury	7439-97-6	mg/kg	0.070													
Silver	7440-22-4	mg/kg	0.016													
Polychlorinated Biphenyls (PCBs)																
Aroclor 1016	12674-11-2	mg/kg	--													
Aroclor 1242	53469-21-9	mg/kg	--													
Aroclor 1248	12672-29-6	mg/kg	--													
Aroclor 1254	11097-69-1	mg/kg	--													
Aroclor 1260	11096-82-5	mg/kg	--													
Aroclor 1262	37324-23-5	mg/kg	--													
Total PCB Aroclors (U=0) (2)	T_PCB (U=0)	mg/kg	0.00000055													
Semi-Volatile Organic Compounds: Polycyclic Aromatic Hydrocarbons (PAHs)																
1-Methylnaphthalene	90-12-0	mg/kg	0.0042													
2-Methylnaphthalene	91-57-6	mg/kg	0.039													
Benzo(a)anthracene	56-55-3	mg/kg	--													
Benzo(a)pyrene	50-32-8	mg/kg	0.000016													
Benzo(b)fluoranthene	205-99-2	mg/kg	--													
Benzo(g,h,i)perylene	191-24-2	mg/kg	0.67													
Benzo(k)fluoranthene	207-08-9	mg/kg	--													
Chrysene	218-01-9	mg/kg	--													
Dibenzo(a,h)anthracene	53-70-3	mg/kg	--													
Fluoranthene	206-44-0	mg/kg	0.090													
Fluorene	86-73-7	mg/kg	0.029													
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg	--													
Naphthalene	91-20-3	mg/kg	0.0021													
Phenanthrene	85-01-8	mg/kg	1.5													
Pyrene	129-00-0	mg/kg	0.14													
Total Naphthalenes (2)	T_Napth (U=0)	mg/kg	--													
cPAHs (MTCA TEQ-ZeroND) (3,4)	BaPEq (U=0)	mg/kg	0.000016													
cPAHs (MTCA TEQ-HalfND) (3,5)	BaPEq (U=1/2)	mg/kg	0.000016													
Total HPAH (U=0) (2)	T_HPAH (U=0)	mg/kg	12													
Total LPAH (U=0) (2)	T_LPAH (U=0)	mg/kg	5.2													
Total PAH (U=0) (2)	T_PAH (U=0)	mg/kg	--													
Semi-Volatile Organic Compounds: Phthalates																
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	0.0051													
Total Petroleum Hydrocarbons																
Gasoline-range organics	GRO	mg/kg	30													
Diesel-range organics	DRO	mg/kg	260													
Oil-range organics	ORO	mg/kg	260													
Total DRO & ORO (2)	T_DRO&ORO (U=0)	mg/kg	260													

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	TP3				TP4				TP5-B1	TP5-B2	TP5-B3	TP5-B4	TP5-E1
			Sample Name	TP3-1	TP3-2	TP3-3	TP3-4	TP4-1	TP4-2	TP4-3	TP4-4	TP5-B1-5	TP5-B2-5	TP5-B3-5	TP5-B4-3.5	TP5-E1-5
			Sample Date	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	6/27/2018	6/27/2018	7/10/2018	7/10/2018	7/10/2018
			Sample Depth	1 ft	2 ft	3 ft	4 ft	1 ft	2 ft	3 ft	4 ft	5 ft	5 ft	5 ft	3.5 ft	5 ft
Analyte	**CAS No.**	**Unit**	**PSL (1)**													
Volatile Organic Compounds: Benzene, Toluene, Ethylbenzene, and Xylenes																
Ethylbenzene	100-41-4	mg/kg	0.010													
Toluene	108-88-3	mg/kg	0.044													
Xylene (meta & para)	108-38-3/106-42-3	mg/kg	--													
Xylene (ortho)	95-47-6	mg/kg	--													
Xylene (total)	1330-20-7	mg/kg	0.055													
Volatile Organic Compounds: Chlorinated Volatile Organic Compounds																
cis-1,2-Dichloroethene	156-59-2	mg/kg	0.0052													
Tetrachloroethene	127-18-4	mg/kg	0.0016													
Trichloroethene	79-01-6	mg/kg	0.00027													
Vinyl chloride	75-01-4	mg/kg	0.000056													
Volatile Organic Compounds: Other																
1,1-Dichloroethene	75-35-4	mg/kg	0.0025													
1,2,4-Trimethylbenzene	95-63-6	mg/kg	0.072													
1,3,5-Trimethylbenzene	108-67-8	mg/kg	0.071													
Cymene	99-87-6	mg/kg	--													
Isopropylbenzene	98-82-8	mg/kg	0.79													
n-Propylbenzene	103-65-1	mg/kg	0.88													
sec-Butylbenzene	135-98-8	mg/kg	1.3													
Trichlorofluoromethane	75-69-4	mg/kg	0.79													

Notes:

Blank cells are intentional.
All results are rounded to two significant figures.
RED/BOLD Detected result exceeds PSL.
Italics Non-detect result exceeds PSL.
1 Preliminary Screening Level as established in Table 5.2.
2 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.
3 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic equivalent Factors as presented in Table 708-2 of WAC 173-340-900.
4 Calculation was performed using only detected cPAH concentrations.
5 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.
6 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.
7 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.
8 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

Abbreviations:

CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbon
DRO Diesel-range organics
ft Feet
GRO Gasoline-range organics
HPAH High molecular weight polycyclic aromatic hydrocarbon
LPAH Low molecular weight polycyclic aromatic hydrocarbon
mg/kg Milligrams per kilogram
MTCA Model Toxics Control Act
ORO Oil-range organics
PSL Preliminary screening level
TEQ Toxic equivalent

Qualifier:

U Analyte was not detected at the associated reporting limit.

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	TP5-E2	TP5-E3	TP5-E4	TP5-N1	TP5-N3	TP5-N4	TP5-N5	TP5-S1	TP5-S2	TP5-W1	TP5-W2	TP5-W3	TP5-W4
			Sample Name	TP5-E2-5	TP5-E3-3	TP5-E4-2.5	TP5-N1-3	TP5-N3-3	TP5-N4-2.5	TP5-N5-3	TP5-S1-5	TP5-S2-5	TP5-W1-5	TP5-W2-5	TP5-W3-2.5	TP5-W4-3
			Sample Date	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018
			Sample Depth	5 ft	3 ft	2.5 ft	3 ft	3 ft	2.5 ft	3 ft	5 ft	5 ft	5 ft	5 ft	2.5 ft	3 ft
Analyte	**CAS No.**	**Unit**	**PSL (1)**													
Metals																
Arsenic	7440-38-2	mg/kg	7.3	3.7	6.1	6.2	5.2	5.6	5.4	3.9	1.6	2.3	4.8	4.3	5.1	7.2
Barium	7440-39-3	mg/kg	8.3													
Cadmium	7440-43-9	mg/kg	0.77	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*
Chromium	7440-47-3	mg/kg	48													
Copper	7440-50-8	mg/kg	36													
Lead	7439-92-1	mg/kg	50													
Mercury	7439-97-6	mg/kg	0.070													
Silver	7440-22-4	mg/kg	0.016													
Polychlorinated Biphenyls (PCBs)																
Aroclor 1016	12674-11-2	mg/kg	--													
Aroclor 1242	53469-21-9	mg/kg	--													
Aroclor 1248	12672-29-6	mg/kg	--													
Aroclor 1254	11097-69-1	mg/kg	--													
Aroclor 1260	11096-82-5	mg/kg	--													
Aroclor 1262	37324-23-5	mg/kg	--													
Total PCB Aroclors (U=0) (2)	T_PCB (U=0)	mg/kg	0.00000055													
Semi-Volatile Organic Compounds: Polycyclic Aromatic Hydrocarbons (PAHs)																
1-Methylnaphthalene	90-12-0	mg/kg	0.0042													
2-Methylnaphthalene	91-57-6	mg/kg	0.039													
Benzo(a)anthracene	56-55-3	mg/kg	--													
Benzo(a)pyrene	50-32-8	mg/kg	0.000016													
Benzo(b)fluoranthene	205-99-2	mg/kg	--													
Benzo(g,h,i)perylene	191-24-2	mg/kg	0.67													
Benzo(k)fluoranthene	207-08-9	mg/kg	--													
Chrysene	218-01-9	mg/kg	--													
Dibenzo(a,h)anthracene	53-70-3	mg/kg	--													
Fluoranthene	206-44-0	mg/kg	0.090													
Fluorene	86-73-7	mg/kg	0.029													
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg	--													
Naphthalene	91-20-3	mg/kg	0.0021													
Phenanthrene	85-01-8	mg/kg	1.5													
Pyrene	129-00-0	mg/kg	0.14													
Total Naphthalenes (2)	T_Napth (U=0)	mg/kg	--													
cPAHs (MTCA TEQ-ZeroND) (3,4)	BaPEq (U=0)	mg/kg	0.000016													
cPAHs (MTCA TEQ-HalfND) (3,5)	BaPEq (U=1/2)	mg/kg	0.000016													
Total HPAH (U=0) (2)	T_HPAH (U=0)	mg/kg	12													
Total LPAH (U=0) (2)	T_LPAH (U=0)	mg/kg	5.2													
Total PAH (U=0) (2)	T_PAH (U=0)	mg/kg	--													
Semi-Volatile Organic Compounds: Phthalates																
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	0.0051													
Total Petroleum Hydrocarbons																
Gasoline-range organics	GRO	mg/kg	30													
Diesel-range organics	DRO	mg/kg	260													
Oil-range organics	ORO	mg/kg	260													
Total DRO & ORO (2)	T_DRO&ORO (U=0)	mg/kg	260													

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	TP5-E2	TP5-E3	TP5-E4	TP5-N1	TP5-N3	TP5-N4	TP5-N5	TP5-S1	TP5-S2	TP5-W1	TP5-W2	TP5-W3	TP5-W4
			Sample Name	TP5-E2-5	TP5-E3-3	TP5-E4-2.5	TP5-N1-3	TP5-N3-3	TP5-N4-2.5	TP5-N5-3	TP5-S1-5	TP5-S2-5	TP5-W1-5	TP5-W2-5	TP5-W3-2.5	TP5-W4-3
			Sample Date	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018
			Sample Depth	5 ft	3 ft	2.5 ft	3 ft	3 ft	2.5 ft	3 ft	5 ft	5 ft	5 ft	5 ft	2.5 ft	3 ft
Analyte	**CAS No.**	**Unit**	**PSL (1)**													
Volatile Organic Compounds: Benzene, Toluene, Ethylbenzene, and Xylenes																
Ethylbenzene	100-41-4	mg/kg	0.010													
Toluene	108-88-3	mg/kg	0.044													
Xylene (meta & para)	108-38-3/106-42-3	mg/kg	--													
Xylene (ortho)	95-47-6	mg/kg	--													
Xylene (total)	1330-20-7	mg/kg	0.055													
Volatile Organic Compounds: Chlorinated Volatile Organic Compounds																
cis-1,2-Dichloroethene	156-59-2	mg/kg	0.0052													
Tetrachloroethene	127-18-4	mg/kg	0.0016													
Trichloroethene	79-01-6	mg/kg	0.00027													
Vinyl chloride	75-01-4	mg/kg	0.000056													
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1,2,4-Trimethylbenzene	95-63-6	mg/kg	0.072													
1,3,5-Trimethylbenzene	108-67-8	mg/kg	0.071													
Cymene	99-87-6	mg/kg	--													
Isopropylbenzene	98-82-8	mg/kg	0.79													
n-Propylbenzene	103-65-1	mg/kg	0.88													
sec-Butylbenzene	135-98-8	mg/kg	1.3													
Trichlorofluoromethane	75-69-4	mg/kg	0.79													

Notes:

Blank cells are intentional.

All results are rounded to two significant figures.

RED/BOLD Detected result exceeds PSL.

Italics Non-detect result exceeds PSL.

1 Preliminary Screening Level as established in Table 5.2.

2 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

3 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic equivalent Factors as presented in Table 708-2 of WAC 173-340-900.

4 Calculation was performed using only detected cPAH concentrations.

5 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.

6 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.

7 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.

8 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

Abbreviations:

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cPAH Carcinogenic polycyclic aromatic hydrocarbon

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ft Feet

GRO Gasoline-range organics

HPAH High molecular weight polycyclic aromatic hydrocarbon

LPAH Low molecular weight polycyclic aromatic hydrocarbon

mg/kg Milligrams per kilogram

MTCA Model Toxics Control Act

ORO Oil-range organics

PSL Preliminary screening level

TEQ Toxic equivalent

Qualifier:

U Analyte was not detected at the associated reporting limit.

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	TP6				TP7-B1	TP7-B2	TP7-B3	TP7-B4	TP7-E1	TP7-E2	TP7-E3	TP7-E4	TP7-E5
			Sample Name	TP6-1	TP6-2	TP6-3	TP6-4	TP7-B1-5	TP7-B2-5	TP7-B3-5	TP7-B4-5	TP7-E1-2.5	TP7-E2-3	TP7-E3-2.5	TP7-E4-2.5	TP7-E5-3
			Sample Date	5/22/2018	5/22/2018	5/22/2018	5/22/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	7/10/2018	7/10/2018
			Sample Depth	1 ft	2 ft	3 ft	4 ft	5 ft	5 ft	5 ft	5 ft	2.5 ft	3 ft	2.5 ft	2.5 ft	3 ft
Analyte	**CAS No.**	**Unit**	**PSL [1]**													
Metals																
Arsenic	7440-38-2	mg/kg	7.3	1.7	5.1		4.1	**8.6**	1.6	3.3	2.8	**97**	**83**	**10**	7.1	**7.5**
Barium	7440-39-3	mg/kg	8.3													
Cadmium	7440-43-9	mg/kg	0.77	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	**1.1**	**1.1**	**1.7**	*1.0 U*	*1.0 U*
Chromium	7440-47-3	mg/kg	48	5.1												
Copper	7440-50-8	mg/kg	36													
Lead	7439-92-1	mg/kg	50	4.2	1.7	3.9		11	1.2	1.7	2.1	**160**	**110**	**59**		
Mercury	7439-97-6	mg/kg	0.070													
Silver	7440-22-4	mg/kg	0.016													
Polychlorinated Biphenyls (PCBs)																
Aroclor 1016	12674-11-2	mg/kg	--													
Aroclor 1242	53469-21-9	mg/kg	--													
Aroclor 1248	12672-29-6	mg/kg	--													
Aroclor 1254	11097-69-1	mg/kg	--													
Aroclor 1260	11096-82-5	mg/kg	--													
Aroclor 1262	37324-23-5	mg/kg	--													
Total PCB Aroclors (U=0) [2]	T_PCB (U=0)	mg/kg	0.00000055													
Semi-Volatile Organic Compounds: Polycyclic Aromatic Hydrocarbons (PAHs)																
1-Methylnaphthalene	90-12-0	mg/kg	0.0042													
2-Methylnaphthalene	91-57-6	mg/kg	0.039													
Benzo(a)anthracene	56-55-3	mg/kg	--													
Benzo(a)pyrene	50-32-8	mg/kg	0.000016													
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Benzo(k)fluoranthene	207-08-9	mg/kg	--													
Chrysene	218-01-9	mg/kg	--													
Dibenzo(a,h)anthracene	53-70-3	mg/kg	--													
Fluoranthene	206-44-0	mg/kg	0.090													
Fluorene	86-73-7	mg/kg	0.029													
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg	--													
Naphthalene	91-20-3	mg/kg	0.0021													
Phenanthrene	85-01-8	mg/kg	1.5													
Pyrene	129-00-0	mg/kg	0.14													
Total Naphthalenes [2]	T_Napth (U=0)	mg/kg	--													
cPAHs (MTCA TEQ-ZeroND) [3,4]	BaPEq (U=0)	mg/kg	0.000016													
cPAHs (MTCA TEQ-HalfND) [3,5]	BaPEq (U=1/2)	mg/kg	0.000016													
Total HPAH (U=0) [2]	T_HPAH (U=0)	mg/kg	12													
Total LPAH (U=0) [2]	T_LPAH (U=0)	mg/kg	5.2													
Total PAH (U=0) [2]	T_PAH (U=0)	mg/kg	--													
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Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	0.0051													
Total Petroleum Hydrocarbons																
Gasoline-range organics	GRO	mg/kg	30													
Diesel-range organics	DRO	mg/kg	260													
Oil-range organics	ORO	mg/kg	260													
Total DRO & ORO [2]	T_DRO&ORO (U=0)	mg/kg	260													

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	TP6				TP7-B1	TP7-B2	TP7-B3	TP7-B4	TP7-E1	TP7-E2	TP7-E3	TP7-E4	TP7-E5
			Sample Name	TP6-1	TP6-2	TP6-3	TP6-4	TP7-B1-5	TP7-B2-5	TP7-B3-5	TP7-B4-5	TP7-E1-2.5	TP7-E2-3	TP7-E3-2.5	TP7-E4-2.5	TP7-E5-3
			Sample Date	5/22/2018	5/22/2018	5/22/2018	5/22/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	7/10/2018	7/10/2018
			Sample Depth	1 ft	2 ft	3 ft	4 ft	5 ft	5 ft	5 ft	5 ft	2.5 ft	3 ft	2.5 ft	2.5 ft	3 ft
Analyte	**CAS No.**	**Unit**	**PSL (1)**													
Volatile Organic Compounds: Benzene, Toluene, Ethylbenzene, and Xylenes																
Ethylbenzene	100-41-4	mg/kg	0.010													
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1,3,5-Trimethylbenzene	108-67-8	mg/kg	0.071													
Cymene	99-87-6	mg/kg	--													
Isopropylbenzene	98-82-8	mg/kg	0.79													
n-Propylbenzene	103-65-1	mg/kg	0.88													
sec-Butylbenzene	135-98-8	mg/kg	1.3													
Trichlorofluoromethane	75-69-4	mg/kg	0.79													

Notes:
Blank cells are intentional.
All results are rounded to two significant figures.
RED/BOLD Detected result exceeds PSL.
Italics Non-detect result exceeds PSL.
1 Preliminary Screening Level as established in Table 5.2.
2 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.
3 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic equivalent Factors as presented in Table 708-2 of WAC 173-340-900.
4 Calculation was performed using only detected cPAH concentrations.
5 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.
6 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.
7 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.
8 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

Abbreviations:
CAS Chemical Abstracts Service
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ft Feet
GRO Gasoline-range organics
HPAH High molecular weight polycyclic aromatic hydrocarbon
LPAH Low molecular weight polycyclic aromatic hydrocarbon
mg/kg Milligrams per kilogram
MTCA Model Toxics Control Act
ORO Oil-range organics
PSL Preliminary screening level
TEQ Toxic equivalent

Qualifier:
U Analyte was not detected at the associated reporting limit.

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	TP7-E6	TP7-N1	TP7-N2	TP7-N3	TP7-S1	TP7-S2	TP7-S3	TP7-W1	TP7-W2	TP7-W3	TP7-W4	TP7-W5	TP8	
			Sample Name	TP7-E6-2.5	TP7-N1-5	TP7-N2-5	TP7-N3-5	TP7-S1-3	TP7-S2-2.5	TP7-S3-3	TP7-W1-3	TP7-W2-5	TP7-W3-3	TP7-W4-2.5	TP7-W5-3	TP8-1	TP8-2
			Sample Date	7/10/2018	7/10/2018	7/10/2018	7/10/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	5/22/2018	5/22/2018
			Sample Depth	2.5 ft	5 ft	5 ft	5 ft	3 ft	2.5 ft	3 ft	3 ft	5 ft	3 ft	2.5 ft	3 ft	1 ft	2 ft
Analyte	**CAS No.**	**Unit**	**PSL (1)**														
Metals																	
Arsenic	7440-38-2	mg/kg	7.3	**7.6**	1.4	2.0	2.1	**9.6**	**16**	5.3	**19**	2.6	6.0	5.7	7.2	**9.6**	6.0
Barium	7440-39-3	mg/kg	8.3														
Cadmium	7440-43-9	mg/kg	0.77	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*
Chromium	7440-47-3	mg/kg	48														10
Copper	7440-50-8	mg/kg	36														
Lead	7439-92-1	mg/kg	50					19	17	4.0	47						30
Mercury	7439-97-6	mg/kg	0.070														
Silver	7440-22-4	mg/kg	0.016														
Polychlorinated Biphenyls (PCBs)																	
Aroclor 1016	12674-11-2	mg/kg	--														
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Aroclor 1248	12672-29-6	mg/kg	--														
Aroclor 1254	11097-69-1	mg/kg	--														
Aroclor 1260	11096-82-5	mg/kg	--														
Aroclor 1262	37324-23-5	mg/kg	--														
Total PCB Aroclors (U=0) (2)	T_PCB (U=0)	mg/kg	0.00000055														
Semi-Volatile Organic Compounds: Polycyclic Aromatic Hydrocarbons (PAHs)																	
1-Methylnaphthalene	90-12-0	mg/kg	0.0042														
2-Methylnaphthalene	91-57-6	mg/kg	0.039														
Benzo(a)anthracene	56-55-3	mg/kg	--														
Benzo(a)pyrene	50-32-8	mg/kg	0.000016														
Benzo(b)fluoranthene	205-99-2	mg/kg	--														
Benzo(g,h,i)perylene	191-24-2	mg/kg	0.67														
Benzo(k)fluoranthene	207-08-9	mg/kg	--														
Chrysene	218-01-9	mg/kg	--														
Dibenzo(a,h)anthracene	53-70-3	mg/kg	--														
Fluoranthene	206-44-0	mg/kg	0.090														
Fluorene	86-73-7	mg/kg	0.029														
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg	--														
Naphthalene	91-20-3	mg/kg	0.0021														
Phenanthrene	85-01-8	mg/kg	1.5														
Pyrene	129-00-0	mg/kg	0.14														
Total Naphthalenes (2)	T_Napth (U=0)	mg/kg	--														
cPAHs (MTCA TEQ-ZeroND) (3,4)	BaPEq (U=0)	mg/kg	0.000016														
cPAHs (MTCA TEQ-HalfND) (3,5)	BaPEq (U=1/2)	mg/kg	0.000016														
Total HPAH (U=0) (2)	T_HPAH (U=0)	mg/kg	12														
Total LPAH (U=0) (2)	T_LPAH (U=0)	mg/kg	5.2														
Total PAH (U=0) (2)	T_PAH (U=0)	mg/kg	--														
Semi-Volatile Organic Compounds: Phthalates																	
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	0.0051														
Total Petroleum Hydrocarbons																	
Gasoline-range organics	GRO	mg/kg	30														
Diesel-range organics	DRO	mg/kg	260														
Oil-range organics	ORO	mg/kg	260														
Total DRO & ORO (2)	T_DRO&ORO (U=0)	mg/kg	260														

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	TP7-E6	TP7-N1	TP7-N2	TP7-N3	TP7-S1	TP7-S2	TP7-S3	TP7-W1	TP7-W2	TP7-W3	TP7-W4	TP7-W5	TP8	
			Sample Name	TP7-E6-2.5	TP7-N1-5	TP7-N2-5	TP7-N3-5	TP7-S1-3	TP7-S2-2.5	TP7-S3-3	TP7-W1-3	TP7-W2-5	TP7-W3-3	TP7-W4-2.5	TP7-W5-3	TP8-1	TP8-2
			Sample Date	7/10/2018	7/10/2018	7/10/2018	7/10/2018	6/27/2018	6/27/2018	6/27/2018	6/27/2018	7/10/2018	7/10/2018	7/10/2018	7/10/2018	5/22/2018	5/22/2018
			Sample Depth	2.5 ft	5 ft	5 ft	5 ft	3 ft	2.5 ft	3 ft	3 ft	5 ft	3 ft	2.5 ft	3 ft	1 ft	2 ft
Analyte	**CAS No.**	**Unit**	**PSL (1)**														
Volatile Organic Compounds: Benzene, Toluene, Ethylbenzene, and Xylenes																	
Ethylbenzene	100-41-4	mg/kg	0.010														
Toluene	108-88-3	mg/kg	0.044														
Xylene (meta & para)	108-38-3/106-42-3	mg/kg	--														
Xylene (ortho)	95-47-6	mg/kg	--														
Xylene (total)	1330-20-7	mg/kg	0.055														
Volatile Organic Compounds: Chlorinated Volatile Organic Compounds																	
cis-1,2-Dichloroethene	156-59-2	mg/kg	0.0052														
Tetrachloroethene	127-18-4	mg/kg	0.0016														
Trichloroethene	79-01-6	mg/kg	0.00027														
Vinyl chloride	75-01-4	mg/kg	0.000056														
Volatile Organic Compounds: Other																	
1,1-Dichloroethene	75-35-4	mg/kg	0.0025														
1,2,4-Trimethylbenzene	95-63-6	mg/kg	0.072														
1,3,5-Trimethylbenzene	108-67-8	mg/kg	0.071														
Cymene	99-87-6	mg/kg	--														
Isopropylbenzene	98-82-8	mg/kg	0.79														
n-Propylbenzene	103-65-1	mg/kg	0.88														
sec-Butylbenzene	135-98-8	mg/kg	1.3														
Trichlorofluoromethane	75-69-4	mg/kg	0.79														

Notes:
Blank cells are intentional.
All results are rounded to two significant figures.
RED/BOLD Detected result exceeds PSL.
Italics Non-detect result exceeds PSL.
1 Preliminary Screening Level as established in Table 5.2.
2 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.
3 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic equivalent Factors as presented in Table 708-2 of WAC 173-340-900.
4 Calculation was performed using only detected cPAH concentrations.
5 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.
6 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.
7 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.
8 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

Abbreviations:
CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbon
DRO Diesel-range organics
ft Feet
GRO Gasoline-range organics
HPAH High molecular weight polycyclic aromatic hydrocarbon
LPAH Low molecular weight polycyclic aromatic hydrocarbon
mg/kg Milligrams per kilogram
MTCA Model Toxics Control Act
ORO Oil-range organics
PSL Preliminary screening level
TEQ Toxic equivalent

Qualifier:
U Analyte was not detected at the associated reporting limit.

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	TP8 (cont.)		TP9				TP10-B1	TP10-E1	TP10-W1	TP11-B1	TP11-E1	TP11-W1	WH-RBank
			Sample Name	TP8-3	TP8-4	TP9-1	TP9-2	TP9-3	TP9-4	TP10-B1-5	TP10-E1-2.5	TP10-W1-2.5	TP11-B1-5	TP11-E1-2.5	TP11-W1-2.5	WH-RBank
			Sample Date	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	7/6/2018	7/6/2018	7/6/2018	7/6/2018	7/6/2018	7/6/2018	7/18/2018
			Sample Depth	3 ft	4 ft	1 ft	2 ft	3 ft	4 ft	5 ft	2.5 ft	2.5 ft	5 ft	2.5 ft	2.5 ft	1.5-4.5 ft
Analyte	**CAS No.**	**Unit**	**PSL** [1]													
Metals																
Arsenic	7440-38-2	mg/kg	7.3	6.1		**9.8**	6.6		5.1	6.8	7.0	**9.5**	6.5	5.7	5.9	7.0
Barium	7440-39-3	mg/kg	8.3													
Cadmium	7440-43-9	mg/kg	0.77	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	*1.0 U*	**47**
Chromium	7440-47-3	mg/kg	48			9.1										
Copper	7440-50-8	mg/kg	36													**14,000**
Lead	7439-92-1	mg/kg	50	8.8	5.8		**92**	11								**2,400**
Mercury	7439-97-6	mg/kg	0.070													
Silver	7440-22-4	mg/kg	0.016													
Polychlorinated Biphenyls (PCBs)																
Aroclor 1016	12674-11-2	mg/kg	--													
Aroclor 1242	53469-21-9	mg/kg	--													
Aroclor 1248	12672-29-6	mg/kg	--													
Aroclor 1254	11097-69-1	mg/kg	--													
Aroclor 1260	11096-82-5	mg/kg	--													
Aroclor 1262	37324-23-5	mg/kg	--													
Total PCB Aroclors (U=0) [2]	T_PCB (U=0)	mg/kg	0.00000055													
Semi-Volatile Organic Compounds: Polycyclic Aromatic Hydrocarbons (PAHs)																
1-Methylnaphthalene	90-12-0	mg/kg	0.0042													
2-Methylnaphthalene	91-57-6	mg/kg	0.039													
Benzo(a)anthracene	56-55-3	mg/kg	--													
Benzo(a)pyrene	50-32-8	mg/kg	0.000016													
Benzo(b)fluoranthene	205-99-2	mg/kg	--													
Benzo(g,h,i)perylene	191-24-2	mg/kg	0.67													
Benzo(k)fluoranthene	207-08-9	mg/kg	--													
Chrysene	218-01-9	mg/kg	--													
Dibenzo(a,h)anthracene	53-70-3	mg/kg	--													
Fluoranthene	206-44-0	mg/kg	0.090													
Fluorene	86-73-7	mg/kg	0.029													
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg	--													
Naphthalene	91-20-3	mg/kg	0.0021													
Phenanthrene	85-01-8	mg/kg	1.5													
Pyrene	129-00-0	mg/kg	0.14													
Total Naphthalenes [2]	T_Napth (U=0)	mg/kg	--													
cPAHs (MTCA TEQ-ZeroND) [3,4]	BaPEq (U=0)	mg/kg	0.000016													
cPAHs (MTCA TEQ-HalfND) [3,5]	BaPEq (U=1/2)	mg/kg	0.000016													
Total HPAH (U=0) [2]	T_HPAH (U=0)	mg/kg	12													
Total LPAH (U=0) [2]	T_LPAH (U=0)	mg/kg	5.2													
Total PAH (U=0) [2]	T_PAH (U=0)	mg/kg	--													
Semi-Volatile Organic Compounds: Phthalates																
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	0.0051													
Total Petroleum Hydrocarbons																
Gasoline-range organics	GRO	mg/kg	30													
Diesel-range organics	DRO	mg/kg	260													
Oil-range organics	ORO	mg/kg	260													
Total DRO & ORO [2]	T_DRO&ORO (U=0)	mg/kg	260													

Table 6.3
Detected Analytes in In Situ Soil

			Location Name	TP8 (cont.)		TP9				TP10-B1	TP10-E1	TP10-W1	TP11-B1	TP11-E1	TP11-W1	WH-RBank
			Sample Name	TP8-3	TP8-4	TP9-1	TP9-2	TP9-3	TP9-4	TP10-B1-5	TP10-E1-2.5	TP10-W1-2.5	TP11-B1-5	TP11-E1-2.5	TP11-W1-2.5	WH-RBank
			Sample Date	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	5/22/2018	7/6/2018	7/6/2018	7/6/2018	7/6/2018	7/6/2018	7/6/2018	7/18/2018
			Sample Depth	3 ft	4 ft	1 ft	2 ft	3 ft	4 ft	5 ft	2.5 ft	2.5 ft	5 ft	2.5 ft	2.5 ft	1.5-4.5 ft
Analyte	**CAS No.**	**Unit**	**PSL [1]**													
Volatile Organic Compounds: Benzene, Toluene, Ethylbenzene, and Xylenes																
Ethylbenzene	100-41-4	mg/kg	0.010													
Toluene	108-88-3	mg/kg	0.044													
Xylene (meta & para)	108-38-3/106-42-3	mg/kg	--													
Xylene (ortho)	95-47-6	mg/kg	--													
Xylene (total)	1330-20-7	mg/kg	0.055													
Volatile Organic Compounds: Chlorinated Volatile Organic Compounds																
cis-1,2-Dichloroethene	156-59-2	mg/kg	0.0052													
Tetrachloroethene	127-18-4	mg/kg	0.0016													
Trichloroethene	79-01-6	mg/kg	0.00027													
Vinyl chloride	75-01-4	mg/kg	0.000056													
Volatile Organic Compounds: Other																
1,1-Dichloroethene	75-35-4	mg/kg	0.0025													
1,2,4-Trimethylbenzene	95-63-6	mg/kg	0.072													
1,3,5-Trimethylbenzene	108-67-8	mg/kg	0.071													
Cymene	99-87-6	mg/kg	--													
Isopropylbenzene	98-82-8	mg/kg	0.79													
n-Propylbenzene	103-65-1	mg/kg	0.88													
sec-Butylbenzene	135-98-8	mg/kg	1.3													
Trichlorofluoromethane	75-69-4	mg/kg	0.79													

Notes:

Blank cells are intentional.
All results are rounded to two significant figures.
RED/BOLD Detected result exceeds PSL.
Italics Non-detect result exceeds PSL.
1 Preliminary Screening Level as established in Table 5.2.
2 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.
3 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic equivalent Factors as presented in Table 708-2 of WAC 173-340-900.
4 Calculation was performed using only detected cPAH concentrations.
5 Calculation was performed using detected cPAH concentrations plus one-half the reported value for cPAHs that were not detected.
6 The laboratory noted that the sample chromatographic pattern does not resemble the fuel standard used for quantitation.
7 The laboratory noted the chromatograms resemble a diesel range product such as diesel #2 or heating oil.
8 The laboratory noted the chromatograms resemble a residual range product such as motor or hydraulic oil.

Abbreviations:

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cPAH Carcinogenic polycyclic aromatic hydrocarbon
DRO Diesel-range organics
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GRO Gasoline-range organics
HPAH High molecular weight polycyclic aromatic hydrocarbon
LPAH Low molecular weight polycyclic aromatic hydrocarbon
mg/kg Milligrams per kilogram
MTCA Model Toxics Control Act
ORO Oil-range organics
PSL Preliminary screening level
TEQ Toxic equivalent

Qualifier:

U Analyte was not detected at the associated reporting limit.

Table 6.4
Detected Analytes in Sediment

			Location Name	LDW18-2109-1	LDW18-2109-2	LDW18-SS-184	LDW-SS2106-A	LDW-SS2106-U	LDW-SS2108-A	LDW-SS2108-U
			Sample Name	LDW18-SSOT-2109-1	LDW18-SSOT-2109-2	LDW18-SS-184	LDW-SS2106-A	LDW-SS2106-U	LDW-SS2108-A	LDW-SS2108-U
			Sample Date	2/23/2018	2/23/2018	2/23/2018	3/4/2011	3/7/2011	3/7/2011	3/7/2011
			Sample Depth	0–10 cm	0–10 cm	0–10 cm	0–10 cm	0–9.5 cm	0–7 cm	0–10 cm
Analyte	**CAS No.**	**Unit**	**PSL (1)**							
Metals										
Arsenic	7440-38-2	mg/kg	7	**8.7**	**9.5**	**8.3**	**10**	**20**	**10**	**20**
Cadmium	7440-43-9	mg/kg	5.1	0.090 J	0.10 J	0.10 J	0.50	0.50	0.50	0.50
Chromium	7440-47-3	mg/kg	260	18	22	20	30	28	28	27
Copper	7440-50-8	mg/kg	390	31	36	27	47	53	59	63
Lead	7439-92-1	mg/kg	450	23	24	19	15	20	24	24
Mercury	7439-97-6	mg/kg	0.41	0.052	0.049	0.064	0.080	0.12	0.090	0.13
Silver	7440-22-4	mg/kg	6.1	0.090 J	0.10 J	0.14 J	0.70 U	0.70 U	0.60 U	0.70 U
Zinc	7440-66-6	mg/kg	410	65	67	70	99	110	110	120
Polychlorinated Biphenyls (PCBs)										
Aroclor 1248	12672-29-6	mg/kg	--	0.021 J	0.019 JN	0.029 J	0.079 U	0.039 U	0.022	0.015
Aroclor 1254	11097-69-1	mg/kg	--	0.025	0.023	0.038	0.20 U	0.058 U	0.040	0.025
Aroclor 1260	11096-82-5	mg/kg	--	0.026	0.024	0.036	1.2	0.20	0.038	0.024
Total PCB Aroclors (U=0) (2)	T_PCB (U=0)	mg/kg	0.128	0.071 J	0.067 JN	0.10 J	**1.2**	**0.20**	0.10	0.064
Total PCB Congeners (U=0) (2)	T_PCBCg (U=0)	mg/kg	0.002			**0.060 J**				
PCB Congeners (MTCA TEQ-ZeroND) (3,4)	PCB_TEQ (U=0)	mg/kg	0.0000007			**0.00000075 J**				
PCB Congeners (MTCA TEQ-HalfND) (4,5)	PCB_TEQ (U=1/2)	mg/kg	--			0.0000011 J				
Dioxins-Furans										
2,3,7,8-TCDD	1746-01-6	mg/kg	2.3305E-05	0.00000012 J			0.00000034 U			
1,2,3,7,8-PeCDD	40321-76-4	mg/kg	--	0.00000042 UJ			0.00000066 J			
1,2,3,4,7,8-HxCDD	39227-28-6	mg/kg	--	0.00000070 J			0.0000011 J			
1,2,3,6,7,8-HxCDD	57653-85-7	mg/kg	--	0.0000024			0.0000035 J			
1,2,3,7,8,9-HxCDD	19408-74-3	mg/kg	--	0.0000014			0.0000030 J			
1,2,3,4,6,7,8-HpCDD	35822-46-9	mg/kg	--	0.000066			0.000072			
OCDD	3268-87-9	mg/kg	--	0.00062			0.00063			
2,3,7,8-TCDF	51207-31-9	mg/kg	--	0.00000039			0.00000037 U			
1,2,3,7,8-PeCDF	57117-41-6	mg/kg	--	0.00000031 J			0.00000032 J			
2,3,4,7,8-PeCDF	57117-31-4	mg/kg	--	0.00000044 J			0.00000053 J			
1,2,3,4,7,8-HxCDF	70648-26-9	mg/kg	--	0.0000016			0.0000018 J			
1,2,3,6,7,8-HxCDF	57117-44-9	mg/kg	--	0.00000058 J			0.00000067 J			
1,2,3,7,8,9-HxCDF	72918-21-9	mg/kg	--	0.000000047 UJ			0.000000085 U			
2,3,4,6,7,8-HxCDF	60851-34-5	mg/kg	--	0.00000046 UJ			0.00000062 J			
1,2,3,4,6,7,8-HpCDF	67562-39-4	mg/kg	--	0.000013			0.000016			
1,2,3,4,7,8,9-HpCDF	55673-89-7	mg/kg	--	0.0000011			0.0000012 J			
OCDF	39001-02-0	mg/kg	--	0.000034			0.000045			
Dioxins/Furans (MTCA TEQ-ZeroND) (3,6)	DF_TEQ (U=0)	mg/kg	0.000002	0.0000020 J			**0.0000030 J**			
Dioxins/Furans (MTCA TEQ-HalfND) (5,6)	DF_TEQ (U=1/2)	mg/kg	--	0.0000022 J			0.0000032 J			

Table 6.4
Detected Analytes in Sediment

			Location Name	LDW18-2109-1	LDW18-2109-2	LDW18-SS-184	LDW-SS2106-A	LDW-SS2106-U	LDW-SS2108-A	LDW-SS2108-U
			Sample Name	LDW18-SSOT-2109-1	LDW18-SSOT-2109-2	LDW18-SS-184	LDW-SS2106-A	LDW-SS2106-U	LDW-SS2108-A	LDW-SS2108-U
			Sample Date	2/23/2018	2/23/2018	2/23/2018	3/4/2011	3/7/2011	3/7/2011	3/7/2011
			Sample Depth	0–10 cm	0–10 cm	0–10 cm	0–10 cm	0–9.5 cm	0–7 cm	0–10 cm
Analyte	**CAS No.**	**Unit**	**PSL[1]**							
Dioxins-Furans (cont.)										
Total TCDD	41903-57-5	mg/kg	--	0.0000025 J			0.0000034			
Total TCDF	55722-27-5	mg/kg	--	0.0000085			0.0000093			
Total PeCDD	36088-22-9	mg/kg	--	0.0000043 J			0.0000060			
Total PeCDF	30402-15-4	mg/kg	--	0.000011 J			0.0000100			
Total HxCDD	34465-46-8	mg/kg	--	0.000020			0.000030			
Total HxCDF	55684-94-1	mg/kg	--	0.000021 J			0.000025			
Total HpCDD	37871-00-4	mg/kg	--	0.00017			0.00019			
Total HpCDF	38998-75-3	mg/kg	--	0.000045			0.000052			
Semi-Volatile Organic Compounds: Polycyclic Aromatic Hydrocarbons (PAHs)										
2-Methylnaphthalene	91-57-6	mg/kg	0.67	0.014 J	0.017 J	0.012 J	0.014 J	0.013 J	0.011 J	0.011 J
Acenaphthene	83-32-9	mg/kg	0.5	0.011 J	0.012 J	0.0084 J	0.024	0.023	0.012 J	0.012 J
Acenaphthylene	208-96-8	mg/kg	1.3	0.014 J	0.022	0.014 J	0.020 U	0.019 U	0.019 U	0.020 U
Anthracene	120-12-7	mg/kg	0.96	0.029	0.043	0.016 J	0.019 J	0.024	0.019	0.022
Benzo(a)anthracene	56-55-3	mg/kg	1.3	0.068	0.096	0.046	0.050	0.061	0.055	0.057
Benzo(a)pyrene	50-32-8	mg/kg	1.6	0.098	0.11	0.045	0.028	0.046	0.048	0.044
Benzo(b)fluoranthene	205-99-2	mg/kg	--							
Benzo(g,h,i)perylene	191-24-2	mg/kg	0.67	0.094	0.096	0.038	0.021	0.037	0.042	0.037
Benzo(k)fluoranthene	207-08-9	mg/kg	--							
Benzofluoranthenes (total)	56832-73-6	mg/kg	3.2	0.16	0.21	0.11	0.064	0.12	0.12	0.11
Chrysene	218-01-9	mg/kg	1.4	0.12	0.15	0.071	0.059	0.081	0.079	0.095
Dibenzo(a,h)anthracene	53-70-3	mg/kg	0.23	0.026	0.024	0.019 U	0.0049 U	0.011 J	0.012 J	0.011
Fluoranthene	206-44-0	mg/kg	1.7	0.17	0.23	0.11	0.14	0.18	0.14	0.14
Fluorene	86-73-7	mg/kg	0.54	0.020 U	0.019 J	0.013 J	0.026	0.026	0.015 J	0.015 J
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg	0.6	0.074	0.079	0.048	0.017 J	0.030	0.036	0.032
Naphthalene	91-20-3	mg/kg	2.1	0.017 J	0.020 J	0.034	0.011 J	0.012 J	0.015 J	0.013 J
Phenanthrene	85-01-8	mg/kg	1.5	0.091	0.20	0.052	0.096	0.11	0.078	0.070
Pyrene	129-00-0	mg/kg	2.6	0.18	0.23	0.12	0.11	0.14	0.13	0.11
cPAHs (MTCA TEQ-ZeroND) [3,7]	BaPEq (U=0)	mg/kg	0.59	0.13	0.15	0.066	0.042 J	0.069 J	0.071 J	0.066
cPAHs (MTCA TEQ-HalfND) [5,7]	BaPEq (U=1/2)	mg/kg	--	0.14	0.16	0.070	0.043 J	0.072 J	0.075 J	0.069
Total HPAH (U=0) [2]	T_HPAH (U=0)	mg/kg	12	0.99	1.2	0.58	0.49 J	0.71 J	0.66 J	0.64
Total LPAH (U=0) [2]	T_LPAH (U=0)	mg/kg	5.2	0.16 J	0.31 J	0.14 J	0.18 J	0.20 J	0.14 J	0.13 J
Total PAH (U=0) [2]	T_PAH (U=0)	mg/kg	--	1.2 J	1.5 J	0.72 J	0.67 J	0.90 J	0.80 J	0.77 J
Semi-Volatile Organic Compounds: Phthalates										
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	1.3	0.11	0.086	0.15	0.088 U	0.12	0.12	0.12
Butyl benzyl phthalate	85-68-7	mg/kg	0.063	0.025	0.047	0.019 U	0.019 J	0.017 J	0.016 J	0.013 J
Dimethyl phthalate	131-11-3	mg/kg	0.071	0.020 U	0.020 U	0.019 U	0.0080	0.0047 U	0.0048 U	0.0049 U

Table 6.4
Detected Analytes in Sediment

			Location Name	LDW18-2109-1	LDW18-2109-2	LDW18-SS-184	LDW-SS2106-A	LDW-SS2106-U	LDW-SS2108-A	LDW-SS2108-U
			Sample Name	LDW18-SSOT-2109-1	LDW18-SSOT-2109-2	LDW18-SS-184	LDW-SS2106-A	LDW-SS2106-U	LDW-SS2108-A	LDW-SS2108-U
			Sample Date	2/23/2018	2/23/2018	2/23/2018	3/4/2011	3/7/2011	3/7/2011	3/7/2011
			Sample Depth	0–10 cm	0–10 cm	0–10 cm	0–10 cm	0–9.5 cm	0–7 cm	0–10 cm
Analyte	**CAS No.**	**Unit**	**PSL(1)**							
Semi-Volatile Organic Compounds: Other										
4-Methylphenol	106-44-5	mg/kg	0.67	0.020 U	0.020 U	0.026	0.16	0.22	0.073	0.46
Benzoic acid	65-85-0	mg/kg	0.65	0.054	0.17	0.040 J	0.38	0.34	0.33	0.48
Benzyl alcohol	100-51-6	mg/kg	0.057	0.015 J	0.035	0.0062 J	**0.35**	**0.65**	**0.17**	**0.33 J**
Carbazole	86-74-8	mg/kg	--				0.020 U	0.010 J	0.011 J	0.011 J
Dibenzofuran	132-64-9	mg/kg	0.54	0.020 U	0.0072 J	0.0061 J	0.024	0.022	0.015 J	0.014 J
Pentachlorophenol	87-86-5	mg/kg	0.36	0.020 UJ	0.0024 J	0.019 UJ	0.024 U	0.024 U	0.024 U	0.024 U
Phenol	108-95-2	mg/kg	0.42	0.020 U	0.012 J	0.010 J	0.038	0.046	0.036	0.087
Volatile Organic Compounds										
1,4-Dichlorobenzene	106-46-7	mg/kg	0.11	0.0050 U	0.00090 J	0.0028 J	0.0049 U	0.0047 U	0.0048 U	0.0049 U
Conventionals										
Black carbon	7440-44-0	%	--			0.010 UJ				
Total Organic Carbon	TOC	%	--	0.75 J	1.8 J	0.98 J	2.6	3.6	2.4	2.8

Notes:

Blank cells are intentional.

All results are rounded to two significant figures.

RED/BOLD Detected result exceeds PSL.

1 Preliminary Screening Level as established in Table 5.3.

2 Summation was performed using only detected concentrations for component analytes. If all analytes were not detected, the maximum reported non-detect concentration is used.

3 Calculation was performed using only detected concentrations.

4 Calculation of PCB TEQ concentrations was performed in accordance with the summation rules specified in Appendix E (Data Management Plan).

5 Calculation was performed using detected concentrations plus one-half the reported value for analytes that were not detected.

6 Calculation of dioxin/furan TEQ concentrations was performed in accordance with the summation rules specified in Appendix E (Data Management Plan).

7 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivalency Factors as presented in Table 708-2 of WAC 173-340-900.

Abbreviations:

CAS Chemical Abstracts Service
cm Centimeters
cPAH Carcinogenic polycyclic aromatic hydrocarbon
HPAH High molecular weight polycyclic aromatic hydrocarbon
HpCDD Heptachlorodibenzo-*p* -dioxin
HpCDF Heptachlorodibenzofuran
HxCDD Hexachlorodibenzo-*p* -dioxin
HxCDF Hexachlorodibenzofuran
LPAH Low molecular weight polycyclic aromatic hydrocarbon
mg/kg Milligrams per kilogram
MTCA Model Toxics Control Act
OCDD Octachlorodibenzodioxin
OCDF Octachlorodibenzofuran
PeCDD Pentachlorodibenzo-*p* -dioxin
PeCDF Pentachlorodibenzofuran
PSL Preliminary screening level
TCDD Tetrachlorodibenzo-*p* -dioxin
TCDF Tetrachlorodibenzofuran
TEF Toxic equivalent factor
TEQ Toxic equivalent

Qualifiers:

J Analyte was detected; concentration is an estimate.
JN Concentration is estimated based on a tentative match to standard or library sample, use needs to be supported by other information.
U Analyte was not detected at the associated reporting limit.
UJ Analyte was not detected at the associated reporting limit, which is an estimate.

Remedial Investigation/Feasibility Study Work Plan

Silver Bay Logging Site

Figures

Note:
· Basemap tiles by Stamen Design, under CC BY 3.0. Data by OpenStreetMap, under ODbL.

Abbreviation:
RI/FS = Remedial Investigation/Feasibility Study

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Silver Bay Logging Site
Seattle, Washington

Figure 1.1
Vicinity Map

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2/2/2023

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Figure 2.1
Historical Property Operations

I:\GIS\Projects\HDR-SPU-WQF\MXD\RIFS Work Plan\Figure 2.1 Historical Property Operations.mxd
2/27/2023

Notes:
1. Approximate shoreline based on Condition Assessment Report (HDR 2022).
· Parcel boundaries obtained from King County, 2020.
· Orthoimagery obtained from Nearmap, 2021.

Abbreviations:
RI/FS = Remedial Investigation/Feasibility Study
ROW = Right-of-way

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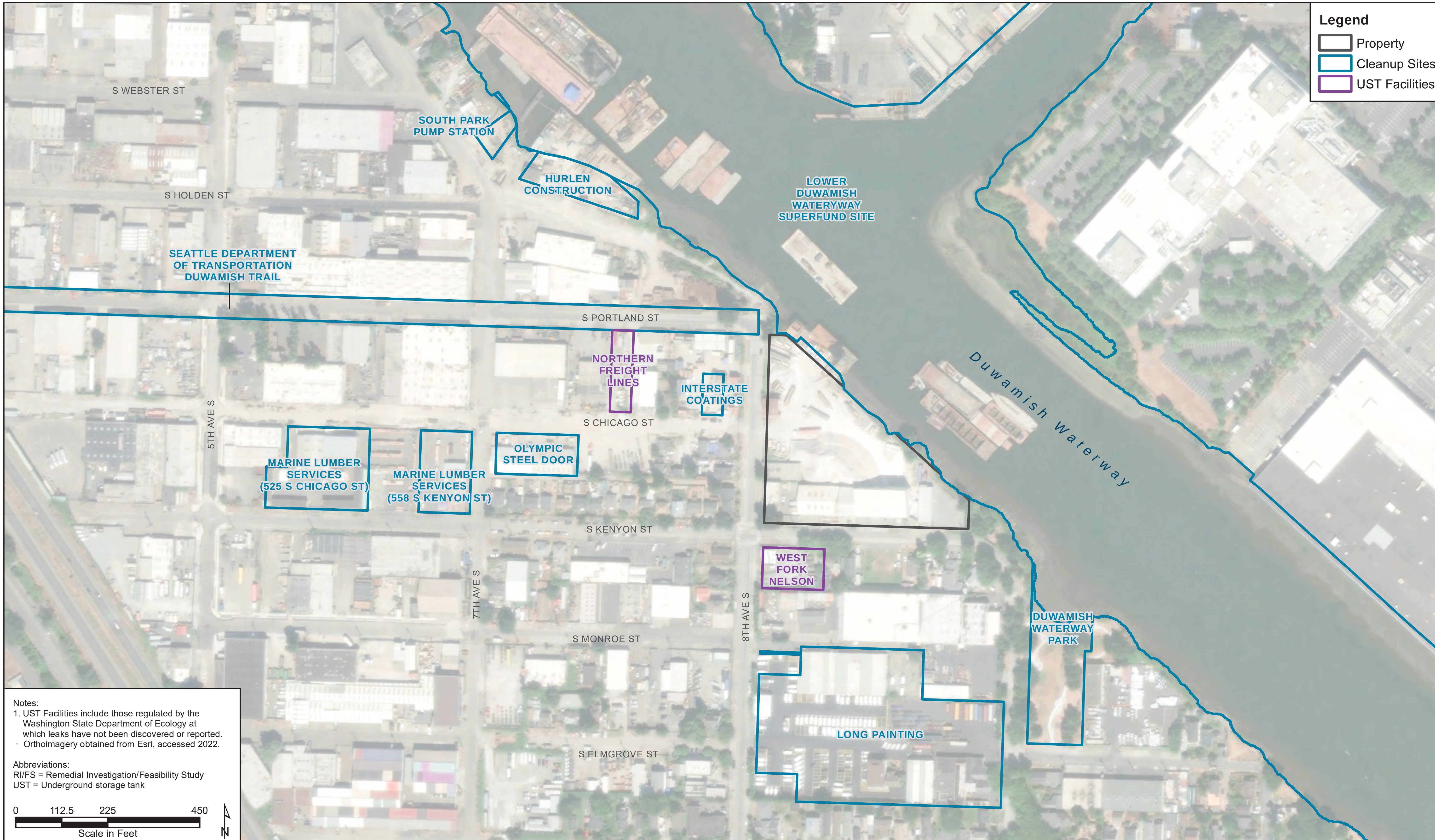
Figure 2.2
Current Property Features

I:\GIS\Projects\HDR-SPU-WQF\MXD\RIFS Work Plan\Figure 2.2 Current Property Features.mxd
2/27/2023



Notes:
1. UST Facilities include those regulated by the Washington State Department of Ecology at which leaks have not been discovered or reported.
· Orthoimagery obtained from Esri, accessed 2022.

Abbreviations:
RI/FS = Remedial Investigation/Feasibility Study
UST = Underground storage tank

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Figure 2.3
Adjacent Sites and Facilities of Interest

I:\GIS\Projects\HDR-SPU-WQF\MXD\RIFS Work Plan\Figure 2.3 Adjacent Sites and Facilities of Interest.mxd
2/27/2023

Remedial Excavation Summary

Area	Targeted or Detected Contaminant(s)	Excavation Depth (feet bgs)
A1A	Metals, TPH, Naphthalene	5–16
A2A	Metals, TPH	2.5–3
A2B	Metals, TPH, PCBs, cPAHs	2
A3A	Metals, TPH, PCBs, cPAHs	0.5–2
A3B	Metals, TPH, PCBs	0.5–2
A3C	Metals, TPH, cPAHs	1
A4A	Metals, TPH, PCBs	2
A4B	Metals, TPH, PCBs, cPAHs	2–3
A4C	Metals, TPH, PCBs, cPAHs	2.5
A5A	Metals, TPH	2–9
A6A	Metals, TPH, PCBs, cPAHs	0.5-3
A6B	Metals, TPH, cPAHs	2
A6C	Metals, TPH, PCBs, cPAHs	2
FT	(no impacts)	12
RT	Metals, TPH	8
TP1	Metals	1.5
TP5/TP7	Metals	5
TP10	Metals	5
TP11	Metals	5

Legend

- Approximate Shoreline Below Dock[(1)]
- A6A Remedial Excavation Limit and Designation[(2)]
- Removed UST
- Property
- Parcel Boundary

Sample Location

- Monitoring Well
- Direct Push Soil Boring
- Hand Auger Soil Boring
- Test Pit
- Excavation Confirmation Sample
- LDW Intertidal Sediment Sample

Notes:
1. Approximate shoreline based on Condition Assessment Report (HDR 2022).
2. Details regarding previous remedial excavations are provided in construction completion reports prepared by The Riley Group, Inc. (Riley 2017, Riley 2018, Riley 2019).

· Parcel boundaries obtained from King County, 2020.
· Orthoimagery obtained from Nearmap, 2021.

Abbreviations:
cPAH = Carcinogenic polycyclic aromatic hydrocarbon
Feet bgs = Feet below ground surface
LDW = Lower Duwamish Waterway
PCB = Polychlorinated biphenyl
RI/FS = Remedial Investigation/Feasibility Study
TPH = Total petroleum hydrocarbons
UST = Underground storage tank

0 35 70 140
Scale in Feet

N

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Figure 3.1
Previous Investigation and Remedial Action Locations

I:\GIS\Projects\HDR-SPU-WQF\MXD\RIFS Work Plan\Figure 3.1 Previous Investigation and Remedial Action Locations.mxd
2/27/2023

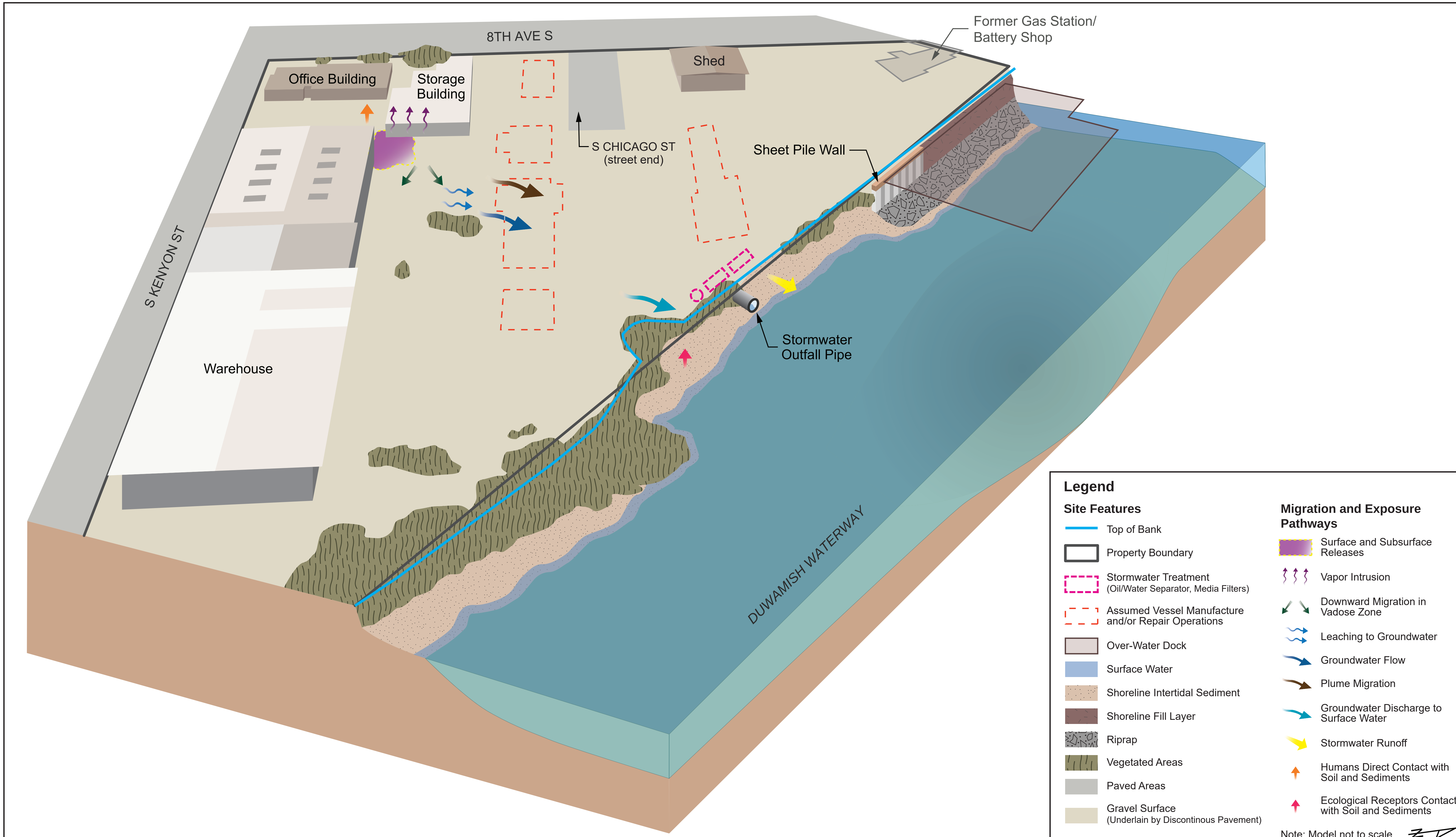

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Figure 4.1
Conceptual Site Model

I:\GIS\Projects\HDR-SPU-WQF\AI\RIFS Work Plan\Figure 4.1 Conceptual Site Model.ai
2/15/2023

Notes:
1. Approximate shoreline based on Condition Assessment Report (HDR 2022).
2. Details regarding previous remedial excavations are provided in construction completion reports prepared by The Riley Group, Inc. (RGI 2017, RGI 2018, RGI 2019).
3. Overall groundwater flow direction was determined from tidal studies conducted by the Riley Group (RGI 2016).
4. The PSL for arsenic in groundwater is 8.0 µg/L. The maximum detected arsenic concentration in the existing dataset is 12 µg/L. Where multiple samples from a monitoring well were collected, the maximum result is shown.
- Parcel boundaries obtained from King County, 2020.
- Orthoimagery obtained from Nearmap, 2021.

Abbreviations:
µg/L = Micrograms per liter
ND = Non Detect
PSL = Preliminary Screening Level
RI/FS = Remedial Investigation/Feasibility Study

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Figure 6.1
Arsenic Detections in Groundwater

I:\GIS\Projects\HDR-SPU-WQF\MXD\RIFS Work Plan\Figure 6.1 Arsenic Detections in Groundwater.mxd
2/27/2023

Notes:
1. Approximate shoreline based on Condition Assessment Report (HDR 2022).
2. Details regarding previous remedial excavations are provided in construction completion reports prepared by The Riley Group, Inc. (RGI 2017, RGI 2018, RGI 2019).
3. Overall groundwater flow direction was determined from tidal studies conducted by the Riley Group (RGI 2016).
4. The PSL for lead in groundwater is 5.6 µg/L. The maximum detected lead concentration in the existing dataset is 170 µg/L.Where multiple samples from a monitoring well were collected, the maximum result is shown.
· Parcel boundaries obtained from King County, 2020.
· Orthoimagery obtained from Nearmap, 2021.

Abbreviations:
µg/L = Micrograms per liter
ND = Non Detect
PSL = Preliminary Screening Level
RI/FS = Remedial Investigation/Feasibility Study

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Figure 6.2
Lead Detections in Groundwater

I:\GIS\Projects\HDR-SPU-WQF\MXD\RIFS Work Plan\Figure 6.2 Lead Detections in Groundwater.mxd
2/27/2023

Notes:
1. Approximate shoreline based on Condition Assessment Report (HDR 2022).
2. Details regarding previous remedial excavations are provided in construction completion reports prepared by The Riley Group, Inc. (RGI 2017, RGI 2018, RGI 2019).
3. Overall groundwater flow direction was determined from tidal studies conducted by the Riley Group (RGI 2016).
4. The PSL for total DRO+ORO in groundwater is 500 µg/L. The maximum detected total DRO+ORO concentration in the existing dataset is 2,500 µg/L. Where multiple samples from a monitoring well were collected, the maximum result is shown.

- Parcel boundaries obtained from King County, 2020.
- Orthoimagery obtained from Nearmap, 2021.

Abbreviations:
DRO = Diesel-range organics
µg/L = Micrograms per liter
ND = Non Detect
ORO = Oil-range organics
PSL = Preliminary Screening Level
RI/FS = Remedial Investigation/Feasibility Study

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Figure 6.3
Total DRO+ORO Detections in Groundwater

I:\GIS\Projects\HDR-SPU-WQF\MXD\RIFS Work Plan\Figure 6.3 Total DRO+ORO Detections in Groundwater.mxd
2/27/2023

Notes:
1. Approximate shoreline based on Condition Assessment Report (HDR 2022).
2. Details regarding previous remedial excavations are provided in construction completion reports prepared by The Riley Group, Inc. (RGI 2017, RGI 2018, RGI 2019).
3. Overall groundwater flow direction was determined from tidal studies conducted by the Riley Group (RGI 2016).
4. The PSL for PCE in groundwater is 2.9 µg/L. The maximum detected PCE concentration in the existing dataset is 16 µg/L. Where multiple samples from a monitoring well were collected, the maximum result is shown.
· Parcel boundaries obtained from King County, 2020.
· Orthoimagery obtained from Nearmap, 2021.

Abbreviations:
µg/L = Micrograms per liter
ND = Non Detect
PCE = Tetrachloroethylene
PSL = Preliminary Screening Level
RI/FS = Remedial Investigation/Feasibility Study

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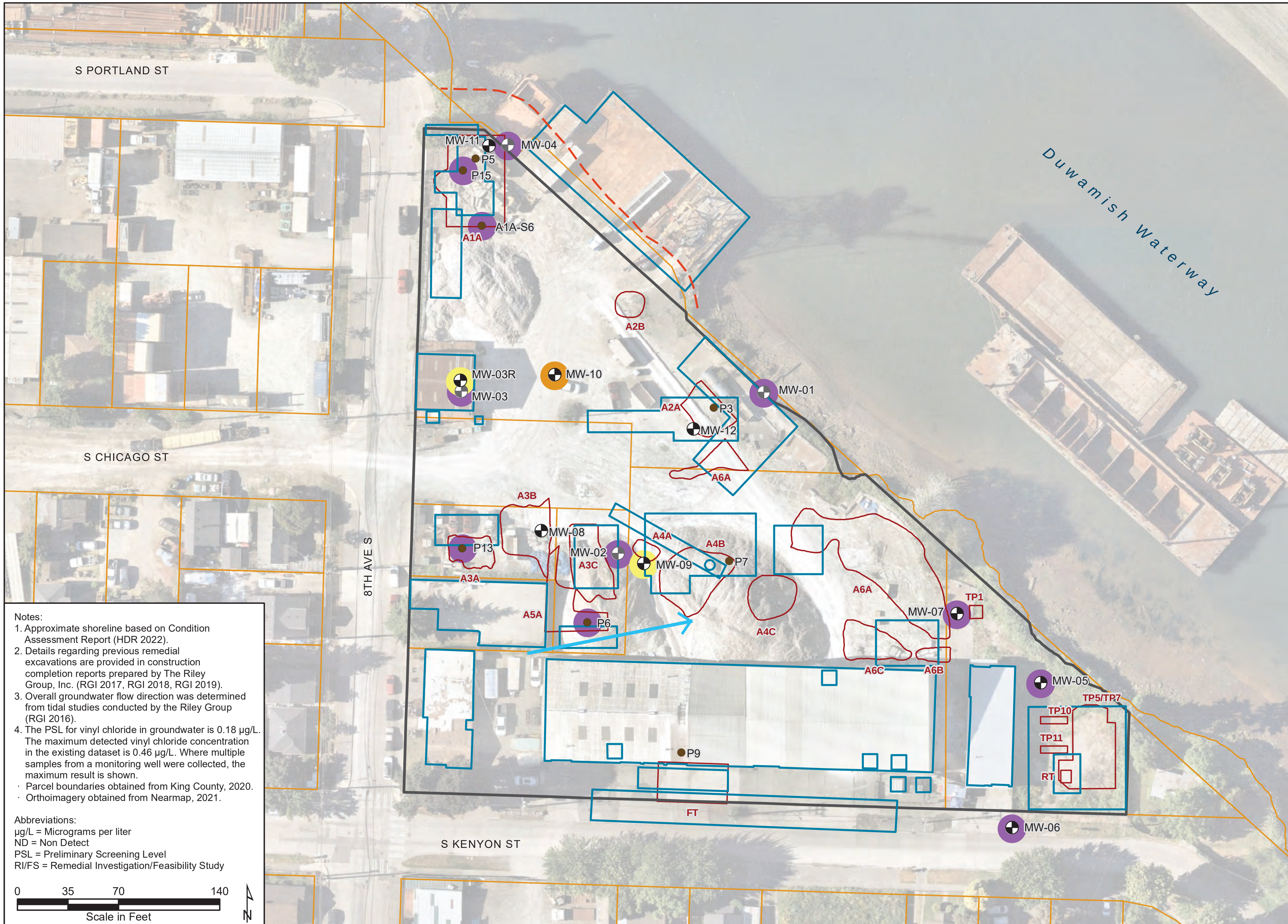
Figure 6.4
PCE Detections in Groundwater

I:\GIS\Projects\HDR-SPU-WQF\MXD\RIFS Work Plan\Figure 6.4 PCE Detections in Groundwater.mxd
4/18/2023



Legend

- Approximate Shoreline Below Dock(1)
- A6A Remedial Excavation Limit and Designation(2)
- Groundwater Flow Direction(3)
- Historical Operational Areas
- Property

Sample Location

- Monitoring Well
- Decommissioned Monitoring Well
- Reconnaissance Groundwater

Vinyl Chloride Result(4)

- Detected, >0.36–0.45 µg/L
- Detected, >0.18–0.36 µg/L
- ND, Laboratory Detection Limit Exceeds PSL

Notes:
1. Approximate shoreline based on Condition Assessment Report (HDR 2022).
2. Details regarding previous remedial excavations are provided in construction completion reports prepared by The Riley Group, Inc. (RGI 2017, RGI 2018, RGI 2019).
3. Overall groundwater flow direction was determined from tidal studies conducted by the Riley Group (RGI 2016).
4. The PSL for vinyl chloride in groundwater is 0.18 µg/L. The maximum detected vinyl chloride concentration in the existing dataset is 0.46 µg/L. Where multiple samples from a monitoring well were collected, the maximum result is shown.

· Parcel boundaries obtained from King County, 2020.
· Orthoimagery obtained from Nearmap, 2021.

Abbreviations:
µg/L = Micrograms per liter
ND = Non Detect
PSL = Preliminary Screening Level
RI/FS = Remedial Investigation/Feasibility Study

0 35 70 140
Scale in Feet

N

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Figure 6.5
Vinyl Chloride Detections in Groundwater

I:\GIS\Projects\HDR-SPU-WQF\MXD\RIFS Work Plan\Figure 6.5 Vinyl Chloride Detections in Groundwater.mxd
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Figure 6.6
Arsenic Detections in In Situ Soil

I:\GIS\Projects\HDR-SPU-WQF\MXD\RIFS Work Plan\Figure 6.6 Arsenic Detections in In Situ Soil.mxd
2/27/2023

Notes:
1. Approximate shoreline based on Condition Assessment Report (HDR 2022).
2. Details regarding previous remedial excavations are provided in construction completion reports prepared by The Riley Group, Inc. (RGI 2017, RGI 2018, RGI 2019).
3. The PSL for lead in soil is 50 mg/kg. The maximum detected lead concentration in the existing dataset is 1,100 mg/kg. Where multiple samples from a soil sample station were collected, the maximum result is shown.
- Parcel boundaries obtained from King County, 2020.
- Orthoimagery obtained from Nearmap, 2021.

Abbreviations:
mg/kg = Milligrams per kilogram
ND = Non Detect
PSL = Preliminary Screening Level
RI/FS = Remedial Investigation/Feasibility Study

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Figure 6.7
Lead Detections in In Situ Soil

I:\GIS\Projects\HDR-SPU-WQF\MXD\RIFS Work Plan\Figure 6.7 Lead Detections in In Situ Soil.mxd
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Legend

- Approximate Shoreline Below Dock[1]
- A6A Remedial Excavation Limit and Designation[2]
- Historical Operational Areas
- Property

Sample Location

- Monitoring Well
- Direct Push Soil Boring
- Hand Auger Soil Boring
- Test Pit
- Excavation Confirmation Sample

Total DRO+ORO Result[3]

- Detected, >2,600–31,000 mg/kg
- Detected, >520–2,600 mg/kg
- Detected, >260–520 mg/kg
- Detected, Does not Exceed PSL
- ND

Notes:
1. Approximate shoreline based on Condition Assessment Report (HDR 2022).
2. Details regarding previous remedial excavations are provided in construction completion reports prepared by The Riley Group, Inc. (RGI 2017, RGI 2018, RGI 2019).
3. The PSL for total DRO+ORO in soil is 260 mg/kg. The maximum detected total DRO+ORO concentration in the existing dataset is 31,000 mg/kg. Where multiple samples from a soil sample station were collected, the maximum result is shown.
- Parcel boundaries obtained from King County, 2020.
- Orthoimagery obtained from Nearmap, 2021.

Abbreviations:
mg/kg = Milligrams per kilogram
ND = Non Detect
PSL = Preliminary Screening Level
RI/FS = Remedial Investigation/Feasibility Study

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Figure 6.8
Total DRO+ORO Detections in In Situ Soil

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2/27/2023

Location	Data Quality Objective[4]										
	1	2	3	4	7	8	9	10	11	12	13
MW-01R	X	X	X		X				X	X	X
MW-03R	X	X	X					X		X	X
MW-05	X		X						X		X
MW-05D			X						X		X
MW-06			X					X			X
MW-07	X		X		X				X		X
MW-08	X	X	X							X	X
MW-09	X	X	X	X	X		X			X	X
MW-10	X		X					X			X
MW-11	X	X	X						X	X	X
MW-12		X	X		X					X	X
MW-13	X	X	X					X			X
MW-14		X	X			X		X		X	X
MW-15			X					X		X	X
MW-16			X		X			X			X
MW-17			X					X			X
MW-18			X					X			X
MW-19			X		X					X	X
MW-20	X	X	X		X				X		X
MW-21	X	X	X						X		X

Legend

- Approximate Shoreline Below Dock[1]
- A6A Remedial Excavation Limit and Designation[2]
- Groundwater Flow Direction[3]
- Historical Operational Areas
- Property

Sample Location

- Existing Monitoring Well

Proposed Groundwater Investigation

- Existing Monitoring Well (Develop & Sample)
- New Monitoring Well
- Transducer/Slug Test

Notes:
1. Approximate shoreline based on Condition Assessment Report (HDR 2022).
2. Details regarding previous remedial excavations are provided in construction completion reports prepared by The Riley Group, Inc. (RGI 2017, RGI 2018, RGI 2019).
3. Overall groundwater flow direction was determined from tidal studies conducted by the Riley Group (RGI 2016).
4. Refer to Table 6.1 for details regarding data quality objectives.

· Parcel boundaries obtained from King County, 2020.
· Orthoimagery obtained from Nearmap, 2021.

Abbreviation:
RI/FS = Remedial Investigation/Feasibility Study

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Figure 6.9
Proposed Groundwater Investigation

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2/27/2023

Location	Data Quality Objective[3]							
	3	4	5	6	7	8	9	12
FS-01			X					
FS-02			X					
FS-03			X					
FS-04/MW-13				X				
FS-05			X	X		X		
FS-06			X					
FS-07			X					
FS-08/MW-14						X		X
FS-09						X		
FS-10			X					
FS-11/MW-21			X	X				
FS-12				X		X		
FS-13						X		
FS-14				X				
FS-15/MW-15				X			X	
FS-16/MW-16				X	X		X	
FS-17					X		X	
FS-18				X	X			
FS-19/MW-19					X			X
FS-20/MW-20				X				
FS-21				X	X			
FS-22				X				
FS-23				X	X			
FS-24					X			
FS-25					X			
FS-26			X					
FS-27			X					
FS-28		X		X			X	
FS-29C		X					X	
FS-30C					X			
FS-31C					X			
FS-32/MW-01R				X				X
FS-33/MW-05D	X			X				
FS-34/MW-17	X							
FS-35/MW-18	X							
FS-36							X	

Notes:
1. Approximate shoreline based on Condition Assessment Report (HDR 2022).
2. Details regarding previous remedial excavations are provided in construction completion reports prepared by The Riley Group, Inc. (RGI 2017, RGI 2018, RGI 2019).
3. Refer to Table 6.1 for details regarding data quality objectives.
· Parcel boundaries obtained from King County, 2020.
· Orthoimagery obtained from Nearmap, 2021.

Abbreviation:
RI/FS = Remedial Investigation/Feasibility Study

0 35 70 140
Scale in Feet

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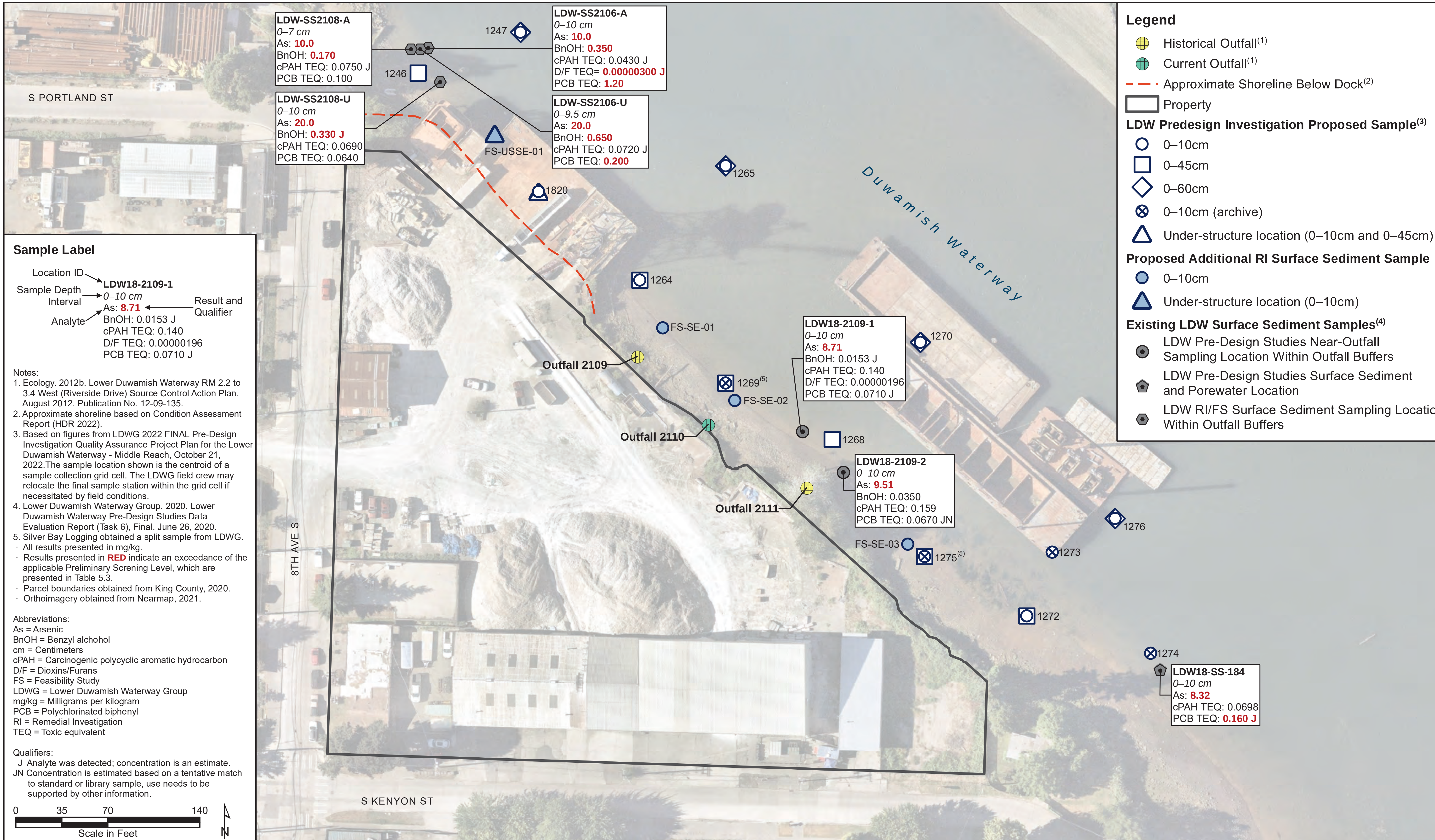
Figure 6.10
Proposed Soil Investigation

I:\GIS\Projects\HDR-SPU-WQF\MXD\RIFS Work Plan\Figure 6.10 Proposed Soil Investigation.mxd
4/18/2023



Notes:
1. Ecology. 2012b. Lower Duwamish Waterway RM 2.2 to 3.4 West (Riverside Drive) Source Control Action Plan. August 2012. Publication No. 12-09-135.
2. Approximate shoreline based on Condition Assessment Report (HDR 2022).
3. Based on figures from LDWG 2022 FINAL Pre-Design Investigation Quality Assurance Project Plan for the Lower Duwamish Waterway - Middle Reach, October 21, 2022.The sample location shown is the centroid of a sample collection grid cell. The LDWG field crew may relocate the final sample station within the grid cell if necessitated by field conditions.
4. Lower Duwamish Waterway Group. 2020. Lower Duwamish Waterway Pre-Design Studies Data Evaluation Report (Task 6), Final. June 26, 2020.
5. Silver Bay Logging obtained a split sample from LDWG.

- All results presented in mg/kg.
- Results presented in RED indicate an exceedance of the applicable Preliminary Screning Level, which are presented in Table 5.3.
- Parcel boundaries obtained from King County, 2020.
- Orthoimagery obtained from Nearmap, 2021.

Abbreviations:
As = Arsenic
BnOH = Benzyl alchohol
cm = Centimeters
cPAH = Carcinogenic polycyclic aromatic hydrocarbon
D/F = Dioxins/Furans
FS = Feasibility Study
LDWG = Lower Duwamish Waterway Group
mg/kg = Milligrams per kilogram
PCB = Polychlorinated biphenyl
RI = Remedial Investigation
TEQ = Toxic equivalent

Qualifiers:
J Analyte was detected; concentration is an estimate.
JN Concentration is estimated based on a tentative match to standard or library sample, use needs to be supported by other information.

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Silver Bay Logging Property
Seattle, Washington

Figure 6.11
Proposed Sediment Investigation and Existing Data

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2/27/2023

Remedial Investigation/Feasibility Study Work Plan

Silver Bay Logging Site

Appendix A
Historical Aerial Photographs and Current Conditions Information

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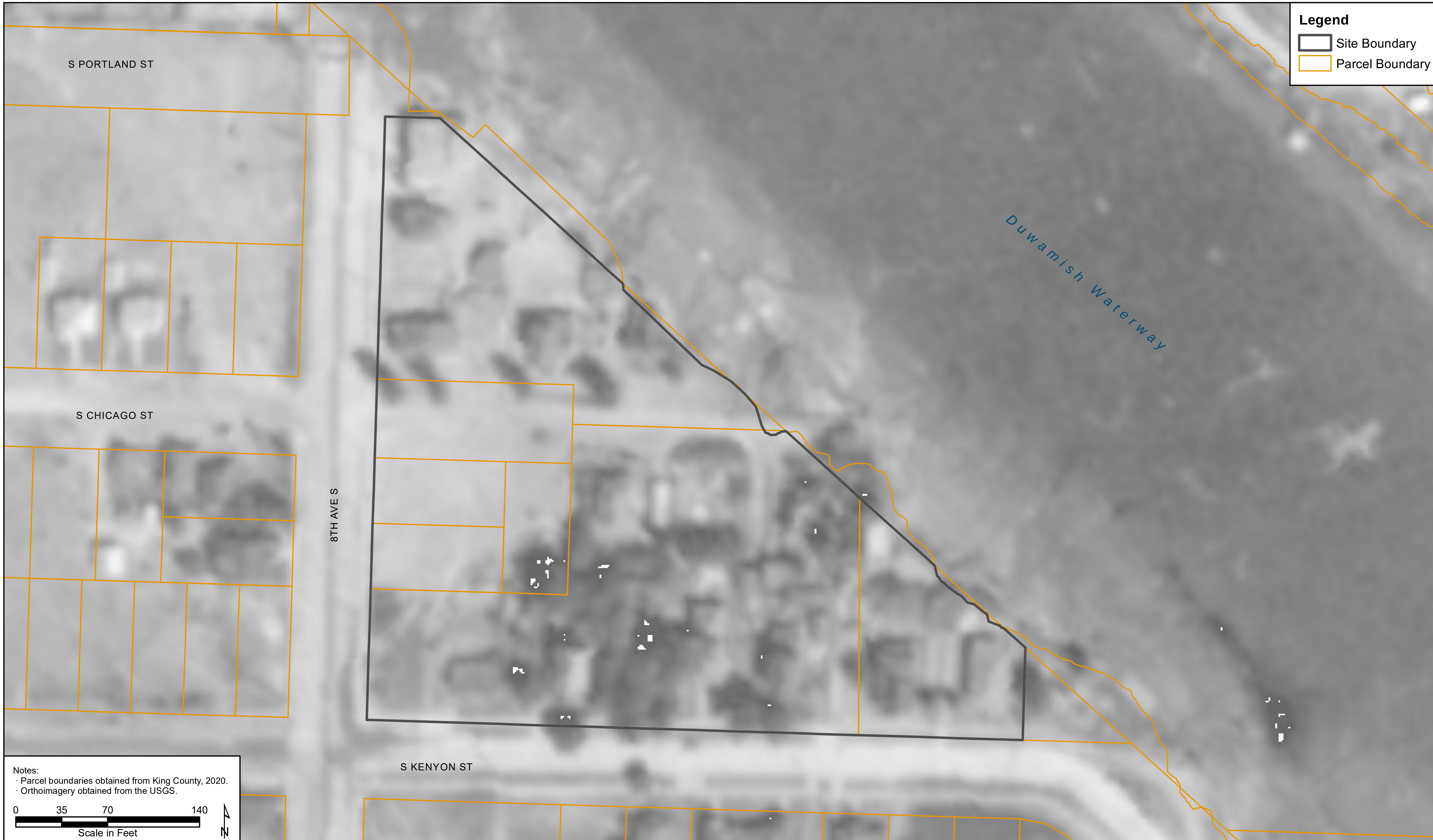
Seattle, Washington

Figure A1.1
1936 Historical Imagery

I:\GIS\Projects\HDR-SPU-WQF\MXD\RIFS Work Plan\Appendix A1\Figure C.1 1936 Historical Imagery.mxd
2/15/2023



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Seattle, Washington

Figure A1.2
1940 Historical Imagery

I:\GIS\Projects\HDR-SPU-WQF\MXD\RIFS Work Plan\Appendix A1\Figure C.2 1940 Historical Imagery.mxd
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Figure A1.3
1951 Historical Imagery

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Figure A1.4
1959 Historical Imagery

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Figure A1.5
1961 Historical Imagery

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2/15/2023

Notes:
· Parcel boundaries obtained from King County, 2020.
· Orthoimagery obtained from the U.S. Army Corps of Engineers.

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Silver Bay Logging Site
Seattle, Washington

Figure A1.6
1969 Historical Imagery

I:\GIS\Projects\HDR-SPU-WQF\MXD\RIFS Work Plan\Appendix A1\Figure C.6 1969 Historical Imagery.mxd
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Seattle, Washington

Figure A1.7
1993 Historical Imagery

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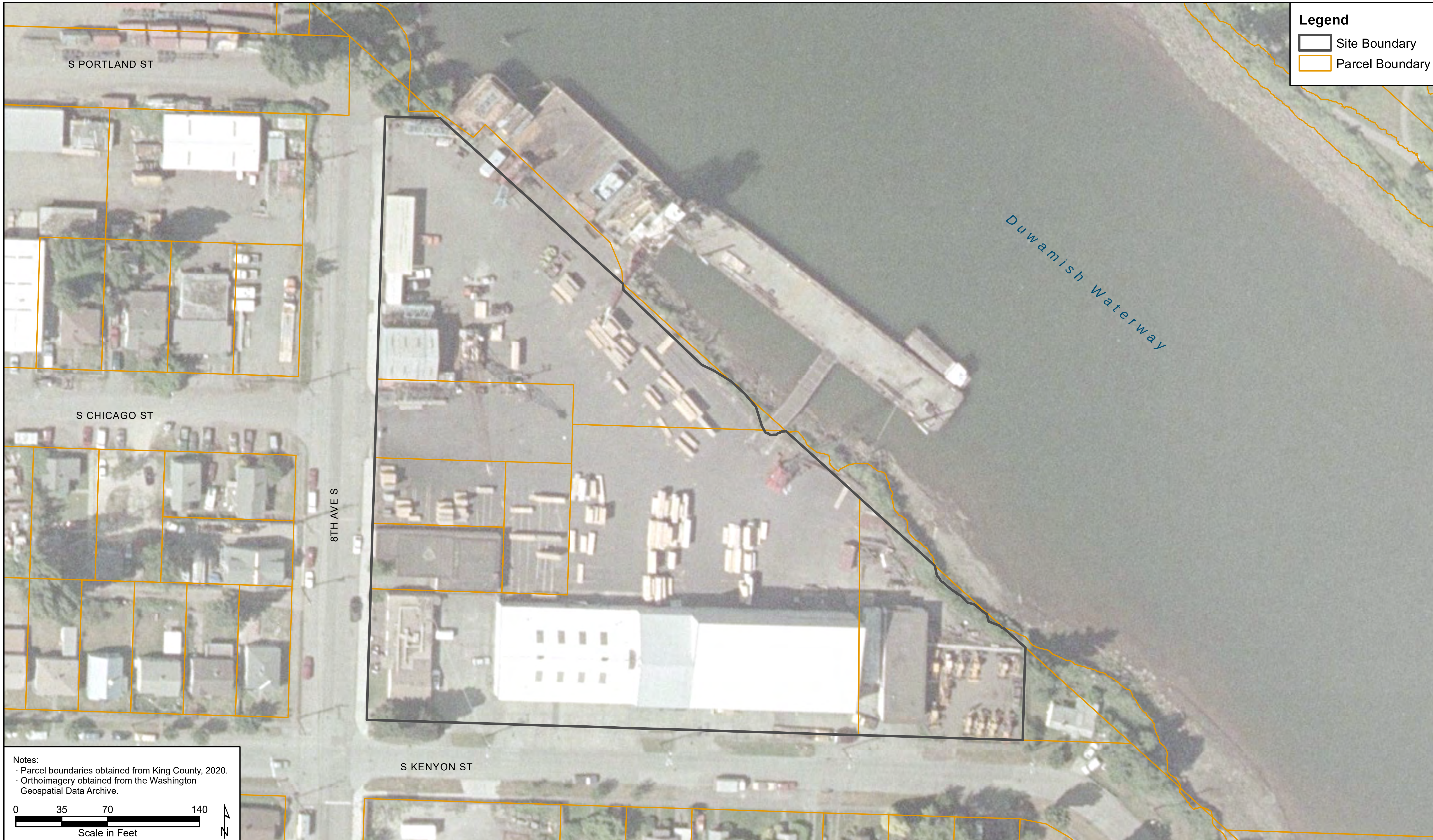
2/15/2023



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Seattle, Washington

Figure A1.8
2002 Historical Imagery

I:\GIS\Projects\HDR-SPU-WQF\MXD\RIFS Work Plan\Appendix A1\Figure C.8 2002 Historical Imagery.mxd
2/15/2023

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Figure A1.9
2009 Historical Imagery

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2/15/2023

Condition Assessment Report

Seattle Public Utilities

South Park Water Quality Facility
Site Investigation

Seattle, WA
June 27, 2022

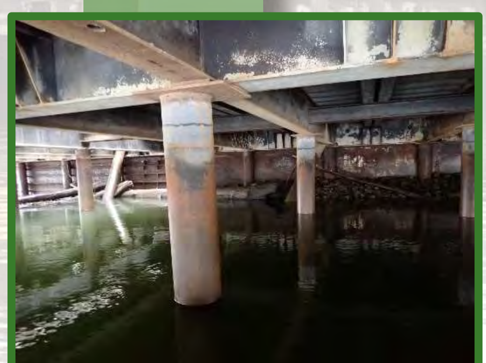
Condition Assessment for Silver Bay Logging Property Dock

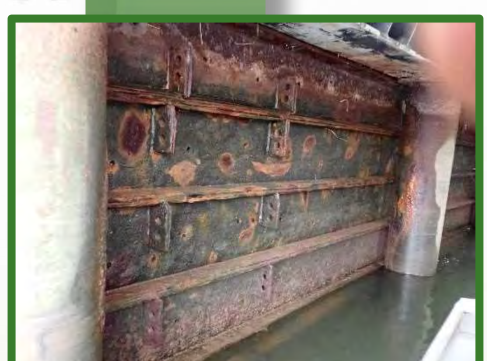
HDR, Inc.

January 2022

FINAL REPORT

Seattle, WA





COLLINS ENGINEERS INC.

7576 West Victory Road
Boise, Idaho 83709
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Appendix B

Inspection Photographs

Photo 1 : Overall view, looking southwest.

Photo 2 : Overall view, looking southeast.

Photo 3 : Overall view, looking west.

Photo 4 : South embankment, looking west.

Photo 5 : North embankment, looking west.

Photo 6 : Erosion behind south wingwall, looking north.

Photo 7 : Erosion under northerly wheelhouse extension, looking west.

Photo 8 : Typical timber debris accumulation, looking south.

Photo 9 : Typical condition of steel piles and underdeck superstructure, C piles from Bent 6, looking northwest.

Photo 10 : Typical rust delamination, Bent 3 Pile C, looking west.

Photo 11 : Typical condition of cleaned steel, Bent 10 Pile E, looking west

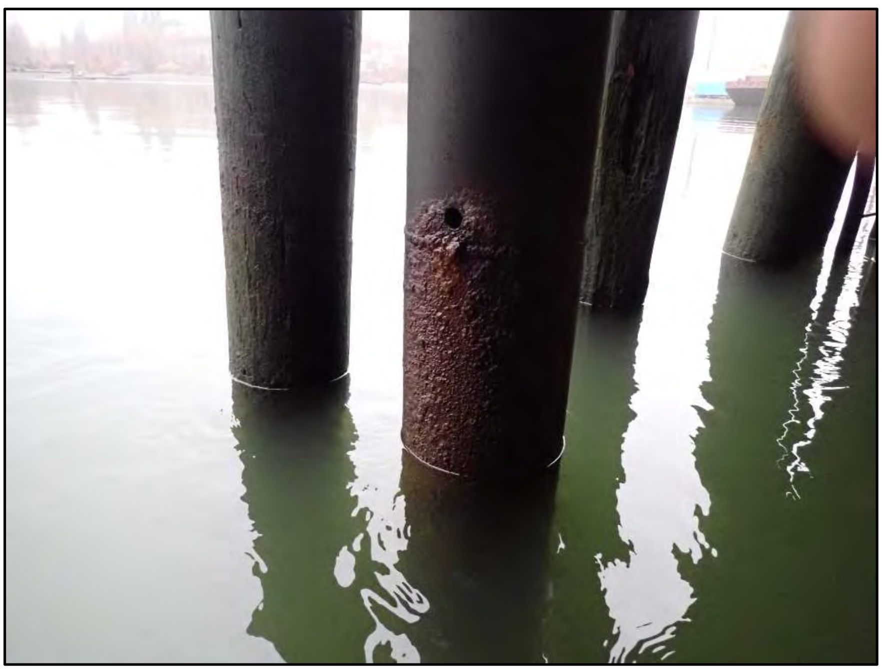

Photo 12 : Nodular corrosion below welded splice, Bent 11 Pile A, looking southeast.

Photo 13 : Pile deformation, Bent 2 Pile A, looking southeast.

Photo 14 : Hole in steel, Bent 10 Pile E, looking north.

Photo 15 : Typical corrosion on steel bulkhead, looking southwest.

Photo 16 : Fractured fender piles, Bents 2-3, looking west.

Photo 17 : Typical condition of steel piles and underdeck superstructure under northerly wheelhouse extension, looking south.

IN-WATER STRUCTURES ASSESSMENT FORM

1. GENERAL FACILITY INFORMATION:

Structure: Silver Bay Logging 8th Avenue Wharf

River Mile: 2.9 Side: West

Structure Type(s)/Use(s): Steel pile, steel beam, timber and steel grating decked wharf. Receipt of lumber by barge.

Structure was Identified during 2012 Feasibility Study (Y/N): Y

Parcel #: 7327903645

Facility Owner: Silver Bay Logging, Inc.

Business Phone #: Unknown

Facility Operator: Silver Bay Logging

Name of Contact:

Business Phone #: 503-973-0651

Assessment Date/Time: 1/25/2018 3:30 PM

Team Leader: BH

Assessment Personnel: AP

2. STRUCTURE DESCRIPTION AND ACCESS RESTRICTIONS:

Description (e.g., length/size, construction type and materials, general physical condition, operational status, shoreline conditions, approximate shoreline slope, outfalls)**:**

Pier and apron with steel pile and steel superstructure, 20ft x 10ft pile spacing. The apron supports a steel cladded building. Timber dolphin cluster north of structure. Shoreline is armored with riprap at 2:1 slope. South portion of structure has a steel bulkhead. Shoreline access park north of structure. The facility is operational.

Access Restrictions (e.g., under pier areas/clearance, extent of riprap vs. soft sediment, and vicinity of dolphins/piling, bulkheads, and riprapped or engineered shorelines which may require adjustments to sampling, cleanup technology or remedial design):

Moored barge restricts inspection access to structure berthing face. Floating timber debris on south face of structure.

3. STRUCTURE VICINITY MAP:

4. PHOTO LOG

Element	Photo No.	Direction	Description / Comments
Pier and Apron	37-5137	S	View of the north end of the pier and apron supporting a building.
Apron	37-5139	SW	Closeup view of the steel apron and small riprap along the shoreline.
Pier	37-5140	S	View of the north end of the pier.
Pier	37-5145	SW	Underdeck view of the pier.
South Shoreline	37-5149	SW	View of the south shoreline. The shoreline is vegetated and has isolated concrete rubble protection.
Pier	37-5151	N	View of the south end of the pier. Debris has accumulated on the south side of the pier.
South Shoreline	37-5154	SW	Timber pile stubs line the shoreline south of the pier.

Photos Required:

- ☐ All Structure Faces (N, S, E, W)
- ☐ Significant Defects/Deterioration
- ☐ Timber Debris (if visible)
- ☐ Upstream/Downstream Views of Channel
- ☐ Typical Shoreline Conditions
- ☐ Access Limitations

STRUCTURE 37

LDW Field Survey Photographs

37-5137

37-5139

37-5140

37-5145

37-5149

37-5151

37-5154

Remedial Investigation/Feasibility Study Work Plan

Silver Bay Logging Site

Appendix B
Soil Boring and Monitoring Well Installation Logs

Boring HA-01

Logged by T. Nanevicz on January 12, 2004 Bored using a hand auger.

Depth (feet)	Sample ID/ Interval	(N) Blows/ft	Moisture Content (%)/ Water Table	PID (ppm)	USCS	Soil Description
						Gravel with medium grained-sand
1						
						Light brown fine to medium-grained SAND with gravel
2						
3						
				0.0		Black fine-grained SAND
4						
5						
6						
7						
8						
9						
10						
11						

Boring terminated at 4.0 feet.

The Riley Group, Inc.
10728 LAKE CITY WAY NE
SEATTLE, WASHINGTON 98125

Silver Bay Logging Company, Inc.

Riley Project #2003-232	Log of Boring HA-01	Appendix B-15
Logged by: T. Nanevicz	Date Logged: 01/12/04	

Site Address: NEC South Kenyon Street & 8th Avenue South, Seattle, Washington

Boring HA-02

Logged by T. Nanevicz on January 12, 2004 Bored using a hand auger.

Depth (feet)	Sample ID/ Interval	(N) Blows/ft	Moisture Content (%)/ Water Table	PID (ppm)	USCS	Soil Description
						Gravel with medium grained-sand
1						
						Light brown sandy SILT
2						
3						
				0.1		Light brown SILT
4						
5						
6						
7						
8						
9						
10						
11						

Boring terminated at 4.0 feet.

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SEATTLE, WASHINGTON 98125

Silver Bay Logging Company, Inc.

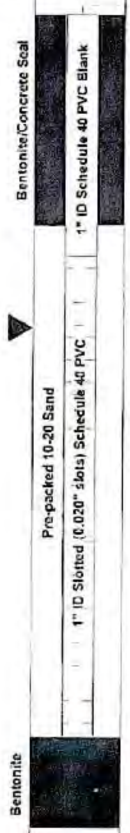
Riley Project #2003-232	Log of Boring HA-02	Appendix B-16
Logged by: T. Nanevicz		Date Logged: 01/12/04
Site Address: NEC South Kenyon Street & 8th Avenue South, Seattle, Washington		

Boring/Well MW-1

Logged by T. Nanevicz on December 16, 2003
Driller: ESN Northwest, Inc.

Drilled using truck-mounted direct push rig.

Depth (feet)	Sample ID/ Interval	(N) Blows/ft	Moisture Content (%)/ Water Table	Well Installation Design	USCS	Soil Description
						flush-mounted traffic-rated monument with locked well cap.
2						
4						
6						
8						
10						



▶ groundwater level during well installation

The Riley Group, Inc.
10728 LAKE CITY WAY NE
SEATTLE, WASHINGTON 98125

Silver Bay Logging Company, Inc.

Riley Project # 2003-232	Log of Boring MW-1	Appendix D-1
Logged by: T. Nanevicz		Date Logged: 12/16/03
Site Address: NEC South Kenyon Street & 8th Avenue South, Seattle, Washington		

Boring/Well MW-2

Logged by T. Nanevicz on December 16, 2003
Driller: ESN Northwest, Inc.

Drilled using truck-mounted direct push rig.

Depth (feet)	Sample ID/ Interval	(N) Blows/ft	Moisture Content (%)/ Water Table	Well Installation Design	USCS	Soil Description
						flush-mounted traffic-rated monument with locked well cap.
2				Bentonite/Concrete Seal		
4				1" ID Schedule 40 PVC Blank		
6				Pre-packed 10-20 Sand		
8			▶	1" ID Slotted (0.020" slots) Schedule 40 PVC		
10						
12				Bentonite		
14						

▶ groundwater level during well installation

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SEATTLE, WASHINGTON 98125

Silver Bay Logging Company, Inc.

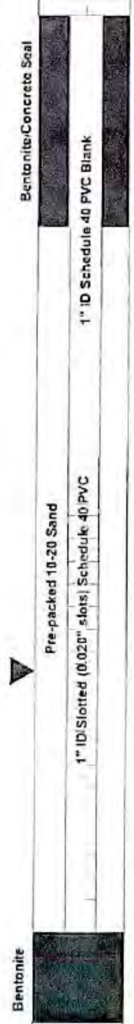
Riley Project # 2003-232	Log of Boring MW-2	Appendix D-2
Logged by: T. Nanevicz		Date Logged: 12/16/03
Site Address: NEC South Kenyon Street & 8th Avenue South, Seattle, Washington		

Boring/Well MW-3

Logged by T. Nanevicz on December 16, 2003
Driller: ESN Northwest, Inc.

Drilled using truck-mounted direct push rig.

Depth (feet)	Sample ID/ Interval	(N) Blows/ft	Moisture Content (%)/ Water Table	Well Installation Design	USCS	Soil Description
						flush-mounted traffic-rated monument with locked well cap.
2						
4						
6						
8						
10						



▶ groundwater level during well installation

The Riley Group, Inc.
10728 LAKE CITY WAY NE
SEATTLE, WASHINGTON 98125

Silver Bay Logging Company, Inc.

Riley Project # 2003-232	*Log of Boring MW-3*	*Appendix D-3*
Logged by: T. Nanevicz		*Date Logged: 12/16/03*
Site Address: NEC South Kenyon Street & 8th Avenue South, Seattle, Washington		

SBL_00000638

Project Name: **Silver Bay Logging** Project Number: **2015-019C** Client: **Silver Bay Logging**	RILEYGROUP Boring/Well No.: **MW3R** **Sheet 1 of 1**

Date(s) Drilled: **03/09/16**	Logged By: **KA**	Surface Conditions: **Asphalt**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type: **2.25" Diameter**	Total Depth of Borehole: **20 feet bgs**
Drill Rig Type: **Track-Mounted**	Drilling Contractor: **RGI**	Approximate Surface Elevation (feet amsl): **n/a**
Groundwater Level and Date Measured: **8'**	Sampling Method(s): **Continuous**	Hammer Data : **n/a**
Borehole Completion: **Bentonite**	Location: **7814 8th Avenue South, Seattle, Washington 98108**	

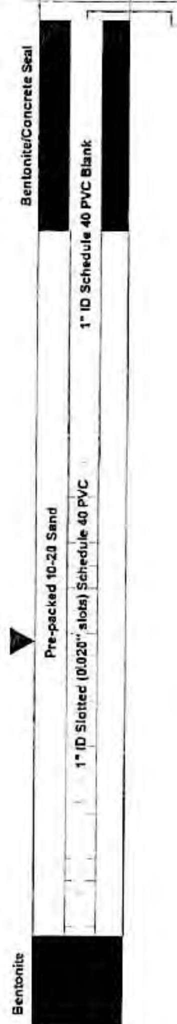
Elevation (feet)	Depth (feet)	Sample Type	Sample ID	Sampling Resistance, blows/ft	PID Reading, ppm	Recovery (%)	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
	0						Asphalt		Asphalt		1.5-inch diameter well screen
							GP		Black and brown, sandy medium to coarse GRAVEL, dry, odor		
			MW3R-2		12.4						
							SW		Brown fine to medium SAND, damp, no odor, no sheen		
			MW3R-4		0.2						
	5										
			MW3R-6		0.2	100%					
	∇ 8				0.0		ML		Gray SILT with scattered wood debris and trace charcoal, wet, no odor, no sheen		
	10										Prepack well screen
			MW3R-12		0.1	80%			Woody layer		
	15										
					0.0	100%	SM		Dark gray, fine SAND with silty sand lense at 17-17.3', wet, no odor, no sheen		
					0.0						
	20								Boring terminated at 20 feet bgs		
	25										

Boring/Well MW-4

Logged by T. Nanevicz on December 16, 2003
Driller: ESN Northwest, Inc.

Drilled using truck-mounted direct push rig.

Depth (feet)	Sample ID/ Interval	(N) Blows/ft	Moisture Content (%)/ Water Table	Well Installation Design	USCS	Soil Description
						flush-mounted traffic-rated monument with locked well cap.
2						
4						
6						
8						
10						



▶ groundwater level during well installation

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SEATTLE, WASHINGTON 98125

Silver Bay Logging Company, Inc.

Riley Project # 2003-232	Log of Boring MW-4	Appendix D-4
Logged by: T. Nanevicz		Date Logged: 12/16/03

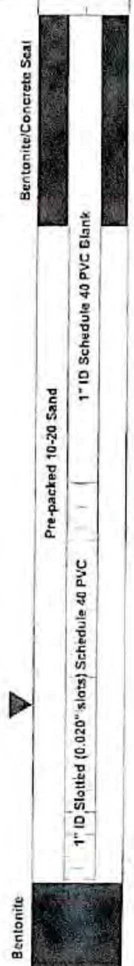
Site Address: NEC South Kenyon Street & 8th Avenue South, Seattle, Washington

Boring/Well MW-5

Logged by T. Nanevicz on December 16, 2003
Driller: ESN Northwest, Inc.

Drilled using truck-mounted direct push rig.

Depth (feet)	Sample ID/ Interval	(N) Blows/ft	Moisture Content (%)/ Water Table	Well Installation Design	USCS	Soil Description
						flush-mounted traffic-rated monument with locked well cap.
2						
4						
6						
8						
10						
12						
14						



▶ groundwater level during well installation

The Riley Group, Inc.
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SEATTLE, WASHINGTON 98125

Silver Bay Logging Company, Inc.

Riley Project # 2003-232	*Log of Boring MW-5*	*Appendix D-5*
Logged by: T. Nanevicz		*Date Logged: 12/16/03*

Site Address: NEC South Kenyon Street & 8th Avenue South, Seattle, Washington

Project Name: **Silver Bay Logging**	Boring/Well No.: **MW-6**
Project Number: **2015-019C**	**Sheet 1 of 1**
Client: **Silver Bay Logging**	

Date(s) Drilled: **03/08/16**	Logged By: **KA**	Surface Conditions: **Concrete**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type: **2.25" Diameter**	Total Depth of Borehole: **15 feet bgs**
Drill Rig Type: **Track-Mounted**	Drilling Contractor: **RGI**	Approximate Surface Elevation (feet amsl): **n/a**
Groundwater Level and Date Measured: **7.5'**	Sampling Method(s): **Continuous**	Hammer Data : **n/a**
Borehole Completion: **Bentonite**	Location: **7814 8th Avenue South, Seattle, Washington 98108**	

Elevation (feet)	Depth (feet)	Sample Type	Sample ID	Sampling Resistance, blows/ft	PID Reading, ppm	Recovery (%)	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
	0						Concrete		Concrete		1.5-inch diameter well screen
					0.0		SM		Brown silty fine SAND, moist, no odor, no sheen		
					0.0		ML		Brown sandy SILT, moist, no odor, no sheen		
	5		MW6:5		0.0	90%					
									Becomes brown-gray		
					0.0				Becomes wet		
							SP		Brown, medium SAND with silt, wet, no odor, no sheen		
	10						SP		Dark brown medium SAND, no odor, no sheen		Prepack well screen
			MW6:11		0.0	100%					
									2' of heave		
	15								Boring terminated at 15 feet bgs		
	20										
	25										

Project Name: **Silver Bay Logging**	Boring/Well No.: **MW-7**
Project Number: **2015-019C**	**Sheet 1 of 1**
Client: **Silver Bay Logging**	RILEYGROUP

Date(s) Drilled: **03/08/16**	Logged By: **KA**	Surface Conditions: **Asphalt**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type: **2.25" Diameter**	Total Depth of Borehole: **21 feet bgs**
Drill Rig Type: **Track-Mounted**	Drilling Contractor: **RGI**	Approximate Surface Elevation (feet amsl): **n/a**
Groundwater Level and Date Measured: **9.5'**	Sampling Method(s): **Continuous**	Hammer Data : **n/a**
Borehole Completion: **Bentonite**	Location: **7814 8th Avenue South, Seattle, Washington 98108**	

Elevation (feet)	Depth (feet)	Sample Type	Sample ID	Sampling Resistance, blows/ft	PID Reading, ppm	Recovery (%)	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
	0						Asphalt		Asphalt		1.5-inch diameter well screen
							Fill		Debris, moist		
							SM		Brown, silty fine SAND with brick, moist, no odor, no sheen		
							ML		Brown-gray SILT, moist, no odor, no sheen		
	5		MW7-5		0.1	100%					
							ML		Rust-stained tan SILT, moist, no odor, no sheen		
	10						SP		Dark brown-black medium SAND		Prepack well screen
			MW7-11		0.0	100%					
	15								No recovery		
	20										
									Boring terminated at 21 feet bgs		
	25										

Project Name: **Silver Bay Logging**	Boring/Well No.: **MW-8**
Project Number: **2015-019C**	**Sheet 1 of 1**
Client: **Silver Bay Logging**	RILEYGROUP

Date(s) Drilled: **03/09/16**	Logged By: **KA**	Surface Conditions: **Asphalt**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type: **2.25" Diameter**	Total Depth of Borehole: **20 feet bgs**
Drill Rig Type: **Track-Mounted**	Drilling Contractor: **RGI**	Approximate Surface Elevation (feet amsl): **n/a**
Groundwater Level and Date Measured: **5.75'**	Sampling Method(s): **Continuous**	Hammer Data : **n/a**
Borehole Completion: **Bentonite**	Location: **7814 8th Avenue South, Seattle, Washington 98108**	

Elevation (feet)	Depth (feet)	Sample Type	Sample ID	Sampling Resistance, blows/ft	PID Reading, ppm	Recovery (%)	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
	0						Asphalt		Asphalt		
							GP		Tan, coarse GRAVEL with trace debris and bricks, damp		1.5-inch diameter well screen
			MW8-3		0.0						
							SP		Black, fine to medium SAND with silt, moist		
			MW8-4		0.0						
	5										
			MW8-6		0.0	90%					
							SP		Becomes brown and wet		
							ML		Brown SILT with fine sand lenses, wet		
	10										Prepack well screen
					0.0						
						100%					
	15		MW8-15		0.0						
							SM		Dark gray, silty SAND, wet, no odor, no sheen		
							SP		Black fine SAND, wet, no odor, no sheen		
					0.0						
	20								Boring terminated at 20 feet bgs		
	25										

Project Name: **Silver Bay Logging**	Boring/Well No.: **MW-9**
Project Number: **2015-019C**	**Sheet 1 of 1**
Client: **Silver Bay Logging**	

RILEYGROUP

Date(s) Drilled: **03/09/16**	Logged By: **KA**	Surface Conditions: **Asphalt**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type: **2.25" Diameter**	Total Depth of Borehole: **17 feet bgs**
Drill Rig Type: **Track-Mounted**	Drilling Contractor: **RGI**	Approximate Surface Elevation (feet amsl): **n/a**
Groundwater Level and Date Measured: **5.5', 9.5'**	Sampling Method(s): **Continuous**	Hammer Data : **n/a**
Borehole Completion: **Bentonite**	Location: **7814 8th Avenue South, Seattle, Washington 98108**	

Elevation (feet)	Depth (feet)	Sample Type	Sample ID	Sampling Resistance, blows/ft	PID Reading, ppm	Recovery (%)	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
	0						Asphalt		Asphalt		1.5-inch diameter well screen
							SM		Dark brown silty SAND, moist, no odor, no sheen		
			MW9-2.5		0.2						
							SP		Dark brown, medium SAND, moist, no odor, no sheen		
	5										
			MW9-5.5		0.1	100%	ML		Gray SILT with trace sand, wet, no odor, no sheen		
							PT		Red-brown PEAT, with silt, charcoal and wood debris, moist, no odor, no sheen		
							ML		Gray SILT, wet		
	10		MW9-10		0.1	100%					Prepack well screen
					0.1						
	15				0						
									Boring terminated at 17 feet bgs		
	20										
	25										

Project Name: **Silver Bay Logging**
Project Number: **2015-019C**
Client: **Silver Bay Logging**

Boring/Well No.: **MW-10**
Sheet 1 of 1

Date(s) Drilled: **03/08/16**	Logged By: **KA**	Surface Conditions: **Asphalt**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type: **2.25" Diameter**	Total Depth of Borehole: **18 feet bgs**
Drill Rig Type: **Track-Mounted**	Drilling Contractor: **RGI**	Approximate Surface Elevation (feet amsl): **n/a**
Groundwater Level and Date Measured: **6'**	Sampling Method(s): **Continuous**	Hammer Data : **n/a**
Borehole Completion: **Bentonite**	Location: **7814 8th Avenue South, Seattle, Washington 98108**	

Elevation (feet)	Depth (feet)	Sample Type	Sample ID	Sampling Resistance, blows/ft	PID Reading, ppm	Recovery (%)	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
	0						SM		Red-brown silty fine to medium SAND with gravel, moist, very slight odor, no sheen		1.5-inch diameter well screen
			MW10-2.5		0.3						
			MW10-4		0.1	100%	SP		Brown, fine to coarse SAND, moist to wet, no odor, no sheen		
	5						SM		Dark brown silty fine SAND, moist, no odor, no sheen		
							ML		Gray SILT, wet, no odor, no sheen		
					0.2						
	10										Prepack well screen
			MW10-11		0.1	80%					
							PT		Red-brown PEAT with silt, wet, no odor, no sheen		
							ML		Gray SILT, wet, no odor, no sheen		
					0.1						
	15		MW10-15		0.1	90%					
					0.1						
									Boring terminated at 18 feet bgs		
	20										
	25										

Project Name: **Silver Bay Logging** Project Number: **2015-019C** Client: **Silver Bay Logging**	RILEYGROUP Boring/Well No.: **P17 / MW-11** **Sheet 1 of 1**

Date(s) Drilled: **03/09/16**	Logged By: **KA**	Surface Conditions: **Asphalt**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type: **2.25" Diameter**	Total Depth of Borehole: **20 feet bgs**
Drill Rig Type: **Track-Mounted**	Drilling Contractor: **RGI**	Approximate Surface Elevation (feet amsl): **n/a**
Groundwater Level and Date Measured: **12'**	Sampling Method(s): **Continuous**	Hammer Data : **n/a**
Borehole Completion: **Bentonite**	Location: **7814 8th Avenue South, Seattle, Washington 98108**	

Elevation (feet)	Depth (feet)	Sample Type	Sample ID	Sampling Resistance, blows/ft	PID Reading, ppm	Recovery (%)	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
	0						Asphalt		Asphalt		
							SP		Brown to dark brown, fine to coarse SAND with trace gravel, moist, no odor, no sheen		1.5-inch diameter well screen
			P17-3		0.4						
							SP		Brown fine to coarse SAND, moist, no odor, no sheen		
	5		P17-5		0.2	100%					
							ML		Gray SILT with scattered wood debris, moist, no odor, no sheen		
	10		P17-10		0.0	100%					Prepack well screen
							ML		Wood debris		
	12 (▽)						ML		Wood debris		
			P17-14.5		0.0						
	15								No recovery, heave encountered		
						0%					
	20								Boring terminated at 20 feet bgs		
	25										

Project Name: **Silver Bay Logging**	Boring/Well No.: **MW-12**
Project Number: **2015-019C**	**Sheet 1 of 1**
Client: **Silver Bay Logging**	RILEYGROUP

Date(s) Drilled: **03/08/16**	Logged By: **KA**	Surface Conditions: **Soil**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type: **2.25" Diameter**	Total Depth of Borehole: **20 feet bgs**
Drill Rig Type: **Track-Mounted**	Drilling Contractor: **RGI**	Approximate Surface Elevation (feet amsl): **n/a**
Groundwater Level and Date Measured: **2.75'**	Sampling Method(s): **Continuous**	Hammer Data : **n/a**
Borehole Completion: **Bentonite**	Location: **7814 8th Avenue South, Seattle, Washington 98108**	

Elevation (feet)	Depth (feet)	Sample Type	Sample ID	Sampling Resistance, blows/ft	PID Reading, ppm	Recovery (%)	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
	0						Fill		FILL, scrap yard debris, sandy, no odor, no sheen		1.5-inch diameter well screen
							SM		Brown, silty SAND with debris, moist, slight odor, slight sheen		
			MW12-2.5		0.1		SP		Brown-gray SAND with silt, wet, slight odor, slight sheen		
							ML		Brown-gray SILT, wet, no odor, no sheen		
	5		MW12-5		0.2	100%					
							ML		Gray SILT with sand to silty sand, wet		
			MW12-8		0.1	100%	SM		Brown silty SAND with trace charcoal, wet		
							ML		Gray SILT, wet, no odor, no sheen		
	10										Prepack well screen
					0.2						
									No recovery, heave encountered		
	15										
						0%					
	20								Boring terminated at 20 feet bgs		
	25										

Project Name: **Silver Bay Logging**	Test Probe No.: **P1**
Project Number: **2015-019B**	**Sheet 1 of 1**
Client: **Silver Bay Logging**	

Date(s) Drilled: **4/21/15**	Logged By: **KA**	Surface Conditions: **Asphalt**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type: **2 .25 inch/3.25 inch**	Total Depth of Borehole: **5 feet bgs**
Drill Rig Type: **Track-Mounted**	Drilling Contractor: **The Riley Group, Inc.**	Approximate Surface Elevation: **n/a**
Groundwater Level: **4 feet bgs**	Sampling Method(s): **Dual Tube Continuous**	Hammer Data : **n/a**
Borehole Backfill: **Bentonite**	Location: **7814 8th Avenue South, Seattle, Washington 98117**	

PID Reading, ppm	Sample ID	Sample Type	% Recovery	GW Depth	Depth (feet)	MATERIAL DESCRIPTION	Graphic Log
					0	Asphalt	
0.0						Gray, sandy, fine to coarse GRAVEL, damp, no odor, no sheen	
0.0						Dark brown, silty, fine SAND, moist, no odor, no sheen	
0.0						Dark brown, fine SAND, moist to wet at 4' bgs, no odor, no sheen	
	P1-4			∇			
0.0						Dark brown, silty, fine SAND with organics, wet, no odor, no sheen	
					5	Test probe terminated at 5 feet bgs	
					10		
					15		
					20		

Project Name: **Silver Bay Logging**
Project Number: **2015-019B**
Client: **Silver Bay Logging**

RILEYGROUP

Test Probe No.: **P2**
Sheet 1 of 1

Date(s) Drilled: **4/21/15**	Logged By: **KA**	Surface Conditions: **Asphalt**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type: **2 .25 inch/3.25 inch**	Total Depth of Borehole: **5 feet bgs**
Drill Rig Type: **Track-Mounted**	Drilling Contractor: **The Riley Group, Inc.**	Approximate Surface Elevation: **n/a**
Groundwater Level: **3 feet bgs**	Sampling Method(s): **Dual Tube Continuous**	Hammer Data : **n/a**
Borehole Backfill: **Bentonite**	Location: **7814 8th Avenue South, Seattle, Washington 98117**	

PID Reading, ppm	Sample ID	Sample Type	% Recovery	GW Depth	Depth (feet)	MATERIAL DESCRIPTION	Graphic Log
					0	Asphalt	
0.0	P2-1					Dark brown, fine to coarse GRAVEL with sand, damp, odor, no sheen	
						Dark brown, silty, fine SAND, moist, no odor, no sheen	
				▽		Dark brown, fine to medium SAND, wet, no odor, no sheen	
0.0	P2-4						
					5	Test probe terminated at 5 feet bgs	
					10		
					15		
					20		

Project Name: **Silver Bay Logging**	Test Probe No.: **P3**
Project Number: **2015-019B**	**Sheet 1 of 1**
Client: **Silver Bay Logging**	

Date(s) Drilled: **4/21/15**	Logged By: **KA**	Surface Conditions: **Asphalt**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type: **2 .25 inch/3.25 inch**	Total Depth of Borehole: **10 feet bgs**
Drill Rig Type: **Track-Mounted**	Drilling Contractor: **The Riley Group, Inc.**	Approximate Surface Elevation: **n/a**
Groundwater Level: **3.5 feet bgs**	Sampling Method(s): **Dual Tube Continuous**	Hammer Data : **n/a**
Borehole Backfill: **Bentonite**	Location: **7814 8th Avenue South, Seattle, Washington 98117**	

PID Reading, ppm	Sample ID	Sample Type	% Recovery	GW Depth	Depth (feet)	MATERIAL DESCRIPTION	Graphic Log
					0	Asphalt	
2.2	P3-1					Dark brown, fine to coarse GRAVEL with sand, damp, odor, sheen	
						Dark brown, fine SAND, damp, odor, no sheen	
						Dark brown to black, fine to coarse SAND, damp, no odor, no sheen	
				▽		Dark brown, silty, fine SAND, wet, possible organic odor, no sheen	
0.0	P3-5				5		
						Dark gray to brown SILT, wet, no odor, no sheen	
0.0	P3-10				10	Test probe terminated at 10 feet bgs	
					15		
					20		

Project Name: **Silver Bay Logging**
Project Number: **2015-019B**
Client: **Silver Bay Logging**

RILEYGROUP

Test Probe No.: **P4**
Sheet 1 of 1

Date(s) Drilled: **4/21/15**	Logged By: **KA**	Surface Conditions: **Asphalt**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type: **2 .25 inch/3.25 inch**	Total Depth of Borehole: **15 feet bgs**
Drill Rig Type: **Track-Mounted**	Drilling Contractor: **The Riley Group, Inc.**	Approximate Surface Elevation: **n/a**
Groundwater Level: **6 feet bgs**	Sampling Method(s): **Dual Tube Continuous**	Hammer Data : **n/a**
Borehole Backfill: **Bentonite**	Location: **7814 8th Avenue South, Seattle, Washington 98117**	

PID Reading, ppm	Sample ID	Sample Type	% Recovery	GW Depth	Depth (feet)	MATERIAL DESCRIPTION	Graphic Log
					0	Asphalt	
						Brown, medium to coarse GRAVEL with sand, dry, no odor, no sheen	
						Brown, fine to medium SAND with silt, damp, no odor, no sheen	
0.0	P4-3						
						Brown, fine to medium SAND, moist to wet at 6' bgs, no odor, no sheen	
					5		
				▽			
0.0	P4-8						
						Gray SILT, wet, no odor, no sheen	
					10		
					15	Test probe terminated at 15 feet bgs	
					20		

Project Name: **Silver Bay Logging**
Project Number: **2015-019B**
Client: **Silver Bay Logging**

Test Probe No.: **P5**
Sheet 1 of 1

Date(s) Drilled: **4/21/15**	Logged By: **KA**	Surface Conditions: **Asphalt**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type: **2 .25 inch/3.25 inch**	Total Depth of Borehole: **15 feet bgs**
Drill Rig Type: **Track-Mounted**	Drilling Contractor: **The Riley Group, Inc.**	Approximate Surface Elevation: **n/a**
Groundwater Level: **8 feet bgs**	Sampling Method(s): **Dual Tube Continuous**	Hammer Data : **n/a**
Borehole Backfill: **Bentonite**	Location: **7814 8th Avenue South, Seattle, Washington 98117**	

PID Reading, ppm	Sample ID	Sample Type	% Recovery	GW Depth	Depth (feet)	MATERIAL DESCRIPTION	Graphic Log
					0	Asphalt	
						Gray, fine to coarse GRAVEL with sand, dry, no odor, no sheen	
						Gray, fine to coarse SAND with silt and gravel, damp, odor, no sheen (Fill)	
2.6	P5-2						
						Dark gray, silty, fine SAND, moist, odor, no sheen	
0.3							
						Gray and orange, fine to medium SAND, moist, no odor, no sheen	
						Black charcoal burned wood	
					5	Brown to gray, fine to medium SAND, moist, no odor, no sheen	
0.0	P5-8			▽			
						Gray to brown SILT with wood fragments, wet, no odor, no sheen	
					10		
0.0	P5-15						
					15	Test probe terminated at 15 feet bgs	
					20		

Project Name: **Silver Bay Logging**
Project Number: **2015-019B**
Client: **Silver Bay Logging**

RILEYGROUP

Test Probe No.: **P6**
Sheet 1 of 1

Date(s) Drilled: **4/21/15**	Logged By: **KA**	Surface Conditions: **Asphalt**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type: **2 .25 inch/3.25 inch**	Total Depth of Borehole: **15 feet bgs**
Drill Rig Type: **Track-Mounted**	Drilling Contractor: **The Riley Group, Inc.**	Approximate Surface Elevation: **n/a**
Groundwater Level: **8 feet bgs**	Sampling Method(s): **Dual Tube Continuous**	Hammer Data : **n/a**
Borehole Backfill: **Bentonite**	Location: **7814 8th Avenue South, Seattle, Washington 98117**	

PID Reading, ppm	Sample ID	Sample Type	% Recovery	GW Depth	Depth (feet)	MATERIAL DESCRIPTION	Graphic Log
4.8	P6-0				0	Black, tar-like, silty SAND with organics, wet with product, odor, sheen	
						Asphalt	
						Brown to gray, silty, gravelly, SAND, moist, odor, sheen	
2.5	P6-5				5	Dark brown, fine to medium SAND, moist, no odor, no sheen	
0.0	P6-8			▽		Gray SILT, massive, moist to wet at 8' bgs, no odor, no sheen	
					10		
						Gray to brown, fine SILT, laminated, wet, no odor, no sheen	
0.0	P6-15				15	Test probe terminated at 15 feet bgs	
					20		

Project Name: **Silver Bay Logging**	Test Probe No.: **P7**
Project Number: **2015-019B**	**Sheet 1 of 1**
Client: **Silver Bay Logging**	

Date(s) Drilled: **4/21/15**	Logged By: **KA**	Surface Conditions: **Asphalt**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type: **2 .25 inch/3.25 inch**	Total Depth of Borehole: **10 feet bgs**
Drill Rig Type: **Track-Mounted**	Drilling Contractor: **The Riley Group, Inc.**	Approximate Surface Elevation: **n/a**
Groundwater Level: **7.5 feet bgs**	Sampling Method(s): **Dual Tube Continuous**	Hammer Data : **n/a**
Borehole Backfill: **Bentonite**	Location: **7814 8th Avenue South, Seattle, Washington 98117**	

PID Reading, ppm	Sample ID	Sample Type	% Recovery	GW Depth	Depth (feet)	MATERIAL DESCRIPTION	Graphic Log
					0	Asphalt	
0.1	P7-1					Gray, fine to coarse SAND, damp, slight odor, slight sheen	
						Gray, coarse GRAVEL with sand and concrete, damp, no odor, no sheen	
0.0							
						Brown, fine to medium SAND, moist, no odor, no sheen	
0.0					5		
						Gray SILT, moist to wet at 7.5' bgs, no odor, no sheen	
0.0	P7-7						
					10	Test probe terminated at 10 feet bgs	
					15		
					20		

Project Name: **Silver Bay Logging** Project Number: **2015-019B** Client: **Silver Bay Logging**	RILEYGROUP Test Probe No.: **P8** **Sheet 1 of 1**

Date(s) Drilled: **4/21/15**	Logged By: **KA**	Surface Conditions: **Debris/Soil**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type: **2 .25 inch/3.25 inch**	Total Depth of Borehole: **10 feet bgs**
Drill Rig Type: **Track-Mounted**	Drilling Contractor: **The Riley Group, Inc.**	Approximate Surface Elevation: **n/a**
Groundwater Level: **8 feet bgs**	Sampling Method(s): **Dual Tube Continuous**	Hammer Data : **n/a**
Borehole Backfill: **Bentonite**	Location: **7814 8th Avenue South, Seattle, Washington 98117**	

PID Reading, ppm	Sample ID	Sample Type	% Recovery	GW Depth	Depth (feet)	MATERIAL DESCRIPTION	Graphic Log
0.0	P8-0				0	Brown, silty, fine SAND, dry, odor, sheen	
0.0	P8-1					Dark brown to gray, fine SAND with silt, moist, no odor, no sheen	
						Brown to gray, silty, fine SAND, moist, no odor, no sheen	
0.0	P8-3.5						
					5		
						Brown, fine to medium SAND, no odor, no sheen	
0.0	P8-8			▽			
						Brown SILT, wet, no odor, no sheen	
					10	Test probe terminated at 10 feet bgs	
					15		
					20		

Project Name: **Silver Bay Logging**
Project Number: **2015-019B**
Client: **Silver Bay Logging**

RILEYGROUP

Test Probe No.: **P9**
Sheet 1 of 1

Date(s) Drilled: **4/21/15**	Logged By: **KA**	Surface Conditions: **Concrete**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type: **2 .25 inch/3.25 inch**	Total Depth of Borehole: **15 feet bgs**
Drill Rig Type: **Track-Mounted**	Drilling Contractor: **The Riley Group, Inc.**	Approximate Surface Elevation: **n/a**
Groundwater Level: **10 feet bgs**	Sampling Method(s): **Dual Tube Continuous**	Hammer Data : **n/a**
Borehole Backfill: **Bentonite**	Location: **7814 8th Avenue South, Seattle, Washington 98117**	

PID Reading, ppm	Sample ID	Sample Type	% Recovery	GW Depth	Depth (feet)	MATERIAL DESCRIPTION	Graphic Log
					0	Concrete	
						Brown, fine to medium SAND, damp, no odor, no sheen	
0.1	P9-2						
						Rust-stained brown, silty, fine SAND, damp, no odor, no sheen	
					5	Gray, fine SAND, damp, no odor, no sheen	
						Tan SILT, moist, no odor, no sheen	
						Brown to gray, fine SAND, moist, slight odor, no sheen	
0.2	P9-9.5						
				▽	10	Dark gray, fine to medium SAND, wet, no odor, no sheen	
	P9-15						
					15	Test probe terminated at 15 feet bgs	
					20		

Project Name: **Silver Bay Logging**	Test Probe No.: **P10**
Project Number: **2015-019B**	**Sheet 1 of 1**
Client: **Silver Bay Logging**	RILEYGROUP

Date(s) Drilled: **4/21/15**	Logged By: **KA**	Surface Conditions: **Concrete**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type: **2 .25 inch/3.25 inch**	Total Depth of Borehole:
Drill Rig Type: **Track-Mounted**	Drilling Contractor: **The Riley Group, Inc.**	Approximate Surface Elevation: **n/a**
Groundwater Level: **9.7 feet bgs**	Sampling Method(s): **Dual Tube Continuous**	Hammer Data : **n/a**
Borehole Backfill: **Bentonite**	Location: **7814 8th Avenue South, Seattle, Washington 98117**	

PID Reading, ppm	Sample ID	Sample Type	% Recovery	GW Depth	Depth (feet)	MATERIAL DESCRIPTION	Graphic Log
					0	Concrete	
0.1						Brown, gravelly, fine to coarse SAND with brick, damp, no odor, no sheen	
0.1	P10-2						
						Rust-stained brown, fine to medium SAND, moist, no odor, no sheen	
					5	Brown, fine to medium SAND with silt, moist, no odor, no sheen	
0.1	P10-9						
				∇		Becomes wet at 9.7' bgs	
					10	Black SAND, wet, no odor, no sheen	
0.0	P10-15						
					15	Test probe terminated at 15 feet bgs	
					20		

Project Name: **Silver Bay Logging**	Test Probe No.: **P11**
Project Number: **2015-019B**	**Sheet 1 of 1**
Client: **Silver Bay Logging**	

Date(s) Drilled: **4/21/15**	Logged By: **KA**	Surface Conditions: **Concrete**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type: **2 .25 inch/3.25 inch**	Total Depth of Borehole: **10 feet bgs**
Drill Rig Type: **Track-Mounted**	Drilling Contractor: **The Riley Group, Inc.**	Approximate Surface Elevation: **n/a**
Groundwater Level: **10 feet bgs**	Sampling Method(s): **Dual Tube Continuous**	Hammer Data : **n/a**
Borehole Backfill: **Bentonite**	Location: **7814 8th Avenue South, Seattle, Washington 98117**	

PID Reading, ppm	Sample ID	Sample Type	% Recovery	GW Depth	Depth (feet)	MATERIAL DESCRIPTION	Graphic Log
					0	Concrete	
						Brown, silty, fine SAND with gravel, moist, no odor, no sheen	
0.0	P11-2						
						Brown, fine SILT with fine sand, wet, no odor, no sheen	
					5	Brown, fine to medium SAND, moist, no odor, no sheen	
						Brown, fine to medium SAND, moist, no odor, no sheen	
0.0	P11-10			▽	10	Becmes wet at 10' bgs	
						Test probe terminated at 10 feet bgs	
					15		
					20		

Project Name: **Silver Bay Logging**	Test Probe No.: **P12**
Project Number: **2015-019B**	**Sheet 1 of 1**
Client: **Silver Bay Logging**	

Date(s) Drilled: **4/21/15**	Logged By: **KA**	Surface Conditions: **Concrete**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type: **2 .25 inch/3.25 inch**	Total Depth of Borehole: **10 feet bgs**
Drill Rig Type: **Track-Mounted**	Drilling Contractor: **The Riley Group, Inc.**	Approximate Surface Elevation: **n/a**
Groundwater Level: **6 feet bgs**	Sampling Method(s): **Dual Tube Continuous**	Hammer Data : **n/a**
Borehole Backfill: **Bentonite**	Location: **7814 8th Avenue South, Seattle, Washington 98117**	

PID Reading, ppm	Sample ID	Sample Type	% Recovery	GW Depth	Depth (feet)	MATERIAL DESCRIPTION	Graphic Log
					0	Concrete	
						Brown, silty SAND with gravel, damp, no odor, no sheen	
0.0	P12-2						
						Brown SILT with sand, moist, no odor, no sheen	
0.0	P12-5				5	Brown SILT with 3" to 4" sand lenses, moist, no odor, no sheen	
				∇		Becomes wet at 6' bgs	
0.0	P12-10				10	Test probe terminated at 10 feet bgs	
					15		
					20		

Project Name: **Silver Bay Logging**	Test Probe No.: **P13**
Project Number: **2015-019B**	**Sheet 1 of 1**
Client: **Silver Bay Logging**	RILEYGROUP

Date(s) Drilled: **4/21/15**	Logged By: **KA**	Surface Conditions: **Soil**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type: **2 .25 inch/3.25 inch**	Total Depth of Borehole: **15 feet bgs**
Drill Rig Type: **Track-Mounted**	Drilling Contractor: **The Riley Group, Inc.**	Approximate Surface Elevation: **n/a**
Groundwater Level: **8 feet bgs**	Sampling Method(s): **Dual Tube Continuous**	Hammer Data : **n/a**
Borehole Backfill: **Bentonite**	Location: **7814 8th Avenue South, Seattle, Washington 98117**	

PID Reading, ppm	Sample ID	Sample Type	% Recovery	GW Depth	Depth (feet)	MATERIAL DESCRIPTION	Graphic Log
85	P13-0				0	Mottled, medium to coarse GRAVEL with sand and silt and debris, moist, odor, sheen	
37	P13-5					Dark brown, fine to medium SAND, moist, odor, no sheen	
					5	Dark brown SILT, moist, no odor, no sheen	
				∇		Becomes wet at 8' bgs	
0.2	P13-10				10	Dark brown, fine SILT, wet, no odor, no sheen	
0.2	P13-15				15	Test probe terminated at 10 feet bgs	
					20		

Project Name: **Silver Bay Logging**	RILEYGROUP
Project Number: **2015-019C**	Test Probe No.: **P14**
Client: **Silver Bay Logging**	**Sheet 1 of 1**

Date(s) Drilled: **03/09/16**	Logged By: **KA**	Surface Conditions: **Asphalt**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type: **2.25" Diameter**	Total Depth of Borehole: **5 feet bgs**
Drill Rig Type: **Track-Mounted**	Drilling Contractor: **RGI**	Approximate Surface Elevation: **n/a**
Groundwater: **Not encountered**	Sampling Method(s): **Continuous**	Hammer Data : **n/a**
Borehole Backfill: **Bentonite**	Location: **7814 8th Avenue South, Seattle, Washington 98108**	

PID Reading, ppm	Sample ID	Sample Type	% Recovery	GW Depth	Depth (feet)	MATERIAL DESCRIPTION	Graphic Log
					0	Asphalt	
						Brown, sandy fine to medium GRAVEL, damp, odor, slight sheen	
0.0	P14-2		100%			Brown and gray, rust-stained silty fine to medium SAND with trace debris, moist (Fill)	
0.0	P14-4		100%			Red brown, peat/organics, wood, moist, no odor, no sheen	
						Gray, silty fine to medium SAND, moist, no odor, no sheen	
					5	Boring terminated at 5 feet bgs.	
					10		
					15		

Project Name: **Silver Bay Logging**	Test Probe No.: **P15**
Project Number: **2015-019C**	**Sheet 1 of 1**
Client: **Silver Bay Logging**	RILEYGROUP

Date(s) Drilled: **03/09/16**	Logged By: **KA**	Surface Conditions: **Asphalt**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type: **2.25" Diameter**	Total Depth of Borehole: **10 feet bgs**
Drill Rig Type: **Track-Mounted**	Drilling Contractor: **RGI**	Approximate Surface Elevation: **n/a**
Groundwater: **6.06'**	Sampling Method(s): **Continuous**	Hammer Data : **n/a**
Borehole Backfill: **Bentonite**	Location: **7814 8th Avenue South, Seattle, Washington 98108**	

PID Reading, ppm	Sample ID	Sample Type	% Recovery	GW Depth	Depth (feet)	MATERIAL DESCRIPTION	Graphic Log
					0	Asphalt	
						Brown, sandy fine to medium GRAVEL with silt, moist, no odor, no sheen	
0.0	P15-2		100%				
						Black, gravelly fine to medium SAND with charred wood debris, moist	
						Tan fine to medium GRAVEL, moist, no odor, no sheen	
0.2	P15-4		100%				
						Brown, fine to medium SAND with gravel, moist, no odor, no sheen	
					5		
0.0	P15-6		100%	∇			
						Gray SILT with brick debris at 8', wet, no odor, no sheen	
					10	Boring terminated at 10 feet bgs.	
					15		

Project Name: **Silver Bay Logging** Project Number: **2015-019C** Client: **Silver Bay Logging**	RILEYGROUP Test Probe No.: **P16** **Sheet 1 of 1**

Date(s) Drilled: **03/09/16**	Logged By: **KA**	Surface Conditions: **Asphalt**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type: **2.25" Diameter**	Total Depth of Borehole: **5 feet bgs**
Drill Rig Type: **Track-Mounted**	Drilling Contractor: **RGI**	Approximate Surface Elevation: **n/a**
Groundwater: **Not encountered**	Sampling Method(s): **Continuous**	Hammer Data : **n/a**
Borehole Backfill: **Bentonite**	Location: **7814 8th Avenue South, Seattle, Washington 98108**	

PID Reading, ppm	Sample ID	Sample Type	% Recovery	GW Depth	Depth (feet)	MATERIAL DESCRIPTION	Graphic Log
					0	Asphalt	
						Gray and brown coarse GRAVEL, damp	
0.0	P16-2		100%				
						Mottled gray SILT with trace debris and sand, moist	
0.0 0.0	P16-4		100%			Mottled, brown silty gravelly fine to medium SAND with burned wood debris at 4', moist, no odor, no sheen	
						Brown fine to medium SAND, moist, no odor, no sheen	
					5	Boring terminated at 5 feet bgs.	
					10		
					15		

Project Name: **Silver Bay Logging**	**Test Probe No.: P18**
Project Number: **2015-019C**	**Sheet 1 of 1**
Client: **Silver Bay Logging**	

Date(s) Drilled: **03/09/16**	Logged By: **KA**	Surface Conditions: **Grass / Gravel**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type: **2.25" Diameter**	Total Depth of Borehole: **10 feet bgs**
Drill Rig Type: **Track-Mounted**	Drilling Contractor: **RGI**	Approximate Surface Elevation: **n/a**
Groundwater: **6'**	Sampling Method(s): **Continuous**	Hammer Data : **n/a**
Borehole Backfill: **Bentonite**	Location: **7814 8th Avenue South, Seattle, Washington 98108**	

PID Reading, ppm	Sample ID	Sample Type	% Recovery	GW Depth	Depth (feet)	MATERIAL DESCRIPTION	Graphic Log
					0	Grass / Gravel	
						Brown, sandy SILT with organics, moist, no odor, no sheen	
0.0	P18-2.5		100%			Rust-stained brown-gray sandy SILT, moist, no odor, no sheen	
0.0							
						Becomes gray	
					5		
				∇		Gray silty fine SAND, wet, no odor, no sheen	
0.0	P18-7.5		95%				
0.0							
					10	Boring terminated at 10 feet bgs. Insufficient groundwater was present at time of drilling for sample collection.	
					15		

Project Name: **Silver Bay Logging**	RILEYGROUP Test Probe No.: **P19**
Project Number: **2015-019C**	**Sheet 1 of 1**
Client: **Silver Bay Logging**	

Date(s) Drilled: **03/09/16**	Logged By: **KA**	Surface Conditions: **Grass / Gravel**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type: **2.25" Diameter**	Total Depth of Borehole: **10 feet bgs**
Drill Rig Type: **Track-Mounted**	Drilling Contractor: **RGI**	Approximate Surface Elevation: **n/a**
Groundwater: **4.5'**	Sampling Method(s): **Continuous**	Hammer Data : **n/a**
Borehole Backfill: **Bentonite**	Location: **7814 8th Avenue South, Seattle, Washington 98108**	

PID Reading, ppm	Sample ID	Sample Type	% Recovery	GW Depth	Depth (feet)	MATERIAL DESCRIPTION	Graphic Log
					0	Grass / Gravel	
0.0			90%			Brown SILT with some sand and organics, moist, no odor, no sheen	
0.0	P19-4		90%			Rust-stained, becomes wet	
				▽	5		
						Gray, sandy SILT, wet, no odor, no sheen	
0.0	P19-8		100%				
						Brown gray fine SAND with silt, wet, no odor, no sheen	
					10	Boring terminated at 10 feet bgs. Insufficient groundwater was present at time of drilling for sample collection.	
					15		

Boring SB-01

Logged by T. Nanevicz on December 4, 2003
Driller: ESN

Drilled using truck-mounted, direct-push Geoprobe.
Boring backfilled with bentonite.

Depth (feet)	Sample ID/ Interval	(N) Blows/ft	Moisture Content (%)/ Water Table	PID (ppm)	USCS	Soil Description
1						
2						
3						
4				0.0		Gray fine-grained silty SAND; woody debris encountered at 3.5 feet
5						
6						
7			▼	0.0		Light to dark brown fine to medium-grained SAND; Water encountered at 7.0 feet
8						
9						
10						
11						

Boring terminated at 8.0 feet.

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Riley Project #2003-232	Log of Boring SB-01	Appendix B-1
Logged by: T. Nanevicz		Date Logged: 12/04/03

Site Address: NEC South Kenyon Street & 8th Avenue South, Seattle, Washington

Boring SB-02

Logged by T. Nanevicz on December 4, 2003
Driller: ESN

Drilled using truck-mounted, direct-push Geoprobe.
Boring backfilled with bentonite.

Depth (feet)	Sample ID/ Interval	(N) Blows/ft	Moisture Content (%)/ Water Table	PID (ppm)	USCS	Soil Description
1						
2						
3				0.0		Gray silty SAND
4						
5						
6			▼	0.0		Gray fine to medium-grained SAND; Water encountered at 6.75 feet
7						
8						
9						
10						
11						

Boring terminated at 8.0 feet.

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Riley Project #2003-232	Log of Boring SB-02	Appendix B-2

Logged by: T. Nanevicz — Date Logged: 12/04/03

Site Address: NEC South Kenyon Street & 8th Avenue South, Seattle, Washington

Boring SB-03

Logged by T. Nanevicz on December 4, 2003
Driller: ESN

Drilled using truck-mounted, direct-push Geoprobe.
Boring backfilled with bentonite.

Depth (feet)	Sample ID/ Interval	(N) Blows/ft	Moisture Content (%)/ Water Table	PID (ppm)	USCS	Soil Description
1						
2						
3						
4				0.4		Gray fine-grained silty SAND
5						
6						
7			▼	0.4		Gray fine to medium-grained SAND; Water encountered at 7.0 feet
8						
9						
10						
11						

Boring terminated at 8.0 feet.

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Riley Project #2003-232	Log of Boring SB-03	Appendix B-3
Logged by: T. Nanevicz	Date Logged: 12/04/03	

Site Address: NEC South Kenyon Street & 8th Avenue South, Seattle, Washington

Boring SB-04

Logged by T. Nanevicz on December 4, 2003
Driller: ESN

Drilled using truck-mounted, direct-push Geoprobe.
Boring backfilled with bentonite.

Depth (feet)	Sample ID/ Interval	(N) Blows/ft	Moisture Content (%)/ Water Table	PID (ppm)	USCS	Soil Description
1						
2						
3						
				0.0		Brown fine-grained silty SAND with cobbles
4						
5						
6						
			▼	0.0		Light to dark brown fine to medium-grained SAND; Water encountered at 6.75 feet
7						
8						
9						
10						
11						

Boring terminated at 8.0 feet.

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Riley Project #2003-232	Log of Boring SB-04	Appendix B-4
Logged by: T. Nanevicz		Date Logged: 12/04/03

Site Address: NEC South Kenyon Street & 8th Avenue South, Seattle, Washington

Boring SB-05

Logged by T. Nanevicz on December 4, 2003
Driller: ESN

Drilled using truck-mounted, direct-push Geoprobe.
Boring backfilled with bentonite.

Depth (feet)	Sample ID/ Interval	(N) Blows/ft	Moisture Content (%)/ Water Table	PID (ppm)	USCS	Soil Description
1						
2						
3						
4				0.0		Light brown fine-grained SAND
5						
6			▼	0.4		Gray silty SAND; Water encountered at 6.0 feet
7						
8						
9						
10						
11						

Boring terminated at 8.0 feet.

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Riley Project #2003-232	*Log of Boring SB-05*	*Appendix B-5*
Logged by: T. Nanevicz		*Date Logged: 12/04/03*

Site Address: NEC South Kenyon Street & 8th Avenue South, Seattle, Washington

Boring SB-06

Logged by T. Nanevicz on December 4, 2003
Driller: ESN

Drilled using truck-mounted, direct-push Geoprobe.
Boring backfilled with bentonite.

Depth (feet)	Sample ID/ Interval	(N) Blows/ft	Moisture Content (%)/ Water Table	PID (ppm)	USCS	Soil Description
1						
2						
3						
4				0.1		Light to dark brown silty SAND
5						
6			▼	0.2		Gray silty SAND; Water encountered at 6.0 feet
7						
8						
9						
10						
11						

Boring terminated at 8.0 feet.

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Riley Project #2003-232	Log of Boring SB-06	Appendix B-6
Logged by: T. Nanevicz		Date Logged: 12/04/03

Site Address: NEC South Kenyon Street & 8th Avenue South, Seattle, Washington

Boring SB-07

Logged by T. Nanevicz on December 4, 2003
Driller: ESN

Drilled using truck-mounted, direct-push Geoprobe.
Boring backfilled with bentonite.

Depth (feet)	Sample ID/ Interval	(N) Blows/ft	Moisture Content (%)/ Water Table	PID (ppm)	USCS	Soil Description
1						
2						
3						
4				0.0		Light gray silt
5						
6						
7						
8			▼	0.0		Light gray silt; Water encountered at 8.0 feet
9						
10						
11						

Boring terminated at 8.0 feet.

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Riley Project #2003-232	Log of Boring SB-07	Appendix B-7
Logged by: T. Nanevicz		Date Logged: 12/04/03
Site Address: NEC South Kenyon Street & 8th Avenue South, Seattle, Washington		

Boring SB-08

Logged by T. Nanevicz on December 4, 2003
Driller: ESN

Drilled using truck-mounted, direct-push Geoprobe.
Boring backfilled with bentonite.

Depth (feet)	Sample ID/ Interval	(N) Blows/ft	Moisture Content (%)/ Water Table	PID (ppm)	USCS	Soil Description
1						
2						
3						
				0.0		Light brown fine-grained silty SAND with cobbles
4						
5						
6						
7						
				0.2		Dark brown fine-grained SAND with cobbles
8						
			▼	0.0		Gray silty SAND; Water encountered at 8.5 feet
9						
10						
11						

Boring terminated at 12.0 feet.

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Riley Project #2003-232	*Log of Boring SB-08*	*Appendix B-8*
Logged by: T. Nanevicz		*Date Logged: 12/04/03*

Site Address: NEC South Kenyon Street & 8th Avenue South, Seattle, Washington

Boring SB-09

Logged by T. Nanevicz on December 4, 2003
Driller: ESN

Drilled using truck-mounted, direct-push Geoprobe.
Boring backfilled with bentonite.

Depth (feet)	Sample ID/ Interval	(N) Blows/ft	Moisture Content (%)/ Water Table	PID (ppm)	USCS	Soil Description
1						
2						
3				0.0		Gray SILT
4						
5						
6						
7				0.0		Gray fine-grained SAND
8						
9				0.0		Light to dark gray fine-grained silty SAND; Water encountered at 10.0 feet
10			▼			
11						

Boring terminated at 12.0 feet.

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Riley Project #2003-232	Log of Boring SB-09	Appendix B-9
Logged by: T. Nanevicz	Date Logged: 12/04/03	
Site Address: NEC South Kenyon Street & 8th Avenue South, Seattle, Washington		

Boring SB-10

Logged by T. Nanevicz on December 4, 2003
Driller: ESN

Drilled using truck-mounted, direct-push Geoprobe.
Boring backfilled with bentonite.

Depth (feet)	Sample ID/ Interval	(N) Blows/ft	Moisture Content (%)/ Water Table	PID (ppm)	USCS	Soil Description
1						
2						
3						
4				0.0		Light gray silty SAND
5						
6						
7						
8				0.0		Light to dark gray silty SAND
9						
10			▼	0.0		Light to dark brown fine to medium-grained SAND; Water encountered at 10.5 feet
11						

Boring terminated at 12.0 feet.

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Riley Project #2003-232	Log of Boring SB-10	Appendix B-10
Logged by: T. Nanevicz	Date Logged: 12/04/03	

Site Address: NEC South Kenyon Street & 8th Avenue South, Seattle, Washington

Boring SB-11

Logged by T. Nanevicz on December 4, 2003
Driller: ESN

Drilled using truck-mounted, direct-push Geoprobe.
Boring backfilled with bentonite.

Depth (feet)	Sample ID/ Interval	(N) Blows/ft	Moisture Content (%)/ Water Table	PID (ppm)	USCS	Soil Description
1						
2						
3						
4				0.0		Light brown silty SAND
5						
6						
7						
8				0.0		Gray fine-grained SAND
9						
10			▼	0.0		Gray fine-grained SAND; Water encountered at 10.0 feet
11						

Boring terminated at 12.0 feet.

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Silver Bay Logging Company, Inc.

Riley Project #2003-232	Log of Boring SB-11	Appendix B-11
Logged by: T. Nanevicz	Date Logged: 12/04/03	

Site Address: NEC South Kenyon Street & 8th Avenue South, Seattle, Washington

Boring SB-12

Logged by T. Nanevicz on December 4, 2003
Driller: ESN

Drilled using truck-mounted, direct-push Geoprobe.
Boring backfilled with bentonite.

Depth (feet)	Sample ID/ Interval	(N) Blows/ft	Moisture Content (%)/ Water Table	PID (ppm)	USCS	Soil Description
1						
2						
3						
				0.0		Light gray gravelly SILT
4						
5						
6						
7			▼	0.0		Dark gray to light brown silty SAND; Water encountered at 7.5 feet
8						
9						
10						
11						

Boring terminated at 8.0 feet.

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Silver Bay Logging Company, Inc.

Riley Project #2003-232	*Log of Boring SB-12*	*Appendix B-12*
Logged by: T. Nanevicz	*Date Logged: 12/04/03*	

Site Address: NEC South Kenyon Street & 8th Avenue South, Seattle, Washington

Boring SB-13

Logged by T. Nanevicz on December 4, 2003
Driller: ESN

Drilled using truck-mounted, direct-push Geoprobe.
Boring backfilled with bentonite.

Depth (feet)	Sample ID/ Interval	(N) Blows/ft	Moisture Content (%)/ Water Table	PID (ppm)	USCS	Soil Description
1						
2						
3						
				0.0		Light brown silty SAND with pebbles
4						
5						
6						
7						
				0.0		Gray fine-grained SAND
8						
9						
10			▼	0.0		Gray fine-grained SAND; Water encountered at 10.5 feet
11						

Boring terminated at 12.0 feet.

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Riley Project #2003-232	Log of Boring SB-13	Appendix B-13
Logged by: T. Nanevicz		Date Logged: 12/04/03
Site Address: NEC South Kenyon Street & 8th Avenue South, Seattle, Washington		

Boring SB-14

Logged by T. Nanevicz on December 12, 2003
Driller: ESN

Drilled using truck-mounted, direct-push Geoprobe.
Boring backfilled with bentonite.

Depth (feet)	Sample ID/ Interval	(N) Blows/ft	Moisture Content (%)/ Water Table	PID (ppm)	USCS	Soil Description
1						
2						
3						
4				0.2		Light gray silty SAND
5						
6						
7						
8			▼	0.2		Light gray silty SAND; Water encountered at 8.0 feet
9						
10						Light gray clayey SILT
11						

Boring terminated at 12.0 feet.

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Riley Project #2003-232	Log of Boring SB-14	Appendix B-14
Logged by: T. Nanevicz	Date Logged: 12/12/03	
Site Address: NEC South Kenyon Street & 8th Avenue South, Seattle, Washington		

Remedial Investigation/Feasibility Study Work Plan

Silver Bay Logging Site

Appendix C
Sampling and Analysis Plan/ Quality Assurance Project Plan

Table of Contents

List of Tables

List of Attachments

List of Abbreviations

Abbreviation	Definition
bgs	Below ground surface
cm	Centimeters
COC	Chain of Custody
COI	Contaminant of interest
DQO	Data quality objective
Ecology	Washington State Department of Ecology
EDD	Electronic data deliverable
FC	Field coordinator
GCMS	Gas chromatography/mass spectrometry
GPS	Global Positioning System
HSA	Hollow-stem auger
ID	Identification
IDW	Investigation-derived waste
K	Hydraulic conductivity
LCS	Laboratory Control Sample

Abbreviation	Definition
LDW	Lower Duwamish Waterway
LDWG	Lower Duwamish Waterway Group
MDL	Method detection limit
MS	Matrix spike
MSD	Matrix spike duplicate
OSHA	Occupational Safety and Health Administration
PCB	Polychlorinated biphenyl
PDI	Pre-design investigation
PID	Photoionization detector
PM	Project manager
Property	Silver Bay Logging Property
PVC	Polyvinyl chloride
QA	Quality assurance
QC	Quality control
RCRA	Resource Conservation and Recovery Act
RI/FS Work Plan	Remedial Investigation/Feasibility Study Work Plan
RL	Reporting limit
RPD	Relative percent difference
SAP/QAPP	Sampling and Analysis Plan/Quality Assurance Project Plan
SDG	Sample delivery group
SMS	Sediment Management Standards
SOP	Standard operating procedure
SPU	Seattle Public Utilities
TBT	Tributyltin
TPH	Total petroleum hydrocarbons
USEPA	U.S. Environmental Protection Agency
XRF	X-ray Fluorescence

1.0 Introduction

This Sampling and Analysis Plan/Quality Assurance Project Plan (SAP/QAPP) is presented as an appendix to the Remedial Investigation/Feasibility Study Work Plan (RI/FS Work Plan) for the Silver Bay Logging Property (Property). It describes details regarding field management responsibilities, sampling locations and field sampling methods. Additionally, this document details the quality assurance (QA) objectives, methods, and procedures to characterize the nature and extent, both vertically and horizontally, of contamination in environmental media to provide sufficient information to evaluate and select clean-up actions. This document was prepared in accordance with U.S. Environmental Protection Agency's (USEPA's) guidance on preparing QAPPs (USEPA 2002a, 2006).

1.1 DOCUMENT ORGANIZATION

This QAPP is organized into the following sections:

- Section 2.0—Project Organization and Responsibilities. Supporting tables for this section include Table C.1.
- Section 3.0—Data Generation and Acquisition. Supporting tables for this section include Tables C.2, C.3, C.4, C.5, C.6, C.7, C.8, C.9, C.10, and C.11. Supporting attachments include Attachments C.1, C.2, and C.3.
- Section 4.0—Assessment and Oversight
- Section 5.0—Data Validation and Usability
- Section 6.0—References
- Section 7.0—Approvals

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2.0 Project Organization and Responsibilities

2.1 PROJECT MANAGEMENT

The following sections describe the responsibilities of project team members for fulfillment of this SAP/QAPP. The contact information for key project team members will be provided prior to implementation of RI/FS using the form provided in Table C.1 (Key project QA contacts form).

2.1.1 Project Managers

The Washington State Department of Ecology (Ecology) and Seattle Public Utilities (SPU) project managers (PMs) will be involved in all aspects of this project, including discussion, review, and interpretation of this SAP/QAPP, and the results of the investigation. The Floyd|Snider PM and HDR, Inc. (HDR) PM will be responsible for the overall implementation of this SAP/QAPP.

2.1.2 Field Coordinators

The Floyd|Snider field coordinator (FC) will be responsible for implementation of the field data collection program, including sample handling and custody documentation. The FC will work closely with the Floyd|Snider and HDR PMs to ensure that the required sample collection and laboratory analyses are completed.

2.1.3 Laboratory Quality Assurance/Quality Control Coordinator

The laboratory quality assurance/quality control (QA/QC) coordinator will oversee coordination of the field sampling and laboratory program, and project QA coordination, including coordination with the analytical laboratories. The laboratory QA/QC coordinator will be an HDR staff member specializing in QA/QC who is independent from the analytical laboratories and field staff responsible for generating the data.

Analytical laboratories will be responsible for chemical analyses and will ensure that submitted samples are handled and analyzed in accordance with the analytical testing procedures and QA/QC requirements, as well as any other requirements specified in this SAP/QAPP. The laboratories will provide certified pre-cleaned sample containers and preservatives, as appropriate, and prepare a data report containing analytical and QA/QC results.

Laboratory PMs will oversee laboratory operations, including receipt of samples, chemical analyses, and laboratory report preparation. They will prepare and review laboratory reports and case narratives describing any discrepancies and exceptions that occurred during chemical analyses. They will also notify the laboratory QA/QC coordinator of any problems when they are identified.

The Floyd|Snider data QA manager (or project chemist) and EcoChem, Inc. (EcoChem) in Seattle, Washington, will provide analytical data review and validation.

2.2 COMMUNICATIONS

Project team communications will be managed by the FCs. The FCs will provide daily summaries of field progress to the PMs and report any deviations from the SAP/QAPP. Floyd|Snider and HDR PMs will be responsible for reporting significant deviations from the SAP/QAPP to the Ecology and SPU PMs.

2.3 PROBLEM DEFINITION/BACKGROUND

The RI/FS Work Plan describes the data quality objectives (DQOs) that will be performed as part of this investigation. The RI/FS Work Plan is intended to characterize the nature and extent (horizontal and vertical) of contamination in environmental media to provide sufficient information to evaluate and select clean-up actions.

2.4 PROJECT TASK DESCRIPTION

Data quality objective activities described in the RI/FS Work Plan will be initiated following Ecology approval.

2.5 DATA QUALITY CRITERIA

The data quality criteria for this SAP/QAPP are to develop and implement procedures that will ensure representative data of known, acceptable, and defensible quality to achieve project objectives as described in the RI/FS Work Plan. Laboratory data is assessed by precision, accuracy, representativeness, comparability, and completeness. Refer to section 3.4 for additional descriptions.

2.6 SPECIAL TRAINING/CERTIFICATIONS

The Floyd|Snider FC, the HDR FC, and all field personnel will be trained in standard data collection methods so that data collected are consistent and accurate throughout the project. All field staff will be fully trained in the collection and processing of groundwater, soil, and sediment samples, decontamination requirements, and chain-of-custody (COC) procedures. Training for staff will be provided by Floyd|Snider, HDR, or by attending external seminars or workshops relevant to subject matter. The Floyd|Snider and HDR FCs will be responsible for ensuring that field staff and contractors will have the necessary training required to conduct field data collection procedures described in this SAP/QAPP.

Additionally, the 29 Code of Federal Regulations of 1910.120 Occupational Safety and Health Administration (OSHA) regulations require employees to be provided with training to enable them with knowledge and skills to perform jobs safely with minimum risk to personal health. All field staff will complete the 40-hour Hazardous Waste Operations and Emergency Response training course and the 8-hour refresher course as necessary, to meet OSHA regulations. Staff using an X-ray Fluorescence (XRF) spectrometer will additionally complete radiation safety training appropriate to the instrument type. Current training certifications will be provided to Ecology prior to field mobilization.

All analytical laboratories will have current environmental laboratory accreditation from the National Environmental Laboratory Accreditation Program and other accreditation agencies as needed, for the analytical methods to be used.

2.7 DOCUMENTATION AND RECORDS

The document will be maintained and updated by the Floyd|Snider PM, who will be responsible for distribution of the approved document and any updated versions to key project contacts as listed in Table C.1. The Floyd|Snider PM will provide key project team members with the SAP/QAPP as determined as necessary to perform the work specified herein. This SAP/QAPP must be approved by PMs, laboratories, and data validation contractors prior to the start of field sampling activities (refer to Section 7.0).

Additionally, Floyd|Snider and HDR will store all project records in a secure manner. Each project team member is responsible for filing all project information and/or records according to Floyd|Snider and HDR internal requirements. All electronic data will be maintained in a database in a designated directory at Floyd|Snider.

2.7.1 Field Records

Documents and records generated in the field should be considered controlled documents that become part of the project file. Field staff will keep daily records of significant events, observations, and measurements on forms specific to the field activity. All field documents will be maintained by the FCs. All sampling forms will contain information on the sample collected and will include at a minimum the following information:

- Project name
- Field staff on site
- Field observations
- Sample collection date and time
- Sampling method and/or description of field activities
- Instruments or equipment used
- Location identifier and sample identification (ID)
- Sample analysis
- Deviations from RI/FS Work Plan DQOs

2.7.2 Laboratory Records

The analytical laboratories will retain analytical data records. Additionally, Floyd|Snider and HDR will retain laboratory data records in central project files. For chemical analyses, data reporting requirements will include items necessary to complete data validation, including copies of raw data, as needed. Laboratory data reports will include the following as applicable:

- Project narrative: This summary, will present any problems encountered during any aspect of sample analyses. The summary will include, but not be limited to, discussion of sample shipment, sample storage, QC deviations, and any other analytical difficulties. Problems encountered and their resolutions will be documented in detail.

- Records: Legible copies of the COC forms will be provided in the data package. This documentation will include the time of receipt and the condition of each sample received by the laboratory. These records will also document any additional internal tracking of sample custody by the laboratory.
- Results: The data package will summarize the results for each sample analyzed. The summary will include the following information, as applicable:
    - Field sample ID code and the corresponding laboratory ID code
    - Sample matrix
    - Date of sample extraction/digestion
    - Date and time of analysis
    - Weight/volume used for analysis
    - Final dilution volumes or concentration factor for the sample
    - Percent solids
    - Identification of the instruments used for analysis
    - Method detection limits (MDLs) and reporting limits (RLs)
    - All data qualifiers and their definitions
- QA/QC summaries: These summaries will contain the results of all QA/QC procedures. Each QA/QC sample analysis will document the same information required for the sample results (as described above). The laboratory will make no recovery or blank corrections, except for isotope dilution method correction prescribed by specific analytical methods.
- Original data: The laboratory Level 4 data packages for dioxins/furans and polychlorinated biphenyl (PCB) congeners will include legible copies of the original data generated by the laboratory, including the following:
    - Sample extraction/digestion, preparation, and cleanup logs
    - Instrument specifications and analysis logs for all instruments used on days of calibration and analysis
    - Reconstructed ion chromatograms for all samples, standards, blanks, calibrations, spikes, replicates, laboratory control samples, and certified reference materials
    - Enhanced and unenhanced spectra of target compounds detected in field samples and method blanks, with associated best-match spectra and background-subtracted spectra, for all gas chromatography/mass spectrometry (GCMS) analyses
    - Enhanced and unenhanced spectra of target performance reference compounds detected in field samples, day-zero blanks, field blanks, and method blanks, with

associated best-match spectra and background-subtracted spectra, for all GCMS analyses

- Quantitation reports for each instrument used, including reports for all field, laboratory, and QA/QC samples

Additionally, the laboratory instruments and equipment used for data generation, employee training requirements, calibration procedures, equipment and standard certification, and record-keeping procedures are detailed in the laboratory standard operating procedure (SOP) documents. These SOP documents also detail the procedures for periodic maintenance, inspection and testing of equipment, resolution of deficiencies and re-inspection, and documentation of corrective actions. Each laboratory employs an internal QA manager who bears responsibility for following SOPs and performing routine audits for SOP compliance; as well as performing routine audits that are required for state accreditation. The PMs may request to review records of SOP compliance.

The analytical laboratories will submit data electronically, in the Floyd|Snider standard electronic data deliverable (EDD) format. Guidelines for EDDs for chemical data will be communicated to the analytical laboratories by the Floyd|Snider QA manager or project chemist.

All electronic data submittals must be tab-delimited text files that include all results, MDLs (as applicable), and RLs, consistent with those provided in the laboratory report. If laboratory replicate analyses are conducted on a single submitted field sample, the laboratory sample identifier must distinguish each replicate analyses.

2.7.3 Data Management and Reduction

The Floyd|Snider data QA manager or project chemist will oversee all environmental and geochemical data and will confirm that analytical data are assembled in the required deliverable format with appropriate qualifiers following acceptance of the data validation.

The Floyd|Snider data QA manager or project chemist will coordinate with the Floyd|Snider and HDR PMs to create and QC an electronic inventory of samples collected, and analyses requested. This inventory will be compared with the received laboratory data, and the Floyd|Snider data QA manager or project chemist will be responsible for coordination with the appropriate laboratories to correct any inconsistencies. Once all required data are confirmed to be received and validated, the Floyd|Snider data QA manager or project chemist will load all records to an electronic database accessed using Microsoft Access software with hard-disc backup. A summary of the data loaded to the database will be provided to the PMs as an additional QC step to ensure that all expected data are accounted for in the database. The database may be queried for all data generated for the project or for targeted subsets of data as needed for specific aspects of this investigation.

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3.0 Data Generation and Acquisition

3.1 SAMPLING DESIGN

This section describes the sampling design to collect data as summarized in the DQOs described in the RI/FS workplan:

- Establish a groundwater monitoring well network to define the presence and extent of known and suspected contaminants of interest (COIs) in groundwater.
- Install soil borings to define the presence and extent of known and suspected COIs in soil.
- Characterize sediment quality relative to COIs.
- Collect additional data to assess groundwater migration, contaminant partitioning, and contaminant toxicity to refine the conceptual site model.

3.2 SAMPLING METHODS

This section provides methods to collect groundwater, soil, and sediment samples as described in DQOs detailed in the RI/FS Work Plan. Additional sampling for subsequent phases of the RI/FS Work Plan, if determined to be necessary, will be addressed in a supplemental work plan addendum. Table C.6 summarizes the container type used during sample collection, preservation method, and holding time for each analyte in applicable sample media. Field standard guidelines for sample collection are provided in Attachment C.1. Additional sediment split samples will be acquired from the Lower Duwamish Waterway Group (LDWG) pre-design investigation (PDI) sampling program, which is expected to occur simultaneously with the RI. The LDWG PDI QAPP is provided in Attachment C.2.

3.2.1 Riverbank Survey

A lot-tide visual survey will be conducted in the Riverbank area to verify assumptions regarding bank conditions and positions of outfall pipes. During the low-tide survey, additional field measurements will be collected for observed seeps and field estimates of metals concentrations will be collected using an XRF spectrometer, as described in the following sections.

3.2.1.1 Seep Survey

Field staff will perform a visual survey for seeps while walking along the shoreline. Seeps will be tracked to their origin to the extent practical. The position of any noted seeps will be recorded in a field notebook using a GPS. Seeps will also be photographed from multiple angles to document their location. Observations of odors, sheens, or nonaqueous phase liquids within the seep will be documented. The spatial extent of the seep (length, width, and depth) will be recorded and the approximate flow rate will be determined. Flow rates can be estimated by using a measuring cup and recording the volume of flow from the seep into the container per minute with a stopwatch.

If seep sampling is determined to be necessary based on the groundwater and soil quality and hydrogeologic study results, samples will be collected in accordance with the procedures in Attachment C.1. The flow rate will be re-measured before sampling. General methodologies for seep sampling include the following:

Direct Collection: If the seeps produce sufficient water to collect groundwater samples directly from the flow emerging at the surface, seeps will be sampled by filling the laboratory-supplied bottle with the water emerging from the ground. Care should be taken to prevent any contact between the bottle and the ground surface to avoid collecting any soil from the ground surface into the sample. For VOC collection, a disposable plastic syringe may be used.

Dam Construction: If direct collection is not feasible due to insufficient flow of the seep, but the seep discharge emerges as a relatively large surface area, producing a thin sheet of flowing water, a dam can be constructed at the periphery of the seep to allow water to accumulate so samples can be collected. A dam can be constructed using clean plastic sheeting as dam material. Then the sample can be collected using the Direct Collection method above.

Temporary Sampling Point: If the seep does not produce sufficient water to collect samples directly from the flow emerging from the surface or if dam construction is not feasible, a temporary sampling point can be placed within the soil to collect a sample. A temporary sampling point may consist of a short-length, slotted polyvinyl chloride (PVC) screen or a stainless-steel gas vapor implant screen with a barbed connector and appropriate diameter tubing compatible with a peristaltic pump.

To install the temporary sampling point, a small depression of approximately 0.5 feet by 0.5 feet by 1 foot can be dug in the areas with the highest flow rate. If fine-grained soils are present, filter fabric or sand pack material, such as 20-40 Colorado, 2-12 Monterey sand, or similar, can be used to surround the slotted PVC screen or gas vapor implant screen connected to new polytetrafluoroethylene (Teflon)-lined polyethylene tubing. The gas vapor implant should be buried horizontally. Tubing attached to a peristaltic pump can then be attached to the gas vapor implant or placed within the PVC casing to pump water from seep.

3.2.1.2 X-ray Fluorescence Spectrometer Survey

An XRF spectrometer will be used to estimate the distribution of lead and arsenic in surface soils exposed along the riverbank. An XRF analyzer calibrated for bulk metals analysis will be used for the investigation and will record metals concentrations in milligrams per kilogram. The XRF instrument will be calibrated by the manufacturer prior to shipment for use. Prior to collecting field measurements, the XRF analyzer calibration will be verified in the field by analyzing a standard (provided by the manufacturer) and monitoring the instrument for drift. Correction for drift will be applied to field XRF measurements if drift is observed.

Soil along the riverbank will be tested in situ with the XRF analyzer per the manufacturer’s instructions to determine the extent of elevated metals in the surrounding surface soils. The soil surface will be tested by smoothing and flattening an area in an approximate 6-inch-by-6-inch square and holding the XRF analyzer to the soil for approximately 60 seconds. If moisture is present in the soil, clear plastic may be placed between the XRF and the soil so moisture will not affect the XRF reading.

The XRF survey will begin at the northernmost extent of the shoreline fill unit noted in the northern Property corner (refer to Figure 2.1) and proceed southward to screen for metals in exposed soil. Measurements of metals concentrations on the surface of the exposed bank soils will be collected at approximately 20-foot intervals laterally along the riverbank, until there are two consecutive lateral readings of non-detect or at concentrations less than the XRF screening levels for arsenic and lead, or exposed bank soil is no longer present. At each interval, at least three measurements (corresponding to depths between approximately 2 to 5 feet below the top of the bank, where stained fill was previously observed to outcrop along the riverbank surface) will be completed.

3.2.2 Well Installation and Development

Monitoring well construction and development will be performed in accordance with the Floyd|Snider monitoring well construction and development standard guidelines (included as Attachment C.1). A 2-inch-diameter PVC well with a 10-foot screen will be installed using hollow-stem auger (HSA) drilling methods unless the field geologist indicates otherwise based on the material encountered in the subsurface. The screened interval will be designed to intercept the water table unless otherwise noted, which has been encountered between 2.5 and 12 feet below ground surface (bgs), during a range of seasonal water level fluctuations. Evidence of the highest groundwater table at a given location may include increased soil moisture, presence of blue/gray color indicating a transition to anoxic conditions, or indications of a “smear zone” if light contaminants such as total petroleum hydrocarbons (TPH) are transported through the soil column by groundwater. Detailed information regarding the highest and lowest anticipated groundwater table and anticipated target well screen intervals to span the water table are presented in Table C.5. The length of the well screen may be adjusted to target more coarse grained soil with greater presumed hydraulic conductivity, if present, at direction of the field geologist. The deeper well MW-05D is anticipated to be constructed with a 10-foot screen from 20 to 30 feet bgs; however, this interval may also be adjusted as needed to sample coarser, more conductive material. Wells will be completed with flush-mounted monuments. Additional well protection, such as placement of concrete ecology block or bollards, may be considered in locations where current Property operations such as stockpile handling with equipment may damage the surface well completion.

Following installation, monitoring wells will be developed to remove fine-grained material by purging with a submersible pump and surging with the pump or a surge block to move water through the sand pack and surrounding soil formation. New wells will be developed until the purge water achieves visual clarity. All existing site wells will be redeveloped prior to sample collection. Purge water will be collected in 55-gallon drums for profiling and disposal.

3.2.3 Soil Boring Sampling

Soil samples will be collected using direct-push, roto-sonic and/or HSA drilling methods from each DQO location as described in the RI/FS Work Plan (refer to RI/FS Work Plan Table 6.1). Detailed information regarding anticipated soil sample intervals at each boring location is presented in Table C.3.

Soil borings will be advanced to a depth of 15 feet bgs (or 30 feet bgs at MW-05D), or the deepest observed field indications of contamination (such as sheen, staining, odors or elevated headspace volatiles concentrations measured using a photoionization detector [PID]). Representative samples will be collected from each soil type or unit observed, with vertical thickness of 2 feet or less unless poor sample recovery is encountered or additional volume is needed for laboratory analysis. A second attempt adjacent to the first boring location will be made if poor recovery results in insufficient volume for the required analyses for a given location and depth interval. If a second attempt also encounters poor recovery, a sample will be collected according to the best professional judgment of the field staff and/or FC. The sample may be composed of a combined volume of the recovered material over the target interval from the two attempts and/or a longer sample interval provided the material is of uniform composition and field indications of contamination. Smaller intervals may additionally be analyzed to target field indications of contamination.

At each boring location, samples are anticipated to be collected from fill soil (if present), native soil in the vadose zone and the capillary fringe overlying the water table, and within the saturated soil intervals below the water table. Identification of the likely water table interval, which may vary by season or tide elevation, is discussed in Section 3.2.2.

When using direct-push or roto-sonic technology, soil cores will be collected continuously using a 4- or 5-foot-long lined sampler. Soil samples from the HSA will be collected for classification and laboratory analysis using an 18-inch-long split spoon.

Soil borings for monitoring well installation will be advanced using HSA or roto-sonic drilling to an anticipated depth of approximately 15 feet bgs. The final depth will be decided based on field indicators in soil and is not anticipated to exceed 20 feet bgs except at location FS-33/MW-05D where a deeper water bearing zone from approximately 20 to 30 feet bgs will be targeted for the well screen. Alternatively, soil samples may be collected using direct-push methodology to determine well depth and collect samples for laboratory analysis, and wells installed by HSA at the same location without further collection of split spoon samples.

All soil borings will be observed by a field geologist, logged, classified according to the Unified Soil Classification System, and photographed. Soil logging/monitoring well construction and sampling field forms are included in Attachment C.1. Soil cuttings will be collected in 55-gallon drums for profiling and disposal.

After soil boring and monitoring well installation, each location will be field located by taking field measurements from permanent features at the site, accompanied with use of a global positioning system unit. All locations will be surveyed for horizontal positioning and elevation by a licensed surveyor. Horizontal positioning of all exploration locations will be reported to the nearest 0.1 foot; monitoring well top-of-casing elevations will be reported the nearest 0.01 foot.

3.2.4 Groundwater Sampling

Groundwater sampling will be performed after a minimum of 1 week following the development of the new (and existing) monitoring wells. Samples will be collected once per quarter for one year, within the window of minimum tidal influence to groundwater levels (i.e., at the lowest tidally influenced groundwater elevation). Given the overall measured tide lag, this period is assumed to extend from the predicted low tide time to approximately 6 hours after low tide. Wells farther than 150 feet from the shoreline where tidal influence is minimal (resulting in water level variation of 1 foot or less) may be sampled before or after the low tide interval. The low tide interval may be adjusted based on the results of additional hydrogeologic study (refer to Section 3.2.7.1). All wells will be purged and sampled using low-flow procedures in accordance with the Floyd|Snider low-flow groundwater sample collection standard guideline (Attachment C.1). Attachment C.1 presents a standard groundwater sampling field form. Table C.6 summarizes the container type used during sample collection, preservation method, and holding time for each analyte. All water samples will be analyzed without centrifugation. If turbidity of 10 nephelometric turbidity units cannot be achieved during low-flow sampling, samples may also be run with centrifugation at the laboratory to remove suspended solid matter prior to analysis, in coordination with Ecology. Evaluation of the relative reproducibility of centrifuged vs non-centrifuged, if determined to be necessary, will be performed on unpreserved samples for analysis of key analytes with a tendency to partition to soil such as total petroleum hydrocarbons-diesel (TPH-D) or polychlorinated biphenyls (PCBs).

3.2.5 Sediment Grab Sampling

Surface sediment grab location coordinates will be logged into a Global Positioning System (GPS) aboard a subcontractor sampling vessel prior to collection. Stations targeted to outfall pipe positions may be adjusted in the field to ensure that samples are collected near the end of the outfall pipe. Surface sediment grab samples will be collected from the top 10 centimeters (cm) of sediment using a clamshell-type hydraulic or pneumatic power grab sampler or equivalent. Field staff will record the sample time, station coordinates, which is measured using the vessel or a handheld GPS, and mudline depth. Samples will be retrieved for processing on board the vessel and evaluated for the following acceptance criteria:

- Grab sampler is not overfilled (i.e., sediment surface is not against the top of the sampler).
- Sediment surface is relatively flat, indicating minimal disturbance or winnowing during retrieval.

- Overlying water is present, indicating minimal leakage.
    - o If debris prevents the sampler jaws from closing fully, allowing overlying water to drain slowly, the sample may still be accepted if the surface remains intact without loss of fine-grained materials.
- Overlying water has low turbidity, indicating minimal sample disturbance.
- A target penetration depth of at least 30 cm is achieved.

Weights will be added or removed from the grab sampler as needed to maintain a penetration depth of 20 cm. Up to three attempts will be made within a 15-foot radius at each station to obtain an acceptable grab. If target depth is not reached due to cobbles, debris, refusal, or other surface conditions at the target location, the Floyd|Snider and HDR PMs will be notified for further discussion, potential sample relocation, and use of alternate sampling methodology.

3.2.6 Riverbank Soil and Sediment Sampling (Hand Auger)

Intertidal sediment samples will be collected adjacent to the riverbanks if sediment sampling cannot be completed via grab sampler. Riverbank surface samples may additionally be collected in areas inaccessible to direct-push drilling. Samples will be collected using a decontaminated hand trowel, shovel, or hand auger as necessitated by soil types encountered, target sample depth, and presence of obstructions. A digging bar may be used to assist in clearing obstructions such as rocks in the path of the sampler. The soil sample material will be transferred from the sampling device into a disposable aluminum tray, onto plastic sheeting, or into a decontaminated stainless-steel bowl as sampling progresses such that a uniform volume of material is collected across each depth interval. Hand samples will be collected to a maximum depth of 5 feet bgs, or until refusal is encountered.

All soil borings will be observed by a field geologist, logged, classified according to the Unified Soil Classification System, and photographed. Soil logging/monitoring well construction and field sampling forms are included in Attachment C.1.

If refusal is encountered and cannot be cleared, the field crew will re-attempt sampling at additional locations identified by project site PMs. The sample material from the first successful sample, or the sample with greatest total depth if repeated refusal is encountered, will be accepted.

3.2.7 Hydrogeologic Study

Hydrogeologic study will consist of water level measurement to gather data on horizontal flow direction and gradients, and slug testing to determine site-specific hydraulic conductivity.

3.2.7.1 Water Level Measurements

Water level measurements will be collected during each quarterly groundwater monitoring event during low tide or within the window of minimal tidal influence to groundwater, as indicated in

Section 3.2.4. Additionally, water level measurements will be collected at high tide for one quarterly sampling event. Water level measurements will be collected using an electronic depth to water meter with an accuracy of 0.01 foot. To minimize effects of the adjacent river level, measurements will be collected at all Property wells at the beginning of the sampling event prior to conducting low-flow sampling.

Additionally, data logging pressure transducers (vented or with a collocated on-site barometer if unvented) will be installed in five monitoring wells as shown on RIWP Figure 6.9 to collect short interval groundwater level data and evaluate seasonal groundwater fluctuations and any potential tidal influences in the wells. Data from the transducers will be downloaded approximately once per quarter. Transducer water level data will also be used in the slug test analysis discussed in Section 3.2.7.2 below.

3.2.7.2 Slug Testing

Hydraulic conductivity information for the groundwater table will be collected through completion of slug tests after installation and development of monitoring wells. Slug testing will be performed in general accordance with the field procedures presented in Attachment C.1 with modifications in accordance with the Design, Performance and Analysis of Slug Tests (Butler 2019), as described in the following sections. A minimum of three repetitions of slug tests in each direction (rising head/slug-in and falling head/slug-out) will be performed using slugs of two different sizes to test variable initial displacement conditions. The use of variable initial displacement verifies the validity of the slug test when the outcome is reproducible across a range of test conditions. All slug tests will be performed in the 6 hours immediately after low tide to minimize the effects of tidal influence.

Initial head measurements will be collected during the period prior to the slug test by data logging pressure transducers placed in each well for 2 to 3 months leading up to the slug testing. Data from the time period prior to initiating the slug test will be used to identify any water level trends for use in future analysis of slug test data. These data will be downloaded prior to beginning the slug test, and the transducer will then be set to perform continuous (every 0.1 to 0.5 seconds) water level measurements during the duration of testing. The position of the transducer will be set to ensure it is not disturbed by insertion of slugs during slug testing, and slug diameter will be sized to fill as much of the width of the well casing as possible without disturbance to the transducer cable. A manual water level meter will be used to verify water levels during performance of the slug tests.

Slug tests will be performed using PVC slugs of two sizes (for example, 1 foot = displacement 1 and 2 feet = displacement 2) and filled with weights to ensure rapid displacement of water in the well casing. The water level will be measured using a water level meter to ensure water level is stable after downloading and reprogramming the transducer if the transducer is disturbed during this process. Data collection on the pressure transducer will begin before starting the slug test to ensure that the pre-test static water level is recorded.

The following procedures will be followed for each repetition of the slug test:

- The slug rod will be lowered as rapidly as possible into the well until it is submerged in the water column in order to obtain near-instantaneous displacement of water in the well casing.
- The recovery of the perturbed water level will be monitored until it has returned to within 95% of the initial head, indicated by the transducer prior to the introduction of the slug rod and verified with a manual water level.
- Once the water level has re-equilibrated, the slug will be quickly removed from the water column and the groundwater level monitored for recovery.
- After the water level has recovered to within tolerance (95%) of the water level prior to removal of the slug, the depth to groundwater will be measured again.
- The slug-in/slug-out test will be repeated a minimum of two times (for a total of three repetitions) at each well using the two sizes of PVC slug. For each test, the water level will be allowed to stabilize, and the initial head will be re-measured prior to beginning the test. For example, the first slug in/slug out test will be conducted using displacement 1 (e.g., 1 foot), and the second test will be conducted using displacement 2 (e.g., 2 feet). A third test can be conducted using displacement 1 again (e.g., 1 foot).
- After data are downloaded from the transducer, the transducer will be reset, for an appropriate water level frequency for ongoing water level monitoring, and restarted, and the well will be secured. After completion of all slug tests, barometer data will be collected from the on-site barometer if non-vented transducers are used.

Water levels obtained from the data logging transducer will be corrected for barometric pressure as needed (if non-vented transducers are used) by the manufacturer's baro-correction software. Deviations in the initial head of static conditions over time will be measured by comparing the initial head between tests. Datasets will be corrected to remove the drift in static head over the course of the test.

Displacement data from each test will be normalized using the expected initial displacement and plotted together. Coincident data indicate that the assumptions underlying standard methods are applicable and the radial component of hydraulic conductivity (K) values will be estimated in accordance with Butler (2019), with the assumption that the shallow saturated zone(s) behave as unconfined aquifers. Hydraulic conductivity will be estimated by using the appropriate model recommended by Butler (2019), and solutions will be fit to the data using AQTESOLV hydrogeologic analysis software. In the event of evidence of filter pack drainage, the solution will be fit to the recovery curve after the cessation of filter pack drainage.

Non-coincident slug tests, outliers in the dataset, or a hydraulic conductivity estimate that is vastly different from expectations based on other site data are strong evidence that a low-K skin may be affecting the response data. If this effect is observed, wells will be redeveloped to remove the low-K skin and the slug testing repeated after redevelopment. An alternate well may also be proposed for slug testing under this circumstance.

3.2.8 Decontamination

Decontamination of non-disposable equipment will be completed between each sample station. Decontamination will consist of a site water or tap water rinse to remove visible particles, followed by scrubbing with phosphate-free detergent and rinsing with distilled water.

3.2.9 Investigation Derived Waste

Any groundwater and soil remaining after processing and decontamination, including intervals not sampled, will be collected in U.S. Department of Transportation-approved drums pending characterization and disposed of at an appropriate Resource Conservation and Recovery Act (RCRA)-licensed facility in accordance with any off-site shipment requirements. For sediment grabs, all remaining sediment after processing and phosphate-free detergent-bearing liquid wastes from decontamination of the sampling equipment will be washed overboard. All other waste material generated at upland sample processing stations will be containerized in drums pending disposal. Solvents used for equipment decontamination will be collected and containerized in drums for disposal. Decontamination waters with sheen will additionally be containerized for characterization and disposal. Waste drums will be labeled and stored on Property in a secure location pending profiling for disposal. Disposable personal protective equipment including coveralls, gloves, paper towels, plastic sheeting, and other waste material generated during sampling will be placed in heavyweight garbage bags or other appropriate containers and placed in normal refuse containers for disposal at a solid waste landfill.

Samples of bulk investigation-derived waste (IDW) will be collected at the frequency specified by the selected RCRA-licensed disposal facility, which is presumed to be a minimum frequency of one sample per three 55-gallon drums. Bulk IDW samples will be analyzed for the contaminants of concern regulated under the Comprehensive Environmental Response, Compensation, and Liability Act, and RCRA.

3.3 SAMPLE ANALYSIS

This section summarizes the analytical requirements of groundwater, soil, and sediment samples presented in DQOs detailed in the RI/FS Work Plan.

3.3.1 Groundwater Analyses

DQOs for each well location are presented in Table C.2. Tier 1 groundwater samples for each well will be analyzed for parameters as presented in Table C.3. Specific parameter analytes are presented in Table C.7. Some tier 2 groundwater samples may be analyzed for TPH with extraction acid/silica gel clean-ups, extractable petroleum hydrocarbons, and/or volatile petroleum hydrocarbons, as needed, if tier 1 samples are identified containing TPH (diesel or gasoline range organic hydrocarbons).

3.3.2 Soil Analyses

DQOs for each soil location are presented in C.4. Soil samples will be collected from each direct--push boring and/or HSA boring for immediate analysis or archival at the laboratory (for potential future analysis). Analytical parameters for each location are listed in Table C.5. Specific parameter analytes are presented in Table C.8. Some sample intervals may be adjusted in the field to obtain sufficient sample volume for laboratory analysis. In all cases, field staff will ensure that the soils in the interval sampled have consistent composition and note any indications of contamination (e.g., odors, sheen, staining, elevated PID readings greater than 10 times background).

3.3.3 Sediment Analyses

All sediment samples will be analyzed for COIs and the full suite of Sediment Management Standards (SMS) parameters and Lower Duwamish Waterway (LDW) contaminants of concern including metals, polycyclic aromatic hydrocarbons, pentachlorophenol, PCBs, and dioxins/furans. Additionally, one or more split samples provided by LDWG will be analyzed for TBT if detected in Site soil. Specific analytes for each analytical parameter are listed in Table C.9. The proposed analytical program is the same at all sediment sample stations. Refer to Section 6.2.3 DQO-14 Sediment Quality and Table 6.1 in the work plan for additional details.

3.4 ANALYTICAL METHODS

Laboratory analytical methods were selected to ensure that the samples can be compared to Model Toxics Control Act, SMS (WAC 173-204), Water Quality Standards for Surface Waters of the State of Washington (WAC 173-201A), and federal surface water quality Applicable Or Relevant And Appropriate Requirements for protection of the adjacent groundwater receiving waterbody, the LDW. The laboratory quantitation limits including practical quantitation limits or RLs and MDLs for the selected analytical methods are presented in Tables C.7, C.8, and C.9.

3.5 DATA QUALITY

3.5.1 Data Quality Criteria

Laboratory QA/QC objectives include obtaining data that are technically sound and properly documented, having been evaluated against established criteria for the principal data quality indicators (i.e., precision, accuracy, representativeness, completeness, comparability, and sensitivity), as defined in USEPA guidance (USEPA 2002b), and of sufficient quality and quantity for their intended purpose. Laboratory results will be evaluated against DQOs and project-specific decision criteria by reviewing results for analysis of laboratory QC and interference check samples as specified by the specific analytical methods and laboratory SOPs. Data QA criteria are presented in Tables C.10 and C.11.

3.5.1.1 Precision and Accuracy

Precision measures the reproducibility of measurements under a given set of conditions. Specifically, precision is a quantitative measure of the variability of a group of measurements compared to their average values. Precision is assessed by performing multiple analyses on a sample and is defined as the relative percent difference (RPD) between results. Precision will be evaluated for both laboratory and field duplicate samples and calculated as follows.

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

Where:

RPD = relative percent difference

C_1 = larger of the two observed values

C_2 = smaller of the two observed values

Laboratory duplicate samples will be analyzed at a minimum frequency of 1 per laboratory analysis batch and 1 per 20 field samples. Field duplicate samples will be collected at a minimum frequency of 1 per 20 field samples. Field duplicate precision will be screened against an RPD of 50% for all samples.

Accuracy is an expression of the degree to which a measured or computed value represents the true value. Analytical accuracy may be assessed by analyzing "spiked" samples with known concentrations (surrogates, laboratory control samples, and matrix spikes) and measuring the percent recovery. Accuracy measurements on matrix spike (MS) samples will be carried out at a minimum frequency of 1 per laboratory analysis batch per matrix analyzed and will be calculated as follows.

$$\%R = 100\% \times \frac{(S-U)}{C_{sa}}$$

Where:

%R = percent recovery

S = measured concentration in the spiked aliquot

U = measured concentration in the unspiked aliquot

C_{sa} = actual concentration of spike added

For precision calculations the reporting limit will be used when a non-detect result is included in the evaluation. For accuracy calculations, non-detect results will be assigned a value of zero. Precision and accuracy will be assessed for results at final dilution (i.e., values flagged as estimated greater than a given concentration, which are superseded with subsequent sample dilutions, will not be used).

3.5.1.2 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Care has been taken in the design of the sampling program to ensure that sample locations are properly selected, sufficient numbers of samples are collected to accurately reflect conditions at the locations, and samples are representative of the sampling locations. Sufficient volume of samples will be collected at each sampling location to minimize bias or errors associated with sample particle size and heterogeneity.

3.5.1.3 Completeness

Completeness is defined as the number of acceptable data points relative to the total number of data points and is also a measure of the amount of validated data collected versus the expected amount of data. Completeness will be assessed for all samples within a given medium. The QA/QC objective for completeness for all components of this project is 90%. Data that were qualified as estimated because the QA/QC criteria were not met will be considered valid for the purpose of assessing completeness. Data that have been qualified as estimated will be further reviewed for usability. Data that were qualified as rejected will not be considered valid for their intended use or for the purpose of assessing completeness. If a sample medium has an unacceptable completeness percentage after comparison to the individual DQOs described above, original samples will be reanalyzed if sufficient sample volume is available, archived samples will be analyzed if appropriate, or additional samples will be obtained (if feasible). The equation used to calculate completeness is as follows:

$$\text{Completeness} = \frac{\text{number of valid measurements}}{\text{total number of data points planned}} \times \mathbf{100}$$

3.5.1.4 Comparability

Comparability is a qualitative parameter expressing the confidence with which one dataset can be compared to another. To ensure that results are comparable, samples will be analyzed using USEPA methods, Standard Methods, American Society for Testing and Materials methods, and/or other acceptable method protocols. Calibration and reference standards will be traceable to certified standards, and standard data reporting formats will be employed. Data will also be reviewed to verify that precision and accuracy criteria were achieved and, if not, that data were appropriately qualified.

3.5.1.5 Sensitivity

Analytical sensitivity is the minimum concentration of an analyte above which a data user can be reasonably confident that the analyte was reliably detected and quantified. For this investigation, the MDL or estimated detection limit will be used as the measure of sensitivity for each analyte.

3.6 QUALITY ASSURANCE/QUALITY CONTROL

Guidance for laboratory QA/QC is derived from the protocols developed for EPA's *Test Methods for the Evaluation of Solid Waste: Physical/Chemical Methods* (USEPA 1986), the EPA Contract Laboratory Program (USEPA 2016, 2020a, 2020b), and cited methods.

The FC or field personnel will assess and implement field QC procedures as required in this SAP/QAPP.

3.6.1 Field Quality Control Sampling

Solid samples for non-volatile analysis will be transferred to a decontaminated stainless-steel bowl and homogenized until uniform in color and texture before being placed into laboratory-provided sample containers. Soil samples for volatile organic compounds and NWTPH-Gx analysis will be transferred directly to the appropriate laboratory-provided jars without homogenization to minimize the potential loss of volatile constituents in accordance with Ecology guidance (Ecology 2004). Table C.6 summarizes the container type, preservation method, and holding times for all analyses.

Field QC is evaluated through the analysis of blind field duplicates and rinsate blank samples. Blind field duplicates will be collected at a rate of 1 per 20 samples per media and used to evaluate the efficiency of field decontamination procedures, variability from sample handling, and sample heterogeneity. If fewer than 20 samples are collected during an event, a field duplicate will be collected. Rinsate blank samples will be collected after decontamination of sampling equipment, at a rate of 1 per sample methodology per field event, and are used to evaluate potential field cross contamination.

3.6.2 Field Quality Assurance/Quality Control Procedures

3.6.2.1 Sample Identification

Each sample will have a label affixed to the container and the container will be labeled at the time of collection. The minimum information will be recorded on the label, as follows:

- Sample identification
- Date/time of collection
- Preservative type (if applicable)
- Sampler’s name or initials

Water samples will be identified by the station location ID followed by an eight-digit numerical date in the *YYMMDD* format. Soil samples will be identified by the station location ID followed by the depth interval in feet and the date. For example, a soil sample collected from 2 to 3 feet at location FS-05 on September 1, 2022, would be labeled “FS-05-2-3-220901.” The number 1000 will be added to location numbers for field duplicate samples. For example, a field duplicate collected from well MW-01R on September 1, 2022, would be labeled “MW-1001R-220901”. All rinsate blank samples will be labeled “RB” followed by an eight-digit numerical date.

At each laboratory, a unique sample identifier (termed either project ID or laboratory ID) will be assigned to each sample. The laboratory will ensure that a sample tracking record follows each sample through all stages of laboratory processing. The sample tracking record must contain, at a minimum, the name/initials of individuals responsible for performing the analyses, dates of sample extraction/preparation and analysis, and types of analyses being performed. The analytical laboratories will meet the sample handling requirements and follow the procedures described in section.

3.6.2.2 Field Quality Control Sampling and Identification

Field QC is evaluated through the analysis of field duplicates, rinse blanks, and trip blanks. Field duplicates are used to assess proper homogenization in the field, reproducibility of the sample preparation and analysis, and heterogeneity of the matrix. Rinse blank samples are used to evaluate potential field cross contamination and will be collected after decontamination of sampling equipment. Trip blank samples are used to evaluate potential cross contamination from volatile compounds from ambient conditions or from other samples during sample handling and transport. Field QA/QC criteria and frequency are presented in Table C.11.

The labeling of field QC samples is described as follows:

- Field duplicates will be labeled with a fictitious sample location by adding 100 to the sample location. For example, a field duplicate collected from monitoring well MW-01R on September 1, 2022, would be named “MW-101R-220901.”
- Rinse blanks will be collected by pouring laboratory-provided distilled water over decontaminated, non-dedicated field equipment. Rinse blanks will be labeled using the following format: “RB”-“Number”-“Date.” For example, one rinse blank collected on September 1, 2022, would be named “RB-1-220901.”
- Trip blanks will be provided by the laboratory and one trip blank for each collection day will be shipped with samples containing volatile parameters. Trip blanks will be labeled using the following format: “TB”-“Number”-“Date.” For example, a trip blank collected on September 1, 2022, would be named “FB-1-220901.”

3.6.2.3 Sample Custody Procedures and Requirements

Samples are considered to be in custody if they are: (1) in the custodian's possession or view; (2) in a secured place (under lock) with restricted access; or (3) in a container and secured with a custody seal such that the sample cannot be reached without breaking the seal. Custody procedures, described in this section, will be used for all samples throughout the collection, transportation, and analytical processes and for all data and data documentation, whether in hard copy or electronic format. Custody procedures will be initiated during sample collection. A COC form will accompany all samples to the analytical laboratory. Each person who has custody of the samples will sign the COC form and ensure that the samples are not left unattended unless properly secured. Minimum documentation of sample handling and custody will include the following:

- Sampling location, project name, and unique sample ID
- Sample collection date and time
- Number of sample containers collected for each sample

- Any special notations on sample characteristics or problems
- Name of the person who initially collected the sample
- Date the sample was sent to the laboratory
- Shipping company name and waybill number (if applicable)

The FC or their designee will be responsible for all sample tracking and custody procedures. The FC or designee will also be responsible for final sample inventory and will maintain sample custody documentation. The FC or designee will complete COC forms prior to transporting samples. At the end of each day, and prior to sample transfer, COC entries will be made for all samples. Information on the sample labels will be checked against sample log entries, and sample tracking forms and samples will be recounted. COC forms will be signed at each point of transfer. If samples are third-party shipped, coolers must be sealed with COC forms provided in each cooler; the COC forms will be signed by the FC or designee before placing in the cooler and by the receiving laboratory upon breaking the cooler seal. The analytical laboratories will ensure that COC forms are properly signed upon receipt of the samples and will note any questions or observations concerning sample integrity on the COC forms. The analytical laboratories will contact the FC and project QA/QC coordinator immediately if discrepancies are discovered between the COC forms and the sample shipment upon receipt.

3.6.2.4 Sample Preservation and Shipping Requirements

Samples will be placed in laboratory-provided jars or bottles and preserved in accordance with the requirements presented in Table C.6. The laboratory-provided sample containers will be shipped pre-filled with appropriate amounts of preservative added as required by the analytical method. The FC or a designee will inspect sample containers before use to verify that the manufacturer's certification of cleanliness has been provided. The FC or a designee will also inspect containers for damage and signs of tampering and for presence of preservative if pre-preserved containers are used. Individual containers with evidence of damage or tampering will be discarded.

Prior to shipping or transporting samples, containers will be wrapped in bubble wrap and securely packed inside a cooler with ice packs or wet ice. The original signed COC forms will be placed in a sealed plastic bag and taped to the inside lid of the cooler. If third-party shipping, each cooler will be sealed with a custody seal. The temperature inside each cooler will be checked by the laboratory upon receipt of the samples. The laboratory will specifically note any coolers are not sufficiently cold upon receipt. All samples will be handled to prevent contamination or sample loss. Any remaining sample material will be disposed of upon receipt of written notification by the Floyd|Snider PM. Holding times will vary by analysis and are summarized in Table C.6.

3.6.3 Laboratory Sample Handling

Samples will be stored in accordance with the conditions specified in the methods. Samples transferred to other laboratories will be packed in coolers on ice and delivered via courier service or shipped on ice in coolers at temperatures of less than 6 degrees Celsius, but not frozen. Archive samples will be stored frozen as allowed by the analytical method (refer to Table C.6). Samples will be disposed after hold times expire, following written authorization from the HDR laboratory QA/QC coordinator. The Floyd|Snider PM may elect to hold archived samples past the specified hold time as needed to gather the additional project data.

3.6.4 Laboratory Quality Assurance/Quality Control

Laboratory results will be evaluated by reviewing analytical results of method blanks, laboratory control samples, certified reference materials, matrix spike/matrix spike duplicate samples, field duplicate samples, internal standards, calibrations, and performance evaluation samples, as specified by the analytical methods.

All samples will be diluted and reanalyzed if target compounds are detected at levels that exceed their respective established calibration ranges. Any required cleanups will be conducted prior to the dilutions. Re-analyses will be performed if surrogate, internal standard, or spike recoveries are outside of the QA parameters. QC samples may be reanalyzed if results are not within control limits, and it cannot be determined that the sample matrix is the cause.

3.6.4.1 Sample Delivery Groups

Project- and/or method-specific QC measures will be used per laboratory sample delivery group (SDG) preparatory batch or per analytical batch. An SDG is defined as 20 samples, or a group of samples received at the laboratory within a 2-week sampling period. Although an SDG may span two weeks, all holding times specific to each analytical method will be met for each sample in the SDG.

3.6.4.2 Method Blanks

Method blanks are analyzed to assess possible laboratory contamination at all stages of sample preparation and analysis. A minimum of one method blank will be analyzed for each batch of samples.

3.6.4.3 Laboratory Control Samples

Laboratory Control Samples (LCSs) are prepared from a clean matrix source using the same process as project samples and are spiked with known amounts of the target compounds. The recoveries of the compounds are used as a measure of the accuracy of the test methods. A minimum of one LCS will be analyzed for each batch of samples.

3.6.4.4 Matrix Spikes and Matrix Spike Duplicates

The analysis of MS and matrix spike duplicate (MSD) samples provides information on the extraction efficiency of the method for the sample matrix. By performing MSD analyses, information on the precision of the method is also provided. A minimum of one MS/MSD pair will be analyzed for every 20 samples, when sufficient sample volume is available. A laboratory duplicate sample may be analyzed in place of MSD samples, as allowed by the analytical method.

3.6.4.5 Laboratory Duplicates

Laboratory duplicate samples provide information on the precision of the analysis and are useful in assessing potential sample heterogeneity and matrix effects. Laboratory duplicates are subsamples of the original sample that are prepared and analyzed as separate samples. A minimum of one laboratory duplicate sample will be analyzed for every 20 samples, when sufficient sample volume is available.

3.6.4.6 Surrogates

All samples, including laboratory QC samples (blanks, LCSs, MS/MSDs, and duplicate samples), analyzed for organic analytes will be spiked with appropriate surrogate compounds. Surrogate recoveries will be reported by the analytical laboratories; however, no sample results will be corrected for recovery using these values.

3.6.4.7 Internal Standards

Internal standards may be used for calibrating and quantifying organic compounds and metals. If internal standards are required by the method, all calibration, QC, and project samples will be spiked with the same concentration of the selected internal standard(s). Internal standard recoveries and retention times must be within method and/or laboratory criteria.

3.6.4.8 Labeled Compounds

All project samples analyzed for dioxins/furans and PCB congeners will be spiked with a known amount of surrogate compounds, as defined in the analytical methods. The labeled surrogate compounds will respond similarly to the effects of extraction, concentration, and gas chromatography. Data will be corrected for the recovery of the labeled surrogates used for quantification.

3.7 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

Inspection and maintenance of field and laboratory equipment are important to determine the quality of sampling and analysis results.

3.7.1 Field Equipment Calibration and Frequency

Field equipment for this investigation that requires maintenance and/or calibration may include but is not limited to: pH probes, specific conductivity probes, turbidity meters, reduction-oxidation potential probes, dissolved oxygen probes, and navigation equipment.

Field equipment will be maintained and calibrated in accordance with the procedures described in the operations manuals supplied by the manufacturer at the intervals recommended in the manual. Equipment maintenance information will be documented in the instrument's maintenance log. Maintenance records will be verified prior to each sampling event by the FC.

Calibrations performed will be traceable through equipment labeling and documentation of field calibration results and/or factory or manufacturers' calibrations. The manufacturers' manuals will accompany each instrument for use in calibration and for troubleshooting procedures.

The subcontractor responsible for navigation will confirm proper operation of the navigation equipment daily, and all equipment will be operated and maintained according to manufacturer specifications.

Any discrepancies or calibration failures will be noted in the field logbook and corrected prior to beginning or continuation of sampling operations.

3.7.2 Laboratory Instruments Calibration and Frequency

Laboratory equipment will be maintained and calibrated according to manufacturer recommendations, the laboratory QA plan, laboratory SOPs, and standard methodologies. Initial calibrations will be performed on each analytical instrument prior to analysis. The analysis must stop if calibrations do not meet specified criteria. The analysis may resume after corrective actions have been taken to meet the method specifications. All project samples analyzed by an instrument found to be out of compliance must be reanalyzed.

3.8 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

Inspection and acceptance of field supplies, including laboratory sampling containers, will be the responsibility of the FCs. Any chemical standards and solutions used in this project in the field and laboratory and will be traceable and documented, and provided by reliable and commercial sources. Any discrepancies will be documented by the FCs.

3.9 DATA MANAGEMENT AND REPORTING

Analytical chemistry results will be provided by the laboratory in PDF and EDD formats. Data packages will be returned within the time frame specified in the service agreement between HDR and each laboratory, with the duration not to exceed 15 business days unless delays are otherwise communicated to and approved by the HDR FC. The data packages will be reviewed to ensure that the correct analyses were performed for each sample submitted and that all analyses requested on the COC-custody form were performed. If discrepancies are noted, the QA/QC coordinator will be notified and will promptly follow up with the laboratory to resolve any issues. Following completion of data validation, the digital files will be used to generate the appropriate report tables.

Laboratory data, which are electronically provided and loaded into Floyd|Snider's electronic database, will undergo a check against the laboratory data deliverable. Data will be validated or reviewed manually, and qualifiers, if assigned, will be entered manually. All manually entered data will be verified by a second party. After entry into the database, the EDD data will be compared to the field information previously entered into the database to confirm that all requested analytical data have been received.

4.0 Assessment and Oversight

4.1 ASSESSMENTS AND OVERSIGHT

The project field activities will be assessed during project implementation by utilizing laboratory and field audits, if deemed necessary by the FCs or the QA/QC coordinator.

4.2 FIELD AND LABORATORY OVERSIGHT

Laboratory and field audits consist of on-site reviews of QA systems and equipment for sampling, calibration, and measurement. Laboratory and field audits are not planned to be conducted as part of this investigation. However, field audits or field performance inspections may be conducted by the Floyd|Snider PM or the QA/QC coordinator to determine if the effectiveness of field QA/QC procedures are in compliance with this SAP/QAPP. All laboratory audit reports will be made available to the QA/QC coordinator upon request. The laboratory will also provide written details of any and all method modifications planned prior to project commencement.

4.3 RESPONSE AND CORRECTIVE ACTIONS

The following sections summarize the responsibilities of key project team members and actions to be taken in the event of an error or problem, or if protocols identified in this document are not conformed to. Corrective actions that do not result in deviations to the sampling program will be documented appropriately; corrective actions that may result in a deviation will be communicated immediately to Ecology and SPU via email.

4.3.1 Corrective Action for Field Sampling

The FCs or designated field leads will be responsible for correcting equipment malfunctions during the field sampling effort. The FCs will be responsible for primary field oversight to identify situations in the field that may result in noncompliance with this SAP/QAPP, and the QA/QC coordinator will additionally be responsible for identifying field issues during periodic inspections. The FCs are responsible for performing corrective actions.

4.3.2 Corrective Action for Laboratory Analyses

The laboratory is required to comply with its SOPs. The laboratory PMs will be responsible for ensuring that appropriate corrective actions are initiated as required for compliance with this SAP/QAPP. All laboratory personnel will be responsible for reporting problems that may compromise the quality of the data. If QC results exceed the laboratory control limits, the analyst will identify and correct the anomaly before continuing with the sample analyses, if possible. If the QC outlier cannot be overcome with standard corrective actions (e.g., redoing sample preparation and/or reanalysis), the causes of the exceedance and steps taken to overcome them will be discussed by the laboratory PM in the data package narrative. If the exceedance is gross or widespread, the Project QA Manager will be notified immediately, and the appropriate corrective action will be decided.

4.4 CULTURAL RESOURCE MONITORING

According to the Washington State Department of Archaeology and Historic Preservation predictive model for encountering historic and prehistoric period cultural resources, the Property is located within a high-probability area on the LDW.

Field staff will monitor for potential indications of cultural resources when conducting ground disturbing investigation and immediately contact the on-call Professional Archaeologist for consultation to determine the provenance of any suspected find. Should cultural resources be identified and confirmed with the on-call archaeologist, all project personnel will follow the SPU Archaeological Inadvertent Discovery plan for the Water Quality Facility Project, which is provided in Attachment C.3.

5.0 Data Validation and Usability

5.1 DATA REVIEW

Floyd|Snider will review the laboratory reports for internal consistency, transmittal errors, laboratory protocols, and adherence to the criteria specified in this QAPP. A Stage 2B validation will be performed as described in this section for all data, except for dioxin/furan and PCB congener data. A Stage 4 validation will be performed by EcoChem on all dioxin/furan and PCB congener data.

Stage 2B and Stage 4 data validations include the following:

- Evaluation of package completeness.
- Verification that sample numbers and analyses match those requested on the COC form.
- Review of method-specified preservation and sample holding times.
- Verification that the required detection limits and RLs have been achieved.
- Verification that the field and laboratory duplicates, MS/MSDs, and LCSs were analyzed at the proper frequency.
- Verification of analytical precision and accuracy via replicate analysis and analyte recoveries.
- Verification that the surrogate compound analyses have been performed and meet QC criteria.
- Verification that the laboratory method blanks are free of contaminants.
- Review of instrument performance—initial calibration, continuing calibration, tuning, sensitivity, and degradation.

Stage 4 validation also includes evaluation of all QC elements as identified above, plus recalculation of instrument and sample results from the raw data. For methods such as USEPA Method 1613B that require spectral interpretation, full validation also includes evaluation of the instrument outputs for confirmation of correct identification and quantitation of analytes (e.g., peak integrations, use of appropriate labeled compounds, retention times, ion ratios, and interferences).

5.2 VALIDATION METHODS AND RECONCILIATION WITH USER REQUIREMENTS

Data validation programs have been established in accordance with USEPA guidance (USEPA 2002a). Data validation will be based on the QA/QC criteria as recommended in the methods identified in this SAP/QAPP and in the USEPA's National Functional Guidelines (USEPA 2016, 2020b, and 2020c) and environmental data verification and validation guidance (USEPA 2002b).

Data usability and any deviations that may have affected the quality of the data, as well as the basis of application of qualifiers, will be included in the final reporting of the data. Any required corrective actions based on the evaluation of the analytical data will be determined by the laboratory PMs, Floyd Snider PM, and data validators in consultation.

6.0 References

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7.0 Approvals

By signing below, I acknowledge that I have reviewed the Quality Assurance Project Plan and agree to follow the methods and quality assurance procedures contained therein.

____ **Date________**

____ **Date________**

____ **Date________**

____ **Date________**

____ **Date________**

____ **Date________**

____ **Date________**

Remedial Investigation/Feasibility Study Work Plan

Silver Bay Logging Site

Appendix C

Tables

Table C.1
Key Project Quality Assurance Contacts

Title	Name	Phone	Email	Address
Ecology PM	David Butler	206-518-3513	david.butler@ecy.wa.gov	15700 Dayton Avenue N., Shoreline, WA, 98133
SPU PM	Christina Kapoi	206-775-4138	christina.kapoi@seattle.gov	700 5th Avenue, Suite 4900, Seattle, WA, 98104
HDR PM	Lanelle Ezzard	206-826-4734	Lanelle.Ezzard@hdrinc.com	600 University Street, Suite 500, Seattle, WA, 98101
Floyd|Snider PM	Dan Hennessy	206-292-2078	Dan.Hennessy@floydsnider.com	601 Union Street, Suite 600, Seattle, WA, 98101
Floyd|Snider FC	Cheronne Oreiro	206-292-2078	Cheronne.Oreiro@floydsnider.com	601 Union Street, Suite 600, Seattle, WA, 98101
QA/QC Coordinator	Kristin Anderson	206-292-2078	Kristin.Anderson@floydsnider.com	601 Union Street, Suite 600, Seattle, WA, 98101
EcoChem PM	Chris Ransom	206-233-9332	cransom@ecochem.net	500 Union Street, Seattle, WA, 981010
Eurofins PM	Steve Gonzales	657-210-6285	Steven.Gonzales@et.eurofinsus.com	2841 Dow Avenue, Suite 100, Tustin, CA, 92780
ARL PM	Kelly Bottom	206-695-6200	Kelly.bottem@arilabs.com	4611 S 134th Place, Suite 100, Tukwila, WA, 98168
OnSite PM	David Baumeister	425-883-3881	dbaumeister@onsite-env.com	14648 NE 95th Street, Redmond, WA, 98052
PAL PM	Kara Greer	503-626-7943	kgreer@pacaglab.com	21830 SW Alexander Lane, Sherwood, OR, 97140
SGS PM	Amy Boehm	910-350-1903	Amy.boehm@sgs.com	5500 Business Drive, Wilmington, NC, 28405

Abbreviations:

ARL	Analytical Resources, LLC	PM	Project Manager
FC	Field Coordinator	QA/QC	Quality assurance/quality control
PAL	Pacific Agricultural Laboratory	SPU	Seattle Public Utilities

Table C.2
Water Sample Locations and Data Quality Objectives

Location	Metals in Groundwater (DQO #1)	Petroleum in Groundwater (DQO #2)	CVOCs in Groundwater (DQO #3)	Remedial Action Area Soil (DQO #4)	Boat Building (DQO #7)	Treated Wood Storage Area (DQO #8)	Slug Bait Handling (DQO #9)	Upgradient Groundwater (DQO #10)	Groundwater Discharge to Surface Water (DQO #11)	Contaminant Partitioning (DQO #12)	Hydrogeology (DQO #13)
MW-01R	x	x	x		x				x	x	x
MW-03R	x	x	x					x		x	x
MW-05	x		x						x		x
MW-05D			x						x		x
MW-06			x					x			x
MW-07	x		x		x				x		x
MW-08	x	x	x		x					x	x
MW-09	x	x	x	X	x		x			x	x
MW-10	x		x					x			x
MW-11	x	x	x						x	x	x
MW-12		x	x		x					x	x
MW-13	x	x	x					x			x
MW-14		x	x			x		x		x	x
MW-15			x					x			x
MW-16			x					x			x
MW-17			x					x			x
MW-18			x					x			x
MW-19			x		x					x	x
MW-20	x	x	x		x				x		x
MW-21	x	x	x						x		x

Abbreviations:
CVOC Chlorinated volatile organic compound
DQO Data quality objective

Table C.3
Water Sample Locations and Analytical Parameters

Location	Well Screen Interval (feet bgs)	Metals	TPHD	TPHG	PCBs (1)	PAHs (5)	SVOCs (5)	D/F	TBT	VOC	TOC	Carbaryl/ Acetaldehyde	EPH	VPH
MW-01R	2–12	X	X (2)	X	X	--	X	X	X (3)	X	X	X (4)	X (2)	X (2)
MW-03R	5–20	X	X (2)	X	X	--	X	X	--	X	--	--	X (2)	X (2)
MW-05	7–12	X	X	X	X	--	X	X	X (4)	X	--	X (4)	--	--
MW-05D	20–30	X	X	X	X	--	X	X	X (4)	X	--	X (4)	--	--
MW-06	5–15	X	X	X	X	--	X	X	--	X	--	--	--	--
MW-07	6–20	X	X	X	X	--	X	X	X (3)	X	--	X (4)	--	--
MW-08	5–20	X	X (2)	X	X	X	--	--	--	X (CVOC)	--	--	X (2)	X (2)
MW-09	7–17	X	X (2)	X	X	X	--	--	X (3)	X (CVOC)	--	X	X (2)	X (2)
MW-10	7–18	X	X	X	X	--	X	X	--	X	--	--	--	--
MW-11	5–20	X	X (2)	X	X	--	X	X	X (4)	X	--	X (4)	X (2)	X (2)
MW-12	5–20	X	X (2)	X	X	X	--	--	X (3)	X (CVOC)	--	--	X (2)	X (2)
MW-13	4–14	X	X	X	X	--	X	X	--	X	--	--	--	--
MW-14	3–12	X	X (2)	X	X	--	X	X	--	X	X	--	--	--
MW-15	2–11	X	X	X	X	--	X	X	--	X	--	--	--	--
MW-16	3–12	X	X	X	X	--	X	X	X (3)	X	--	--	--	--
MW-17	5–14	X	X	X	X	--	X	X	--	X	--	--	--	--
MW-18	6–14	X	X	X	X	--	X	X	--	X	--	--	--	--
MW-19	5–14	X	X (2)	X	X	X	--	X	X (3)	X (CVOC)	X	--	--	--
MW-20	4–14	X	X	X	X	X	X	X	X (3)	X (CVOC)	--	X (4)	--	--
MW-21	3–13	X	X	X	X	--	X	X	X (4)	X (CVOC)	--	X (4)	--	--

Notes:

1 Initial PCB Aroclor analysis will be performed. Additional PCB congener analysis will be performed if PCB Aroclor results are non-detect.
2 Analyze TPHD with acid/silica gel clean-ups and EPH/VPH only if TPH is detected.
3 Analyze if detected in soil.
4 Analyze during subsequent monitoring rounds if detected in upgradient groundwater results during initial groundwater monitoring.
5 PAHs are a subset of the list of SVOCs. See Table C.7 for PAH and SVOC analyte lists.

Abbreviations:

bgs Below ground surface
CVOC Chlorinated volatile organic compound
D/F Dioxins/furans
EPH Extractable petroleum hydrocarbons
PAH Polycyclic aromatic hydrocarbon
PCB Polychlorinated biphenyl
PCP Pentachlorophenol
SVOC Semi-volatile organic compound
TBT Tributyltin
TOC Total organic carbon
TPH Total petroleum hydrocarbons
TPHD Total petroleum hydrocarbons-diesel
TPHG Total petroleum hydrocarbons-gasoline
VPH Volatile petroleum hydrocarbons
VOC Volatile organic compound

Table C.4
Soil Sample Locations and Data Quality Objectives

Location	CVOCs in Groundwater (DQO #3)	Remedial Action Area Soil (DQO #4)	Bank FIll Soil (DQO #5)	Fill Soil (DQO #6)	Boat Building (DQO #7)	Treated Wood Storage Area (DQO #8)	Slug Bait Handling (DQO #9)	Contaminant Partitioning (DQO #12)
FS-01			x					
FS-02			x					
FS-03			x					
FS-04/MW-13				x				
FS-05			x	x		x		
FS-06			x					
FS-07			x					
FS-08/MW-14						x		x
FS-09						x		
FS-10			x					
FS-11/MW-21			x	x				
FS-12				x		x		
FS-13C						x		
FS-14				x				
FS-15/MW-15				x			x	
FS-16/MW-16				x	x		x	
FS-17					x		x	
FS-18				x	x			
FS-19/MW-19					x			x
FS-20/MW-20				x				
FS-21				x	x			
FS-22				x				
FS-23				x	x			
FS-24					x			
FS-25					x			
FS-26			x					
FS-27			x					
FS-28		x		x			x	
FS-29C		x					x	
FS-30C					x			
FS-31C					x			
FS-32/MW-01R				x				x
FS-33/MW-05D	x			x				
FS-34/MW-17	x							
FS-35/MW-18	x							
FS-36							x	

Abbreviations:

CVOC Chlorinated volatile organic compound

DQO Data quality objective

Table C.5
Soil Sample Locations and Analytical Parameters

Location	Intervals (1)	Archive (2)	Metals	TPHD	PCBs (3)	PAHs (11)	PCP	SVOCs (11)	D/F	TBT	VOCs	TPHG	pH	TOC	Acetaldehyde/ Carbaryl
FS-01	2–3	--	x	x (4)	x (4)	--	--	x (4)	x (4)	--	x (5)	x (5)	x	--	--
	3–4	--	x	x (4)	x (4)	--	--	x (4)	x (4)	--	x (5)	x (5)	x	--	--
	4–5	--	x	x (4)	x (4)	--	--	x (4)	x (4)	--	x (5)	x (5)	x	--	--
	5–15	x	--	--	--	--	--	--	--	--	--	--	--	--	--
FS-02	2–3	--	x	x (4)	x (4)	--	--	x (4)	x (4)	--	x (5)	x (5)	x	--	--
	3–4	--	x	x (4)	x (4)	--	--	x (4)	x (4)	--	x (5)	x (5)	x	--	--
	4–5	--	x	x (4)	x (4)	--	--	x (4)	x (4)	--	x (5)	x (5)	x	--	--
	5–15	x	--	--	--	--	--	--	--	--	--	--	--	--	--
FS-03	2–3	--	x	x (4)	x (4)	--	--	x (4)	x (4)	--	x (5)	x (5)	x	--	--
	3–4	--	x	x (4)	x (4)	--	--	x (4)	x (4)	--	x (5)	x (5)	x	--	--
	4–5	--	x	x (4)	x (4)	--	--	x (4)	x (4)	--	x (5)	x (5)	x	--	--
	5–15	x	--	--	--	--	--	--	--	--	--	--	--	--	--
FS-04/MW-13	Fill	--	x	x	x		--	--	x	--	x	x	--	--	--
	Native - 15	x	--	--	--	--	--	--	--	--	--	--	--	--	--
FS-05	2 - 3 (6)	--	x	--	--	--	--	--	--	--	--	--	x	--	--
	3 - 4 (6)	--	x	--	--	--	--	--	--	--	--	--	x	--	--
	4 - 5 (6)	--	x	--	--	--	--	--	--	--	--	--	x	--	--
	Fill (6)	--	--	x	x	--	x	x	x	--	x	x	--	--	--
	Native - Capillary fringe	--	x (7)	x	--	x	x	--	x (8)	--	x	x	--	--	--
	Capillary fringe (4–6)	--	x (7)	x	--	x	x	--	x (8)	--	x	x	--	--	--
	Water table - 15	x	--	--	--	--	--	--	--	--	--	--	--	--	--
FS-06	2–3	--	x	x (4)	x (4)	--	--	x (4)	x (4)	--	x (5)	x (5)	x	--	--
	3–4	--	x	x (4)	x (4)	--	--	x (4)	x (4)	--	x (5)	x (5)	x	--	--
	4–5	--	x	x (4)	x (4)	--	--	x (4)	x (4)	--	x (5)	x (5)	x	--	--
	5–15	x	--	--	--	--	--	--	--	--	--	--	--	--	--
FS-07	2–3	--	x	x (4)	x (4)	--	--	x (4)	x (4)	--	x (5)	x (5)	x	--	--
	3–4	--	x	x (4)	x (4)	--	--	x (4)	x (4)	--	x (5)	x (5)	x	--	--
	4–5	--	x	x (4)	x (4)	--	--	x (4)	x (4)	--	x (5)	x (5)	x	--	--
	5–15	x	--	--	--	--	--	--	--	--	--	--	--	--	--
FS-08/MW-14	Fill	x	x (7)	x	--	x	x	--	x (8)	--	x	x		--	--
	Native - Capillary fringe	x	x (7)	x	x	x	x	--	x (8)	x	x	x	--	--	--
	Capillary fringe (4–6)	--	x (7)	x	x	x	x	x	x	x	x	x	--	x	--
	Water table-15	--	x (7)	x	x	x	x	x	x	x	x	x	--	x	--
FS-09	Fill	x	x (7)	x	--	x	x	--	x (8)	--	x	x		--	--
	Native - Capillary fringe	x	x (7)	x	--	x	x	--	x (8)	--	x	x	--	--	--
	Capillary fringe (4–6)	x	x (7)	x	--	x	x	--	x (8)	--	x	x	--	--	--
	Water table - 15	x	--	--	--	--	--	--	--	--	--	--	--	--	--
FS-10	2–3	--	x	x (4)	x (4)	--	--	x (4)	x (4)	--	x	x	x	--	--
	3–4	--	x	x (4)	x (4)	--	--	x (4)	x (4)	--	x (5)	x (5)	x	--	--
	4–5		x	x (4)	x (4)	--	--	x (4)	x (4)	--	x (5)	x (5)	x	--	--
	5–15	x	--	--	--	--	--	--	--	--	--	--	--	--	--
FS-11/MW-21	2–3 (6)	--	x	--	--	--	--	--	--	--	--	--	x	--	--
	3–4 (6)	--	x	--	--	--	--	--	--	--	--	--	x	--	--
	4–5 (6)	--	x	--	--	--	--	--	--	--	--	--	x	--	--
	Fill (6)	--	--	x	x	--	--	x	x	--	x	x	--	--	--
	Native - 15	x	--	--	--	--	--	--	--	--	--	--	--	--	--
FS-12	Fill	--	x	x	x	--	x	x	x	--	x	x	--	--	--
	Native - Capillary fringe	x (8)	x (7)	x	--	x	x	--	--	--	x	x	--	--	--
	Capillary fringe (4–6)	x (8)	x (7)	x	--	x	x	--	--	--	x	x	--	--	--
	Water table- 15	x	--	--	--	--	--	--	--	--	--	--	--	--	--

Table C.5
Soil Sample Locations and Analytical Parameters

Location	Intervals (1)	Archive (2)	Metals	TPHD	PCBs (3)	PAHs (11)	PCP	SVOCs (11)	D/F	TBT	VOCs	TPHG	pH	TOC	Acetaldehyde/ Carbaryl
FS-13C	Fill	x (8)	x (7)	x	--	x	x	--	--	--	x	x	--	--	--
	Native-15	x	--	--		--	--	--	--						
FS-14	Fill	--	x	x	x	--	--	x	x	--	x	x	--	--	--
	Native - 15	x	--	--	--	--	--	--	--	--	--	--	--	--	--
FS-15/MW-15	Fill	--	x	x	x	--	--	x	x	--	x	x	--	--	x
	Native - 15	x	--	--	--	--	--	--	--	--	--	--	--	--	x
FS-16/MW-16	Fill	x (9)	x	x	x	--	--	x	x	x	x	x	--	--	--
	Native - Capillary fringe	x (9)	x	x	x	x	--	--	--	x	x	x	--	--	--
	Capillary fringe (4–6)	x (9)	x	x	x	x	--	--	--	x	x	x	--	--	--
	Water table - 15	x (9)	--	--	--	--	--	--	--	--	--	--	--	--	--
FS-17	Fill	x (9)	x	x	x	x	--	--	--	x	x	x	--	--	--
	Native - Capillary fringe	x (9)	x	x	x	x	--	--	--	x	x	x	--	--	--
	Capillary fringe (4–6)	x (9)	x	x	x	x	--	--	--	x	x	x	--	--	--
	Water table- 15	x (9)	--	--	--	--	--	--	--	--	--	--	--	--	--
FS-18	Fill	--	x	x	x	--	--	x	x	x	x	x	--	--	--
	Native - Capillary fringe	--	x	x	x	x	--	--	--	x	x	x	--	--	--
	Capillary fringe (5–7)	--	x	x	x	x	--	--	--	x	x	x	--	--	--
	Water table - 15	x	--	--	--	--	--	--	--	--	--	--	--	--	--
FS-19/MW-19	Fill		x	x	x	x	--	--	--	x	x	x	--	--	--
	Native- Capillary fringe	--	x	x	x	x	--	--	--	x	x	x	--	--	--
	Capillary fringe (6–8)	--	x	x	x	--	--	x	x	x	x	x	--	x	--
	Water table - 15	--	x	x	x	--	--	x	x	x	x	x	--	x	--
FS-20/MW-20	Fill	--	x	x	x	--	--	x	x	--	x	x	--	--	--
	Native -15	x	--	--	--	--	--	--	--	--	--	--	--	--	--
FS-21	Fill	--	x	x	x	--	--	x	x	x	x	x	--	--	--
	Native - Capillary fringe	--	x	x	x	x	--	--	--	x	x	x	--	--	--
	Capillary fringe (7 - 9)	--	x	x	x	x	--	--	--	x	x	x	--	--	--
	Water table - 15	x	--	--	--	--	--	--	--	--	--	--	--	--	--
FS-22	Fill	--	x	x	x	--	--	x	x	--	x	x	--	--	--
	Native to 15	x	--	--	--	--	--	--	--	--	--	--	--	--	--
FS-23	Fill	--	x	x	x	--	--	x	x	x	x	x	--	--	--
	Native to Capillary fringe	--	x	x	x	x	--	--	--	x	x	x	--	--	--
	Capillary fringe (5–7)	--	x	x	x	x	--	--	--	x	x	x	--	--	--
	Water table - 15	x	--	--	--	--	--	--	--	--	--	--	--	--	--
FS-24	Fill		x	x	x	x	--	--	--	x	x	x	--	--	--
	Native to Capillary fringe	--	x	x	x	x	--	--	--	x	x	x	--	--	--
	Capillary fringe (4–6)	--	x	x	x	x	--	--	--	x	x	x	--	--	--
	Water table - 15	x	--	--	--	--	--	--	--	--	--	--	--	--	--
FS-25	Fill		x	x	x	x	--	--	--	x	x	x	--	--	--
	Native - Capillary fringe	--	x	x	x	x	--	--	--	x	x	x	--	--	--
	Capillary fringe (3–5)	--	x	x	x	x	--	--	--	x	x	x	--	--	--
	Water table - 15	x	--	--	--	--	--	--	--	--	--	--	--	--	--
FS-26	2–3	--	x	x (4)	x (4)	--	--	x (4)	x (4)	--	x (5)	x (5)	x	--	--
	3–4	--	x	x (4)	x (4)	--	--	x (4)	x (4)	--	x (5)	x (5)	x	--	--
	4–5	--	x	x (4)	x (4)	--	--	x (4)	x (4)	--	x (5)	x (5)	x	--	--
	5–15	x	--	--	--	--	--	--	--	--	--	--	--	--	--
FS-27	2–3	--	x	x (4)	x (4)	--	--	x (4)	x (4)	--	x (5)	x (5)	x	--	--
	3–4	--	x	x (4)	x (4)	--	--	x (4)	x (4)	--	x (5)	x (5)	x	--	--
	4–5	--	x	x (4)	x (4)	--	--	x (4)	x (4)	--	x (5)	x (5)	x	--	--
	5–15	x	--	--	--	--	--	--	--	--	--	--	--	--	--

Table C.5
Soil Sample Locations and Analytical Parameters

Location	Intervals (1)	Archive (2)	Metals	TPHD	PCBs (3)	PAHs (11)	PCP	SVOCs (11)	D/F	TBT	VOCs	TPHG	pH	TOC	Acetaldehyde/ Carbaryl
FS-28	2–2.5/Fill	x (9)	x	x	x	--	x (10)	x	x	--	x	x	--	--	--
	2.5–7	x (9)	--	--	--	--	--	--	--	--	--	--	--	--	--
	7–9	x (9)	x	x	x (10)	x (10)	x (10)	--	x (10)	--	x (5)	x (5)	--	--	--
	9–15	x (9)	--	--	--	--	--	--	--	--	--	--	--	--	--
FS-29C	2–2.5	x (9)	x	x	x (10)	x (10)	x (10)	--	x (10)	--	x (5)	x (5)	--	--	--
	2.5–7	x (9)	--	--	--	--	--	--	--	--	--	--	--	--	--
	7–9	x (9)	x	x	x (10)	x (10)	x (10)	--	x (10)	--	x (5)	x (5)	--	--	--
	9–15	x (9)	--	--	--	--	--	--	--	--	--	--	--	--	--
FS-30C	Fill	--	x	x	x	x	--	--	--	x	x	x	--	--	--
	Native - Capillary fringe	--	x	x	x	x	--	--	--	x	x	x	--	--	--
	Capillary fringe (5–7)	--	x	x	x	x	--	--	--	x	x	x	--	--	--
	Water table - 15	x	--	--	--	--	--	--	--	--	--	--	--	--	--
FS-31C	Fill		x	x	x	x	--	--	--	x	x	x	--	--	--
	Native - Capillary fringe	--	x	x	x	x	--	--	--	x	x	x	--	--	--
	Capillary fringe (6–8)	--	x	x	x	x	--	--	--	x	x	x	--	--	--
	Water table - 15	x	--	--	--	--	--	--	--	--	--	--	--	--	--
FS-32/MW-01R	Fill	--	x	x	x	--	--	x	x	--	x	x	--	--	--
	Native - Capillary fringe	x	--	--	--	--	--	--	--	--	--	--	--	--	--
	Capillary fringe (3–5)	--	x	x	x	--	--	x	x	x	x	x	--	x	--
	Water table - 15	--	x	x	x	--	--	x	x	x	x	x		x	--
FS-33/MW-05D	Fill	--	x	x	x	--	--	x	x	--	x	x	--	--	--
	Native - Capillary fringe	x	--	--	--	--	--	--	--	--	--	--	--	--	--
	Capillary fringe (4–6)	x	--	--	--	--	--	--	--	--	x (CVOC)	--	--	--	--
	Water table - 30	x	--	--	--	--	--	--	--	--	x (CVOC)	--	--	--	--
FS-34/MW-17	Fill	--	--	--	--	--	--	--	--	--	x (CVOC)	--	--	--	--
	Native - Capillary fringe	--	--	--	--	--	--	--	--	--	x (CVOC)	--	--	--	--
	Capillary fringe (6–8)	--	--	--	--	--	--	--	--	--	x (CVOC)	--	--	--	--
	Water table - 15	--	--	--	--	--	--	--	--	--	x (CVOC)	--	--	--	--
FS-35/MW-18	Fill	--	--	--	--	--	--	--	--	--	x (CVOC)	--	--	--	--
	Native - Capillary fringe	--	--	--	--	--	--	--	--	--	x (CVOC)	--	--	--	--
	Capillary fringe (7–9)	--	--	--	--	--	--	--	--	--	x (CVOC)	--	--	--	--
	Water table - 15	--	--	--	--	--	--	--	--	--	x (CVOC)	--	--	--	--
FS-36	Fill	--	--	--	--	--	--	--	--	--	--	--	--	--	x
	Native - Capillary fringe	--	--	--	--	--	--	--	--	--	--	--	--	--	x
	Capillary fringe (4–6)	--	--	--	--	--	--	--	--	--	--	--	--	--	x
	Water table - 15	x	--	--	--	--	--	--	--	--	--	--	--	--	--

Notes:

1 Sample collection will begin below recent gravel surfacing and/or asphalt pavement. Assuming all intervals are in 'feet' and will be 2-feet or less in length when possible. Borings will be expanded deeper if needed to vertically delineate field indications of contamination. If a boring location has poor recovery, a second attempt will be advanced. See QAPP section 3.2.3 for further description of sample collection..
2 Assume archive sample intervals will be 2 feet or less when possible. If archive analyses are triggered, samples will be analyzed sequentially from shallower to deeper depths until results are less than PSLs.
3 Initial PCB Aroclor analysis will be performed. Additional PCB congener analysis will be performed if PCB Aroclor results are non-detect.
4 Five samples with highest metals results from the shoreline fill unit will be analyzed for this parameter. If any additional COIs exceed PSLs, the samples bounding the area of metals impacts will also be analyzed for those COIs.
5 Analysis will only be performed if PID field screen is greater than 10 times background. Additionally, the interval immediately below initial interval will be collected and analyzed.
6 Representative samples will be collected from each fill unit to characterize general fill quality, and will additionally be collected from the specified intervals to characterize the extent of the unit of metals-impacted shoreline fill.
7 Metals: As, Cr, Cu, Hg, Pb
8 Archive for dioxin/furan analysis if pentachlorophenol is detected.
9 Slug bait COIs will be analyzed if detected at a concentration exceeding the PSL at location FS-36 or FS-15.
10 Two samples with the highest metals results will be analyzed for this parameter.
11 PAHs are as subset of the list of SVOCs. See Table C.8 for PAH and SVOC analyte lists.
Shading indicates volume required for analysis will be collected and archived.

Abbreviations:

As Arsenic
COI Contaminant of interest
Cr Chromium
Cu Copper
CVOC Chlorinated volatile organic compound
D/F Dioxins/furans
EPH Extractable petroleum hydrocarbons
Hg Mercury
PAH Polycyclic aromatic hydrocarbon
Pb Lead
PCB Polychlorinated biphenyl
PCP Pentachlorophenol
PID Photoionization detector
PSL Preliminary screening level
SVOC Semi-volatile organic compound
TBT Tributyltin
TOC Total organic carbon
TPHD Total petroleum hydrocarbons-diesel
TPHG Total petroleum hydrocarbons-gasoline
VPH Volatile petroleum hydrocarbons
VOC Volatile organic compound

Table C.6
Containers, Preservations, and Holding Times

Analyte	Method	Container Type[1]	Holding Time	Preservation/Holding Time
Soils/Sediments				
Grain size	PSEP	16oz WMG or 1 gallon Ziploc bag	180 days	Cool <6°C
pH	EPA 9045D	8oz WMG	28 days	Cool <6°C
Total solids	SM 2540B	combine with total organic carbon jar	14 days	Cool <6°C
			1 year	Freeze -18°C
Total organic carbon	EPA 9060	4oz WMG	28 days	Cool <6°C
			6 months	Freeze -18°C
Gasoline range organics	NWTPH-Gx	4oz WMG, 1 x 40mL VOC vial (w/out stir bar)	14 days	Cool <6°C
Diesel/Oil range organics	NWTPH-Dx	8oz WMG	14 days to extract, 40 days to analyze	Cool <6°C
Volatile petroleum hydrocarbons	VPH	4oz WMG, 1 x 40ml VOA vial (w/out stir bar)	14 days	Cool <6°C
Extrable petroleum hydrocarbons	WA EPH	8oz WMG	14 days to extract, 40 days to analyze	Cool <6°C
				Freeze -18°C
Metals	EPA 6020B	8 oz WMG	6 months	Cool <6°C
			6 months	Freeze -18°C
Mercury	EPA 7471	combine with metals jar	28 days	Cool <6°C
PCB Aroclors	EPA 8082	combine with semivolatiles jar	14 days to extract, 40 days to analyze	Cool <6°C
			1 year to extract, 40 days to analyze	Freeze -18°C
Total PCB Congeners	EPA 1668	combine with PCB congeners jar	1 year to extract, 40 days to analyze	Cool <6°C
				Freeze -18°C
Dioxin/furans	EPA 1613B	4oz amber WMG	1 year to extract, 40 days to analyze	Cool <6°C
				Freeze -18°C
Volatiles	EPA 8260D	4oz WMG, 2 x 40mL VOC vials (w/stir bar) 1 x 40mL VOC vial (w/out stir bar)	14 days	Cool <6°C
Semivolatiles	EPA 8270E/SIM	16oz WMG	14 days to extract, 40 days to analyze	Cool <6°C
			1 year to extract, 40 days to analyze	Freeze -18°C
Acetaldehyde	EPA 8315A	4oz WMG	7 days to extract, 40 days to analyze	Cool <6°C
Carbaryl	EPA 8321B Mod	8oz WMG	14 days to extract, 40 days to analyze	Cool <6°C
			1 year to extract, 40 days to analyze	Freeze -18°C
Tributyltin	EPA 8270E-SIM	8oz WMG	14 days to extract, 40 days to analyze	Cool <6°C
			1 year to extract, 40 days to analyze	Freeze -18°C
Waters				
Total organic carbon	EPA 9060	250mL HDPE	28 days	H2SO4, Cool <6°C
Gasoline range organics	NWTPH-Gx	2 x 40mL VOC vials	14 days	HCl, Cool <6°C
Diesel/Oil range organics	NWTPH-Dx	2 x 500mL amber glass	7 days to extract, 40 days to analyze	HCl, Cool <6°C
Volatile petroleum hydrocarbons	VPH	2 x 40mL VOC vials	14 days	HCl, Cool <6°C
Extrable petroleum hydrocarbons	WA EPH	2 x 1L amber glass	7 days to extract, 40 days to analyze	Cool <6°C
Metals	EPA 6020B	500mL HDPE	6 months	HNO3, Cool <6°C
Mercury	EPA 7470		28 days	HNO3, Cool <6°C
Total PCB Congeners	EPA 1668	2 x 1L amber glass	1 year to extract, 40 days to analyze	Cool <6°C
Dioxins/furans	EPA 1613B	2 x 1L amber glass	1 year to extract, 40 days to analyze	Cool <6°C
Semivolatiles	EPA 8270E/SIM	2 x 1L amber glass	7 days to extract, 40 days to analyze	Cool <6°C
Acetaldehyde	EPA 8315A	500 mL amber glass	3 days to extract, 40 days to analyze	Cool <6°C
Carbaryl	EPA 8321B Mod	2 x 1L amber glass	7 days to extract, 40 days to analyze	Cool <6°C
Tributyltin	EPA 8270E-SIM	2 x 1L amber glass	7 days to extract, 40 days to analyze	Cool <6°C
Volatiles	EPA 8260D	3 x 40mL VOC vials	14 days	HCl, Cool <6°C

Abbreviations:

°C Degrees Celsius
H2SO4 Sulfuric acid
HCL Hydrochloric acid
HDPE High density polyethylene
HNO3 Nitric acid
L Liter
mL Milliliters
PCB Polychlorinated biphenyl
oz Ounces
VOC Volatile organic compound
WMG Wide mouth glass

Notes

1 The laboratory may adjust or consolidate containers as needed.

Table C.7
Water Analytes, Screening Levels, and Target Reporting Limits

Analyte	Method	Laboratory Detection Limits		PSLs	
		MDL	RL	Most Stringent PSL	Basis for Most Stringent PSL
Conventionals (mg/L)					
Total organic carbon	EPA 9060	0.563	1	--	--
Total Petroleum Hydrocarbons (µg/L)					
Diesel-range organics	NWTPH-Dx	41.3	200	50	Protect Surface Water
Oil-range organics	NWTPH-Dx	75.1	200	500	Protect Drinking Water
Gasoline-range organics	NWTPH-Gx	7.97a	100	800	Protect Drinking Water
Extractable Petroleum Hydrocarbons (µg/L)					
C8-C10 Aliphatics	WA EPH	20	40	--	--
C10-C12 Aliphatics	WA EPH	20	40	--	--
C12-C16 Aliphatics	WA EPH	20	40	--	--
C16-C21 Aliphatics	WA EPH	20	40	--	--
C21-C34 Aliphatics	WA EPH	20	40	--	--
C8-C10 Aromatics	WA EPH	20	40	--	--
C10-C12 Aromatics	WA EPH	20	40	--	--
C12-C16 Aromatics	WA EPH	20	40	--	--
C16-C21 Aromatics	WA EPH	20	40	--	--
C21-C34 Aromatics	WA EPH	20	40	--	--
Volatile Petroleum Hydrocarbons (µg/L)					
C5-C6 Aliphatics	WA VPH	25	50	--	--
C6-C8 Aliphatics	WA VPH	25	50	--	--
C8-C10 Aliphatics	WA VPH	25	50	--	--
C10-C12 Aliphatics	WA VPH	25	50	--	--
C8-C10 Aromatics	WA VPH	25	50	--	--
C10-C12 Aromatics	WA VPH	25	50	--	--
C12-C13 Aromatics	WA VPH	25	50	--	--
Metals (µg/L)					
Arsenic	EPA 6020B	0.363	3.30	8	Natural Background
Cadmium	EPA 6020B	0.183	0.05	1.2	Protect Sediment
Chromium	EPA 6020B	1.030	11.00	100	Protect Drinking Water
Copper	EPA 6020B	0.67	2.0	3.1	Protect Surface Water
Mercury	EPA 7471	0.0126	0.025	0.025	Protect Surface Water
Lead	EPA 6020B	0.3	1.1	5.6	Protect Surface Water
Silver	EPA 6020B	0.3	1.0	1.9	Protect Surface Water
Zinc	EPA 6020B	3.06	28	81	Protect Surface Water
Polychlorinated Biphenyls (PCBs; µg/L)					
Total PCB Aroclors	EPA 8082	17.2	20	0.000007	Protect Surface Water
Total PCB Congeners	EPA 1668	0.000003–0.000051	0.00001	0.000007	Protect Surface Water
Dioxins/Furans (µg/L)					
2,3,7,8-TCDD	EPA 1613B	0.000003	5E-06	0.0000000051	Protect Surface Water
1,2,3,7,8-PeCDD	EPA 1613B	0.000005	2.5E-05	--	--
1,2,3,4,7,8-HxCDD	EPA 1613B	0.000005	2.5E-05	--	--
1,2,3,6,7,8-HxCDD	EPA 1613B	0.000005	2.5E-05	--	--
1,2,3,7,8,9-HxCDD	EPA 1613B	0.000007	2.5E-05	--	--
1,2,3,4,6,7,8-HpCDD	EPA 1613B	0.000008	2.5E-05	--	--
OCDD	EPA 1613B	0.000018	0.00005	--	--
2,3,7,8-TCDF	EPA 1613B	0.000003	5E-06	--	--
1,2,3,7,8-PeCDF	EPA 1613B	0.000005	2.5E-05	--	--
2,3,4,7,8-PeCDF	EPA 1613B	0.000005	2.5E-05	--	--
1,2,3,4,7,8-HxCDF	EPA 1613B	0.000004	2.5E-05	--	--
1,2,3,6,7,8-HxCDF	EPA 1613B	0.000004	2.5E-05	--	--
1,2,3,7,8,9-HxCDF	EPA 1613B	0.000005	2.5E-05	--	--
2,3,4,6,7,8-HxCDF	EPA 1613B	0.000006	2.5E-05	--	--
1,2,3,4,6,7,8-HpCDF	EPA 1613B	0.00001	2.5E-05	--	--
1,2,3,4,7,8,9-HpCDF	EPA 1613B	0.000005	2.5E-05	--	--
OCDF	EPA 1613B	0.000014	0.00005	--	--
Dioxin/furan TEQ	EPA 1613B	--	--	0.000000028	Protect Surface Water
Semivolatile Organic Compounds (µg/L)					
Polycyclic Aromatic Hyrdrocarbons					
Naphthalene	EPA 8270E-SIM	0.0133	0.10	1.4	Protect Surface Water
2-Methylnaphthalene	EPA 8270E-SIM	0.0115	0.10	14	Protect Sediment
1-Methylnaphthalene	EPA 8270E-SIM	0.00748	0.10	1.5	Protect Drinking Water
Acenaphthylene	EPA 8270E-SIM	0.00494	0.10	--	--
Acenaphthene	EPA 8270E-SIM	0.0249	0.10	5.3	Protect Sediment
Fluorene	EPA 8270E-SIM	0.00588	0.10	3.7	Protect Sediment
Phenanthrene	EPA 8270E-SIM	0.0117	0.10	--	--
Anthracene	EPA 8270E-SIM	0.00559	0.10	2.1	Protect Sediment
Fluoranthene	EPA 8270E-SIM	0.00793	0.10	1.8	Protect Sediment
Pyrene	EPA 8270E-SIM	0.0564	0.10	2.0	Protect Sediment
Benzo(a)anthracene	EPA 8270E-SIM	0.00661	0.010	0.00016	Protect Surface Water

Table C.7
Water Analytes, Screening Levels, and Target Reporting Limits

Analyte	Method	Laboratory Detection Limits: MDL	Laboratory Detection Limits: RL	PSLs: Most Stringent PSL	PSLs: Basis for Most Stringent PSL
Semivolatile Organic Compounds (µg/L) (cont.)					
Polycyclic Aromatic Hyrdrocarbons (cont).					
Chrysene	EPA 8270E-SIM	0.00767	0.010	0.016	Protect Surface Water
Benzo(b)fluoranthene	EPA 8270E-SIM	0.00798	0.010	0.00016	Protect Surface Water
Benzo(j,k)fluoranthene	EPA 8270E-SIM	0.00681	0.010	0.0016	Protect Surface Water
Benzo(a)pyrene	EPA 8270E-SIM	0.00625	0.010	0.000016	Protect Surface Water
Indeno(1,2,3-cd)pyrene	EPA 8270E-SIM	0.00811	0.010	0.00016	Protect Surface Water
Dibenz(a,h)anthracene	EPA 8270E-SIM	0.00729	0.010	0.000016	Protect Surface Water
Benzo(g,h,i)perylene	EPA 8270E-SIM	0.00868	0.010	--	--
Total benzofluoranthenes	EPA 8270E-SIM	--	--	--	--
Total cPAHs TEQ	EPA 8270E-SIM	--	--	0.000016	Protect Surface Water
Other Semivolatile Organic Compounds					
2,4-Dimethylphenol	USEPA 8270E	0.105	5	2.9	Protect Sediment
2-Methylphenol	USEPA 8270E	0.1	1	11	Protect Sediment
3&4-Methylphenol	USEPA 8270E	0.064	1	110	Protect Drinking Water
Pentachlorophenol	USEPA 8270E	0.109	5	0.0020	Protect Surface Water
Pentachlorophenol	USEPA 8270E-SIM	0.1	0.1	0.0020	Protect Surface Water
Benzoic acid	USEPA 8270E	--	5	590	Protect Sediment
Benzyl alcohol	USEPA 8270E	0.0627	1	56	Protect Sediment
Phenol	USEPA 8270E	0.0409	1	100	Protect Sediment
N-nitrosodiphenylamine	USEPA 8270E	0.0996	1	0.55	Protect Sediment
Bis(2-Ethylhexyl)phthalate	USEPA 8270E	0.187	1	0.046	Protect Surface Water
Butylbenzyl phthalate	USEPA 8270E	0.149	1	0.013	Protect Surface Water
Diethyl phthalate	USEPA 8270E	0.116	1	93	Protect Sediment
Dimethyl phthalate	USEPA 8270E	1.07	5	59	Protect Sediment
Di-n-butyl phthalate	USEPA 8270E	0.209	5	8.0	Protect Surface Water
Di-n-octyl phthalate	USEPA 8270E	0.152	1	2.3	Protect Sediment
1,2-Dichlorobenzene	USEPA 8270E	0.121	1	4.5	Protect Sediment
1,4-Dichlorobenzene	USEPA 8270E	0.154	1	5.0	Protect Indoor Air
1,2,4-Trichlorobenzene	USEPA 8270E	0.143	1	0.96	Protect Sediment
Hexachlorobenzene	USEPA 8270E	0.184	1	0.0000050	Protect Surface Water
Hexachlorobutadiene	USEPA 8270E	0.135	1	0.010	Protect Surface Water
Organometallics (µg/L)					
Tributyltin	EPA 8270E-SIM	0.043	0.193	0.0000043	Protect Sediment
Insecticides (µg/L)					
Acetaldehyde	EPA 8315A	5.37	10	--	--
Carbaryl	EPA 8321B Mod	--	0.06	--	--
Volatile Organic Compounds (µg/L)					
Benzene	EPA 8260D	0.04	0.2	1.6	Protect Surface Water
1,2,4-Trimethylbenzene	EPA 8260D	0.041	0.2	80	Protect Drinking Water
1,3,5-Trimethylbenzene	EPA 8260D	0.0373	0.2	80	Protect Drinking Water
1,1-Dichloroethane	EPA 8260D	0.04	0.2	7.7	Protect Drinking Water
1,1-Dichloroethene	EPA 8260D	0.05	0.2	7	Protect Drinking Water
cis-1,2-Dichloroethene	EPA 8260D	0.05	0.2	16	Protect Drinking Water
trans-1,2-Dichloroethene	EPA 8260D	0.04	0.2	77	Protect Indoor Air
Ethylbenzene	EPA 8260D	0.03	0.2	21	Protect Surface Water
Tetrachloroethene	EPA 8260D	0.05	0.2	2.9	Protect Surface Water
Toluene	EPA 8260D	0.13	1.0	100	Protect Surface Water
Trichloroethene	EPA 8260D	0.03	0.2	0.7	Protect Surface Water
Vinyl chloride	EPA 8260D	0.04	0.2	0.18	Protect Surface Water
m,p-Xylene	EPA 8260D	0.09	0.4	--	--
o-Xylene	EPA 8260D	0.04	0.2	--	--
Total xylenes	EPA 8260D	--	--	110	Protect Surface Water

Abbreviations:

cPAH Carcinogenic polycyclic aromatic hydrocarbon
HpCDD Heptachlorodibenzo-*p*-dioxin
HpCDF Heptachlorodibenzofuran
HxCDD Hexachlorodibenzo-*p*-dioxin
HxCDF Hexachlorodibenzofuran
LDW Lower Duwamish Waterway
MDL Method detection limit
µg/L Micrograms per liter
mg/L Milligrams per liter
OCDD Octachlorodibenzodioxin
OCDF Octachlorodibenzofuran
PeCDD Pentachlorodibenzo-*p*-dioxin
PeCDF Pentachlorodibenzofuran
PSL Preliminary screening level
RL Reporting limit
SMS Sediment Management Standards
TCDD Tetrachlorodibenzo-*p*-dioxin
TCDF Tetrachlorodibenzofuran
TEQ Toxic equivalent

Table C.8
Soil Analytes, Screening Levels, and Target Reporting Limits

Analyte	Method	Laboratory Detection Limits (1) MDL	RL	PSLs Most stringent PSL	Basis for Most Stringent PSL
Conventionals					
pH	EPA 9045D	--	--	--	--
Total solids	SM 2540B	--	0.01	--	--
Total organic carbon	EPA 9060	0.004	0.04	--	--
Total Petroleum Hydrocarbons (µg/kg)					
Diesel-range organics	NWTPH-Dx	9,150	25,000	260,000	Site-Specific TEE Unrestricted
Oil-range organics	NWTPH-Dx	18,100	50,000	260,000	Site-Specific TEE Unrestricted
Gasoline-range organics	NWTPH-Gx	589	5,000	30,000	Protect Drinking Water Saturated Zone
Extractable Petroleum Hydrocarbons (µg/kg)					
C8-C10 Aliphatics	WA EPH	1,000	2,000	--	--
C10-C12 Aliphatics	WA EPH	1,000	2,000	--	--
C12-C16 Aliphatics	WA EPH	1,000	2,000	--	--
C16-C21 Aliphatics	WA EPH	1,000	2,000	--	--
C21-C34 Aliphatics	WA EPH	1,000	2,000	--	--
C8-C10 Aromatics	WA EPH	1,000	2,000	--	--
C10-C12 Aromatics	WA EPH	1,000	2,000	--	--
C12-C16 Aromatics	WA EPH	1,000	2,000	--	--
C16-C21 Aromatics	WA EPH	1,000	2,000	--	--
C21-C34 Aromatics	WA EPH	1,000	2,000	--	--
Volatile Petroleum Hydrocarbons (µg/kg)					
C5-C6 Aliphatics	WA VPH	--	5,000	--	--
C6-C8 Aliphatics	WA VPH	--	5,000	--	--
C8-C10 Aliphatics	WA VPH	--	5,000	--	--
C10-C12 Aliphatics	WA VPH	--	5,000	--	--
C8-C10 Aromatics	WA VPH	--	5,000	--	--
C10-C12 Aromatics	WA VPH	--	5,000	--	--
C12-C13 Aromatics	WA VPH	--	5,000	--	--
Metals (mg/kg)					
Arsenic	EPA 6020B	--	5.00	7.3	Natural Background
Cadmium	EPA 6020B	--	0.50	0.77	Natural Background
Chromium	EPA 6020B	--	0.50	48	Natural Background
Copper	EPA 6020B	--	0.5	36	Natural Background
Mercury	EPA 7471B	0.00041	0.05	0.07	Natural Background
Lead	EPA 6020B	--	5.00	50	Site-Specific TEE Unrestricted
Silver	EPA 6020B	--	0.05	0.016	Protect Surface Water via Ground Water Saturated Zone
Zinc	EPA 6020B	--	2.5	85	Natural Background
Polychlorinated Biphenyls (PCBs; µg/kg)					
Total PCB Aroclors	EPA 8082	11.7	20.0	0.00055	Protect Surface Water via Ground Water Saturated Zone
Total PCB Congeners	EPA 1668	0.00034–0.108	0.001	0.00055	Protect Surface Water via Ground Water Saturated Zone
Dioxins/Furans (µg/kg)					
2,3,7,8-TCDD	EPA 1613B	0.0002	0.0005	0.0052	Natural Background
1,2,3,7,8-PeCDD	EPA 1613B	0.0005	0.0025	--	--
1,2,3,4,7,8-HxCDD	EPA 1613B	0.0007	0.0025	--	--
1,2,3,6,7,8-HxCDD	EPA 1613B	0.0018	0.0025	--	--
1,2,3,7,8,9-HxCDD	EPA 1613B	0.0006	0.0025	--	--
1,2,3,4,6,7,8-HpCDD	EPA 1613B	0.0005	0.0025	--	--
OCDD	EPA 1613B	0.0027	0.005	--	--
2,3,7,8-TCDF	EPA 1613B	0.0002	0.0005	--	--
1,2,3,7,8-PeCDF	EPA 1613B	0.0006	0.0025	--	--
2,3,4,7,8-PeCDF	EPA 1613B	0.0019	0.0025	--	--
1,2,3,4,7,8-HxCDF	EPA 1613B	0.0006	0.0025	--	--
1,2,3,6,7,8-HxCDF	EPA 1613B	0.0006	0.0025	--	--
1,2,3,7,8,9-HxCDF	EPA 1613B	0.0006	0.0025	--	--
2,3,4,6,7,8-HxCDF	EPA 1613B	0.0007	0.0025	--	--
1,2,3,4,6,7,8-HpCDF	EPA 1613B	0.0006	0.0025	--	--
1,2,3,4,7,8,9-HpCDF	EPA 1613B	0.0005	0.0025	--	--
OCDF	EPA 1613B	0.0012	0.005	--	--
Dioxin/furan TEQ	EPA 1613B	--	--	0.0052	Natural Background

Table C.8
Soil Analytes, Screening Levels, and Target Reporting Limits

Analyte	Method	Laboratory Detection Limits (1) MDL	RL	PSLs Most stringent PSL	Basis for Most Stringent PSL
Semivolatile Organic Compounds (µg/kg)					
Polycyclic Aromatic Hydrocarbons					
Naphthalene	EPA 8270E-SIM	0.64	6.7	2.1	Protect Surface Water via Ground Water Saturated Zone
2-Methylnaphthalene	EPA 8270E-SIM	0.6	6.7	39	Protect Sediment via Ground Water Saturated Zone
1-Methylnaphthalene	EPA 8270E-SIM	0.72	6.7	4.2	Protect Drinking Water Saturated Zone
Acenaphthylene	EPA 8270E-SIM	0.4	6.7	1,300	Protect Sediment via Erosion
Acenaphthene	EPA 8270E-SIM	0.49	6.7	28	Protect Sediment via Ground Water Saturated Zone
Fluorene	EPA 8270E-SIM	0.41	6.7	29	Protect Sediment via Ground Water Saturated Zone
Phenanthrene	EPA 8270E-SIM	0.72	6.7	1,500	Protect Sediment via Erosion
Anthracene	EPA 8270E-SIM	0.2	6.7	51	Protect Sediment via Ground Water Saturated Zone
Fluroanthene	EPA 8270E-SIM	0.91	6.7	90	Protect Sediment via Ground Water Saturated Zone
Pyrene	EPA 8270E-SIM	0.85	6.7	140	Protect Sediment via Ground Water Saturated Zone
Benzo(a)anthracene	EPA 8270E-SIM	0.64	6.7	--	--
Chrysene	EPA 8270E-SIM	0.55	6.7	--	--
Benzo(b)fluoranthene	EPA 8270E-SIM	0.67	6.7	--	--
Benzo(j,k)fluoranthene	EPA 8270E-SIM	0.41	6.7	--	--
Benzo(a)pyrene	EPA 8270E-SIM	0.42	6.7	0.016	Protect Surface Water via Ground Water Saturated Zone
Indeno(1,2,3-cd)pyrene	EPA 8270E-SIM	0.51	6.7	--	--
Dibenz(a,h)anthracene	EPA 8270E-SIM	0.67	6.7	--	--
Benzo(g,h,i)perylene	EPA 8270E-SIM	0.73	6.7	670	Protect Sediment via Erosion
Total benzofluoranthenes	EPA 8270E-SIM	--	--	3,200	Protect Sediment via Erosion
Total LPAHs	EPA 8270E-SIM	--	--	5,200	Protect Sediment via Erosion
Total HPAHs	EPA 8270E-SIM	--	--	12,000	Protect Sediment via Erosion
Total PAHs	EPA 8270E-SIM	--	--	--	--
Total cPAHs TEQ	EPA 8270E-SIM	--	--	0.016	Protect Surface Water via Ground Water Saturated Zone
Semivolatile Organic Compounds					
2,4-Dimethylphenol	USEPA 8270E	9.06	33	2.3	Protect Sediment via Ground Water Saturated Zone
2-Methylphenol	USEPA 8270E	8.4	33	6.4	Protect Sediment via Ground Water Saturated Zone
3&4-Methylphenol	USEPA 8270E	8.8	33	62	Protect Sediment via Ground Water Saturated Zone
Pentachlorophenol	USEPA 8270E	20	170	0.0018	Protect Surface Water via Ground Water Saturated Zone
Pentachlorophenol	EPA 8270E-SIM	7	7	0.0018	Protect Surface Water via Ground Water Saturated Zone
Benzoic acid	USEPA 8270E	--	170	170	Protect Sediment via Ground Water Saturated Zone
Benzyl alcohol	USEPA 8270E	46.8	170	17	Protect Sediment via Ground Water Saturated Zone
Phenol	USEPA 8270E	8.9	33	48	Protect Sediment via Ground Water Saturated Zone
N-nitrosodiphenylamine	USEPA 8270E	4.3	33	1.6	Protect Sediment via Ground Water Saturated Zone
Bis(2-Ethylhexyl)phthalate	USEPA 8270E	6.5	33	5.1	Protect Surface Water via Ground Water Saturated Zone
Butylbenzyl phthalate	USEPA 8270E	5.04	33	0.18	Protect Surface Water via Ground Water Saturated Zone
Diethyl phthalate	USEPA 8270E	2.73	170	34	Protect Sediment via Ground Water Saturated Zone
Dimethyl phthalate	USEPA 8270E	5.21	33	19	Protect Sediment via Ground Water Saturated Zone
Di-n-butyl phthalate	USEPA 8270E	5.26	33	15	Protect Surface Water via Ground Water Saturated Zone
Di-n-octyl phthalate	USEPA 8270E	4.23	33	330	Protect Sediment via Ground Water Saturated Zone
1,2-Dichlorobenzene	USEPA 8270E	8.85	33	3.0	Protect Sediment via Ground Water Saturated Zone
1,4-Dichlorobenzene	USEPA 8270E	7.57	33	8.1	Protect Sediment via Ground Water Saturated Zone
1,2,4-Trichlorobenzene	USEPA 8270E	10.6	33	0.072	Protect Surface Water via Ground Water Saturated Zone
Hexachlorobenzene	USEPA 8270E	5.31	33	0.00040	Protect Surface Water via Ground Water Saturated Zone
Hexachlorobutadiene	USEPA 8270E	8.01	33	0.011	Protect Surface Water via Ground Water Saturated Zone
Organometallics (µg/kg)					
Tributyltin	EPA 8270E-SIM	0.45	3.86	0.11	Protect Sediment via Ground Water Saturated Zone
Insecticides (µg/kg)					
Acetaldehyde	EPA 8315A	0.5	1	--	--
Carbaryl	EPA 8321B Mod	--	6.7	--	--
Volatile Organic Compounds (µg/kg)					
Benzene	EPA 8260D	0.2	1.0	0.56	Protect Surface Water via Ground Water Saturated Zone
1,2,4-Trimethylbenzene	EPA 8260D	0.2	1.0	72	Protect Drinking Water Saturated Zone
1,3,5-Trimethylbenzene	EPA 8260D	0.215	1.0	71	Protect Drinking Water Saturated Zone
1,1-Dichloroethane	EPA 8260D	0.3	1.0	2.6	Protect Drinking Water Saturated Zone
1,1-Dichloroethene	EPA 8260D	0.37	1.0	2.5	Protect Drinking Water Saturated Zone
cis-1,2-Dichloroethene	EPA 8260D	0.19	1.0	5.2	Protect Drinking Water Saturated Zone
trans-1,2-Dichloroethene	EPA 8260D	0.18	1.0	32	Protect Drinking Water Saturated Zone
Ethylbenzene	EPA 8260D	0.16	1.0	10	Protect Surface Water via Ground Water Saturated Zone
Tetrachloroethyene	EPA 8260D	0.42	1.0	1.6	Protect Surface Water via Ground Water Saturated Zone
Toluene	EPA 8260D	0.12	1.0	44	Protect Surface Water via Ground Water Saturated Zone
Trichloroethene	EPA 8260D	0.38	1.0	0.27	Protect Surface Water via Ground Water Saturated Zone
Vinyl chloride	EPA 8260D	0.32	1.0	0.056	Protect Surface Water via Ground Water Saturated Zone
m,p-Xylene	EPA 8260D	0.43	2.0	--	--
o-Xylene	EPA 8260D	0.20	1.0	--	--
Total xylenes	EPA 8260D	--	--	55	Protect Surface Water via Ground Water Saturated Zone

Note:

1 All laboratory limits are subject to change based on final dry weight corrections.

Abbreviations:

cPAH Carcinogenic polycyclic aromatic hydrocarbon
HPAH High molecular weight polycyclic aromatic hydrocarbon
HpCDD Heptachlorodibenzo-*p*-dioxin
HpCDF Heptachlorodibenzofuran
HxCDD Hexachlorodibenzo-*p*-dioxin
HxCDF Hexachlorodibenzofuran
LDW Lower Duwamish Waterway
LPAH Low molecular weight polycyclic aromatic hydrocarbon
MDL Method detection limit
µg/kg Micrograms per kilogram
OCDD Octachlorodibenzodioxin
OCDF Octachlorodibenzofuran
PeCDD Pentachlorodibenzo-*p*-dioxin
PeCDF Pentachlorodibenzofuran
PSL Preliminary screening level
RL Reporting limit
SMS Sediment Management Standards
TCDD Tetrachlorodibenzo-*p*-dioxin
TCDF Tetrachlorodibenzofuran
TEE Terrestrial Ecological Evaluation
TEQ Toxic equivalent

Table C.9
Sediment Analytes, Screening Levels, and Target Reporting Limits

Analyte	Method	Laboratory Detection Limits (1) MDL	RL	SMS Marine Sediment SQS
Conventionals (%)				
Grain size	PSEP	--	0.01	--
Total solids	PSEP	--	0.01	--
Total organic carbon	Plumb 1981	0.020	0.02	--
Metals (mg/kg)				
Arsenic	EPA 6020B	0.038	0.20	7
Cadmium	EPA 6020B	0.03	0.10	5.1
Chromium	EPA 6020B	0.260	0.50	260
Copper	EPA 6020B	0.35	0.5	390
Mercury	EPA 7471B	0.00525	0.03	0.41
Lead	EPA 6020B	0.052	0.1	450
Silver	EPA 6020B	0.022	0.2	6.1
Zinc	EPA 6020B	2.920	6.000	410
Polychlorinated Biphenyls (PCBs; µg/kg)				
Total PCB Aroclors	EPA 8082A		4.0	130
Dioxins/Furans (µg/kg)				
2,3,7,8-TCDD	EPA 1613B	0.0002	0.0005	--
1,2,3,7,8-PeCDD	EPA 1613B	0.0005	0.0025	--
1,2,3,4,7,8-HxCDD	EPA 1613B	0.0007	0.0025	--
1,2,3,6,7,8-HxCDD	EPA 1613B	0.0018	0.0025	--
1,2,3,7,8,9-HxCDD	EPA 1613B	0.0006	0.0025	--
1,2,3,4,6,7,8-HpCDD	EPA 1613B	0.0005	0.0025	--
OCDD	EPA 1613B	0.0027	0.005	--
2,3,7,8-TCDF	EPA 1613B	0.0002	0.0005	--
1,2,3,7,8-PeCDF	EPA 1613B	0.0006	0.0025	--
2,3,4,7,8-PeCDF	EPA 1613B	0.0019	0.0025	--
1,2,3,4,7,8-HxCDF	EPA 1613B	0.0006	0.0025	--
1,2,3,6,7,8-HxCDF	EPA 1613B	0.0006	0.0025	--
1,2,3,7,8,9-HxCDF	EPA 1613B	0.0006	0.0025	--
2,3,4,6,7,8-HxCDF	EPA 1613B	0.0007	0.0025	--
1,2,3,4,6,7,8-HpCDF	EPA 1613B	0.0006	0.0025	--
1,2,3,4,7,8,9-HpCDF	EPA 1613B	0.0005	0.0025	--
OCDF	EPA 1613B	0.0012	0.005	--
Dioxin/furan TEQ	EPA 1613B	--	--	0.002
Semivolatile Organic Compounds- PAHs (µg/kg)				
Naphthalene	USEPA 8270E	4.24	20	2,100
2-Methylnaphthalene	USEPA 8270E	4.51	20	670
1-Methylnaphthalene	USEPA 8270E	5.26	20	39,000
Acenaphthylene	USEPA 8270E	6.24	20	1,300
Acenaphthene	USEPA 8270E	5.22	20	500
Fluorene	USEPA 8270E	14.6	20	540
Phenanthrene	USEPA 8270E	8.72	20	1,500
Anthracene	USEPA 8270E	7.19	20	960
Fluoranthene	USEPA 8270E	6.09	20	1,700
Pyrene	USEPA 8270E	5.68	20	2,600
Benzo(a)anthracene	USEPA 8270E	5.96	20	1,300
Chrysene	USEPA 8270E	6.06	20	1,400
Benzo(a)pyrene	USEPA 8270E	4.23	20	1,600
Indeno(1,2,3-cd)pyrene	USEPA 8270E	14.6	20	600
Dibenzo(a,h)anthracene	USEPA 8270E	17.2	20	230
Benzo(g,h,i)perylene	USEPA 8270E	13.6	20	670
Dibenzofuran	USEPA 8270E	14.1	20	540
Total benzofluoranthenes	USEPA 8270E	10	40	3,200
Total LPAH	USEPA 8270E	--	--	5,200
Total HPAH	USEPA 8270E	--	--	12,000
Pentachlorophenol	USEPA 8270E	31.2	100	360
Other Semivolatile Organic Compound- Other SMS/LDW (µg/kg)				
2,4-Dimethylphenol	USEPA 8270E SIM	2.17	20	29
2-Methylphenol	USEPA 8270E	6.66	20	69
4-Methylphenol	USEPA 8270E	7.39	20	670
Benzoic acid	USEPA 8270E	39	200	650
Benzyl alcohol	USEPA 8270E	16.3	20	57
Phenol	USEPA 8270E	4.39	20	420
N-nitrosodiphenylamine	USEPA 8270E	5.32	20	28
Bis(2-Ethylhexyl)phthalate	USEPA 8270E	5.46	50	1,300
Butylbenzyl phthalate	USEPA 8270E	9.41	20	63
Diethyl phthalate	USEPA 8270E	19.7	50	200
Dimethyl phthalate	USEPA 8270E	4.39	20	71
Di-n-butyl phthalate	USEPA 8270E	5.61	20	1,400
Di-n-octyl phthalate	USEPA 8270E	4.39	20	6,200
1,2,4-Trichlorobenzene	USEPA 8270E SIM	2.68	5	31
1,2-Dichlorobenzene	USEPA 8270E SIM	0.74	5	35
1,4-Dichlorobenzene	USEPA 8270E SIM	0.6	5	110
Hexachlorobenzene	USEPA 8270E SIM	0.7	5	22
Hexachlorobutadiene	USEPA 8270E SIM	0.72	5	11
Organometallics (µg/kg)				
Tributyltin	EPA 8270E-SIM	0.45	3.86	2.1

Note:

1 All laboratory limits are subject to change based on final dry weight corrections.

Abbreviations:

cPAH Carcinogenic polycyclic aromatic hydrocarbon
HPAH High molecular weight polycyclic aromatic hydrocarbon
HpCDD Heptachlorodibenzo-*p*-dioxin
HpCDF Heptachlorodibenzofuran
HxCDD Hexachlorodibenzo-*p*-dioxin
HxCDF Hexachlorodibenzofuran
LDW Lower Duwamish Waterway
LPAH Low molecular weight polycyclic aromatic hydrocarbon
MDL Method detection limit
µg/kg Micrograms per kilogram
mg/kg Milligrams per kilogram
OCDD Octachlorodibenzodioxin
OCDF Octachlorodibenzofuran
PeCDD Pentachlorodibenzo-*p*-dioxin
PeCDF Pentachlorodibenzofuran
RL Reporting limit
SMS Sediment Management Standards
SQS Sediment Quality Standards
TCDD Tetrachlorodibenzo-*p*-dioxin
TCDF Tetrachlorodibenzofuran
TEQ Toxic equivalent

Table C.10
Data Quality Criteria

Parameter	QA/QC Criteria		
	Precision	Accuracy	Completeness
Soils/Sediments			
Geotechnical analyses	--	--	90%
pH	±25%	--	90%
Total solids	±25%	70–130%	90%
Total organic carbon	±25%	70–130%	90%
Volatiles/Gasoline range organics	±35%	50–150%	90%
Diesel/oil range organics	±35%	50–150%	90%
Extractable petroleum hydrocarbons	±35%	50–150%	90%
Volatile petroleum hydrocarbons	±35%	50–150%	90%
Metals/Mercury	±25%	70–130%	90%
PCB Aroclors	±35%	50–150%	90%
PCB congeners	±35%	50–150%	90%
Dioxins/Furans	±35%	50–150%	90%
Semivolatiles	±35%	50–150%	90%
Waters			
Total organic carbon	±20%	75–125%	90%
Volatiles/Gasoline range organics	±30%	60–140%	90%
Diesel/oil range organics	±30%	60–140%	90%
Extractable petroleum hydrocarbons	±30%	60–140%	90%
Volatile petroleum hydrocarbons	±30%	60–140%	90%
Metals/Mercury	±20%	75–125%	90%
PCB Aroclors	±30%	60–140%	90%
PCB congeners	±30%	60–140%	90%
Dioxins/Furans	±30%	60–140%	90%
Semivolatiles	±30%	60–140%	90%

Abbreviations:
PCB Polychlorinated biphenyl
QA/QC Quality assurance/quality control

Table C.11
QA/QC Sample Frequency

Parameter	QA/QC Sample Frequency								
	Method Blank	LCS or SRM	MS	MSD (1)	Duplicate	Surrogate Spike	Field duplicate	Rinse blank	Trip blank
Geotechnical analyses	--	--	--	--	--	--	--	--	--
pH	--	--	--	--	1 per batch	--	--	--	--
Total solids	--	--	--	--	1 per batch	--	1 per 20 samples	--	--
Total organic carbon	1 per batch	1 per batch	1 per batch	--	1 per batch	--	1 per 20 samples	--	--
Volatiles/Gasoline range organics	1 per batch	1 per batch	1 per batch	1 per batch	--	every sample	1 per 20 samples	1 per event	1 per collection
Diesel/Oil range organics	1 per batch	1 per batch	1 per batch	1 per batch	--	every sample	1 per 20 samples	1 per event	--
Extractable petroleum hydrocarbons	1 per batch	1 per batch	1 per batch	1 per batch	--	every sample	1 per 20 samples	1 per event	
Volatile petroleum hydrocarbons	1 per batch	1 per batch	1 per batch	1 per batch	--	every sample	1 per 20 samples	1 per event	
Metals/Mercury	1 per batch	1 per batch	1 per batch	1 per batch	1 per batch	--	1 per 20 samples	1 per event	--
PCB Aroclors	1 per batch	1 per batch	1 per batch	1 per batch	--	every sample	1 per 20 samples	1 per event	--
PCB congeners	1 per batch	1 per batch	--	--	1 per batch	every sample	1 per 20 samples	1 per event	--
Dioxins/Furans	1 per batch	1 per batch	--	--	1 per batch	every sample	1 per 20 samples	1 per event	--
Semivolatiles	1 per batch	1 per batch	1 per batch	1 per batch	--	every sample	1 per 20 samples	1 per event	--

Note:

1 A duplicate may be analyzed in place of an MSD.

Abbreviations:

LCS Laboratory Control Sample
MS Matrix spike
MSD Matrix spike duplicate
PCB Polychlorinated biphenyl
QA/QC Quality assurance/quality control
SRM Standard Reference Material

Remedial Investigation/Feasibility Study Work Plan

Silver Bay Logging Site

Appendix C

Attachment C.1
Floyd|Snider Field Standard Guidelines

FLOYD | SNIDER
strategy • science • engineering

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F|S STANDARD GUIDELINE:
Special Condition

Utility Clearance

DATE/LAST UPDATE: October 17, 2018

This Special Condition applies to ground-disturbing work including drilling, excavation, and trenching. Standard Guideline(s) to which this Special Condition is appended include:

1. Soil Logging
2. Well Construction
3. Soil Sample Collection

These procedures should be considered standard guidelines and are intended to provide useful guidance when in the field, but are not intended to be step-by-step procedures, as some steps may not be applicable to all projects.

All field staff should be sufficiently trained in the standard guidelines and special procedures for the sampling method they intend to use and should review and understand these procedures prior to going into the field. It is the responsibility of the field staff to review the standard guidelines and special conditions with the field manager or project manager and identify any deviations from these guidelines prior to field work. When possible, the project-specific Sampling and Analysis Plan should contain any expected deviations and should be referenced in conjunction with these standard guidelines and special conditions.

1.0 Special Condition Applicability

This Special Condition Standard Guideline should be used by the field staff prior to performing subsurface activities, such as collecting subsurface soil samples, monitoring well installation, excavation, or trenching activities. A public locate should always be conducted and scheduled at least 3 to 5 days prior to conducting the private locate and in compliance with the guidelines herein.

2.0 Equipment and Supplies

Logging Equipment and Tools:

- 100-foot tape measure or measuring wheel
- Handheld Global Positioning System (GPS)
- Spray paint:
  - White for proposed work area (boring locations or limits of work)
  - Optional colors for utilities:
    - Red for electrical
    - Green for sewers and drain lines
    - Blue for water
    - Orange for fiber optics, communications, or cable
    - Yellow for natural gas or fuel lines
- Flagging or wax lumber pencils if raining (preferably **white**; if white is not available choose **a color other than designated utility colors** above such as pink)
- Hammer and roofing nails to nail flagging if raining
- Pry bar or manhole lift for lifting heavy sewer or manhole lids
- Camera

Paperwork:

- Work Plan and/or Sampling and Analysis Plan (SAP) and/or Quality Assurance Project Plan (QAPP)
- Health and Safety Plan (HASP)
- Copies of figures showing proposed boring locations or work area and all known utilities
- Public locate ticket
- As-built drawings, if available

Personal Equipment:

- Steel-toed boots
- Safety vest
- Safety glasses
- Rain gear
- Work gloves

3.0 Special Condition Guidelines and Procedures

3.1 PUBLIC UTILITY LOCATE

A public utility locate notification must be completed in accordance with state law approximately 3 to 5 days prior to conducting the private locate and subsurface disturbance activities. Prior to contacting the public locate service, the outer limits of the work area or the proposed soil boring locations should be marked out in white spray paint. The public locate can then be submitted online (http://www.callbeforeyoudig.org/washington) or by calling 811. The ticket number should be submitted to the drilling and excavation subcontractors and logged on the attached utility clearance field checklist.

3.2 METHODOLOGIES FOR LOCATING UTILITIES

Surface and subsurface conditions can affect the accuracy of a specific locating technology, and no single method is universally fail proof. Review each project and its site-specific conditions to choose the proper technique(s). Below are the four most common techniques used for locating utilities; however, locating activities should not be limited to those described here.

1. **Pipe Tracing Transmitter and Receiver**

   This technique can be used to detect metal utilities, tracing wires, or warning tapes. The metal pipes or tracer wire must be exposed in order to transmit the signal to be traced. The limitations of this methodology are (1) that it is not useful for nonconductible utilities, and (2) that the metallic pipes or tracer wire must be exposed.

2. **Electromagnetic**

   This technique locates buried materials that have a high conductance, such as buried pipes, tanks, and drums, by inducing alternating electromagnetic waves at the surface into the ground. Any buried conducting body can be detected at the surface with a receiver. The limitations of this technique are that results are affected by nearby or adjacent power lines, metal fences, cars, and metal debris and it cannot detect utilities constructed of nonconductive material such as PVC or concrete sewer lines.

3. **Ground Penetrating Radar (GPR)**

   This technique is an extremely useful for locating shallow nonconductible features, such as concrete conduits, polyvinyl chloride (PVC) piping, underground storage tanks (USTs), former excavations, trenches, buried drums, other metallic objects, or hydrogeologic features. GPR can also be useful in locating voids beneath concrete or asphalt. The limitation of this technique is that penetration depth can be limited in soils with high electrical conductivity such as clayey or wet soil.

4. **Metal Taping or Radio Frequency Transmitter**

   This technique can be used to locate drain or sewer lines that extend from a building out to the main sewer line. Generally, sewer and drain lines are constructed of PVC and cannot be detected using electromagnetic or pipe tracing, as a result they are sometimes missed during these surveys. Metallic fish tape or a radio frequency transmitter is inserted into the pipe from the building or a cleanout and then a radio frequency is sent along a wire. The signal is detected aboveground with a receiver that can determine the location of the centerline and approximate depth.

3.3 PRIVATE LOCATE

A private locate is also necessary since public locates generally are useful only up to the property line or to their own meters; rarely do public locates mark the utilities on the property if there is not a meter present on the property. Therefore, if the interior of the site is likely to have complex buried utilities or the alignments of utilities running through the site interior are unknown (i.e., accurate utility plans are not available), it is appropriate to conduct a private locate.

Upon arriving at the site, confirm that all entities, notified per the public locate ticket, have marked their respective utilities. Even if a utility does not exist on the property, the site should still be marked (e.g., “No Gas” or “No Fiber”) by all utilities listed on the public locate ticket. Take care to note the path of utilities marked at the street and directed toward the property. For example, a water line at the street may connect to a faucet or bathroom on property. The private locating subcontractor should use the public locating marks to help locate utilities on the property.

Mark all proposed boring locations or the limits of work in white spray paint so that the private utility locator can be thorough in these areas. Some projects may require additional soil borings beyond the initial scope of work. In this case, either mark a larger limit of work area prior to utility locate or have a private utility locate conducted throughout the property, including inside existing structures if needed.

Identify other subsurface features on the property such as, sewer/storm/roof drains and aboveground electrical lines that have not been identified by the public locate. During the private locate conduct all activities in the following list that apply to the subject property.

- Open all sewer lids and storm drains, and mark the direction of the visible pipes.
- Open any utility vaults (e.g., fiber optics, fire alarm, or electrical vaults) and mark the direction of lines, then extrapolate these lines to the building.
- Locate all roof drains and take care to note how these drains may connect to subsurface drainage lines.
- If multiple drains are visible, take care to notice possible subsurface connections (e.g., straight lines between drains).
- Look for subsidence features, such as former filled in trenches (which may contain subsurface lines), and including patched concrete/asphalt.
- Note the location of other relevant features, such as building water faucets, bathrooms, and water valve shut-offs at the street (attempt to extrapolate potential lines from these features).

- Identify aboveground utilities on the property (i.e., electrical lines along walls of buildings, lines on telephone poles). Confirm with subcontractor (driller or excavator) that overhead utilities will not obstruct subsurface work activities.
- Communicate with property owners or site managers to gain information on the location of subsurface utilities or other features. If possible, focus on utilities that may not have been located by standard techniques, such as plastic or PVC lines.
- Take care to locate irrigation lines and sprinklers in planters.
- Locate emergency stops for fuel lines if working on an active service station.

Plot all utilities, overhead and subsurface, on the site map so that investigations are not carried out in these areas.

3.4 ESTABLISHING A BUFFER

Establish a buffer around identified overhead and subsurface features where work should not be conducted. Maintain at least a 3-foot buffer on either side of a marked utility or in-line inference of a pipe or storm drain connections. Mark the buffer zone on the site map so that subsurface work is not completed in these locations. The buffer zone for overhead utilities may be greater than 3 feet, depending on the overhead line. For example, noninsulated electrical lines can arc over a certain distance. Confirm overhead buffer zones with the drillers or excavators.

Utilities such as electrical, fiber optics, or natural gas should have a 5-foot buffer, if possible. If subsurface activities need to be conducted within 5 feet of a fiber optics/communications line, notify the utility company. Generally, fiber optics/communication companies want to have their personnel on site to observe any subsurface activities within 5 feet as a safety precaution.

In the event of uncertainty on pipe location, determine if an air knife/vacuum truck is needed to safely clear the boring to a depth of 5 feet below ground surface or other appropriate depth to safely clear the utility line.

3.5 MARKING MAINTENANCE

Public locate marks expire after 45 days if the markings are not maintained. Best practices for maintaining locate marks include:

- Using stakes or nail flagging with roofing nails along the markings if markings are continuously destroyed by weather or traffic;
- Using wax lumber pencils if raining;
- Using white spray paint to maintain the original markings;
- Bookending the original marks with solid white painted squares;
- Painting dots between the original markings; and
- Requesting relocates, if needed.

3.6 EMERGENCY CONTACT NUMBERS

If any damage is caused to a utility, immediately notify the property owner and the respective utility company. Keep emergency contact numbers on hand in case of damage.

4.0 Field Documentation

The attached utility clearance checklist should be reviewed and completed at the beginning of each project, prior to conducting subsurface activities, or before establishing sample locations. If appropriate, the checklist should be reviewed and completed for each proposed sampling location or subsurface disturbance area.

Enclosure: Utility Clearance Field Checklist

Project: ______________________________

Completed by: ______________________________

Date Completed: ______________________________

Public Ticket No: ______________________________

This checklist is intended for use prior to field activities associated with subsurface site investigations. The field manager should complete this checklist in its entirety before beginning work or establishing sample locations. There may be site-specific features that are not included on this form so be sure to complete a thorough review of all available information and complete a pre-field inspection prior to the work.

SUBSURFACE UTILITIES

- ☐ **PUBLIC UTILITY LOCATE** completed for the property.
  Mark limits of work in white paint. Call the appropriate Call Before You Dig hotline (dial 811 in Washington) or complete online utility locate request; provide public locate service with location info including cross streets and/or other geographic features to locate work area. If not present for the utility locate, make sure to verify all marked utilities. Plot marked utilities on the site map and record location (by GPS survey or licensed surveyor if feasible, or by measurement from existing features). Take care to note the path of utilities marked at the street and directed toward the private property (i.e., water line at street may connect to faucet or bathroom on property).

- ☐ **PRIVATE UTILITY LOCATE** completed inside and outside existing structures on the property.
  If not present for the utility locate, make sure to verify all marked utilities. Plot marked utilities on the site map and record location (by GPS survey or licensed surveyor if feasible, or by measurement from existing features).
  - ☐ Is the method of utility locate appropriate for the site conditions (i.e., metal taping may be necessary for undetected PVC drain lines where the outlet is visible in a storm drain)?

- ☐ **FACILITY PLAN REVIEW** completed.
  If not readily available, request utility or as-built plans from the client that may include subsurface utilities or other features (i.e., tanks or vaults).

UTILITY COMPANIES

- ☐ Natural Gas Marked (YELLOW)
  Natural gas emergency contact number(s): ______________________________

- ☐ Electrical Marked (RED)
  Electrical emergency contact number(s): ______________________________

- ☐ Water Marked (BLUE)
  Water emergency contact number(s): ______________________________

- ☐ Sewer/Drain Lines Marked (GREEN)
  Sewer emergency contact number(s): ______________________________

- ☐ Communications/Fiber Optics/Cable Marked (ORANGE)
  Communications emergency contact number(s): ______________________________

PRIVATE SUBSURFACE FEATURES

IDENTIFY OTHER SUBSURFACE FEATURES on the property, such as storm/sewer drains or aboveground electrical lines that have not already been discovered by the public or private locate.

- ☐ Open sewer lids and storm drains and mark the direction of visible pipes.
- ☐ Open any utility vaults (e.g., fiber optics, fire alarm, or electrical vaults), mark the direction of lines, and extrapolate these lines to the building.
- ☐ Locate all roof drains and take care to note how these drains may connect to subsurface drainage lines.
- ☐ If multiple drains are visible, take care to notice possible subsurface connections (straight lines between drains).
- ☐ Look for subsidence features (former filled in trenches) that may contain subsurface lines; including patched concrete/asphalt.
- ☐ Note location of other relevant features, such as building water faucets, bathrooms, and water shut-offs at the street (attempt to extrapolate potential lines from these features).
- ☐ Identify aboveground utilities on the property (electrical lines along walls of buildings, lines on telephone poles). Confirm with drillers that overhead utilities will not obstruct drill rig activities.
- ☐ Locate yard or parking lot lights and confirm electrical connections.
- ☐ Communicate with property owners or site managers to gain information on the location of subsurface utilities or other features, such as nonconductible plastic or PVC lines.
- ☐ Locate emergency stops for fuel lines if working on an active service station.
- ☐ Locate any irrigation or sprinklers that may be present in planters.

ESTABLISH A BUFFER around identified subsurface features (or aboveground lines) where investigations should not be conducted. Maintain at least a 3-foot buffer on either side of a marked utility or in-line inference of a pipe. Utilities such as electrical, fiber optics, or natural gas should have a 5-foot buffer. Mark the buffer zone on the site map clearly so that investigations are not carried out in these locations.

- ☐ Is an air knife/vacuum truck needed to safely clear the boring to a depth of 5 feet below ground surface?

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F|S STANDARD GUIDELINE

Seep and Spring Identification and Sample Collection

DATE/LAST UPDATE: May 2021

These procedures should be considered standard guidelines and are intended to provide useful guidance when in the field, but are not intended to be step-by-step procedures, as some steps may not be applicable to all projects.

All field staff should be sufficiently trained in the standard guidelines for the sampling method they intend to use and should review and understand these procedures prior to going into the field. It is the responsibility of the field staff to review the standard guidelines with the field manager or project manager and identify any deviations from these guidelines prior to field work. When possible, the project-specific Sampling and Analysis Plan should contain any expected deviations and should be referenced in conjunction with these standard guidelines.

1.0 Scope and Purpose

This standard guideline provides information for identifying seeps and springs and procedures for sampling seeps and/or springs. This standard guideline is limited to seeps or springs which are defined as moist or wet areas (saturated soil) or pools (visible water) where groundwater is present at the ground surface. This guideline is not applicable to fresh water/marine water transition zone sampling. The following sections contain protocols that are specific to seep and/or spring sampling. This guideline may be modified on a site-by-site basis as required to accommodate varying site conditions, equipment limitations or limitations imposed by the procedure. Field personnel should always document actual procedures employed.

2.0 Equipment and Supplies

The following is a list of typical equipment and supplies that may be necessary to complete seep or spring sample collection. It is important to note that this list is for a typical project; site-specific conditions may warrant different equipment for completion of the work.

Seep/Spring Sampling Equipment and Tools:

- Peristaltic pump with fully-charged internal battery or standalone battery and appropriate connectors
- Multi-parameter water quality meter or turbidity meter
- Hand trowel, scoop, or shovel
- Polyethylene tubing (0.25-inch outer diameter)
- Silicone tubing (for use with the peristaltic pump)
- Filters (if field filtering)
- Tube cutters, razor blade, or scissors
- 500 milliliter (mL) or 1 liter (L) beaker to measure flow rate
- Paper towels
- Alconox (or similar decontamination solution), deionized water, spray bottles
- Tape measure to measure dimensions
- Plastic sheeting
- Disposable syringes (one per sample)
- Stainless-steel, 6-inch soil vapor screen
- Flume and water flow meter
- Stopwatch
- Calculator
- GPS
- Paper towels
- Trash bags

Lab Equipment:

- Sample jars/various types of pre-cleaned bottles (as appropriate)
- Coolers
- Chain-of-Custody Forms
- Labels
- Ice
- Ziploc bags

Paperwork:

- Field notebook with site maps
- Sampling forms
- Seep and Spring Surveys
- Rite-in-the-Rain pens, paper, and permanent markers
- Site-Specific Health and Safety Plan (HASP)
- Sampling and Analysis Plan (SAP) and/or Quality Assurance Project Plan (QAPP) (including tables of analytes and bottle types)

Personal Protective Equipment (PPE):

- Boots/waders
- Safety vest
- PFD
- Snake gaiters (if appropriate by location)
- Safety glasses
- Hard hat (if appropriate)
- Rain gear
- Nitrile gloves
- Work gloves

3.0 Standard Procedures

The procedures for sampling are designed to ensure that collected samples are representative of the groundwater emerging at the surface at the seep or spring location. Identifying the nature and type of seep or spring encountered will facilitate the sampling procedures required. Seeps or springs may be associated with a pool of standing water or may be present as an area of moist soil without a pool of water. Knowing how to identify and sample seeps/springs can provide information regarding seasonal fluctuations in the groundwater potentiometric surface. Generally, seeps do not yield sufficient volume to be flowing beyond their above ground locations; while springs yield greater flow rates and can flow beyond their above ground location. For the purpose of this standard guideline, seeps and spring can be used interchangeably. Deviations from these standard procedures should be approved by the Project Manager and fully documented.

3.1 SEEP AND SPRING IDENTIFICATION ACTIVITIES

The process of identifying seeps and springs consist of visual inspections, beginning within drainage areas and expanding to attempt to identify all seeps and springs present in drainage areas. Seeps and springs should be tracked to their origin to the extent practical. Seep and spring locations must be recorded using a GPS and/or marked accurately on a topographic map, and photographs must be taken from multiple angles to document location.

Once a seep or spring is identified, detailed observations should be recorded on field report forms throughout the sampling event. Before collecting a sample, the sampler should assess and record observations, if possible, including but not limited:

- Spatial extent of the seep/spring-impacted ground surface or pool, if present (i.e. length, width, depth);
- The approximate rate of flow from the seep/spring (or out of the pool);
- Water flow into the pool from sources other than the seep. Flow rate measurements can be estimated, typically in mL per minute, using a container with a known volume and stopwatch or with a flow meter, if needed.

3.2 VARIOUS SAMPLING TECHNIQUES USED FOR SEEPS AND SPRINGS

Seeps commonly produce little water and can require a considerable length of time to collect a representative sample, and they can be seasonal, often they stop flowing when low groundwater conditions are present (i.e., dry summer/drought conditions). Also, they often emerge from a relatively large surface area, producing a thin sheet of flowing water. Because of these characteristics, various sampling techniques can be used.

3.2.1 Direct Collection

If the flow rate from a spring is sufficiently high, a sample container can be directly filled with the water emerging from the subsurface by direct dipping of the sampling container into the seep or spring. If a pool of water is present, a sample can be collected directly from the pool using a peristaltic pump and associated tubing, disposable plastic syringe, or by directly filling the sample container. If sampling for VOCs, using a peristaltic pump or syringe to collect the seep samples is recommended. The known volume of the sample container can be used to estimate the flow rate.

3.2.2 Temporary Sampling Points

If the seep or spring does not produce sufficient water to collect samples directly from the flow emerging from the surface, a temporary sampling point can be placed within the soil to collect a sample. A temporary sampling point can also be used if the flow from the seep is diffused and discharged over a relatively large area. A temporary sampling point may consist of a short-length, slotted PVC screen or a stainless-steel gas vapor implant screen with a barbed connector and appropriate diameter tubing compatible with a peristaltic pump. The stainless-steel gas vapor implant can be used when low turbidity is required (i.e., less than 5 NTU) and cannot be achieved using other methods. Steps for sampling temporary points can include:

- Dig a small depression, approximately 6 inches by 6 inches by 1 foot in size within the area with the highest observed flow rate.
- If fine grained soils are present, use filter fabric or sand pack material, such as 20-40 Colorado, 2-12 Monterey sand, or similar, to surround the slotted PVC screen or 6-inch, stainless-steel, gas vapor implant screen connected to new polyethylene tubing. Bury the gas vapor implant horizontally.
- Use a peristaltic pump and tubing, either attached to the gas vapor implant or placed within the PVC casing, to pump water from seep. See Section 3.3 below.

Below is an example image of a stainless-steel gas vapor implant screen and a diagram showing an example of the installation method used to collect a seep sample. The image below is to illustrate the installation method of installing a gas vapor implant horizontally and is not limited to the site conditions shown below, such as rip rap and shoreline environments with freshwater/marine water transition zones.

AMS Vapor Implants have double woven stainless steel wire screens with a .0057-in. (0.15mm Pore).

3.2.3 Dam Construction

If the seep discharge emerges as a relatively large surface area, producing a thin sheet of flowing water, a dam can be constructed at the periphery of the seep to allow water to accumulate so samples can be collected. A dam can be constructed using clean plastic sheeting as dam material. Then the sample can be collected using the Direct Collection method (Section 3.2.1).

3.3 WATER QUALITY PARAMETERS AND SAMPLING PROCEDURES

Various methods can be employed for collecting samples from seeps. The sampling procedure using a syringe includes:

1. Put on clean nitrile gloves; use clean hands technique if required (refer to Clean Hands Sampling for Trace Metals Analysis in Water Standard Guideline).
2. Use a clean disposable syringe.
3. Remove the caps from the sample containers.
4. Place the syringe tip at least one inch below the surface of the water and fill by slowly pulling back on the plunger. Avoid drawing sediment or other foreign objects into the syringe.
5. Tilt the bottles upright at an angle and fill slowly until nearly full.
6. Place the cap back on and check for air bubbles if sampling for VOCs.

If using a syringe is impracticable, it is possible to use a clean (i.e., decontaminated) stainless-steel container or a clean disposable polyethylene container to collect the samples by submerging the container and transferring the sample to the sample containers. This technique is useful to obtain large sample volumes and if a pool is present. This technique should only be used if analyzing for analytes other than VOCs.

1. Put on clean nitrile gloves; use clean hands technique if required.
2. Invert and submerge a clean, stainless-steel pouring beaker at the desired location.
3. Slowly upright the container so that water flows in and avoid collecting sediment or other foreign objects into the container.
4. Lift the container up and slowly pour into sample containers.
5. Repeat until containers are filled and place the caps on immediately. Check for air bubbles if sampling for VOCs.

If using a temporary sampling point as described in Section 3.2.2, collect samples similar to the Low-Flow Groundwater Sample Collection Standard Guideline.

1. Put on clean nitrile gloves; use clean hands technique if required.
2. Place the peristaltic pump and water quality equipment near the sampling location. Slowly lower new polyethylene tubing down into the PVC casing or connect new polyethylene tubing from the gas vapor implant to the peristaltic pump.
3. Pump water until turbidity has stabilized, either visually or using a water quality meter or standalone turbidity meter. Once turbidity has stabilized or after 30 minutes have elapsed, collect the seep sample using the pumping rate during purging.

4. The sample can be collected by directly filling the laboratory-provided bottles from the pump discharge line.
5. Repeat until containers are filled and place the caps on immediately. Check for air bubbles if sampling for VOCs.

If sampling for filtered metals, collect these samples last and fit an in-line filter at the end of the discharge line. Take note of the flow direction arrow on the filter prior to fitting. A minimum of 0.5 to 1 liter of groundwater must pass through the filter prior to collecting the sample.

Once the sample is collected, water quality can be measured for field parameters including pH, conductivity, DO, ORP, and temperature by directly submerging the water quality meter probes into the pool. If insufficient flow is present at the seep or spring to completely immerse the multi-meter probe, water can be collected into a dedicated polyethylene bottle or through a transfer/flow-through cell to facilitate measurement of field parameters.

Sample labels must clearly identify the project name, sampler's initials, sample location and unique sample ID, analysis to be performed, date, and time. After collection, samples must be placed in a cooler maintained at a temperature of approximately 4 to 6 degrees Celsius (°C) using ice. Chain-of-Custody Forms must be completed. Upon transfer of the samples to the laboratory, the Chain-of-Custody Form must be signed by the persons transferring custody of the sample containers to document change in possession.

4.0 Decontamination

All reusable equipment that comes into contact with groundwater from seeps and springs should be decontaminated using the processes described in this section prior to moving to the next sampling location.

Water Quality Sensors and Flow-Through Cell: Distilled water or deionized water should be used to rinse the water quality sensors and flow-through cell. No other decontamination procedures are recommended since they are sensitive equipment. After the sampling event, the water quality meters will be cleaned and maintained according to their manufacturer equipment manual.

Reusable Equipment: All stainless-steel equipment, such as trowels and beakers, will be decontaminated between sampling locations and at the end the day by spraying the entire surface area with an Alconox (or similar)/clean water solution followed by a scrub to remove particles and then a thorough rinse with distilled or deionized water.

5.0 Investigation-Derived Waste

Typically, water generate during seep and/or spring sampling is minimal and should be placed back on the ground surface to infiltrate in the immediate area of the seep/spring. However, if the project requires that water generated during sampling activities be disposed off-site, then water generated during sampling activities will be contained, transported, disposed of in accordance with applicable laws, and stored in a designated area until transported off-site for disposal. If the latter is required, the approach to handling and disposal of these materials for a typical cleanup site is as follows: For investigation-derived waste (IDW) that is containerized, such as purge water, 55-gallon drums (or other smaller sized drums) approved by the Washington State Department of Transportation will be used for temporary storage pending profiling and disposal. Each container holding IDW will be sealed and labeled as to its contents (e.g., "purge water"), the dates on which the wastes were placed in the container, the owner's name and contact information for the field person who generated the waste, and the site name.

IDW containerized within drums will be characterized relative to applicable waste criteria using data from the sampling locations whenever possible. Material that is designated for off-site disposal will be transported to an off-site facility permitted to accept the waste. Manifests will be used, as appropriate for disposal.

Disposable sampling materials and incidental trash such as paper towels and PPE used in sample processing will be placed in heavy-duty garbage bags or other appropriate containers and disposed of as trash in the municipal collection system.

6.0 Field Documentation

Seep sampling activities will be documented in field sampling forms (Attachment A) and/or field notebooks, and Chain-of-Custody Forms. Information recorded will, at a minimum, include personnel present (including subcontractors or client representatives), purpose of field event, weather conditions, and seep locations (GPS coordinates and/or field topographic maps). Additional information may include sample collection date and times, sample analytes, seep pool dimensions, estimated flow rates, water quality parameters, amount of purged water generated, and any deviations from the SAP. Photographs of the seeps should be taken, and directions of photographs should be documented.

7.0 Health and Safety

Many seeps and springs are located in remote areas and are not entirely accessible by roads or trails. Sampling at these locations often requires field personnel to hike through areas that may contain dangerous plant and animal species. In addition, seeps may be located in areas that are surrounded by steep and/or unstable terrain. Field personnel should be familiar with the sections of the health and safety plan that address these hazards and should always exercise good common sense.

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F|S STANDARD GUIDELINE

Well Construction

DATE/LAST UPDATE: May 2015

These procedures should be considered standard guidelines and are intended to provide useful guidance when in the field, but are not intended to be step-by-step procedures, as some steps may not be applicable to all projects.

All field staff should be sufficiently trained in the standard guidelines and should review and understand these procedures prior to going in the field. It is the responsibility of the field staff to review the standard guidelines with the field manager or project manager and identify any deviations from these guidelines prior to field work. When possible, the project-specific Sampling and Analysis Plan should contain any expected deviations and should be referenced in conjunction with these standard guidelines.

1.0 Scope and Purpose

This standard guideline presents commonly used procedures for the installation of resource protection wells, in accordance with applicable sections of the Washington State Minimum Standards for Construction and Maintenance of Wells (Washington Administrative Code [WAC] 173-160, Part Two) and ASTM Standard Practice for Design and Installation of Groundwater Monitoring Wells (ASTM D5092-04[2010]e1). These wells may include groundwater monitoring wells, piezometers, groundwater extraction wells, injection wells, or vapor extraction wells. The guideline is intended to be used by field staff who are overseeing well drilling and construction.

2.0 Equipment and Supplies

Well Installation Equipment and Tools:

- Tape measure or measuring wheel
- Weighted tape or leadline
- Water level meter
- Hand-held Global Positioning System (GPS; optional)
- Camera
- Trash bags

- Well construction materials including polyvinyl chloric (PVC) screen and riser, sandpack, bentonite and well monument will be provided by the drilling subcontractor.

Paperwork

- Work Plan and/or Sampling and Analysis Plan (SAP)/Quality Assurance Project Plan (QAPP)
- Health and Safety Plan (HASP)
- Copies of figures showing previous boring locations and boring logs from previous investigations and historical depth to water levels, if available
- Well installation forms (printed on Rite in the Rain paper)
- Permanent markers and pencils

Personal Equipment:

- Steel-toed boots
- Hard hat
- Safety vest
- Safety glasses
- Nitrile gloves
- Ear plugs
- Rain gear
- Work gloves

3.0 Standard Procedures

3.1 PREPARATION

First, before going into the field, it is important to discuss the project needs with the Project Manager (PM). These include the appropriate aquifer for well screening (especially if it is not the shallowest aquifer), soil sampling interval (if applicable to drilling method), screen length and placement (especially important at tidally influenced sites), well construction materials (i.e., screen slot size and grain size of the filter pack), surface completion of the wells, and any other important construction details. Any non-standard materials needed for well construction should also be communicated to the drilling firm when the work is scheduled, or a minimum of two weeks prior to the field event. Select a boring log template that is appropriate for the project needs.

Next, review the work plan and existing materials such as cross-sections, historical depth to water levels, or boring logs from previous investigations (if available) to familiarize yourself with the site geology. In addition to site-specific information (or alternatively if other information is not available), a geologic map of the area from a reputable source such as the U.S. Geological Survey (USGS) may also be reviewed.

Finally, check the area of the site where drilling will occur for underground objects. A OneCall locate request should be made at least one week and no less than three days prior to commencement of drilling in order to give public utility locators time to mark known, buried utility lines. All planned boring locations should be marked on the ground with white spray paint prior to making a locate request. In almost all cases, site maintenance managers or equivalent should be consulted for site selection and a private utility locator should clear any underground objects using electromagnetic techniques from the drilling area. If drilling in close proximity to buried utilities, field staff may need to request authorization for use of an air knife or vacuum extraction to clear the borehole to a depth below the utility lines.

3.2 DRILLING

1. Mark the desired well location using coordinates pre-loaded into a handheld GPS, or by measuring from known Site features. It is best to use both methods, if possible.
2. Before drilling begins, record the following information on each log:
    a. Operator's name and company, equipment make/model, equipment measurements (i.e., sampler length and diameter, hammer weight and stroke if using hollow stem auger, boring diameter).
    b. Your name, date, project, boring name, and approximate descriptive location relative to existing site features. Include a description of the ground surface and whether or not concrete coring was necessary; if so, include core diameter, concrete thickness, and subcontractor information.
    c. A small hand drawn map showing your location with measurements to a stationary reference point, or GPS coordinates (or ideally, both). This is also a good place to note if you have had to move a boring location because of underground utilities, access issues, etc. It is important to record the reason for relocation and the direction and distance moved (i.e., moved 10 feet to the north due to presence of subsurface water line).
3. If you are using a hollow stem auger, it is important to communicate to the driller how often you would like a split spoon sample collected. Typically this would be continuous or every 5 feet but may be different depending on the project needs. Usually this is established before the driller issues a quote. Any changes will affect the cost of the work and should be discussed with the PM.
    a. Record any feedback from the driller about the drilling conditions. This may include difficult drilling or rig chatter (usually caused by hard materials), heaving sands (usually caused by hydrostatic pressure on the borehole), caving, or hole instability.

4. For split spoon samples, record the number of hammer blows (blow counts) necessary to drive the sampler each 6-inch increment, as reported by the driller. If more than 50 blows are needed, record the distance that the sampler was driven in 50 blows (i.e., 2-inches in 50 blows). This is referred to as the standard penetration test (SPT).
5. For all drilling methods, create a log of the soils encountered according to the Floyd|Snider Soil Logging Standard Guideline. Pay particular attention to the moisture content of the soils, making careful notation of the water table where free water is first encountered. After drilling has been completed to the desired depth, confirm the depth to the water table using a water level meter.

3.3 WELL DESIGN AND CONSTRUCTION

1. Determine the length and placement of the well screen based on the observed depth to the water table, the specifics of the work plan, and the observed lithology. The well screen is typically set across the water table of shallow aquifers for monitoring wells and piezometers. However, the screened interval may be fully submerged for groundwater extraction wells, sites with very shallow groundwater, or wells installed in deeper aquifers below confining units. If an area is tidally influenced, note the tide elevation during well completion; if the tide is at a high or low at the time of drilling the well screen may need to be lowered or raised accordingly so that the screen spans the water table when the tide is at zero. The hydraulic conductivity of the aquifer material will also factor into well screen placement. For example, wells screened in tight silts may not produce enough water to adequately develop and sample. In this case, it may be preferable to screen the well in a more transmissive unit. Include the length of any required bottom caps or sumps below the well casing when determining the total depth of the boring required to place the well screen at the desired interval. The Washington State minimum standards also require that the diameter of the well screen relative to the diameter of the borehole (annual space) be small enough to allow placement of a filter pack that is 4 inches in diameter larger than the screen. For example, a 2-inch diameter monitoring well should be completed within a borehole that has a minimum 6-inch diameter.

6. Determine the filter pack material. The purpose of the filter pack is to prevent fine-grained aquifer material from entering the well while still allowing groundwater to flow through. Filter pack is composed of clean, rounded, relatively uniform silica sand. The choice of sand for the filter pack will depend on the grain size range of the aquifer material, with emphasis on the finest aquifer material. Filter pack material should be approximately 10 to 15 times the grain size of the surrounding aquifer material. The particle size ranges of fine, medium, and coarse sand, and the particle size ranges of common filter pack materials are given in the two tables below. As indicated in these tables, suitable filter pack choices for an aquifer with appreciable fine sand would include a range from 20-40 to 10-20 sand. For aquifers where the smallest particle size is medium sand, a filter pack of 2-12 sand or similar may be appropriate. More precise filter pack designs are possible based on grain size curves (see Driscoll 1986, Blair 2006).

Unified Soil Classification System (USCS) Classification	U.S. Sieve Size	Grain Size (inches)	Grain Size (millimeters)
Fine Sand	40 to 200	.003 to 0.16	.074 to .42
Medium Sand	10 to 40	.016 to .06	.42 to 1.68
Coarse Sand	10 to 4	.06 to 0.19	1.68 to 4.76

Example Sand Pack Gradations (U.S. Sieve Sizes)	Grain Size (inches)	Grain Size (millimeters)
32-40	.016 to .02	.42 to .55
20-40	.016 to .03	.42 to .84
16-30	.05 to .02	.59 to 1.2
10-20	.03 to .08	.84 to 2
2-12	.06 to .3	1.7 to 8

7. Determine the screen slot diameter. The purpose of the well screen is to allow groundwater to flow into and through the well screen for sample collection. Monitoring well casings are typically constructed of PVC (Washington State minimum standards require Schedule 40 or thicker-walled PVC for borings up to 200 feet deep); however, materials such as stainless steel may be used for the purposes of longevity, heat, specific chemical resistance, or other site-specific concerns. The screened interval of the well consists of a series of slots that are commonly 0.01 inch or 0.02 inch in width. Similar to filter pack material, narrower slots allow less fine-grained material and also less groundwater to pass through them. The screen slot size should be selected to retain approximately 90% or greater of the filter pack material. The largest screen slot size practical should be selected.
8. Once the driller has assembled the well casing of the appropriate length, oversee placement of the casing and filter pack. The casing should be centered in the borehole and level. When using a hollow stem auger, the sand is typically poured from the surface while the augers are being lifted from the borehole. When using sonic drilling or other methods where the drill rods are removed prior to sand placement, it is preferable to use a Tremie tube lowered to the bottom of the borehole to deliver the sand, which helps to ensure that the sand has actually reached the bottom of the borehole. As the driller is pouring sand into the annular space, monitor the height of the sand in the borehole using a weighted tape or leadline to ensure that the space is being filled evenly. If possible, use a surge block to force water from the well out into the sand pack periodically to eliminate any bridges or gaps in the sand. The sand pack

placement is complete when it has reached a height minimum of 1 foot (but no more the 5 feet) above the top of the well screen.

9. A bentonite seal must be placed above the sand pack to isolate the screened interval of the aquifer and to prevent the annular space from acting as a preferential pathway for surface water, water above the screen zone, or other liquid (i.e., free product). The purpose of the bentonite plug is to prevent downward migration inside the borehole, which has the potential to cause groundwater contamination. Monitor the placement of the bentonite plug above the sand pack. The bentonite plug is typically composed of dehydrated bentonite chips, which are poured into the annual space from the surface; or a bentonite slurry, which is pumped into the space via a Tremie tube. A bentonite chip seal is still recommended (but not necessary) immediately above the sand pack when using bentonite slurry to minimize migration of the slurry into the sandpack. Pumping is preferable in situations where bentonite will be placed below the water table. The U.S. Environmental Protection Agency (USEPA) recommends that the bentonite seal consist of a minimum of 2 feet of bentonite placed above the sand pack. If using a bentonite chip seal, hydrate the chips with clean water so that they expand to seal the borehole.
10. Communicate the desired surface completion to the driller (i.e., an aboveground well monument or a monument flush with the ground surface) if you have not already done so. Verify that the well monument has been installed correctly. For flush-mounted wells, ensure that the well is level with the surrounding grade, especially in areas with pedestrian or vehicle traffic. In areas with frequent or heavy vehicle traffic, heavy-duty traffic-rated monuments or manholes should be used. For aboveground well monuments (i.e., stand pipes), ensure that the monument is level, anchored in a minimum of 2 feet of concrete, and protected by steel bollards, unless otherwise specified in the work plan. The concrete surrounding any well monument should seal the borehole at the ground surface.

4.0 Decontamination

All reusable equipment that comes into contact with soil and groundwater should be decontaminated as follows prior to moving to the next sampling location.

Split spoons, stainless steel bowls and spoons, the water level tape, and any other tools used for well drilling and installation must be decontaminated between boring locations. If collecting soils samples for chemical analysis, split spoons and any tools used for sample processing will be decontaminated between each sample; alternatively, disposable bowls and spoons may be used. Equipment decontamination will consist of a tap water rinse to remove soil particles, followed by scrubbing with brushes and an alconox (or similar)/clean water solution, and a final rinse with distilled or deionized water.

5.0 Investigation-Derived Waste

Unless otherwise specified in the project work plan, waste soils, liquids, and other drilling materials generated during well drilling and installation will be contained in accordance with applicable laws, and stored in a designated area until transported off-site for disposal.

The approach to handling and disposal of these materials is as follows. For investigation-derived waste (IDW) that is contained, such as waste soils, 55-gallon drums approved by the Washington State Department of Transportation (WSDOT) will be supplied by the driller and used for temporary storage pending profiling and disposal. Each container holding IDW will be sealed and labeled with its contents (e.g., “soil cuttings”), the date(s) on which the wastes were placed in the container, the owner’s name, contact information for the field person who generated the waste, and the site name.

IDW contained within drums will be characterized relative to applicable waste criteria using data from the sampling locations whenever possible. Material that is designated for off-site disposal will be transported to an off-site facility permitted to accept the waste. Manifests will be used as appropriate for disposal.

Disposable sampling materials and incidental trash such as paper towels and personal protective equipment (PPE) used in sample processing will be placed in heavy-duty garbage bags or other appropriate containers and disposed of as solid waste in the municipal collection system (i.e., site dumpster).

6.0 Field Documentation

All observations should be recorded on a soil boring/well completion form appropriate for the drilling method or in a bound field notebook. Field staff should record as much detail as possible in the field log (including well construction materials, Ecology well ID tag number, and surface completions) and note any anomalies or details that varied from the SAP. After the field work is complete, a set of final well construction logs (usually electronic) that serve as the record for the project will be completed in consultation with the project manager or field manager.

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F|S STANDARD GUIDELINE

Well Development

DATE/LAST UPDATE: May 2015

These procedures should be considered standard guidelines and are intended to provide useful guidance when in the field, but are not intended to be step-by-step procedures, as some steps may not be applicable to all projects.

All field staff should be sufficiently trained in the standard guidelines and should review and understand these procedures prior to going in the field. It is the responsibility of the field staff to review the standard guidelines with the field manager or project manager and identify any deviations from these guidelines prior to field work. When possible, the project-specific Sampling and Analysis Plan should contain any expected deviations and should be referenced in conjunction with these standard guidelines.

1.0 Scope and Purpose

This Standard Guideline for Well Development presents commonly used procedures for monitoring well development for newly installed monitoring wells and/or existing wells that may require redevelopment. Monitoring well development restores hydraulic conductivity with the surrounding formations that were disturbed during the drilling process. Development removes residual fines from well filter pack materials and the borehole wall and reduces the turbidity of the water, which provides more representative groundwater samples. These wells may include groundwater monitoring wells, piezometers, or groundwater extraction wells. This guideline describes the purge and surge method of development and is intended to be used by field staff who are overseeing or completing well development. Often, the drilling subcontractors are asked to complete well development activities subsequent to new well installations, in which case, Floyd|Snider staff would oversee the development. Other development methods, such as jetting, are not described herein, but may be used if specified in the project-specific Work Plan or Sampling and Analysis Plan (SAP).

Well development shall be completed by continuous pumping at a steady rate using a portable pump and polyethylene tubing, with regular surging (e.g., using a surge block) to force water through the filter pack and surrounding formation. Wells should ideally be developed either during installation (following sand placement but prior to sealing) or soon after installation, unless otherwise specified in the work plan, using the described methodologies or equivalents. For wells that are completed using a grout or concrete seal, if development does not take place prior to sealing, it should be completed within 48 hours following well installation in order allow for grout and concrete to cure.

2.0 Equipment and Supplies

Well Development Equipment and Tools:

- Appropriate high volume pump (centrifugal, submersible, etc.) and correct diameter tubing, or bailer
- Hose clamps (optional)
- Power source (generator, 12-volt battery, or car battery) and appropriate power adapter for pump
- Water quality meter or turbidity meter (if needed)
- 2-, 4-, or 6-inch surge block (typically provided by the driller)
- Water level meter
- Washington State Department of Transportation (WSDOT)-approved 55-gallon drums
- Equipment decontamination supplies including:
    - Scrub brushes
    - Alconox or other soap
    - Distilled or deionized water
    - Paper towels
- Trash bags
- Camera

Paperwork:

- Work Plan and/or SAP/Quality Assurance Project Plan (QAPP)
- Bound field notebook or appropriate field forms
- Well development form (printed on Rite in the Rain paper)
- Health and Safety Plan (HASP)
- Well installation forms (printed on Rite in the Rain paper)

Personal Equipment:

- Steel-toed boots

- Safety vest
- Safety glasses
- Nitrile gloves
- Rain gear
- Work gloves

3.0 Standard Procedures

3.1 OFFICE PREPARATION

Meet with the project manager to identify key information and goals of the well development, including how long after construction the wells should be developed. Determine if Floyd|Snider or the driller will be doing the development.

3.2 WELL DEVELOPMENT PROCEDURES

The following procedures are general guidelines for monitoring well development. These same procedures are also appropriate for extraction wells, injection wells, and/or piezometers. Specific instructions provided in individual work plans shall supersede these procedures in the event there are discrepancies.

Visually inspect all well development equipment for damage; repair as necessary.

1. Decontaminate all hoses, surge blocks, and/or submersible pump by scrubbing with brush and alconox or other soap solution and rinsing with deionized water.
2. Prior to development, use a water level meter to measure the depth in each well to the static water level and total depth to a reference mark on the top of the well casing.
3. Attach a length of clean or disposable tubing, approximately 5 feet longer than the well casing, to the outlet of the submersible pump.
4. Each well development cycle consists of surging followed by well evacuation (pumping). Surging may be accomplished with a surge block sized to fit snugly inside the well casing, or with the submersible pump. Surging using a pump increases the hydraulic gradient and velocity of groundwater near the well by drawing the water level down and moving more fine-grained soil particles into the well casing. Surging using a pump is only effective if the well produces enough water for continuous pumping and the pump is of a large enough diameter relative to the well casing. If pumping must be stopped to allow the well to recharge, a surge block is preferable for surging. If using a surge block, connect polyvinyl chloride (PVC) pipe or other rods longer than the well casing to the surge block. Lower the surging device into the well to a depth within the screened interval. A bailer can be used to surge in situations

when a surge block is not available and the well has insufficient recharge for the submersible pump.

5. During development, it is important to note the color and clarity of the water and any other visual or olfactory observations on the field form or in the field notebook. Note any significant changes as development progresses.
6. Surging should consist of a minimum of ten consecutive surges (i.e., quickly raise and lower surge block or pump in well) with an appropriately sized surge block or pump over the full length of the screen. For long well screens (greater than 10 feet), surging should be done in short intervals of 2 to 3 feet at a time. In cases where the screen extends to above the water table, clean water may have to be added to the well to develop the top of the filter pack.
7. After surging, water is purged from well until the pumped stream starts to run clear. At that point, stop pumping and initiate another surge cycle. If a well has more hydraulic head than the pump is able to overcome, or if an insufficient volume of water for pumping is present, a disposable bailer may also be used for purging.
8. Repeat this procedure until evacuated water is visibly clear and essentially free of sediment. Perform a minimum of three surge and pump cycles.
9. Well development will be terminated when the variation in the turbidity Nephelometric Turbidity Units (NTUs) readings is less than 10 percent or until the discharge is visibly clear and free of sediment after a minimum of three surge and purge cycles. As an alternative, periodic water samples can be collected for field measurements of temperature, specific conductivity, and pH; well development should continue until field parameters stabilize to within ±5 percent on three consecutive measurements or 10 well volumes have been purged. If it is not possible reduce the turbidity further, the well should be purged up to a maximum of four hours or as determined sufficient by the field geologist or project manager.
10. Report field observations and volume of water removed on the standard well development form (attached). Take final water level measurements and record then on the field form or in the field notebook.
11. Contain the purged water and manage in accordance with the project-specific SAP or Section 5.0 below. Prior to developing the next well or after the completion of development activities, decontaminate all reusable equipment used in development in accordance with Section 4.0 below.
12. If feasible, it is best to wait at least two weeks after development to sample the wells. Wells can be sampled a minimum of 48 hours after the completion of development if the project schedule requires a quick turnaround. However, the groundwater sample will be more representative of static conditions in the aquifer if allowed to stabilize for at least one to two weeks after development.

4.0 Decontamination

All reusable equipment that comes into contact with groundwater should be decontaminated as follows prior to moving to the next sampling location.

Water level meter and surge block: The water level indicator and tape will be decontaminated between sampling locations and at the end the day by spraying the entire length of tape that came in contact with groundwater with an Alconox (or similar)/clean water solution followed by a thorough rinse with distilled or deionized water. Surge block decontamination will consist of a tap water rinse to remove soil particles, followed by scrubbing with brushes and an alconox (or similar)/clean water solution and a final rinse with distilled or deionized water.

Submersible Pump: Decontaminating the pump requires running the pump in three progressively cleaner grades of water. Place the pump and the length of the power cord that was in contact with water into a bucket containing approximately four gallons of an Alconox (or similar)/clean water solution. Run the pump for approximately two minutes or until the volume of water in the bucket has been exhausted. Next, place the pump and cord into a second bucket containing approximately four gallons of clean water and run the pump for approximately two minutes or until the volume of water in the bucket is exhausted. Lastly, place the pump and power cord into a third bucket containing approximately four gallons of distilled or deionized water and run the pump for approximately two minutes or until the volume of water in the bucket is exhausted. The soap/water solution and rinse water may be re-used. When done for the day, dry the exterior of the pump and power cord with clean paper towels to the extent practical prior to storage. All decontamination water and rinse water (including soapy solution) should be managed in accordance with Section 5.0 below.

5.0 Investigation-Derived Waste

Unless otherwise specified in the project work plan, well development and decontamination water generated during development and any drilling materials will be contained and stored in a designated area until transported off-site for disposal in accordance with applicable laws.

The approach to handling and disposal of these materials is as follows. For investigation-derived waste (IDW) that is contained, such as well development water, WSDOT-approved 55-gallon drums will be supplied by the driller and used for temporary storage pending profiling and disposal. Each container holding IDW will be sealed and labeled as to its contents (e.g., "MW-1 Well development water"), the date(s) on which the wastes were placed in the container, the owner's name, contact information for the field person who generated the waste, and the site name.

IDW contained within drums will be characterized relative to applicable waste criteria using data from the sampling locations whenever possible. Material that is designated for off-site disposal will be transported to an off-site facility permitted to accept the waste. Manifests will be used as appropriate for disposal.

Disposable sampling materials and incidental trash such as paper towels and personal protective equipment (PPE) used in sample processing will be placed in heavy duty garbage bags or other appropriate containers and disposed of as trash in the municipal collection system (i.e., site dumpster).

6.0 Field Documentation

Well development procedures will be documented on the well development field form (attached) or a bound field notebook. Information recorded will at a minimum include date, personnel present (including subcontractors), purpose of field event, weather conditions, depth of water, well construction details for the well(s) being developed (i.e., diameter, total depth, screen interval), water quality field measurements (if collected), amount of purged water generated, and any deviations from the SAP.

Enclosure: Well Development Field Form

Well Development Field Form

FLOYD | SNIDER

Project Name:______________________________ Date: _________________

Project Number:______________________________ Field Personnel: ______________________________

Driller (if applicable): ____________________________

Purge Data

Well ID:	Total Well Depth:	Well Condition/Damage Description:
Well Casing Type/Diameter/Screened Level:	One Casing Volume (gal):	
Method of Development (Circle): Surge Block Pump Surge Bailer	Equipment Used (type of pump, etc.):	

Begin Purge (time):	
End Purge (time):	
Gallons Purged (time):	
Purge Water Disposal Method (circle): On-site Storage Tank On-site Treatment Drum Other:	

Volume of Schedule 40 PVC Pipe

Diameter	O.D.	I.D.	Volume (Gal/Linear Ft.)	Weight of Water (Lbs/Lineal Ft.)
1 ¼"	1.660"	1.380"	0.08	0.64
2"	2.375"	2.067"	0.17	1.45
3"	3.500"	3.068"	0.38	3.2
4"	4.500"	4.026"	0.66	5.51
6"	6.625"	6.065"	1.5	12.5

Time	Depth to Water (feet)	Vol. Purged (gallons)	Rate (gpm)	pH	Conductivity	Turbidity	Temp	Comments
			--	--	--	--	--	Prior to purging

Notes:

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F|S STANDARD GUIDELINE

Low-Flow Groundwater Sample Collection

DATE/LAST UPDATE: October2019

These procedures should be considered standard guidelines and are intended to provide useful guidance when in the field, but are not intended to be step-by-step procedures, as some steps may not be applicable to all projects.

All field staff should be sufficiently trained in the standard guidelines for the sampling method they intend to use and should review and understand these procedures prior to going into the field. It is the responsibility of the field staff to review the standard guidelines with the field manager or project manager and identify any deviations from these guidelines prior to field work. When possible, the project-specific Sampling and Analysis Plan should contain any expected deviations and should be referenced in conjunction with these standard guidelines.

1.0 Scope and Purpose

This standard guideline provides details necessary for collecting representative groundwater samples from monitoring wells using low-flow methods. These guidelines are designed to meet or exceed guidelines set forth by the Washington State Department of Ecology (Ecology). Low-Flow sampling provides a method to minimize the volume of water that is purged and disposed from a monitoring well, and minimizes the impact that purging has on groundwater chemistry during sample collection.

2.0 Equipment and Supplies

Groundwater Sampling Equipment and Tools:

- For wells with head less than 25 feet:
    - Peristaltic pump with fully-charged internal battery or standalone battery and appropriate connectors

- For wells with head greater than 25 feet:
  - Bladder pump and controller, as well as an air cylinder, or air compressor (with extension cord if near an electrical outlet; with battery and appropriate connectors or generator if not near an outlet)

    OR
  - Low-flow submersible pump and controller (with extension cord if near an electrical outlet; with battery and appropriate connectors or generator if not near an outlet)
- Multi-parameter water quality meter
- Water level meter
- Poly tubing
- Silicone tubing
- Filters (if field filtering)
- Tools for opening wells (1/2-inch, 9/16-inch, and 5/8-inch sockets, ratchet, screwdriver)
- Well keys
- Tube cutters, razor blade, or scissors
- 5-gallon buckets and clamp
- Paper towels
- Bailer or pump to drain well box if full of stormwater
- Hammer
- Alconox (or similar decontamination solution), deionized water, spray bottles
- Tape measure
- Trash bags

Lab Equipment:

- Sample jars/bottles
- Coolers
- Chain-of-Custody Forms
- Labels
- Ice
- Ziploc bags

Paperwork:

- Field notebook with site maps
- Table of well construction details and/or well logs, if available
- Sampling forms (enclosed)
- Purge water plan
- Rite-in-the-Rain pens, paper, and permanent markers
- Site-Specific Health and Safety Plan (HASP)
- Sampling and Analysis Plan (SAP) and/or Quality Assurance Project Plan (QAPP) (including tables of analytes and bottle types)

Personal Protective Equipment (PPE):

- Boots/waders
- Safety vest
- Safety glasses
- Rain gear
- Nitrile gloves
- Work gloves

3.0 Standard Procedures

Low-Flow groundwater sampling consists of purging groundwater within the well casing at a rate equal to or less than the flow rate of representative groundwater from the surrounding aquifer into the well screen. The flow rate will depend on the hydraulic conductivity of the aquifer and the drawdown, with the goal of minimizing drawdown within the monitoring well. Field parameters are monitored during purging and groundwater samples are collected after field parameters have stabilized. Deviations from these procedures should be approved by the Project Manager and fully documented.

3.1 CALIBRATION OF WATER QUALITY METERS

All multi-parameter water quality meters to be used will be calibrated prior to each sampling event. Calibration procedures are outlined in each instrument's specific user manual.

3.2 MONITORING, MAINTENANCE, AND SECURITY

Prior to sampling, depth to water and total depth measurements will be collected and recorded for accessible monitoring wells onsite (or an appropriate subset for larger sites). Check for an existing measuring point (notch or visible mark on top of casing). If a measuring point is not observed, a measuring point should be established on the north side of the casing. The conditions of the well box and bolts will also be observed and deficiencies will be recorded on the sampling forms or logbook (i.e., missing or stripped bolt). The following should also be recorded:

- Condition of the well box, lid, bolts, locks, and gripper cap, if deficiencies
- Condition of gasket if deficient and if water is present in the well box
- Note any obstructions or kinks in the well casing
- Note any equipment in the well casing, such as transducers, bailers, or tubing
- Condition of general area surrounding the well, such as subsidence, potholes, or if the well is submerged within a puddle.

Replace any missing or stripped bolts, and redevelop wells if needed.

3.3 LOW-FLOW PURGING METHOD AND SAMPLING PROCEDURES

Groundwater samples will be collected using low-flow purging and sampling procedures consistent with Ecology guidelines and the U.S. Environmental Protection Agency (USEPA) standard operating procedures (USEPA 1996). The following describes the Low-Flow purging and sampling procedures for collecting groundwater samples using a peristaltic pump. If the water level is greater than 20 feet below ground surface (bgs), Grundfos or Geotech submersible pumps or bladder pumps can be used since their pumping rates can be adjusted to low-flow levels.

- Place the peristaltic pump and water quality equipment near the wellhead. Slowly lower new poly tubing down into the well casing approximately to the middle of the well screen. If the depth of the well screen is not known, lower the tubing to the bottom of the well, making sure that the tubing has not been caught on the slotted well casing, and then raise the tubing 3 to 5 feet off the bottom of the casing. Document the estimated depth of the tubing placement within the well. Connect the tubing to the peristaltic pump using new flex tubing and connect the discharge line to the flow-through cell of the water quality meter. The discharge line from the flow cell should be directed to a bucket to contain the purged water.
- If using a low-flow submersible pump, connect the pump head to dedicated or disposable tubing. If using a bladder pump, connect both the air intake and water discharge ports to decontaminated or disposable tubing, using the manufacturer's instructions to ensure a secure connection. Lower the pump with tubing into the well as described above and connect the water discharge tubing directly to the flow-through cell.
- Measure the depth to water to the nearest 0.01 foot with a decontaminated water level meter and record the information on a sampling form.
- Start pumping the well at a purge rate of 0.1 to 0.2 liters per minute and slowly increase the rate. Purge rate is adjusted using a speed control knob or arrows on peristaltic and low-flow submersible pumps. The purge rate for bladder pumps is controlled by the air compressor, which first pressurizes the pump chamber in order

to compress the flexible bladder and force water through the discharge line, and then vents the chamber in order to allow the bladder to refill with water.

- A good rule of thumb is to pressurize to 10 psi + 0.5 psi/foot of tubing depth and begin with 4 discharge/refill cycles per minute; using greater air pressure and accelerating the pump cycles will increase the purge rate.

- Check the water level. If the water level is dropping, lower the purge rate. Maintain a steady flow with no or minimal drawdown (less than 0.33 feet according to USEPA 2002). Maintaining a drawdown of less than 0.33 feet may not be feasible depending on hydrogeological conditions. If possible, measure the discharge rate of the pump with a graduated cylinder or use a stopwatch when filling sampling jars (500 milliliters [mL] polyethylene or glass ambers) to estimate the rate. When purging water through a flow cell, the maximum flow rate for accurate water quality readings is about 0.5 liters per minute (L/minute).
- Monitor and record water quality parameters every three to five minutes after one tubing volume (including the volume of water in the flow cell) has been purged.
  - One foot of ¼-inch interior diameter tubing holds about 10 mL of water, and flow-through cells typically hold less than 200 mL of water; one volume should be purged after about 5 minutes at a flow rate of 0.1 L/minute.
- Water-quality indicator parameters that will be monitored and recorded during purging include:
  - pH
  - Specific conductivity
  - Dissolved oxygen
  - Temperature
  - Turbidity
  - Oxidation reduction potential (ORP)
- Purging will continue until temperature, pH, turbidity, and specific conductivity are approximately stable (when measurements are within 10 percent) for three consecutive readings, or 30 minutes have elapsed. Because these field parameters (especially dissolved oxygen and ORP) may not reach the stabilization criteria, collection of the groundwater sample will be based on the professional judgment of field personnel at the time of sampling.
- The water sample can be collected once the criteria above have been met.
- If drawdown in the well cannot be maintained at 0.33 feet or less, reduce the flow or turn off the pump for 15 minutes and allow for recovery. If the water quality parameters have stabilized, and if at least two tubing volumes and the flow cell volume have been purged, then sample collection can proceed when the water level has recovered and the pump is turned back on. This should be noted on the sampling form.

- To collect the water sample, maintain the same pumping rate. After the well has been purged and the sample bottles have been labeled, the groundwater sample will be collected by directly filling the laboratory-provided bottles from the pump discharge line prior to passing through the flow cell. All sample containers should be filled with minimum disturbance by allowing the water to flow down the inside of the bottle or vial. When collecting a volatile organic compound (VOC) sample, fill to the top to form a meniscus over the mouth of the vial prior to placing the cap to eliminate air bubbles. Be careful not to overflow preserved bottles/pre-cleaned Volatile Organic Analyte (VOA) vials.
- If sampling for filtered metals, collect these samples last and fit an in-line filter at the end of the discharge line. Take note of the flow direction arrow on the filter prior to fitting. A minimum of 0.5 to 1 liter of groundwater must pass through the filter prior to collecting the sample.
- Sample labels will clearly identify the project name, sampler's initials, sample location and unique sample id, analysis to be performed, date, and time. After collection, samples will be placed in a cooler maintained at a temperature of approximately 4 to 6 degrees Celsius (°C) using ice. Chain-of-Custody Forms will be completed. Upon transfer of the samples to the laboratory, the Chain-of-Custody Form will be signed by the persons transferring custody of the sample containers to document change in possession.
- When sample collection is complete at a designated location, remove and properly dispose of the non-dedicated tubing. In most cases, this waste is considered solid waste and can be disposed of as refuse. Close and lock the well.

4.0 Decontamination

All reusable equipment that comes into contact with groundwater should be decontaminated using the processes described in this section prior to moving to the next sampling location.

Water Level Meter: The water level indicator and tape will be decontaminated between sampling locations and at the end the day by spraying the entire length of tape that came in contact with groundwater with an Alconox (or similar)/clean water solution followed by a thorough rinse with distilled or deionized water.

Water Quality Sensors and Flow-Through Cell: Distilled water or deionized water will be used to rinse the water quality sensors and flow-through cell. No other decontamination procedures are recommended since they are sensitive equipment. After the sampling event, the water quality meters will be cleaned and maintained according to the specific manual.

Submersible Pump (if applicable: Decontaminating the pump requires running the pump in three progressively cleaner grades of water.

1. Fill a bucket with approximately 4 gallons or more to sufficiently cover the pump of an Alconox (or similar)/clean water solution. Place the pump and the length of the

power cord (if applicable) that was in contact with water into the bucket and run the pump for approximately two minutes or until the volume of water in the bucket has been exhausted.

2. Fill a second bucket containing approximately 4 gallons or more to sufficiently cover the pump of clean water. Place the pump and cord into this bucket and run the pump for approximately two minutes or until the volume of water in the bucket has been exhausted.
3. Fill a third bucket with approximately 4 gallons or more to sufficiently cover the pump of distilled or deionized water. Place the pump and cord into this bucket and run the pump for approximately two minutes or until the volume of water in the bucket has been exhausted.

Bladder Pump: Clean the inside and outside of the pump body with an Alconox (or similar)/clean water solution, followed by a thorough rinse with distilled or deionized water. The outside of the air supply line that came in contact with groundwater may also be cleaned with Alconox (or similar) solution and re-used; bladders and water discharge lines must be replaced after each sample is collected.

5.0 Investigation-Derived Waste (IDW)

Unless otherwise specified in the project work plan, water generated during groundwater sampling activities will be contained, transported, disposed of in accordance with applicable laws, and stored in a designated area until transported off-site for disposal.

The approach to handling and disposal of these materials for a typical cleanup site is as follows. For IDW that is containerized, such as purge water, 55-gallon drums (or other smaller sized drums) approved by the Washington State Department of Transportation will be used for temporary storage pending profiling and disposal. Each container holding IDW will be sealed and labeled as to its contents (e.g., "purge water"), the dates on which the wastes were placed in the container, the owner's name and contact information for the field person who generated the waste, and the site name.

IDW containerized within drums will be characterized relative to applicable waste criteria using data from the sampling locations whenever possible. Material that is designated for off-site disposal will be transported to an off-site facility permitted to accept the waste. Manifests will be used, as appropriate for disposal.

Disposable sampling materials and incidental trash such as paper towels and PPE used in sample processing will be placed in heavy-duty garbage bags or other appropriate containers and disposed of as trash in the municipal collection system.

6.0 Field Documentation

Groundwater sampling activities will be documented in field sampling forms and/or field notebooks, and Chain-of-Custody Forms. Information recorded will, at a minimum, include personnel present (including subcontractors or client representatives), purpose of field event, weather conditions, sample collection date and times, sample analytes, depths to water, water quality parameters, well box/lid conditions, amount of purged water generated, and any deviations from the SAP. Photographs of damaged well casings or well boxes should be taken.

7.0 References

USEPA. 1996. Low-Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells, Revision 2. Region 1. July 30, 1996.

_____. 2002. Groundwater Sampling Guidelines for Superfund and CAR Project Managers. Office of Solid Waste and Emergency Response. EPA 542.S-02-001. May 2002.

Enclosures: Groundwater or Surface Water Sample Collection Form

GROUNDWATER OR SURFACE WATER SAMPLE COLLECTION FORM

Project Name:______________________________ Date of Collection: ______________________________

Project Number:______________________________ Field Personnel: ______________________________

Purge Data

Well ID: ______________________ Secure: ☐ Yes ☐ No Well Condition/Damage Description: ______________________________

____

Depth Sounder decontaminated Prior to Placement in Well: ☐ Yes ☐ No One Casing Volume (gal): ______________________

Depth of water (from top of well casing): ______________________ Well Casing Type/Diameter/Screened Interval: ______________________

After 5 minutes of purging (from top of casing): ______________________

Begin purge (time):______________________

End purge (time): ______________________

Volume purged: ______________________

Purge water disposal method: ______________________

Volume of Schedule 40 PVC Pipe

Diameter	O.D.	I.D.	Volume (Gal/Linear Ft.)	Weight of Water (Lbs/Lineal Ft.)
1 ¼"	1.660"	1.380"	0.08	0.64
2"	2.375"	2.067"	0.17	1.45
3"	3.500"	3.068"	0.38	3.2
4"	4.500"	4.026"	0.66	5.51
6"	6.625"	6.065"	1.5	12.5

Time	Depth to Water	Vol. Purged	pH	DO	Conductivity	Turbidity	Temp	ORP	Comments

Sampling Data

Sample No:______________________ Location and Depth: ______________________

Date Collected (mo/dy/yr): ______________ Time Collected: ____________ Weather: ______________________

Type: ☐ Ground Water ☐ Surface Water Other: ______________ Sample: ☐ Filtered ☐ Unfiltered Other:______________

Sample Collected with: ☐ Bailer ☐ Pump Other: ______________ Type: ______________________

Water Quality Instrument Data Collected with: Type: ☐ Horiba U-50 Other: ______________________

Sample Decon Procedure: Sample collected with (circle one): decontaminated <u>all</u> tubing; disposable and/or dedicated silicon and poly tubing Other: ____________

Sample Description (Color, Turbidity, Odor, Other): ______________________

Sample Analyses

TPH-D	(HCl) ☐	Chlor / Fluor	(unpres) ☐	COD / TOC	(H2SO4) ☐	Orthophos	(FILTER) ☐	Diss. Metals	(HNO3) ☐
TPH-G	(HCl) ☐	BTEX	(HCl) ☐	Total Metals	(HNO3) ☐	TKN/Phos	(N2SO4) ☐	VOCs	(HCl) ☐

Additional Information

Types of Sample Containers:	Quantity:	Duplicate Sample Numbers:	Comments:

Signature: ______________________________ **Date:** ______________________

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F|S STANDARD GUIDELINE

Aquifer Testing

DATE/LAST UPDATE: June 2022

These procedures should be considered standard guidelines and are intended to provide useful guidance when in the field, but are not intended to be step-by-step procedures, as some steps may not be applicable to all projects.

All field staff should be sufficiently trained in the standard guidelines for the sampling method they intend to use and should review and understand these procedures prior to going into the field. It is the responsibility of the field staff to review the standard guidelines with the field manager or project manager and identify any deviations from these guidelines prior to field work. When possible, the project-specific Sampling and Analysis Plan should contain any expected deviations and should be referenced in conjunction with these standard guidelines.

1.0 Scope and Purpose

This standard guideline provides details necessary for conducting constant-rate drawdown (pumping test) and falling-head slug (slug test) tests to assess well performance and collect data to estimate aquifer parameters (i.e., transmissivity, hydraulic conductivity, and storage coefficient). These guidelines are designed to be in accordance with ASTM standard procedures D4050-20 and 4044/4044M-15. Typically, a pumping test is preferred method for estimating aquifer parameters, but a slug test can be used in instances where the hydraulic conductivity of the surrounding geology is low or the test well cannot be pumped.

This standard guideline is intended for basic, short-duration (less than 8 hours) pumping tests utilizing 2”-4” diameter monitoring wells that are typical at cleanup sites. These basic tests are limited by the pumping well diameter, which constrains the choice of pumps and the maximum pumping rate. The relatively low pumping rate and short duration of the tests contribute to relatively low drawdown. Longer duration and higher rate pumping tests may be designed using these principles and other site-specific information. Longer-duration tests (e.g. 24-hour, 72-hour, etc.) may be appropriate for specific data collection goals that require greater aquifer stress, such as testing boundary conditions, supporting a transient numerical model calculation, or other specific design purposes. Longer duration tests include additional considerations including maintaining pump power and monitoring the test overnight that are not considered here.

2.0 Equipment and Supplies

- For a short-duration constant-rate drawdown test:
  - Submersible pump and controller (~1-9 gallons per minute [gpm] range is typically the limit for use in 2" wells; considerably greater rates are possible using 3" diameter pumps if larger diameter wells are available) with extension cord if near an electrical outlet; with battery and appropriate connectors or generator (without GFCI switch) if not near an outlet. The pump should be equipped with a check or foot valve to prevent water from flowing back into the well once the pump is turned off. Rental pumps typically are not equipped with check valves removed so it is important to request one from the equipment vendor.

    OR
  - A peristaltic pump with an internal/external battery and appropriate connectors can be used if a submersible pump is expected to produce excessive drawdown in the pumping well. This method has applicability only to very low-producing wells and should generally be used as a last resort because it provides very limited stress on the aquifer.
  - Poly tubing, garden hose with fittings, or flexible hose with camlock fittings (for use with 3" diameter and larger pumps)
  - Silicone tubing, if using a peristaltic pump
  - In-line "T" setup with two valves for diverting flow (allowing for manual flow measurements), three male barbs, and hose clamps
  - In-line flow gauge (optional, but recommended for more accurate manual flow measurements), rated for expected flow rates
  - Stopwatch, watch, phone, or other time-keeping device that can record elapsed time with seconds accuracy
  - Tube cutters, razor blade, or scissors
  - Graduated 5-gallon buckets, lids, and clamp
  - Adequate purge water containers for the anticipated volume of purge water at the pumping well (i.e., 55-gallon drums, tote tanks, or a water truck) if water is contaminated and must be contained. If water can be discharged to the ground, ensure enough tubing or hose to convey water outside of the recharge zone of the pumping well (i.e., at least 200 feet away and downgradient). Consult the project SAP for detailed information regarding purge water containerization and/or disposal.

- For a slug test:
  - Slug(s) of known volume, typically a solid polyvinyl chloride (PVC) or stainless-steel rod with sufficient weight to sink into the groundwater. The slug diameter should allow for sufficient clearance inside the well to avoid interference with cables as well as prevent the instrument from getting stuck in the well.
  - Rope and/or cord to suspend the slug in the well.
- Water pressure transducer(s) (for pumping tests, sufficient transducers to place into the pumping well and each of its designated observation wells; for slug tests, one transducer for each test if tests are being conducted simultaneously at multiple wells)
- Barometric sensor or data logger (for unvented pressure transducers)
- Transducer cradle and/or USB connector (for transducers suspended by direct-read data cables)
- Field computer with transducer software
- Non-stretch stainless steel or direct-read data cable, crimps, and crimper
- Wire clippers and/or bolt cutter
- Water level meter(s) (for pump tests, sufficient meters to place at the pumping well and each of its designated observation wells; for slug tests, one meter for each test if tests are being conducted simultaneously at multiple wells)
- Tools for opening wells (1/2-inch, 9/16-inch, and 5/8-inch sockets, ratchet, screwdriver)
- Well keys
- Paper towels
- Bailer or pump to drain well box if full of stormwater
- Alconox (or similar decontamination solution), deionized or distilled water, and spray bottles
- Tape measure
- Trash bags
- Shade/rain canopy for inclement weather

Paperwork:

- Field notebook with site maps
- Table of well construction details and/or well logs, if available
- Aquifer testing forms (enclosed)
- Semi log-graph paper for preliminary field aquifer test analyses
- Purge water plan

- Rite-in-the-Rain pens, paper, and permanent markers
- Site-Specific Health and Safety Plan (HASP) and Tailgate Safety Meeting Forms for each day you expect to be on Site
- Sampling and Analysis Plan (SAP)

Safety Equipment:

- PPE:
  - Boots/waders
  - Safety vest
  - Safety glasses
  - Rain gear
  - Nitrile gloves
  - Work gloves
- Traffic barricades or cones
- Vehicle emergency kit (road flares, fire extinguisher, ect.)
- First aid kit

3.0 Standard Procedures

The following sections describe the procedures for conducting pumping and slug tests. Before entering the field, project considerations including testing equipment and key testing parameters should be discussed with the Project Manager. Any deviations from these procedures should be approved by the Project Manager and fully documented.

3.1 TAILGATE SAFETY MEETING

Conduct a tailgate safety meeting prior to beginning work at the Site. The safety meeting should cover the hazards specific to aquifer tests. Typical hazards include:

- Test setup and testing
  - Lifting heavy equipment and buckets
  - Splash hazards from water
  - Sharp blades
  - Electrical hazards when working with exposed battery contacts
  - Electrical and fire hazards when using a portable generator
- Site Hazards
  - Traffic
  - Slips, trips and falls (uneven terrain, wet ground, equipment on site, etc.)
  - Biological (insects, animals, plants)
- Chemical hazards (refer to HASP for Site COCs)

Record the meeting attendees and topics discussed on the front page of the tailgate safety meeting form. All attendees should sign the form.

3.2 PUMPING TEST PROCEDURE

A pumping test involves withdrawing/pumping water at a known rate from a pumping well and measuring the response of the aquifer in at least one observation well, which may be the pumping well. The key phases of a pumping test include baseline measurement, initial drawdown, water level stabilization, and recovery periods. While water pressure transducers are the preferred method of measuring water levels, manual water level measurements should also be recorded to compare against transducer measurements and in the event of any electronic data loss. Raw transducer data from pumping tests may need to be corrected for any applicable changes in atmospheric pressure (in the case of unvented transducers) and/or tidal influence.

The steps below provide general guidelines for conducting a pumping test, but consult the project SAP for key testing parameters, including the necessity of any preliminary tests, measurement intervals, and test duration. Ideally, there will be multiple staff on site for the test; one staff can record initial water level measurements, while the other can verify and record the flow rate.

- Open and inspect all pumping and observation monitoring wells and collect initial water level measurements to the nearest 0.01 foot using a decontaminated depth to water meter. Be sure to note the time of each water level measurement.

- Determine the static water level in all monitoring wells by measuring the depth to water periodically over five minutes and taking the average of the readings, ensuring to record the measurement time for each reading. If possible, leave depth to water meter probes in each well (suspended one to two feet above the static water level) for ease of measurement during the test. Ideally, sufficient water level data should be collected in the hours or days prior to the test to allow for identification of ambient trends.

- Place the decontaminated pump and associated equipment (i.e., external battery, pump controller, and/or generator) next to the pumping well. Make appropriate connections so the pump can be powered on. Connect the appropriate size tubing to the pump and lower it into the well casing to a depth as low as possible that is appropriate for the pump design; check manufacturer recommendations for pump intake placement relative to screened interval. For typical 2” submersible pumps (e.g. Redi-flo 2), the pump can sit approximately two to three feet from the bottom of the well. Using a clamp, secure the tubing and pump power cords to the well casing to ensure they do not shift during the test. Document the estimated depth of the pump placement and connect the pump tubing to an in-line, decontaminated “T” or similar device with valves to divert flow for manual flow rate measurements. Connect a discharge line to the “T” and direct the discharge tubing to a 55-gallon drum or other receptacle to contain the purge water. Set a graduated 5-gallon bucket below the third “T” connection, which can be used for manual flow rate measurements. An in-line flow meter and/or totalizer is preferred and can be installed as part of the “T” setup, and can be used in place of manual measurements once checked for accuracy using manual measurements at test flow rates. This can be done during a step-drawdown test. Note that many pumping setups are possible, but this setup is commonly used in aquifer testing for environmental investigations.

- Program and install decontaminated water pressure transducers in both the pumping and observation wells using stainless-steel, Kevlar, or other non-stretchable cable and crimps. Check transducer specifications for recommended deployment depth range, and allow for anticipated drawdown, particularly in the pumping well. For example, a 5M transducer can measure accurately when submerged up to 5 meters or about 15 feet; the transducer would typically be set above this maximum depth and below the expected maximum drawdown. Within these constraints, leave as much distance as possible between the transducer and the pump to avoid electrical interference that may interfere with data collection. Transducer logging frequency will depend on the expected initial drawdown rate, duration of the test, and datalogger capacity. High frequency (e.g., intervals of 1 second or less) measurements are generally desirable during the first several minutes of a pumping test. After the first few minutes, a minimum recording frequency of 30 seconds is recommended. Transducers may be programmed for logarithmic intervals to avoid collection of too much high-frequency data, but this increases the importance of timing measurement to the start of the test.

- When unvented transducers are used, install a barometric pressure sensor or data logger either in a protected outdoor location at the site (such as an observation well monument) or suspended in one of the observation wells, making sure that it is above the high water point in the monitoring well. The logger can be crimped to the same cord as the transducer or suspended using a separate stainless-steel cord. Barometric pressure logging frequency should be the same as the transducer logging frequency. Only one barometric pressure sensor is needed per site.

- Allow water levels in the pumping well to equilibrate following the addition of the pump and transducer. Conduct a step-drawdown test at the pumping well to establish the sustainable yield, or the pumping rate at which the well water-level remains stable following initial drawdown. A step-drawdown test involves withdrawing water from the pumping well for a short period of time (relative to the planned test) at several different steps while measuring depth to water to establish the sustainable yield. The approximate target pumping rates should be specified in the project SAP. Note the start time of each step, and progressively increase the pumping rate, until the sustainable yield for the pumping well is reached. Conduct each step for a minimum amount of time established in the SAP, which can range from as little as 1 minute to 2 hours, and record water levels in the pumping well at a regular frequency. After the sustainable yield is reached, turn off the pump and allow water level in the pumping well to recover to the pre-step-drawdown test level. Continue to record water levels at regular frequency during the recovery period.

Table 1. Suggested manual depth-to water measurement interval at the pumping well.

Elapsed Time (drawdown or recovery)	Measurement Interval
1 minute	1 second
3 minutes	30 seconds
3 to 15 minutes	1 minute
15 to 60 minutes	5 minutes
1 to 2 hours	10 minutes

2 to 3 hours	2 minutes
3 to 15 hours	1 hour
15 to 60 hours	5 hours

- Conduct a constant-rate drawdown test. After the water level in the pumping well has recovered to the pre-step-drawdown test level, turn on the pump and set the flow rate to the sustainable yield rate discerned in the step above. Note the start time and immediately start recording manual water level measurements at the pumping well according to the recommended frequencies in Table 1. Manual water level measurements should also be collected from observation wells at regular intervals specified in the project SAP. If the project SAP does not specify measurement intervals, monitor observation wells at the same or lower frequency than the pumping well, also considering the observed aquifer response at the pumping well. As shown in Table 1, it is important to collect a high frequency of measurements during the initial drawdown and recovery periods.

- During the initial minute of the pumping test, check the flow rate using either a manual measurement or an in-line flow meter and record it on the field form. Throughout the test, flow rate should be recorded at regular intervals (i.e., every 5 or 10 minutes), and ideally should remain within 5% of the sustainable yield for the duration of the test. Note that pump settings may require adjustment to respond to the decrease in flow rate that accompanies drawdown of the pumping well. The pump will require more power to overcome the increasing head over the course of the test.

- Continue to record water level measurements from the pumping and observation wells as well as flow rate for the duration of the test specified in the SAP, adjusting pump rate, if significant water level deviations are observed following the initial drawdown period. If the pumping rate is equal to the sustainable yield, water levels theoretically should stabilize after an initial period of drawdown in the pumping well. The duration of the drawdown portion of the test will depend on test goals and available time and resources. For basic, short-duration pumping tests which are the focus of this standard guideline, it is common to achieve sufficient water level stabilization within three log cycles to obtain a suitable drawdown and recovery curve to estimate aquifer properties. For tests such as these, therefore, it is recommended that the test be conducted for approximately 100 minutes or until a stable water level is achieved. A preliminary analysis of results can be done to check the test progress using semi-log paper and the time-drawdown Cooper-Jacob straight line method (refer to the solution method for additional details). The length of time should also consider allowing a roughly equivalent period of time for monitoring recovery.

- When the appropriate test duration is reached, turn off the pump, note the stop time, and immediately start recording manual water level measurements at the pumping well according to the recommended frequencies in Table 1. Check to make sure that the pump valve is closed, if applicable, to ensure no backflow into the pumping well. Manual water levels should also be collected at observation wells at regular intervals. Continue to record water levels until the static water level in the pumping well has recovered to within 95% of the pre-pump test water level.

- Remove all equipment from the pumping and observation wells and discard disposable tubing as appropriate. Using the transducer cradle and USB connector, connect the transducers and barometer to a field computer and download data from the duration of the test. Verify that the data has been saved (and backed up) correctly on the field computer before reprogramming and/or redeploying the equipment. Decontaminate field equipment and manage purge water according to the procedures outlined in Sections 4.0 and 5.0, respectively.

3.3 SLUG TEST PROCEDURE

In a slug test, a known volume of water is displaced from a well and the resulting fluctuation of the groundwater level in that well is measured. Note that slug tests may be initiated in many ways including a solid slug (most common) or by pneumatic pressurization. Key phases in a slug test include baseline measurement, initial displacement, and water level stabilization periods. While water pressure transducers are the preferred method of measuring water levels, manual water level measurements should also be recorded to compare against transducer measurements and in the event of any electronic data loss. Raw transducer data from pump tests need to be corrected for any applicable changes in atmospheric pressure and/or tidal influences. Consult the project SAP for test parameters, including measurement intervals and test duration.

- Open and inspect the testing well and collect an initial water level measurement to the nearest 0.01 foot using a decontaminated depth to water meter.

- Determine the static water level in the testing well by measuring the depth to water periodically over five minutes and taking the average of the readings. Leave the depth to water meter probe in the well (suspended one to two feet above the static water level) for measurements during the test. If the monitoring well is 2-inch diameter or smaller, it may be necessary to remove the depth to water probe from the well prior to inserting the slug.

- Program and install a decontaminated water pressure transducer in the testing well using stainless-steel or direct-read data cable (or other non-stretchable) and crimps. Check transducer specifications for recommended deployment depth relative to the anticipated maximum water surface (refer to discussion in pumping test description), ensure the transducer is placed below the slug target depth interval, and securely tie-off or clamp the transducer cable so the instrument will not shift during the test. Logging frequency will depend on the hydraulic conductivity of the material being tested (higher hydraulic conductivity = greater logging frequency), but a minimum measurement interval of 1 second is recommended to capture the detailed aquifer response and recovery to the slug.

- When unvented transducers are used, install a barometric pressure sensor or data logger in either the testing well or a nearby location at the site, making sure that logger in a well is suspended above the high-water point. The logger can be crimped to the same cord as the transducer or suspended using a separate stainless-steel cord. Only one barometric pressure sensor is needed per site.

- Allow water levels in the testing well to equilibrate following transducer installation. Secure end of the rope attached to the slug to a nearby static object (i.e., bollard, tree, IDW drum, or car) to prevent the slug from being lost into the well during the test. As quickly as possible, introduce a decontaminated slug of known volume to the water column until it is completely submerged. Note the time on the field sheet and immediately start taking manual depth to water measurements, noting the time of each reading. It is important to take as many measurements as possible in the early part of the test to accurately define and verify the water level response curve generated by the transducer data. Measurement interval depends on the hydraulic conductivity of the material being tested; material with a high hydraulic conductivity will require more frequent measurements and vice versa. Similar to Table 1, increase the length of time between measurements with increasing test duration, although the exact frequencies of measurement will depend on hydraulic conductivity of the material being tested. Continue measuring and recording depth to water measurements until the water level reaches equilibrium conditions (i.e., within 95% of initial head), which may vary from several minutes to several hours.

- Remove the water level meter, slug, and water pressure transducer and barometer from the well and decontaminate equipment. Using the transducer cradle and USB connector, connect the transducer to a field computer and download data from the duration of the test. Verify that the data has been saved (and backed up) correctly on the field computer before reprogramming and/or redeploying the equipment. Decontaminate field equipment according to the procedures outlined in Section 4.0.

4.0 Decontamination

All reusable equipment that contacts groundwater should be decontaminated using the processes described in this section prior to moving to the next sampling location.

Slug: A solid slug will be decontaminated following removal from wells by spraying the slug and the entire length of cable that encountered groundwater with an Alconox (or similar)/clean water solution followed by a thorough rinse with distilled or deionized water.

Submersible Pump: Decontaminating the pump requires running the pump in three progressively cleaner grades of water.

1. Fill a bucket with approximately 4 gallons or more to sufficiently cover the pump of an Alconox (or similar)/clean water solution. Place the pump and the length of the power cord (if applicable) that was in contact with water into the bucket and run the pump for approximately two minutes or until the volume of water in the bucket has been exhausted.
2. Fill a second bucket containing approximately 4 gallons or more to sufficiently cover the pump of clean water. Place the pump and cord into this bucket and run the pump for approximately two minutes or until the volume of water in the bucket has been exhausted.
3. Fill a third bucket with approximately 4 gallons or more to sufficiently cover the pump of distilled or deionized water. Place the pump and cord into this bucket and run the pump for approximately two minutes or until the volume of water in the bucket has been exhausted.

Transducers: Transducers and associated stainless-steel and/or direct-read data cables will be decontaminated following removal from wells by spraying the transducer and the entire length of cable that encountered groundwater with an Alconox (or similar)/clean water solution followed by a thorough rinse with distilled or deionized water.

Water Level Meters: The water level indicator and tape will be decontaminated between test locations and at the end the day by spraying the entire length of tape that contacted groundwater with an Alconox (or similar)/clean water solution followed by a thorough rinse with distilled or deionized water.

5.0 Investigation-Derived Waste (IDW)

Unless otherwise specified in the project work plan, water generated during groundwater sampling activities will be contained, transported, disposed of in accordance with applicable laws, and stored in a designated area until transported off-site for disposal.

The approach to handling and disposal of these materials for a typical cleanup site is as follows. For IDW that is containerized, such as purge water, 55-gallon drums (or other smaller sized drums) approved by the Washington State Department of Transportation will be used for temporary storage pending profiling and disposal. Each container holding IDW will be sealed and labeled as to its contents (e.g., “purge water”), the dates on which the wastes were placed in the container, the owner’s name and contact information for the field person who generated the waste, and the site name. As pump tests generally yield substantial amounts of purge water, a water/vacuum truck can also be employed to collect and dispose of purge water if a representative sample of the groundwater is available to generate a disposal profile prior to implementing the pump test.

IDW containerized within drums will be characterized relative to applicable waste criteria using data from the sampling locations whenever possible. Material that is designated for off-site disposal will be transported to an off-site facility permitted to accept the waste. Manifests will be used, as appropriate for disposal.

Disposable sampling materials and incidental trash such as paper towels and PPE used in sample processing will be placed in heavy-duty garbage bags or other appropriate containers and disposed of as trash in the municipal collection system.

6.0 Field Documentation

Aquifer test activities will be documented in field sampling forms and/or field notebooks. Information recorded will, at a minimum, include personnel present (including subcontractors or client representatives), purpose of field event, weather conditions, transducer logging frequency, aquifer test start and finish times, depth to water and flow rate measurements, times of depth to water and flow rate measurements, amount of purge water generated, and any deviations from the SAP or this standard guideline. Photographs of the test setup and relevant site conditions should be taken.

7.0 Demobilization

Upon returning to the office, ensure that all equipment is property cleaned and put away in the field room. Equipment with rechargeable batteries should be plugged in as appropriate. It is preferable to dispose of trash on-site, but any trash left in the field vehicle should be brought upstairs, labeled, and placed in the front production room for building staff to dispose of.

If rented equipment or sample coolers will be placed at the front desk for pickup, clearly label each item with the company picking it up, anticipated pickup time frame, and your contact information so front desk staff can contact you if there are any questions. Notify front desk staff if any items require a signature at pickup.

Within one week of returning from the field, the field lead for the event should review field notes, sampling forms, and tailgate safety meeting forms with the PM. Following PM review and approval, field notes will be scanned and saved to the project folder. Hard copies should be filed. The PM will provide copies of near miss and incident reports to the Health and Safety Administrator.

8.0 References

American Society for Testing and Materials (ASTM). 2020. *Standard Test Method for (Field Procedure) for Withdrawal and Injection Well Testing for Determining Hydraulic Properties of Aquifer Systems*. Designation: D4050−20. 15 May.

_____. 2021. *Standard Test Method for (Field Procedure) for Instantaneous Change in Head (Slug) Tests for Determining Hydraulic Properties of Aquifers*. Designation: D4044/D4044M-15. 6 January.

Washington State Department of Ecology (Ecology). 2020. *Aquifer Test Procedures*. Water Resources Program. Publication 20-11-093. October.

U.S. Environmental Protection Agency (USEPA). 1993. Suggested Operating Procedures for Aquifer Pumping Tests. EPA/540/S-93/503. February.

_____. 1994. Slug Test Guidance. SOP#: 2046. 3 October.

Enclosures: Pumping Test Field Form

Slug Test Field Form

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F|S STANDARD GUIDELINE:
Special Condition

Tidally Influenced Sites

DATE/LAST UPDATE: November 2018

Standard Guideline(s) this Special Condition may be appended to include:

1. Soil Logging
2. Well Construction
3. Low-Flow Groundwater Sample Collection
4. Groundwater Sample Collection with a Submersible Pump
5. Groundwater Sample Collection with a Direct-Push Drill Rig

These procedures should be considered standard guidelines and are intended to provide useful guidance when in the field, but are not intended to be step-by-step procedures, as some steps may not be applicable to all projects.

All field staff should be sufficiently trained in the standard guidelines and special conditions for the sampling method they intend to use and should review and understand these procedures prior to going into the field. It is the responsibility of the field staff to review the standard guidelines and special conditions with the field manager or project manager and identify any deviations from these guidelines prior to field work. When possible, the project-specific Sampling and Analysis Plan should contain any expected deviations and should be referenced in conjunction with these standard guidelines and special conditions.

1.0 Special Condition Applicability

This Special Condition applies to sites that are immediately adjacent to or within close proximity to tidally influenced waterways.

It presents protocols for field measurements and field equipment that should be used to obtain representative data at tidally influenced sites. Field measurements to determine salinity and tidal influence are also important for determining groundwater potability. Additional considerations for laboratory analysis of samples collected at tidally influenced sites should be addressed in a site-specific sampling and analysis plan/quality assurance project plan (SAP/QAPP) that is tailored to the particular data needs for the site.

2.0 Equipment and Supplies

In addition to the equipment outlined in the applicable Standard Guidelines, the following equipment is necessary:

- Equipment to measure salinity, total dissolved solids (TDS), or conductivity, which include any of the following:
  - Refractometer (measures salinity directly).
  - Handheld water quality meter or multiparameter water quality meter capable of measuring salinity or TDS and manufacturer-provided calibration solution (measures salinity or TDS directly).
  - Handheld water quality meter or multiparameter water quality meter capable of temperature-corrected conductivity (used to calculate salinity) and manufacturer-provided calibration solution. If the meter does not display temperature-corrected conductivity, a means of measuring temperature (multi-meter that displays temperature or thermometer) is also necessary.
- Tide prediction chart(s) for the nearest observation station to the site

3.0 Special Condition Guidelines and/or Procedures

At all tidally influenced sites, the field staff should familiarize themselves with the daily predicted tide elevations for the closest tide station in order to complete or phase shoreline site work according to tidal conditions specified in the SAP/QAPP (i.e., at high tide or low tide). If there is a known lag time between low tide and the lowest tidally influenced effects at the shoreline at a Site, this tide lag should additionally be accounted for when scheduling shoreline work. In general, it is preferable to collect soil and groundwater samples nearest to the shoreline at low tide or in the 1–3 hours immediately after low tide to minimize the effects of tidal influence such as matrix interference that causes false positive detections for metals. Specific considerations for soil logging, well construction, and groundwater sampling when adjacent to a tidally influenced waterway are presented in the following sections.

3.1 SOIL LOGGING

When logging soil at sites with potential tidal influence, perform field screening to measure salinity and determine the tidally influenced smear zone using the procedures in the following sections.

3.1.1 Determination of Salinity

When groundwater is encountered during drilling or test pit excavations, collect groundwater samples for field screening of salinity, TDS, or conductivity using the equipment listed above and consistent with the site-specific SAP. Groundwater samples for field screening can be collected using one of the following methods.

1. Collect a groundwater sample from the drill casing or a retractable screen or directly from a test pit using a peristaltic pump or disposable bailer. This method is preferred because the water sample can be used directly for measurement without further processing.
2. Collect a sample of saturated soil from the recovered soil core or test pit. Place the sample in a volumetric flask and record the soil volume. Dilute with *distilled* water to create a sufficient volume for measurement; if possible, try to add less than twice the soil volume to avoid overly diluting the sample. Record the solution volume and use the ratio of soil sample volume to solution volume to apply a dilution factor to the measured TDS, salinity, or conductivity. This method is less preferable because it requires additional mathematical steps to calculate the in-situ values. Refer to Equations for Salinity Calculation (enclosed) for equations to calculate in situ values from diluted samples.

Field procedures for measurement of salinity, TDS, or conductivity using the equipment listed above are as follows:

1. Measure salinity with a refractometer: Lift the protective cover of the angled lens and place a few drops of water onto the lens. Close the lid and peer through the eyepiece. Record the salinity result that appears along a scale within the eyepiece. Rinse the lens with distilled water and pat dry with a clean cloth between readings.
2. Measure salinity or TDS with a water quality meter: Place the water sample in a jar large enough to hold the meter. Submerge the sensors and allow salinity or TDS to stabilize (generally 30 seconds or less), then record the salinity or TDS reading. Rinse the sensors with distilled water between readings.
3. Measure conductivity: Place water sample in a jar large enough to hold the conductivity meter and other measuring devices, if using. Allow conductivity to stabilize (generally 30 seconds or less), then record temperature-corrected conductivity or conductivity and temperature. Calculate salinity using the equations provided in Equations for Salinity Calculation (enclosed). Rinse the meter between readings.

If collecting field screening samples in soil or groundwater, take the same measurements from the adjacent waterway for direct comparison. The general classifications of water based on salinity or TDS, assuming salinity and TDS are primarily influenced by tidal fluctuation and are therefore roughly equivalent, are as follows:

- Fresh: <1,000 milligrams per liter (mg/L), or <1 part per thousand (ppt)
- Brackish: 1,000 to 10,000 mg/L, or 1 to 10 ppt
- Saline: >10,000 mg/L, or >10 ppt

Tidal influence is assumed when groundwater has a salinity or TDS measurement greater than freshwater (i.e., > 1 ppt). If the adjacent water body is brackish (i.e., tidally influenced river), the salinity or TDS effect from tidal influence may be more subtle and can be evaluated by comparing these values in shoreline locations relative to locations farther upland.

If apparent tidal influence based on field measurements is encountered at locations where it is not expected (i.e., farther upland), field staff should consult the SAP/QAPP and contact the project manager. Additional soil or groundwater samples may be necessary for laboratory analysis to determine the potential for matrix interference due to salinity.

3.1.2 Determination of Tidally Influenced Smear Zone

When sampling at tidally influenced sites with the potential for light non-aqueous phase liquid (LNAPL) contamination such as petroleum, field staff should also be familiar with the average tidal fluctuations, which can cause the smear zone to be thicker closer to the shoreline. Record the estimated top and bottom depths of the smear zone based on field indications of contamination.

3.2 WELL CONSTRUCTION AND GROUNDWATER SAMPLE COLLECTION

Well locations with potential elevated groundwater salinity due to tidal influence should be identified during soil logging as described above. Permanent wells in locations with the potential for tidal influence should be installed with non-corrosive materials such as PVC.

When collecting groundwater samples within the area of potential tidal influence, record the predicted tide elevation, as well as the time, depth to water, conductivity, pH, temperature, and salinity/TDS (if reported by the water quality meter) during purging. Additional parameters to evaluate salinity (such as analytical data) may be specified in the site-specific SAP. Groundwater samples should be collected at the tide-stage specified in the site-specific SAP, typically at low tide to minimize salinity interference and accounting for tide lag if this information is known.

4.0 Field Documentation

Record field observations and measurements of tidal influence as described in the above sections on the appropriate field log forms or in the project field book.

Enclosure: Equations for Salinity Calculation

Equations for Salinity Calculation

Equation 1: Calculate in situ salinity, total dissolved solids (TDS), or conductivity from a diluted sample (use when taking measurements of a soil sample that has been diluted in distilled water for field screening).

$$C_1 = C_2 * (V_2/V_1)$$

where:
C_1 = in situ salinity, TDS, or conductivity
C_2 = diluted screening sample salinity, TDS, or conductivity
V_1 = volume of soil sample
V_2 = volume of soil sample plus distilled water added to dilution

Equation 2: Calculate temperature-corrected conductivity (use to correct conductivity measurements to a reference temperature of 25 °C when using a conductivity meter that is not temperature-corrected; rule of thumb using a temperature variation coefficient of 2%).

$$C_{25} = C / (1+ 0.02 * (T-25))$$

where:
C_{25} = corrected conductivity at reference temperature of 25 °C
C = conductivity of sample
T = temperature of sample

Equation 3: Calculate salinity from conductivity at reference temperature of 25 °C (rule of thumb for average seawater).

$$S = C^{1.0878} * 0.4665$$

where:
S = salinity (in parts per thousand)
C = conductivity at 25 °C (in microsiemens per centimeter)

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F|S STANDARD GUIDELINE

Shallow Soil Sample Collection

DATE/LAST UPDATE: May 2015

These procedures should be considered standard guidelines and are intended to provide useful guidance when in the field, but are not intended to be step by step procedures, as some steps may not be applicable to all projects.

All field staff should be sufficiently trained in the standard guidelines for the sampling method they intend to use and should review and understand these procedures prior to going into the field. It is the responsibility of the field staff to review the standard guidelines with the field manager or project manager and identify any deviations from these guidelines prior to field work. When possible, the project-specific Sampling and Analysis Plan should contain any expected deviations, and should be referenced in conjunction with these standard guidelines.

1.0 Scope and Purpose

This standard guideline presents commonly used procedures for the manual collection of shallow soils by means of scoop, trowel, shovel, or hand auger. The guideline is intended to be used by field staff who collect shallow soil samples in the field. Shallow is typically defined as ground surface to approximately 4 feet below ground surface (bgs).

It is important that the field staff completing the soil sample collection discusses the specific needs for a particular investigation with the project geologist, the project manager, or whoever will ultimately be responsible for interpreting the findings of the field investigation. This discussion is in addition to the field training and general knowledge about soil sampling, and should happen prior to entering the field, with additional follow-up before finalizing the field forms, after the investigation is complete.

2.0 Equipment and Supplies

Soil Sampling Equipment and Tools:

- Tape measure or measuring wheel
- Shovel or trowel
- Hand auger (typically used for sample depths > 2 and < 4 feet; an extension can be used if conditions allow deeper sample collection using this method)
- Stainless steel bowls and spoons
- Graduated plunger and collection tubes for volatile organic carbon (VOC) samples (if needed)
- Trash bags and plastic sheeting (if necessary)
- Decontamination tools including:
    - Paper towels
    - Spray bottles of alconox (or similar) solution
    - Deionized or distilled water
- Camera
- Hand-held global position system (GPS; optional)
- Coolers, sample jars, labels, ice

Paperwork:

- Work Plan and/or Sampling and Analysis Plan/Quality Assurance Project Plan (SAP/QAPP)
- Health and Safety Plan (HASP)
- Sample collection forms printed in Rite in the Rain paper, or Rite in the Rain field notebook

Personal Equipment:

- Steel-toed boots
- Safety vest
- Safety glasses
- Nitrile gloves
- Rain gear
- Work gloves

3.0 Standard Procedures

3.1 OFFICE PREPARATION

Prior to going into the field, review the SAP/QAPP tables to become familiar with the desired sample locations and depth intervals. Note any locations that may be covered by pavement and arrange for these locations to be pre-cored or cored on the day of sampling.

At least one week prior to sampling, coordinate with the laboratory specified in the SAP/QAPP to get coolers and appropriate sample containers. Familiarize yourself with the volume requirements and container types, preservation methods and holding times for each class of analytes.

3.2 SAMPLING

1. Locate the desired sample location, using a handheld GPS or by taking field measurements from known site features. Remove surface coverings such as pavement, vegetation, gravel, or landscape materials.
2. Dig or auger to the bottom depth of the shallowest sample to be collected, using a tool that has been cleaned and decontaminated. Verify that the target depth has been reached using a measuring tape.
3. If using a scoop or trowel, collect the soil in a decontaminated stainless steel bowl; if using a shovel, the soil may either be collected in bowls or set aside on plastic sheeting in favor of scraping the sides of the shovel hole to collect the sample. Any soil from depth intervals that are not targeted for sampling should be set aside on plastic sheeting. If using a hand auger, it may be necessary to empty the hand auger onto plastic sheeting, or into a bowl, in order to reach the target depth without overflowing the sampler.
4. If collecting soil samples for VOC analysis by the U.S. Environmental Protection Agency (USEPA) Method 5035, collect these samples from the undisturbed soil, if practical; VOC samples may also be collected from the base or sides of a shovel hole.
5. Note the soil types encountered at each target depth, changes in lithology, and any other observations or indications of contamination on a soil sample collection form or in a field notebook. Detailed procedures for soil classification using the Unified Soil Classification System (USCS), if needed, are provided in the Soil Logging Standard Guideline. Take photographs to document soil type and sample location.
6. Homogenize the soils that have been collected into a bowl, or use a decontaminated or disposable scoop to scrape soil from the shovel hole at the desired depth interval and then homogenize these soils.

7. Fill the required laboratory-provided jars, taking care not to overfill. If large gravels (diameter greater than ~ 1 inch) are encountered, these should be discarded to ensure that an adequate soil volume is collected for analysis. Use a clean paper towel to remove soil particles from the threaded mouth of the jar before securing lids to ensure a good seal.
8. Label each jar with the sample name, date, time, sampler initials and required analyses. If collecting a field duplicate, use the sample nomenclature specified in the work plan and note the field duplicate name and sample time in the sample log. If collecting extra volume for matrix spike/matrix spike duplicate (MS/MSD) analysis, use the same name on all jars. Soil samples should be protected from moisture by placing the filled sample jars into separate sealed Ziploc bags before placing them into a cooler containing ice.
9. Complete a chain-of-custody form for all samples, including sample names, date and time of collection, number of containers, and required analyses and methods. Keep samples on ice to maintain temperatures of 4-6 degrees Celsius (°C) and transport to the laboratory under chain of custody procedures.

4.0 Decontamination

All reusable equipment that comes into contact with soil should be decontaminated as follows prior to moving to the next sampling location.

Stainless steel bowls and spoons, shovels, trowels, hand augers and any other tools used for sample processing will be decontaminated between each sample; alternatively, disposable bowls and spoons may be used. Equipment decontamination will consist of a tap water rinse to remove soil particles, followed by scrubbing with brushes and an alconox (or other soap)/clean water solution and a final rinse with distilled or deionized water.

5.0 Investigation-Derived Waste

Unless otherwise specified in the project work plan, the excavated shallow soils should be used to backfill the hole and restore the grade to the surrounding ground surface. Waste soil that cannot be used to backfill the hole should be placed in 55-gallon drums approved by the Washington State Department of Transportation (WSDOT) for temporary storage pending profiling and disposal. Each container holding investigation-derived waste (IDW) will be sealed and labeled as to its contents (e.g., “soil”), the dates on which the wastes were placed in the container, the owner’s name and contact information for the field person who generated the waste, and the site name.

IDW that is placed into drums for temporary storage will be characterized relative to applicable waste criteria using data from the sampling locations whenever possible. Material that is designated for off-site disposal will be transported to an off-site facility permitted to accept the waste. Manifests will be used, as appropriate for disposal.

Disposable sampling materials and incidental trash such as paper towels and personal protective equipment (PPE) used in sample processing will be placed in heavy duty garbage bags or other appropriate containers and disposed of as solid waste in the municipal collection system (i.e., site Dumpster).

6.0 Field Documentation

All observations including sample collection locations, soil descriptions, sample depths, and sample collection times should be recorded on a soil sample collection form or in a bound field notebook. Information recorded should additionally include personnel present (including subcontractors), purpose of field event, weather conditions, sample collection date and times, sample analytes, and any deviations from the SAP.

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F|S STANDARD GUIDELINE

Soil Sample Collection

DATE/LAST UPDATE: October 2019

These procedures should be considered standard guidelines and are intended to provide useful guidance when in the field, but are not intended to be step by step procedures, as some steps may not be applicable to all projects.

All field staff should be sufficiently trained in the standard guidelines for the sampling method they intend to use and should review and understand these procedures prior to going into the field. It is the responsibility of the field staff to review the standard guidelines with the field manager or project manager and identify any deviations from these guidelines prior to field work. When possible, the project-specific Sampling and Analysis Plan should contain any expected deviations and should be referenced in conjunction with these standard guidelines.

1.0 Scope and Purpose

This standard guideline presents commonly used procedures for collection of soil samples for characterization and laboratory analysis. The methods presented in this guideline apply to the collection of soil samples during the following characterization activities: soil borings via drilling, manual collection of shallow soil samples, test pit excavation, excavation confirmation, and stockpile characterization. Specific details regarding the collection of discrete and composite samples, and special sampling techniques for volatile organic compounds (VOCs) are also included. The guideline is intended to be used by staff who collect soil samples in the field.

It is important that the field staff completing the soil sample collection discusses the specific needs for a particular investigation with the project geologist, the project manager, or whoever will ultimately be responsible for interpreting the findings of the field investigation. This discussion is in addition to field training and general knowledge about soil sampling, and should happen prior to entering the field, with additional follow-up before finalizing the field forms, after the investigation is complete.

2.0 Equipment and Supplies

Soil Sampling Equipment and Tools:

- Tape measure or measuring wheel
- Stainless steel bowls and spoons
- Graduated plunger and collection tubes for VOC samples (if needed)
- Trash bags
- Decontamination tools including:
  - Paper towels
  - Spray bottles of alconox (or similar) solution
  - Deionized or distilled water
- Adhesive drum labels, or paint or grease pen
- Washington State Department of Transportation- (WSDOT) approved drums for investigation-derived waste (IDW) disposal, if needed (if drilling, to be provided by driller)
- Camera
- Hand-held global position system (GPS; optional)
- Coolers, sample jars, labels, ice

Paperwork:

- Work Plan and/or Sampling and Analysis Plan/Quality Assurance Project Plan (SAP/QAPP)
- Health and Safety Plan (HASP)
- Sample collection forms printed in Rite in the Rain paper, or Rite in the Rain field notebook

Personal Equipment:

- Steel-toed boots
- Safety vest
- Safety glasses
- Nitrile gloves
- Rain gear
- Work gloves

3.0 Standard Procedures

3.1 OFFICE PREPARATION

Prior to going into the field, review the SAP/QAPP tables to become familiar with the desired sample intervals, nomenclature, field Quality Assurance (QA) samples, analytes, sample containers, and holding times for each analytical method.

At least one week prior to sampling, coordinate with the laboratory specified in the SAP/QAPP to get coolers and appropriate sample containers. Familiarize yourself with the volume requirements and container types, preservation methods, and holding times for each class of analytes.

3.2 GENERAL SOIL SAMPLE COLLECTION PROCEDURES

1. Locate the desired sample location and depth interval using a handheld GPS or by taking field measurements from known site features. Note the soil type and any other observations or indications of contamination on a soil boring log (enclosed), soil sample collection form or field notebook, as described in the Soil Logging Standard Guideline. Note the location and depth of the sample and take a photograph, if possible.
2. Refer to subsections 3.2.1 through 3.2.4 for the appropriate soil collection procedures for drilling, shallow soil, test pit excavation, excavation confirmation, and stockpiles. If collecting samples for VOC analysis by the U.S. Environmental Protection Agency (USEPA) Method 5035, refer to Section 3.3 for specific sample collection procedures for this method. If composite soil sampling is recommended, refer to Section 3.4 for details.
3. Once soil has been collected from the desired depth or interval, mix thoroughly until the sample is homogenous in color, texture, and moisture.
4. Fill the required laboratory-provided jars, taking care not to overfill. If large gravels (diameter greater than ~ 1 inch) are encountered, these should be discarded to ensure that an adequate soil volume is collected for analysis. If necessary, use a clean paper towel to remove soil particles from the threaded mouth of the jar before securing lids to ensure a good seal.
5. Label each jar with the sample name, date, time, field staff initials and required analyses. If collecting a field duplicate, use the sample nomenclature specified in the work plan and note the field duplicate name and sample time in the sample log. If extra volume for matrix spike/matrix spike duplicate (MS/MSD) analysis is being collected, use the same name on all jars. Soil samples should be protected from moisture by placing the filled sample jars into separate sealed Ziploc bags before placing them into a cooler.

6. Complete a chain-of-custody form for all samples, including sample names, date and time of collection, number of containers, and required analyses and methods. Keep samples on ice to maintain temperatures of 4-6 degrees Celsius (°C) and transport to the laboratory under chain-of-custody procedures.

3.2.1 Soil Sample Collection via Drilling

These procedures should be used for drilling via direct-push, hollow stem auger, or roto-sonic methods where a pre-designated sample interval (i.e. 0 to 5 feet below ground surface [bgs]) is retrieved from the subsurface using a split spoon sampling device, lined core, or bag sampler.

1. Ensure that reusable sampling equipment has been thoroughly decontaminated prior to sampling.
2. Use a stainless steel spoon or trowel, or disposable scoop to remove an equal volume of soil across the targeted depth interval from the sampler.
   a. If using a split spoon sampler or other reusable sampler, avoid collecting the soil that is touching the sides of the sampler to the extent practical.
   b. If the soil touching a reusable sampler must be collected to obtain adequate volume for analysis, notify the PM and record in the field logbook.

3.2.2 Manual Collection of Shallow Soil Samples

These procedures should be used for shallow soil sampling via scoop, trowel, shovel, or hand auger.

1. Dig or auger to the bottom depth of the shallowest sample to be collected, using a tool that has been cleaned and decontaminated. Verify that the target depth has been reached using a measuring tape.
2. If using a scoop or trowel, collect the soil directly into a decontaminated stainless steel bowl.
3. If using a shovel, the soil may either be collected in bowls or set as aside on plastic sheeting in favor of collecting the sample from the sidewall of the hole. If sampling the sidewall, use a decontaminated or disposable scoop or trowel to collect soil from the target depth, or scrape along the sidewall to collect soil across a target depth interval. Transfer soil to a decontaminated stainless steel bowl, repeating until a sufficient volume has been collected.
4. If using a hand auger, empty the cylinder of the auger directly into a decontaminated stainless steel bowl. It may be necessary to empty the hand auger onto plastic sheeting or into a bowl in order to reach the target depth without overflowing the sampler.
5. Any soil from depth intervals that are not targeted for sampling should be set aside on plastic sheeting and returned to the hole after sampling.

3.2.3 Sample Collection from Test Pits or Limited Soil Excavations

These procedures should be used for collecting samples from test pit explorations excavated using a back hoe or excavator. These same general procedures should also be followed for post-excavation soil samples used to confirm that an excavation has removed contaminated material or to document post-excavation conditions after target excavation limits have been reached.

1. Measure the length, width, and depth of the test pit or excavation area to verify that the target extents have been reached. The lateral spacing of the test pit or excavation confirmation samples, or exact location of samples should be specified in the work plan and typically depend on the size of the excavation area but can vary significantly from project to project.
2. If not specified in the work plan, sidewall samples may be collected either midway between the ground surface and base of the excavation, or incrementally along the entire height of the sidewall. Both sidewall and base (bottom) samples should penetrate a minimum of 6 inches beyond the excavated surface.
3. If the test pit or excavation is less than 4 feet deep, or has been benched to accommodate safe entry, a sample may be collected directly from the sidewall(s). To collect soil from a sidewall, use a decontaminated or disposable scoop, trowel, or shovel to obtain soil from the desired depth or depth interval directly into a decontaminated stainless steel bowl.
4. If a test pit or excavation cannot be safely entered, instruct the excavator operator to scoop sidewall material from the target depth or depth interval. Collect the soil sample from the excavator bucket using a decontaminated stainless steel spoon, trowel, or disposal scoop, avoiding material that has come into contact with the teeth or sides of the bucket. Place an adequate volume of soil into a decontaminated stainless steel bowl. If necessary, follow the compositing procedures in Section 3.4.

3.2.4 Stockpile Sampling

These procedures should be used for classifying stockpiled soil, including excavated soil and imported backfill material.

1. Where potentially contaminated soils have been previously excavated and stockpiled on site, Washington State Department of Ecology (Ecology) guidance recommends using a decontaminated or disposable scoop or trowel, penetrating 6 to 12 inches beneath the surface of the pile at several locations until sufficient volume for analysis is achieved. A decontaminated shovel may also be used to facilitate collection of soil from large piles. The locations for soil collection should be where contamination is most likely to be present based on field screening (i.e. staining, odor, sheen, or elevated photoionization detector [PID] readings). If there are not field indications of contamination, the locations should be distributed evenly around the stockpile.

2. The stockpile may need to be broken up into sections for sample collection depending on the size of the pile (i.e., segregate the pile in half or quarters). If this is necessary, it is important to document where each set of samples were collected from (i.e., north quadrant) and create a field sketch of the pile for reference.
3. If a sampling frequency is not specified in the work plan, the general rule of thumb for contaminated soil stockpile profiling is to collect and submit 3 analytical samples (these samples can be multi-point composites or grabs) for stockpiles less than 100 cubic yards (CY), 5 samples for stockpiles between 100 and 500 CY, 7 samples for stockpiles 500 to 1,000 CY, 10 samples for stockpiles 1,000 to 2,000 CY, and 10 samples for stockpiles larger than 2,000 CY with an additional sample collected for every 500 CY of material. This rule of thumb is consistent with Ecology guidance for site remediation.
4. Samples for characterization of stockpiles of imported backfill or other presumed clean material should also be collected as described above. If not described in the work plan, the typical sample frequency for imported or clean material characterization is one sample per 500 CY.

3.3 SOIL SAMPLE COLLECTION FOR VOC ANALYSIS

If collecting soil samples for VOC analysis by USEPA Method 5035, collect these samples first before disturbing the soil. This method uses a soil volume gauge fitted with a disposable soil sampling plunger tube to collect a soil plug that can be discharged directly to a VOA vial, limiting the loss of volatiles during sampling. The collection of VOC samples using the 5035 method specifies use of an airtight VOA vial with a septum lid. Ecology's interpretation of the USEPA 5035 method allows for field preservation of the sample with methanol or sodium bisulfate, or laboratory preservation (i.e. field collection into an un-preserved vial). It is important to note that if laboratory preservation is the selected method, samples must be received at the laboratory within 48-hours of sample collection. The method of sample preservation for the 5035 method will vary for each site and is dependent on site-specific conditions. Preservation method selection should be coordinated with the laboratory and specified in the sampling plan.

1. Note the volume of soil needed for analysis as specified by the laboratory (commonly 5 or 10 grams). Raise the handle of the soil volume gauge to the slot in the gauge body corresponding to the desired volume and turn clockwise until the tabs in the handle lock into the slot.
2. Insert a sample tube at the open end of the gauge body and turn clockwise until the tabs on the tube lock into the "0 gram" slot. Remove the cap from the sample tube and press directly (where possible) into the shallow soil, soil core/sampler, excavation base or sidewall, or stockpile.
3. Continue pressing the sample tube until the plunger is stopped by the sample volume gauge. If a depth interval (for example 9 to10 feet) is targeted for VOC sampling, collect small volumes of soil across this interval until the sample tube is filled

4. Twist counterclockwise to disengage the sample tube, then depress the plunger to eject the soil plug directly into a laboratory-provided VOA vial. If multiple vials per sample are required, the same plunger may be re-used to fill the remaining vials.

3.4 COMPOSITE SAMPLE COLLECTION

For this guideline, composites are considered to be samples that are collected across more than one location, or multiple depth intervals at a single location. Samples collected over continuous depth intervals within a sampling device (i.e. split spoon) are addressed for each sampling method in Section 3.2 above.

Compositing of sample material may be performed in the field, or by the analytical laboratory. To collect a field composite sample, identify the locations and depth(s) that will comprise the composite. Collect soil from the first target sub-sample depth or depth interval and hold in a decontaminated stainless steel bowl, covered with aluminum foil to prevent cross contamination and label with the location and depth. Continue to collect and hold individual sub-samples until all components of the composite have been collected, then transfer an equal amount of each sub-sample to a clean bowl and homogenize. Fill necessary sample jars from homogenized composite. In some cases, project plans may require that each individual sample that comprised the composite be collected in jars and submitted to the laboratory in the event that individual sample analysis is desired, or if laboratory compositing is requested in addition to field compositing as a field quality control measure. In this case, label each individual jar, but indicate HOLD on the chain-of-custody, and note that the sample is part of composite XYZ.

To collect a laboratory composite sample, collect, and label each sub-sample using the procedures described above in Section 3.2. Record each sub-sample on the chain-of-custody form, and indicate on this form which samples should be composited by the laboratory and the desired name of the composite sample. It is important to communicate to the laboratory if discrete samples will also require analysis (in some cases) or only the composite sample.

4.0 Decontamination

All reusable equipment that comes into contact with soil should be decontaminated prior to moving to the next sampling location.

Stainless steel bowls and spoons, and any tools used for sample processing will be decontaminated between each sample; alternatively, disposable bowls and spoons may be used. Equipment decontamination will consist of a tap water rinse to remove soil particles, followed by scrubbing with brushes and an alconox (or other soap)/clean water solution and a final rinse with distilled or deionized water.

5.0 Investigation-Derived Waste

Unless otherwise specified in the project work plan, waste soils will be contained, transported, disposed of in accordance with applicable laws, and stored in a designated area until transported off-site for disposal.

The approach to handling and disposal of these materials is as follows. For IDW that is containerized, such as waste soils, 55-gallon drums approved by WSDOT will be used for temporary storage pending profiling and disposal. Each container holding IDW will be sealed and labeled as to its contents (e.g., “soil”), the dates on which the wastes were placed in the container, the owner’s name and contact information for the field person who generated the waste, and the site name.

IDW that is placed into drums for temporary storage will be characterized relative to applicable waste criteria using data from the sampling locations whenever possible. Material that is designated for off-site disposal will be transported to an off-site facility permitted to accept the waste. Manifests will be used, as appropriate for disposal.

Disposable sampling materials and incidental trash such as paper towels and personal protective equipment (PPE) used in sample processing will be placed in heavy duty garbage bags or other appropriate containers and disposed of as solid waste in the municipal collection system (i.e., site Dumpster).

6.0 Field Documentation

All observations including sample collection locations, soil descriptions, sample depths, collection times, analyses, and field QC samples should be recorded on a boring log, soil sample collection form, or bound field notebook. Information recorded should additionally include personnel present (including subcontractors), purpose of field event, weather conditions, sample collection date and times, sample analytes, and any deviations from the SAP.

Enclosures: Boring Log

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PROJECT:		LOCATION:	BORING ID:
LOGGED BY:		COORDINATE SYSTEM:	
DRILLED BY:		NORTHING:	EASTING:
DRILLING EQUIPMENT:		GROUND SURFACE ELEVATION:	
DRILLING METHOD:		TOTAL DEPTH (ft bgs):	DEPTH TO WATER (ft bgs):
SAMPLING METHOD:		BORING DIAMETER:	DRILL DATE:

Depth (feet)	USCS	Description	Drive	Recovery	# of Blows	PID (ppm)	Sample ID
0							

ABBREVIATIONS:
ft bgs = feet below ground surface
USCS = Unified Soil Classification System
ppm = parts per million
▼ = denotes groundwater table

NOTES:

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PROJECT:		LOCATION:	BORING ID:
LOGGED BY:		COORDINATE SYSTEM:	
DRILLED BY:		NORTHING:	EASTING:
DRILLING EQUIPMENT:		GROUND SURFACE ELEVATION:	
DRILLING METHOD:		TOTAL DEPTH (ft bgs):	DEPTH TO WATER (ft bgs):
SAMPLING METHOD:		BORING DIAMETER:	DRILL DATE:

Depth (feet)	USCS	Description	Drive	Recovery	# of Blows	PID (ppm)	Sample ID

ABBREVIATIONS:
ft bgs = feet below ground surface
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USCS = Unified Soil Classification System
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NOTES:

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F|S STANDARD GUIDELINE

Soil Logging

DATE/LAST UPDATE: October 2019

These procedures should be considered standard guidelines and are intended to provide useful guidance when in the field, but are not intended to be step by step procedures, as some steps may not be applicable to all projects.

All field staff should be sufficiently trained in the standard guidelines and should review and understand these procedures prior to going in the field. It is the responsibility of the field staff to review the standard guidelines with the field manager or project manager and identify any deviations from these guidelines prior to field work. When possible, the project-specific Sampling and Analysis Plan should contain any expected deviations and should be referenced in conjunction with these standard guidelines.

1.0 Scope and Purpose

These soil logging standard guidelines should be used by the field staff performing subsurface investigations, such as a direct push or roto-sonic soil boring, installation of a monitoring well via hollow stem auger, or roto-sonic or mud rotary drilling. While many projects will not necessarily have a Licensed Geologist (LG) or Hydrogeologist (LHG) who reviews and stamps every boring log, it is important that the field staff discusses the soil logging needs for a particular investigation with the project geologist, the project manager, or whoever will ultimately be responsible for interpreting the findings of the field investigation. This discussion is in addition to field training and general knowledge about soil logging, and should happen prior to entering the field, with additional follow-up before drafting a final set of electronic logs, after the investigation is complete.

2.0 Equipment and Supplies

Logging Equipment and Tools:

- 100-foot tape measure or measuring wheel
- Handheld Global Positioning System (GPS; optional)
- Unified Soil Classification System (USCS) Soil Classification Field Guide
- Soil logging kit containing:

- Stainless steel spoons
- Paint scraper or trowel
- Small Ziploc bags
- Small stainless steel bowls or black mining pans for sheen testing
- Spray bottle filled with water
- Paper towels (preferably white)
- Engineers tape
- Note cards
- Optional items include:
  - Empty VOA vials or small glass jars
  - Munsell color chart
  - Sieves
  - White and grayscale color cards for photographs

- Plastic sheeting and duct tape or clamps to cover the sampling table
- Camera
- Trash bags
- Coolers
- Jars
- Labels
- Ice

Paperwork:

- Work Plan and/or Sampling and Analysis Plan (SAP)/Quality Assurance Project Plan (QAPP)
- Health and Safety Plan (HASP)
- Copies of figures showing previous boring locations and boring logs from previous investigations, if available
- Boring log forms (enclosed) appropriate for drilling method, printed in Rite in the Rain paper and/or bound field notebook
- Permanent markers and pencils

Personal Equipment:

- Steel-toed boots
- Hard hat
- Safety vest

- Safety glasses
- Nitrile gloves
- Ear plugs
- Rain gear
- Work gloves

3.0 Standard Procedures

3.1 OFFICE PREPARATION

First, meet with the project manager or field manager to identify the key information and goals of the soil boring investigation. These may include fill history, known or suspected sources of contamination and potential field indications of these contaminants, identification of specific units, or important geotechnical measurements. If possible, select a boring log template that is appropriate for the project needs.

Next, review the work plan and all available existing materials such as cross-sections or boring logs from previous investigations to familiarize yourself with the site geology. In addition (or alternatively if other information is not available), you may also review a geologic map of the area from a reputable source such as United States Geological Survey (USGS).

Finally, check the area of the site where drilling will occur for underground objects. At minimum, a OneCall locate request should be made at least one week in advance of drilling in order to give public utility locators time to mark known buried utility lines. All planned boring locations should be marked on the ground with white spray paint prior to making a locate request. In almost all cases, a private utility locator should also clear the area of drilling any underground objects using electromagnetic techniques. If drilling is to occur in close proximity to buried utilities, the work plan may specify use of an air knife or vacuum to clear the borehole to a depth below the utility lines.

3.2 COLLECTING SOIL SAMPLES FOR CLASSIFICATION

1. Before beginning drilling, record the following information on each log:
    a. Operator’s name and company, equipment make/model, equipment measurements (i.e., sampler length and diameter, hammer weight and stroke if using hollow stem auger, boring diameter)
    b. Your name, date, project, boring name and approximate descriptive location (i.e., where is the soil boring relative to known site features). Include a description of the ground surface and whether or not coring was necessary, if coring was necessary, include core diameter, concrete thickness, and subcontractor information.

   c. A small hand drawn map showing your location with measurements to a stationary reference point, or GPS coordinates (ideally, both). This is also a good place to note if you have had to move a boring location because of underground utilities, access issues, etc. It is important to note the reason for relocation and the direction and distance moved (i.e., moved 10 feet to the north due to presence of subsurface water line).

2. If you are using a hollow stem auger drilling method, it is important to communicate to the driller how often you would like a split spoon sample collected. Typically this would be continuous or every 5 feet but may be different depending on the project needs.
3. Note any feedback from the driller about the drilling conditions. This may include difficult drilling or rig chatter (usually caused by hard materials), heaving sands (usually caused by hydrostatic pressure on the borehole), caving, or hole instability.
4. For split spoon samples, record the number of hammer blows (blow counts) necessary to drive the sampler each 6-inch increment, as reported by the driller. If more than 50 blows are needed, record the distance that the sampler was driven in 50 blows (i.e., 2-inches in 50 blows). This is referred to as the standard penetration test.
5. Cover the sampling table with plastic sheeting. Lay an engineer's tape lengthwise across the sampling table. Once a sample has been collected, orient it on the table so that the top is aligned with the 0-foot mark on the tape.
6. Split open the sampler, core barrel liner, or sample collection bag. Record the depth interval that the sampler was driven and the depth interval of soil that was recovered. For split spoons or single-cased core barrels, such as Geoprobe direct-push rods, determine whether any loose 'slough' soil has been dislodged by the drilling equipment and deposited at the top of your core (AMS direct push rods are double cased and do not create slough). Do not include slough in the measurement of the soil recovered. Often the core will be filled with an uninterrupted column of soil that is shorter in length than the total drive interval. In such cases, record the recovery interval as it is situated in the core unless you are able to determine the actual depth where the soil sample originated. For the purposes of recording soil observations and collecting samples for analysis, assume that the recovered column of soil has been evenly compressed unless you are able to determine the interval(s) in which compression has occurred. Decompress the recovered soil when making further observations (e.g., if the recovered soil column is 80 percent of the length of the drive interval, assume 0.8 feet of recovered soil represent 1 foot of soil in situ).
7. Before further disturbing the soil, take volatile organic compound (VOC) measurements with a photoionization detector (PID), if using. Take measurements by making crevices in the soil with a spoon or scraper and inserting the PID probe into these openings. Alternatively, collect small spoonfuls of soil into Ziploc bag(s), seal the bag(s), gently shake the bag(s), and insert the PID probe through the top of the bag(s) and into the headspace once the soil vapor has been allowed to equilibrate with the

surrounding air (headspace method). The bag headspace screening method is typically more accurate and is useful at sites with low concentrations of VOCs, whereas the in-situ method is a faster and more qualitative method, best used at sites with higher VOC concentrations. If sampling for VOCs by the U.S. Environmental Protection Agency (USEPA) Method 5035, these soil samples should also be collected prior to disturbing the core. Soil sampling procedures using USEPA Method 5035 are described in detail in the Soil Sample Collection Standard Guideline.

8. Use a straight edge to scrape the soil level and expose the center of the core. Photograph the core alongside the measuring tape and an index card displaying the soil boring location/ID and depth interval.

3.3 SOIL CLASSIFICATION

Soils are described using the following characteristics: Color, consistency, MAJOR CONSTITUENT, minor constituent, geotechnical properties, moisture content, other observations (e.g. visual or olfactory indications of contamination). The USCS field guide is included in this guidance for reference. The steps below should help guide the logger in classifying soils according to the USCS.

1. Record the color of the soil. A descriptive color (i.e., light brown) or a color identified using the Munsell color chart are both valid.
2. Determine whether organic matter influences the properties of the material. If so, record as an organic soil.
3. If the soil is predominantly inorganic, identify whether the major constituent is coarse- or fine-grained. Coarse-grained soils include sands and gravels; fine-grained soils include silts and clays.
    a. For coarse grained soils, determine:
        i. Grain size(s) present including fine, medium, or coarse, and grain size distribution including well-graded (a mixture of fine to coarse grains) or poorly-graded (uniform in size). The USCS guide is helpful for determining grain sizes. If the major constituent is gravel, note its angularity using “rounded,” “sub-angular” or “angular.”
        ii. Minor constituent(s). If a minor constituent represents less than approximately 15% of the sample, note this as “with [minor constituent]” and optionally, whether it is “trace” (<5%) or “few” (5-15%). If a minor constituent represents more than 15% of the sample, use “[minor constituent]-y.” For example, a sand with 5% silt would be classified as a “SAND with trace silt” and sand with 30% silt would be classified as a “SILTY SAND.” For coarse-grained soils with fines between 5% and 15%, the USCS includes several dashed classifications, such as SW-SM. It is often helpful to record an estimated percentage for soil constituents to aid in classification according to the USCS.

b. For fine-grained soils, determine:

    i. Major constituent. To determine whether a material is silt or clay, a simple settling test may be performed in a glass vial or gloved hand by spraying a small amount of the sample with water. Silt particles will settle out of suspension in water within a few minutes, whereas clay particles will remain suspended for a longer period of time.

    ii. Minor constituent(s). As described above, determine the approximate percentage and record as "with [minor constituent]" or "[minor constituent]-y" as appropriate. It is often helpful to record an estimated percentage to aid in classification according to the USCS.

    iii. Geotechnical properties. Depending on project data needs, geotechnical properties may be optional but often provide helpful information. Geotechnical properties include plasticity (ranging from "non-plastic" to "highly plastic" as determined by a thread test) and consistency (ranging from "loose" to "very dense" for coarse-grained soils and "soft" to "hard" for fine-grained soils). When using split spoon samplers, blow counts recorded during the standard penetration test (also referred to as N-values) are used to determine consistency; when using direct-push or sonic drilling, consistency is described qualitatively.

4. Using the USCS guide and the description of the soil, determine the appropriate USCS symbol and record it on the log. If it is difficult to distinguish the major constituent of a soil, a borderline "/" symbol may be used to denote the two potential major constituents present. This is not the same as the USCS classifications that utilize a dash, such as SW-SM.

5. Determine whether contacts between stratigraphic units are abrupt, or gradational. Note abrupt contacts using a solid line and gradational contacts using a dotted line. If the contact between units is not visible and was missed between sample depths, a dashed line is used.

6. If the site or area geology is known, and you are confident in your identification of a specific stratum, note the geologic unit. At a site where the geology is uncertain, you may make some more general notes about the depositional environment, such as identifying probable estuarine deposits, colluvium, glacial till, etc.

7. Note the moisture content of the soil, using "dry," "moist," "wet," or "saturated." Mark the water table at the time of drilling on the log at the depth where saturated soil is first observed.

3.4 OTHER OBSERVATIONS

1. Record other materials observed in the sample. These may include minor amounts of rootlets or other plant matter, evidence of organisms such as shell fragments, and/or anthropogenic debris such as brick fragments, plastic, or metal debris.
2. Record potential indications of contamination. These may include odors, colored or black staining on soils, colored crystals, hydrocarbon sheens, or non-aqueous phase liquid (NAPL) product.
   a. To test for hydrocarbon sheen, put a small amount of soil in a bowl, saturate with water and swirl, noting whether a rainbow sheen appears on the surface of the water. Alternatively, place a small amount of water in the bottom of the bowl and a small amount of soil along the side, then tilt the bowl so that the water slowly touches the soil. If observed, note the color of the sheen and describe as slight (discontinuous on the water surface), moderate (continuous but spreading slowly) or high (rainbow sheen covering entire surface water).
   b. To test for the presence of NAPL, use a clean paper towel to blot the surface of the core and note the proportion of the towel that is saturated with oil (be sure to allow the towel to dry when blotting moist to wet soils to distinguish between saturation due to NAPL and due to water).
3. Note the final depth of the boring and any reasons for early termination of the boring (i.e., refusal).
4. If monitoring wells will be installed, follow the Standard Guidelines for monitoring well construction and well development.

4.0 Decontamination

All reusable equipment that comes into contact with soil should be decontaminated as follows prior to moving to the next sampling location.

Split spoons, stainless steel bowls and spoons, and any other tools used for soil classification must be decontaminated between boring locations. If collecting soil samples for chemical analysis, split spoons and any tools used for sample processing must be decontaminated between each sample; alternatively, disposable bowls and spoons may be used. Equipment decontamination will consist of a tap water rinse to remove soil particles, followed by scrubbing with brushes and an alconox (or similar)/clean water solution and a final rinse with distilled or deionized water.

5.0 Investigation-Derived Waste

Unless otherwise specified in the project work plan, waste soils and other drilling materials generated during soil boring activities will be contained, transported, disposed of in accordance with applicable laws, and stored in a designated area until transported off-site for disposal.

The approach to handling and disposal of these materials is as follows. For investigation-derived waste (IDW) that is contained, such as waste soils, 55-gallon drums approved by the Washington State Department of Transportation (WSDOT) will be supplied by the driller and used for temporary storage pending profiling and disposal. Each container holding IDW will be sealed and labeled as to its contents (e.g., “soil cuttings”), the dates on which the wastes were placed in the container, the owner’s name, contact information for the field person who generated the waste, and the site name.

Whenever possible, IDW contained within drums will be characterized relative to applicable waste criteria using data from the sampling locations. Material that is designated for off-site disposal will be transported to an off-site facility that is permitted to accept the waste. Manifests will be used as appropriate for disposal.

Disposable sampling materials and incidental trash such as paper towels and personal protective equipment (PPE) used in sample processing will be placed in heavy duty garbage bags or other appropriate containers and disposed of as solid waste in the municipal collection system (i.e., site dumpster).

6.0 Field Documentation

All observations should be recorded on a soil boring form appropriate for the drilling method or in a bound field notebook. Field staff should make an effort to record as much detail as possible in the field log. After the field work is complete, a set of final logs (usually electronic) that serve as the record for the project will be completed in consultation with the project manager or field manager.

Enclosure: USCS Soil Classification Field Guide
Boring Log

USCS SOIL CLASSIFICATION FIELD GUIDE

FIELD GUIDE FOR SOIL AND STRATIGRAPHIC ANALYSIS v.2

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START HERE

DENSITY OR CONSISTENCY

COARSE GRAINED DEPOSITS N-VALUE		FINE GRAINED DEPOSITS N-VALUE	q_u (tsf)	
0-4	► VERY LOOSE	0-2	<0.25	► VERY SOFT
5-10	► LOOSE	3-4	0.25-0.50	► SOFT
11-29	► MEDIUM DENSE	5-8	0.50-1.0	► MEDIUM
30-49	► DENSE	9-15	1.0-2.0	► STIFF
>50	► VERY DENSE	16-30	2.0-4.0	► VERY STIFF
		>30	>4.0	► HARD

COLOR
Use Standard Munsell Color Notation

IS THE COLOR A MATRIX COLOR?
- YES ► MATRIX COLOR — List in sequence, dominant first
- NO ► IS THE COLOR FROM A COATING OR CONCENTRATION?
  - YES ► COATING or CONCENTRATION — Note frequency, color, and size
  - NO ► MOTTLE — Note contrast, color, and size

CLASSIFICATION
Unified Soil Classification System - adopted ASTM D2488

STEP 1: IS SEDIMENT COARSE GRAINED OR FINE GRAINED?

COARSE-GRAINED DEPOSITS
>50% coarse-grained sediments, <50%fines

STEP 2: DETERMINE SAND VS. GRAVEL RATIO

INCREASING GRAIN SIZE

SAND: FINE | MEDIUM | COARSE — GRAVEL: SMALL | LARGE

0.075 MM | 0.425 MM | 2.0 MM | 4.75 MM | 19.0 MM | 75.0 MM

STEP 3: *CONTINUE WITH* ***SAND*** *OR* ***GRAVEL*** *ON FLOW CHART (REVERSE)*

FINE-GRAINED DEPOSITS
(organic and inorganic)
>50% fines, <50% coarse-grained sediments

STEP 2: DETERMINE PLASTICITY AND ASSIGN USCS GROUP SYMBOL

INCREASING PLASTICITY

NON PLASTIC | LOW PLASTICITY | MEDIUM PLASTICITY | HIGH PLASTICITY

ML | CL | CH

STEP 3: *CONTINUE WITH* ***GROUP SYMBOL*** *ON FLOW CHART (REVERSE)*

MOISTURE

MOISTURE ABSENT ► DRY
DAMP ► MOIST
VISIBLE WATER ► WET

FOR NON-PLASTIC FINES
WATER RISES TO SURFACE SLOWLY ► SLOW DILATENCY
WATER RISES TO SURFACE QUICKLY ► RAPID DILATENCY

PLASTICITY
(Use with CLASSIFICATION)

WILL NOT SUPPORT 6mm DIAMETER ROLL IF HELD ON END ► NON-PLASTIC
6mm DIA. ROLL CAN BE REPEATEDLY ROLLED AND SUPPORTS ITSELF, 4mm DIA. ROLL DOES NOT ► LOW PLASTICITY
4mm DIA. ROLL CAN BE REPEATEDLY ROLLED AND SUPPORTS ITSELF, 2mm DIA. ROLL DOES NOT ► MEDIUM PLASTICITY
2mm DIA. ROLL CAN BE REPEATEDLY ROLLED AND SUPPORTS ITSELF ► HIGH PLASTICITY

6mm 4 2

COHESIVENESS

6mm DIAMETER ROLL CANNOT BE FORMED ► NONCOHESIVE
6mm DIAMETER ROLL CAN BE FORMED ► COHESIVE

SEDIMENTARY STRUCTURE

UNIFORM ► MASSIVE
BEDS >30cm ► THICKLY BEDDED
BEDS 3cm to 30cm ► BEDDED
BEDS 0.5cm to 3cm ► THINLY BEDDED
BEDS <0.5cm ► LAMINATED

SECONDARY SOIL STRUCTURE (IN SOLUM ONLY)
Spheroidal peds or granules usually packed loosely ► GRANULAR
Irregular, roughly cubelike peds with planer faces (angular or subangular) ► BLOCKY
Flat and horizontal peds ► PLATY
Vertical, pillarlike peds with flat tops ► PRISMATIC
Vertical, pillarlike peds with curved tops (which are commonly "bleached") ► COLUMNAR

WEATHERING ZONE ABBREVIATION

MODIFIER SYMBOL (if present)		1st SYMBOL		2nd SYMBOL		LAST SYMBOL (if present)	
MOTTLED	► M	OXIDIZED	► O	LEACHED	► L	SECONDARY	
JOINTED	► J	REDUCED	► R	UNLEACHED	► U	CARBONATE	► 2
		UNOXIDIZED	► U				

EXAMPLE: solum, OJL, MOJL, MOJL2, MOJU | MRJU, RJU, RU, UU

SECONDARY GRAIN SIZE INFORMATION

< 5% ► TRACE
6% to 15% ► LITTLE
16% to 30% ► FEW
31% to 49% ► SOME

► UNIFORM (poorly graded)
► NON-UNIFORM (well graded)

► FINE SAND
► MEDIUM-GRAINED SAND
► COARSE-GRAINED SAND
► FINE GRAVEL
► COARSE GRAVEL

FOR GLACIAL DIAMICTONS ► CLAST FRACTION ► CLAST LITHOLOGY

DEPOSITIONAL ENVIRONMENT

VARIOUS DEPOSITIONAL ENVIRONMENTS (interpretation)
► EOLIAN (LOESS)
► FLUVIAL
► ALLUVIAL
► LACUSTRINE
► COASTAL
► RESEDIMENTED

GLACIAL DEPOSITIONAL PROCESSES
► SUBGLACIAL
► GLACIOFLUVIAL
► GLACIOLACUSTRINE
► RESEDIMENTED

GENERALIZED RESEDIMENTATION PROCESSES
► MASS SLUMP
► SEDIMENT FLOW
► COLLUVIUM

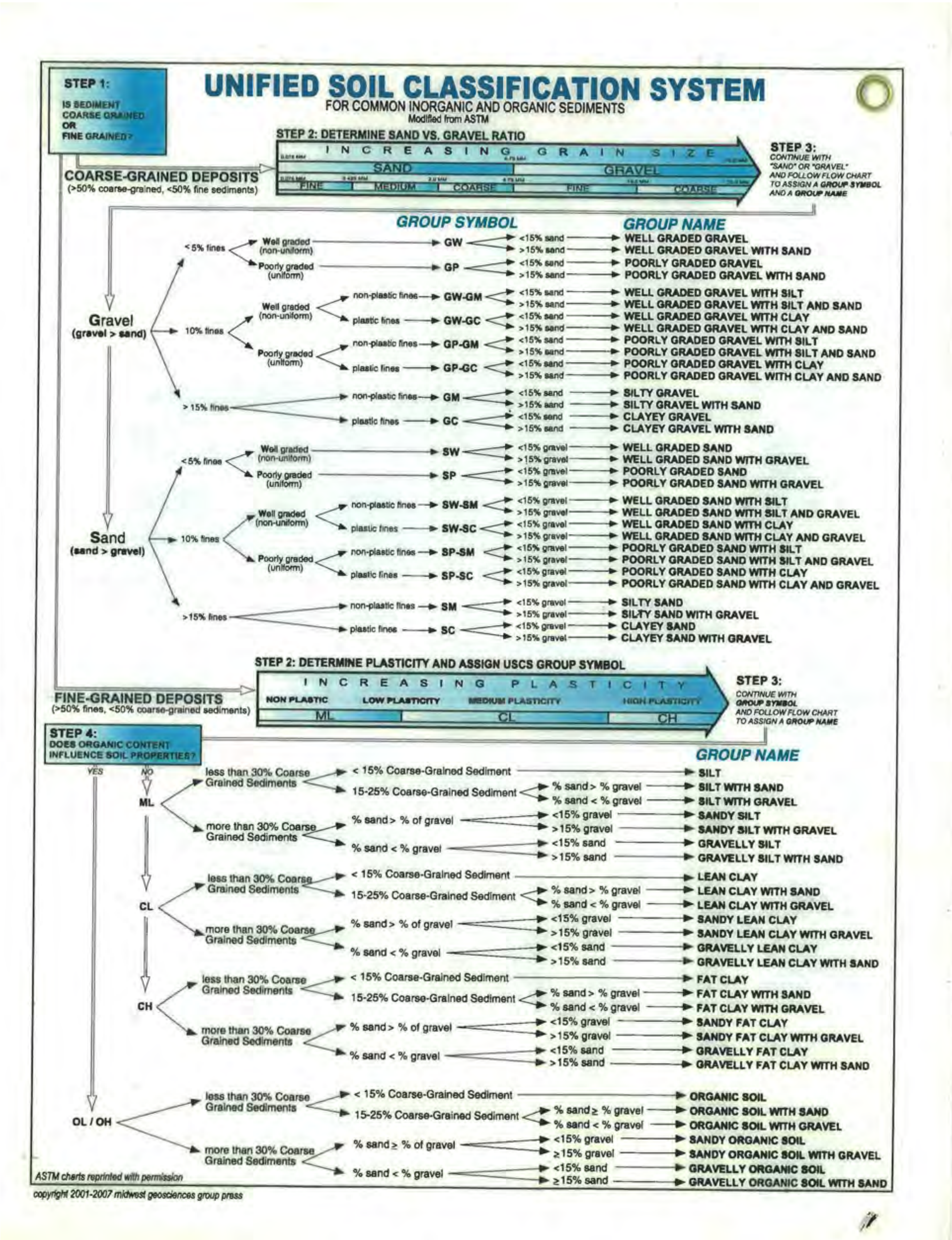
STRATIGRAPHIC NAME

USE FORMAL STATE GEOLOGICAL SURVEY NOMENCLATURE WHEN POSSIBLE;
IF NOT POSSIBLE, ASSIGN SITE-SPECIFIC UNIT NAME ACCORDING TO DEPOSITIONAL ENVIRONMENT / FACIES ASSEMBLAGE

STRATIGRAPHIC CONTACT

010106

< 10 cm ► SHARP (or ABRUPT for pedogenic alternation)
> 10 cm (Note transition interval) ► GRADATIONAL (or TRANSITIONAL for weathering zone change)


STEP 1:
IS SEDIMENT COARSE GRAINED OR FINE GRAINED?
UNIFIED SOIL CLASSIFICATION SYSTEM
FOR COMMON INORGANIC AND ORGANIC SEDIMENTS
Modified from ASTM
STEP 2: DETERMINE SAND VS. GRAVEL RATIO
INCREASING GRAIN SIZE
SAND
GRAVEL
FINE
MEDIUM
COARSE
FINE
COARSE
STEP 3:
CONTINUE WITH "SAND" OR "GRAVEL" AND FOLLOW FLOW CHART TO ASSIGN A GROUP SYMBOL AND A GROUP NAME
COARSE-GRAINED DEPOSITS
(>50% coarse-grained, <50% fine sediments)
GROUP SYMBOL
GROUP NAME
Gravel
(gravel > sand)
<5% fines
Well graded (non-uniform)
Poorly graded (uniform)
GW
<15% sand
WELL GRADED GRAVEL
>15% sand
WELL GRADED GRAVEL WITH SAND
GP
<15% sand
POORLY GRADED GRAVEL
>15% sand
POORLY GRADED GRAVEL WITH SAND
10% fines
Well graded (non-uniform)
non-plastic fines
GW-GM
<15% sand
WELL GRADED GRAVEL WITH SILT
>15% sand
WELL GRADED GRAVEL WITH SILT AND SAND
plastic fines
GW-GC
<15% sand
WELL GRADED GRAVEL WITH CLAY
>15% sand
WELL GRADED GRAVEL WITH CLAY AND SAND
Poorly graded (uniform)
non-plastic fines
GP-GM
<15% sand
POORLY GRADED GRAVEL WITH SILT
>15% sand
POORLY GRADED GRAVEL WITH SILT AND SAND
plastic fines
GP-GC
<15% sand
POORLY GRADED GRAVEL WITH CLAY
>15% sand
POORLY GRADED GRAVEL WITH CLAY AND SAND
>15% fines
non-plastic fines
GM
<15% sand
SILTY GRAVEL
>15% sand
SILTY GRAVEL WITH SAND
plastic fines
GC
<15% sand
CLAYEY GRAVEL
>15% sand
CLAYEY GRAVEL WITH SAND
Sand
(sand > gravel)
<5% fines
Well graded (non-uniform)
SW
<15% gravel
WELL GRADED SAND
>15% gravel
WELL GRADED SAND WITH GRAVEL
Poorly graded (uniform)
SP
<15% gravel
POORLY GRADED SAND
>15% gravel
POORLY GRADED SAND WITH GRAVEL
10% fines
Well graded (non-uniform)
non-plastic fines
SW-SM
<15% gravel
WELL GRADED SAND WITH SILT
>15% gravel
WELL GRADED SAND WITH SILT AND GRAVEL
plastic fines
SW-SC
<15% gravel
WELL GRADED SAND WITH CLAY
>15% gravel
WELL GRADED SAND WITH CLAY AND GRAVEL
Poorly graded (uniform)
non-plastic fines
SP-SM
<15% gravel
POORLY GRADED SAND WITH SILT
>15% gravel
POORLY GRADED SAND WITH SILT AND GRAVEL
plastic fines
SP-SC
<15% gravel
POORLY GRADED SAND WITH CLAY
>15% gravel
POORLY GRADED SAND WITH CLAY AND GRAVEL
>15% fines
non-plastic fines
SM
<15% gravel
SILTY SAND
>15% gravel
SILTY SAND WITH GRAVEL
plastic fines
SC
<15% gravel
CLAYEY SAND
>15% gravel
CLAYEY SAND WITH GRAVEL
STEP 2: DETERMINE PLASTICITY AND ASSIGN USCS GROUP SYMBOL
INCREASING PLASTICITY
NON PLASTIC
LOW PLASTICITY
MEDIUM PLASTICITY
HIGH PLASTICITY
ML
CL
CH
FINE-GRAINED DEPOSITS
(>50% fines, <50% coarse-grained sediments)
STEP 3:
CONTINUE WITH GROUP SYMBOL AND FOLLOW FLOW CHART TO ASSIGN A GROUP NAME
STEP 4:
DOES ORGANIC CONTENT INFLUENCE SOIL PROPERTIES?
YES
NO
GROUP NAME
ML
less than 30% Coarse Grained Sediments
< 15% Coarse-Grained Sediment
SILT
15-25% Coarse-Grained Sediment
% sand > % gravel
SILT WITH SAND
% sand < % gravel
SILT WITH GRAVEL
more than 30% Coarse Grained Sediments
% sand > % of gravel
<15% gravel
SANDY SILT
>15% gravel
SANDY SILT WITH GRAVEL
% sand < % gravel
<15% sand
GRAVELLY SILT
>15% sand
GRAVELLY SILT WITH SAND
CL
less than 30% Coarse Grained Sediments
< 15% Coarse-Grained Sediment
LEAN CLAY
15-25% Coarse-Grained Sediment
% sand > % gravel
LEAN CLAY WITH SAND
% sand < % gravel
LEAN CLAY WITH GRAVEL
more than 30% Coarse Grained Sediments
% sand > % of gravel
<15% gravel
SANDY LEAN CLAY
>15% gravel
SANDY LEAN CLAY WITH GRAVEL
% sand < % gravel
<15% sand
GRAVELLY LEAN CLAY
>15% sand
GRAVELLY LEAN CLAY WITH SAND
CH
less than 30% Coarse Grained Sediments
< 15% Coarse-Grained Sediment
FAT CLAY
15-25% Coarse-Grained Sediment
% sand > % gravel
FAT CLAY WITH SAND
% sand < % gravel
FAT CLAY WITH GRAVEL
more than 30% Coarse Grained Sediments
% sand > % of gravel
<15% gravel
SANDY FAT CLAY
>15% gravel
SANDY FAT CLAY WITH GRAVEL
% sand < % gravel
<15% sand
GRAVELLY FAT CLAY
>15% sand
GRAVELLY FAT CLAY WITH SAND
OL / OH
less than 30% Coarse Grained Sediments
< 15% Coarse-Grained Sediment
ORGANIC SOIL
15-25% Coarse-Grained Sediment
% sand ≥ % gravel
ORGANIC SOIL WITH SAND
% sand < % gravel
ORGANIC SOIL WITH GRAVEL
more than 30% Coarse Grained Sediments
% sand ≥ % of gravel
<15% gravel
SANDY ORGANIC SOIL
≥15% gravel
SANDY ORGANIC SOIL WITH GRAVEL
% sand < % gravel
<15% sand
GRAVELLY ORGANIC SOIL
≥15% sand
GRAVELLY ORGANIC SOIL WITH SAND
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PROJECT:	LOCATION:	BORING ID:	
LOGGED BY:	COORDINATE SYSTEM:		
DRILLED BY:		NORTHING:	EASTING:
DRILLING EQUIPMENT:		GROUND SURFACE ELEVATION:	
DRILLING METHOD:		TOTAL DEPTH (ft bgs):	DEPTH TO WATER (ft bgs):
SAMPLING METHOD:		BORING DIAMETER:	DRILL DATE:

Depth (feet)	USCS	Description	Drive	Recovery	# of Blows	PID (ppm)	Sample ID
0							

ABBREVIATIONS:
ft bgs = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

FLOYD | SNIDER strategy ▪ science ▪ engineering	PROJECT:	LOCATION:	BORING ID:
	LOGGED BY:	COORDINATE SYSTEM:	
DRILLED BY:		NORTHING:	EASTING:
DRILLING EQUIPMENT:		GROUND SURFACE ELEVATION:	
DRILLING METHOD:		TOTAL DEPTH (ft bgs):	DEPTH TO WATER (ft bgs):
SAMPLING METHOD:		BORING DIAMETER:	DRILL DATE:

Depth (feet)	USCS	Description	Drive	Recovery	# of Blows	PID (ppm)	Sample ID

ABBREVIATIONS:
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▼ = denotes groundwater table

NOTES:

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F|S STANDARD GUIDELINE

Sediment Grab Sample Collection

DATE/LAST UPDATE: May 2015

These procedures should be considered standard guidelines and are intended to provide useful guidance when in the field, but are not intended to be step by step procedures, as some steps may not be applicable to all projects.

All field staff should be sufficiently trained in the standard guidelines for the sampling method they intend to use and should review and understand these procedures prior to going into the field. It is the responsibility of the field staff to review the standard guidelines with the field manager or project manager and identify any deviations from these guidelines prior to field work. When possible, the project-specific Sampling and Analysis Plan should contain any expected deviations and should be referenced in conjunction with these standard guidelines.

1.0 Scope and Purpose

These sediment grab standard guidelines should be used by the field staff performing sediment grab sampling via a grab type sampler (e.g., van Veen, Power Grab) or a diver-collected hand core (i.e., cookie cutter) sampler for sediment sampling in freshwater or marine environments. The van Veen grab and diver-collected hand core samplers are two of the most commonly used to collect surface sediment. Power Grab samplers are often used when requiring collection of sediment deeper than 10 cm (4 in.) or in areas with debris.

It is important that the field staff completing the sediment sample collection discusses the sediment logging needs for a particular investigation with the project geologist, the project manager, or whoever will ultimately be responsible for interpreting the findings of the field investigation. This discussion is in addition to field training and general knowledge about sediment logging and sampling, and should happen prior to entering the field, with additional follow-up before finalizing the field forms, after the investigation is complete.

2.0 Equipment and Supplies

Logging Equipment and Tools:

- Tape measure (at least 1 foot long)
- Lead line (if not provided by vessel operator)
- Soil/sediment logging kit containing:
  - Small and Large Ziploc bags
  - Note cards
  - Field guide for soil and stratigraphic analysis
  - Optional items from kit including: Munsell color chart, sieves, white and grayscale color cards for photographs
- Large stainless steel bowls for homogenizing
- Large stainless steel spoons or mixer (as an alternative, disposal spoons or spatulas can be used)
- Small stainless steel spoon
- Trash bags
- Decontamination equipment including:
  - Pump sprayer for tap water or site water
  - Spray bottles filled with alconox (or other soap) solution
  - Distilled or deionized water
  - Scrub brushes
  - Paper towels
  - 5-gallon buckets
- Siphoning hose (usually on board vessel)
- Camera
- Hand-held global positioning system (GPS; if GPS not on board vessel)
- Coolers, sample jars, labels, chain-of-custody forms, ice

Paperwork:

- Work Plan and/or Sampling and Analysis Plan/Quality Assurance Project Plan (SAP/QAPP)
- Key figures/coordinate table with sampling locations
- Tide prediction tables
- Health and Safety Plan (HASP)

- Sediment grab sampling forms, printed in Rite in the Rain paper, and optional bound field notebook
- Permanent markers and pencils

Personal Equipment:

- Steel-toed boots
- Hard hat
- Life vest
- Safety glasses
- Nitrile gloves
- Rain gear
- Work gloves
- First aid kit

3.0 Standard Procedures

3.1 PREPARATION

First, meet with the project manager to identify key information and goals of the sediment sampling investigation. These may include fill/capping/dredging history, known or suspected sources of contamination and potential field indications of these contaminants, and identification of specific units, if applicable.

Next, review the work plan and existing materials such as surface sediment grab forms or sediment core logs from previous investigations to familiarize yourself with the site geology. If site-specific information about geology is not available, or in addition to site-specific information, a geologic map of the area from a reputable source such as the U.S. Geological Survey (USGS) may also be reviewed.

3.2 COLLECTING SEDIMENT SAMPLES

Sediment grab samples will be processed on board the sampling vessel or shoreline (if diver assisted). All working surfaces and instruments will be thoroughly cleaned and decontaminated between sample locations.

1. Before starting, record the following information on each field form:
    a. Sample Method (i.e., Van Veen Surface Grab, Power Grab, or Diver Cookie Cutter) and Sample Type/Depth (e.g., 0 to 10 cm).
    b. Your name, date, project, weather, subcontractor (if applicable), sample location ID name and approximate descriptive location (if possible or applicable).

2. Have the boat operator maneuver the sampling vessel to the proposed sample location. Locations will be, in most situations, pre-determined in northings and eastings (to the nearest US survey foot) referenced to the appropriate state plane system for the site, using the vessel mounted Digital Global Positioning System (DGPS) receiver referenced to North American Datum of 1983 (NAD 83). If collecting a cookie cutter sample, the diver will need to get on location. If there is no vessel mounted DGPS available, a handheld portable GPS may be used.

3. Record the time, depth to mudline below water surface, actual sample location coordinates (get from vessel operator), and estimated tide elevation (can be determined in the office prior to sampling) on the field form as the sample is collected.

4. Once the sampler or cookie cutter has been retrieved, examine the sample for the following sediment acceptance criteria and include on field form:

   a. Sampler jaw or bottom lid (if cookie cutter) is closed.

   b. The sample does not contain foreign objects.

   c. The sampler is not overfilled so that the sediment surface presses against the top of the sampler.

   d. Leakage has not occurred, as indicated by overlying water on the sediment surface (not relevant with cookie cutter).

   e. Sample disturbance has not occurred, as indicated by limited turbidity in the overlying water (not relevant with cookie cutter).

   f. Winnowing has not occurred, as indicated by a relatively flat undisturbed surface (not relevant with cookie cutter).

   g. A penetration depth of at least 1 inch greater than desired sample depth has been achieved for grabs, and at least the depth of the desired sample for cookie cutter sampling. If after four attempts, the penetration depth has not been achieved, accept the sample as is.

5. If sample acceptance criteria are not achieved, the sample will be rejected and the location resampled after rinsing the sampler. If the proposed sample location cannot be achieved (within ±10 feet, or within a distance specified in the sampling plan), notify the Floyd|Snider Project Manager to determine an appropriate alternate location.

6. Siphon off any standing water from the surface of the sediment using a hose primed with site water. Care should be taken not to disturb the integrity of the sediment surface (not relevant with cookie cutter).

7. If using the cookie cutter, position the cookie cutter over a large stainless steel bowl and carefully slide out the bottom lid of the sampler so the sediment falls into the bowl.

8. Take a digital photograph of the sediment surface prior to removal from the sampler (not relevant with cookie cutter). Write the sample location ID and grab replicate or run number (e.g., Run #1) with a large felt-tip marker on a sheet of paper, or index card (or similar) and photograph next to, but not touching, the sediment sample.
9. Visually classify the surface (and subsurface, if collecting) sediment characteristics according to the American Society for Testing and Materials (ASTM) standards using the Unified Soil Classification System (USCS). Refer to the Floyd|Snider Soil Logging Standard Guideline for additional details regarding logging and classification. In addition to the visual classification, qualitative descriptive parameters, including biota (e.g., worms, crabs, and seaweed), debris (e.g., shells, wood, concrete, and glass), staining, sheen, and other observations (including olfactory if relevant) should also be recorded.
10. Collect the surface sediment sample over the desired surface sediment sampling depth (e.g., 0 to 10 cm) using a clean, stainless steel spoon and place the sample material into a clean stainless steel bowl. If collecting a subsurface sediment sample as well, then collect sediment for this sample over the desired sampling depth (e.g., 10 to 20 cm) using a clean, stainless steel spoon and place this sample material in a separate clean stainless steel bowl. To prevent possible cross-contamination, do not collect sediments that are in direct contact with the margins of the sampler.
11. Take a digital photograph of each sediment interval collected while in the bowl. Write the sample location name, grab replicate number, and sample depth interval with a large felt-tip marker on a sheet of paper or index card (or similar) and photograph next to, but not touching, the sediment sample.
12. Homogenize until the sediment appears uniform in color and texture and distribute to appropriate sample containers and ensure that sample labels are completely filled out and affixed to the containers. If collecting sample volume for volatile organic carbons (VOCs), collect prior to homogenizing. If there isn't enough sediment volume to fill sample containers, repeat Steps 1 through 11 at a new location within 5 to 10 feet of current location and label as subsequent Run # or Grab #.
13. Clean the exterior of all sample containers and store them in a cooled ice chest away from the immediate work area. The cooled ice chest should be maintained at 4 degrees Celsius (°C).
14. Thoroughly rinse the interior of the sampler until all loose sediment has been washed off, and decontaminate the sampler by following the procedures provided in Section 4.0.
15. Ensure that sediment descriptions and supporting field form entries are complete.
16. Complete filling out chain-of-custody and transport samples to analytical laboratory under standard chain-of-custody procedures.

4.0 Decontamination

All reusable equipment that comes into contact with sediment should be decontaminated as follows prior to moving to the next sampling location.

Stainless steel bowls and spoons, sediment samplers, and any other tools used for sampling must be decontaminated between grab sample locations. Equipment decontamination will consist of a preliminary water rinse using water from the site to remove sediment particles, followed by scrubbing with brushes and an alconox (or other soap)/clean water solution and a final rinse with distilled or deionized water.

5.0 Investigation-Derived Waste

Unless otherwise specified in the project work plan, waste sediment and decontamination water and rinse water generated during sediment grab sample activities may be returned to the site by disposing of material overboard the vessel, as close to the sample location as possible. If using an uplands processing area, waste sediment should be containerized in 55-gallon drums approved by the Washington State Department of Transportation pending profiling and disposal. Each container holding investigation-derived waste (IDW) will be sealed and labeled as to its contents (e.g., “sediments”), the dates on which the wastes were placed in the container, the owner’s name and contact information for the field person who generated the waste, and the site name.

IDW contained within drums will be characterized relative to applicable waste criteria using data from the sampling locations whenever possible. Material that is designated for off-site disposal will be transported to an off-site facility permitted to accept the waste. Manifests will be used, as appropriate for disposal.

Disposable sampling materials and incidental trash such as paper towels and personal protective equipment (PPE) used in sample processing will be placed in heavy duty garbage bags or other appropriate containers and disposed of as solid waste in the municipal collection system (i.e. site dumpster).

6.0 Field Documentation

All observations should be recorded on the surface sediment sample collection form (attached) and/or in a bound field notebook. Field staff should make an effort to record as much detail as possible.

Enclosure: Surface Sediment Sample Collection Form

SURFACE SEDIMENT SAMPLE COLLECTION FORM

Project Name: ______________________ Date/Time Collected: ______________________

Field Personnel: ______________________ Weather: ______________________

Subcontractor: ______________________

Sample Type:

☐ Surface Sample: 0 - ____cm
☐ Subsurface Sample: ___ to ___cm

Sample Location ID: ______________________

Sample Method (circle): van Veen or Power Grab or Diver Collected-Cookie Cutter or other. Explain:

Datum (Horizontal/Vertical)

Leadline Water Depth: ______________ (A) Mudline Elevation ______________ (B-A)

Predicted Tide Elevation: ______________ (B) Actual Tide Elevation ______________

Run # or Composite Pt	Time	Latitude (Northing)	Longitude (Easting)	Sample Criteria (Surface Grab Only)					Accept Sample Y/N	Comments (Include depth of penetration)
				1	2	3	4	5		

Acceptance criteria: 1 Overlying water is present, 2 Water has low turbidity, 3 Sampler is not over filled, 4 Sample surface is flat, 5 Desired sample depth is reached

Decon Procedure (Alconox Wash, DI water rinse, other):______________________

Sediment Sample Description

Surface Interval: (Depth in cm ________)

Biological: ____% Describe: __________ **Debris:** ____% Describe: __________ **Oil Sheen:** ____% Describe: __________

Moisture

Very Wet | Wet | Moist | Damp | Dry

Color **(Circle major & underline modifying)**

Light | Medium | Dark | Olive | Gray | Brown | Black | Other: ________

Major Constituent **(Circle major & underline modifying)**

Fine | Medium | Coarse | Gravel | Sand | Silt | Clay

Density/Consistency

Sand/Gravel: Very Loose | Loose | Medium Dense | Dense | Very Dense

Silt/Clay: Very Soft | Soft | Medium Stiff | Stiff | Very Stiff | Hard

Minor Constituent with Trace **(Circle major & underline modifying)**

Fine | Medium | Coarse | Gravel | Sand | Silt | Clay

Notes: ______________________

SURFACE SEDIMENT SAMPLE COLLECTION FORM

Subsurface Interval (Depth in cm ________)

Biological: ____% Describe: __________ **Debris:** ____% Describe: __________ **Oil Sheen:** ____% Describe: __________

Moisture							
Very Wet	Wet	Moist	Damp	Dry			
Color			**(Circle major & underline modifying)**				
Light	Medium	Dark	Olive	Gray	Brown	Black	Other: ________
Major Constituent			**(Circle major & underline modifying)**				
Fine	Medium	Coarse	Gravel	Sand	Silt	Clay	
Density/Consistency							
Sand/Gravel:	Very Loose	Loose	Medium Dense		Dense	Very Dense	
Silt/Clay:	Very Soft	Soft	Medium Stiff		Stiff	Very Stiff	Hard
Minor Constituent with Trace			**(Circle major & underline modifying)**				
Fine	Medium	Coarse	Gravel	Sand	Silt	Clay	

Notes: ____________________

Sample containers filled (number and type):

Laboratory analysis:

Additional Notes/Comments:

FLOYD | SNIDER
strategy ▪ science ▪ engineering

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F|S STANDARD GUIDELINE:
Special Condition

Investigation-Derived Waste

DATE/LAST UPDATE: October 2, 2020

Standard Guideline(s) to which this Special Condition is appended:

1. Groundwater Sample Collection with a Submersible Pump
2. Groundwater Sample Collection with a Direct-Push (i.e., Geoprobe) Drill Rig
3. Low-Flow Groundwater Sample Collection
4. Sediment Coring
5. Sediment Grab Sample Collection
6. Shallow Soil Sample Collection
7. Soil Sample Collection
8. Well Development

These procedures should be considered standard guidelines and are intended to provide useful guidance when in the field, but are not intended to be step-by-step procedures, as some steps may not be applicable to all projects.

All field staff should be sufficiently trained in the standard guidelines and special procedures for the sampling method they intend to use and should review and understand these procedures prior to going into the field. It is the responsibility of the field staff to review the standard guidelines and special conditions with the field manager or project manager and identify any deviations from these guidelines prior to field work. When possible, the project-specific Sampling and Analysis Plan should contain any expected deviations and should be referenced in conjunction with these standard guidelines and special conditions.

1.0 Special Condition Applicability

This special condition applies to any sampling method that may produce investigation-derived waste (IDW) solids or liquids that will be containerized for characterization and offsite disposal. These wastes may include excess sample material; drill cuttings; or well development, purge, or equipment decontamination water. Field staff should always consult their work plan to determine whether IDW must be containerized; some sampling methods such as sediment grab sampling and shallow soil sampling may allow for returning excess sample material to the sample station. Additionally, some facilities may have existing permits or regulatory agreements governing waste disposal that should be followed in addition to this special condition. It is also important to note that additional precautions must be taken when handling pure non-aqueous phase liquid (NAPL) product as detailed in the special condition for light non-aqueous phase liquid in groundwater.

2.0 Equipment and Supplies

Management of IDW may require the equipment outlined in the standard guidelines to which this special condition is attached, and also may require the following items:

- U.S. Department of Transportation (USDOT)-approved drums
- Adhesive labels identifying nonhazardous waste, waste pending characterization, and/or hazardous waste as appropriate for the site and waste stream (refer to Section 3.4 for details regarding preliminary waste designation)
- Broad-tip indelible marker
- Grease pen or paint marker
- Photoionization detector (PID)
- 1-gallon ziplock bags or large jars
- Bung wrench and socket or speed wrench with 15/16-inch socket
- Screw auger or push tube (for solids)
- Composite Liquid Waste Sampler (COLIWASA), drum thief or bailer (for liquids)
- Stainless steel spoon and bowl
- Sufficient laboratory-provided jars or bottles for required analyses
- Cooler with ice
- Site-specific Health and Safety Plan (HASP)

3.0 Special Condition Guidelines and/or Procedures

This section details protocols for IDW storage, waste sampling methods, sample frequency and waste characterization.

3.1 IDW STORAGE

Before arriving at the field site, ensure that there will be adequate drums on site for the scope of work. For drilling projects, drums are typically supplied by the drilling company, but for well development or groundwater sampling, field staff may need to purchase a drum from a local vendor (these companies are usually referred to as barrel companies). Reconditioned drums are acceptable if they are inspected and found to be in good condition (free of large dents, rust, debris, and residues). For drums that will be used to store liquids, a lid with a bung (i.e., a small opening with a threaded cap) is recommended. When planning for drummed storage of IDW, the following quantities of material represent an approximate volume of 55 gallons, or one standard-sized drum:

- 20 feet of soil boring or sediment coring by hollow-stem auger or rotosonic methods (generally 6 to 8 inches in diameter); larger diameter borings will require additional drum volume
- 100 to 200 feet of direct push soil samples
- Development water from a 2-inch well with a screened interval of 5 to 10 feet (some sites may require additional volume for well development if fines in the formation necessitate additional pumping)
- Development water from four to five prepacked wells with ¾-inch or 1-inch casing
- Decontamination water from steam cleaning rods/casing for 1 day of drilling
- Purge water from 10 to 20 wells sampled using low-flow sampling methodology

First determine the location of the temporary drum staging area at the site. This area should be secured from the public when possible and out of the way of any active site operations or traffic. When staging IDW at an active facility, always coordinate the location of the drum staging with your facility manager or contact. The drum staging area should ideally be accessible by truck, or easily accessible via a level and solid surface for moving drums with a drum dolly or other equipment (i.e., forklift) to a truck for offsite transport.

During field activities, label each drum with its contents as it is filled. Use a grease or paint pen to write on sides and lid of the drum. Include contact info (Floyd|Snider main phone line) on at least one drum. Affix appropriate labels with generator information and Floyd|Snider contact information; note, however, that these labels fade quickly outdoors so should always be backed up with grease/paint pen. If there are existing site data, the drums may be labeled as hazardous or nonhazardous as appropriate (refer to Section 3.4 for waste categorization). When in doubt, label the drums as IDW pending characterization.

Before leaving the site each day, make sure the drum lids are closed securely and that the storage area is secured, if applicable.

3.2 IDW SAMPLE COLLECTION

IDW samples of the same medium and from the same investigation at a site can generally be composited for characterization. A frequency of one sample per three 55-gallon drums is typically required for waste disposal characterization, but always check with your preferred disposal vendor to verify the number of samples needed. If sampling drums with unknown contents, compositing may be guided by field observations or screening, and the presence of irregular material or NAPL may necessitate individual drum samples for proper characterization.

The most efficient way to characterize IDW solids (i.e., soil or sediment) is to collect samples during your field event. Collect representative material from each location and place immediately into a large ziplock bag or unpreserved jar stored on ice in your sample cooler. Alternately, if the scope of field sampling includes all required IDW analyses, discrete field samples collected for the investigation may also be used for IDW characterization. Liquid samples may be collected at the end of the field event by sampling directly from the drums, or in the case of purged groundwater, representative samples collected during groundwater sampling may be sufficient for characterization.

In some instances, field staff may need to characterize drums that were not generated by Floyd|Snider but were left on a site. If existing drums will be sampled, it is important to determine their likely contents. This information may be obtained by reviewing labels or markings on the drum(s) if legible, reviewing prior site reports that describe field sampling and IDW management, communicating with facility operators or generators, or communicating with prior consultants who performed work at the site. If a remediation system is or was in place (such as NAPL recovery), it is especially important to verify whether drums left on site contain environmental media (i.e., soil, sediment, or groundwater) or remediation system waste that may have specific handling and disposal requirements.

The procedure for drum sampling varies slightly depending on whether the contents are known or unknown. For drums with known contents:

- Assess the condition of the drums. Look for indications of pressurization (bulging), crystals around opening, rust, and holes/weeping/leaking. Do not open drums exhibiting pressurization or crystal formation; these drums should be handled by a professional hazardous waste contractor. Ground any drums not in contact with the earth using grounding wires, alligator clips, and a grounding rod or metal structure.
- Record the contents of the drums. Group drums of like material for compositing and record composite groups in the field notebook.
- For solids: Open the lid. If volatile contaminants are known or suspected at the site, measure the headspace volatile organic compound (VOC) concentration above the drum with a PID to determine whether it is safe to proceed with sampling in accordance with the air monitoring action levels provided in the site-specific HASP. Use a screw auger or push tube to collect a core sample. Discharge the sample to a decontaminated stainless steel bowl. Repeat as needed to generate the representative sample amount of the composite needed for analysis. Once all representative samples of the composite have been collected, fill volatile organic analysis (VOA) vials (refer to Soil Sample Collection standard guideline) prior to homogenizing.

- For water: Open the bung (if present) or lid. If volatile contaminants are known or suspected at the site, measure the headspace VOC concentration above the drum with a PID to determine whether it is safe to proceed with sampling in accordance with the air monitoring action levels provided in the site-specific HASP. Collect a sample with a COLIWASA, drum thief, or bailer by lowering the sampler to bottom of the drum and closing the inner tube of the COLIWASA, plugging the upper end of the drum thief with a gloved fingertip, or pulling up on the bailer to engage the ball plug. Fill each container with a representative amount of the needed composite volume, collecting additional volume from each drum as needed to fill the sample containers.
- For all media: Record field observations such as overlying water (in drums containing solids) sheen, odor, and the presence of NAPL in the field notebook. If overlying water is present in solids drums, estimate the percentage of the drum volume occupied by water. If NAPL is encountered in water drums, estimate the percentage of drum volume that is occupied by NAPL. Contact the intended disposal company to determine whether additional NAPL samples are needed for characterization and report field observations to the disposal company to ensure an accurate disposal profile.

For drums with unknown contents:

- Assess the condition of the drums. Look for indications of pressurization (bulging), crystals around opening, rust, and holes/weeping/leaking. Do not open drums suspected to contain hazardous materials or drums exhibiting pressurization or crystal formation; these drums should be handled by a professional hazardous waste contractor. Ground any drums not in contact with the earth using grounding wires, alligator clips, and a grounding rod or metal structure.
- Record the contents of the drums. Check for a label indicating drum contents. Designate drums with media type and number if the label listing the contents is missing or illegible (i.e., "Solids-01"). The contents (solid or liquid) of an IDW drum with a missing or illegible label can be determined by knocking on the outside of the drum with a steel-toe boot or rubber mallet and listening for reverberation indicating that the drum is filled with liquid. The drum type may also indicate the contents; drums containing water are often fitted with a lid that has a bung, whereas drums containing solids are often fitted with a lid that does not have a bung. Group drums of like material for compositing and record composite groups in the field notebook.
- For solids: Open the lid. If volatile contaminants are known or suspected at the site, measure the headspace VOC concentration above the drum with a PID to determine whether it is safe to proceed with sampling in accordance with the air monitoring action levels provided in the site-specific HASP. Use a screw auger or push tube to collect a core sample. Discharge the sample to a decontaminated stainless steel bowl. Repeat as needed to generate the representative sample amount of the composite needed for analysis. Once all representative samples of the composite have been

collected, fill VOA vials (refer to Soil Sample Collection standard guideline) prior to homogenizing.

- For water: Open the bung (if present) or lid. If volatile contaminants are known or suspected at the site, measure the headspace VOC concentration above the drum with a PID to determine whether it is safe to proceed with sampling in accordance with the air monitoring action levels provided in the site-specific HASP. Collect a sample with a COLIWASA, drum thief, or bailer by lowering the sampler to bottom of the drum and closing the inner tube of the COLIWASA, plugging the upper end of the drum thief with a gloved fingertip, or pulling up on the bailer to engage the ball plug. Fill each container with a representative amount of the needed composite volume, collecting additional volume from each drum as needed to fill the sample containers.
- For all media: Record field observations such as overlying water (in drums containing solids) sheen, odor, and the presence of NAPL in the field notebook. If overlying water is present in solids drums, estimate the percentage of the drum volume occupied by water. If NAPL is encountered in water drums, estimate the percentage of drum volume that is occupied by NAPL. Contact the intended disposal company to determine whether additional NAPL samples are needed for characterization and report field observations to the disposal company to ensure an accurate disposal profile.

3.3 LABORATORY ANALYSIS

IDW samples should be analyzed for the Resource Conservation and Recovery Act (RCRA) list of contaminants that define hazardous waste on the basis of toxicity, other wastes with disposal restricted by federal statutes, and contaminants that are defined as Washington State dangerous wastes. These contaminants may include the following:

- Metals: arsenic, cadmium, chromium, lead, mercury, selenium, and silver
- VOCs: benzene, carbon tetrachloride, chlorobenzene, chloroform, 1,4-dichlorobenzene, 1,2-dichloroethane, 1,1-dichloroethene, methyl ethyl ketone, tetrachloroethene, trichloroethene, vinyl chloride, and other halogenated VOCs
- Semivolatile organic compounds (SVOCs): cresol (m-, o-, and p- isomers), 2,4-dinitrotoluene, hexachlorobenzene, hexachlorobutadiene, hexachloroethane, nitrobenzene, pentachlorophenol, pyridine, 2,4,5-trichlorophenol, 2,4,6-trichlorophenol, 2,4,5-TP (Silvex), and polycyclic aromatic hydrocarbons (PAHs)
- Pesticides: chlordane, 2,4-D, endrin, heptachlor (and epoxide), lindane, methoxychlor, and toxaphene
- Polychlorinated biphenyls (PCBs)

If a contaminant was known to never have been used on a site, or existing analytical data from likely contaminated areas of a site demonstrate that a contaminant is not present, this generator knowledge may be used to eliminate some analyses. However, at a minimum, waste characterization generally requires analysis for metals, VOCs, SVOCs, and PCBs, which are common industrial contaminants. Specific analytical requirements should be provided by the disposal vendor to ensure that adequate characterization is performed.

3.4 WASTE CATEGORIZATION

Wastes generated by environmental investigations are often suitable for disposal as unregulated materials at a Subtitle D landfill. However, there are some instances where wastes are regulated under RCRA, the Toxic Substances Control Act (TSCA), or Washington States dangerous waste regulations and may require specialized disposal at a Subtitle C/hazardous waste landfill. Situations where wastes may require specialized handling and disposal are described in the following sections.

It is important to note that the information in this section should be used as a guideline for waste characterization only. Staff should always verify the proper waste designation with the waste disposal company in accordance with the appropriate rules and regulations, noting that there are some exemptions to certain rules.

3.4.1 Resource Conservation and Recovery Act

Wastes are categorized by RCRA according to the processes by which they are generated and their characteristics including ignitability, corrosivity, reactivity, and toxicity. Toxicity is the most common characteristic that may cause IDW to be regulated under RCRA; however, other wastes (for example, water with very high or low pH) may also require specialized handling and disposal. Wastes that may require specialized handling and disposal on the basis of toxicity are discussed in further detail below.

Toxicity is determined by contaminant concentrations in liquid or leachate. For solids, a rule of thumb can be applied to predict a solid concentration that will produce a leachate concentration equivalent to the RCRA Regulatory Level. The rule of thumb conservatively assumes that the leachate concentration in milligrams per liter (mg/L) will be one-twentieth of the solid concentration in milligrams per kilogram (mg/kg).

Contaminant	RCRA Regulatory Level (mg/L)
Arsenic	5.0
Barium	100
Benzene	0.5
Cadmium	1.0
Carbon tetrachloride	0.5
Chlordane	0.03
Chlorobenzene	100

Contaminant	RCRA Regulatory Level (mg/L)
Chloroform	6.0
Chromium	5.0
o-Cresol	200
m-Cresol	200
p-Cresol	200
2,4-D	10
1,4-Dichlorobenzene	7.5
1,2-Dichloroethane	0.5
1,1-Dichloroethylene	0.7
2,4-Dinitrotoluene	0.13
Endrin	0.02
Heptachlor (and its epoxide)	0.008
Hexachlorobenzene	0.13
Hexachlorobutadiene	0.5
Hexachloroethane	3.0
Lead	5.0
Lindane	0.4
Mercury	0.2
Methoxychlor	10
Methyl ethyl ketone	200
Nitrobenzene	2.0
Pentachlorophenol	100
Pyridine	5.0
Selenium	1.0
Silver	5.0
Tetrachloroethene	0.7
Toxaphene	0.5
Trichloroethene	0.5
2,4,5-Trichlorophenol	400
2,4,6-Trichlorophenol	2.0
2,4,5-TP (Silvex)	1.0
Vinyl chloride	0.2

If a contaminant concentration is greater than 20 times the RCRA Regulatory Level, follow-up analysis using the Toxicity Characteristic Leaching Procedure (TCLP) to determine the leachability of the contaminant should be completed. TCLP results may demonstrate that the contaminant does not produce leachate concentrations exceeding its RCRA Regulatory Level. Waste requires specialized handling and disposal under RCRA if the liquid or leachate concentration of any contaminant exceeds its RCRA Regulatory Level.

3.4.2 Toxic Substances Control Act

TSCA regulates wastes containing PCBs. Wastes require specialized handling and disposal if they contain total PCBs greater than 5 mg/L in liquids or 50 mg/kg in solids.

3.4.3 Washington State Dangerous Waste

Wastes may also be categorized as Washington State dangerous waste or extremely hazardous waste requiring specialized handling and disposal on the basis of total halogenated VOC or PAH concentrations. Washington State categorization includes the following:

- Dangerous waste: total halogenated VOCs 0.01% to 1.0%
- Extremely hazardous waste: total halogenated VOCs or PAHs greater than 1.0%

3.5 DISPOSAL PROFILE PREPARATION

A disposal profile is typically created by the selected waste disposal company using laboratory analytical data and drum inventories supplied by Floyd|Snider. In some instances, additional information regarding site history may be needed to complete portions of a disposal profile based on generator knowledge.

Sites and vendors may vary; however, the property owner or operator is usually listed as the generator of a waste. Floyd|Snider personnel may sign a disposal profile, when allowed and approved by the property owner or operator, as the authorized representative of the generator.

4.0 Field Documentation

The number of drums filled during the field investigation, contents of each drum, and location of the drum staging area should be documented in the field notebook. IDW sample logs should also be recorded in the field notebook and include the date and time, sample collection method, and drums represented by each composite sample as well as any field observations.

Disposal records are mailed by the disposal company. These records should be retained in the project files and provided to the property owner/generator.

stop watch problems.

Appendix Two

Recording Forms

It is very important that each well data form stand alone. The data forms must contain all information which may have a bearing on the analysis of the data. See the suggested format for pumping test data recording sheets located at the end of this appendix. The form should allow for the following data to be recorded on the data sheet for each well:

(a) date
(b) temperature
(c) discharge rate
(d) weather
(e) well location
(f) well number
(g) owner of the well
(h) type of test (drawdown or recovery)
(i) description of measuring point
(j) elevation of measuring point
(k) type of measuring equipment
(l) radial distance from center of pumped well to the center of the observation well
(m) static depth to water
(n) person recording the data
(o) page number of total pages

In addition to the above information to be recorded on each page, the forms should have columns for recording of the following data:

(a) the elapsed time since pumping started, shown as the value (t)
(b) the elapsed time since pumping stopped, shown as (t')
(c) the depth in feet to the water level
(d) drawdown or recovery of the water level in feet
(e) the time since pumping started divided by the time since pumping stopped, shown as (t/t')
(f) the discharge rate in gallons per minute
(g) a column for comments to note any problems encountered, weather changes (i.e. barometric changes, precipitation), natural disasters, or other pertinent data.

AQUIFER TEST FIELD DATA SHEET

Page___ of____

_________ Pumped Well No.___________________ Date ____

_________ Observation Well No.________________ Weather ____

Owner __________________________________ Location ____

Observers: ____

Measuring Point is ___________________ which is _____________________ feet above/below surface.

Static Water Level _____________________________ feet below land surface.

Distance to pumped well _________________________ feet. Type of Test _________________________________

Discharge rate of pumped well ________________ gpm (gallons per minute).

Total number of observation wells __________________________________ .

Water Measurement Technique ____________________________________ .

Recorded by ________________________________ . Temperature during test ___________________________________ .

Clock Time	Elapsed Time Since Pump Started or Stopped (min)	Depth to Water Below Land (feet)	Drawdown or Recovery (feet)	Discharge or Recharge (GPM)	t/t'	Comments

AQUIFER TEST FIELD DATA SHEET

Continuation Sheet

Distance to pumped well __________________ Bearing __________________ Page _____ of _______

________ Pumped Well No.__________________ Date ____

________ Observation Well No._______________ Recorded by ____

Clock Time	Elapsed Time Since Pump Started or Stopped (min)	Depth to Water Below Land (feet)	Drawdown or Recovery (feet)	Discharge or Recharge (GPM)	t/t’	Comments

APPENDIX A

Slug Test Data Form

Page __ of __

FIGURE 1. Slug Test Data Form

DATE: ______________________________

SITE ID: ____________________________ SLUG VOLUME (ft^3): ____________________

LOCATION ID: ______________________ LOGGER: ______________________________

TEST METHOD: __ SLUG INJECTION __ SLUG WITHDRAWAL

COMMENTS: ____

____

____

Time Beginning of Test #1 __________ Time Beginning of Test #2 __________

Time End of Test #1 __________ Time End of Test #2 __________

ELAPSED TIME (MIN)	DEPTH TO WATER (FT)	ELAPSED TIME (MIN)	DEPTH TO WATER (FT)

Remedial Investigation/Feasibility Study Work Plan

Silver Bay Logging Site

Appendix C

Attachment C.2
PDI QAPP for the LDW – Middle Reach

Lower Duwamish Waterway Group
Port of Seattle / City of Seattle / King County / The Boeing Company

Pre-Design Investigation Quality Assurance Project Plan for the Lower Duwamish Waterway - Middle Reach

FINAL

For submittal to

The US Environmental Protection Agency
Region 10
Seattle, WA

October 21, 2022

Prepared by:

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in association with

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FINAL

Title and Approval Page
Remedial Design of Middle Reach
Quality Assurance Project Plan

Windward Project Manager	Kathy Godtfredsen	October 10, 2022 Date
Windward Field Coordinator	Thai Do	October 10, 2022 Date
Windward QA/QC Manager	Amara Vandervort	October 10, 2022 Date
Anchor QEA Project Manager	Tom Wang	October 13, 2022 Date
Anchor QEA Health and Safety Officer	Timothy Shaner	October 13, 2022 Date
EPA Project Manager	ELLEN HALE Digitally signed by ELLEN HALE Date: 2022.10.13 16:26:44 -07'00' Elly Hale	Date
EPA QA/QC Manager	Don Matheny Digitally signed by Matheny, Don Date: 2022.10.17 06:39:12 -07'00' Donald Brown	Date

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APPENDICES

ABBREVIATIONS

%RSD	percent relative standard deviation
AET	apparent effects threshold
AFDW	ash-free dry weight
Anchor QEA	Anchor QEA, LLC
AOC5	Fifth Amendment to the Administrative Order on consent
ARL	Analytical Resources, LLC
ASTM	American Society for Testing and Materials
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	contaminant of concern
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CPT	cone penetration testing
CQAP	construction quality assurance plan
CRM	certified reference material
DCP	dynamic cone penetrometer
DER	data evaluation report
GPS	global positioning system
DL	detection limit
DMMP	Dredged Material Management Program
DO	dissolved oxygen
DQI	data quality indicator
DQO	data quality objective
dw	dry weight
EC50	concentration that causes a non-lethal effect in 50% of an exposed population
EcoAnalysts	EcoAnalysts, Inc.
Ecology	Washington State Department of Ecology
EDL	estimated detection limit
EF	exceedance factor
EIM	Environmental Information Management
EPA	US Environmental Protection Agency
ESD	explanation of significant differences
FC	field coordinator
FFP	full-flow penetrometer
FNC	Federal Navigation Channel
GC/MS	gas chromatography/mass spectrometry

GPC	gel permeation chromatography
HDPE	high-density polyethylene
HPAH	high-molecular-weight polycyclic aromatic hydrocarbon
HRGC/HRMS	high-resolution gas chromatography/high-resolution mass spectrometry
HpCDD	heptachlorodibenzo-*p*-dioxin
HpCDF	heptachlorodibenzofuran
HSP	health and safety plan
HxCDD	hexachlorodibenzo-*p*-dioxin
HxCDF	hexachlorodibenzofuran
ICAL	initial calibration
ICP-MS	inductively coupled plasma-mass spectrometry
ID	identification
LC50	concentration that is lethal to 50% of an exposed population
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LDC	Laboratory Data Consultants, Inc.
LDW	Lower Duwamish Waterway
LDWG	Lower Duwamish Waterway Group
LOQ	limit of quantitation
LPAH	low-molecular-weight polycyclic aromatic hydrocarbon
MDL	method detection limit
MHHW	mean higher high water
MLLW	mean lower low water
MS	matrix spike
MSD	matrix spike duplicate
MTC	Materials & Testing Consulting, Inc.
OC	organic carbon
OCDD	octachlorodibenzo-*p*-dioxin
OCDF	octachlorodibenzofuran
OSHA	Occupational Safety and Health Administration
OnSite	OnSite Environmental Inc.
PAH	polycyclic aromatic hydrocarbon
PARCCS	precision, accuracy, representativeness, completeness, comparability, and sensitivity
PCB	polychlorinated biphenyl
PDI	Pre-Design Investigation
PDIWP	Pre-Design Investigation Work Plan
PeCDD	pentachlorodibenzo-*p*-dioxin

PeCDF	pentachlorodibenzofuran
PM	project manager
PSEP	Puget Sound Estuary Program
QA	quality assurance
QC	quality control
QAPP	quality assurance project plan
RAL	remedial action level
RAO	remedial action objective
RD	remedial design
RDWP	Remedial Design Work Plan
RI/FS	remedial investigation/feasibility study
RL	reporting limit
RM	river mile
ROD	Record of Decision
RPD	relative percent difference
SCO	sediment cleanup objective
SCUM	Sediment Cleanup User's Manual II
SDG	sample delivery group
SIM	selective ion monitoring
SM	Standard Method
SMS	Washington State Sediment Management Standards
SOP	standard operating procedure
SPT	standard penetration testing
SVOC	semivolatile organic compound
TCDD	tetrachlorodibenzo-*p*-dioxin
TCDF	tetrachlorodibenzofuran
TEQ	toxic equivalent
TOC	total organic carbon
TM	task manager
UCT-KED	universal cell technology-kinetic energy discrimination
VST	vane shear testing
Windward	Windward Environmental LLC
ww	wet weight

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1 Introduction

This quality assurance project plan (QAPP) describes the quality assurance (QA) objectives, methods, and procedures for Pre-Design Investigation (PDI) sampling in the middle reach of the Lower Duwamish Waterway (LDW) (river mile [RM] 1.6 to RM 3.0) (Map 1). This work supports the remedial design (RD) for the middle reach per the Fifth Amendment to the Administrative Order on Consent (AOC5) for the LDW (EPA 2021a). Sampling will include the collection and chemical analysis of sediment samples to delineate exceedances of sediment remedial action levels (RALs) presented in Tables 27 and 28[1] of the US Environmental Protection Agency (EPA) Record of Decision (ROD) (EPA 2014b) and in the Explanation of Significant Differences (ESD) (EPA 2021b) for carcinogenic polycyclic aromatic hydrocarbons (cPAHs). Sampling will also include the collection of engineering data to provide the information needed to determine appropriate remedial technologies in remedial action areas as well as other information needed to design the area-specific remedy in the middle reach. The remedial action areas and technologies in the remedy will be determined in accordance with ROD Figures 19 and 20.[2]

The Middle Reach Pre-Design Investigation Work Plan (PDIWP) (Windward and Anchor QEA 2022) provides the objectives, background, and conceptual study design for PDI sampling. This QAPP presents a more detailed study design, including project organization and schedule, sampling locations, field collection methods, laboratory analysis methods and procedures, data management protocols, and reporting requirements. This document was prepared in accordance with EPA's (2002) guidance on preparing QAPPs.

Design sampling will be done in phases (Figure 1-1). Phase I will involve the collection of data needed to delineate the extent of RAL exceedances in surface (0- to 10-cm), subsurface (0- to 45-cm and 0- to 60-cm), and shoaled sediment in the Federal Navigation Channel (FNC) to identify Phase I RAL exceedance areas and make preliminary technology assignments. Phase II will involve the collection of data to further refine the delineation of RAL exceedances (as needed), to assess the vertical distribution of contamination in dredge and cap areas, and to acquire area-specific engineering information needed for design. Phase II data may also be collected during Phase I if access is limited in certain areas. Phase III will be conducted if data needs remain after Phase II. Following Phases I and II, data evaluation reports (DERs) will be prepared to interpret the information and guide the development of subsequent design sampling phases.

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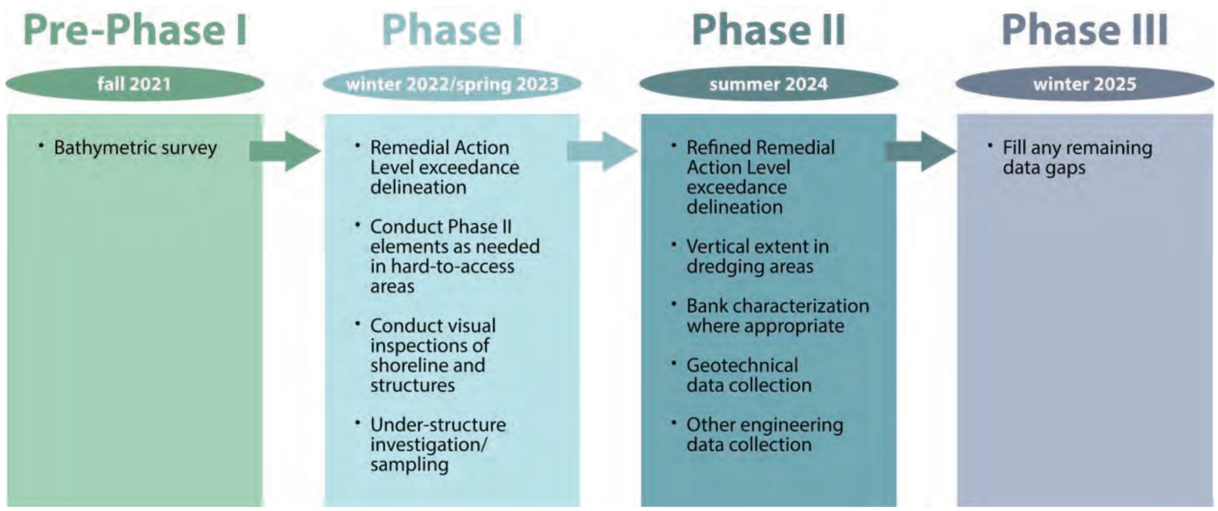
[1] ROD Table 27 is titled *Selected Remedy RAO 3 RALs* and Table 28 is titled *Remedial Action Levels, ENR Upper Limits, and Areas and Depths of Application*.

[2] ROD Figures 19 and 20 are titled *Intertidal Areas – Remedial Technology Applications* and *Subtidal Areas – Remedial Technology Applications*, respectively. Note that ROD Figure 20 was updated in an erratum (EPA 2015).

Figure 1-1
Design Sampling Phases



The PDI sampling design, which has multiple phases, is intended to provide sufficient characterization (horizontal and vertical data) for the engineering design, and to limit contingency action work during remedial action construction. The conceptual site model for the site, as well as the previous sampling data, inform the PDI sampling design.

The PDI information to be collected will help identify both the horizontal extent of the remedial action and the depths of required removal in areas necessitating dredging. Engineering design takes into account uncertainties in the horizontal and vertical definitions of remedial action area boundaries when developing the limits of dredging and other remedial actions (e.g., capping). As discussed in the Remedial Design Work Plan (RDWP) (Section 3), the engineering design will define the limits of dredging and other remedial actions (e.g., capping) using the interpolated RAL exceedance area boundaries defined in the Phase II DER. The boundaries will be developed using the most appropriate interpolation method based on the data (e.g., kriging, inverse distance weighting, Thiessen polygon). These boundaries will then be adjusted during 30, 60, and 90% design to account for design considerations, such as equipment capabilities, constructability, geography, and waterway use.

Sampling during construction (to be defined in the construction quality assurance plan) helps to reduce vertical extent uncertainties within remedial action areas requiring dredging. The construction quality assurance plan sampling results will be used to assess whether pockets of deeper contamination (i.e., missed inventory) may remain that may require contingency actions (e.g., contingency re-dredging and/or placing residuals management clean cover material) within the remedial action areas following initial dredging to design depths.

This QAPP provides detailed methods and protocols for all phases and types of design data collection. Details regarding study design for Phase I design sampling, including location coordinates and rationale, are also provided. Based on the Phase I results, QAPP addenda will be prepared to present detailed locations and other specifics—including any additional standard operating procedures (SOPs) or modified SOPs—for Phase II and, if needed, Phase III.

This QAPP is organized into the following sections:

- Section 2 – Project Objectives and Description
- Section 3 – Project Organization and Responsibilities
- Section 4 – Data Generation and Acquisition for Sediment and Bank-Area Sediment Samples
- Section 5 – Data Generation and Acquisition of Engineering PDI Elements
- Section 6 – Data Validation and Usability
- Section 7 – Assessment and Oversight
- Section 8 – References

This QAPP is supported by seven appendices, as follows:

- Appendix A – Health and Safety Plan
- Appendix B – Archaeological Monitoring and Inadvertent Discovery Plan
- Appendix C – Field Forms
- Appendix D – Sampling Location Details
- Appendix E – SOPs
- Appendix F – Site-specific Dive Safety and Work Plan
- Appendix G – Analytical Methods and Reporting Limits (RLs)

2 Project Objectives and Description

This section presents an overview of the data quality objectives (DQOs) and the scope of the design sampling.

2.1 Data Quality Objectives

The PDI has two objectives: 1) to collect data needed to delineate remedial action areas, and 2) to support remedial technology applications in designing a remedy consistent with the ROD (ROD Tables 27 and 28 and ROD Figures 19, 20, and 21 (8/26/15 revision); EPA 2014b).[3]

DQOs were identified in the PDIWP (Windward and Anchor QEA 2022) for Phases I and II and are further discussed in Tables 2-1, 2-2, and 2-3. Eight of the nine Phase I DQOs focus on delineating exceedances of the RALs,[4] including under-structure characterization. The eighth DQO involves a visual inspection of the middle reach banks. The RAL exceedances to be delineated are based on the depth interval of sediment (e.g., 0- to 10-cm), bathymetry (e.g., intertidal, shoaling area in the navigation channel), and recovery category.[5] Phase II DQOs involve additional refinement of the extent of RAL exceedances, as needed, and collection of engineering data (including vertical contamination and bank characterization) required for design of the remedy in the middle reach. DQOs for bathymetric surveying are included in the Pre-Design Survey QAPP (Attachment B to the PDIWP).

The Phase II PDI will collect all data needed to progress through 30% design. Phase III will be conducted if data needs remain following Phase II or are otherwise identified during preparation or EPA review of the 30% design. Phase III DQOs will be presented in the QAPP Addendum for Phase III, if needed, and the data will be available for the 90% design.

[3] ROD Figure 21 is titled *Intertidal and Subtidal Areas – Natural Recovery Application*.

[4] The RALs are listed in ROD Tables 27 and 28 (EPA 2014b) (and in the ESD (EPA 2021b) for cPAHs).

[5] As defined in ROD Figure 12, three recovery categories have been delineated based on whether limited natural recovery is presumed for an area (Recovery Category 1), recovery is less certain (Recovery Category 2), or natural recovery through sedimentation (Recovery Category 3) is predicted.

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Table 2-1
DQOs for Phases I and II of the PDI in the Middle Reach

Phase I	Phase II
DQO1 – Delineate 0–10-cm RAL exceedances in Recovery Category 2/3 DQO2 – Delineate 0–10-cm RAL exceedances in Recovery Category 1 DQO3 – Delineate 0–45-cm intertidal RAL exceedances in Recovery Category 2/3 DQO4 – Delineate 0–45-cm intertidal RAL exceedances in Recovery Category 1 DQO5 – Delineate 0–60-cm PCB RAL exceedances in potential vessel scour areas in Recovery Category 2/3 DQO6 – Delineate 0–60-cm RAL exceedances in Recovery Category 1 DQO7 – Delineate RAL exceedances in shoaling areas DQO8 – Conduct a visual inspection of the banks in the middle reach to identify features relevant to design, such as the presence/absence of bank armoring, and to plan how to access banks and areas under structures for sampling purposes DQO9 – Sample areas under structures, if feasible, safe, and appropriate, to delineate RAL exceedances	DQO10 – Further delineate RAL exceedances, as needed for unbounded areas DQO11 – Assess chemical and physical characteristics of sediment in banks, as needed, depending on remedial technology selected and whether or not the bank is erosional DQO12 – Delineate vertical elevation of RAL exceedances in dredge (and dredge/cap) areas and collect vertical information in cap areas where deeper contamination under caps may be located. DQO13 – Collect geotechnical data as needed depending on technology proposed and/or physical characteristics of remedial action areas DQO14 – Collect other engineering applicable data as needed (e.g., structures inspection, utility location verification, thickness of sediment on top of riprap layers)

Notes:
The topographic survey in banks areas within RAL exceedance areas will be conducted in Phase II and will be described in a Survey QAPP Addendum, including survey specific DQOs.
DQO: data quality objective
PCB: polychlorinated biphenyl
PDI: Pre-Design Investigation
RAL: remedial action level

Table 2-2
DQOs for RAL Delineation in the Phase I Middle Reach PDI

DQO Step	DQO 1	DQO 2	DQO 3	DQO 4	DQO 5	DQO 6	DQO 7
STEP 1: State the problem.	Additional sediment data are needed to delineate RAL exceedances in the 0- to 10-cm interval to define horizontal and vertical extents of contamination that require remedial action, and to assess whether any revisions to recovery categories are needed based on chemical trends.		Additional sediment data are needed to delineate RAL exceedances in the 0- to 45-cm interval to define horizontal and vertical extents of contamination that require remedial action.		Additional sediment data are needed to delineate RAL exceedances in the 0- to 60-cm interval to define horizontal and vertical extents of contamination that require remedial action, and to assess whether any revisions to recovery categories are needed.		Additional sediment data are needed to delineate RAL exceedances in the shoals in the FNC to define horizontal and vertical extents of contamination that require remedial action.
STEP 2: Identify the goals of the study.	Collect sufficient data in sediment intervals identified in ROD Table 28 to identify the following in the Phase I DER: 1) preliminary remedial action area boundaries and technologies, and 2) data needs for Phase II.						
STEP 3: Identify the information inputs.	Sediment data from the LDW were used to identify existing locations of RAL exceedances in the middle reach. Upland information was used to identify areas with potential sources of COCs. Recovery category and 2021 bathymetry information was used to identify where RALs apply.						
STEP 4: Define the boundaries of the study.	The boundary of the study has been defined by AOC5 as the middle reach (RM 1.6 to RM 3.0). Other relevant boundaries include those of recovery categories, RAL-application areas, intertidal areas, shoals, etc.						
STEP 5: Develop the analytical approach.	Sample analysis will be tiered. Tier 1 samples will be analyzed for chemicals with RALs, as described in ROD Table 28. The Tier 1 results will be used to determine which analytes are appropriate for the analysis of Tier 2 samples.						
STEP 6: Specify performance or acceptance criteria.	Performance or acceptance criteria are described in Section 4.11, including criteria for field QC samples and laboratory QC samples. DQIs for laboratory analyses (i.e., PARCCS) will be met, as described in Section 4.10. In addition, Phase II and Phase III data gaps analyses—including reviews of interpolation metrics—will be used to assess sampling needs to delineate contamination for design.						

Table 2-2
DQOs for RAL Delineation in the Phase I Middle Reach PDI

DQO Step	DQO 1	DQO 2	DQO 3	DQO 4	DQO 5	DQO 6	DQO 7
STEP 7: Develop the detailed plan for obtaining data.	Phase I samples will generally be collected at the centroid of each grid cell, except where data from 2011 or newer exist within 50 ft of the centroid. Re-occupation of some locations with EFs > 0.9 will also occur.		Samples in the 0- to 45-cm interval will be collected in the intertidal area, often from the same locations as the 0- to 10-cm[1] samples unless data 2011 or newer exist within the 50-ft radius of the grid cell centroid.		Samples in the 0- to 60-cm interval will be collected in the subtidal area, often from the same locations as the 0- to 10-cm[1] samples in those areas unless data 2011 or newer exist within the 50-ft radius of the grid cell centroid.		Samples will be collected in the FNC in areas defined as shoals in ROD Table 28. The depth of the interval will be based on the depth of the shoal as discussed in Section 4.1.1.

Notes:

1. It is not necessary for the 0- to 10-cm and the 0- to 45-cm (or 0- to 60-cm) samples to be co-located because the data interpolations in the DERs will be done separately for surface and subsurface sediment. Several factors could result in surface and subsurface samples not being co-located, including the presence of existing data in just one of the intervals, field conditions (especially under structures), and the location of the centroid relative to intertidal and shoal boundaries.

AOC5: Fifth Amendment to the Administrative Order on Consent
COC: contaminant of concern
DER: data evaluation report
DQI: data quality indicator
DQO: data quality objective
EF: exceedance factor
FNC: Federal Navigation Channel
LDW: Lower Duwamish Waterway
PARCCS: precision, accuracy, representativeness, completeness, comparability, and sensitivity
PDI: Pre-Design Investigation
QC: quality control
RAL: remedial action level
RM: river mile
ROD: Record of Decision

Table 2-3
Phase I (DQOs 8 and 9) and Phase II (DQOs 10–14) PDI Data Needs for the Middle Reach

DQO Step	DQO 8	DQO 9	DQO 10	DQO 11	DQO 12	DQO 13	DQO 14
STEP 1: State the problem.	Insufficient information is available about bank features (e.g., access, stability, erodibility, armoring, vegetation) that may affect the design and implementation of remedial actions.	Limited sampling has been conducted under over-water structures.	Preliminary boundaries may need to be refined following Phase I data collection.	Additional information needed to assess bank areas below MHHW within and adjacent to RAL exceedances areas will depend on remedial technology and whether the bank is erosional.	In dredge and partial dredge and cap areas, additional sediment data are needed to delineate the depth of contamination. In capping areas, additional subsurface sediment chemistry information is needed to inform the design of caps.	Geotechnical data are needed to evaluate the remedial technology proposed and/or physical characteristics of remedial action areas.	Other engineering data are needed to design the remedy (e.g., structures inspection, utility location verification, thickness of sediment on top of riprap layers).
STEP 2: Identify the goals of the study.	Document bank features and conditions at a scale relevant for design.	Sample beneath over-water structures, where feasible, safe, and appropriate, to delineate RAL exceedances.	Collect data in sediment intervals identified in ROD Table 28 to bound or refine the horizontal extents of remedial action areas.	Collect characterization data and topographic survey data as needed for design.	Collect data to bound the vertical extents of contamination in dredge and dredge/cap areas, and collect vertical data as needed for cap design in capping areas.	Collect data required to evaluate remedial actions for dredge cut design, slope areas, actions adjacent to structures, and where caps will be placed.	Collect other engineering data needed to design the remedy.

Table 2-3
Phase I (DQOs 8 and 9) and Phase II (DQOs 10–14) PDI Data Needs for the Middle Reach

DQO Step	DQO 8	DQO 9	DQO 10	DQO 11	DQO 12	DQO 13	DQO 14
STEP 3: Identify the information inputs.	Visual inspection and documentation (e.g., photos, notes, measurements) of the presence and condition of bank armoring, vegetation, and other features to be considered during RD); existing information collected during the RI and 2018 Waterway Users Survey maps	Waterway Users Survey information on structures, structure access and conditions identified during the Phase I structures inspection, and 2021 bathymetry and recovery category information	Existing and Phase I PDI data	Existing and Phase I PDI sediment data (below MHHW) as well as bank visual inspection data	Existing and Phase I PDI sediment data	Preliminary remedial action area boundaries identified in Phase I, existing geotechnical data, structure locations, and 2021 bathymetry	Preliminary remedial action area boundaries identified in Phase I
STEP 4: Define the boundaries of the study.	The boundary of the study has been defined in AOC5 as the middle reach (RM 1.6 to RM 3.0). Other relevant boundaries include those of recovery categories, RAL-application areas, intertidal areas, shoals, etc.						

Table 2-3
Phase I (DQOs 8 and 9) and Phase II (DQOs 10–14) PDI Data Needs for the Middle Reach

DQO Step	DQO 8	DQO 9	DQO 10	DQO 11	DQO 12	DQO 13	DQO 14
STEP 5: Develop the analytical approach.	Not applicable	Sediment samples will be analyzed for chemicals with RALs, per ROD Table 28.	Samples will be analyzed for chemicals based on Phase I results. Toxicity testing may also be conducted where warranted for remedial action area boundary delineation for areas with benthic RAL-only exceedances.	Samples will be analyzed for chemicals based on the results of Phase I.	Samples will be analyzed for chemicals based on Phase I results.	Geotechnical sampling locations will be provided in the PDI QAPP Addendum for Phase II. Geotechnical analyses will follow standard ASTM testing protocols.	Not applicable

Table 2-3
Phase I (DQOs 8 and 9) and Phase II (DQOs 10–14) PDI Data Needs for the Middle Reach

DQO Step	DQO 8	DQO 9	DQO 10	DQO 11	DQO 12	DQO 13	DQO 14
STEP 6: Specify performance or acceptance criteria.	Not applicable	Performance or acceptance criteria for chemistry and toxicity test samples are described in Sections 4.11 and 4.12.1, respectively, including those for field QC samples and laboratory QC samples. DQIs for laboratory analyses (i.e., PARCCS) will be met, as described in Section 4.10. In addition, Phase II and Phase III data gaps analyses—including reviews of interpolation metrics—will be used to assess sampling needs to delineate contamination for design.		Chemistry performance or acceptance criteria are as described for DQOs 9 and 10.	Performance or acceptance criteria are as described for DQOs 9 and 10.	Performance criteria for geotechnical testing are as described in each relevant ASTM standard for the test method used.	Not applicable
STEP 7: Develop the detailed plan for obtaining data.	Details on bank visual inspections are provided in Section 5.1.1.	Details on under-structure sampling are provided in Section 4.1.4.	Detailed plans for obtaining data will be provided in the PDI QAPP Addendum for Phase II.				Data will be obtained in accordance with standard engineering practices.

Notes:
AOC5: Fifth Amendment to the Administrative Order on Consent
ASTM: American Society for Testing and Materials
DQI: data quality indicator
DQO: data quality objective
MHHW: mean higher high water
PARCCS: precision, accuracy, representativeness, completeness, comparability, and sensitivity

PDI: pre-design investigation
QAPP: quality assurance project plan
QC: quality control
RAL: remedial action level
RI: remedial investigation
RD: remedial design
RM: river mile
ROD: Record of Decision

2.2 Project Description and Schedule

To meet the DQOs, the conceptual design sampling plan described in the PDIWP (Windward and Anchor QEA 2022) identified the need for the following types of data. These data will be collected per the methods outlined in this QAPP, the *Quality Assurance Project Plan: Pre-Design Surveys of the Lower Duwamish Waterway Middle Reach* (PDIWP Attachment B) (hereinafter referred to as the Survey QAPP), and in forthcoming addenda to these documents.

- Phase I
  - Sediment chemistry data in sediment intervals with RALs (0 to 10 cm, 0 to 45 cm, 0 to 60 cm, and FNC shoals) to delineate RAL exceedances (DQOs 1 through 7)
  - Visual bank characterization data of the entire middle reach to identify key physical features that may factor into RD, general shoreline conditions (e.g., armoring), and vegetation (DQO 8)
  - Sediment chemistry data from under structures, as needed (DQO 9)
  - Bathymetry data from areas not accessible during the 2021 survey (DQOs 1 through 3 in the Pre-Design Survey QAPP; Attachment B to the PDIWP)
  - Phase II information from hard-to-access areas that may not be accessible during later phases (see DQOs below)
- Phase II (and III if needed)
  - Additional RAL delineation as needed (DQO 10)
  - Vertical (> 45 or 60 cm) extent data to evaluate depth of dredge prisms in dredge areas (DQO 12)
  - Subsurface sediment chemistry (> 45 or 60 cm) data below caps for cap design modeling (DQO 12)
  - Toxicity testing data in areas where only benthic RAL exceedances exist (DQO 1 and 2)
  - Bank-area sediment chemical characterization where needed and focused topographic survey data (as described in the upcoming Survey QAPP Addendum[6]) in middle reach bank areas where needed (DQO 11)
  - Area-specific sediment geotechnical properties, including geological characterization, sediment index, and sediment strength and consolidation properties (DQO 13), to:
    - Determine sediment stability and stable dredge cut side-slope requirements.
    - Characterize sediment dredgeability.

[6] The Survey QAPP Addendum will be developed in parallel with the PDI QAPP Addendum for Phase II in 2023 and will be submitted to EPA with the draft Phase I DER.

  - Support sediment consolidation assessment for cap design.
  - Support contractor’s selection of dredge equipment.
  - Support design of sediment handling, transport, dewatering, treatment systems, and disposal requirements.
- Specialized surveys as appropriate to characterize utilities and/or debris (as described in the Survey QAPP Addendum) and to measure thickness of sediment overlying bank armoring (as will be described in the PDI QAPP Addendum for Phase II) (DQO 14)

All data collection and sampling activities will be conducted in conformance with the health and safety plan (HSP) (Appendix A) and the Archaeological Monitoring and Inadvertent Discovery Plan (Appendix B). This information will be collected and reported per the following schedule, as outlined in the RDWP (Anchor QEA and Windward 2022b).

Upon approval of the QAPP or QAPP Addendum, PDI field work is expected to be completed in accordance with the schedule provided in the PDIWP, unless otherwise approved by EPA. Phase I field work is anticipated to begin in late 2022.

Two tiers of analytical chemistry are planned for Phase I of the PDI (see Section 4.1.1). In Phase II, the work will focus on geotechnical and vertical sampling and refinement of Phase I RAL exceedance areas. The refinement will include chemical analysis and toxicity testing, primarily in Tier 1. Phase III will focus on filling any remaining design data gaps. Significant toxicity testing is not expected in Phase III. To minimize the schedule impact of tiering in any of the phases, working meetings will be held with EPA following receipt of unvalidated analytical results from Tier 1 to determine which archive samples will be analyzed in Tier 2. Most of the Phase I samples will be analyzed in Tier 1. A data package will be submitted to EPA 10 days after validated data from Tiers 1 and 2 (for Phase II PDI, this will include all toxicity results) have been received.

PDI DERs will be submitted to EPA following Phases I and II data submittals. The PDI DERs will present and interpret the data (including existing data), define interpolated RAL exceedance area boundaries, assign preliminary remedial technologies to these areas, and identify remaining general data needs. The Phase I PDI DER and PDI QAPP Addendum for Phase II are scheduled to be submitted to EPA 80 days after submittal of the Phase I PDI data package; this date is estimated to be in December 2023. The Phase II PDI DER is scheduled to be submitted to EPA 60 days after submittal of the Phase II PDI data package. The Phase I and II data will be incorporated into the 30% design. If Phase III design sampling is conducted, a Phase III data package will be submitted to EPA and the Phase III results will be incorporated into and appended to the 90% design document.

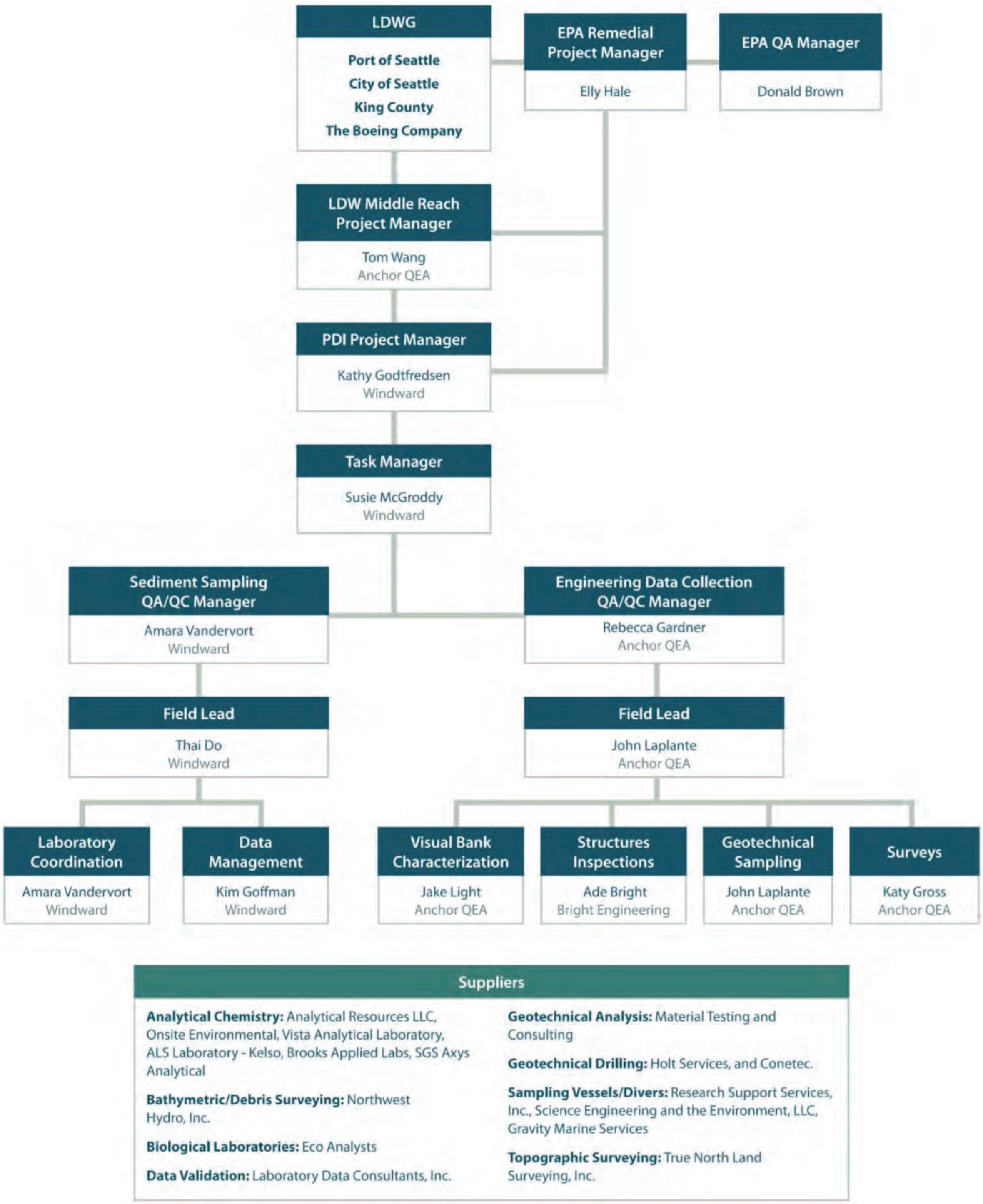
The 2021 bathymetry data, summarized in PDIWP Attachment B, have been incorporated into all of the maps in this QAPP to aid in determining sampling locations. In addition, these data were used to propose changes to recovery categories from RM 1.6 to RM 3.0, as summarized in PDIWP Attachment C. Any proposed final revisions to the recovery categories will be documented in the Phase II DER. This timing will allow for consideration of Phase I and II sediment data in establishing the final recovery category boundaries.

The 2021 bathymetric survey was not able to cover the entire middle reach because of access restrictions (e.g., moored barges). These data gaps will be addressed by completion of the Phase I sampling event.

3 Project Organization and Responsibilities

Figure 3-1 shows the overall project organization and the individuals responsible for the various tasks required for PDI sampling and analysis. The following sections describe the responsibilities of project team members, as well as laboratory project managers (PMs).

Figure 3-1
Project Organization and Team Responsibilities



3.1 Project Management

Both the Lower Duwamish Waterway Group (LDWG) and EPA are involved in all aspects of this project, including discussion, review, and approval of this QAPP and interpretation of the results of the investigation. Elly Hale is the EPA remedial project manager for the PDI and RD for the middle reach.

Tom Wang is the Anchor QEA LLC (Anchor QEA) PM for the middle reach RD. In this capacity, he will be responsible for providing oversight for planning and coordination, work plans, all project deliverables, and performance of the administrative tasks needed to provide timely and successful completion of the project. He will also be responsible for coordinating with LDWG and EPA on schedule, deliverables, and other administrative details. Mr. Wang can be reached as follows:

> Mr. Tom Wang
> Anchor QEA LLC
> 1201 3rd Avenue, Suite 2600
> Seattle, WA 98101
> Telephone: 206.903.3314
> Email: twang@anchorqea.com

Kathy Godtfredsen is the Windward Environmental LLC (Windward) PM for the middle reach PDI. In this capacity, she will be responsible for PDI project coordination, and for providing oversight for planning and coordination, PDI-related project deliverables, and performance of the administrative tasks needed to provide timely and successful completion of the PDI. She will also be responsible for coordinating with LDWG and EPA on PDI-related details. Dr. Godtfredsen can be reached as follows:

> Dr. Kathy Godtfredsen
> Windward Environmental LLC
> 200 First Avenue West, Suite 500
> Seattle, WA 98119
> Telephone: 206.577.1283
> Email: kathyg@windwardenv.com

Susan McGroddy (Windward) is the task manager (TM) for the PDI. As such, she will be responsible for communicating with the Windward PM on the progress of project tasks, conducting detailed planning and coordination, and monitoring and communicating to the Windward PM any deviations from the QAPP. Significant deviations from the QAPP will be further reported to representatives of LDWG and EPA. Dr. McGroddy can be reached as follows:

Dr. Susan McGroddy
Windward Environmental LLC
200 First Avenue West, Suite 500
Seattle, WA 98119
Telephone: 206.812.5421
Email: susanm@windwardenv.com

3.2 Field Coordination

Thai Do is the field coordinator and health and safety officer (FC/HSO) for Windward and will be responsible for managing field sampling activities and general field and QA/quality control (QC) oversight. He will oversee sample collection, preservation, and holding times, and he will coordinate delivery of environmental samples to the designated laboratories for chemical analyses. Mr. Do will familiarize field staff with the field SOPs attached to the QAPP, including any updates, if needed. Mr. Do will report deviations from this QAPP to the TM and PMs for consultation. Windward will report significant deviations from the QAPP to representatives of LDWG and EPA. Mr. Do can be reached as follows:

Mr. Thai Do
Windward Environmental LLC
200 First Avenue West, Suite 500
Seattle, WA 98119
Telephone: 206.812.5407[7]
Email: thaid@windwardenv.com

John Laplante is the engineering FC for Anchor QEA, overseeing engineering field leaders for the geotechnical, engineering field inspection, and surveying work. In this capacity, he will be responsible for managing geotechnical sampling, engineering field inspections (including visual bank characterization and structure inspection efforts), and surveys (as described in Section 5 and in the Survey QAPP Addendum). Mr. Laplante, working closely with other engineering field leads, will oversee geotechnical sample collection, processing, and delivery to the designated laboratories for geotechnical analyses, and he will familiarize the field staff with the field SOPs attached to the QAPP, including any updates, if needed. Mr. Laplante will report deviations from QAPPs to the TM and PM for consultation. Windward will report significant deviations from the QAPPs to representatives of LDWG and EPA. Mr. Laplante can be reached as follows:

[7] This is Mr. Do's office phone number. A mobile phone number will be provided prior to field sampling.

Mr. John Laplante
Anchor QEA LLC
1201 3rd Avenue, Suite 2600
Seattle, WA 98101
Telephone: 206.903.3323
Email: jlaplante@anchorqea.com

Mr. Laplante will work with Ade Bright with Bright Engineering Inc. on the structures inspections. Mr. Bright can be reached as follows:

Mr. Ade Bright
Bright Engineering Inc.
1809 7th Avenue, Suite 1100
Seattle, WA 98101
Telephone: 206.625.3777
Email: ab@brighteng.com

Eric Parker, Shawn Hinz, and Tim Thompson will provide vessel support. They will be responsible for operating their boats and will coordinate closely with the FC to collect samples in accordance with the methods and procedures presented in this QAPP. They can be reached as follows:

Mr. Eric Parker
Research Support Services
321 Northeast High School Road, Suite D3/563
Bainbridge Island, WA 98110
Mobile: 206.550.5202
Email: eparker@rssincorporated.com

Mr. Shawn Hinz
Gravity Consulting LLC
32617 Southeast 44th Street
Fall City, WA 98024
Mobile: 425.281.1471
Email: shawn@gravity.com

Mr. Tim Thompson
Science Engineering and the Environment LLC
4401 Latona Avenue Northeast
Seattle WA, 98105
Mobile: 206.418.6173
Email: tthompson@seellc.com

3.3 Quality Assurance/Quality Control

Amara Vandervort is the Windward QA/QC coordinator. In this capacity, she will oversee coordination of the field sampling and laboratory programs, and she will supervise data validation and project QA coordination, including coordination with the analytical laboratories and the EPA QA chemist, Don Matheny. Mr. Matheny is the EPA contact for AOC5 and works on behalf of the QA manager, Donald Brown. Ms. Vandervort will also maintain the official approved QAPP and coordinate the distribution of any updated versions of the QAPP to EPA. Ms. Vandervort can be reached as follows:

Ms. Amara Vandervort
Windward Environmental LLC
200 First Avenue West, Suite 500
Seattle, WA 98119
Telephone: 206.812.5415
Email: amarav@windwardenv.com

Mr. Matheny can be reached as follows:

Mr. Don Matheny
US Environmental Protection Agency, Region 10
1200 6th Avenue
Seattle, WA 98101
Telephone: 206.553.2599
Email: matheny.don@epa.gov

Rebecca Gardner is the Anchor QEA QA/QC coordinator for engineering PDI data collection and management. In this capacity, she will oversee coordination of the engineering data collection programs. Ms. Gardner can be reached as follows:

Ms. Rebecca Gardner
Anchor QEA LLC
1201 3rd Avenue, Suite 2600
Seattle, WA 98101
Telephone: 206.903.3332
Email: rgardner@anchorqea.com

Laboratory Data Consultants, Inc. (LDC) will provide independent third-party chemical data review and validation. The PM at LDC can be reached as follows:

Ms. Pei Geng
Laboratory Data Consultants, Inc.
2701 Loker Avenue West, Suite 220

Carlsbad, CA 92010
760.827.1100 (ext. 141)
Email: pgeng@lab-data.com

3.4 Laboratory Responsibilities

Amara Vandervort of Windward is the laboratory coordinator for the analytical chemistry and toxicity testing laboratories. John Laplante of Anchor QEA is the geotechnical laboratory coordinator for geotechnical testing. Analytical Resources LLC (ARL) will perform all chemical analyses on the sediment samples. Backup laboratories include: OnSite Environmental Inc. (OnSite), Vista Analytical Laboratory, ALS Environmental, Brooks Applied Laboratory, and SGS Axys Analytical Services Ltd. EcoAnalysts, Inc. (EcoAnalysts) will perform the toxicity testing. Materials Testing and Consulting, Inc. (MTC) will perform geotechnical testing and grain size analysis.

The laboratory PM at ARL can be reached as follows:

Ms. Susan Dunnihoo
Analytical Resources LLC
4611 South 134th Place
Tukwila, WA 98168-3240
Telephone: 206.695.6207
Email: limsadm@arilabs.com

The laboratory PM at EcoAnalysts can be reached as follows:

Mr. Jay Word
EcoAnalysts, Inc.
4729 Northeast View Drive
PO Box 216
Port Gamble, WA 98364
Telephone: 206.779.9500
Email: jword@ecoanalysts.com

The geotechnical laboratory PM at MTC can be reached as follows:

Mr. Alex Eifreg
Materials Testing & Consulting, Inc.
77 Chrysler Drive
Burlington, WA 98233
Telephone: 360.755.1990 Ext. 1114
Email: alex.eifrig@mtc-inc.net

The laboratories will meet the following requirements:

- Adhere to the methods outlined in this QAPP, including those methods referenced for each procedure.
- Adhere to documentation, custody, and sample logbook procedures.
- Implement QA/QC procedures defined in this QAPP.
- Meet all reporting requirements.
- Deliver electronic data files as specified in this QAPP.
- Meet turnaround times for deliverables as described in this QAPP.
- Allow EPA and the QA/QC manager, or a representative, to perform laboratory and data audits.

3.5 Data Management

Kim Goffman of Windward will oversee all environmental and geotechnical data management and will confirm that analytical data are incorporated into the LDW database with appropriate qualifiers following acceptance of the data validation. QA/QC of the database entries will provide accuracy for use in the Pre-Design Studies. Ms. Goffman can be reached as follows:

Ms. Kim Goffman
Windward Environmental LLC
200 First Avenue West, Suite 500
Seattle, WA 98119
Telephone: 206.812.5414
Email: kimg@windwardenv.com

3.6 Special Training/Certification

The Superfund Amendments and Reauthorization Act of 1986 required the Secretary of Labor to issue regulations through the Occupational Safety and Health Administration (OSHA) providing health and safety standards and guidelines for workers engaged in hazardous waste operations. Accordingly, 29 Code of Federal Regulations (CFR) 1910.120 requires that employees be given the training necessary to provide them with the knowledge and skills to enable them to perform their jobs safely and with minimum risk to their personal health. All sampling personnel will have completed the 40-hour HAZWOPER training and 8-hour refresher courses, as necessary, to meet OSHA regulations. The FC/HSO will also have completed the eight-hour HAZWOPER supervisor training.

Also, all analytical laboratories have current environmental laboratory accreditation from the Washington State Department of Ecology (Ecology) and other accreditation agencies for the analytical methods to be used. Geotechnical laboratories are not accredited; MTC is a qualified geotechnical laboratory that has 20 years' experience conducting American Society for Testing and Materials (ASTM) procedures for geotechnical testing.

3.7 Documentation and Records

All field activities and laboratory analyses will be documented following the protocols described in this section. In addition, this section provides data reduction rules and data report formats.

3.7.1 Field Observations

All field activities will be recorded in a field logbook maintained by the FC or designee. The field logbook will provide a description of all sampling activities, conferences between the FC and EPA oversight personnel associated with field sampling activities, sampling personnel, and weather conditions, as well as a record of all modifications to the procedures and plans identified in this QAPP and the HSP (Appendix A). The field logbook will consist of bound, numbered pages, and all entries will be made in indelible ink. Photographs, taken with a digital camera, will provide additional documentation of the surface sediment collection activities and all bank sediment sampling areas. The field logbook is intended to provide sufficient data and observations to enable participants to reconstruct events that occurred during the sampling period.

The project team will use the following field forms, included as Appendix C, to record pertinent information after sample collection:

- Surface sediment collection form
- Sediment core collection form
- Sediment core processing log
- Shoreline visual inspection form
- Facilities condition assessment report including photo log and concrete, wood, and steel materials visual inspection checklists
- Soil boring form
- Vane shear form
- Dynamic cone penetrometer (DCP) field form
- Protocol modification form
- Chain of custody form

The project team will document information regarding equipment calibration and other sampling activities in the field logbook.

3.7.2 Laboratory Records

3.7.2.1 Chemistry Records

The analytical laboratories will be responsible for internal checks and data verification on sample handling and analytical data reporting and will correct errors identified during the QA review. The analytical laboratories will submit data packages electronically, including the following as applicable:

- **Project narrative**: This summary, in the form of a cover letter, will present any problems encountered during any aspect of sample analyses. The summary will include, but not be limited to, discussion of QC, sample shipment, sample storage, and analytical difficulties. The project narrative will document any problems encountered by the laboratory and their resolutions. In addition, the summary will provide operating conditions for instruments used for the analysis of each suite of analytes and definitions of laboratory qualifiers.
- **Records**: The data package will include legible copies of the chain of custody forms. This documentation will include the time of receipt and the condition of each sample received by the laboratory. These records will also document additional internal tracking of sample custody by the laboratory.
- **Sample results**: The data package will summarize the results for each sample analyzed. The summary will include the following information, as applicable:
    - Field sample identification (ID) code and the corresponding laboratory ID code
    - Sample matrix
    - Date of sample extraction/digestion
    - Date and time of analysis
    - Weight used for analysis
    - Final dilution volumes or concentration factor for the sample
    - Percent solids in the samples
    - Identification of the instruments used for analysis
    - Method detection limits (MDLs)[8] and RLs[9]
    - All data qualifiers and their definitions
- **QA/QC summaries**: These summaries will contain the results of all QA/QC procedures. Each QA/QC sample analysis will document the same information required for the sample results (see above). The laboratory will make no recovery or blank corrections, except for

[8] The term MDL includes other types of detection limits (DLs), such as estimated detection limit (EDL) values calculated for dioxin/furan congeners.

[9] RL values are consistent with the lower limit of quantitation LLOQ values required under EPA-846.

isotope dilution method corrections prescribed by EPA. The required summaries will include the following information, as applicable:

- The calibration data summary will contain the concentrations of the initial calibration and daily calibration standards and the date and time of analysis. This summary will also list the response factor, percent relative standard deviation (%RSD), relative percent difference (RPD), and retention time for each analyte, as appropriate, as well as standards analyzed to indicate instrument sensitivity.
- The internal standard area summary will report the internal standard areas, as appropriate.
- The method blank analysis summary will report the method blank analysis associated with each sample and the concentrations of all compounds of interest identified in these blanks.
- The surrogate spike recovery summary will report all surrogate spike recovery data for organic analyses, and it will list the names and concentrations of all compounds added, percent recoveries, and QC limits.
- The labeled compound recovery summary will report all labeled compound recovery data for EPA method 1613b, and it will list the names and concentrations of all compounds added, percent recovery, and QC limits.
- The matrix spike (MS) recovery summary will report the MS or MS/matrix spike duplicate (MSD) recovery data for analyses, as appropriate, including the names and concentrations of all compounds added, percent recoveries, and QC limits. The MS recovery summary will also report the RPD for all MS and MSD analyses.
- The matrix duplicate summary will report the RPD for all matrix duplicate analyses and will list the QC limits for each compound or analyte.
- The certified reference material (CRM) analysis[10] summary will report the results of the CRM analyses and compare these results with published concentration ranges for the CRMs.
- The LCS analysis summary will report the results of the analyses of LCSs, including the QC limits for each compound or analyte.
- The relative retention time summary will report the relative retention times for the primary and confirmational columns of each analyte detected in the samples and the percent difference between the columns, as appropriate.

[10] CRMs will be analyzed for polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyl (PCB) Aroclors, and dioxins/furans. All other analyses will include a laboratory control sample (LCS). Specific information is listed in Section 4.10.

  - The ion abundance ratio summary for samples analyzed by EPA method 1613b will report computed ion abundance ratios compared to theoretical ratios listed in the applicable method.
- **Original data**: The data package will include legible copies of the original data generated by the laboratory, including the following:
  - Sample extraction/digestion, preparation, and cleanup logs
  - Instrument specifications and analysis logs for all instruments used on days of calibration and analysis
  - Reconstructed ion chromatograms for all samples, standards, blanks, calibrations, spikes, replicates, LCSs, and CRMs
  - Enhanced and unenhanced spectra of target compounds detected in field samples and method blanks, with associated best-match spectra and background-subtracted spectra, for all gas chromatography/mass spectrometry (GC/MS) analyses
  - Enhanced and unenhanced spectra of target performance reference compounds detected in field samples, day-zero blanks, field blanks, and method blanks, with associated best-match spectra and background-subtracted spectra, for all GC/MS analyses
  - Quantitation reports for each instrument used, including reports for all samples, blanks, calibrations, MSs/MSDs, laboratory replicates, LCSs, and CRMs

The analytical laboratories will submit data electronically, in EarthSoft EQuIS® standard four-file or EZ_EDD format. Guidelines for electronic data deliverables for chemical data will be communicated to the analytical laboratories by the project QA/QC coordinator or data manager. All electronic data submittals must be tab-delimited text files that include all results, MDLs (as applicable), and RLs consistent with those provided in the laboratory report. If laboratory replicate analyses are conducted on a single submitted field sample, the laboratory sample identifier must distinguish among the replicate analyses.

3.7.2.2 Toxicity Testing Records

The bioassay laboratory, EcoAnalysts, will be responsible for internal checks on sample handling and toxicity test data reporting and will correct errors identified during the QA review. EcoAnalysts will submit its laboratory data packages electronically, including the following as applicable:

- **Project narrative**: This summary, in the form of a cover letter, will present any problems encountered during any aspect of sample analyses. The summary will include, but not be limited to, summary of test methods, discussion of QC, sample shipment, sample storage, and analytical difficulties. This summary will document any problems encountered by the laboratory and their resolutions, and it will provide definitions of laboratory qualifiers.

- **Records**: The data package will include legible copies of the chain of custody forms. This documentation will include the time of receipt and the condition of each sample received by the laboratory, as well as additional internal tracking of sample custody by the laboratory.
- **Sample results**: The data package will summarize the bioassay results and replicate data for each sample analyzed. The summary will include the following information, as applicable:
    - Field sample ID code and the corresponding laboratory ID code
    - Toxicity test and test species
    - Bioassay start and end date and time
    - Weight of a representative subsample of organisms at the start of sediment exposures
    - Test acceptability requirements and discussion of any deviations from these requirements
- **QA/QC summaries**: These summaries will contain the results of all QA/QC checks, including the following as applicable:
    - Serial dilutions
    - LCS and reference toxicant tests
    - Any additional QC procedures required by applicable method protocols and laboratory SOPs
- **Original data**: The data package will include legible copies of the original data generated by the laboratory, including the following:
    - Source of control sediment and associated measurements
    - Water quality monitoring results
    - Measured light intensity during testing
    - Laboratory worksheets

EcoAnalysts will submit data electronically, in a Microsoft™ Excel spreadsheet format to be provided by Windward.

3.7.2.3 Geotechnical Testing Records

The geotechnical laboratory, MTC, will be responsible for internal checks on sample handling and geotechnical data reporting. MTC will submit laboratory data packages as electronic reports that include the following, as applicable:

- **Project narrative**: This summary, in the form of a cover letter, will present any problems encountered during any aspect of geotechnical testing. The summary will include, but not be limited to, summary of test methods, discussion of QC, sample shipment, sample storage, and testing difficulties as applicable. This summary will document any problems encountered by the laboratory and their resolutions.
- **Records**: The data package will provide legible copies of the chain of custody forms. This documentation will include the time of receipt and the condition of each geotechnical sample received by the laboratory.
- **Sample results**: The geotechnical data report will summarize the geotechnical testing results for each sample analyzed. The summary will include the following information, as applicable:
  - Field sample ID code and the corresponding laboratory ID code
  - Geotechnical data for each type of testing performed
  - Test acceptability requirements and discussion of any deviations from these requirements
- **Original data**: The data package will include legible copies of the original data generated by the laboratory.

MTC will submit data electronically, in PDF report and Excel format, where applicable.

3.7.3 Data Reduction

Data reduction is the process by which original data (i.e., analytical measurements) are converted or reduced to a specified format or unit to facilitate analysis of the data. Data reduction requires that all aspects of sample preparation that could affect the test result, such as sample volume analyzed or dilutions required, be taken into account in the final result. It is the laboratory analyst's responsibility to reduce the data, which the laboratory PM, the Windward TM, the QA/QC coordinator, and independent reviewers then subject to further review and reduction. The laboratory will generate the data in a format amenable to review and evaluation. Data reduction may be performed manually or electronically.

3.7.4 Data Storage and Backup

All electronic files related to the project will be stored on a secure server on Windward's network. The server contents are backed up on an hourly basis, and a copy of the backup is uploaded nightly to a secure off-site facility.

4 Data Generation and Acquisition for Sediment and Bank-area Sediment Samples

This section presents details of the PDI data generation and acquisition of chemistry data for the middle reach, and it addresses how samples will be collected, processed, and analyzed, including QA/QC, instrument maintenance and calibration, and data management requirements. PDI sampling includes the following elements that involve the sampling and analysis of sediment samples to address DQOs 1 through 7, 9, 10, and 11:

- Sediment collection and analysis of 0- to 10-cm, 0- to 45-cm, 0- to 60-cm, FNC shoal, and vertical extent core samples collected at locations below mean higher high water (MHHW)[11]
- Toxicity testing of sediment samples as needed[12]

Other PDI elements associated with engineering design elements are discussed in Section 5.

4.1 Sampling Design for Sediment Samples

This section discusses the sampling design for sediment and under-structure sampling, including approaches and rationale for depth intervals, analytes, tiering, sampling locations, and toxicity testing.

4.1.1 Sediment Sample Depth Intervals

The ROD defines which sediment depth intervals will be sampled to delineate RAL exceedances in PDI samples. Most locations will be sampled at two depth intervals. Some locations will require only one interval of sampling, depending on existing data and RAL applicability in certain areas. In the intertidal area, 0- to 10-cm and 0- to 45-cm samples will be collected as needed. In the subtidal areas, 0- to 10-cm and 0- to 60-cm samples (or FNC shoaling intervals) will be collected as needed. In subtidal areas outside of both Recovery Category 1 areas and potential vessel scour areas,[13] there are no subsurface RALs, and thus, no subsurface samples will be collected. Sampling intervals for Phase I are summarized in Table 4-1.

[11] Per Section 4.3 of the ROD (EPA 2014a), "The Selected Remedy addresses, to the extent practicable, contaminated sediments and surface water below the MHHW level (in the LDW, MHHW is 11.3 ft above the mean lower low water [MLLW] level) that are expected to remain after the EAA cleanup work (component 1) is completed."

[12] As discussed in Section 4.1.7, toxicity testing may be conducted in Phase II or III at locations with only benthic RAL exceedances and where the results would affect remedial action area boundaries if they were to pass the benthic toxicity tests.

[13] Potential vessel scour areas are defined in Table 28 of the ROD as subtidal areas (i.e., below -4 ft MLLW) that are above -24 ft MLLW north of the 1st Ave South Bridge and above -18 ft MLLW south of the 1st Ave South Bridge.

Table 4-1
Sample Depth Intervals for Phase I

Area Type	Applicable RAL Intervals	
	Surface	Subsurface
Intertidal	0–10 cm	0–45 cm
Subtidal	0–10 cm	0–60 cm (in Recovery Category 1 and potential vessel scour areas[1])
Shoaled areas in the FNC	0–10 cm	shoaled material (depth and number of samples varies, depending on the depth of shoal)[2]
		2 ft of overdredge

Notes:
1. The only segment of the FNC with the potential for vessel scour is RM 2.8 to RM 3.0, with an authorized navigation depth of -15 ft MLLW, which is shallower than the vessel scour depth of -18 ft MLLW. Between RM 1.6 and RM 2.8, the authorized depths (-20 ft MLLW and -30 ft MLLW) are deeper than the corresponding potential vessel scour depths (-18 ft MLLW and -24 ft MLLW, respectively).
2. The depth intervals for the shoaled material are shown in Table 4-2 and on Figure 4-1. One 2-ft Z-sample will also be collected in shoaling cores below the overdredge interval (Inouye and DMMP 2010). The Z-sample represents the post-dredge sediment conditions following maintenance dredging (DMMP 2021).

FNC: Federal Navigation Channel
MLLW: mean lower low water
RAL: remedial action level
RM: river mile

Sampling intervals in shoaling areas of the FNC are dependent on the depth of the shoal and the authorized navigation depth. In the middle reach, there are three different authorized navigation depths (Table 4-2), which dictate the depths of the samples to be taken for comparison to RALs. In FNC areas with shoals (i.e., areas in which the current elevation is shallower than the authorized depth), the 0- to 10-cm interval will be sampled, and other intervals will be sampled depending on the thickness of the shoal material, as shown in Figure 4-1 for the three FNC segments.

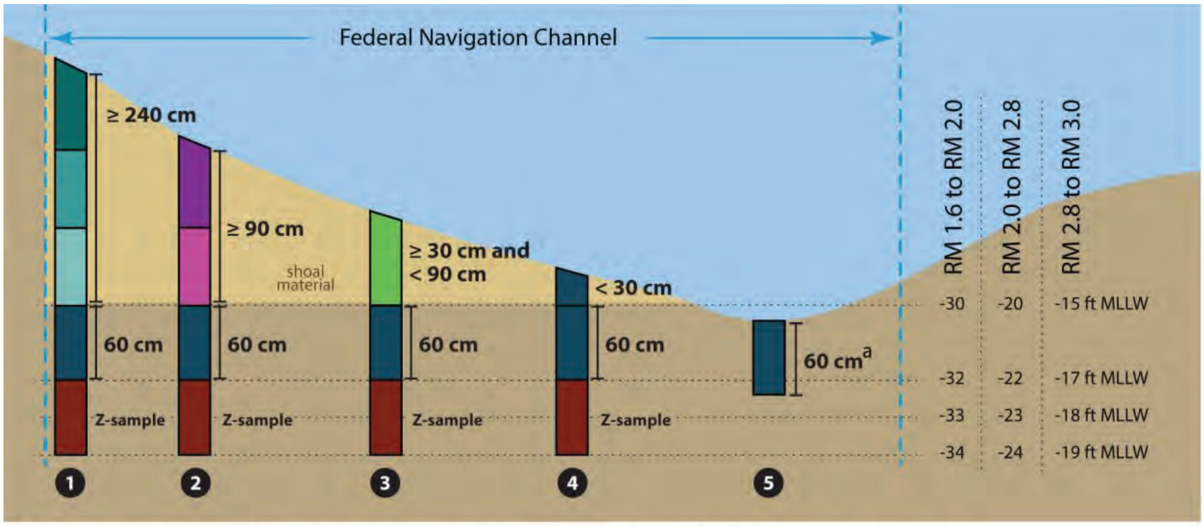
Table 4-2
Authorized FNC Depths and Associated Sample Intervals for Shoaled Areas in the Middle Reach

FNC Segment[1]	Authorized Navigation Depth (ft MLLW)	Sample Intervals in Shoaled Areas (ft MLLW)		
		Shoal (1–3 samples)[1]	Overdredge (1 sample)[2]	Z-Layer (1 sample)
RM 1.6 to RM 2.0	-30	surface to -30	-30 to -32	-32 to -34
RM 2.0 to RM 2.8	-20	surface to -20	-20 to -22	-22 to -24
RM 2.8 to RM 3.0	-15	surface to -15	-15 to -17	-17 to -19

Notes:
1. The USACE stations for these segments are provided in Table 2-1 of the PDIWP (Windward and Anchor QEA 2022).
2. When less than 30 cm of shoal material is present, the shoal material and overdredge material will be combined into a single sample (see Figure 4-1).

FNC: Federal Navigation Channel
MLLW: mean lower low water
RM: river mile

Figure 4-1
Shoal Design Sampling Approach RM 1.6 to RM 3.0



[a] The 0 - 60 cm RAL interval applies in recovery category 1 or potential vessel scour areas (RM 2.8 to RM 3.0)

1. When the thickness of shoal material is ≥ 240 cm, the shoal material will be characterized in three equal intervals.
2. When the thickness of the shoal material is ≥ 90 cm and < 240 cm, the shoal material will be characterized in two equal intervals.
3. When the thickness of the shoal material is ≥ 30 cm and < 90 cm, the shoal material will be characterized as one interval.
4. When the thickness of the shoal material is < 30 cm, the shoal material will be characterized as one interval by analyzing a combined sample with the shoal material and the 60 cm overdredge interval.
5. Between RM 2.8 and RM 3.0, a 0-60 cm sample will be analyzed in areas that are not shoaled and are shallower than the potential vessel scour elevation of -18 ft MLLW. Samples from these areas will not be characterized as a shoaling locations because they have no shoaling material.

Note: The interval between the authorized navigation depth and the overdredge depth will be characterized as a separate interval whenever the shoal interval is greater than or equal to 30 cm. In addition, a 0-10 cm sample and a 60 cm Z-sample will be collected at all shoaling core locations.

4.1.2 Tiered Analysis and Analytes

The PDI sediment sampling design involves the collection of two tiers of samples:

- Tier 1 – Locations sampled for immediate analysis
- Tier 2 – Locations sampled for sample archival with analysis dependent on the results of Tier 1 analyses

Tier 1 and Tier 2 samples will be collected during the same sampling effort. The majority of the Phase I samples will be analyzed in Tier 1. Tier 2 locations will be selected for analysis in consultation with EPA based on the general principles discussed in the PDIWP (Windward and Anchor QEA 2022). Specifically, some samples in Phase I may be analyzed as Tier 2 because they have been added to the gridded design as re-occupation or bounding samples (see Section 4.1.3).

In addition, some of the Phase I shoaling intervals will be analyzed in Tier 2. In the FNC, the overdredge core interval samples (the 2 ft below the authorized depth) will be analyzed as a Tier 1 in all locations with more than 30 cm of shoal material. When the thickness of shoal material is 30 cm or less, the shoal material and the overdredge interval will be analyzed as one sample in Tier 1. The remaining subsurface intervals will be archived as Tier 2 samples and analyzed using the following guidelines.

- When the overdredge core interval in a shoaling core does not have any RAL exceedances, then the archived shoal intervals above the overdredge interval will be analyzed to determine if all intervals are below the RAL.
- When the overdredge core interval in a shoaling core has a RAL exceedance, then archived intervals will be analyzed as needed for design purposes. For example, the analysis of the Z-sample interval would provide additional vertical delineation, and the analysis of interval(s) to characterize the uppermost 0- to 2-ft core interval could provide helpful information in determining if dredging may be deferred if USACE determines that shoaled sediment is not an impediment to navigation (per footnote 23 of the ROD).

Grain size archive samples will be collected for each interval in each shoaling core in Phase I. Shoaling samples will be analyzed for grain size in Tier 2 if Tier 1 results at a given location indicate RAL exceedances. The interval(s) (or composited intervals) to be analyzed at these locations will be determined by the engineer to meet design needs. All remaining grain size analyses will be conducted in Phase II as needed in vertical extent samples (see Section 4.2.5) or for toxicity testing (see Section 4.2.7).

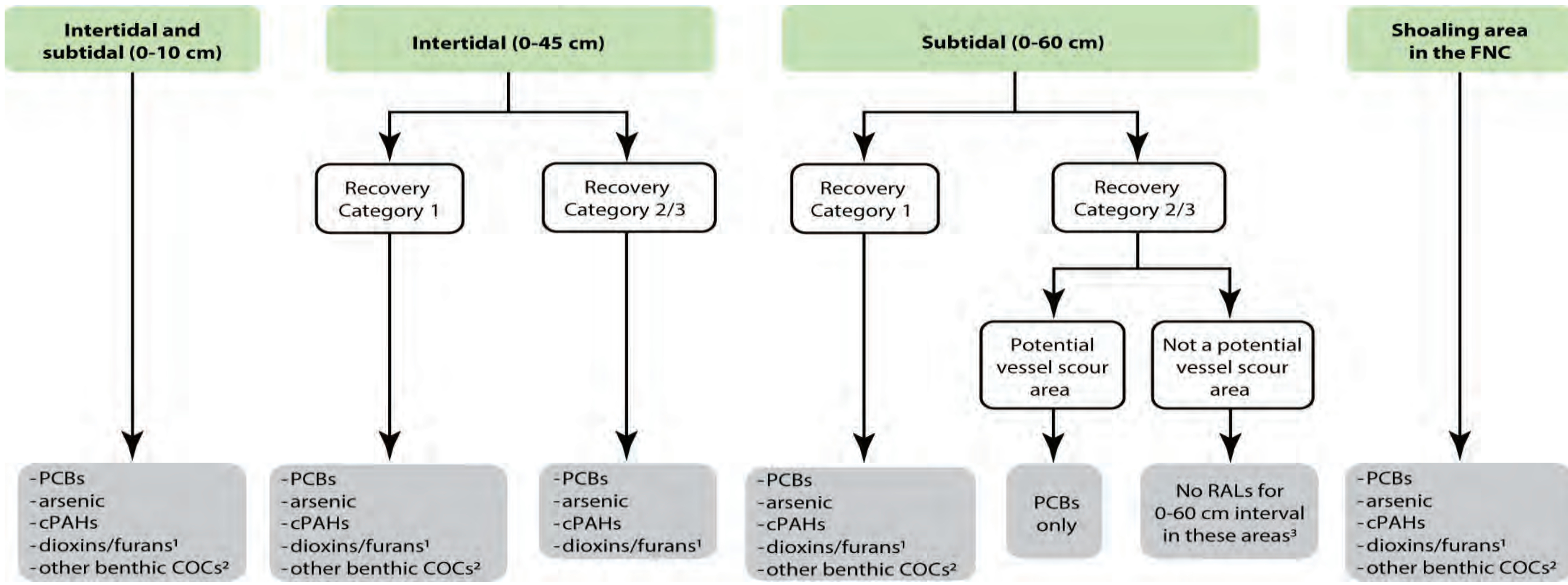
The analyte list for each Phase I sediment sample will differ depending on which RALs are applicable. RAL applicability is determined based on the sample type (i.e., intertidal or subtidal), sample interval, recovery category, and other location-specific factors. RAL applicability is summarized in Figure 4-2 and Map 2 according to the RALs presented in ROD Tables 27 and 28 (EPA 2014b) and the ESD (EPA 2021b) for cPAHs.[14]

In general, Tier 1 samples in Phase I will be analyzed for all contaminants of concern (COCs) with an applicable RAL for that sample, with the exception of dioxins/furans. Dioxins/furans will be analyzed in a subset of Phase I Tier 1 samples, as described in Section 4.1.3.

The analyte list for each Tier 2 (archive) sample will be determined based on unvalidated Tier 1 data in a meeting with EPA. COC(s) with RAL exceedance(s) in a Tier 1 sample will be analyzed in the adjacent Tier 2 samples. In addition, other COCs may be selected for Tier 2 analysis based on area-specific Tier 1 results and other existing sediment and nearby upland source data.

[14] LDWG will voluntarily evaluate any additional RAL exceedance areas using the 2014 ROD RALs for cPAHs in the DER.

Figure 4-2
Required analytes per ROD Tables 27 and 28



Notes:

Sediment will be archived to allow for potential analysis of additional RC1 analytes at all locations that may be affected by the recovery category review following the resolution of the bathymetry data gaps.

1. A subset of samples will be analyzed for dioxins/furans.
2. Other benthic COCs are the benthic risk drivers in ROD Table 27 (see Table 4-10); while PCBs, arsenic. and the seven individual PAHs in cPAHs are also benthic COCs, they are addressed by the human health RALs because they are also human health COCs.
3. Disturbance of sediment by anthropogenic sources (e.g., vessels) is not expected in these areas, so sediment deeper than 10 cm would not be exposed.

4.1.3 Phase I Sediment Sampling Design (Excluding Areas Under Structures)

This section defines the guidelines followed in identifying specific sediment sampling locations and intervals and the number of PDI samples that will be collected and analyzed to support the interpolation of RAL exceedances areas (DQOs 1 through 7). Based on these guidelines, details for each location are summarized in Appendix D. The sampling design for samples to be collected under structures (DQO 9) is discussed in Section 4.1.5.

To support the interpolation of RAL exceedance areas, a gridded design was selected to serve as the basis for Phase I sampling; this approach provides a relatively even distribution of data points. This approach differs from that used in Phase I in the upper reach, because RI/FS data used to develop the ROD indicated that the upper reach had larger areas without RAL exceedances compared to the middle reach.

For this design, a total of 243 grid cells have been identified (Maps 3a, 3b, and 3c); individual grid cells are referred by to row and column (e.g., 41C). Grid cells are rectangular (100 × 200 ft) and oriented with water flow direction along the FNC and along slips. Grid cells were altered where necessary to adapt to the geometry of the middle reach and to result in a transect-like data distribution from one side of LDW to the other (or bank to bank), because transects are often helpful in design. Within each grid cell, a centroid (center of the grid) with a 50-ft radius around it were identified to aid in the sampling design.

Maps 4a, 4b, and 4c show the data in the design dataset within the grid cell design, including exceedance factors (EFs) relative to RALs for locations with EFs > 0.9. The design dataset, as discussed in Section 3.1 and Attachment D of the PDIWP (Windward and Anchor QEA 2022), includes the data that will be used to design the remedy (i.e., to define RAL exceedance areas and the vertical extent of contamination). The design dataset includes surface sediment data collected from 2011 to the present (post-FS data[15]), as well as subsurface sediment data (both RI/FS[16] and post-FS data). A small subset of data from areas with > 1.5 ft of deepening since 2003 was not included in the design dataset because the degree of deepening indicates that previously analyzed interval(s) may no longer exist at those locations, creating uncertainty regarding representativeness.

Maps 5a and 5b show the PDI sampling locations within the gridded cells. These locations have been placed according to the steps and guidelines discussed below.

The first step was to determine if the default position of the PDI sampling location within a grid should be moved from the centroid to a new location (within 50 ft of the centroid when

[15] The post-FS dataset includes available data from January 2011 to October 2021.
[16] The surface and subsurface RI/FS dataset includes data collected from 1990 to January 2010.

possible). The default sampling location was moved from the centroid of the cell in the following circumstances.

- **RAL-applicable areas** – In grid cells with more than one RAL-applicable area (e.g., intertidal, potential vessel scour, shoal, Recovery Category 1 area), the default PDI sampling location was shifted from the centroid to a sampling location in the grid that occupies the majority of the grid cell or is the area with the lowest RALs. For example, in grid cell 41C on Map 4b, the sampling location was shifted to the southwest to be within the Recovery Category 1 area.
- **Sampleability** – In areas with steep banks, structures, or riprap, centroid locations may not be sampleable. In these places, sampling locations within grid cells were moved to an area anticipated to be sampleable. For example, the centroid in grid cell 23A on Map 4a is on riprap, so the default PDI sampling location was shifted to the north. The new locations in some grid cells with centroids near the MHHW line are more than 50 ft from the centroid (e.g., 13A, 14A, 15G, and 26A).
- **Beach play and clamming areas** – In grid cells that include intertidal areas listed as potential beach play or clamming areas, the default PDI sampling locations were sometimes moved into locations that target these intertidal areas of interest to ensure adequate coverage. For example, in grid cell 41B on Map 4b, the sampling location was shifted north to better target the intertidal area that includes beach play area 5.

Once a default PDI sampling location was established in each grid cell, the next step was to assess whether each grid cell needs to be sampled. Key considerations included: 1) what RALs apply at each location, 2) whether all or part of a grid cell is likely to be remediated, and 3) whether representative data in the design dataset already exist. The relevant guidelines are listed below.

- **Applicability of subsurface RALs** – Some grid cells are in locations that do not have an applicable subsurface RAL. In these grid cells, no subsurface sample will be collected in Phase I.[17] For example, a 0- to 60-cm sample will not be collected in grid cell 23D on Map 4a, because there is no subsurface RAL at this location.
- **Likely active remediation area** – Some grid cells have existing data in the design dataset that indicate that a remedy is likely needed in this area. In these cases, bounding through the sampling of a PDI location outside the centroid or re-occupation of an existing location may be more appropriate. For example, the sampling location in grid cell 25A was shifted north to help bound the exceedances in the inlet at RM 2.2W. In addition, an active

[17] For these locations, if the Phase I 0 to 10-cm surface sample has RAL exceedances, sediment cores will be collected at representative locations in those areas during Phase II to determine the vertical extent of contamination.

remedy is assumed for Beach 6 (grid cells 38F and 39F), with bounding samples being collected in Phase 1.

- **Coverage with existing data** – If design dataset data already exist within the grid cell, PDI sampling may not be necessary because the existing data may represent that grid cell. In order for an existing sample to substitute for a PDI sample, it must have been collected within 50 ft of the centroid, to maintain a relatively even sample distribution, and it must have been analyzed for most if not all of the analytes listed in Section 4.8.2. For example, samples analyzed for only PCBs or samples without PCBs analyses (e.g., grid cell 9A) do not qualify.

Once a PDI sampling location for each grid has been established (or substitute data have been identified), some of the existing data locations may be re-occupied as additional samples if they have an EF of ≥ 0.9. For example, in grid cells 31E and 43D, locations with EFs of 1.3 to 1.0, respectively, are being re-occupied because these EFs are close to 1. The decision to analyze these re-occupation samples, many of which are Tier 2, will be based on the results of the adjacent Tier 1 samples. For example, if concentrations in adjacent samples are below RALs, a Tier 2 sample may be analyzed to see if the sample location is also below applicable RALs. Conversely, if concentrations in adjacent samples are above RALs, the analysis of the Tier 2 sample may be unnecessary, because the Phase I results indicate that an active remedy is needed in this area (potentially with additional horizontal/vertical delineation of the area in Phase II). As discussed in Attachment D to the PDIWP (Windward and Anchor QEA 2022), when newer data are collected at a location, these data replace the older data in the design dataset if the sample is collected within 10 ft of the original location.

In addition, although remedial investigation/feasibility study (RI/FS) surface sediment data were excluded from the design dataset due to their age and the conceptual site model, these data were reviewed to determine if any RI/FS locations had EFs > 4. If so, they were re-occupied to determine if exceedances still exist in that area and to improve understanding of how concentrations are changing in the area. For example, a PDI sampling location was placed in grid cell 36E to re-occupy a 2005 surface sediment sampling location with a PCB EF of 29.

Sampling in the Slip 4 area (grid cells 40G, 42ABC) will be addressed using a tiered approach, with potentially two sampling events during Phase I (which has a multi-month sampling period). This area has received more than 2 ft of depositional material, based on differences in bathymetric surveys between 2003 and 2021. In addition, dredging was conducted in the southern part of Slip 4 in three construction seasons from 2013 to 2015 as part of the Boeing Plant 2 Early Action Area (see Attachment A of the PDIWP). As part of this action, perimeter samples were collected in this area and analyzed yearly from 2012 through 2015 (see Table A-4 in the PDIWP). Many of these perimeter locations had PCB concentrations above the applicable

RAL at least once in the last three years (see Table A-3 in the PDIWP). No data have been collected in this area since 2015.

To assess current conditions north of the dredging area, 10 perimeter monitoring stations (508, 509, 510, 511, 513, 514, 515, 516, 517, and 518) will be re-occupied early in the Phase I field effort (Map 4c). At these stations, 0- to 10-cm samples will be collected and analyzed for PCBs.[18] Based on the results, either additional Phase I sampling and analysis will be conducted in these four grid cells, or the area will be designated as a remedy area for further characterization (e.g., bounding and vertical extent of contamination) during Phase II. If additional sampling and analysis is conducted during Phase I, a 0- to 60-cm subsurface sample would be collected from each of the four grid cells, and archived PDI samples from these perimeter monitoring locations would be analyzed for the full analyte list. Additional surface sediment samples, such as re-occupations of past RAL exceedance locations, may also be collected.

Based on the above guidelines, a total of 278 sampling locations (excluding areas under structures)[19] have been identified in the 243 grids for Phase I sampling in the middle reach; most of the locations have both a surface and subsurface interval. Table 4-3 summarizes Phase I surface and subsurface sampling locations. The location of each of the Phase I sampling locations, along with other relevant data, is shown on Maps 4a, 4b and 4c (relative to RAL application areas), Map 5a and 5b (relative to the isopach analysis results), and Maps 6a and 6b (relative to the aerials). In addition, the rationale for the placement of each sampling location, the intervals collected at each location, and applicable analytes (as described in Figure 4-2 and Section 4.1.2) are presented in Appendix D. Approximately 95% of the Phase I PDI sampling locations will be analyzed in Tier 1, including 221 of the 237 surface sediment locations and at least 1 interval from all 218 subsurface sediment locations.

Table 4-3
Summary of Middle Reach Phase I PDI Sampling Locations

Grid Category	Count by Sample Type	
	Surface	**Subsurface**
Total number of grids (excludes the under-structure grids and grids where there is not an applicable RAL)	237	220
Count of grids with PDI sample	198 (84% of grids)	204 (93% of grids)
Count of grids with no PDI sample (either because of existing data, assumed active remedy, or analysis of upper reach archive sample)	39	16

[18] All samples will also be analyzed for total organic carbon (TOC) and total solids.
[19] Sampling location counts do not include under-structure sampling locations, which are discussed in Section 4.5.1.

Grid Category	Count by Sample Type	
	Surface	Subsurface
Total number of sampling locations		
Count of locations to satisfy grid coverage	191[1]	202[2]
Count of additional re-occupation samples, bounding or bank area samples, or samples adjacent to potential upland sources	46[3] (16 are Tier 2)	16
Total Phase I PDI Sampling Locations[4]	**237 (221 are Tier 1; 16 are Tier 2)**	**218[5] (all 218 are Tier 1)**

Notes:

1. This count (191 samples) includes 7 re-occupation samples that are also being used for grid coverage. This is less than the count of 198 grids where a PDI sample is being collected, because of the 4 grids in Slip 4 (40G and 42ABC) where PCB trends are being evaluated and the bounding samples in Slip 3 (grid 18D) and Beach 6 (grids 37F and 38F). These seven grids are not included in the count of locations to satisfy grid coverage because there are existing data in these grids.
2. This count (202) is less than the 204 grids where a PDI sample is being collected, because of the bounding samples in Slip 3 (grid 18D) and in Beach 6 (grid 38F) that are not also used to satisfy grid coverage.
3. This count includes only additional re-occupation/bounding samples, as well as samples adjacent to potential upland sources that were added per Ecology request. The seven re-occupation samples that are also being used for grid coverage are not included in this count.
4. Counts do not include the 21 under-structure sampling locations, which are discussed in Section 4.1.5.
5. Of the 218 subsurface locations, 65 are 0–45-cm intertidal locations, 114 are 0–60-cm subtidal locations, and 39 are shoaling locations. For the 39 shoaling locations, one interval at each location will be analyzed in Tier 1 (see Section 4.1.2).

PDI: pre-design investigation

A subset of the Tier 1 samples has been identified for dioxin/furan analysis; 44 surface and 45 subsurface sampling locations (Maps 7a and 7b). The PDI locations identified for Tier 1 dioxin/furan analysis were determined based on all existing surface and subsurface sediment data, including RI/FS surface sediment data. The selected Tier 1 samples are intended to target areas that have had dioxin/furan TEQs greater than 20 ng/kg dry weight [dw], collect subsurface data in areas with elevated surface sediment dioxin/furan TEQs, and provide spatial coverage of dioxin/furan data near outfalls where higher dioxin/furan TEQs have been reported. Archive samples from locations not analyzed for dioxins/furans in Tier 1 (surface and subsurface samples) will be retained for potential analysis of dioxins/furans in Tier 2.

The Phase I PDI Tier 1 and Tier 2 results will be included in the design dataset, as defined in the PDIWP (Windward and Anchor QEA 2022), and used to define the interpolated preliminary RAL exceedance areas in the Phase I DER. Phase II PDI data, which will also be tiered, will be used in the Phase II DER to refine the RAL exceedance area boundaries through updated data interpolations. Phase II data will also be used to define the depths of contamination in dredge or capped remedial action areas.

In addition, a probability analysis will be presented in the Phase I DER regarding the size of a contiguous area with concentrations exceeding the RAL that would be detected with a specified level of confidence, if such an area were to exist. This type of analysis is best conducted once the PDI Phase I data can be included. The results of this analysis will be considered in identifying Phase II data gaps.

4.1.4 Phase I Sampling Design Under Structures

In Phase I, sediment sampling will also be conducted under over-water structures that are at least 50 ft wide (perpendicular to the bank) and 50 ft long with safe access (DQO 9). The density of sampling locations under structures was designed to loosely conform to the grid sampling density established in Section 4.1.3, with one sample targeted for each approximately 200 linear ft of structure.[20] This work may require the use of a diver.

Prior to initiating investigations under structures, a reconnaissance inspection will be made by the Dive Supervisor and the engineering team, including the structural engineer, to verify the stability of each structure and whether or not the areas beneath them can be accessed safely. Sediment probing and sampling will not occur under any structures that are found to be unsafe to access. At this time, only one structure has been identified as unsafe to sample beneath—the southern Seattle Iron and Metals wharf at RM 2.55E. Samples will be collected from four locations immediately adjacent to this structure. If any other structures are determined to be unsafe, LDWG will coordinate with EPA to determine if sampling adjacent to the structure will be required in addition to standard grid sampling. Factors to be considered in that discussion will include the results of the analysis of the surrounding sediment data, proximity to an upland source or outfall, and visual observations.

Depending on the nature of the substrate under the structure, the first step in under-structure sediment sampling may include sediment probing to determine the horizontal limits of slope armoring (e.g., riprap) and the thickness of sediment overlying armor materials. Bathymetric elevations will also be verified during the probing effort.

When safe and feasible to collect sediment, under-structure sampling will target a surface and subsurface sediment sample at each location, if sufficient sediment is present. The specific sediment intervals collected will depend on whether the observed elevations are intertidal or subtidal. If both intertidal and subtidal conditions are present and sufficient sediment exists to collect samples, preference will be given to collecting samples within the intertidal area. Maps 8a and 8b identify 21 understructure locations. All samples will be analyzed for the Tier 1 analyte list at applicable RAL locations,[21] as discussed in Section 4.1.2. Surface sediment samples from five locations will also be analyzed for dioxins/furans: one surface sample each from under

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[20] A minimum of one sample would be collected for each targeted structure less than 200 ft long.
[21] Note, the applicable RALs under many structures are not currently known because of bathymetry data gaps, which are to be filled during Phase I sampling.

structures at Terminal 115 (RM 1.65W) and Pacific Pile and Marine (RM 2.75W), and one surface sample each from three locations under the structure at the 8th Avenue Terminal (RM 2.85E).

It is expected that some sampling locations may require location adjustments based on field conditions and the results of the sediment probing. An under-structure sampling SOP describing the details of the approach for determining the final location is included in Appendix E.
Table 4-4 provides an overview of the structures and conditions at each location that will be targeted during Phase I. The locations of each of the Phase I under-structure sampling locations, along with other relevant data, are shown on Maps 4 through 8. Maps 8a and 8b best show the locations relative to the structures in the aerial photo. All structures will be assessed for potential safety concerns prior to sampling, and unsafe conditions will be documented and reported to EPA if they prohibit under-structure sampling in specific locations. Table 4-4 also lists five structures that will not be sampled during Phase I due to their small size and proximity to a grid sample. Depending on the Phase I results, sampling may be recommended at these locations for Phase II.

Table 4-4
Identified Over-water Structures in the Middle Reach and Targeted Phase I Sampling

Approximate RM (side)	Overwater Structure Name	Description[1]	Targeted Phase I Sampling[2]	Notes
1.65 (east)	Certainteed Pier	50-ft-wide T-head pier supported on steel pipe piles at approximately 10×10-ft spacing with horizontal bracing.	1 intertidal location (0–10-cm and 0–45-cm samples if possible)	Several composite samples predating 2011 have been collected around the structure. Based on current understanding of conditions that indicate the presence of soft sediment, no sediment probing on armoring or diver inspection is anticipated.
1.7 (east)	Glacier Northwest Slip 2 Pier	Small 20-ft-wide timber pier	No Phase I sampling	Structure is smaller than minimum target width for Phase I sampling. The need for sampling will be re-evaluated during Phase II. PDI samples that are located near the structure will be collected during Phase I.
1.6–1.75 (west)	Northland North Wharf (Terminal 115)	Concrete pile-supported wharf (90 ft wide and 860 ft long within the study area).	5 subtidal locations (0–10-cm and 0–60-cm samples if possible)	Conduct sediment probing on armoring to identify five locations for sediment sampling, targeting -15 feet MLLW. Due to the presence of hard armoring, diving will likely be required to facilitate probing and sampling.
1.8 (west)	Northland South Pier (Terminal 115)	Two timber finger piers (30 ft wide each).	No Phase I sampling	Structure is smaller than minimum target width for Phase I sampling. The need for sampling will be re-evaluated during Phase II. PDI samples that are located near the structure will be collected during Phase I.
1.9 (west)	Seafreeze Pier (Terminal 115)	<20-ft-wide concrete pile-supported pier.	No Phase I sampling	Structure is smaller than minimum target width for Phase I sampling. The need for sampling will be re-evaluated during Phase II. PDI samples that are located near the structure will be collected during Phase I.

Table 4-4
Identified Over-water Structures in the Middle Reach and Targeted Phase I Sampling

Approximate RM (side)	Overwater Structure Name	Description[1]	Targeted Phase I Sampling[2]	Notes
1.8–1.9 (east)	Samson Tug	The facility is composed of three waterfront structures: one 75-ft wide T-head pier (on the mouth of Slip 2) and two single-span piers (25 ft wide each).	1 intertidal location at main pier (0–10-cm and 0–45-cm samples if possible); smaller piers are below size threshold	Several surface samples predating 2011 have been collected around the structure. Based on current understanding of conditions that indicate the presence of soft sediment, no sediment probing on armoring or diver inspection is anticipated.
1.9–2.0 (east)	Duwamish Marine Center	The central structure is a floating dock with several integrated boat houses.	Sampling will occur as part of the primary grid plan described in Section 4.1.3	Structures are floating and can be accessed via boat like other main areas of the waterway.
2.05 (east)	Muckleshoot Tribe Marina	230-ft-long wharf and floating structures	1 intertidal location (0–10-cm and 0–45-cm samples, if possible)	Based on preliminary reconnaissance, only a short distance along the wharf is not armored; therefore, only one sample will be collected. Sampling may occur by foot at low tide.
2.1 (west)	Alaska Marine Lines Yard No. 2	95-ft-wide concrete wharf.	1 subtidal location (0–10-cm and 0–60-cm samples if possible)	Conduct sediment probing on armoring to identify location for sediment sampling. Diving may be required to facilitate probing and sampling.
2.1–2.2 (east)	SeaTac Marine	On Slip 3, a configuration of concrete wharfs, aprons, and a long finger pier (600 ft long and 40 ft wide) make up a vessel slip. On the main waterway, a 400-ft-long wharf exists.	3 locations under main waterway wharf; targeting intertidal, but may be subtidal; collect 0–10-cm and subsurface (0–45- or 0–60-cm) samples if possible	At concrete wharf, conduct sediment probing on armoring to identify locations for sediment sampling. Diving may be required to facilitate probing and sampling. The finger pier is narrow and adjacent samples collected as part of the primary sampling grid will be representative of conditions under this structure.

Table 4-4
Identified Over-water Structures in the Middle Reach and Targeted Phase I Sampling

Approximate RM (side)	Overwater Structure Name	Description[1]	Targeted Phase I Sampling[2]	Notes
2.35 (west)	Boyer Alaska Barge Line North Lay Berth	Plastic float system (less than 10 feet wide) with steel raised decking and timber guide piles.	No Phase I sampling	Structure is smaller than minimum target width for Phase I sampling. The need for sampling will be re-evaluated during Phase II. PDI samples that are located near the structure will be collected during Phase I.
2.45 (west)	Boyer Alaska Barge Line Seattle Main Wharf	Timber pile-supported wharf structure (125 ft wide) with concrete cap and deck.	1 subtidal location (0–10-cm and 0–60-cm samples if possible)	Several surface and composite samples predating 2011 have been collected around and beneath the structure. Based on current understanding of conditions that indicate the presence of soft sediment, no sediment probing on armoring or diver inspection is anticipated.
2.4–2.55 (east)	Seattle Iron & Metals Wharves	Two timber wharves are present at the facility (one 135 ft long and one 315 ft long). The south structure is not in use and unsafe to conduct investigations below.	2 locations under the north wharf; targeting intertidal, but may be subtidal; collect 0–10-cm and subsurface (0–45- or 0–60-cm) samples if possible	Conduct sediment probing on armoring to identify locations for sediment sampling. Target water depth is within the intertidal; however, water is likely deeper. Due to the presence of hard armoring, diving is likely to be required to facilitate probing and sampling.
2.6 (west)	Pacific Pile and Marine Mooring	One 25-ft-wide timber pier.	No Phase I sampling	Structure is smaller than minimum target width for Phase I sampling. The need for sampling will be re-evaluated during Phase II. PDI samples that are located near the structure will be collected during Phase I.
2.75 (west)	Pacific Pile and Marine Wharf	Triangular timber pile wharf (265 ft long and <10 ft deep along waterway and 125 ft wide and >10 ft deep towards shore).	1 subtidal location; collect 0–10-cm and 0–60-cm samples	Based on preliminary reconnaissance, only a short distance along the wharf is not armored; therefore, only one sample will be collected. Conduct sediment probing on armoring to identify final location for sediment sampling. Diving may be required to facilitate probing and sampling.

Table 4-4
Identified Over-water Structures in the Middle Reach and Targeted Phase I Sampling

Approximate RM (side)	Overwater Structure Name	Description[1]	Targeted Phase I Sampling[2]	Notes
2.8 (east)	8th Avenue Terminal Wharf	Segmented concrete pile-supported wharf (600 ft long in total).	4 subtidal locations; collect 0–10-cm and 0–60-cm samples if possible	Conduct sediment probing on armoring to identify locations for sediment sampling. Diving may be required to facilitate probing and sampling.
2.9 (west)	Silver Bay Logging Wharf	Pier (115 ft wide) and apron with steel pile and steel superstructure.	1 location targeting intertidal; collect 0–10-cm and 0–45-cm samples if possible	Conduct sediment probing on armoring to identify location for sediment sampling. Diving may be required to facilitate probing and sampling.

Notes:

1. Description modified from the *Waterway User Survey and Assessment of In-Water Structures – Data Report* (Integral et al. 2018). Only structures with notable overwater coverage are included in this table. Other structures (e.g., bridge abutments, mooring dolphins, private docks and floats) were omitted since sampling would occur adjacent to those structure types (i.e., no proposed under-structure sampling). General dimensions of structures are approximate.
2. Details regarding these samples are presented in Appendix D (Table D-5).

MLLW: mean lower low water
RM: river mile

4.1.5 Phase II Sediment Sampling to Refine RAL exceedance area delineation

Following Phase I PDI sampling, a PDI QAPP Addendum for Phase II will be prepared to address Phase II DQOs (Table 2-1) and any other identified data gaps based on the interpretation of the results in the Phase I DER.

Phase II surface and subsurface sediment samples will be collected[22] to further refine the interpolated boundaries of RAL exceedance areas (DQOs 10 and 11). Sampling will target locations near RAL exceedance areas and address areas with greater data interpolation uncertainty to further refine RAL exceedance areas. For DQO 11, sediment samples will be collected where needed to refine the horizontal extent of potential contamination in bank areas[23] up to the MHHW that are within and adjacent to Phase I RAL exceedance areas. All Phase II sediment sampling locations, intervals, and analytes will be described in detail in a PDI QAPP Addendum. Topographical surveys and other characterization will also be conducted in these bank areas as needed and will be described in the Survey QAPP Addendum.

4.1.6 Phase II Vertical Extent Delineation

Sediment cores deeper than 60 cm (referred to herein as vertical extent cores) will be collected to determine the depth of contamination in dredging or partial dredging and capping remediation areas (DQO 12). Details of sampling to determine vertical extent of contamination in different types of areas are described below.

4.1.6.1 Vertical Extent Delineation within the FNC

For vertical extent delineation within the FNC, the target elevation for the vertical extent of the cores is tied to the elevation of the top of an engineered cap. The ROD (Section 13.2.1.1) states: *All post-remedy surfaces within the FNC will be maintained at or below their current authorized depths. In order to avoid damage to a cap or ENR layer during federal maintenance dredging, the top of any ENR layer will be at least 2 ft and the top of any cap will be at least 4 ft below the authorized federal navigation channel depth* (EPA 2014b). The ROD assumed a cap thickness of 3 ft in subtidal areas, a reasonable average thickness for an engineered cap. However, because a typical cap may be designed to be 2 to 3.5 ft thick, the final constructed cap thickness can vary from an anticipated minimum thickness of 2 ft to an anticipated maximum thickness of less than 5 ft (accounting for construction tolerances). In addition, because the top of the cap elevation must be 4 ft below the authorized depth within the FNC, the bottom elevation of an engineered cap, if constructed, may vary depending on authorized depth, with an assumed maximum thickness of 5 ft (Figure 4-3).

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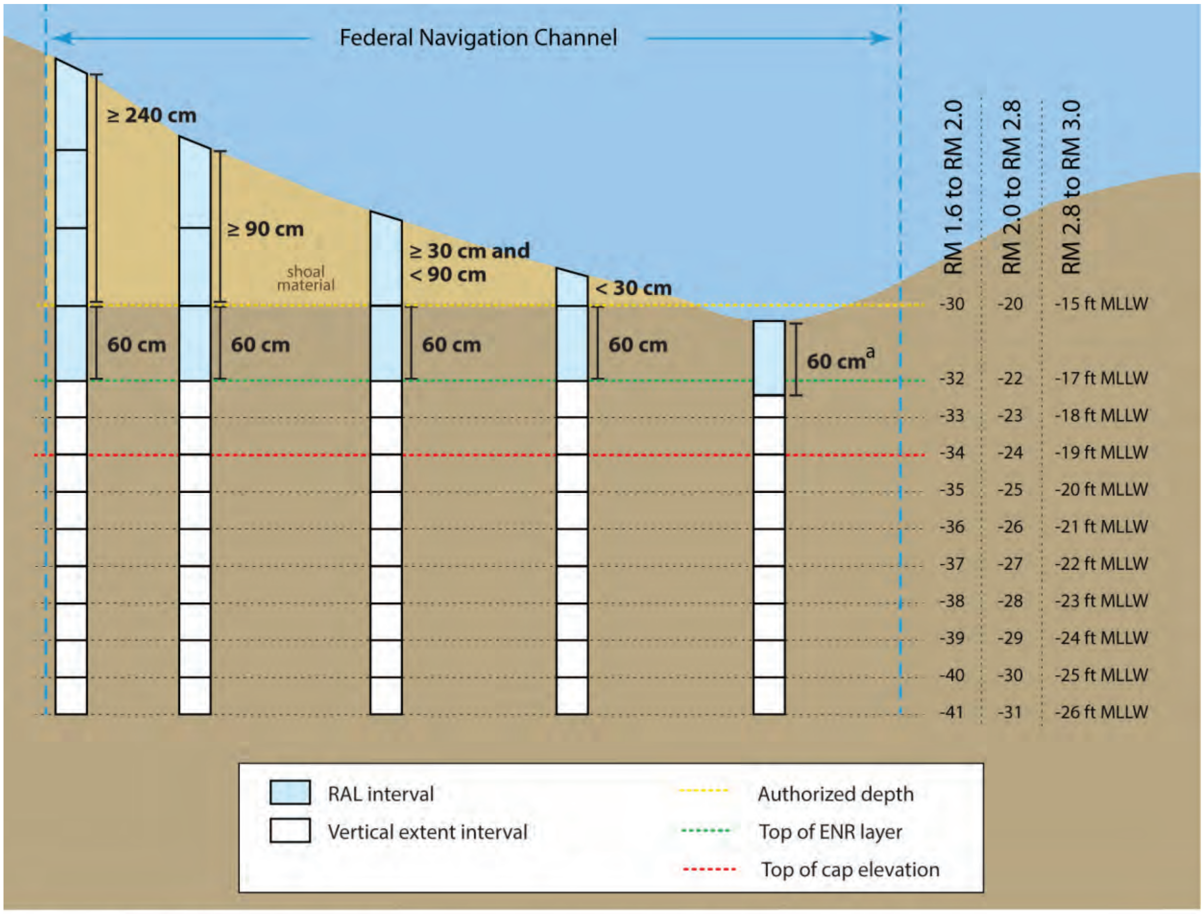
[22] If some Phase I data gaps can be satisfied through the analysis of archived Phase I locations (or intervals) that were not analyzed as part of Tier 2 in Phase I, these samples could be analyzed in Phase II.

[23] See Map 9 in the PDIWP for the locations of bank area data collected to date.

Figure 4-3
FNC Design Sampling for Vertical Extent



[a] The 0 - 60 cm RAL interval applies in recovery category 1 or potential vessel scour areas (RM 2.8 to RM 3.0)

Therefore, within the FNC, the vertical extent cores will be collected to target elevations of -26 ft MLLW (between RM 2.8 and RM 3.0), -31 ft MLLW (between RM 2.0 and RM 2.8), and -41 ft MLLW (between RM 1.6 and RM 2.0), allowing for characterization of at least 2 ft of sediment below the anticipated maximum cap thickness. In addition, any sediment collected below the target elevation (or depth) will be archived in 30-cm (approximately 1-ft) intervals, as described in Appendix E. The target elevations will apply to cores collected within the FNC and within a 10-ft buffer on either side of the channel boundary.

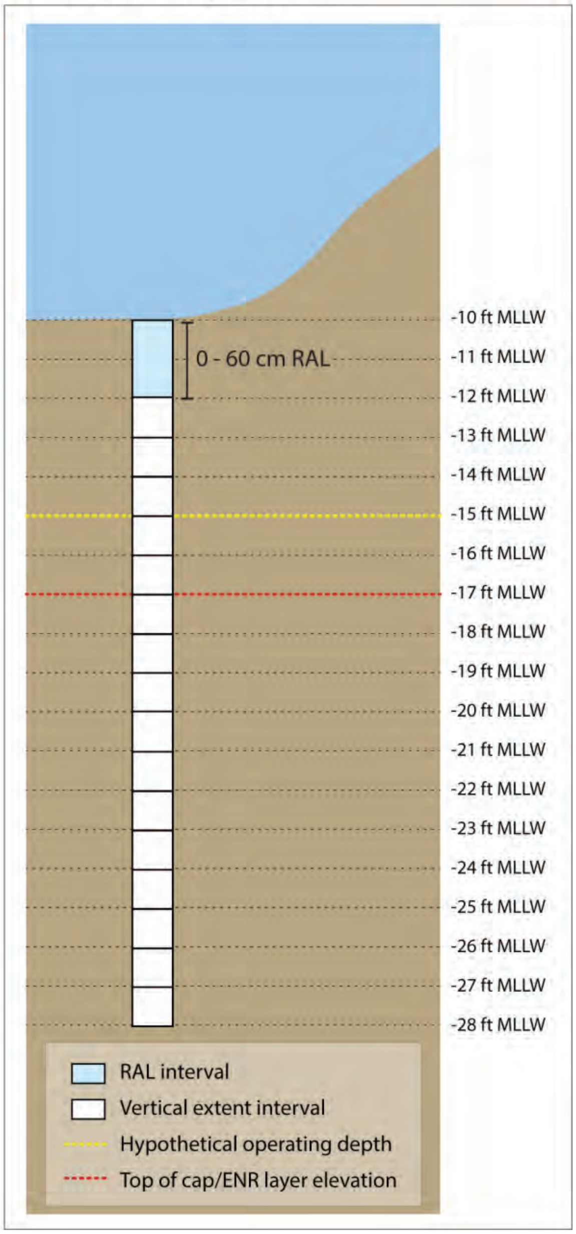
Section 2.5 of the LDW RI (Windward 2010) summarizes the geologic conditions below the LDW. In general, recently deposited sediments are underlain by alluvium consisting of silts and sands with silt interbeds of varied thicknesses. These native layers are encountered between elevations -20 ft MLLW and -25 ft MLLW, depending on the location within the middle reach. Therefore, the minimum target depths for vertical cores will be sufficient to characterize potential contamination within the FNC. If contamination does extend to the target depths, dredging more than 7 ft below the maximum top of cap elevation will need to be carefully considered, due to potential impacts on side slope stability in areas outside of the FNC, including habitat areas.

4.1.6.2 Vertical Extent Delineation in Berthing Areas

Outside of the FNC, the ROD (Section 13.2.1.1) states: *For areas outside the FNC where depths are maintained by private or public entities (called berthing areas in this ROD, but could include slips, entrance channels, or restorations areas) the top of any cap or ENR layer will be a minimum of 2 ft below the operating depth* (EPA 2014b). Thus, where vertical extent delineation is required within a berthing area outside of the FNC, vertical extent cores are targeted to extend at least 9 ft below the operating depth (i.e., obtaining 7 ft of vertical extent below the 2-ft overdredge buffer below the operating depth) in order to accommodate an anticipated maximum cap thickness of 5 ft (Figure 4-4). Berthing depths will be presented in the PDI QAPP Addendum once it has been determined where vertical extent cores will be collected based on Phase I RAL exceedance areas.

Figure 4-4
Berthing Area Outside the FNC Design Sampling

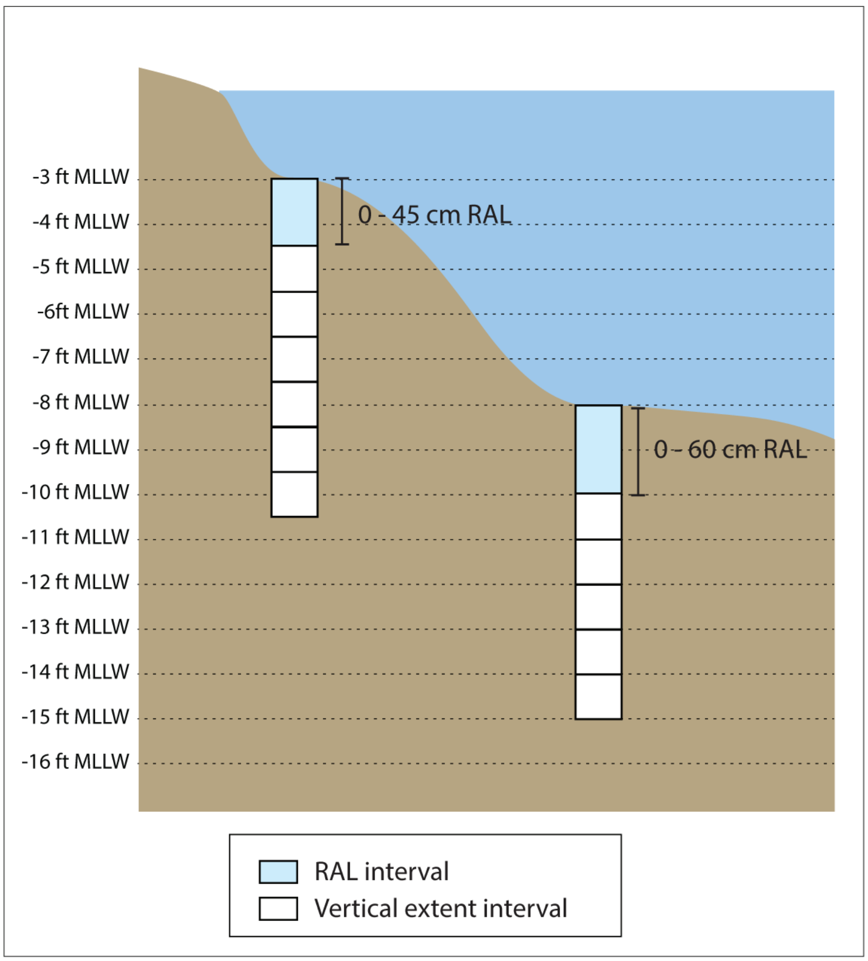
Example Berthing Area



4.1.6.3 Vertical Extent Delineation in Habitat Areas and Areas Outside of the FNC or Berthing Areas

Within habitat areas (defined as areas above -10 ft MLLW in the ROD), the ROD states: *Post-remedy surfaces will be maintained at their current depth and backfilled or capped with suitable habitat materials* (EPA 2014b). Thus, vertical extent cores in these areas will not include any buffer depth below the existing grade, and a targeted 7-ft core will provide sufficient vertical extent delineation to design a cap with habitat substrate on top (Figure 4-5). The ROD does not require any specific elevation limits when placing enhanced natural recovery or caps in areas that are not within the FNC, berthing areas, or habitat areas (EPA 2014b). Backfilling to grade is not required for non-habitat areas. However, some backfilling of a dredge area may be needed for slope stability, to avoid morphological changes, or for other reasons.

Figure 4-5
Sampling Design for Habitat Areas and Areas Outside of the FNC or Berthing Areas



4.1.7 Phases II and III Toxicity Testing Design

Toxicity testing can be used to help delineate remedial action area boundaries (DQOs 1 and 2). If sediment is not toxic at a location based on benthic toxicity tests, then the toxicity result will override the benthic RAL chemistry result[24] in areas without human health RAL exceedances.

In Phase II or III, toxicity testing may be conducted at locations with only benthic RAL exceedances and at locations where the results would affect remedial action area boundaries if they were to pass the benthic toxicity tests. Toxicity testing will not be done at locations with human health COC RAL exceedances. The specific locations to be tested, sample collection protocols, and timing considerations will be identified in QAPP addenda.

It is anticipated that most of the locations for toxicity testing will be identified in the Phase I DER. These locations will be re-occupied in Tier 1 of Phase II, and toxicity testing will be conducted. The results of the Phase II toxicity testing will be included in the Phase II DER, wherein Phase I RAL exceedance area boundaries and technologies will be refined, and remaining data gaps based on Phase II data will be identified. If the need for additional toxicity testing is identified as a data gap in the Phase II DER, the locations and timing for additional toxicity testing in Phase III will be considered. Options to expedite the testing will be investigated. Testing results may refine the 30% RD areas defined based on Phase I and II results. If significant changes to these areas are possible, LDWG will work with EPA to update stakeholders in a timely manner.

4.2 Sediment Sampling Methods

This section provides methods to locate and collect surface and subsurface sediment samples as part of PDI sampling efforts. Detailed sediment sampling methods are included as SOPs in Appendix E.

Sampling activities will be coordinated with other activities occurring within the middle reach. These activities include tribal fishing, waterfront operations at active facilities, and potential construction activities.

4.2.1 Sediment Sampling Sequencing and Logistics

Phase I sediment sampling is anticipated to begin in November 2022. For sampling locations where both a surface (i.e., 0- to 10-cm) and subsurface sediment (i.e., 0- to 45-cm, 0- to 60-cm, or deeper shoaling area cores) sample will be collected, the subsurface sediment sample will be collected first when possible to ensure that an acceptable core can be collected at a given

[24] Per the note to ROD Table 20.

location.[25] The coordinates from the actual core location (or surface location if the surface sample is collected first) will be used as the target sample coordinates, unless the location is a re-occupation, in which case the sample will be collected at the original target coordinates.

LDWG notified property owners in February 2022 regarding upcoming sampling, including the need for coordination of access to locations that will be accessed via adjacent uplands or samples that will be collected from privately owned aquatic lands. LDWG will obtain access agreements where needed (see RDWP Map 4-1) (Anchor QEA and Windward 2022b). LDWG will notify property owners well in advance of sampling to coordinate access; property owners will notify their tenants as necessary. In the event that LDWG or EPA cannot obtain timely access, alternative locations, a later phase of sampling, or a reasonable assumption regarding potential RAL exceedances will be considered in consultation with EPA.

4.2.2 Target Sampling Locations

Target sampling locations are presented in Maps 4a, 4b, and 4c and listed in Appendix D. For all sampling locations, the field crew will confirm the sampling area type (i.e., within or outside of the FNC and subtidal vs. intertidal) in real-time during sample collection. This confirmation will be particularly important for locations without existing bathymetry information at the time of sampling (i.e., in bathymetry data gap locations).

For samples intended to re-occupy previous sampling locations, sample collection will be attempted as close as possible to and no further than 3 m (10 ft) from the target coordinates. The field crew will have field sheets (based on information in Appendix D) that will provide all relevant information for each location, including which locations are re-occupations.

For samples not intended to re-occupy a previous sampling location, more flexibility is permitted. First, sample collection will be attempted within 3 m (10 ft) of the target coordinates. If this is not possible (e.g., due to an obstruction or because the location is too shallow to sample from a boat), the field crew will either move the sampling location (within a maximum distance of 10 m [32 ft]) or, in the case of shallow water, attempt to manually collect the sample on foot during a low tide. To minimize the need to move the sampling location, property owners with barges will be notified prior to the sampling event, and samples will be collected from shallow areas during higher tide levels.

If the sample cannot be collected due to difficult substrate (e.g., presence of riprap or other obstruction) or after up to three subsequent attempts within 10 m (32 ft), the closest sampleable

[25] Surface sediment samples cannot be collected from the cores because insufficient volume for analysis would be available in the 0- to 10-cm section of the core.

location meeting the needs of the location will be sampled. If no sample can be collected meeting the location needs, EPA and LDWG will be consulted.

When the sample is moved, the sample ID will be assigned the coordinates of the revised location. Sampling locations positioned under known structures will remain under structures if it is safe to sample in these locations. Safety concerns will be documented in field forms, and EPA and LDWG will be notified to discuss options for these locations.

4.2.3 Surface Sediment Collection

Surface sediment samples (0- to 10-cm) will be collected from a boat, or from land by manually collecting the sample on foot during a low tide. Based on the Phase I bank visual inspection, any locations that are determined to be inaccessible by boat or land may be deferred for collection by a diver if it is safe to do so (Section 4.3). Under-structure surface sediment sampling may be conducted from a boat, from land, or by diver, depending upon site access considerations. Surface sediment grab sample collection and processing will follow standardized procedures described in Ecology's Sediment Cleanup User's Manual (SCUM) (Ecology 2021). SOPs for the collection of surface sediment by boat and from land are presented in Appendix E. Sediment volumes are discussed in Section 4.10.

4.2.4 Subsurface Sediment Collection

Subsurface sediment core samples will be collected primarily using a vibracorer deployed from a sampling vessel. However, conditions may arise in the intertidal area where sampling from a vessel is not possible; in these cases, the core must be manually collected from shore during low tide. The SOPs for collecting and processing intertidal (0- to 45-cm), subtidal (0- to 60-cm), and shoaling location sediment cores are presented in Appendix E. Sediment volumes are discussed in Section 4.9. Based on the Phase I visual bank characterization, any intertidal locations determined to be inaccessible from a boat or from land may be deferred for collection by a diver if the sample can be safely collected (Section 4.3). Under-structure subsurface sediment sampling may be conducted from a boat, from land, or by diver, depending upon site access considerations.

4.2.5 Processing Vertical Extent Cores

The procedures for processing sample intervals in vertical extent cores are provided in detail in the subsurface sample collection SOP included in Appendix E. All intervals will be recovery corrected following the procedures in the subsurface sample collection SOP (Appendix E). The RAL intervals in the vertical extent cores will be processed following the same methods used for subsurface sediment (Section 4.2.4). The deeper sample intervals will be processed as separate 30-cm (approximately 1-ft) intervals for archival or analysis. If any of the sediment cores contain at least 15 cm of sediment below the targeted depth, that sediment will also be archived. If more than 30 cm of sediment is collected in a core below the targeted depth, the sediment will be archived in 30-cm intervals (Appendix E).

In general, first two 30-cm sample intervals below the depth interval where RALs apply will be analyzed; then, each subsequent alternating interval will be archived or analyzed, until reaching the end of the core, native sediment,[26] or the target depth. Any native sediment identified will not be composited with non-native sediment. If the boundary with native sediment falls on an even 30-cm increment, starting at the top of the native sediment boundary, 30-cm interval archive samples will be collected. If the boundary does not fall at an even 30-cm increment, the 15-cm rule for material at the end of a core (described above) will be used to determine intervals. For example, if native material is encountered at 265 cm (8.7 ft) in a 366-cm (12-ft) subtidal core, the intervals would be as follows: Interval A would represent the 0- to 60-cm interval, intervals B through G would represent 30-cm intervals of non-native material, interval H would represent material 240 to 265 cm (i.e., the bottom of the non-native material), and intervals I through K would represent native material (intervals I and J would each be 30 cm, and interval K would be 41 cm because less than 15 cm would remain if a 30-cm interval was used). The proposed analysis and archive intervals for each vertical core will be provided in the PDI QAPP Addendum for Phase II with the vertical core locations.

Core interval delineation and Tier 2 assignments may be affected by stratigraphy. If a sample interval is changed to reflect a change in geologic unit, the decision will be made in the field during core processing and documented on the Sediment Core Processing Log (Appendix C). An experienced[27] field geologist or geotechnical engineer will either directly oversee or coordinate with the field geologist or geotechnical engineer during the sediment core logging process in order to identify major stratigraphic boundaries in vertical extent cores, and to determine if native material is present in the core. Any changes to Tier 2 analysis assignments will require EPA approval.

Grain size analyses will be performed on approximately 10% to 25% of the cores to help the project engineer understand the dredgeability of the sediment. One or more composite samples representing the full length of the core above any native material layer encountered will be selected for analysis. Grain size data will also be collected for native materials. The compositing interval(s) will be determined when the core is examined during sediment core logging. The field geologist or geotechnical engineer will identify spatially representative cores from which to obtain the grain size composite(s).

[26] The LDW Upper Reach Phase II DER (Anchor QEA and Windward 2022a) defines native as an alluvial unit that is composed primarily of sand with varying amounts of silt, as well as interbedded lenses of silt, clay, and poorly graded sand throughout. The upper 2 to 17 ft may contain significant wood and sometimes anthropogenic debris, as well as laminations of shell hash.

[27] An "experienced" geologist or engineer has at least five years of field experience that includes geologic interpretation of sediment or soil cores.

4.2.6 Special Considerations for Sampling Sediment on Banks

Banks, which are defined as the transition areas from the LDW subtidal or intertidal bed to MHHW (Anchor QEA and Windward 2019), can be more challenging to sample than the other waterway sediments. Banks can be steeply sloped, covered by hard materials, or difficult to access due to limited water depth. Before the sampling program begins, the field crew will inspect the banks to determine how areas could be accessed. If a target location listed in Appendix D is not accessible, the field crew will move the sampling location to a nearby area within the same bank, as described in the SOP (Appendix E). In addition to the proposed samples, additional samples will be collected at any location within an interpolated RAL exceedance area that appears to be a unique potential source (i.e., area with discoloration or visible seepage of material).

If the global positioning system (GPS) does not work in a bank area (e.g., due to poor reception caused by structures obstructing satellite signals), sediment samples will be collected as close to the target location as possible, using zoomed-in aerial photo maps as guidance. Sampling locations will be recorded using distances measured from landmarks (e.g., pier structures and pilings). Additional photographs will be taken as needed in order to record the sampling location.

Vertical extent cores on the banks will be collected by boat wherever possible, following protocols in the SOP (Appendix E). However, water depths may limit the ability of the sampling boat to get close enough to a bank to collect samples on the bank below MHHW, and bank physical conditions (e.g., debris, riprap) may limit the effectiveness of vibracoring or drill rig equipment. Drilling methods for vertical extent delineation sampling will be the same as those described in Section 5.3.2 for barge-based geotechnical drilling. The drill rig may be deployed from a barge, or from the top of the bank, set back to provide a flat surface. The approach to be used will be determined prior to the field effort in consultation with EPA and the drilling company, based on site access and safety considerations. Where necessary, a probe rig may be deployed to collect vertical extent cores on the bank. Sample collection using a probe rig is described in Appendix E.

If neither vibracoring nor collection using a drill rig or probe rig is feasible, it may be necessary to use hand auger sampling methods for vertical extent cores. The practical depth of hand augering is typically 2 to 3 ft. The use of hand augers, if needed, will be discussed with EPA during the field effort.

4.2.7 Sediment Collection for Toxicity Testing

4.2.7.1 LDW Sediment

For locations identified for toxicity testing, additional sediment will be collected during the collection of surface sediment grabs (Section 4.2.3). A total of 200 oz (6 L) of sediment will be collected at these locations. Thus, multiple grabs will be collected from the same location until sufficient volume has been obtained. Sediment from all grabs will be thoroughly homogenized prior to distribution into the appropriate sample containers for both conventionals analysis and toxicity testing. The sediment from locations identified for toxicity testing will be submitted for expedited analysis of grain size and TOC to identify appropriate reference sediments. The expedited data will be available within 2 weeks of sample collection in order to initiate the bioassays within the holding time (56 days). In addition, ammonia and sulfide will be analyzed due to the short holding time (seven days) for those parameters.

4.2.7.2 Reference Area Sediment

Reference area sediment will be collected by EcoAnalysts from locations in Carr Inlet such that the grain size and TOC are similar to those of the LDW samples being tested. In order to obtain a suitable reference sample and to best match the LDW samples, five locations will be sampled from the reference area following the reference area sediment sampling protocols in SCUM (Ecology 2021) and the Dredged Material Management Program (DMMP) User Manual (DMMP 2021). Field measurements of grain size will be used to inform the selection of the five sampling locations.

At each reference area location, multiple grab samples will be combined and homogenized thoroughly to create a composite sample with sufficient volume for toxicity testing and analysis of TOC, grain size, ammonia, and total sulfides. Additional sediment from the reference sites will be archived in case chemical analyses are needed at a later date.

In order to review reference area grain size and TOC data prior to initiating the bioassay testing, these analyses will be expedited. The grain size and TOC data for the five composite reference samples will be reviewed, and the toxicity test reference will be selected. The reference sediment percent fines should be within 20% of the test sediment percent fines and the TOC should be similar. If there is no single sample with TOC and grain size comparable to those of the LDW samples, then combining reference area samples to create a composite reference sample will be considered.

4.3 Diver-related Activities

Based on the field conditions, any sediment sampling locations that are determined to be inaccessible by boat or from land may be accessed by a diver. A dive plan (including health and safety requirements) is included in Appendix F.

4.4 Sample Identification

Unique alphanumeric IDs will be assigned to each sample and recorded on the collection and processing forms (Appendix C).

The sample IDs for individual sediment samples will include the following:

- Project area ID (i.e., LDW) and two-digit year (i.e., 22 will be used for all Phase I samples to indicate that sample collection for this phase began in 2022[28])
- Sample type:
  - o SS – surface sediment (0 to 10 cm)
  - o IT – intertidal sediment (0 to 45 cm)
  - o SC – subsurface core (depths variable)
  - o GT – geotechnical sample
- Location number (which will begin with 1,000 outside structures and 1,800 under structures)
- For all subsurface cores (SC), a sequential letter (e.g., A, B, etc.) will be used to identify the interval. The letter A will be used to indicate the targeted surface interval, with B, C, etc. used to indicate each subsequent interval.

For example, a surface sediment sample from location 1027 would be labeled LDW22-SS1027. The subtidal sediment core samples from that location would be labeled LDW22-SC1027A for the first core interval (e.g., the 0- to 60-cm sample) and LDW22-SC1027B for the next core interval sample (if applicable), and so forth.

The number of RAL intervals at shoaling locations is dependent on the depth of the shoal material (Figure 4-1). In a shoaling core with more than 90 cm of shoal material, the surface-most three intervals are all RAL intervals, and these intervals would be labelled A, B, and C. In a shoaling core with less than 30 cm of shoal material, the surface-most interval is the only RAL interval; it would be labelled as the A interval. Z-samples would also be labelled using this approach. For example, for a shoaling core with more than 30 cm and less than 60 cm of shoal material, the shoal material would be the A interval, the overdredge interval would be the B interval, and the Z-sample would be the C interval.

Any field duplicate sample collected will have the same sample ID as its parent sample but will be appended with "-FD" to identify it as a field duplicate.

4.5 Sample Custody and Shipping Requirements

Sample custody is a critical aspect of environmental investigations. Sample possession and handling must be traceable from the time of sample collection, through laboratory and data analyses, to delivery of the sample results to the recipient. Procedures to be followed for sample custody and shipping are detailed in this section.

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[28] The sample IDs for all Phase I samples (even if some are collected in 2023) will begin with LDW22 to indicate the initiation of the Phase I sampling effort.

4.5.1 Sample Custody Procedures

Samples are considered to be in custody if they are: 1) in the custodian's possession or view; 2) in a secured place (under lock) with restricted access; or 3) in a container and secured with an official seal(s) such that the sample cannot be reached without breaking the seal(s). Custody procedures, described below, will be used for all samples throughout the collection, transportation, and analytical processes, and for all data and data documentation, whether in hard copy or electronic format. Custody procedures will be initiated during sample collection.

A chain of custody form will accompany all samples to the analytical laboratory. Each person who has custody of the samples will sign the chain of custody form and ensure that the samples are not left unattended unless properly secured. Minimum documentation of sample handling and custody will include:

- Sampling location, project name, and unique sample ID
- Sample collection date and time
- Any special notations on sample characteristics or problems
- Name of the person who initially collected the sample
- Date sample was sent to the laboratory
- Shipping company name and waybill number (if applicable)

In the field, the FC or a designee will be responsible for all sample tracking and custody procedures. The FC will also be responsible for final sample inventory and will maintain sample custody documentation. The FC or a designee will complete chain of custody forms prior to transporting samples. At the end of each day, and prior to sample transfer, chain of custody entries will be made for all samples. Information on the sample labels will be checked against sample log entries, and sample tracking forms and samples will be recounted. Chain of custody forms, which will accompany all samples, will be signed at each point of transfer. Copies of all chain of custody forms will be retained and included as appendices to the data reports. Samples will be shipped in sealed coolers.

The analytical laboratories will ensure that chain of custody forms are properly signed upon receipt of the samples and will note any questions or observations concerning sample integrity on the chain of custody forms. The analytical laboratories will contact the FC and project QA/QC coordinator immediately if discrepancies are discovered between the chain of custody forms and the sample shipment upon receipt.

4.5.2 Shipping Requirements

Sediment chemistry samples will be transported directly to ARI (i.e., by lab courier or field staff) and will be shipped or transported via courier to EcoAnalysts. Geotechnical samples will be transported via courier or shipped to MTC. Prior to shipping, containers with sediment samples will be wrapped in bubble wrap and securely packed inside a cooler with ice packs. The original signed chain of custody forms will be placed in a sealed plastic bag and taped to the inside lid of the cooler. Fiber tape will be wrapped completely around the cooler. On each side of the cooler, a *This Side Up* arrow label will be attached; a *Handle with Care* label will be attached to the top of the cooler, and the cooler will be sealed with a custody seal in two locations.

The temperature inside the cooler(s) containing the sediment samples will be checked by the laboratory upon receipt of the samples. The laboratory will specifically note any coolers that do not contain ice packs or that are not sufficiently cold[29] upon receipt. All samples will be handled in a manner to prevent contamination or sample loss. Any remaining sediment samples will be disposed of upon receipt of written notification by the Windward PM. Holding times will vary by analysis and are summarized in Section 4.8.2.

4.6 Decontamination Procedures

Sampling requires strict measures to prevent contamination. Sources of extraneous contamination can include sampling gear, grease from ship winches or cables, spilled engine fuel (gasoline or diesel), engine exhaust, dust, ice chests, and ice used for cooling. All potential sources of contamination in the field will be identified by the FC, and appropriate steps will be taken to minimize or eliminate contamination. For example, during retrieval of sampling gear, the boat will be positioned, when feasible, so that engine exhaust does not fall on the deck. Ice chests will be scrubbed clean with Alconox® detergent and rinsed with distilled water after use to prevent potential cross contamination. To avoid contamination from melting ice, the wet ice will be placed in separate plastic bags.

All sediment sampling and homogenizing equipment, including the mixing bowl and stainless steel implements, will be decontaminated between sampling locations per Ecology guidelines (2021) and the following procedures:

1. Rinse with site water and wash with a scrub brush until free of sediment.
2. Wash with phosphate-free detergent.
3. Rinse with site water.
4. Rinse with distilled water.

Acid or solvent washes will not be used in the field because of safety considerations and problems associated with rinsate disposal and sample integrity, specifically:

- Use of acids or organic solvents may pose a safety hazard to the field crew.
- Disposal and spillage of acids and solvents during field activities pose an environmental concern.

[29] As stated in validation guidance documents, sample shipping coolers should arrive at the laboratory with an internal temperature of ≤ 6ºC; however, due to the short transit distance and time from the site to ARL, not all samples may have reached this temperature by the time they arrive at the laboratory.

- Residues of solvents and acids on sampling equipment may affect sample integrity for chemical testing.

Any sampling equipment that cannot be cleaned to the satisfaction of the FC will not be used for further sampling activities.

4.7 Field-generated Waste Disposal

Excess surface sediment will be returned to each sampling location after sampling has been completed for that location. Excess subsurface sediment will be containerized (e.g., in steel drums) as non-hazardous waste, labelled, and secured for off-site disposal via a licensed waste disposal company. Decontamination water will not be contained.[30] All disposable sampling materials and personal protective equipment used in sample processing, such as disposable coveralls, gloves, and paper towels, will be placed in heavyweight garbage bags or other appropriate containers. Disposable supplies will be removed from the site by sampling personnel and placed in a normal refuse container for disposal as solid waste.

4.8 Laboratory Methods for Sediment Samples

At each laboratory, a unique sample identifier (termed either project ID or laboratory ID) will be assigned to each sample. The laboratory will ensure that a sample tracking record follows each sample through all stages of laboratory processing. The sample tracking record must contain, at a minimum, the name/initials of individuals responsible for performing the analyses, dates of sample extraction/preparation and analysis, and types of analyses being performed.

The analytical laboratories will meet the sample handling requirements and follow the procedures described in this section. In addition, analytical methods and data quality indicator (DQI) criteria are provided herein. Laboratory methods for geotechnical testing are discussed in Section 5.3.3.

4.8.1 Laboratory Sample Handling

Samples will be stored initially at ARL in accordance with the conditions specified in the methods. Samples for the other laboratories will be packed in coolers on ice and delivered via courier service or shipped in coolers on ice. Bioassay sediments will be stored, refrigerated, after nitrogen purging of the headspaces in the jars at ARL. Archive samples will be stored, frozen, at ARL. The analytical laboratories will preserve and store samples as described in Section 4.8.2. Samples will be disposed of after hold times expire, following written authorization from the Windward PM.

[30] Because decontamination water is an Alconox®/water solution (i.e., phosphate-free), it does not require containment.

4.8.2 Analytical Methods

The analyte list for each Phase I sediment sample is summarized in Appendix D by sample type. Chemical analysis of the sediment samples will be conducted by ARL, grain size analyses will be conducted by MTC, and toxicity testing will be conducted by EcoAnalysts (Table 4-5). Analytical methods, toxicity test methods, and laboratory sample handling requirements for all measurement parameters are presented in Table 4-6. Geotechnical testing methods are presented in Section 5.3.3.

Table 4-5
Sediment Analyses to be Conducted at each Analytical Laboratory

Laboratory	Analyte Group	Individual Analytes
ARL	conventionals	TOC, percent solids, ammonia, and sulfides
	metals	arsenic, cadmium, chromium, copper, lead, silver, zinc, mercury
	PAHs	acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(j)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, 2-methylnaphthalene, naphthalene, phenanthrene, and pyrene
	PCB Aroclors	Aroclor 1016, Aroclor 1221, Aroclor 1232, Aroclor 1242, Aroclor 1248, Aroclor 1254, Aroclor 1260
	SVOCs	1,2-dichlorobenzene, 1,2,4-trichlorobenzene, 1,4-dichlorobenzene, 2,4-dimethylphenol, 4-methylphenol, benzoic acid, benzyl alcohol,[1] bis(2-ethylhexyl)phthalate, butyl benzyl phthalate, dibenzofuran, dimethyl phthalate, hexachlorobenzene, n-nitrosodiphenylamine, pentachlorophenol, and phenol
	dioxin/furan congeners	2,3,7,8-TCDD, 1,2,3,7,8-PeCDD, 1,2,3,4,7,8-HxCDD, 1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 1,2,3,4,6,7,8-HpCDD, OCDD, 2,3,7,8-TCDF, 1,2,3,7,8-PeCDF, 2,3,4,7,8-PeCDF, 1,2,3,4,7,8-HxCDF, 1,2,3,6,7,8-HxCDF, 1,2,3,7,8,9-HxCDF, 2,3,4,6,7,8-HxCDF, 1,2,3,4,6,7,8-HpCDF, 1,2,3,4,7,8,9-HpCDF, and OCDF
MTC	conventionals	grain size[2]
EcoAnalysts	toxicity testing	acute amphipod 10-day mortality test, acute 48-hr bivalve larvae combined mortality and abnormality test, and chronic 20-day juvenile polychaete survival and growth test

Notes:

1. Because benzyl alcohol is not a CERCLA hazardous substance, benzyl alcohol data will not be included in the DERs. Benzyl alcohol data obtained through routine SVOC analysis of the PDI sediment samples will be provided to EPA.
2. For engineering-related tests, ASTM methods D6913 and D7928 will be used. For toxicity-related tests, the PSEP method will be used.

ARL: Analytical Resources LLC

ASTM: American Society for Testing and Materials
CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act
DER: data evaluation report
EcoAnalysts: EcoAnalysts, Inc.
EPA: US Environmental Protection Agency
HpCDD: heptachlorodibenzo-*p*-dioxin
HpCDF: heptachlorodibenzofuran
HxCDD: hexachlorodibenzo-*p*-dioxin
HxCDF: hexachlorodibenzofuran
MTC: Materials & Testing Consulting, Inc.
OCDD: octachlorodibenzo-*p*-dioxin
OCDF: octachlorodibenzofuran
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
PDI: Pre-Design Investigation
PeCDD: pentachlorodibenzo-*p*-dioxin
PeCDF: pentachlorodibenzofuran
PSEP: Puget Sound Estuary Program
SVOC: semivolatile organic compound
TCDD: tetrachlorodibenzo-*p*-dioxin
TCDF: tetrachlorodibenzofuran
TOC: total organic carbon

Table 4-6
Analytical Methods and Sample Handling Requirements for Sediment Samples

Parameter[1]	Method	Reference[2]	Extraction Solvent	Cleanup	Laboratory	Container	Preservative	Sample Holding Time
Chemistry								
TOC	high-temperature combustion	EPA 9060A	na	na	ARL	4-oz glass jar	cool to ≤ 6°C; freeze to ≤ -18°C	28 days 6 months if frozen
Percent solids	drying oven	SM 2540G	na	na	ARL		cool to 4 ± 2°C	6 months
Metals	ICP-MS	EPA 3050B EPA 6020B UCT-KED	na	na	ARL	4-oz glass jar	cool to ≤ 6°C; freeze to ≤ -18°C	6 months 2 years if frozen
Mercury	cold vapor-atomic fluorescence spectroscopy	EPA 7471B	na	na	ARL			28 days 1 year if frozen
Grain size	sieve/hydrometer	ASTM D7913 and D7928	na	na	MTC	16-oz plastic jar	cool to 4 ± 2°C	6 months
cPAHs[3,4]	GC/MS-SIM	EPA 3546/ EPA 8270E-SIM	dichloromethane/ acetone	Silica gel	ARL	16-oz glass jar	cool to 0–6°C; freeze to ≤ -18°C	1 year to extraction if frozen; 14 days to extraction if refrigerated; when thawed, 40 days after extraction; store extracts at ≤ 6°C and in the dark

Table 4-6
Analytical Methods and Sample Handling Requirements for Sediment Samples

Parameter[1]	Method	Reference[2]	Extraction Solvent	Cleanup	Laboratory	Container	Preservative	Sample Holding Time
PAHs[4]/SVOCs[5]	GC/MS	EPA 3546/ EPA 8270E/EPA 8270E-SIM	dichloromethane/ acetone	GPC (optional)	ARL		cool to 0–6°C; freeze to ≤ -18°C	1 year to extraction if frozen; 14 days to extraction if refrigerated; when thawed, 40 days after extraction; store extracts at ≤ 6°C and in the dark
PCB Aroclors	gas chromatography/electron capture detection	EPA 3546 Mod EPA 8082A	Hexane/ acetone	Silica gel, sulfuric acid/ permanganate sulfur, or acid/ base partition (optional)	ARL		cool to 0–6°C; freeze to ≤ -18°C	1 year to extraction if frozen; 14 days to extraction if refrigerated; when thawed, 40 days after extraction; store extracts at ≤ 6°C and in the dark
Hexachloro-benzene	gas chromatography/electron capture detection	EPA 3546/EPA 8081B	Hexane/ acetone	Silica gel, sulfur removal, GPC (optional)	ARL		cool to 0–6°C; freeze to ≤ -18°C	1 year to extraction if frozen; 14 days to extraction if refrigerated; when thawed, 40 days after extraction; store extracts at ≤ 6°C and in the dark
Ammonia[6]	Flow injection	SM 4500-NH3 H-97	na	na	ARL	4-oz glass jar	cool to 4 ± 2°C	7 days
Total sulfide[6]	Colorimetric	SM 4500-S2 D-0 PSEP prep	na	na	ARL	4-oz glass jar	2 mL 2 Normal zinc acetate; cool 4 ± 2°C	7 days

Table 4-6
Analytical Methods and Sample Handling Requirements for Sediment Samples

Parameter[1]	Method	Reference[2]	Extraction Solvent	Cleanup	Laboratory	Container	Preservative	Sample Holding Time
Dioxins/furans	HRGC/HRMS	EPA 1613b	Toluene	Florisil, silica gel, sulfuric acid	ARL	8-oz amber glass jar	cool to ≤ 4°C; freeze to ≤ -18°C	1 year until extraction and 1 year after extraction if stored in the dark at ≤ -18°C
Toxicity Testing								
Amphipod and polychaete toxicity testing	na	PSEP 1995/ Ecology 2021	na	na	EcoAnalysts	32-oz HDPE wide-mouth jars	cool to 4 ± 2°C nitrogen purge of headspace	56 days until test initiation
Bivalve larvae toxicity testing								

Notes:

1. Individual analytes are listed in Table 4-5.
2. Laboratory SOPs are confidential and are available upon EPA request.
3. Per the ROD (EPA 2014a), cPAHs consist of a subset of seven PAHs that EPA has classified as probable human carcinogens: benz[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.
4. cPAHs will be analyzed by 8270E-SIM in samples that require only cPAH analysis (i.e., 0- to 45-cm samples in Recovery Category 2/3) and not the full SVOC list.
5. In the analysis of the full SVOC list, 2,4-dimethylphenol, benzoic acid, benzyl alcohol, n-Nitrosodiphenylamine, pentachlorophenol, 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, and 1,4-dichlorobenzene will be analyzed by 8270-SIM.

6. Ammonia and total sulfide analyses will only be conducted on the sediment locations targeted for possible toxicity testing

ARL: Analytical Resources LLC
ASTM: American Society for Testing and Materials
cPAH: carcinogenic polycyclic aromatic hydrocarbon
EcoAnalysts: EcoAnalysts, Inc.
EPA: US Environmental Protection Agency
GC/MS: gas chromatography/mass spectrometry
GPC: gel permeation chromatography
HDPE: high-density polyethylene
HRGC/HRMS: high-resolution gas chromatography/high-resolution mass spectrometry
ICP-MS: inductively coupled plasma-mass spectrometry

MTC: Materials & Testing Consulting, Inc.
na: not applicable or not available
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
PSEP: Puget Sound Estuary Program
ROD: Record of Decision
SIM: selected ion monitoring
SM: Standard Method
SOP: standard operating procedure
SVOC: semivolatile organic compound
TOC: total organic carbon
UCT-KED: universal cell technology-kinetic energy discrimination

4.9 Sediment Chemistry Analytical Data Quality Objective and Criteria

The analytical DQO for sediment samples is to develop and implement procedures that will ensure the collection of representative data of known, acceptable, and defensible quality. Parameters used to assess data quality are precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS). These parameters are discussed below.

Precision is the measure of reproducibility among individual measurements of the same property, usually under similar conditions, such as multiple measurements of the same sample. Precision is assessed by performing multiple analyses on a sample; it is expressed as an RPD when duplicate analyses are performed, and as a %RSD when more than two analyses are performed on the same sample (e.g., triplicates). Precision is assessed by laboratory duplicate analyses (e.g., duplicate samples, MSDs, and LCS duplicates) for all parameters. Precision measurements can be affected by the nearness of a chemical concentration to the DL, whereby the percent error (expressed as either %RSD or RPD) increases. The DQI for precision varies depending on the analyte. The equations used to express precision are as follows:

$$\%\ \text{Recovery} = \frac{(\text{measured conc - measured duplicate conc})}{(\text{measured conc + measured duplicate conc}) \div 2} \times 100$$ **Equation 1a**

$$\%\ \text{RSD} = {}^{\text{SD}}/_{\text{D}_{\text{ave}}} \times 100$$

Where:

$$\text{SD} = \sqrt{\left(\frac{\sum(\text{D}_\text{n} - \text{D}_{\text{ave}})^2}{(\text{n}-1)}\right)}$$ **Equation 1b**

D = sample concentration

D_{ave} = average sample concentration

n = number of samples

SD = standard deviation

Accuracy is an expression of the degree to which a measured or computed value represents the true value. Accuracy may be expressed as a percentage recovery for MS, LCS, or CRM analyses. The DQI for accuracy varies depending on the analyte. The equation used to express accuracy for spiked samples is as follows:

$$\%\ \text{Recovery} = \frac{\text{spike sample results - unspiked sample results}}{\text{amount of spike added}} \times 100$$ **Equation 2**

Representativeness is an expression of the degree to which data accurately and precisely represent an environmental condition. The sampling approach was designed to address the specific objectives described in Section 2.1. Assuming those objectives are met, the samples collected should be considered adequately representative of the environmental conditions they are intended to characterize.

Comparability is an expression of the confidence with which one dataset can be evaluated in relation to another dataset. Therefore, sample collection and chemical and physical testing will adhere to the most recent Puget Sound Estuary Program (PSEP) and SCUM QA/QC procedures (PSEP 1997; Ecology 2021) and EPA and Standard Methods (SMs) analysis protocols.

Completeness is a measure of the amount of data that is determined to be valid in proportion to the amount of data collected. The equation used to calculate completeness is as follows:

$$\text{Completeness} = \frac{\text{number of valid measurements}}{\text{total number of data points planned}} \times \mathbf{100} \qquad \textbf{Equation 3}$$

The DQI for completeness for all components of this project is 90%. Data that have been qualified as estimated because the QC criteria were not met will be considered valid for the purpose of assessing completeness. Data that have been qualified as rejected will not be considered valid for the purpose of assessing completeness.

Analytical sensitivity is the minimum concentration of an analyte above which a data user can be reasonably confident that the analyte was reliably detected and quantified. For this study, the MDL[31] or the lower limit of quantitation will be used as the measure of sensitivity for each analyte.

Table 4-7 lists specific DQIs for laboratory analyses of sediment samples.

Table 4-7
DQIs for Laboratory Analyses

Parameter[1]	Unit	Precision[2]	Accuracy[2]		Completeness
			CRM/LCS[3]	Spiked Samples	
TOC	%	± 20%	80-120%	75/125%	90%
Percent solids	%	± 20%	na	na	90%
Grain size	%	± 20%	na	na	90%
Metals	mg/kg dw	± 20%	80–120%	75–125%	90%

[31] The term MDL includes other types of DLs, such as EDL values calculated for dioxin/furan congeners. Recent revisions to EPA SW846 methods no longer require the calculation of MDLs.

Table 4-7
DQIs for Laboratory Analyses

Parameter[1]	Unit	Precision[2]	Accuracy[2]		Completeness
			CRM/LCS[3]	Spiked Samples	
Mercury	mg/kg dw	± 20%	80–120%	75–125%	90%
PAHs[4]	µg/kg dw	± 35%	44 - 203%/ 30–160%	30–160%	90%
cPAHs[5]	µg/kg dw	± 35%	45 - 155%/ 35 - 129%	35 - 129%	90%
PCB Aroclors	µg/kg dw	± 35%	50 - 150%/ 56 - 120%	56–120%	90%
SVOCs	µg/kg dw	± 35%	10–160%	10–160%	90%
Hexachlorobenzene	µg/kg dw	± 35%	50–120%	50–120%	90%
Ammonia	mg/kg dw	± 20%	90-110%	75 - 125%	90%
Total sulfides	mg/kg dw	± 20%	75–125%	75 - 125%	90%
Dioxins/furans	ng/kg dw	± 25%	50 - 150%/ 63–170%	63 - 170%[6]	90%

Notes:

1. Individual analytes are listed in Table 4-5.
2. Values listed are method limits provided by ARL. The percentages provided represent the recovery range for each parameter. Individual compound recoveries for PAHs and SVOCs are provided in Appendix G.
3. An LCS may be used to assess accuracy when CRM is unavailable. CRMs will be analyzed for PAHs, PCB Aroclors, and dioxins/furans only. The satisfactory acceptance limit for CRM recovery will include the uncertainty range around the CRM mean as well as the uncertainty of the method measurement
4. PAHs analyzed by EPA 8270E.
5. cPAHs analyzed by EPA 8270E-SIM.
6. Labelled compound percent recovery range.

ARL: Analytical Resources LLC
cPAH: carcinogenic polycyclic aromatic hydrocarbon
CRM: certified reference material
DQI: data quality indicator
dw: dry weight
EPA: US Environmental Protection Agency
LCS: laboratory control sample
na: not applicable
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
SIM: selected ion monitoring
SVOC: semivolatile organic compound
TOC: total organic carbon

The laboratory MDL and RL goals for each analytical method are compared to their respective minimum sediment RALs in Tables 4-8 and 4-9. All the analytical methods are sufficiently sensitive.

Table 4-8
RAO 1, 2, and 4 COCs and Associated RL Goals and RALs for Sediment Samples

COC	Method	Unit	RL	RAL[1]
PCBs	EPA 8082A (Aroclors)[2]	μg/kg dw	4	240[2]
Arsenic	EPA 6020B	mg/kg dw	0.500	28
cPAH[3]	EPA 8270E	μg TEQ/kg dw	18.1[4]	900[5]
cPAH[3,6]	EPA 8270E SIM	μg TEQ/kg dw	4.5[4]	900[5]
Dioxins/ furans	EPA 1613b	ng TEQ/kg dw	1.59[7]	25

Notes:

1. RAL is the minimum value for a COC listed in the ROD Table 28 (EPA 2014b) or cPAH ESD (EPA 2021b).
2. The OC-normalized RAL was converted for this table to dry weight values using 2% TOC based on average LDW TOC. The RAL is 12 mg/kg OC; sample results will be compared to the RAL based on the sample-specific TOC value.
3. Per the ROD (EPA 2014a), cPAHs consist of a subset of seven PAHs that EPA has classified as probable human carcinogens: benz[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.
4. The RL for the cPAH TEQ value was calculated using one-half the RL for each of the cPAH compounds and the appropriate toxic equivalency factor values (California EPA 2009). Individual compound RLs are listed in Appendix G.
5. The 2014 ROD RAL is based on a benzo(a)pyrene slope factor that has since been updated. The updated value from the cPAH ESD (EPA 2021b) is listed in this table.
6. cPAHs will be analyzed by 8270E-SIM in samples that require only cPAH analysis and not the full SVOC list (i.e., 0- to 45-cm sediments in Recovery Category 2/3 and beach play areas).
7. The RL for the dioxin/furan TEQ value is based on the laboratory minimum calibration level from ARL; the dioxin/furan mammalian TEQ value was calculated using one-half the RL for each dioxin/furan compound and appropriate mammal toxic equivalency factor values (Van den Berg et al. 2006). Individual congener LOQs are listed in Appendix G.

ARL: Analytical Resources LLC
COC: contaminant of concern
cPAH: carcinogenic polycyclic aromatic hydrocarbon
dw: dry weight
EPA: US Environmental Protection Agency
ESD: Explanation of Significant Differences
LDW: Lower Duwamish Waterway
LOQ: limit of quantitation
OC: organic carbon
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
RAL: remedial action level
RAO: remedial action objective
RL: reporting limit
ROD: Record of Decision
SIM: selected ion monitoring
SVOC: semi-volatile organic compound
TEQ: toxic equivalent
TOC: total organic carbon

Table 4-9
RAO 3 COCs and Associated RL Goals and RALs for Individual 0–10-cm Sediment Samples

COC	Method	RL	Lowest RAL (Benthic SCO)
Metals (mg/kg dw)			
Arsenic	EPA 6020B	0.2	57
Cadmium	EPA 6020B	0.1	5.1
Chromium	EPA 6020B	0.5	260
Copper	EPA 6020B	0.5	390
Lead	EPA 6020B	0.1	450
Silver	EPA 6020B	0.2	6.1
Zinc	EPA 6020B	6	410
Mercury	EPA 7471B	0.025	0.41
PAHs and SVOCs (µg/kg dw)			
Benzo(a)anthracene	EPA 8270E	20.0	2,200[1]
Benzo(a)pyrene	EPA 8270E	20.0	1,980[1]
Total benzofluoranthenes	EPA 8270E	40.0	4,600[1]
Chrysene	EPA 8270E	20.0	2,200[1]
Dibenzo(a,h)anthracene	EPA 8270E	20.0	240[1]
Indeno(1,2,3-cd)pyrene	EPA 8270E	20.0	680[1]
Anthracene	EPA 8270E	20.0	4,400[1]
Acenaphthene	EPA 8270E	20.0	320[1]
Acenapthylene	EPA 8270E	20.0	1,320[1]
Benzo(g,h,i)perylene	EPA 8270E	20.0	620[1]
Fluoranthene	EPA 8270E	20.0	3,200[1]
Fluorene	EPA 8270E	20.0	460[1]
Naphthalene	EPA 8270E	20.0	1,980[1]
Phenanthrene	EPA 8270E	20.0	2,000[1]
Pyrene	EPA 8270E	20.0	20,000[1]
Total HPAHs[2]	EPA 8270E	40.0	19,200[1]
Total LPAHs[3]	EPA 8270E	20.0	7,400[1]
2,4-dimethylphenol	EPA 8270E-SIM	20.0	29
2-methylnaphthalene	EPA 8270E	20.0	760[1]
4-methylphenol	EPA 8270E	20.0	670
Benzoic acid	EPA 8270E-SIM	100	650
Benzyl alcohol[4]	EPA 8270E-SIM	20.0	57

Table 4-9
RAO 3 COCs and Associated RL Goals and RALs for Individual 0–10-cm Sediment Samples

COC	Method	RL	Lowest RAL (Benthic SCO)
Bis(2-ethylhexyl)phthalate	EPA 8270E	50.0	940[1]
Butyl benzyl phthalate	EPA 8270E	20.0	98[1]
Dibenzofuran	EPA 8270E	20.0	300[1]
Dimethyl phthalate	EPA 8270E	20.0	1,060[1]
Hexachlorobenzene	EPA 8081B	0.5	7.6[1]
n-Nitrosodiphenylamine	EPA 8270E-SIM	5.0	220[1]
Pentachlorophenol	EPA 8270E-SIM	20.0	360
Phenol	EPA 8270E	20.0	420
1,2,4-trichlorobenzene	EPA 8270E-SIM	5.0	16.2[1]
1,2-dichlorobenzene	EPA 8270E-SIM	5.0	46.0[1]
1,4-dichlorobenzene	EPA 8270E-SIM	5.0	62.0[1]
PCBs (µg/kg dw)			
PCBs	EPA 8082A (Aroclors)	4.0	240[1]

Notes:

1. OC-normalized RAL was converted to dry weight value for this table using 2% TOC (average LDW sediment TOC). This value, which is below the dry weight AETs in Table 8-1 of SCUM (Ecology 2021), is presented herein as a dry weight value only for the purpose of comparison to RLs.
2. HPAH compounds include fluoranthene, pyrene, benzo(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3 cd)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.
3. LPAH compounds include naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, and 2-methylnaphthalene.
4. Because benzyl alcohol is not a CERCLA hazardous substance (Windward and Anchor QEA 2020), benzyl alcohol data will not be included in the DERs. Benzyl alcohol data obtained through routine SVOC analysis of the PDI sediment samples will be provided to EPA.

AET: apparent effects threshold
CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act
COC: contaminant of concern
DER: data evaluation report
dw: dry weight
EPA: US Environmental Protection Agency
HPAH: high-molecular-weight polycyclic aromatic hydrocarbon
LDW: Lower Duwamish Waterway
LPAH: low-molecular-weight polycyclic aromatic hydrocarbon
na: not applicable
OC: organic carbon
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
PDI: Pre-Design Investigation
RAL: remedial action level
RAO: remedial action objective

RL: reporting limit
SCO: sediment cleanup objective
SCUM: Sediment Cleanup User's Manual
SIM: selective ion monitoring
SVOC: semivolatile organic compound
TOC: total organic carbon

Standard mass requirements are specified to meet RL goals for each particular analytical method. Table 4-10 summarizes the sample volume needed for each sample type. The masses listed include those required for QC samples.

Table 4-10
Sample Mass Required per Analysis

Analyte	Sediment Mass (ww)	Container Size
Chemistry samples		
TOC	6 g	4-oz jar
Percent solids	45 g	
Metals	3 g	4-oz jar
Mercury	1 g	
Grain size	600 g	16-oz jar
PAHs	60 g	16-oz jar
PCB Aroclors	75 g	
Hexachlorobenzene	60 g	
SVOCs	60 g	
Dioxins/furan congeners[1]	40 g	8-oz jar
Archive	na	8-oz jar
All chemical analyses	950 g	56 oz
Toxicity samples		
Toxicity testing	2,400 g	6 32-oz jars
Toxicity chemistry samples		
Ammonia[2]	25 g	4-oz jar
Total sulfides[2]	25 g	4-oz jar

Notes:
1. This 8-oz jar will be collected at all locations and intervals and either analyzed for dioxins/furans in Tier 1 or archived.
2. Ammonia and total sulfide samples will be collected only at the sediment locations targeted for possible toxicity testing.

na: not applicable
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
SVOC: semivolatile organic compound
TOC: total organic carbon
ww: wet weight

For all locations and intervals, following homogenization in the field, sediment for chemistry analysis will be dispensed into two 4-oz, two 8-oz, and two 16-oz jars.

Of the two 8-oz jars (from all locations and intervals), one will be archived in the event that issues arise (e.g., jar is lost or broken). The other will either be analyzed in Tier 1 for dioxins/furans or be archived for potential Tier 2 analysis. All jars for potential chemistry analysis will remain archived until the analytical holding times expire (one year following collection).

For Phase II locations for which toxicity testing is planned (see Section 4.1.8), two additional 4-oz jars and six additional 32-oz jars will be collected.

4.10 Sediment Chemistry Quality Assurance/Quality Control

The types of samples to be analyzed and the procedures to be conducted for QA/QC in the field and laboratory are described in this section.

4.10.1 Field Quality Control Samples

Field QA/QC samples, such as field duplicate samples, are generally used to evaluate the variability attributable to sample handling and processing. For Tier 1 surface and subsurface samples, a minimum of 1 duplicate sample[32] for every 20 samples will be collected. Field duplicate samples will be analyzed for the same analytes as the parent sample. Grain size will be analyzed in duplicates as mass allows.

4.10.2 Laboratory Quality Control

Before analyzing the samples, the laboratory must provide written protocols for the analytical methods to be used, calculate RLs for each analyte in each matrix of interest as applicable, and establish an initial calibration curve for all analytes. The laboratory must also demonstrate its continued proficiency by participation in inter-laboratory comparison studies, and by repeated analysis of CRMs, calibration checks, laboratory reagent blanks, and spiked samples.

4.10.2.1 Sample Delivery Group

Project- and/or method-specific QC measures, such as MSs and MSDs or laboratory duplicates, will be used per sample delivery group (SDG) preparatory batch or per analytical batch, as specified in Table 4-11. An SDG is defined as no more than 20 samples or a group of samples received at the laboratory within a 2-week period. Although an SDG may span two weeks, all holding times specific to each analytical method will be met for each sample in the SDG.

[32] Field duplicates are defined as samples for which twice as much volume as necessary to fill the sample containers has been collected. Following homogenization, aliquots of this sample are equally distributed in two sets of sample containers. Field duplicate results are used to measure and document the repeatability of sample handling procedures and heterogeneity of the sample matrix (PSEP 1997).

Table 4-11
Laboratory QC Sample Analysis Summary

Analysis Type	Method	Initial Calibration	Initial Calibration Verification (2nd source) and Calibration Blank	Continuing Calibration Verification and Calibration Blank	CRM or LCS[1]	Laboratory Replicates	MS	MSD	Method Blanks	Internal Standards/ Surrogate Spikes
TOC	EPA 9060A	Prior to analysis	After initial calibration	Every 10 samples	1 per 20 samples or per batch	1 per 20 samples or per batch	1 per 20 samples or per batch	na	1 per 20 samples or per batch	na
Percent solids	SM 2540G	na	na	na	na	1 per 20 samples or per batch	na	na	na	na
Grain size	ASTM D7913 and D7928	na	na	na	na	Triplicate per 20 samples	na	na	na	na
Metals	EPA 6020A UCT-KED	Daily, prior to analysis	After initial calibration; interference check standard and spectral interference check at beginning of analytical run; spectral interference check every 12 hours	Every 10 samples and at end of analytical sequence	1 per prep batch	1 per batch or SDG	1 per batch or SDG	na	1 per prep batch	Each sample (internal standard only)

Analysis Type	Method	Initial Calibration	Initial Calibration Verification (2nd source) and Calibration Blank	Continuing Calibration Verification and Calibration Blank	CRM or LCS[1]	Laboratory Replicates	MS	MSD	Method Blanks	Internal Standards/ Surrogate Spikes
Mercury	EPA 7471B	Prior to analysis	After initial calibration	Every 10 samples and at end of analytical sequence	1 per prep batch	1 per batch or SDG	1 per batch or SDG	na	1 per prep batch	na
PAHs/ cPAHs	EPA 8270E/ EPA 8270E-SIM	Prior to analysis	After initial calibration	Before and after sample analysis, and every 12 hours	1 per prep batch[2]	na	1 per batch or SDG	1 per batch or SDG	1 per prep batch	Each sample
PCB Aroclors	Mod EPA 8082A	Prior to analysis	After initial calibration	Before and after sample analysis, every 10-20 analyses or 12 hours	1 per prep batch[3]	na	1 per batch or SDG	1 per batch or SDG	1 per prep batch	Each sample
Hexachlorobenzene[4]	EPA 8081B	Prior to analysis	After initial calibration	Before and after sample analysis, every 10-20 analyses or 12 hours	1 per prep batch	na	1 per batch or SDG	1 per batch or SDG	1 per prep batch	Each sample
SVOCs	EPA 8270E/ EPA 8270E-SIM	Prior to analysis	After initial calibration	Before and after sample analysis and every 12 hours	1 per prep batch	na	1 per batch or SDG	1 per batch or SDG	1 per prep batch	Each sample
Ammonia	SM 4500-NH3 H-97	Prior to analysis	After initial calibration	Every 10 samples	1 per prep batch	1 per batch or SDG	1 per batch or SDG	na	1 per prep batch	na
Total sulfides	SM 4500-S2 D-0 PSEP prep	Prior to analysis	After initial calibration	Every 10 samples	1 per prep batch	1 per prep batch or SDG	1 per batch or SDG	na	1 per prep batch	na

Analysis Type	Method	Initial Calibration	Initial Calibration Verification (2nd source) and Calibration Blank	Continuing Calibration Verification and Calibration Blank	CRM or LCS[1]	Laboratory Replicates	MS	MSD	Method Blanks	Internal Standards/ Surrogate Spikes
Dioxins/ furans	EPA 1613b	Prior to analysis	After initial calibration	Before and after sample analysis and every 12 hours	1 CRM and LCS/LCSD per prep batch[3]	na	na	na	1 per prep batch	Each sample

Notes:

A batch is a group of samples of the same matrix analyzed or prepared at the same time, not exceeding 20 samples.

1. An LCS may be used to assess accuracy when CRM is unavailable.
2. Sigma-Aldrich SQC017-40G and CRM 143 BNA will be used to assess accuracy for cPAHs and PAHs.
3. Puget Sound sediment reference material will be used to assess accuracy for PCB Aroclors and dioxins/furans.
4. Hexachlorobenzene will be analyzed separately from the other SVOCs following EPA method 8081B.

ASTM: American Society for Testing and Materials
cPAH: carcinogenic polycyclic aromatic hydrocarbon
CRM: certified reference material
EPA: US Environmental Protection Agency LCS: laboratory control sample
LCS: laboratory control sample
LCSD: laboratory control sample duplicate
MS: matrix spike
MSD: matrix spike duplicate
na: not applicable or not available
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
PSEP: Puget Sound Estuary Program
QC: quality control
SDG: sample delivery group
SIM: selected ion monitoring
SM: Standard Method
SVOC: semivolatile organic compound
TOC: total organic carbon
UCT-KED: universal cell technology-kinetic energy discrimination

4.10.2.2 Laboratory Quality Control Samples

The analyst will review the results of QC analyses from each sample group immediately after a sample group has been analyzed. The QC sample results will then be evaluated to determine whether control limits have been exceeded.

If control limits have been exceeded, then appropriate corrective action, such as recalibration followed by reprocessing of the affected samples, must be initiated before a subsequent group of samples is processed. The project QA/QC coordinator must be contacted immediately by the laboratory PM if satisfactory corrective action to achieve the DQIs outlined in this QAPP is not possible. All laboratory corrective action reports relevant to the analysis of project samples must be included in the data deliverable packages.

All primary chemical standards and standard solutions used in this project will be traceable to the National Institute of Standards and Technology, Environmental Resource Associates, National Research Council of Canada, or other documented, reliable, commercial sources. Standards will be validated to determine their accuracy by comparing them to independent standards. Laboratory QC standards are verified in a multitude of ways: Second-source calibration verifications (i.e., same standard, two different vendors) are analyzed to verify initial calibrations; new working standard mixes (e.g., calibrations, spikes, etc.) are verified against the results of the original solution and must be within 10% of the true value; newly purchased standards are verified against current data. Any impurities found in the standard will be documented.

The following sections summarize the procedures that will be used to assess data quality throughout sample analysis. Table 4-11 summarizes the QC procedures to be performed by the laboratory. The associated control limits for precision and accuracy are listed in Table 4-7.

4.10.2.3 Method Blanks

Method blanks are analyzed to assess possible laboratory contamination at all stages of sample preparation and analysis. A minimum of 1 method blank will be analyzed for each SDG or for every 20 samples, whichever is more frequent.

4.10.2.4 Certified Reference Material

CRMs are samples of similar matrices and known analyte concentrations, processed through the entire analytical procedure and used as an indicator of method accuracy. A minimum of 1 CRM will be analyzed for each SDG or for every 20 samples, whichever is more frequent. CRMs will be analyzed for PAHs, PCB Aroclors, and dioxins/furans. An LCS sample can be used to assess accuracy if appropriate CRM is not available. An LCS will be analyzed for conventional, metals, and semivolatile organic compound (SVOC) analyses.

4.10.2.5 Laboratory Control Samples

LCSs are prepared from a clean matrix using the same process as the project samples that are spiked with known amounts of the target compounds. The recoveries of the compounds are used as a measure of the accuracy of the test methods. A laboratory control duplicate will be analyzed for dioxins/furans.

4.10.2.6 Laboratory Replicate Samples

Laboratory replicate samples provide information on the precision of the analysis and are useful in assessing potential sample heterogeneity and matrix effects. Laboratory replicates are subsamples of the original sample that are prepared and analyzed as separate samples, assuming sufficient sample matrix is available. A minimum of 1 laboratory replicate sample will be analyzed for each SDG or for every 20 samples, whichever is more frequent, for metals and conventional parameters.

4.10.2.7 Matrix Spikes and Matrix Spike Duplicates

The analysis of MS samples provides information on the extraction efficiency of the method on the sample matrix. By performing MSD analyses, information on the precision of the method is also provided for organic analyses. For organic analyses, a minimum of 1 MS/MSD pair will be analyzed for each SDG or for every 20 samples, whichever is more frequent, when sufficient sample volume is available, with the exception of dioxins/furans. For inorganic analyses (i.e., metals), a minimum of one MS sample will be analyzed for each SDG, when sufficient sample volume is available.

4.10.2.8 Surrogate Spikes

All project samples analyzed for organic compounds will be spiked with appropriate surrogate compounds, as defined in the analytical methods. Surrogate recoveries will be reported by the analytical laboratories; however, no sample results will be corrected for recovery using these values.

4.10.2.9 Isotope Dilution Quantitation

All project samples analyzed for dioxin/furan congeners will be spiked with a known amount of surrogate compounds, as defined in the analytical methods. The labeled surrogate compounds will respond similarly to the effects of extraction, concentration, and gas chromatography. Data will be corrected for the recovery of the surrogates used for quantification.

4.10.2.10 Internal Standard Spikes

Internal standards may be used for calibrating and quantifying organic compounds and metals using MSs. If internal standards are required by the method, all calibration, QC, and project samples will be spiked with the same concentration of the selected internal standard(s). Internal standard recoveries and retention times must be within method and/or laboratory criteria.

4.11 Sediment Toxicity Testing Quality Objectives and Quality Assurance/Quality Control

4.11.1 Laboratory Sediment Handling

Sediment submitted for toxicity testing will be obtained from the same field homogenate as the sediment submitted for chemical analyses. The homogenized sediment will be placed into six I-Chem™ 32-oz high-density polyethylene (HDPE) wide-mouth jars with zero headspace. These samples will be refrigerated after nitrogen purging of the headspaces in the jars at ARL, after which they will be shipped to EcoAnalysts, as needed. The sediment samples will be stored in the dark at 4 ± 2°C . The toxicity tests will be initiated within eight weeks of sample collection.

Three standard PSEP sediment toxicity tests will be conducted on each sample collected from the locations identified for toxicity testing. These tests are:

- Acute 10-day amphipod mortality test (*Ampelisca abdita* or *Eohaustorius estuarius*)
- Acute 48-hr larval-embryo combined mortality and abnormality test (*Mytilus galloprovincialis* or *Dendraster excentricus*)
- Chronic 20-day juvenile polychaete survival and growth test (*Neanthes arenaceodentata*)

Toxicity testing will be conducted according to *Recommended Guidelines for Conducting Laboratory Bioassays on Puget Sound Sediments* (PSEP 1995), and consistent with the updated protocols presented at the Seattle US Army Corps of Engineers District Sediment Management Annual Review Meeting. Data interpretation will follow recommended guidance (Ecology 2021). The laboratory SOPs for the sediment toxicity tests are provided in Appendix E.

4.11.1.1 Acute 10-day Amphipod Mortality Test

Short-term adverse effects of sediments will be evaluated by measuring the survival of adult amphipods. The appropriate test species will be selected based on sediment grain size data (Table 4-12). Amphipods will be exposed to LDW sediment and reference sediment from Carr Inlet for a 10-day period. The test will be performed according to the procedures and QA/QC performance standards described in (Ecology 2021) with survival as the endpoint.

Table 4-12
Sediment Conditions and Preferred Amphipod Test Species

Sediment Condition	Grain Size	Preferred Amphipod Test Species
Coarse, sand, or silty sand	<60% fines	*E. estuarius*
Fine-grained	>60% fines	*A. abdita or E. estuarius*
High clay	>20% clay	*A. abdita*

4.11.1.2 Acute Larval- Embryo Combined Mortality and Abnormality Test

The endpoint assessed in bivalve larvae after a 48- to 60-hr exposure period is normal survivorship, which is a combined assessment of mortality and abnormality. Larvae of the mussel species *M. galloprovincialis* are the preferred test organisms for this study. If *M. galloprovincialis* in spawning condition are unavailable, the sand dollar echinoderm *D. excentricus* will be used (test duration 48 to 96 hours). Test protocols and QA/QC performance standards will be in accordance with guidance (USACE et al. 2018; Ecology 2021).

4.11.1.3 Chronic 20-day Juvenile Polychaete Survival and Growth

The juvenile polychaete sublethal bioassay is used to characterize the toxicity of marine sediments based on polychaete worm survival and growth. The target initial worm weight for test organisms will be between 0.25 and 1.0 mg. Parameters measured after 20-day sediment exposure are survival and growth in juvenile polychaetes (*N. arenaceodentata*). The test will be performed according to the procedures described in PSEP protocols (1995) and Johns et al. (1990), as well as the most recent *N. arenaceodentata* protocol adjustments presented in the 2013 clarification paper regarding the use of ash-free dry weights (AFDWs) (DMMP 2013) and the QA/QC guidance provided by (Ecology 2021).

4.11.2 Toxicity Test Evaluation Criteria

The results of the toxicity tests will be evaluated relative to the marine biological criteria in SCUM (Ecology 2021). The evaluation criteria are provided in Table 4-13. Per ROD Table 20, benthic sediment cleanup objective (SCO) biological criteria (Ecology 2013) may be used to override benthic SCO chemical criteria where human health-based RALs are not also exceeded.

Table 4-13
SMS Marine Biological Criteria

Toxicity Test	Test Endpoint	SCO/Sediment Quality Standards	Cleanup Screening Level
Amphipod	10-day mortality	Test mortality >25% and statistical difference between test mortality and reference mortality ($p<0.05$)	Test mortality – reference mortality ≥30% and statistical difference between test mortality and reference mortality ($p<0.05$)
Larval	Bivalve or echinoderm abnormality/ mortality	Test normal survivorship/reference normal survivorship < 0.85 and statistical difference between test and reference response ($p<0.10$)	Test normal survivorship/ reference normal survivorship < 0.70 and statistical difference between test and reference response ($p<0.10$)

Table 4-13
SMS Marine Biological Criteria

Toxicity Test	Test Endpoint	SCO/Sediment Quality Standards	Cleanup Screening Level
Polychaete	Neanthes 20-day growth (AFDW)	Test mean individual growth/reference mean individual growth <0.70 and statistical difference between test response and reference response ($p<0.05$)	Test mean individual growth/reference mean individual growth <0.50 and statistical difference between test response and reference response ($p<0.05$)

Notes:
AFDW: ash-free dry weight
SCO: sediment cleanup objective
SMS: Washington State Sediment Management Standards

4.11.3 Data Quality Indicators

DQIs for sediment toxicity tests (Table 4-14) are based on guidelines provided in Ecology (2021). Compliance with these indicators will be confirmed by EcoAnalysts and Windward.

Table 4-14
DQIs for Sediment Toxicity Testing

Toxicity Test	DQI
Acute 10-day amphipod mortality test with *R. abronius, E. estuarius,* and *A. abdita*	• Mean mortality in the negative control is ≤10%. • Mean mortality in reference sediments is ≤ 25% • All organisms in a test must be from the same source. • The mean of the daily test temperature must be within ± 1°C of 15°C (20°C for *A. abdita*) • Test must be conducted under continuous light. • DO, pH, and salinity must be within the acceptable ranges established by the protocol. • Test chambers must be identical and contain the same volume of sediment and overlying water. • The LC50 for a positive control test should be within the mean LC50 ± 2 standard deviations of the control chart.

Table 4-14
DQIs for Sediment Toxicity Testing

Toxicity Test	DQI
Acute 48-hr bivalve larvae combined mortality and abnormality test with *M. galloprovincialis*	• Normal survivorship expressed as actual counts is ≥ 0.70 for the control sediment and ≥ 0.65 for the reference sediment. • All organisms in a test must be from the same source. • The mean of the daily test temperature must be within ± 1°C of 16°C (15°C for echinoderm *D. excentricus*). • Test must be conducted under a light cycle of 14 hrs light to 10 hrs dark. • DO, pH, and salinity must be within the acceptable ranges established by the protocol. • Test chambers must be identical and contain the same volume of sediment and overlying water. • The EC50 for a positive control test should be within the mean EC50 ± 2 standard deviations of the control chart.
Chronic 20-day juvenile polychaete survival and growth test with *N. arenaceodentata*	• Mean juvenile polychaete weight must be between 0.25 and 1.0 mg dw at test initiation. • Mean mortality in the negative control must be ≤ 10%. • Mean individual growth rate must be ≥ 0.38 mg/individual/day AFDW in the control. • Mean individual growth rate in reference sediment divided by mean individual growth rate in negative control must be ≥ 0.80 as AFDW. • All organisms in a test must be from the same source. • The mean of the daily test temperature must be within ± 1°C of 20°C. • Test must be conducted under continuous light. • DO, pH, and salinity must be within the acceptable ranges established by the protocol. • Test chambers must be identical and contain the same volume of sediment and overlying water. • The EC50 for a positive control test should be within the mean EC50 ± 2 standard deviations of the control chart.

Notes:
AFDW: ash-free dry weight
DO: dissolved oxygen
DQI: data quality indicator
dw: dry weight
EC50: concentration that causes a non-lethal effect in 50% of an exposed population
LC50: concentration that is lethal to 50% of an exposed population

4.11.4 Sediment Toxicity Testing Quality Control Criteria

All three sediment toxicity tests will incorporate standard QA/QC procedures to ensure that the test results are valid. Standard QA/QC procedures include the use of a negative control, a positive control, and reference sediment samples, as well as the measurement of water quality during testing.

The negative control will be a test using a clean, inert material and the same diluent seawater used in testing sediment toxicity. For the amphipod and polychaete tests, the negative control will be native sediment from the organism collection site (Appendix E). For the polychaete test, the negative control will be sand collected from Yaquina Bay (*Eohaustorius* home sediment) or other clean amphipod control sediment. For the bivalve larvae test, the negative control seawater will be ambient seawater from North Hood Canal.

For the positive control, a reference toxicant will be used to establish the relative sensitivity of the test organism. The positive control for sediment tests is typically conducted with diluent seawater and without sediment. Reference toxicants are often used in positive controls. In addition to the positive controls with reference toxicants, positive controls using ammonia (water exposure only) will be performed.

Reference sediment will also be included with each toxicity test series. Reference sediments provide toxicity data that can be used to separate toxicant effects from unrelated effects, such as those of sediment grain size. Reference sediments are also used in statistical comparisons to determine whether test sediments are toxic. Sediment samples selected to be test reference sediment should represent the range of important natural, physical, and chemical characteristics of the test sediments, specifically sediment grain size and TOC. Sediments to be used as reference sediment for the three bioassays will be collected from Carr Inlet (PSEP 1995).

Bioassays require that proper water quality conditions be maintained to ensure that organisms survive and do not experience undue stress unrelated to test sediments. Salinity, dissolved oxygen (DO), pH, ammonia, total sulfides, and temperature will be regularly measured during testing. Temperature, salinity, DO, and pH will be measured daily for all three tests.

Interstitial porewater will be analyzed for ammonia and total sulfides at test initiation and termination for both the amphipod and polychaete tests. Ammonia and total sulfides will be measured in overlying water in all three tests at test initiation and test termination.

DMMP (USACE et al. 2018) protocols will be followed for samples with unacceptable ammonia, sulfides, wood waste, or grain size.

4.12 Instrument/Equipment Testing, Inspection, and Maintenance

Prior to each field event, measures will be taken to test, inspect, and maintain all field equipment. All equipment used, including the differential GPS unit and digital camera, will be tested for accuracy before leaving for the field event.

The FC will be responsible for overseeing the testing, inspection, and maintenance of all field equipment.

Laboratory instrument testing, inspection, and maintenance procedures are described in the laboratory SOPs.[33] The laboratory PM will be responsible for ensuring laboratory equipment testing, inspection, and maintenance requirements are met.

4.13 Instrument/Equipment Calibration and Frequency

Multipoint initial calibration will be performed on each analytical instrument at the start of the project, after each major interruption to the instrument, and when any continuing calibration does not meet the specified criteria. The number of points used in the initial calibration is defined in each analytical method. Continuing calibrations will be performed daily for organic analyses, every 10 samples for inorganic analyses, and with every sample batch for conventional parameters to ensure proper instrument performance.

Gel permeation chromatography (GPC) calibration verifications will be performed at least once every seven days, and corresponding raw data will be submitted by the laboratory with the data package. In addition, florisil performance checks will be performed for every florisil lot, and the resulting raw data will be submitted with the data package.

Calibration of analytical equipment used for chemical analyses includes the use of instrument blanks or continuing calibration blanks, which provide information on the stability of the baseline established. Continuing calibration blanks will be analyzed immediately after the continuing calibration verification, at a frequency of 1 blank for every 10 samples analyzed for inorganic analyses, and 1 blank every 12 hours for organic analyses. If the continuing calibration does not meet the specified criteria, the analysis must stop. Analysis may resume after corrective actions have been taken to meet the method specifications. All project samples analyzed by an instrument found to be out of compliance must be reanalyzed.

4.14 Inspection/Acceptance of Supplies and Consumables

The FC will gather and check field supplies daily for satisfactory conditions before each field event. Batteries used in the digital camera will be checked daily and recharged as necessary.

[33] Laboratory SOPs are confidential and can be provided upon EPA request.

Supplies and consumables for the field sampling effort will be inspected upon delivery and accepted if the condition of the supplies is satisfactory.

4.15 Analytical Data Management

All field data will be recorded on field forms, which the FC will check for missing information at the end of each field day and amend as necessary. A QC check will be done to ensure that all data have been transferred accurately from the field forms to the database. Field forms will be archived in the Windward library.

Analytical laboratories are required to submit data in an electronic format, as described in Section 3.7.2. The laboratory PM will contact the project QA/QC coordinator prior to data delivery to discuss specific format requirements.

A library of routines will be used to translate typical electronic output from laboratory analytical systems and to generate data analysis reports. The use of automated routines will ensure that all data are consistently converted to the desired data structures, and that operator time is kept to a minimum. In addition, routines and methods for quality checks will be used to ensure such translations are correctly applied.

Written documentation will be used to clarify how field and analytical laboratory duplicates and QA/QC samples were recorded in the data tables, and to provide explanations of other issues that may arise. The data management task will include keeping accurate records of field and laboratory QA/QC samples so that project team members who use the data will have appropriate documentation. All data management files will be secured on the Windward network. Data management procedures outlined in Attachment D of the PDIWP will be followed (Windward and Anchor QEA 2022).

5 Data Generation and Acquisition of Engineering PDI Elements

This section discusses the study design and procedures for collecting, handling, and managing data that will be acquired in support of the engineering PDI elements. This section presents methods for the following key elements:

- Bank visual inspection (DQO 8) and focused topographic surveys (DQO 11)
- Inspections and evaluations of existing structures within or adjacent to active remedial action areas to develop design criteria for remedial activities that may impact existing structures (DQO 14)
- Collection of geotechnical data for use in RD; assessing material behavior; and conducting stability modeling for banks, structures, and dredge or capping areas (DQO 13)
- Specialized surveys (e.g., utilities, debris characterization, sediment thickness overlying armoring in bank areas) as necessary to adequately characterize site conditions for engineering design and construction bid documents (DQO 14)

Certain details for engineering data needs will be defined using the results of Phase I data collection. For example, determining geotechnical sampling locations will require initial horizontal RAL exceedances to have been delineated (i.e., DQOs 1 through 7 to have been addressed). Specifics regarding locations and methods for the tasks in this section will be provided in the PDI QAPP Addendum for Phase II based on the analyses presented in the Phase I DER. Methods specified in the PDI QAPP Addendum for Phase II for geotechnical data collection will use the SOPs provided in Appendix E; these SOPs are not anticipated to require modification for the PDI QAPP Addendum for Phase II.

5.1 Banks

5.1.1 Phase I Visual Inspection of Banks

To address DQO 8, a visual survey and inspection of shoreline conditions in bank areas located within the middle reach will be performed during the Phase I PDI to document overall bank conditions that will inform RD (i.e., presence/absence of bank armoring, evidence of significant erosion, presence of structures, presence of vegetation, visual observation of potential stormwater discharge pathways or groundwater seeps along shoreline). This effort will build upon the existing *Waterway User Survey and Assessment of In-Water Structures – Data Report* (hereafter referred to as the Waterway User Survey) (Integral et al. 2018)—which focused on existing structures by adding additional detail to support engineering design—and will update the information gathered, as appropriate, for areas where conditions have changed.

Bank areas may be armored or unarmored. The presence of armoring will be documented, as will the nature of any armoring (e.g., concrete blocks, mats, riprap, bulkheads) and its superficial condition. For unarmored banks, factors that may affect bank stability or indicate erosion will be noted, including: bank steepness, surface material type, observed bank undermining, and presence and stability of vegetation (e.g., trees and exposed tree roots). Vegetation located on bank areas will be documented to establish existing conditions so that decisions can be made during RD regarding any need for clearing, protection, and/or replacement.

The Phase I DER will identify bank areas that may require remedial actions (i.e., banks that are located within or adjacent to Phase I RAL exceedance areas) and additional detailed inspection during Phase II. Phase II results will be presented in the Phase II DER, as described in Section 7.3.

The Phase I bank inspection will be conducted primarily by boat. It will be completed for all bank areas within the middle reach within approximately four hours around a daytime low tide (two hours before, two hours after), depending on weather conditions.

The Phase I bank area visual inspection results will supplement information gathered during the Waterway User Survey (Integral et al. 2018). The Waterway User Survey included general descriptions of bank areas in some locations, with more information on banks near structures, as well as maps presenting four different types of bank conditions: armored slope, vertical bulkhead, exposed bank, and dock face. The crew performing the bank area visual inspection will review the Waterway User Survey before commencing work and will refer to existing information as needed while performing the Phase I visual inspection.

The following activities will be completed prior to the visual inspection:

- Review the Waterway User Survey (Integral et al. 2018) for existing information relevant to bank conditions.
- Check tide charts to develop a schedule for the visual inspection.
- Prepare a daily float plan that includes locations to be observed each day (and existing drawings) and communication protocols for use among the field team.

Documentation will be developed for representative sections of banks and will exclude EAAs. High-resolution photographs will be taken with a camera and DGPS receiver (to tag the photograph location). Visual observations will also be documented for representative sections of banks, providing descriptive attributes of bank area features, which may include:

- Armored (e.g., riprap, bulkhead) and un-armored banks
- Presence of sediment accumulated on armored slopes
- Observed bank erosion
- Observed utility crossings
- Observed outfalls/pipes

- Locations with discharge flowing from outfalls
- Navigational obstructions
- Access points (including nature and condition)
- Vegetation
- Other features of note

For armored banks, the following information will be noted:

- Type of armor material (e.g., riprap, concrete, grout mat, bulkhead)
- Estimated slope/grade
- Presence of nearby structures that may indicate waterway traffic patterns that could affect the armoring

For unarmored banks, the following information will be noted:

- Qualitative observation of unarmored bank steepness
- Presence and condition of vegetation that may stabilize the slope (note if vegetation obscures observation of the condition of the underlying slope; note if roots that may indicate bank erosion are visible)
- Evidence of erosion (e.g., over-steepened bank, collapsed bank) or conditions (e.g., surface runoff) that may promote erosion
- Presence of nearby structures that may indicate waterway traffic or current flow patterns that could affect the stability of the bank

Bank conditions, vegetation, and features will be described on the shoreline visual inspection form (Appendix C), or in an electronic data dictionary capable of recording the same information and will be used to develop the Phase I DER described in Section 7.3. Features will be photographed, and location data, photographs, and descriptions will be recorded on the shoreline visual inspection form. If a bank feature is not approachable by boat due to bathymetric conditions, safety concerns, or obstructions, a DGPS offset or digitized location will be collected instead.

5.1.2 Phase II Focused Topographic Surveys

Following completion of Phase I PDI activities, the Phase I DER will identify bank areas adjacent to or within interpolated RAL exceedance areas. The Survey QAPP Addendum will identify survey DQOs and the bank areas that will be targeted for the collection of focused topographic survey data to support RD.

The proposed topographic survey methods and timing will be detailed in an addendum to the Survey QAPP that will be prepared at the same time as the PDI QAPP Addendum for Phase II.

These topographic survey methods could include traditional ground point elevation data collection, the use of aerial or boat-mounted light detection and ranging equipment, aerial photogrammetry, or a combination of methods, depending on site access limitations, presence of vegetation, and data accuracy and density requirements informing engineering design. Additional topographic data collection locations and methods will be evaluated in coordination with EPA.

5.2 Structure Inspections

Structures within the middle reach of the LDW will be visually inspected during Phase I. Structure inspections will be planned and conducted in cooperation with structure owners/operators to ensure information is up to date. Phase I inspection efforts will include a review of available information, comprised in the Waterway User Survey (Integral et al. 2018), to inform the scope of additional visual inspections and supplement existing information. Structures identified in the Waterway User Survey included bridge foundations and wingwalls, piers, docks, fender pilings, dolphin piles, bulkheads, and outfalls.

For structures located within or adjacent to the Phase I RAL exceedance areas, available as-built information will be obtained from facility owners and reviewed in Phase II. Detailed condition inspections (via land access, vessel, and/or dive inspections) will be conducted as needed after Phase I. Structure inspections will be completed in accordance with the American Society of Civil Engineers manual of practice No. 130 regarding waterfront facilities inspection and assessment.

Specific Phase I visual inspection activities will include:

- Making general observations of structure condition, visible physical damage, and surface deterioration or defects of structure component materials. An example structure inspection form is included in Appendix C. Documentation of structure engineering assessments will be included in the RD.
- Collecting information to supplement existing data in the Waterway User Survey (Integral et al. 2018), including structure ID numbers, physical descriptions of the structures observed, and notations of any discrepancies or changed conditions.
- Visually assessing access or safety concerns that may be important considerations for chemistry or geotechnical sampling in the vicinity of or beneath the structure during the Phase I and II PDI. If access conditions are deemed unsafe, then only a general visual inspection of the structure will be performed, subject to EPA agreement. Key issues for safety include visible damage to or decay of overhead structures, dangerous gaps or space between supports, cables or other entanglement hazards, excessive height above slopes (fall hazards), and slippery, sharp, or unstable slope armoring.

Inspections will be documented using the Facilities Condition Assessment Report template forms (Appendix C), which will include written observations, photographs, and detailed checklists for the materials used in the structure (concrete, wood, and/or steel).

Following completion of the Phase I visual inspections, a summary of findings will be provided in the Phase I DER. The Phase I DER information will add to the existing Waterway User Survey (Integral et al. 2018) information; the Phase I DER will present structures' location information and relevant background information.

Following the Phase I DER, Phase II inspection and evaluation activities will be conducted for structures that may be impacted by remedial activities. Because unsound structures may fail or be repaired or replaced, areas with such structures will be evaluated for construction accessibility during follow-up inspections to be conducted during Phase II data collection. These evaluations may include more detailed condition inspections, potential structure materials sampling, and additional evaluation of equipment accessibility. Phase II inspection activities will be conducted in accordance with American Society of Civil Engineers manual of practice No. 130. The results of these inspections will be documented in the Phase II DER.

5.3 Geotechnical Investigation

To address DQO 13, geotechnical sediment samples (surface and subsurface) will be collected in locations that take into account the middle reach's Phase I RAL exceedance areas, as identified in the Phase I DER, as part of Phase II investigation efforts. These samples will be tested to identify *in situ* and *ex situ* sediment strength characteristics to support engineering design and address sediment management/disposal considerations. The data collection efforts will be completed using different sampling equipment than that used to collect the environmental samples described in Section 4. A summary of the proposed geotechnical sampling and testing program is provided in the following sections. Based on preliminary reconnaissance, geotechnical sampling is anticipated to be conducted during Phase II. In the event that new site access challenges are identified and require geotechnical work during Phase I, the proposed geotechnical sampling location(s) will be provided in a separate map for EPA approval that will be developed after such locations have been identified. Otherwise, details on proposed geotechnical field and laboratory testing and geotechnical sampling locations will be provided in the PDI QAPP Addendum for Phase II.

Geotechnical explorations will be completed using barge-mounted or land-based exploration equipment and handheld testing equipment to collect surface and subsurface geotechnical data. Sampling locations will be in the general vicinity of the Phase I RAL exceedance areas (as defined in the Phase I DER). Where appropriate, explorations will be conducted adjacent to bank areas and existing structures to collect engineering data that will inform structural engineering evaluations in design.

5.3.1 Geotechnical Investigation Design

The specific locations, numbers, and types (surface vs. subsurface) of geotechnical samples will be presented in the PDI QAPP Addendum for Phase II following evaluation of Phase I data and interpolation of RAL exceedance areas in the Phase I DER. Specific types of *in situ* geotechnical testing that may be performed include:

- Standard penetration testing (SPT) performed at regular depth intervals within select borings to identify subsurface sediment density with depth and to assess dredgeability, as described in Appendix E
- Thin-walled, undisturbed sample collection for consolidation testing to evaluate settlement as part of engineered sediment cap design, as described in Appendix E
- Cone penetration testing (CPT) at select locations to provide a continuous subsurface profile of sediment density and strength to assess dredgeability, as described in Appendix E. As appropriate, the CPT testing setup may be supplemented with a full-flow penetrometer (FFP) capable of measuring the shear strength of soft sediments at a higher resolution than can conventional CPT. FFP, if used, will generally follow procedures described in DeJong et al. (2011).
- Vane shear testing (VST) to measure sediment shear strength and for use in the design of engineered sediment caps, as described in Appendix E
- Handheld DCP testing at select locations, if appropriate, to provide *in situ* soil or sediment density and augment SPT and CPT data to assess dredgeability, as described in Appendix E

Geotechnical explorations may also be advanced to deeper elevations than those used to collect samples to be tested for chemistry. These deeper elevations will yield data to support the evaluation of slope stability and sediment-bearing capacity, and to identify contacts between different lithologic units (i.e., locations of previously undisturbed native sediments).

Ex situ geotechnical testing will also be performed on a subset of geotechnical locations, and the method to determine which locations and samples will be subject to *ex situ* geotechnical testing will be described in the PDI QAPP Addendum for Phase II. Sample identification for *ex situ* geotechnical testing will be numbered as described in Section 4.4.

Testing requirements, as identified in Section 5.3.3, will be used to characterize variations in sediment physical properties both laterally and vertically. The characterization tests to be conducted *ex situ* at the geotechnical testing laboratory are likely to include:

- Moisture content
- Grain size distribution (sieve and hydrometer) and percent fines (percent passing the U.S. No. 200 sieve)

- Specific gravity
- Atterberg limits
- Unit weight
- One-dimensional consolidation
- Direct shear
- Triaxial compression (unconsolidated-undrained and consolidated-undrained)

The data from this *ex situ* testing program will be evaluated to assess the variability of sediment physical properties in each active remedial action area. The results will support the assessment of dredgeability, evaluations of sediment stability, evaluations of slope stability for temporary and permanent slopes, development of design criteria for structural stability, and potential options for dewatering, treatment, and disposal during RD.

5.3.2 Geotechnical Field Methods

Collecting geotechnical samples and data during implementation of Phase II activities will generally require the use of a hollow-stem auger, mud rotary, or rotosonic drill rig and *in situ* testing equipment, such as a cone penetrometer rig, vane shear device, and potentially a handheld DCP. Requirements for the collection of geotechnical samples and data are described in the following sections. Decontamination procedures and field-generated waste procedures are described in Sections 4.6 and 4.7, respectively.

5.3.2.1 Station Location Positioning Control

To meet the goals of the pre-design sampling activities, appropriate positioning control at geotechnical station locations is required. Both absolute accuracy (i.e., ability to define position) and repeatable accuracy (i.e., ability to return to a sampling station) are important. The process for station location positioning is the same as used during sediment sampling and is described in Appendix E.

5.3.2.2 Geotechnical Boring Procedures and Sample Collection

A general SOP for geotechnical borehole sampling is provided in Appendix E. It contains the procedures for SPT testing and split-spoon sampling. SOPs may be modified as necessary to complete geotechnical borings within bank areas based on access considerations, type of equipment to be utilized, water depth, and other factors. Identification of location-specific methods for collecting geotechnical data within bank areas will be documented in the PDI QAPP Addendum for Phase II.

Upon positioning the drilling vessel at the proposed location, the coordinates and other field notes regarding the sampling location will be entered onto the soil boring form (Appendix C). A water depth reading will be taken using appropriate equipment (e.g., survey rod or weighted tape) to measure the depth of water to the sediment-water interface. The water depth will be recorded on the soil boring form.

SPT blow counts will be recorded for each interval sampled, in accordance with ASTM method D1586. Disturbed samples for ex situ geotechnical testing will be collected by split-spoon sampling techniques, in accordance with ASTM method D1586. Samples will be contained in air-tight glass or plastic jars or double-sealed in Ziploc® bags for transport to the geotechnical laboratory. Each sample jar or bag will be labeled with appropriate sample ID information prior to sample collection (see Section 4.4).

In addition to the split-spoon samples, undisturbed, thin-walled tube samples may be collected during geotechnical drilling, in accordance with ASTM method D1587 and as described in Appendix E. Once collected, the thin-walled tube will be capped and sealed at both ends, serving as the container for that sample during transport to the laboratory. Similar labeling practices will be followed for these samples.

5.3.2.3 Cone Penetration Testing Procedures

An SOP for CPT is provided in Appendix E of this QAPP. CPT tests will be conducted in accordance with ASTM method D3441. CPT field data will be recorded electronically by the CPT contractor, so there is no specific field data collection form for CPT. For soft sediments, the CPT instrument may be outfitted with an FFP to record higher-resolution shear strength data, as described in DeJong et al. (2011). FFP data will also be recorded electronically by the CPT contractor and therefore also do not utilize a specific field data collection form. Results of CPT and FFP testing will be provided in the contractor's data report and included in the Phase II DER.

5.3.2.4 In situ Vane Shear Testing Procedures

An SOP for *in situ* VST using a handheld device is provided in Appendix E. *In situ* VST may be performed from the same vessel as the geotechnical drilling or from a separate data-collection vessel. *In situ* VST will be performed in general accordance with ASTM method D2573. VST field data collected with a handheld device will be recorded on the vane shear field form, provided in Appendix C. Alternately, VST data will be included with a contractor-prepared data report when the VST is advanced using the contractor's equipment.

5.3.2.5 Dynamic Cone Penetrometer Testing Procedures

An SOP for DCP testing is provided in Appendix E. DCP testing may be performed in difficult-to-access bank areas to obtain a subsurface profile of soil or sediment density for use in engineering evaluations. DCP testing field data will be recorded on the DCP field form, provided in Appendix C.

5.3.3 Geotechnical Laboratory Methods

Samples for laboratory analyses will be transported or shipped to MTC for geotechnical laboratory testing. MTC will follow the sample handling and custody procedures described in Section 4.5 and perform testing on a subset of samples (determined by the geotechnical engineer). Table 5-1 summarizes standards, laboratory methods, sample container requirements, preservation methods, and holding time limitations for geotechnical samples. Geotechnical sampling is not anticipated to occur during the Phase I PDI. Results of geotechnical testing that will be conducted during the Phase II PDI will be included in the Phase II DER.

Table 5-1
Analytical Methods and Sample Handling Requirements for Geotechnical Samples

Parameter	Method	Sample Size	Container Type	Container Size	Preservative	Sample Holding Time
Grain size with hydrometer	ASTM D6913 ASTM D7928	300 g	Jar or double-bagged Ziploc®	16 oz	--	6 months
Atterberg limits	ASTM D4318	300 g	Jar or double-bagged Ziploc®	16 oz	--	6 months
Moisture content	ASTM D2216	50 g	Jar or double-bagged Ziploc®	4 oz	cool to 4 ± 2°C	6 months
Specific gravity	ASTM D854	100 g	Jar or double-bagged Ziploc®	8 oz	--	6 months
Percent fines	ASTM D1140	100 g	Jar or double-bagged Ziploc®	8 oz	--	6 months
1-dimensional consolidation	ASTM D2435	na	Shelby tube	--	--	6 months
Direct shear	ASTM D3080	na	Shelby tube	--	--	6 months
Unconsolidated undrained triaxial shear test	ASTM D2850	na	Shelby tube	--	--	6 months
Consolidated undrained triaxial shear test	ASTM D4767	na	Shelby tube	--	--	6 months
Unit weight	ASTM D7263	na	Shelby tube	--	--	6 months

Notes:

In some cases, multiple tests may be run using a sample in a single container. For example, a sample in a container for grain size testing might also be used for moisture content and/or specific gravity testing. Container requirements will be confirmed with the geotechnical testing laboratory prior to sampling.

ASTM: American Society for Testing and Materials

na: not applicable

5.4 Specialized Surveys

Depending upon the results from the Phase I PDI, to address DQO 14, specialized surveys (e.g., utility, sediment thickness over armor material, and debris surveys) may need to be performed to supplement bathymetric and topographic surveys, and to further define site physical conditions during the engineering design phase of the project. The need for any specialized surveys will be identified in the PDI QAPP addendum for Phase II, including the survey design and methods.

6 Data Validation and Usability

6.1 Data Validation

The data validation process for analytical samples will begin in the laboratory with the review and evaluation of data by supervisory personnel or QA specialists. The laboratory analyst will be responsible for confirming that the analytical data are correct and complete, that appropriate procedures have been followed, and that QC results have been compared to acceptable limits. The project QA/QC coordinator will be responsible for confirming that all analyses performed by the analytical laboratories are correct, properly documented, and complete, and that they satisfy the project DQIs specified in this QAPP. The data validator will confirm that data qualifiers are applied to QC results that are outside of acceptable limits.

Chemistry data will not be considered final until validated. Data validation will be conducted following EPA guidance (EPA 2020a, b, c, 2009). Geotechnical data will not undergo data validation. Instead, the geotechnical laboratory will be responsible for completing the testing in accordance with the appropriate ASTM standards and will report if any anomalies in the data are observed.

Independent third-party data review and validation of the analytical chemistry data will be conducted by LDC or a suitable alternative. All chemistry data will undergo Stage 2B data validation, and a minimum of 10% or one SDG will undergo Stage 4 data validation. Full data validation parameters will include:

- QC analysis frequencies
- Analysis holding times
- Laboratory blank contamination
- Instrument calibration
- Surrogate recoveries
- LCS/CRM recoveries
- MS recoveries
- MS/MSD RPDs
- Compound identifications—verification of raw data with the reported results (10% of analytes)
- Compound quantitations—verification of calculations and RLs (10% of analytes)
- Instrument performance check (tune) ion abundances
- Internal standard areas and retention time shifts
- Ion abundance ratio compared to theoretical ratios for samples analyzed by EPA method 1613b

If no discrepancies are found between reported results and raw data in the dataset that undergoes full data validation, then a summary validation of the rest of the data will proceed using all of the QC forms submitted in the laboratory data package.

QA review of the sediment chemistry data will be performed in accordance with the QA requirements specified in this QAPP, the technical specifications of the analytical methods and laboratory SOPs indicated in Tables 4-7 through 4-12, and EPA guidance for organic and inorganic data review (EPA 2020a, b, c, 2009). The EPA PM may have EPA peer review the third-party validation or perform data assessment/validation on a percentage of the data.

All discrepancies and requests for additional, corrected data will be discussed with the analytical laboratories prior to issuance of the formal data validation report. The project QA/QC coordinator should be informed of all contacts with the analytical laboratories during data validation. Procedures used and findings made during data validation will be documented on worksheets. The data validator will prepare a data validation report that summarizes QC results, qualifiers, and possible data limitations. This data validation report will be appended to the data evaluation report. Only data that have been validated and qualified with appropriate qualifiers will be used for RD.

Toxicity test data will be reviewed internally by Windward. Data will be compared to DQIs and testing conditions listed in Section 4.11.3. EcoAnalysts will be contacted to correct any discrepancies.

6.2 Reconciliation with Data Quality Indicators

Chemistry data QA will be conducted by the project QA/QC coordinator in accordance with EPA guidelines (EPA 2020a, b, c, 2009). The results of the third-party independent review and validation will be reviewed, and cases wherein the project DQIs were not met will be identified. Any potential data usability issues will be discussed with EPA and described in the DER.

7 Assessment and Oversight

7.1 Compliance Assessments and Response Actions

EPA or its designees may observe field activities during each sampling event, as needed. If situations arise wherein there is a significant inability to follow the QAPP methods precisely, the Windward PM will determine the appropriate actions and consult EPA (or its designee).

7.1.1 Compliance Assessments

Laboratory and field performance assessments will consist of on-site reviews conducted by EPA of QA systems and equipment for sampling, calibration, and measurement. EPA personnel may conduct a laboratory audit prior to sample analysis. Any pertinent laboratory audit reports will be made available to the project QA/QC coordinator upon request. All laboratories are required to have written procedures addressing internal QA/QC. All laboratories and QA/QC coordinators are required to ensure that all personnel engaged in sampling and analysis tasks have appropriate training.

7.1.2 Response Actions for Field Sampling

The FC, or a designee, will be responsible for correcting equipment malfunctions throughout field sampling, and for resolving situations in the field that may result in nonconformance or noncompliance with this QAPP. All corrective measures will be immediately documented in the field logbook, and protocol modification forms will be completed, as necessary.

7.1.3 Corrective Action for Laboratory Analyses

All laboratories will be required to comply with their current written SOPs, laboratory QA plans, and analytical methods. All laboratory personnel will be responsible for reporting problems that may compromise the quality of the data. The analysts will identify and correct any anomalies before continuing with sample analysis. The laboratory PMs will be responsible for ensuring that appropriate corrective actions are initiated as required for conformance with this QAPP.

The project QA/QC coordinator will be notified immediately if any QC sample exceeds the DQIs outlined in this QAPP (Tables 4-7, 4-11, and 4-14), and the exceedance cannot be resolved through standard corrective action procedures (Table 7-1). A description of the anomaly, the steps taken to identify and correct the anomaly, and the treatment of the relevant sample batch (i.e., recalculation, reanalysis, and re-extraction) will be submitted with the data package using the case narrative or corrective action form.

Table 7-1
Acceptance Limits and Corrective Actions for Laboratory Analyses

Parameter	QC Sample	Acceptance Limits	Corrective Action
TOC	Method blank	Less than ½ the LOQ or greater than 1/10th the amount measured in any sample or 1/10th the regulatory limit, whichever is greater	Reprocess affected samples in batch. If insufficient sample volume remains for reprocessing or if holding times have been exceeded, the results shall be reported with B-flags.
	CRM	+/- 25%	Rerun CRM to confirm outlying condition. Verify operating conditions on a Corrective Action Form. As the CRM is received dry, no batch sample control is based on recovery values.
	Laboratory replicate	+/- 20%	Review data for errors. Matrix QC control limits are advisory as they are an indication of sample characteristics. Flag outliers.
	MS/MSD	+/- 25% recovery, +/-20% RPD	Review data for errors. Matrix QC control limits are advisory as they are an indication of sample characteristics. Flag outliers.
Percent Solids	Laboratory replicate	+/- 20%	Review data for errors and notes for indications of sample appearance (rocks, wood chips, etc.). Flag outliers.
Grain size	Laboratory triplicate	+/-20%	For matrix evaluation only. Note outliers.

Table 7-1
Acceptance Limits and Corrective Actions for Laboratory Analyses

Parameter	QC Sample	Acceptance Limits	Corrective Action
Metals	Method blank	Less than ½ the LOQ or greater than 1/10th the amount measured in any sample or 1/10th the regulatory limit, whichever is greater	Reprocess affected samples in batch. If insufficient sample volume remains for reprocessing or if holding times have been exceeded, the results shall be reported with the appropriate data qualifiers.
	LCS	+/- 20%	Correct problem; then, if necessary, re-prep and reanalyze the LCS and all samples for failed analytes if sufficient sample material is available. If reanalysis cannot be performed, explain in the Case Narrative.
	Laboratory replicate	+/- 20%	Review data for errors. Matrix QC control limits are advisory as they are an indication of sample characteristics. Flag outliers.
	MS	+/- 25%	Review data for errors. For matrix evaluation only; no corrective action required.
	Internal standards	30-120% if IS in the ICAL Blank	If recoveries area is acceptable for QC samples but not field samples, the field samples may be considered to suffer from matrix effect.
Mercury	Method Blank	Less than ½ the LOQ or greater than 1/10th the amount measured in any sample or 1/10th the regulatory limit, whichever is greater	Reprocess affected samples in batch. If insufficient sample volume remains for reprocessing or if holding times have been exceeded, the results shall be reported with the appropriate data qualifiers.
	LCS	+/- 20%	Correct problem; then, if necessary, re-prep and reanalyze the LCS and all samples for failed analytes if sufficient sample material is available. If reanalysis cannot be performed, explain in the Case Narrative.
	Laboratory replicate	+/- 20%	Review data for errors. Matrix QC control limits are advisory as they are an indication of sample characteristics. Flag outliers.
	MS	+/- 25%	Review data for errors. For matrix evaluation only; no corrective action required.

Table 7-1
Acceptance Limits and Corrective Actions for Laboratory Analyses

Parameter	QC Sample	Acceptance Limits	Corrective Action
PAHs	Method blank	Less than ½ the LOQ or greater than 1/10th the amount measured in any sample or 1/10th the regulatory limit, whichever is greater	Reprocess affected samples in batch. If insufficient sample volume remains for reprocessing or if holding times have been exceeded, the results shall be reported with the appropriate data qualifiers.
	LCS	Laboratory acceptance criteria (see Table 4-6 for limits) or 50 - 150% until sufficient data have been generated for in-house limits	Correct problem; then, if necessary, re-prep and reanalyze the method blank, LCS, and all samples in the batch (including matrix QC) for failed analytes if sufficient sample material is available. If reanalysis cannot be performed, data must be explained in the Case Narrative.
	CRM	See reference material certification for windows	Review data for errors. Flag outliers on summary sheet. If all laboratory QC and field samples have surrogates within limits, narrate the outliers in the Case Narrative.
	MS/MSD	Use LCS limits as advisory limits	Review data for errors. For matrix evaluation only; no corrective action required.
	Internal standards	50 - 200% of ICAL Midpoint standard	Inspect instrument for malfunctions, correct problem, and reanalyze extracts. Review data for possible matrix effect and rerun samples at dilution to bring internal standards into control. If corrective action fails, explain in Case Narrative.
	Surrogates	Laboratory acceptance criteria 21 - 134% or 50 - 150% until sufficient data have been generated for in-house limits	Correct problem; then, if necessary, re-prep and reanalyze failed samples for surrogates in the batch if sufficient material is available. If obvious chromatographic interference is present, reanalysis may not be necessary, but the client must be notified prior to reporting data, and failures must be discussed in the Case Narrative.

Table 7-1
Acceptance Limits and Corrective Actions for Laboratory Analyses

Parameter	QC Sample	Acceptance Limits	Corrective Action
PCB Aroclors	Method blank	Less than ½ the LOQ or less than 1/10th the amount measured in any sample or 1/10th the regulatory limit, whichever is greater	Reprocess affected samples in batch. If insufficient sample volume remains for reprocessing or if holding times have been exceeded, the results shall be reported with the appropriate data qualifiers.
	RM (Puget Sound Reference Material)	See Table 4-6 for limits	Review data for errors. Flag outliers on summary sheet. If all laboratory QC and field samples have surrogates within limits, narrate the outliers in the Case Narrative.
	LCS	Laboratory acceptance criteria (see Table 4-6 for limits) or 50 - 150% until sufficient data have been generated for in-house limits	Correct problem; then, if necessary, re-prep and reanalyze the method blank, LCS, and all samples in the batch (including matrix QC) for failed analytes if sufficient sample material is available. If reanalysis cannot be performed, data must be explained in the Case Narrative.
	MS/MSD	Use LCS limits as advisory limits	Review data for errors. For matrix evaluation only; no corrective action required.
	Internal standards	50 - 200% of ICAL Midpoint standard	Inspect instrument for malfunctions, correct problem, and reanalyze extracts. Review data for possible matrix effect and rerun samples at dilution to bring internal standards into control. If corrective action fails, explain in Case Narrative.
	Surrogates	Laboratory acceptance criteria 44 - 126% or 50 - 150% until sufficient data have been generated for in-house limits	Correct problem; then, if necessary, re-prep and reanalyze failed samples for surrogates in the batch if sufficient material is available. If obvious chromatographic interference is present, reanalysis may not be necessary, but the client must be notified prior to reporting data, and failures must be discussed in the Case Narrative.

Table 7-1
Acceptance Limits and Corrective Actions for Laboratory Analyses

Parameter	QC Sample	Acceptance Limits	Corrective Action
SVOCs	Method blank	Less than ½ the LOQ or greater than 1/10th the amount measured in any sample or 1/10th the regulatory limit, whichever is greater. Common contaminants must not be detected > LOQ	Correct problem. Reprocess affected samples in batch. If insufficient sample volume remains for reprocessing or if holding times have been exceeded, the results shall be reported with the appropriate data qualifiers.
	LCS	Laboratory acceptance criteria (see Table 4-6 for limits) or 50-150% until sufficient data have been generated for in-house limits	Correct problem; then, if necessary, re-prep and reanalyze the method blank, LCS, and all samples in the batch (including matrix QC) for failed analytes if sufficient sample material is available. If reanalysis cannot be performed, data must be explained in the Case Narrative.
	MS/MSD	Use LCS limits as advisory limits	Review data for errors. For matrix evaluation only; no corrective action required.
	Internal standards	50-200% of ICAL Midpoint standard	Inspect instrument for malfunctions, correct problem, and reanalyze extracts. Review data for possible matrix effect and rerun samples at dilution to bring internal standards into control. If corrective action fails, explain in Case Narrative.
	Surrogates	Laboratory acceptance criteria 24-134% or 50-150% until sufficient data have been generated for in-house limits	Correct problem, then re-prep and reanalyze failed samples for surrogates in the batch if sufficient material is available. If obvious chromatographic interference is present, reanalysis may not be necessary, but the client must be notified prior to reporting data, and failures must be discussed in the Case Narrative.

Table 7-1
Acceptance Limits and Corrective Actions for Laboratory Analyses

Parameter	QC Sample	Acceptance Limits	Corrective Action
Dioxin/Furans	Method blank	Less than ½ the LOQ, except OCDF and OCDD, which should be less than three times the LOQ, or less than 1/10th the amount measured in any sample or 1/10th the regulatory limit, whichever is greater	Confirm results by reanalyzing method blank. Re-extract and reprocess all associated samples if attributed to processing. Qualify data with B-flags as appropriate.
	Internal standards	25 - 150% of the continuing calibration verification	Correct problem, then reanalyze the sample(s) with failed internal standards. If corrective action fails in field samples with passing internal standards in laboratory QC, data must be explained in the Case Narrative.
	RM (Puget Sound Reference Material)	See Table 4-6	Review data for errors. If labels are in control for all samples and targets are in control for LCS, describe the issue in the case narrative.
	Extraction (cleanup) standard	35 - 197%	Review data for matrix effect. Rerun at dilution to prove matrix effect. Re-extract affected sample if attributed to processing error. If insufficient sample volume remains for reprocessing, the results shall be reported with the appropriate data qualifiers and narrated.
	Labeled compounds	See Table 4-6	If matrix affects are noted from perfluorkerosene dropouts, rerun samples at dilution to bring labels into control. If not attributed to matrix effect, re-extract and reanalyze affected sample.
	Laboratory replicate	+/- 25%	For matrix evaluation only. Review data for errors. Flag outliers on summary sheet.

Table 7-1
Acceptance Limits and Corrective Actions for Laboratory Analyses

Parameter	QC Sample	Acceptance Limits	Corrective Action
Ammonia	Method blank	Less than ½ the LOQ or greater than 1/10th the amount measured in any sample or 1/10th the regulatory limit, whichever is greater	Reprocess affected samples in batch. If insufficient sample volume remains for reprocessing or if holding times have been exceeded, the results shall be reported with the appropriate B-flag qualifiers.
	LCS	+/-10%	Correct problem, then, if necessary, re-prep and reanalyze the LCS and all samples in the associated batch if sufficient sample material available. If reanalysis cannot be performed, data must be explained in the Case Narrative.
	Laboratory replicate	+/- 20%	Review data for errors. Matrix QC control limits are advisory, as they are an indication of sample characteristics. Flag outliers.
	MS	+/-25%	For matrix evaluation only. If MS results are outside the limits, the data shall be evaluated to the source of the difference (i.e., matrix effect or analytical error). Explain in the Case Narrative.
Total sulfides	Method blank	Less than ½ the LOQ or greater than 1/10th the amount measured in any sample or 1/10th the regulatory limit, whichever is greater	Reprocess affected samples in batch. If insufficient sample volume remains for reprocessing or if holding times have been exceeded, the results shall be reported with the appropriate B-flag qualifiers.
	LCS	+/-25%	Correct problem; then, if necessary, re-prep and reanalyze the LCS and all samples in the associated batch if sufficient sample material available. If reanalysis cannot be performed, data must be explained in the Case Narrative.
	Laboratory replicate	+/- 20%	Review data for errors. Matrix QC control limits are advisory as they are an indication of sample characteristics. Flag outliers.
	MS	+/-25%	For matrix evaluation only. If MS results are outside the limits, the data shall be evaluated to the source of the difference (i.e. matrix effect or analytical error). Explain in the Case Narrative.

Notes:

Acceptance limits and corrective actions were provided by ARL based on its standard analytical protocols.

ARL: Analytical Resources LLC
CRM: certified reference material
ICAL: initial calibration
LCS: laboratory control sample
LOQ: limit of quantitation
MS: matrix spike
MSD: matrix spike duplicate
OCDD: octachlorodibenzo-*p*-dioxin
OCDF: octachlorodibenzofuran
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
QC: quality control
RM: reference material
RPD: relative percent difference
SVOC: semivolatile organic compound
TOC: total organic carbon

7.2 Reports to Management

The FC or designee will prepare a summary email for submittal to LDWG and EPA following each sampling and survey day. The project QA/QC coordinator will also email LDWG and EPA after sampling has been completed and samples have been submitted for analysis. In these progress reports, the statuses of the samples and analyses will be indicated, with emphasis on any deviations from this QAPP. A DER will be written after validated data are available, as described in Section 7.3.

7.3 Data Evaluation Reports

A DER will be prepared documenting all activities associated with the collection, handling, and analysis of samples for each phase of sampling, as specified in AOC5 (EPA 2018). The reports will document the sampling events and present and interpret the analytical results. EPA comments on the Phase I DER will be reflected in subsequent deliverables, rather than in revised versions of that report.

The following base information will be included in the Phase I and II DERs or posted on http://ldwg.org as part of data packages. If Phase III sampling is required, the results and will be included in the 90% design package.

- Summary of all field activities, including descriptions of any deviations from the approved QAPP
- Sampling locations reported in latitude and longitude to the nearest one-tenth of a second and in northing and easting to the nearest foot
- Summary of the chemical data QA/QC review
- Summary of field QC result evaluation
- Summary of the geotechnical data (*in situ* and *ex situ* data results)
- Results of structure inspections, including field inspection forms and structure conditions ratings
- Results of the visual bank inspection, including maps, photographs, video (if used), and detailed observations collected on field inspection forms
- Results from the analyses of field samples; included as summary tables in the main body of the report, data forms submitted by the analytical laboratories, and cross-tab tables produced from the project SQL Server database
- Copies of field logs and photographs
- Copies of chain of custody forms
- Laboratory and data validation reports
- Results of focused topographic surveys and additional shoreline/bank survey data collected during Phase II efforts

Once the data in the DERs have been approved by EPA, the bioassay results and the chemistry database exports will be created from the project SQL Server database. The chemistry data will be exported in two formats: one that is compatible with Ecology's Environmental Information Management (EIM) system, and one that is compatible with EPA's Scribe database. The bioassay data will be exported in a format that is compatible with EIM. The exported data files will be uploaded to EIM and EPA Scribe databases, and a copy of the EPA Scribe EDDs will be provided to EPA per AOC5 deliverable requirements. The EIM Study ID will be included in the Phase II DER. Based on preliminary reconnaissance, geotechnical data are not planned to be collected during Phase I but will be collected during Phase II. They will be presented in the Phase II DER as an appendix to the document or posted on http://ldwg.org in the data package.

As described in Section 6.1.4 of the RDWP (Anchor QEA and Windward 2022b), the DERs will also contain an interpolation of the data in order to define RAL exceedance area boundaries, depths, technologies, and remaining data needs for the next phase.

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Appendix A
Health and Safety Plan

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Appendix B
Archaeological Monitoring and Inadvertent Discovery Plan

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Appendix C
Field Forms

DRAFT

Appendix D
Sampling Location Details

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Appendix E
SOPs

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DRAFT

Appendix F
Site-specific Dive Safety and Work Plan

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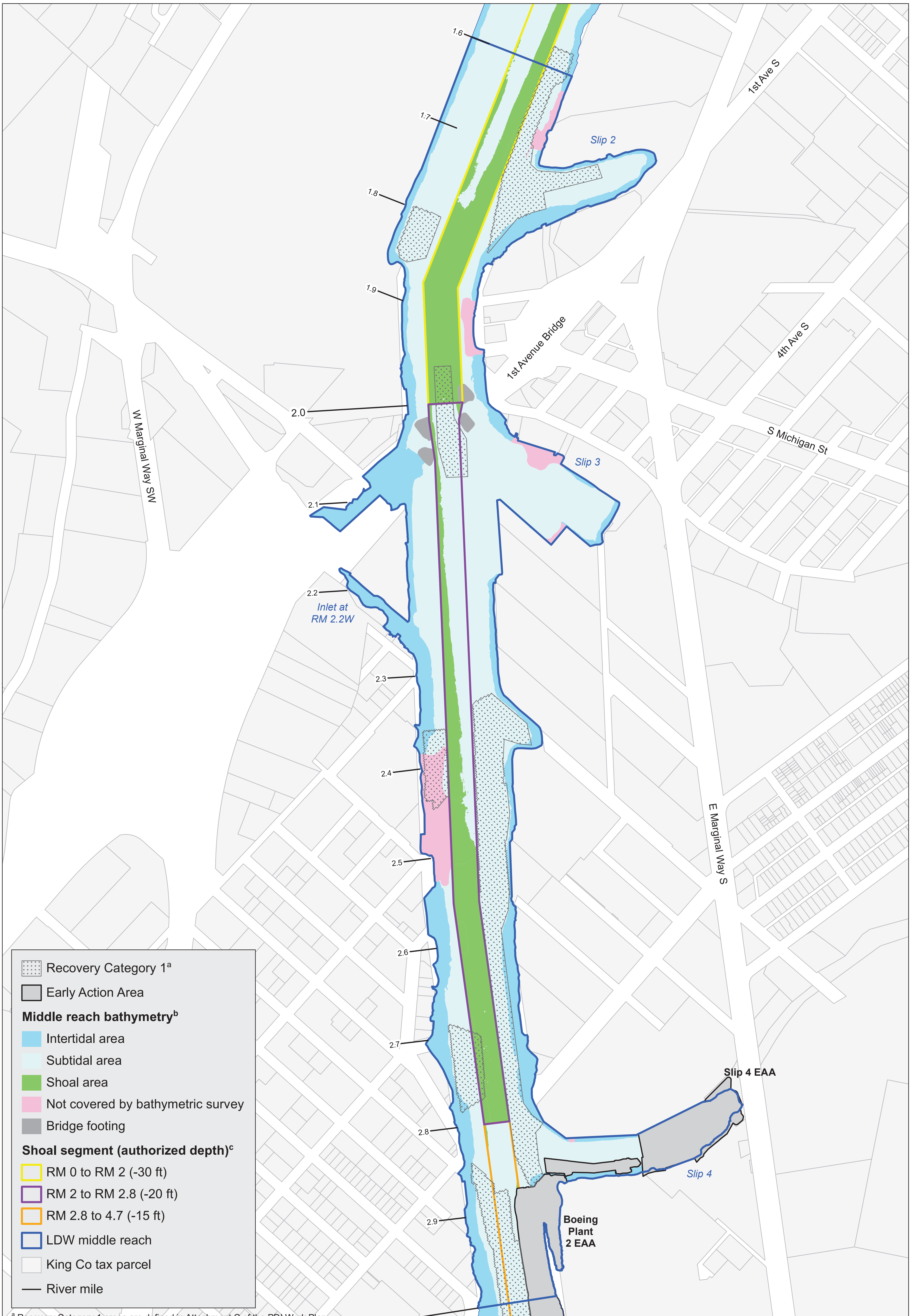
DRAFT

Appendix G
Analytical Methods and Reporting Limits



[a] Recovery Category 1 areas are defined in Attachment C of the PDI Work Plan.
[b] Source: 2021 middle reach bathymetric survey; USACE 2022 and Evans 2003 bathymetric surveys used to fill in survey gaps where possible. For the intertidal area, the area between the survey extent and the LDW Superfund Site boundary is inferred.
[c] The USACE Federal Navigation Channel partitioned according to the 2014 ROD.

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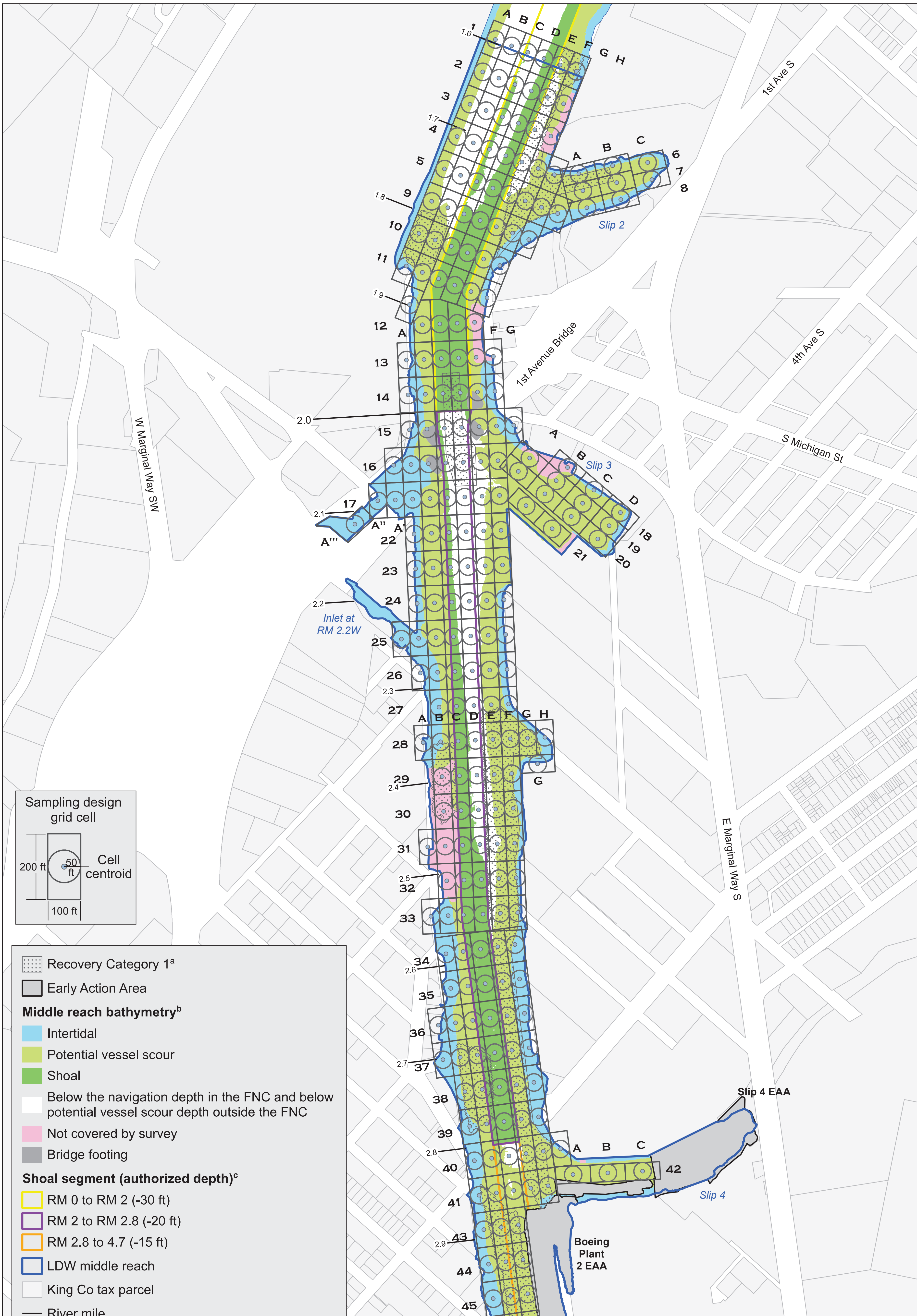
Map 1. Overview of the middle reach (RM 1.6 to RM 3.0)

LDW QAPP for Remedial Design of Middle Reach: Pre-design Investigation

OCTOBER 21, 2022

Prepared by nicolase, 10/13/2022; W:\Projects\Duwamish AOC5\GIS\Maps and Analyses\Phase 1\QAPP\Map 01 7419 Middle Reach Vicinity Map.mxd



[a] Recovery Category 1 areas are defined in Attachment C of the PDI Work Plan.
[b] Source: 2021 middle reach bathymetric survey; USACE 2022 and Evans 2003 bathymetric surveys used to fill in survey gaps where possible. For the intertidal area, the area between the survey extent and the LDW Superfund Site boundary is inferred.
[c] The USACE Federal Navigation Channel partitioned according to the 2014 ROD.

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N

0 500 1,000 Feet

0 100 200 Meters

Lower Duwamish Waterway Group

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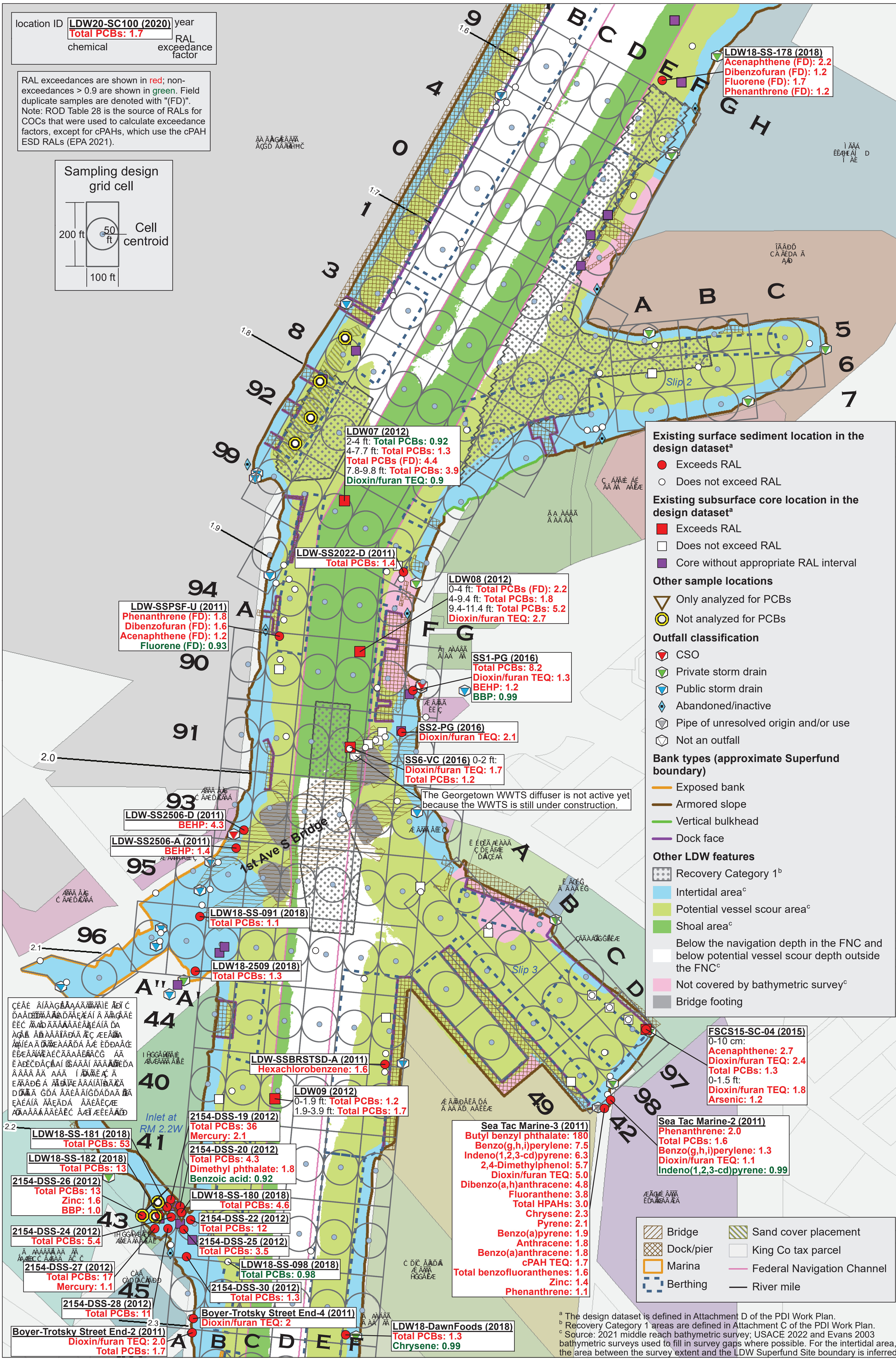
Map 2. Middle reach sampling grid

LDW QAPP for Remedial Design of Middle Reach: Pre-design Investigation

OCTOBER 21, 2022

Prepared by nicolase, 10/13/2022; W:\Projects\Duwamish AOC5\GIS\Maps and Analyses\Phase 1\QAPP\Map 02 7414 Middle reach sampling design grid.mxd



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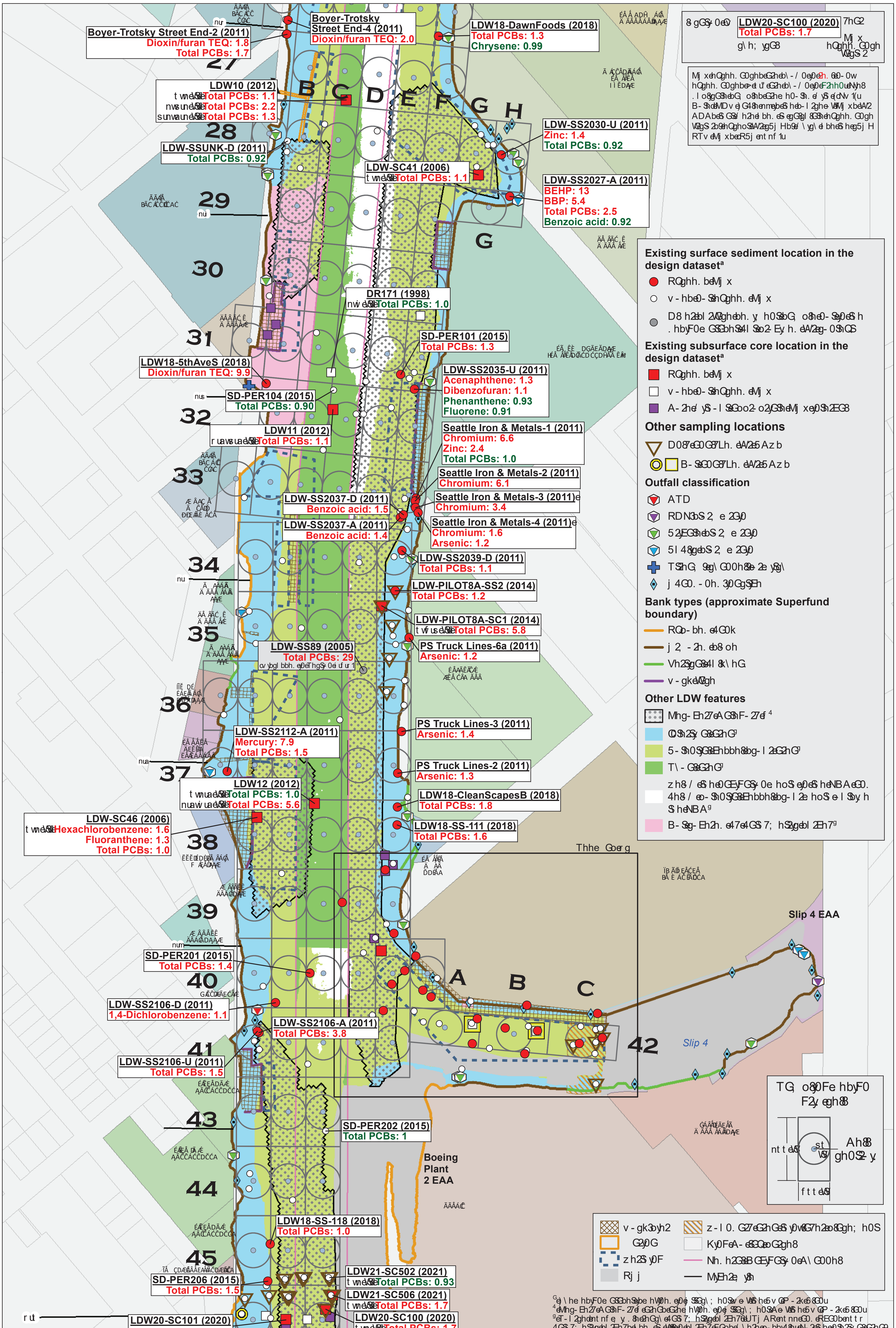
0 200 400 Feet
0 50 100 Meters

Map 3a. Middle reach Phase I sediment sampling grids with existing design data (RM 1.6 to RM 2.3)

LDW QAPP for Remedial Design of Middle Reach: Pre-design Investigation

OCTOBER 21, 2022

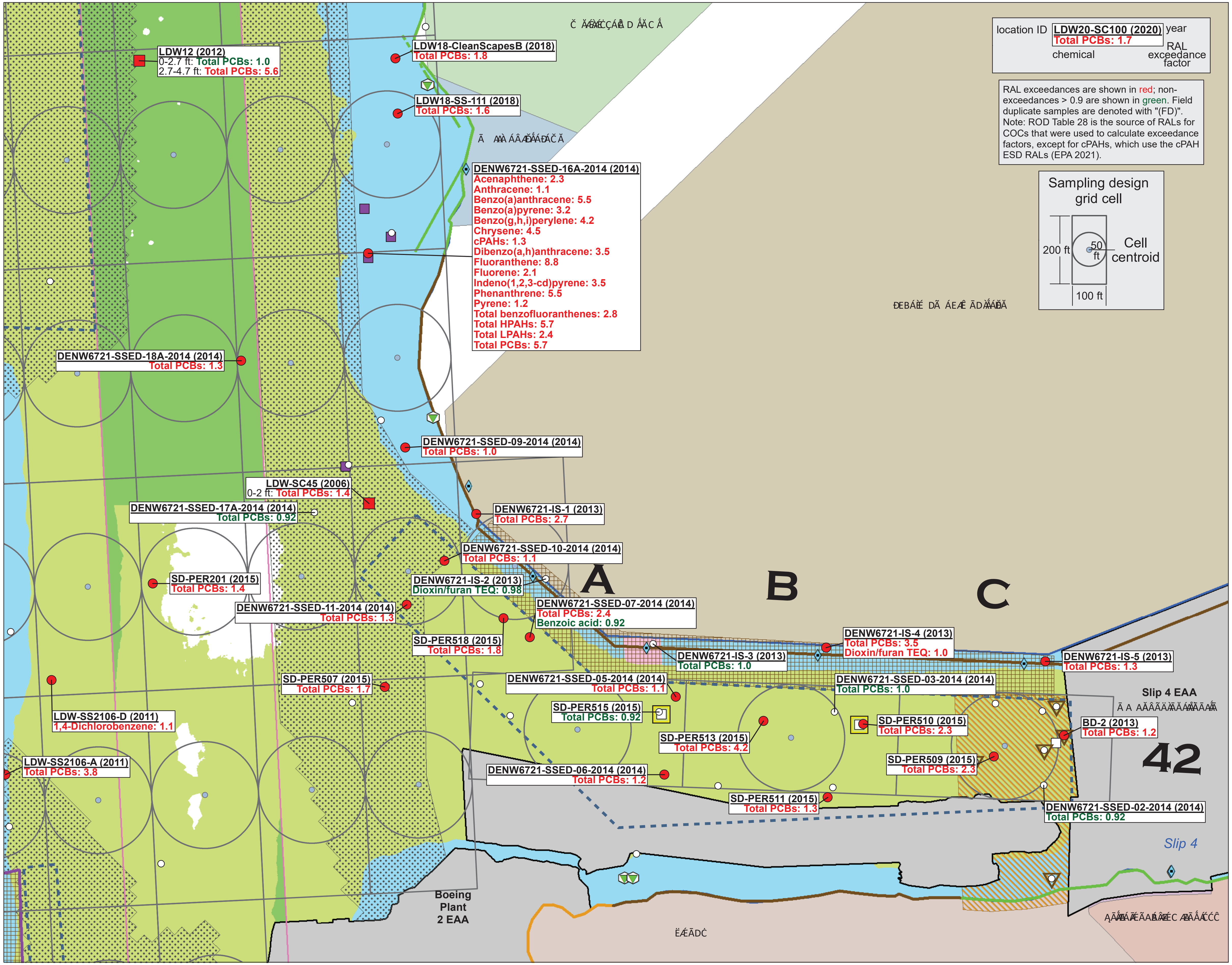
Prepared by nicolase, 10/13/2022; W:\Projects\Duwamish AOC5\GIS\Maps and Analyses\Phase 1\QAPP\Map 03a 7321 Middle reach RM1.6-2.3.mxd



Map 3b. Middle reach Phase I sediment sampling grids with existing design data (RM 2.3 to RM 3.0)

LDW QAPP for Remedial Design of Middle Reach: Pre-design Investigation

OCTOBER 21, 2022



Existing surface sediment location in the design dataset[a]
- Exceeds RAL
- Does not exceed RAL

Existing subsurface core location in the design dataset[a]
- Exceeds RAL
- Does not exceed RAL
- Core without appropriate RAL interval

Other sampling locations
- Only analyzed for PCBs
- Not analyzed for PCBs

Outfall classification
- Private storm drain
- Abandoned/inactive

Bank types (approximate Superfund boundary)
- Exposed bank
- Armored slope
- Vertical bulkhead
- Dock face

Other LDW features
- Recovery Category 1[b]
- Intertidal area[c]
- Potential vessel scour area[c]
- Shoal area[c]
- Below the navigation depth in the FNC and below potential vessel scour depth outside the FNC[c]
- Not covered by bathymetric survey[c]
- Early Action Area
- Boundary area thin-layer placement
- Dock/pier
- Berthing
- King Co tax parcel
- Federal Navigation Channel

[a] The design dataset is defined in Attachment D of the PDI Work Plan.
[b] Recovery Category 1 areas are defined in Attachment C of the PDI Work Plan.
[c] Source: 2021 middle reach bathymetric survey; USACE 2022 and Evans 2003 bathymetric surveys used to fill in survey gaps where possible. For the intertidal area, the area between the survey extent and the LDW Superfund Site boundary is inferred.

N

0 20 40 Yards

0 20 40 Meters

Map 3c. Middle reach Phase I sediment sampling grids with existing design data (Slip 4)

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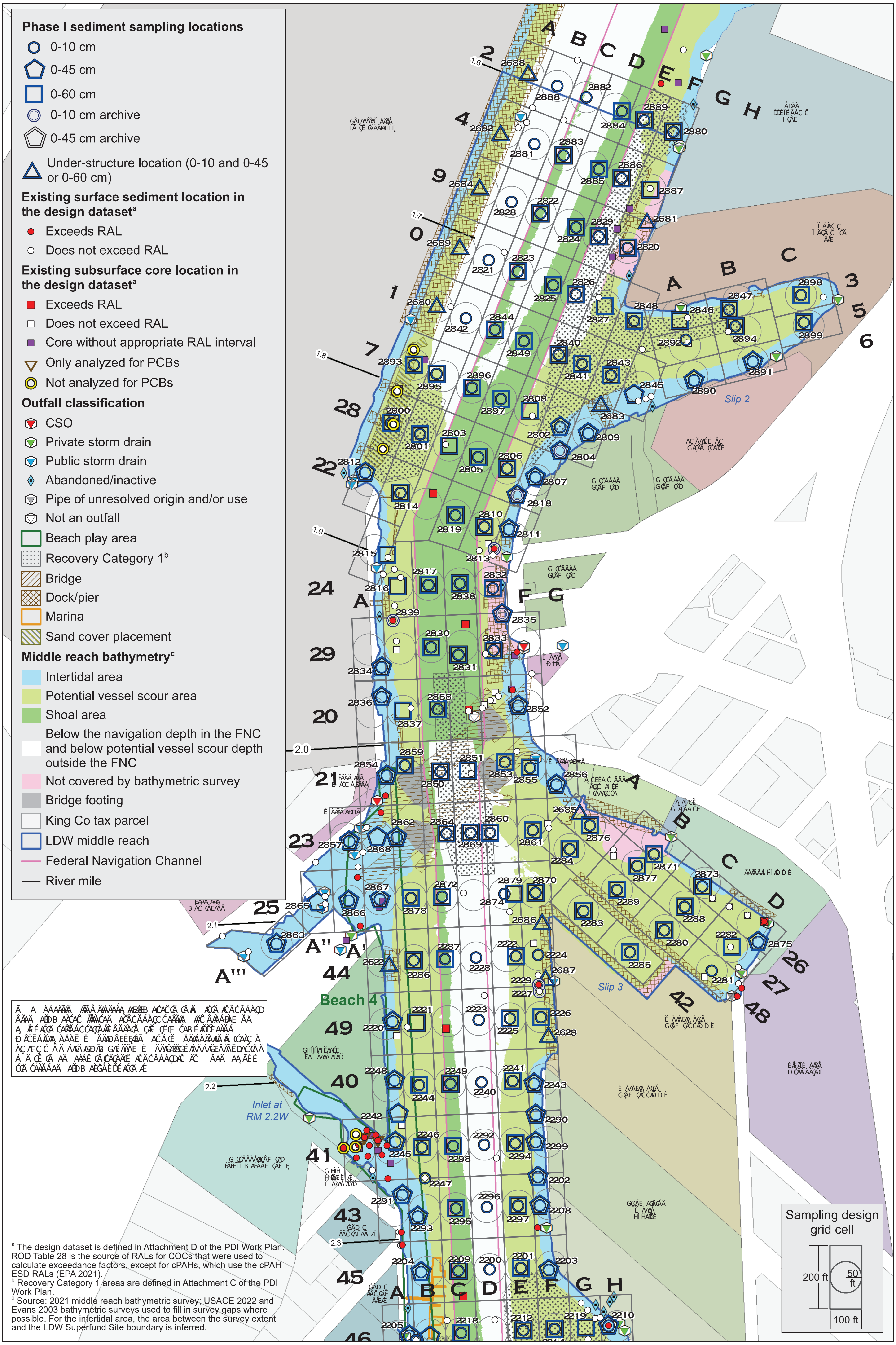
Prepared by nicolase, 10/13/2022; W:\Projects\Duwamish AOC5\GIS\Maps and Analyses\Phase 1\QAPP\Map 03c 7321 Middle reach Slip 4.mxd



[a] The design dataset is defined in Attachment D of the PDI Work Plan. ROD Table 28 is the source of RALs for COCs that were used to calculate exceedance factors, except for cPAHs, which use the cPAH ESD RALs (EPA 2021).
[b] Recovery Category 1 areas are defined in Attachment C of the PDI Work Plan.
[c] Source: 2021 middle reach bathymetric survey; USACE 2022 and Evans 2003 bathymetric surveys used to fill in survey gaps where possible. For the intertidal area, the area between the survey extent and the LDW Superfund Site boundary is inferred.

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Map 4a. Middle reach Phase I sediment sampling locations (RM 1.6 to RM 2.3)

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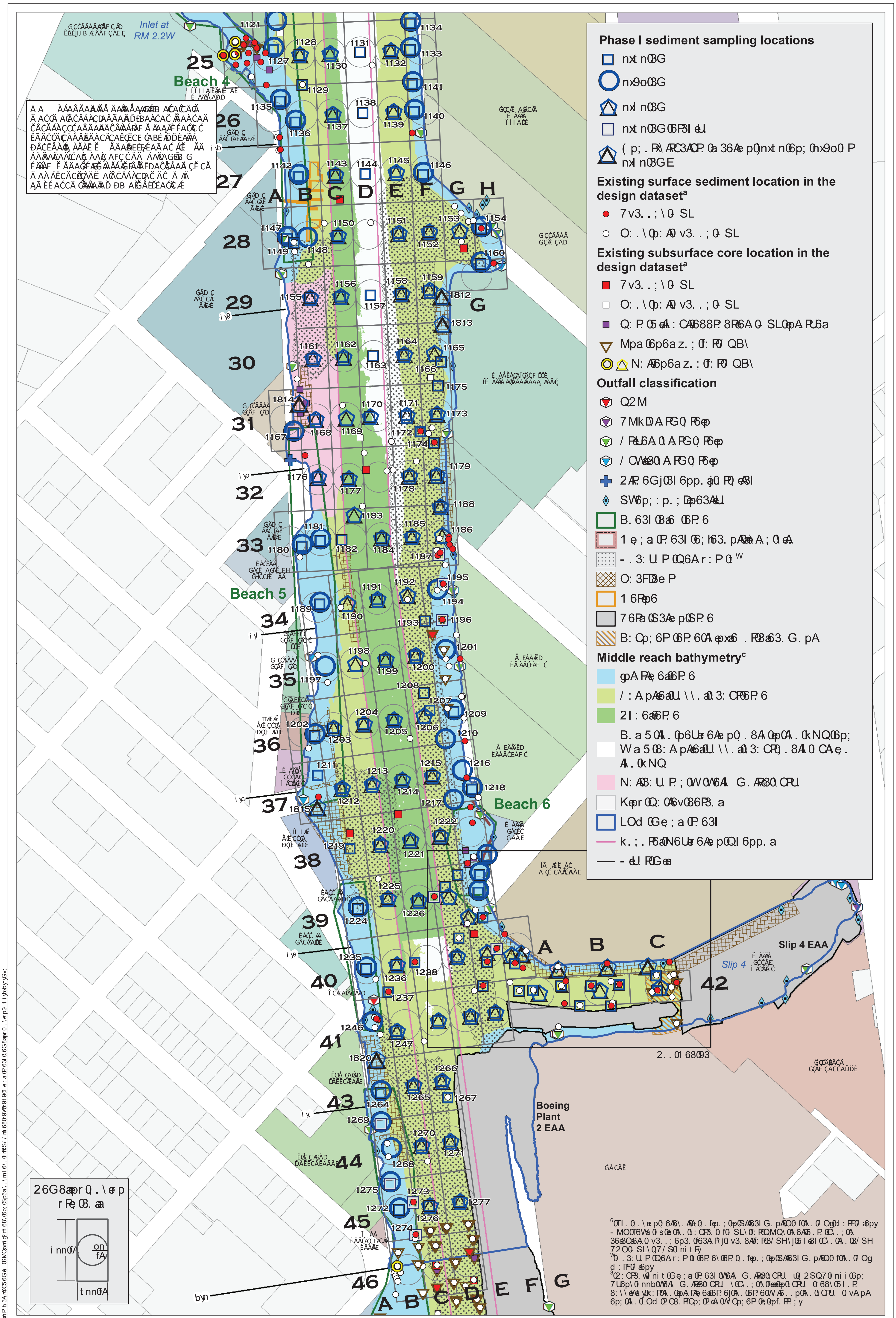

Map 4b. Middle reach Phase I sediment sampling locations (RM 2.3 to RM 3.0)

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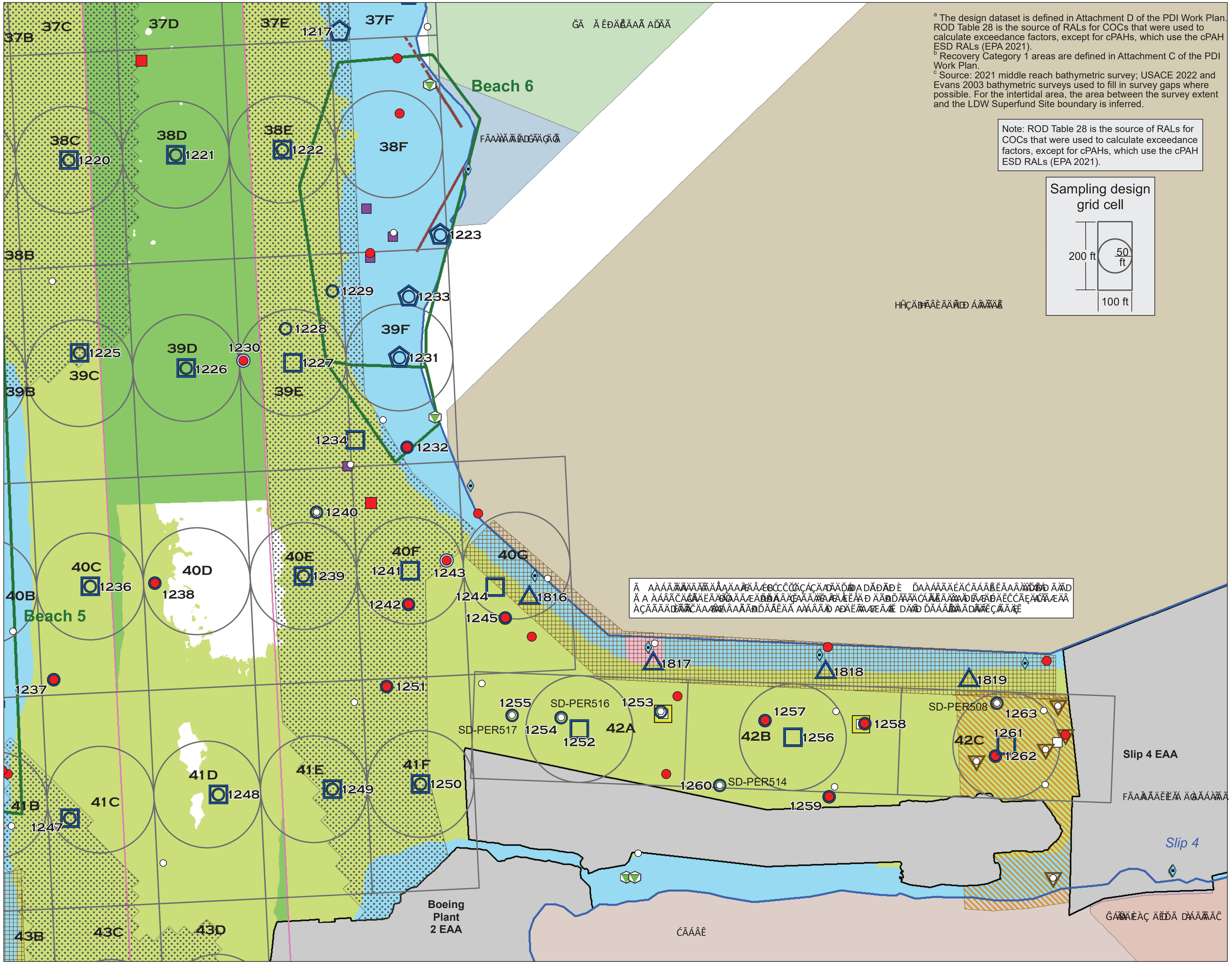

[a] The design dataset is defined in Attachment D of the PDI Work Plan. ROD Table 28 is the source of RALs for COCs that were used to calculate exceedance factors, except for cPAHs, which use the cPAH ESD RALs (EPA 2021).
[b] Recovery Category 1 areas are defined in Attachment C of the PDI Work Plan.
[c] Source: 2021 middle reach bathymetric survey; USACE 2022 and Evans 2003 bathymetric surveys used to fill in survey gaps where possible. For the intertidal area, the area between the survey extent and the LDW Superfund Site boundary is inferred.

Note: ROD Table 28 is the source of RALs for COCs that were used to calculate exceedance factors, except for cPAHs, which use the cPAH ESD RALs (EPA 2021).

Phase I sediment sampling locations

- 0-10 cm
- 0-45 cm
- 0-60 cm
- 0-10 cm archive
- 0-45 cm archive
- Under-structure location (0-10 and 0-45 or 0-60 cm)

Existing surface sediment location in the design dataset[a]

- Exceeds RAL
- Does not exceed RAL

Existing subsurface core location in the design dataset[a]

- Exceeds RAL
- Does not exceed RAL
- Core without appropriate RAL interval
- Only analyzed for PCBs
- Not analyzed for PCBs

Outfall classification

- CSO
- Private storm drain
- Abandoned/inactive
- Beach play area
- Recovery Category 1[b]
- Dock/pier
- Early Action Area
- Boundary area thin-layer placement

Middle reach bathymetry[c]

- Intertidal area
- Potential vessel scour area
- Shoal area
- Below the navigation depth in the FNC and below potential vessel scour depth outside the FNC
- Not covered by bathymetric survey
- King Co tax parcel
- Federal Navigation Channel

0 20 40 Meters

Map 4c. Middle reach Phase I sediment sampling locations (Slip 4)

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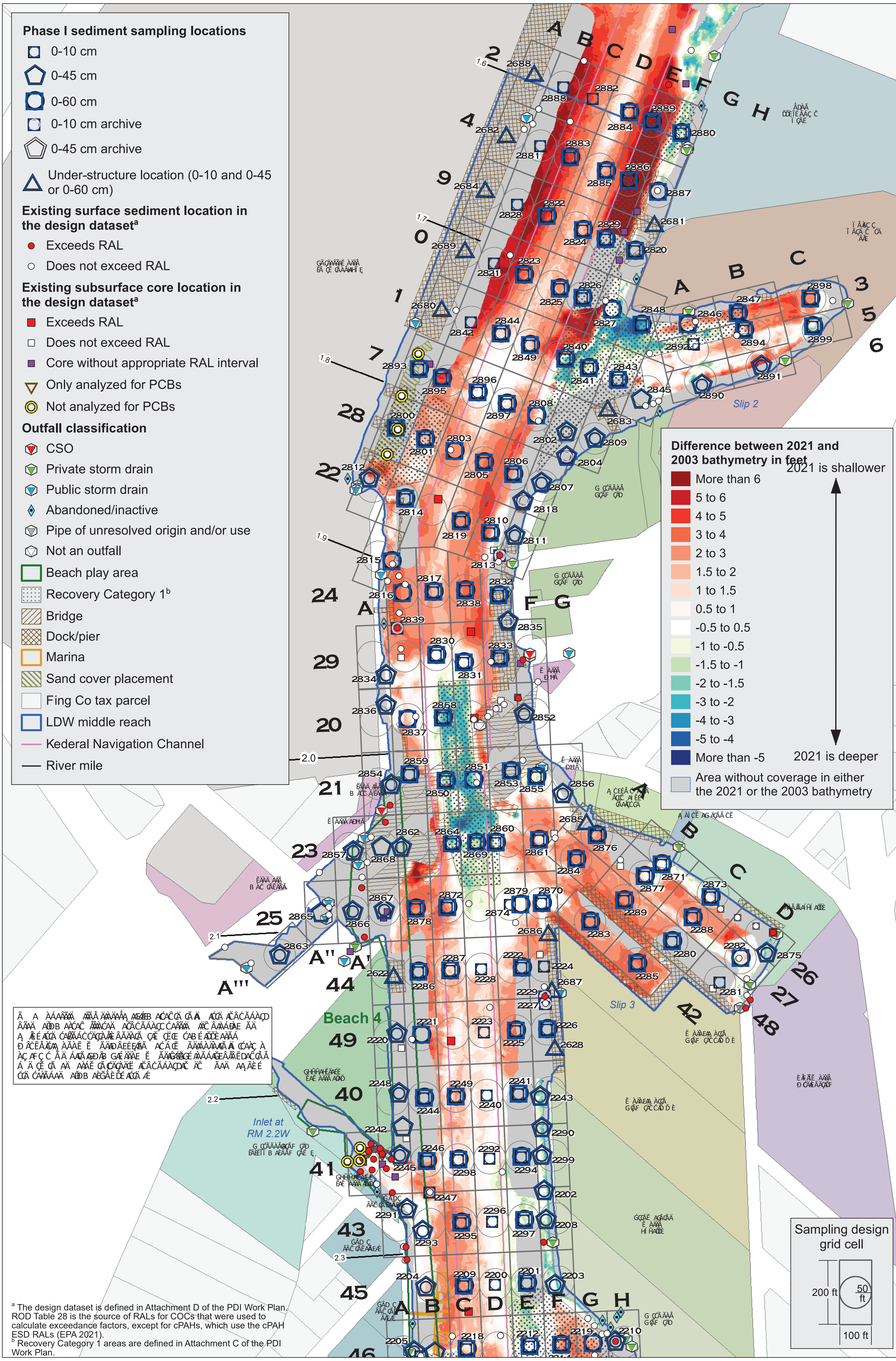

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Map 5a. Middle reach Phase I sediment sampling locations with the isopach analysis results (RM 1.6 to RM 2.3)

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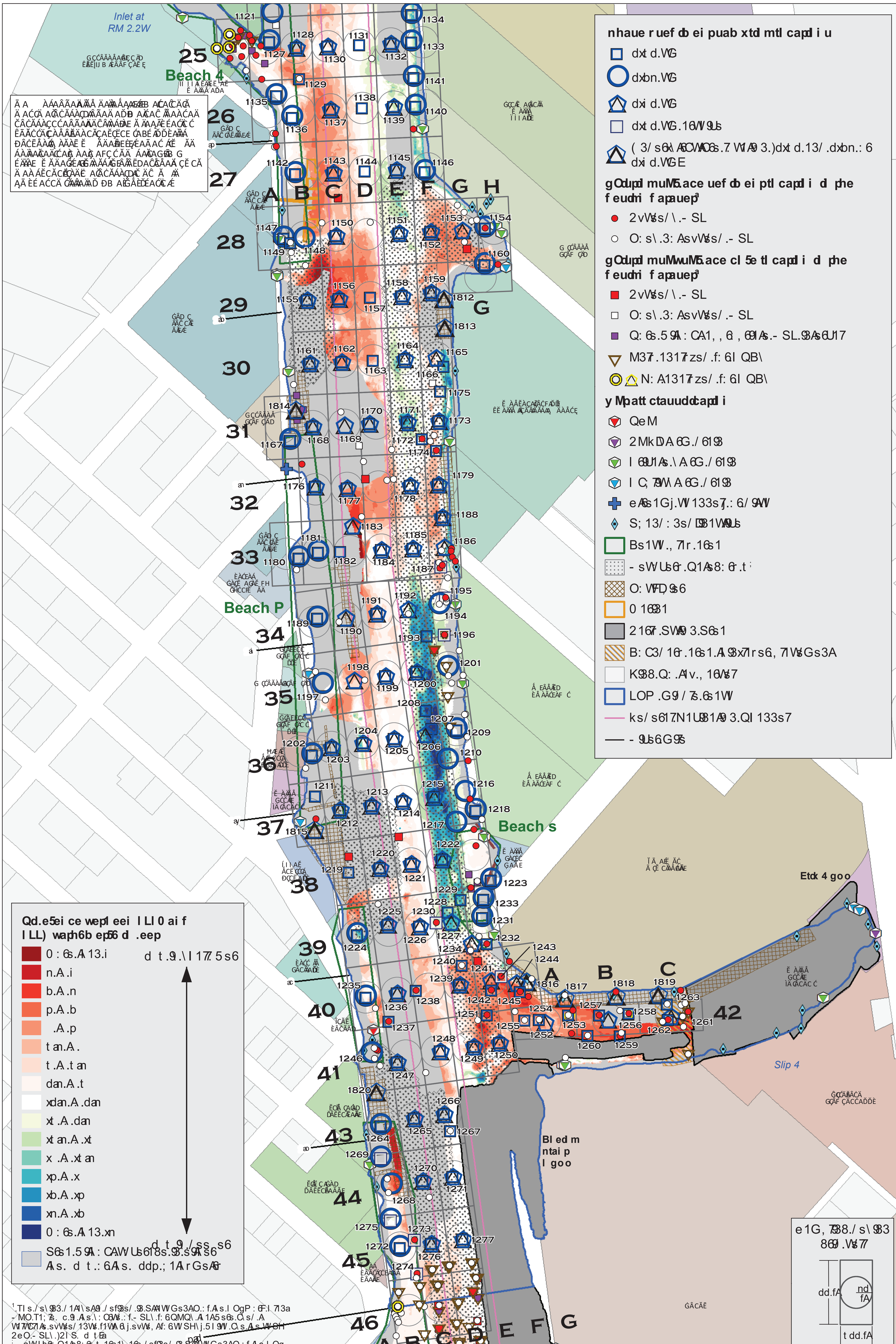

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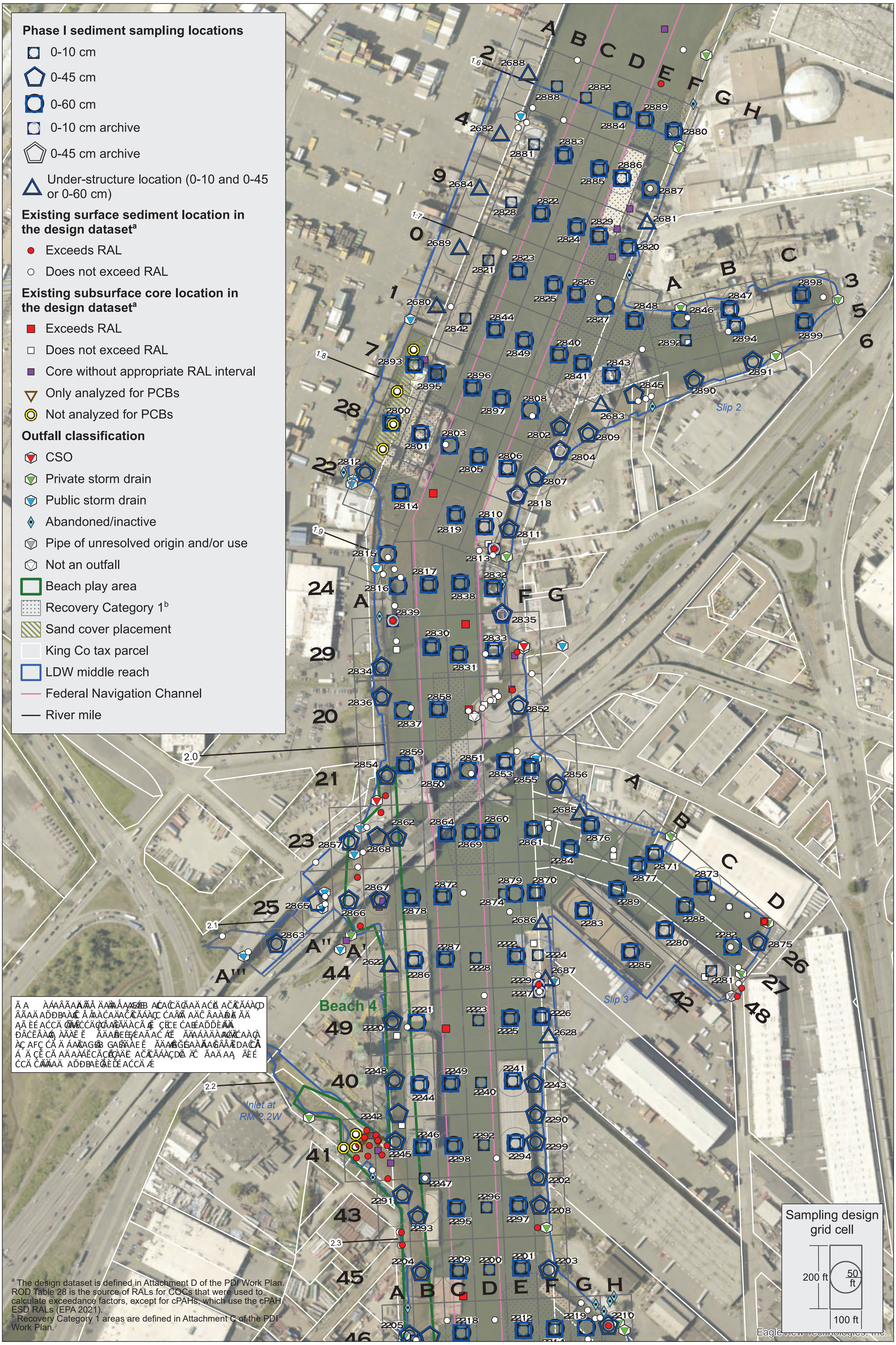

[a] The design dataset is defined in Attachment D of the PDI Work Plan. ROD Table 28 is the source of RALs for COCs that were used to calculate exceedance factors, except for cPAHs, which use the cPAH ESD RALs (EPA 2021).
[b] Recovery Category 1 areas are defined in Attachment C of the PDI Work Plan.

Prepared by nicolase, 10/13/2022; W:\Projects\Duwamish AOC5\GIS\Maps and Analyses\Phase 1\QAPP\Map 06a 7414 Middle reach sampling design RM1.6-2.3 - aerial.mxd

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Map 6a. Middle reach Phase I sediment sampling locations with the aerial photo (RM 1.6 to RM 2.3)

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Map 6b. Middle reach Phase I sediment sampling locations with the aerial photo (RM 2.3 to RM 3.0)

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0 250 500 Feet

0 50 100 Meters

Map 7a. Middle reach Phase I sediment sampling locations for dioxins/furans (RM 1.6 to RM 2.3)

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Map 7b. Middle reach Phase I sediment sampling locations for dioxins/furans (RM 2.3 to RM 3.0)

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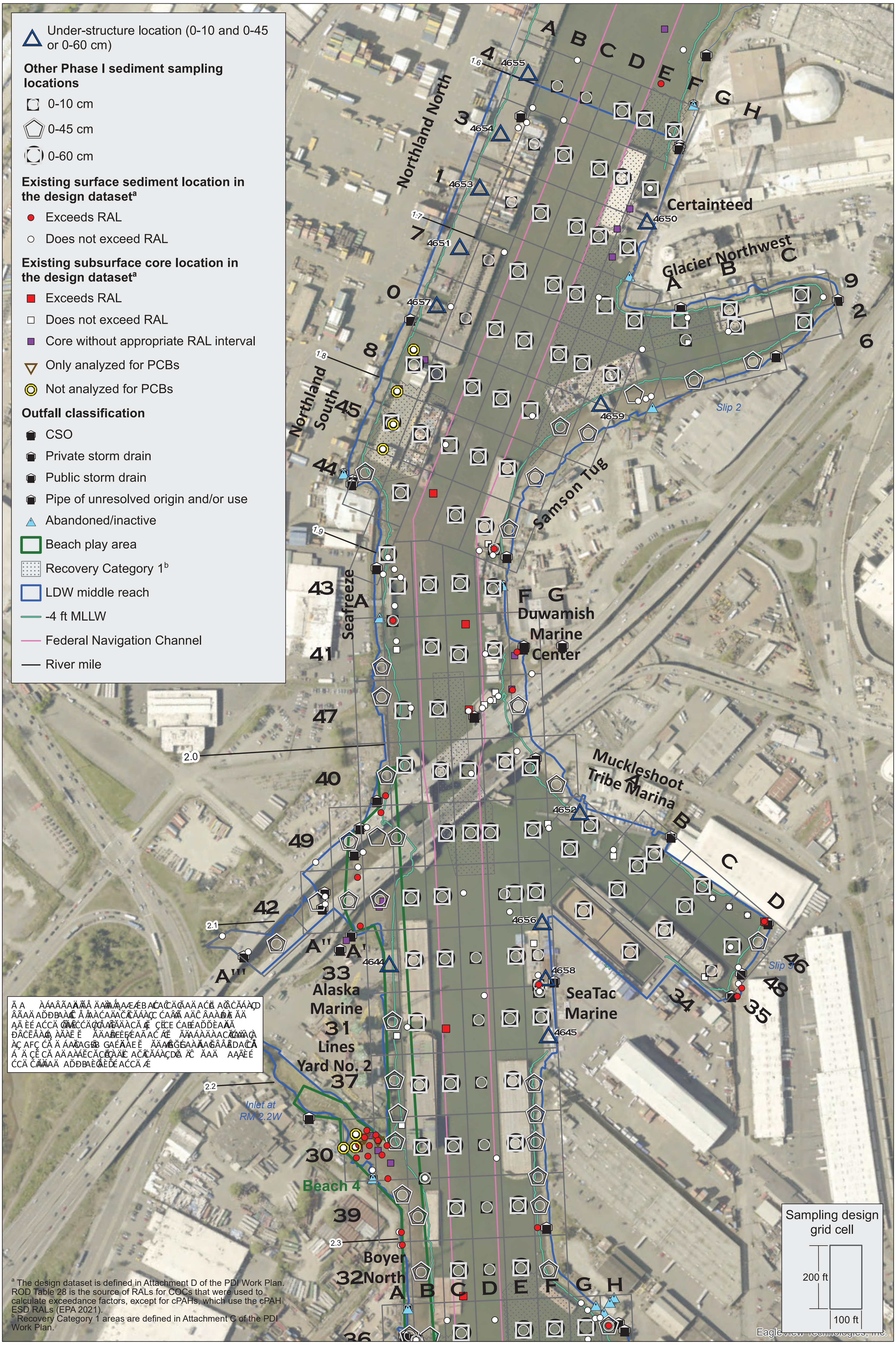

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0 250 500 Feet

0 50 100 Meters

Map 8a. Middle reach Phase I under-structure sediment sampling locations with the aerial photo (RM 1.6 to RM 2.3)

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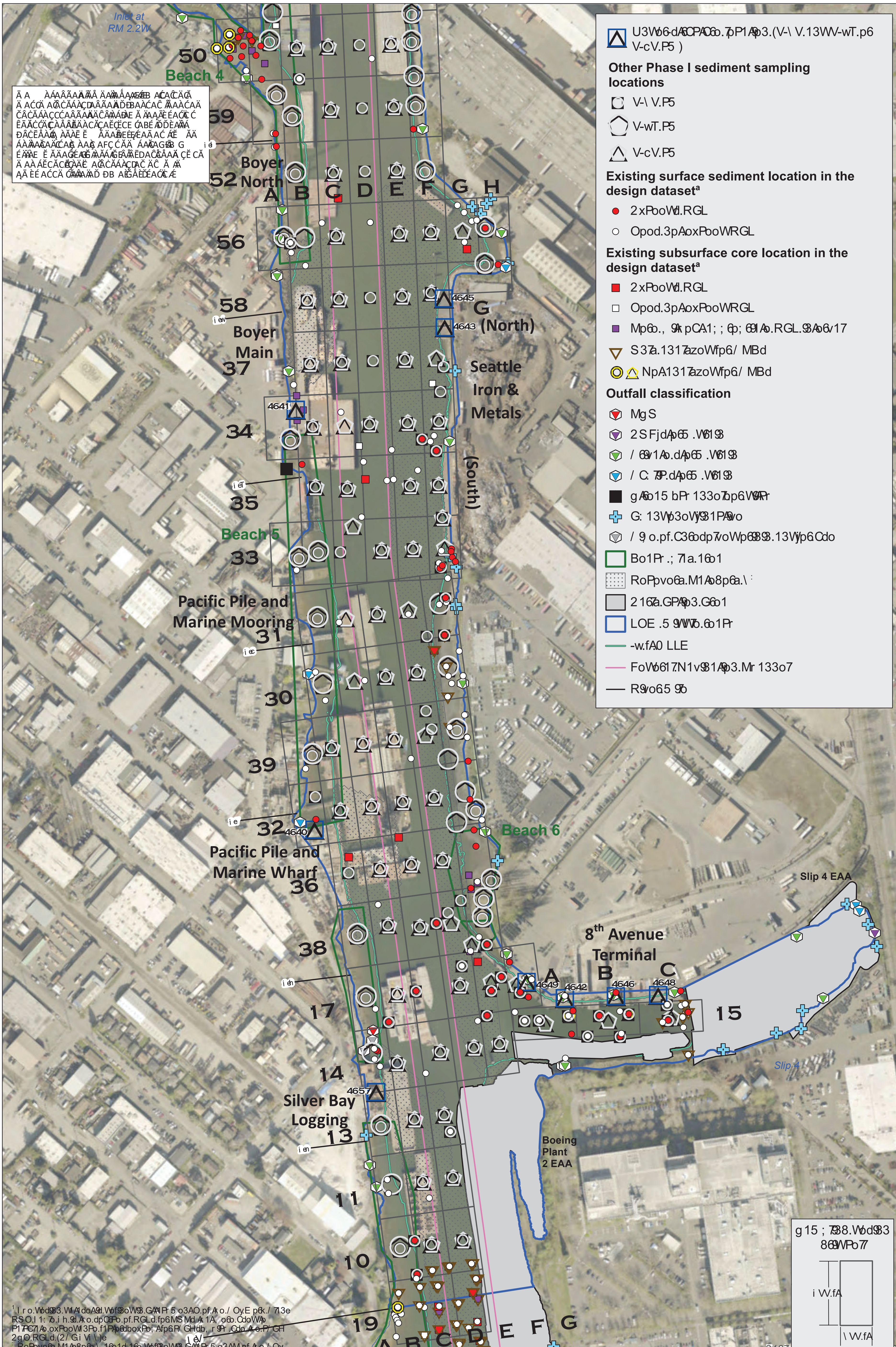

Map 8b. Middle reach Phase I under-structure sediment sampling locations with the aerial photo (RM 2.3 to RM 3.0)

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Appendix D
Sampling Location Details

This appendix provides detailed information regarding sediment sampling locations. The tables included in this appendix are:

- Table D-1. Overview of Grid Cells
- Table D-2. Sample Location Rationale and Analytes
- Table D-3. Rationale for Selected Tier 1 Dioxin/Furan Samples
- Table D-4. Sample Location Details
- Table D-5. Under-Structure Sample Location Details
- Table D-6. Summary of Shoreline Reconnaissance Survey
- Table D-7. Summary of Under-structure Reconnaissance Survey

In Table D-1, which provides an overview of the sampling decisions for each grid cell, gray shading indicates that no sample is needed. Rationale for when no sample is needed in a given grid is discussed in Section 4.1.3 in the main Quality Assurance Project Plan (QAPP) document to which this is an appendix.

For grids where a sample will be collected, Table D-1 provides information regarding the samples to be collected to satisfy grid coverage, as well as information regarding other samples to be collected (e.g., reoccupations and bounding).

Table D-1
Overview of Grid Cells

	A'''		A''		A'		A		B		C		D		E		F		G		H	
Row	**Surface**	**Sub-surface**	**Surface**	**Sub-surface**	**Surface**	**Sub-surface**	**Surface**	**Sub-surface**	**Surface**	**Sub-surface**	**Surface**	**Sub-surface**	**Surface**	**Sub-surface**	**Surface**	**Sub-surface**	**Surface**	**Sub-surface**	**Surface**	**Sub-surface**	**Surface**	**Sub-surface**
RM 1.6 to 1.8																						
1	-	-	-	-	-	-	covered by under-structure sampling (Table D-5)	covered by under-structure sampling (Table D-5)	centroid	no RAL[1]	centroid	no RAL in most of grid	shift to target shoal	co-locate with SS (shoal)	centroid (RC1)	co-locate with SS	shift to target subtidal/RC1 (no sampleable intertidal)	co-locate with SS	-	-	-	-
2	-	-	-	-	-	-	covered by under-structure sampling (Table D-5)	covered by under-structure sampling (Table D-5)	centroid	no RAL[1]	centroid	co-locate with SS (shoal)	shift to target shoal	co-locate with SS (shoal)	centroid (RC1)	co-locate with SS	covered by existing data[2]	centroid (no sampleable intertidal)	-	-	-	-
3	-	-	-	-	-	-	covered by under-structure sampling (Table D-5)	covered by under-structure sampling (Table D-5)	centroid	no RAL[1]	centroid	co-locate with SS (shoal)	shift to target shoal	co-locate with SS (shoal)	centroid (RC1)	co-locate with SS	centroid (no sampleable intertidal)	co-locate with SS	-	-	-	-
4	-	-	-	-	-	-	covered by under-structure sampling (Table D-5)	covered by under-structure sampling (Table D-5)	centroid	no RAL[1]	centroid	co-locate with SS (shoal)	shift to target shoal	co-locate with SS (shoal)	centroid (RC1)	co-locate with SS	covered by existing data[2]	centroid	shift to target RC1/ subtidal	co-locate with SS	-	-
5	-	-	-	-	-	-	covered by under-structure sampling (Table D-5)	covered by under-structure sampling (Table D-5)	centroid	no RAL[1]	centroid	co-locate with SS (shoal)	centroid	co-locate with SS (shoal)	shift to target RC1	co-locate with SS	centroid	co-locate with SS	centroid	co-locate with SS	covered by existing data	shift to target intertidal
Slip 2																						
6	-	-	-	-	-	-	covered by existing data	shift to target subtidal/RC1	shift to target subtidal/RC1	co-locate with SS	centroid	co-locate with SS	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	shift to target RC1	covered by existing data	shift to target RC1	co-locate with SS	shift to target subtidal (no sampleable intertidal)	co-locate with SS	-	`	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	shift to target intertidal	co-locate with SS	centroid (intertidal)	co-locate with SS	-	-	-	-	-	-	-	-	-	-	-	-
RM 1.8 to RM 2.1																						
9	-	-	-	-	-	-	centroid (existing has limited analytes)	co-locate with SS	shift to target potential vessel scour area	co-locate with SS	centroid	co-locate with SS (shoal)	centroid	co-locate with SS (shoal)	covered by existing data[2]	centroid	shift to target intertidal and sample (T2) adjacent to possible upland source[4]	co-locate with both SS (2 samples)[4]	centroid	co-locate with SS	-	-

Row	A'''		A''		A'		A		B		C		D		E		F		G		H	
	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface
10	-	-	-	-	-	-	centroid (existing has limited analytes)	co-locate with SS	centroid	co-locate with SS	covered by existing data[2]	centroid (shoal)	centroid	co-locate with SS (shoal)	centroid	co-locate with SS	shift to target sampleable intertidal and sample (T2) adjacent to possible upland source[4]	co-locate with both SS (2 samples)[4]	-	-	-	-
11	-	-	-	-	-	-	shift to target sampleable intertidal	co-locate with SS	shift offshore of structure	co-locate with SS	no (subsurface exceedances; assume active remedy)	covered by existing data (LDW07)	centroid	co-locate with SS (shoal)	centroid	co-locate with SS	shift to target intertidal; reoccupy LDW-SS2022-D (T2)	co-locate with SS closer to centroid	-	-	-	-
12	-	-	-	-	-	-	covered by existing data	shift to target subtidal (no sampleable intertidal)	covered by existing data[2]	centroid	centroid	co-locate with SS (shoal)	centroid	co-locate with SS (shoal)	shift SE to bound bank area	co-locate with SS	-	-	-	-	-	-
13	-	-	-	-	-	-	shift to target sampleable intertidal[3]	co-locate with SS	covered by existing data; reoccupy LDW-SSPSF-U (T2)	covered by existing data	centroid	co-locate with SS (shoal)	co-locate with subsurface	shift upstream to bound LDW08 (shoal)	shift to S to bound exceedance in 13F (in marina) and sample (T2) adjacent to possible upland source[4]	co-locate with both SS (2 samples)	covered by existing data; assume active remedy	assume active remedy (collect vertical in Phase II)	-	-	-	-
14	-	-	-	-	-	-	shift to target sampleable intertidal[3]	co-locate with SS	covered by existing data[2]	centroid	shift to target RC1	co-locate with SS (shoal)	covered by existing data	no (collect vertical in Phase II)	covered by existing data	covered by existing data	shift to target intertidal	co-locate with SS	-	-	-	-
15	-	-	-	-	-	-	shift E to sampleable intertidal, bound exceedances to south	co-locate with SS	shift N away from bridge footing	co-locate with SS	shift to target RC1	co-locate with SS	covered by existing data[2]	centroid (RC1)	shift to NE away from bridge footing	co-locate with SS	centroid	co-locate with SS	shift S to avoid boat ramp and riprap (intertidal)[3]	co-locate with SS	-	-
16	-	-	-	-	shift to target intertidal	co-locate with SS	covered by existing data	centroid	shift to target intertidal	co-locate with SS	shift to target RC1	co-locate with SS	centroid	co-locate with SS	shift to target RC1	co-locate with SS	centroid	co-locate with SS	-	-	-	-
17	centroid (target center of inlet)	co-locate with SS	covered by existing data	centroid (target center of inlet)	centroid (bounding PCB exceed-ances in this area)	co-locate with SS	centroid	co-locate with SS	centroid	co-locate with SS	centroid	co-locate with SS (shoal)	covered by existing data[2]	no RAL	centroid	shift to target potential vessel scour area	centroid	co-locate with SS	-	-	-	-

Row	A'''		A''		A'		A		B		C		D		E		F		G		H	
	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface
Slip 3																								
18	-	-	-	-	-	-	-	-	shift to avoid covered boat house (subtidal)	co-locate with SS	shift off of riprap slope (subtidal)	co-locate with SS	covered by existing data; assume active remedy to north; add bounding sample in intertidal	covered by existing data; assume active remedy to north; add bounding sample co-located with SS	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	centroid	co-locate with SS	centroid	co-locate with SS	centroid	co-locate with SS	covered by existing data[2]	centroid	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	centroid	co-locate with SS	centroid	co-locate with SS	centroid	co-locate with SS	centroid	covered by existing data	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	centroid	co-locate with SS	centroid	co-locate with SS	-	-	-	-	-	-	-	-	-	-
RM 2.1 to 2.9																								
22	-	-	-	-	-	-	covered by under-structure sampling (Table D-5)	covered by under-structure sampling (Table D-5)	centroid	co-locate with SS	centroid	co-locate with SS (shoal)	centroid	no RAL	shift to target potential vessel scour area	co-locate with SS	centroid and reoccupy LDW-SSBRSTSD-A (T2)	covered by existing data	-	-	-	-
23	-	-	-	-	-	-	shift to target sampleable intertidal	co-locate with SS	covered by existing data[2]	centroid	no (subsurface exceedances; assume active remedy)	covered by existing data (LDW09); assume active remedy	centroid	no RAL	centroid (potential vessel scour area)	co-locate with SS	centroid and reoccupy SSBRSTSD-U (T2) for cPAHs	co-locate with SS at centroid	-	-	-	-
24	-	-	-	-	-	-	shift to target sampleable intertidal	co-locate with SS and sample adjacent to possible upland source[4]	centroid	co-locate with SS	centroid	co-locate with SS (shoal)	centroid	no RAL	centroid	co-locate with SS[1]	shift to target intertidal	co-locate with SS	-	-	-	-
25	-	-	-	-	assume active remedy	assume active remedy	assume active remedy (mouth of inlet); target intertidal to north to bound remedy area	co-locate with SS	centroid and reoccupy LDW18-SS-098	co-locate with SS	centroid	co-locate with SS (shoal)	centroid	no RAL	centroid	co-locate with SS[1]	shift to target intertidal and sample adjacent to possible upland source[4]	co-locate with both SS[4]	-	-	-	-

Row	A'''		A''		A'		A		B		C		D		E		F		G		H	
	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface
26	-	-	-	-	-	-	shift to target sampleable intertidal and bound active remedy area[3]	co-locate with SS	shift to target intertidal and bound active remedy area/ bank-area samples	co-locate with SS	centroid	co-locate with SS (shoal)	centroid	no RAL	centroid	co-locate with SS	shift to target intertidal (bounding for PCB exceedance) and sample adjacent to possible upland source[4]	co-locate with both SS[4]	-	-	-	-
27	-	-	-	-	-	-	-	-	shift to target intertidal	co-locate with SS	centroid	co-locate with SS (shoal), bounding sample to south	centroid	no RAL	centroid	co-locate with SS	shift to target intertidal	co-locate with SS	-	-	-	-
28	-	-	-	-	-	-	shift to target intertidal/BP area	co-locate with SS	reoccupy LDW-SSUNK-D for grid coverage	shift south (off of structure)	centroid	co-locate with SS (shoal)	covered by existing data	no RAL	centroid	co-locate with SS	centroid	co-locate with SS	covered by existing data; reoccupy LDW-SS2029-D (T2)	centroid	assume active remedy to south; reoccupy LDW-SS2030-U for grid coverage and bounding	co-locate with SS
29	-	-	-	-	-	-	-	-	centroid	co-locate with SS	centroid	co-locate with SS (shoal)	centroid	no RAL	centroid	co-locate with SS	shift NW (keep target close to structure)	co-locate with SS	shift N to target intertidal/ RC1 and bound assumed active remedy area to east	co-locate with SS	-	-
30	-	-	-	-	-	-	-	-	centroid	co-locate with SS	centroid	co-locate with SS (shoal)	centroid	no RAL	centroid	co-locate with SS	reoccupy (LDW-SS2034-D, 2011) for grid coverage in area with > 1.5 ft of deepening	centroid	-	-	-	-
31	-	-	-	-	-	-	shift to target BP/ intertidal, bounding sample to south	co-locate with SS	centroid	co-locate with SS	covered by existing data[2]	centroid (shoal)[1]	shift to target shoal	co-locate w/ SS	centroid and reoccupy SD-PER101	co-locate with SS at centroid	centroid and reoccupy LDW-SS2035-U and sample adjacent to possible upland source[4]	co-locate with SS at centroid	-	-	-	-

Row	A''' Surface	A''' Sub-surface	A'' Surface	A'' Sub-surface	A' Surface	A' Sub-surface	A Surface	A Sub-surface	B Surface	B Sub-surface	C Surface	C Sub-surface	D Surface	D Sub-surface	E Surface	E Sub-surface	F Surface	F Sub-surface	G Surface	G Sub-surface	H Surface	H Sub-surface
32	-	-	-	-	-	-	-	-	assume active remedy to north; collect centroid (subtidal[1]), for bounding	co-locate with SS	centroid	co-locate with SS (shoal)	covered by existing data; assume active remedy (no need to reoccupy of PCB 0.9 EF)	covered by existing data (LDW11)	centroid	co-locate with SS	shift to target sample along structure	co-locate with SS	-	-	-	-
33	-	-	-	-	-	-	shift to target sampleable intertidal	co-locate with SS	centroid	co-locate with SS	shift to avoid sunken barge	shift to avoid sunken barge and target shoal[3]	centroid	co-locate with SS (shoal)	centroid	co-locate with SS	covered by existing data; sample adjacent to possible upland source[4] and reoccupy LDW-SS2307-A/D (T2) (also bounding exceedances to west)	centroid and co-located with sample adjacent to possible upland source[4]	-	-	-	-
34	-	-	-	-	-	-	-	-	centroid (intertidal)	co-locate with SS	covered by existing data[2]	centroid (structure smaller than shown)	centroid	co-locate with SS (shoal)	covered by existing data;[2] reoccupy PILOT8A-SS1[5] in area with > 1.5 ft of deepening	centroid	covered by existing data; reoccupy PILOT8A-SS2 (T2) and LDW-SS2039-D (T2)	centroid	-	-	-	-
35	-	-	-	-	-	-	-	-	covered by existing data	centroid	covered by existing data[2]	centroid	centroid	co-locate with SS (shoal)	centroid	co-locate w/ SS	covered by existing data	centroid	-	-	-	-
36	-	-	-	-	-	-	shift to target intertidal	co-locate with SS	centroid (along structure)	co-locate with SS	centroid	co-locate with SS	centroid	co-locate with SS (shoal)	reoccupy PILOT8B-SS4[5] for grid coverage and LDW-SS89[5] (RI/FS sample, PCB EF of 29) in area with > 1.5 ft of deepening	centroid	centroid (existing just PCBs)	co-locate with SS and sample adjacent to possible upland source[4]	-	-	-	-
37	-	-	-	-	-	-	reoccupy SS530 (2009) RI/FS sample with higher EFs and bounding assumed active remedy area to south	assume active remedy (collect vertical in Phase II)	centroid	co-locate with SS	centroid	co-locate with SS[1]	centroid	co-locate with SS (shoal)	centroid	co-locate with SS	covered by existing data; collect bank sample adjacent to assumed remedy area	centroid, co-locate with SS in bank area, and sample adjacent to possible upland source[4]	-	-	-	-

Row	A'''		A''		A'		A		B		C		D		E		F		G		H	
	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface
38	-	-	-	-	-	-	-	-	centroid (and bounding exceedance to north)	covered by existing data; assume active remedy	centroid	co-locate with SS[1]	centroid	co-locate with SS (shoal), bounding sample to north	centroid	co-locate with SS	covered by existing data; assume active remedy; collect bank sample adjacent to assumed remedy area	assume active remedy (collect vertical in Phase II); co-locate with SS in bank area	-	-	-	-
39	-	-	-	-	-	-	-	-	centroid (intertidal, RC1)	co-locate with SS	shift to target RC1	co-locate with SS[1]	centroid	co-locate with SS (shoal)	reoccupy SSED-15A[5] for grid coverage, SSED-13A[5] in area with > 1.5 ft of deepening, and SSED-18A[5] (T2)	centroid	centroid, collect bank sample adjacent to assumed remedy area, and reoccupy SSED-09	co-locate with SS at centroid and in bank area; collect additional bounding sample in subtidal	-	-	-	-
40	-	-	-	-	-	-	-	-	centroid (intertidal) [2]	co-locate with SS	centroid and reoccupy LDW-SS2106-D	co-locate with SS at centroid[1]	reoccupy SD-PER201 for grid coverage	no RAL in most of grid	centroid and reoccupy SSED-17A	co-locate with SS	reoccupy SSED-11 for grid coverage and SSED-10 (T2)	centroid	reoccupy PER518 (T1, PCBs only) to evaluate trends in Slip 4[6]	shift out from under pier area (pending results of surface sediment sample)[6]	-	-
41	-	-	-	-	-	-	-	-	covered by existing data; assume active remedy	shift to target BP/ intertidal area	shift to target RC1 (and bounding exceedances to west)	co-locate with SS	shift to target potential vessel scour area	co-locate with SS	shift to target RC1	co-locate with SS	centroid (target RC1) and reoccupy PER507	co-locate with SS at centroid	-	-	-	-
Slip 4																						
42	-	-	-	-	-	-	reoccupy PER515, PER516, and PER517 to evaluate trends in Slip 4[6] (all T1, PCBs only); grid covered by existing data	centroid (pending results of surface sediment samples)[6]	reoccupy PER510, PER511, PER513, and PER514 to evaluate trends in Slip 4[6] (all T1, PCBs only); grid covered by existing data	centroid (pending results of surface sediment samples)[6]	reoccupy PER508 and PER509 to evaluate trends in Slip 4[6] (both T1, PCBs only); grid covered by existing data	centroid (pending results of surface sediment samples)[6]	-	-	-	-	-	-	-	-	-	-
RM 2.9 to 3.0																						
43	-	-	-	-	-	-	-	-	shift to target intertidal/BP area	co-locate with SS	centroid	co-locate with SS	shift to target RC1 and reoccupy PER202	co-locate with SS	-	-	-	-	-	-	-	-

Row	A'''		A''		A'		A		B		C		D		E		F		G		H	
	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface	Surface	Sub-surface
44	-	-	-	-	-	-	-	-	covered by existing data; sample (T2) adjacent to possible upland source[4]	centroid (intertidal) and co-locate with SS adjacent to possible upland source[4]	centroid	co-locate with SS	shift to target RC1	co-locate with SS	-	-	-	-	-	-	-	-
45	-	-	-	-	-	-	-	-	centroid, sample (T2) adjacent to possible upland source,[4] and reoccupy LDW18-SS-118 (T2) and PER206 (T2)	co-locate with SS at centroid (intertidal) and co-locate with SS adjacent to possible upland source[4]	centroid	co-locate with SS	centroid	co-locate with SS	-	-	-	-	-	-	-	-
46	-	-	-	-	-	-	-	-	analyze upper reach archive sample (SS507)	covered by existing data (IT507 from upper reach)	covered by existing data; assume active remedy	covered by existing data; assume active remedy	covered by existing data (PCB-only); assume active remedy	covered by existing data; assume active remedy	-	-	-	-	-	-	-	-

Notes:

Gray shading indicates that no sample is needed for that interval in a given grid cell. A dash (-) indicates that the particular grid cell is not applicable for that row.

1. No bathymetry information is available in this area. Assumption regarding RAL area designation is based on nearby bathymetry data, information gathered during the April 19, 2022, reconnaissance survey, and aerial imagery. RAL-application area will be confirmed as part of the bathymetry survey to be conducted as part of the Phase I PDI.
2. The analyte list for this existing sample in the design dataset is limited to PCBs, a subset of metals (arsenic, chromium, lead, and mercury), and PAHs.
3. The target location is outside of the 50-ft radius circle at this location because of limited sampleable area in this grid (e.g., the majority of the grid is above MHHW and thus outside of the site boundary).
4. Sample added adjacent to possible upland source (including listed MTCA sites or sites considered potential sources) per Ecology request.
5. These locations will be reoccupied to evaluate current conditions; existing data at these locations are not part of the design dataset based on the relative bathymetry elevations between 2003 and 2021, as discussed in Section 3.1 of the PDIWP.
6. To assess current conditions in Slip 4 (grids 40G and 42ABC), 10 Boeing Plant 2 perimeter monitoring stations (508, 509, 510, 511, 513, 514, 515, 516, 517, and 518) will be re-occupied early in the Phase I field effort (Map 4c). At these stations, 0- to 10-cm samples will be collected and analyzed for PCBs. Based on the results, either additional Phase I sampling and analysis will be conducted in these four grid cells, or the area will be designated as an active remedy area for further characterization during Phase II.

BP: Beach Play area
EF: exceedance factor
MHHW: mean higher high water
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
PDI: Pre-Design Investigation
RAL: remedial action level
RC1: Recovery Category 1
RM: river mile
SS: surface sediment sample
T1: Tier 1 sample
T2: Tier 2 archive sample

Table D-2
Sample Location Rationale and Analytes

Location ID	Grid Cell	RM	Tidal Category	Interval Type[1] 0-10 cm	0-45 cm	0-60 cm	Shoal	Recovery Category	In FNC?	Shoaling Area	Potential Vessel Scour Area	Mudline Elevation (ft MLLW)	Bathymetry Survey Year[2]	Rationale: Grid Coverage	Bounding	Reoccupation	Notes	Analytes for Surface Sample[3]: PCBs	Arsenic	Dioxins/ Furans	Other Benthic Risk Drivers	Analytes for Subsurface Sample[3]: PCBs	Arsenic	cPAHs	Dioxins/ Furans	Other Benthic Risk Drivers
1000	1B	1.6	subtidal	x				2	No	-	No	-34.3	2003	x				x	x	a	x	-	-	-	-	-
1001	1C	1.6	subtidal	x				3	Yes	No	No	-30.3	2021	x				x	x	a	x	-	-	-	-	-
1002	1D	1.6	subtidal	x			x	3	Yes	Yes	No	-27.8	2021	x				x	x	a	x	x	x	-	a	x
1003	1E	1.6	subtidal	x		x		1	No	-	No	-24.1	2021	x				x	x	a	x	x	x	-	a	x
1004	1F	1.6	subtidal	x		x		1	No	-	Yes	-7.1	2021	x				x	x	x	x	x	x	-	x	x
1005	2B	1.6	subtidal	x				2	No	-	No	-33.6	2003	x				x	x	a	x	-	-	-	-	-
1006	2C	1.6	subtidal	x			x	3	Yes	Yes	No	-29.4	2021	x				x	x	a	x	x	x	-	a	x
1007	2D	1.6	subtidal	x			x	3	Yes	Yes	No	-27.3	2021	x				x	x	a	x	x	x	-	a	x
1008	2E	1.6	subtidal	x		x		1	No	-	No	-25.0	2021	x				x	x	a	x	x	x	-	a	x
1009	2F	1.6	subtidal			x		3	No	-	Yes	-11.4	2021	x				-	-	-	-	x	-	-	-	-
1010	3B	1.7	subtidal	x				2	No	-	No	-32.9	2003	x				x	x	a	x	-	-	-	-	-
1011	3C	1.7	subtidal	x			x	3	Yes	Yes	No	-29.3	2021	x				x	x	a	x	x	x	-	a	x
1012	3D	1.7	subtidal	x			x	3	Yes	Yes	No	-28.1	2021	x				x	x	a	x	x	x	-	a	x
1013	3E	1.7	subtidal	x		x		1	No	-	No	-32.7	2003	x				x	x	a	x	x	x	-	a	x
1014	3F	1.7	subtidal	x		x		3	No	-	Yes	no data	-	x				x	x	a	x	x	-	-	-	-
1015	4B	1.7	subtidal	x				2	No	-	No	-33.0	2003	x				x	x	a	x	-	-	-	-	-
1016	4C	1.7	subtidal	x			x	3	Yes	Yes	No	-29.7	2021	x				x	x	a	x	x	x	-	a	x
1017	4D	1.7	subtidal	x			x	3	Yes	Yes	No	-28.3	2021	x				x	x	a	x	x	x	-	a	x
1018	4E	1.7	subtidal	x		x		1	No	-	No	-33.4	2003	x				x	x	a	x	x	x	-	a	x
1019	4F	1.7	subtidal			x		1	No	-	Yes	-12.1	2021	x				-	-	-	-	x	x	-	a	x
1020	4G	1.7	subtidal	x		x		1	No	-	Yes	-10.3	2021	x				x	x	a	x	x	x	-	a	x
1021	5B	1.7	subtidal	x				2	No	-	No	-31.0	2003	x				x	x	a	x	-	-	-	-	-
1022	5C	1.7	subtidal	x			x	3	Yes	Yes	No	-29.2	2021	x				x	x	a	x	x	x	-	a	x
1023	5D	1.7	subtidal	x			x	3	Yes	Yes	No	-28.6	2021	x				x	x	x	x	x	x	-	x	x
1024	5E	1.7	subtidal	x		x		1	No	-	Yes	-22.7	2021	x				x	x	a	x	x	x	-	a	x
1025	5F	1.7	subtidal	x		x		1	No	-	Yes	-17.3	2021	x				x	x	a	x	x	x	-	a	x
1026	5G	1.7	subtidal	x		x		1	No	-	Yes	-11.6	2021	x				x	x	a	x	x	x	-	a	x
1027	5H	1.8	intertidal		x			3	No	-	No	no data	-	x				-	-	-	-	x	x	x	a	-
1028	6A	1.7	subtidal			x		1	No	-	Yes	-13.4	2021	x				-	-	-	-	x	x	-	x	x
1029	6B	1.7	subtidal	x		x		1	No	-	Yes	-12.6	2021	x				x	x	a	x	x	x	-	a	x
1030	6C	1.7	subtidal	x		x		3	No	-	Yes	-9.7	2021	x				x	x	a	x	x	-	-	-	-
1031	7A	1.7	subtidal	x				1	No	-	Yes	-17.8	2021	x				x	x	x	x	-	-	-	-	-
1032	7B	1.7	subtidal	x		x		1	No	-	Yes	-15.0	2021	x				x	x	a	x	x	x	-	a	x
1033	7C	1.7	subtidal	x		x		3	No	-	Yes	-6.0	2021	x				x	x	a	x	x	-	-	-	-
1034	8A	1.7	intertidal	x	x			3	No	-	No	0.1	2021	x				x	x	a	x	x	x	x	a	-
1035	8B	1.7	intertidal	x	x			3	No	-	No	3.3	2021	x				x	x	x	x	x	x	x	x	-
1036	9A	1.8	subtidal	x		x		3	No	-	Yes	-19.5	2003	x				x	x	a	x	x	-	-	-	-
1037	9B	1.8	subtidal	x		x		2	No	-	Yes	-21.8	2021	x				x	x	x	x	x	-	-	-	-
1038	9C	1.8	subtidal	x			x	3	Yes	Yes	No	-28.6	2021	x				x	x	a	x	x	x	-	a	x
1039	9D	1.8	subtidal	x			x	3	Yes	Yes	No	-26.7	2021	x				x	x	a	x	x	x	-	a	x
1040	9E	1.8	subtidal			x		3	No	-	Yes	-21.9	2021	x				-	-	-	-	x	-	-	-	-

Location ID	Grid Cell	RM	Tidal Category	Interval Type[1] 0-10 cm	0-45 cm	0-60 cm	Shoal	Recovery Category	In FNC?	Shoaling Area	Potential Vessel Scour Area	Mudline Elevation (ft MLLW)	Bathy-metry Survey Year[2]	Rationale Grid Coverage	Bounding	Reoccupation	Notes	Analytes for Surface Sample[3] PCBs	Arsenic	Dioxins/ Furans	Other Benthic Risk Drivers	Analytes for Subsurface Sample[3] PCBs	Arsenic	cPAHs	Dioxins/ Furans	Other Benthic Risk Drivers
1041	9F	1.8	intertidal	x	x			1	No	-	No	-2.2	2021	x				x	x	a	x	x	x	x	a	x
1042	9F	1.8	intertidal	a	x			3	No	-	No	no data	-		x		Additional sample adjacent to possible upland source; Tier 2 surface sediment sample will be analyzed if 0-45 cm samples is below RALs	a	a	a	a	x	x	x	a	-
1043	9G	1.8	intertidal	x	x			3	No	-	No	no data	-	x				x	x	a	x	x	x	x	x	-
1044	10A	1.8	subtidal	x		x		1	No	-	Yes	-15.7	2003	x				x	x	a	x	x	x	-	a	x
1045	10B	1.8	subtidal	x		x		1	No	-	Yes	-19.8	2021	x				x	x	x	x	x	x	-	x	x
1046	10C	1.8	subtidal				x	3	Yes	Yes	No	-25.2	2021	x				-	-	-	-	x	x	-	x	x
1047	10D	1.8	subtidal	x			x	3	Yes	Yes	No	-24.1	2021	x				x	x	a	x	x	x	-	a	x
1048	10E	1.8	subtidal	x		x		3	No	-	Yes	-15.4	2021	x				x	x	a	x	x	-	-	-	-
1049	10F	1.8	intertidal	x	x			3	No	-	No	no data	-	x				x	x	a	x	x	x	x	a	-
1050	10F	1.8	intertidal	a	x			3	No	-	No	no data	-		x		Additional sample adjacent to possible upland source; Tier 2 surface sediment sample will be analyzed if 0-45 cm samples is below RALs	a	a	a	a	x	x	x	a	-
1051	11A	1.9	intertidal	x	x			3	No	-	No	-2.4	2021	x			Based on the April 2022 reconnaissance survey, the sampleability of the target location in the intertidal area is uncertain; if an intertidal sample cannot be collected, samples to be collected in the nearby Recovery Category 1 subtidal area (analytes would be updated to reflect this change)	x	x	x	x	x	x	x	x	-
1052	11B	1.9	subtidal	x		x		2	No	-	Yes	-18.0	2003	x				x	x	x	x	x	-	-	-	-
1053	11D	1.9	subtidal	x			x	3	Yes	Yes	No	-26.1	2021	x				x	x	x	x	x	x	-	x	x
1054	11E	1.9	subtidal	x		x		2	No	-	Yes	-16.9	2021	x				x	x	a	x	x	-	-	-	-
1055	11F	1.9	intertidal	x	x			3	No	-	No	0.1	2021	x				x	x	a	x	x	x	x	a	-
1056	11F	1.9	subtidal	a				2	No	-	Yes	no data	-			x	Reoccupy LDW-SS2022-D (2011); total PCB EF of 1.4; analysis of this Tier 2 sample dependent on the results of the adjacent Tier 1 samples	a	a	a	a	-	-	-	-	-
1057	12A	1.9	subtidal			x		3	No	-	Yes	-6.8	2021	x				-	-	-	-	x	-	-	-	-
1058	12B	1.9	subtidal			x		2	No	-	Yes	-14.6	2021	x				-	-	-	-	x	-	-	-	-
1059	12C	1.9	subtidal	x			x	3	Yes	Yes	No	-24.0	2021	x				x	x	x	x	x	x	-	x	x
1060	12D	1.9	subtidal	x			x	3	Yes	Yes	No	-22.2	2021	x				x	x	x	x	x	x	-	x	x
1061	12E	1.9	subtidal	x		x		3	No	-	Yes	no data	-	x				x	x	a	x	x	-	-	-	-
1062	13A	2	intertidal	x	x			3	No	-	No	3.2	2021	x			Sample outside 50 ft circle to target sampleable intertidal	x	x	a	x	x	x	x	a	-
1063	13B	1.9	subtidal	a				2	No	-	Yes	-11.8	2021			x	Reoccupy LDW-SSPSF-U (2011); PAH EFs up to 2.8; analysis of this Tier 2 sample dependent on the results of the adjacent Tier 1 samples	a	a	a	a	-	-	-	-	-
1064	13C	1.9	subtidal	x			x	3	Yes	Yes	No	-25.4	2021	x				x	x	x	x	x	x	-	x	x
1065	13D	1.9	subtidal	x			x	3	Yes	Yes	No	-23.6	2021	x	x			x	x	x	x	x	x	-	x	x

FINAL

Location ID	Grid Cell	RM	Tidal Category	Interval Type[1] 0-10 cm	0-45 cm	0-60 cm	Shoal	Recovery Category	In FNC?	Shoaling Area	Potential Vessel Scour Area	Mudline Elevation (ft MLLW)	Bathy-metry Survey Year[2]	Rationale: Grid Coverage	Bounding	Reoccupation	Notes	Analytes for Surface Sample[3]: PCBs	Arsenic	Dioxins/ Furans	Other Benthic Risk Drivers	Analytes for Subsurface Sample[3]: PCBs	Arsenic	cPAHs	Dioxins/ Furans	Other Benthic Risk Drivers
1066	13E	1.9	subtidal	x		x		3	No	-	Yes	no data	-	x	x		Sample located within boat slip at marina	x	x	x	x	x	-	-	-	-
1067	13E	1.9	intertidal	a	x			3	No	-	No	no data	-		x		Additional sample adjacent to possible upland source (note that sampleability of this location is uncertain and will be determined in the field); Tier 2 surface sediment sample will be analyzed if 0-45 cm samples is below RALs	a	a	a	a	x	x	x	a	-
1068	14A	2	intertidal	x	x			3	No	-	No	4.0	2003	x			Sample outside 50 ft circle to target sampleable intertidal	x	x	a	x	x	x	x	a	-
1069	14B	2	subtidal			x		3	No	-	Yes	-7.2	2021	x				-	-	-	-	x	-	-	-	-
1070	14C	2	subtidal	x			x	1	Yes	Yes	No	-27.8	2021	x				x	x	x	x	x	x	-	x	x
1071	14F	2	intertidal	x	x			3	No	-	No	no data	-	x				x	x	x	x	x	x	x	x	-
1072	15A	2	intertidal	x	x			3	No	-	No	1.5	2021	x	x			x	x	a	x	x	x	x	a	-
1073	15B	2	subtidal	x		x		3	No	-	Yes	-6.5	2021	x				x	x	a	x	x	-	-	-	-
1074	15C	2	subtidal	x		x		1	Yes	No	No	-26.9	2021	x				x	x	a	x	x	x	-	a	x
1075	15D	2	subtidal			x		1	Yes	No	No	-28.1	2021	x				-	-	-	-	x	x	-	x	x
1076	15E	2	subtidal	x		x		3	No	-	Yes	-12.7	2021	x				x	x	a	x	x	-	-	-	-
1077	15F	2	subtidal	x		x		3	No	-	Yes	-6.8	2021	x				x	x	x	x	x	-	-	-	-
1078	15G	2	intertidal	x	x			3	No	-	No	1.2	2003	x			Sample outside 50 ft circle to target sampleable intertidal	x	x	a	x	x	x	x	a	-
1079	16A′	2.1	intertidal	x	x			3	No	-	No	no data	-	x				x	x	a	x	x	x	x	a	-
1080	16A	2.1	intertidal		x			3	No	-	No	no data	-	x				-	-	-	-	x	x	x	a	-
1081	16B	2.1	intertidal	x	x			3	No	-	No	-2.5	2021	x				x	x	a	x	x	x	x	a	-
1082	16C	2.1	subtidal	x		x		1	Yes	No	No	-25.1	2021	x				x	x	a	x	x	x	-	a	x
1083	16D	2.1	subtidal	x		x		1	Yes	No	No	-27.4	2021	x				x	x	a	x	x	x	-	a	x
1084	16E	2.1	subtidal	x		x		1	No	-	No	-21.9	2021	x				x	x	a	x	x	x	-	a	x
1085	16F	2.1	subtidal	x		x		3	No	-	Yes	-14.5	2021	x				x	x	a	x	x	-	-	-	-
1086	17A′′′	2.1	intertidal	x	x			3	No	-	No	no data	-	x				x	x	a	x	x	x	x	x	-
1087	17A′′	2.1	intertidal		x			3	No	-	No	no data	-	x				-	-	-	-	x	x	x	a	-
1088	17A′	2.1	intertidal	x	x			3	No	-	No	no data	-	x	x			x	x	a	x	x	x	x	a	-
1089	17A	2.1	intertidal	x	x			3	No	-	No	3.2	2003	x				x	x	x	x	x	x	x	x	-
1090	17B	2.1	subtidal	x		x		3	No	-	Yes	-10.2	2021	x				x	x	a	x	x	-	-	-	-
1091	17C	2.1	subtidal	x			x	3	Yes	Yes	No	-18.0	2021	x				x	x	a	x	x	x	-	a	x
1092	17E	2.1	subtidal	x				3	No	-	No	-19.4	2021	x				x	x	a	x	-	-	-	-	-
1093	17E	2.1	subtidal			x		3	No	-	Yes	-17.3	2021	x				-	-	-	-	x	-	-	-	-
1094	17F	2.1	subtidal	x		x		3	No	-	Yes	-15.3	2021	x				x	x	a	x	x	-	-	-	-
1095	18B	2.1	subtidal	x		x		3	No	-	Yes	-8.5	2021	x				x	x	x	x	x	-	-	-	-
1096	18C	2.1	subtidal	x		x		3	No	-	Yes	-5.0	2021	x				x	x	a	x	x	-	-	-	-
1097	18D	2.1	intertidal	x	x			2	No	-	No	3.2	2003		x			x	x	x	x	x	x	x	x	-
1098	19A	2.1	subtidal	x		x		2	No	-	Yes	-9.0	2021	x				x	x	a	x	x	-	-	-	-
1099	19B	2.1	subtidal	x		x		3	No	-	Yes	-12.0	2021	x				x	x	a	x	x	-	-	-	-
1100	19C	2.1	subtidal	x		x		2	No	-	Yes	-13.9	2021	x				x	x	a	x	x	-	-	-	-
1101	19D	2.1	subtidal			x		2	No	-	Yes	-11.5	2021	x				-	-	-	-	x	-	-	-	-
1102	20A	2.1	subtidal	x		x		3	No	-	Yes	-13.7	2021	x				x	x	a	x	x	-	-	-	-

Location ID	Grid Cell	RM	Tidal Category	Interval Type[1]				Recovery Category	In FNC?	Shoaling Area	Potential Vessel Scour Area	Mudline Elevation (ft MLLW)	Bathy-metry Survey Year[2]	Rationale			Notes	Analytes for Surface Sample[3]				Analytes for Subsurface Sample[3]				
				0-10 cm	0-45 cm	0-60 cm	Shoal							Grid Coverage	Bounding	Reoccupation		PCBs	Arsenic	Dioxins/ Furans	Other Benthic Risk Drivers	PCBs	Arsenic	cPAHs	Dioxins/ Furans	Other Benthic Risk Drivers
1103	20B	2.1	subtidal	x		x		2	No	-	Yes	-13.0	2021	x				x	x	a	x	x	-	-	-	-
1104	20C	2.1	subtidal	x		x		2	No	-	Yes	-16.2	2003	x				x	x	a	x	x	-	-	-	-
1105	20D	2.1	subtidal	x				2	No	-	Yes	-15.8	2003	x				x	x	x	x	-	-	-	-	-
1106	21B	2.1	subtidal	x		x		2	No	-	Yes	-14.2	2021	x				x	x	a	x	x	-	-	-	-
1107	21C	2.1	subtidal	x		x		2	No	-	Yes	-15.0	2021	x				x	x	a	x	x	-	-	-	-
1108	22B	2.1	subtidal	x		x		2	No	-	Yes	no data	-	x				x	x	a	x	x	-	-	-	-
1109	22C	2.1	subtidal	x			x	3	Yes	Yes	No	-18.1	2021	x				x	x	a	x	x	x	-	a	x
1110	22D	2.1	subtidal	x				3	Yes	No	No	-24.7	2021	x				x	x	a	x	-	-	-	-	-
1111	22E	2.1	subtidal	x		x		2	No	-	Yes	-18.7	2003	x				x	x	a	x	x	-	-	-	-
1112	22F	2.1	subtidal	x				2	No	-	Yes	-15.2	2003	x				x	x	a	x	-	-	-	-	-
1113	22F	2.1	subtidal	a				2	No	-	Yes	no data	-			x	Reoccupy LDW-SSBRSTSD-A (2011); hexachlorobenzene EF of 1.6; analysis of this Tier 2 sample dependent on the results of the adjacent Tier 1 samples	a	a	a	a	-	-	-	-	-
1114	23A	2.2	intertidal	x	x			3	No	-	No	-1.5	2003	x				x	x	x	x	x	x	x	a	-
1115	23B	2.2	subtidal			x		3	No	-	Yes	-14.4	2003	x				-	-	-	-	x	-	-	-	-
1116	23D	2.2	subtidal	x				3	Yes	No	No	-23.5	2021	x				x	x	a	x	-	-	-	-	-
1117	23E	2.2	subtidal	x		x		2	No	-	Yes	-17.6	2021	x				x	x	a	x	x	-	-	-	-
1118	23F	2.2	subtidal	x		x		2	No	-	Yes	no data	-	x				x	x	a	x	x	-	-	-	-
1119	23F	2.2	subtidal	a				2	No	-	Yes	no data	-			x	Reoccupy LDW-SSBRSTSD-U (2011); sample with cPAH ROD RAL exceedance (and no other exceedances); analysis of this Tier 2 sample dependent on the results of the adjacent Tier 1 samples	a	a	a	a	-	-	-	-	-
1120	24A	2.2	intertidal	x	x			3	No	-	No	no data	-	x				x	x	a	x	x	x	x	a	-
1121	24A	2.2	intertidal		x			3	No	-	No	no data	-		x		Additional sample adjacent to possible upland source	-	-	-	-	x	x	x	a	-
1122	24B	2.2	subtidal	x		x		3	No	-	Yes	-11.7	2003	x				x	x	a	x	x	-	-	-	-
1123	24C	2.2	subtidal	x			x	3	Yes	Yes	No	-17.5	2021	x				x	x	a	x	x	x	-	a	x
1124	24D	2.2	subtidal	x				3	Yes	No	No	-22.4	2021	x				x	x	a	x	-	-	-	-	-
1125	24E	2.2	subtidal	x		x		2	No	-	Yes	-15.5	2003	x				x	x	a	x	x	-	-	-	-
1126	24F	2.2	intertidal	x	x			3	No	-	No	-1.7	2021	x				x	x	a	x	x	x	x	a	-
1127	25A	2.2	intertidal	x	x			2	No	-	No	-2.9	2003	x	x			x	x	x	x	x	x	x	x	-
1128	25B	2.2	subtidal	x		x		2	No	-	Yes	-12.2	2003	x				x	x	a	x	x	-	-	-	-
1129	25B	2.3	subtidal	x				2	No	-	Yes	-7.9	2021			x	Reoccupy LDW18-SS-098 (2018); total PCB EF of 0.98	x	x	a	x	-	-	-	-	-
1130	25C	2.2	subtidal	x			x	3	Yes	Yes	No	-17.7	2021	x				x	x	a	x	x	x	-	a	x
1131	25D	2.2	subtidal	x				3	Yes	No	No	-22.1	2021	x				x	x	a	x	-	-	-	-	-
1132	25E	2.2	subtidal	x		x		2	No	-	Yes	-12.7	2003	x				x	x	a	x	x	-	-	-	-
1133	25F	2.2	intertidal	x	x			3	No	-	No	-2.7	2021	x				x	x	a	x	x	x	x	a	-
1134	25F	2.2	intertidal	x	x			3	No	-	No	-2.3	2021		x		Additional sample adjacent to possible upland source	x	x	a	x	x	x	x	a	-
1135	26A	2.3	intertidal	x	x			2	No	-	No	3.4	2021	x	x		sample outside 50 ft circle to target sampleable intertidal	x	x	x	x	x	x	x	x	-

				Interval Type[1]										Rationale				Analytes for Surface Sample[3]				Analytes for Subsurface Sample[3]				
Location ID	Grid Cell	RM	Tidal Category	0-10 cm	0-45 cm	0-60 cm	Shoal	Recovery Category	In FNC?	Shoaling Area	Potential Vessel Scour Area	Mudline Elevation (ft MLLW)	Bathy-metry Survey Year[2]	Grid Coverage	Bounding	Reoccupation	Notes	PCBs	Arsenic	Dioxins/ Furans	Other Benthic Risk Drivers	PCBs	Arsenic	cPAHs	Dioxins/ Furans	Other Benthic Risk Drivers
1136	26B	2.3	intertidal	x	x			2	No	-	No	-1.5	2021	x	x			x	x	x	x	x	x	x	x	-
1137	26C	2.3	subtidal	x			x	3	Yes	Yes	No	-15.8	2021	x				x	x	a	x	x	x	-	a	x
1138	26D	2.3	subtidal	x				3	Yes	No	No	-21.7	2021	x				x	x	a	x	-	-	-	-	-
1139	26E	2.3	subtidal	x		x		2	No	-	Yes	-12.5	2021	x				x	x	a	x	x	-	-	-	-
1140	26F	2.3	intertidal	x	x			3	No	-	No	-1.8	2021	x	x			x	x	a	x	x	x	x	a	-
1141	26F	2.3	intertidal	x	x			3	No	-	No	-2.1	2021		x		Additional sample adjacent to possible upland source	x	x	a	x	x	x	x	a	-
1142	27B	2.3	intertidal	x	x			2	No	-	No	-0.8	2021	x				x	x	x	x	x	x	x	x	-
1143	27C	2.3	subtidal	x			x	3	Yes	Yes	No	-14.4	2021	x	x			x	x	x	x	x	x	-	x	x
1144	27D	2.3	subtidal	x				3	Yes	No	No	-21.4	2021	x				x	x	a	x	-	-	-	-	-
1145	27E	2.3	subtidal	x		x		2	No	-	Yes	-14.2	2022	x				x	x	a	x	x	-	-	-	-
1146	27F	2.3	intertidal	x	x			3	No	-	No	-1.3	2021	x				x	x	a	x	x	x	x	a	-
1147	28A	2.4	intertidal	x	x			3	No	-	No	no data	-	x				x	x	a	x	x	x	x	a	-
1148	28B	2.4	intertidal		x			2	No	-	No	-1.3	2021	x				-	-	-	-	x	x	x	x	-
1149	28B	2.4	intertidal	x				1	No	-	No	1.1	2021	x		x	Reoccupy LDW-SSUNK-D (2011); total PCB EF of 0.92	x	x	a	x	-	-	-	-	-
1150	28C	2.4	subtidal	x			x	3	Yes	Yes	No	-14.7	2021	x				x	x	a	x	x	x	-	a	x
1151	28E	2.4	subtidal	x		x		1	No	-	Yes	-14.7	2021	x				x	x	a	x	x	x	-	a	x
1152	28F	2.4	subtidal	x		x		1	No	-	Yes	-8.4	2021	x				x	x	a	x	x	x	-	a	x
1153	28G	2.4	subtidal			x		1	No	-	Yes	-5.2	2021	x				-	-	-	-	x	x	-	a	x
1154	28H	2.4	intertidal	x	x			3	No	-	No	-2.5	2021	x	x	x	Reoccupy LDW-SS2030-U (2011); Efs > 1 for zinc, HCB, and benzoic acid and total PCB EF of 0.92	x	x	x	x	x	x	x	x	-
1155	29B	2.4	subtidal	x		x		1	No	-	Yes	no data	-	x				x	x	a	x	x	x	-	a	x
1156	29C	2.4	subtidal	x			x	3	Yes	Yes	No	-17.1	2021	x				x	x	a	x	x	x	-	a	x
1157	29D	2.4	subtidal	x				3	Yes	No	No	-21.0	2021	x				x	x	a	x	-	-	-	-	-
1158	29E	2.4	subtidal	x		x		1	No	-	Yes	-16.2	2021	x				x	x	a	x	x	x	-	a	x
1159	29F	2.4	subtidal	x		x		1	No	-	Yes	-9.7	2022	x				x	x	a	x	x	x	-	a	x
1160	29G	2.4	intertidal	x	x			1	No	-	No	-3.7	2021	x	x			x	x	x	x	x	x	x	x	x
1161	30B	2.4	subtidal	x		x		1	No	-	Yes	no data	-	x				x	x	a	x	x	x	-	a	x
1162	30C	2.4	subtidal	x			x	3	Yes	Yes	No	-18.5	2021	x				x	x	x	x	x	x	-	x	x
1163	30D	2.4	subtidal	x				3	Yes	No	No	-20.5	2021	x				x	x	a	x	-	-	-	-	-
1164	30E	2.4	subtidal	x		x		1	No	-	Yes	-16.9	2021	x				x	x	a	x	x	x	-	a	x
1165	30F	2.4	subtidal			x		1	No	-	Yes	-9.2	2021	x				-	-	-	-	x	x	-	a	x
1166	30F	2.4	subtidal	x				1	No	-	Yes	-6.5	2021	x		x	Reoccupy LDW-SS2034-D (2011); total PCB and arsenic EFs of 1.1 in area with > 1.5 ft of deepening	x	x	a	x	-	-	-	-	-
1167	31A	2.5	intertidal	x	x			3	No	-	No	no data	-	x	x			x	x	x	x	x	x	x	x	-
1168	31B	2.5	subtidal	x		x		2	No	-	Yes	no data	-	x				x	x	x	x	x	-	-	-	-
1169	31C	2.5	subtidal				x	3	Yes	Yes	No	-15.9	2022	x				-	-	-	-	x	x	-	a	x
1170	31D	2.5	subtidal	x			x	3	Yes	Yes	No	-19.9	2022	x				x	x	a	x	x	x	-	a	x
1171	31E	2.5	subtidal	x		x		1	No	-	No	-20.0	2021	x				x	x	a	x	x	x	-	a	x
1172	31E	2.5	subtidal	x				1	No	-	Yes	-14.3	2021			x	Reoccupy SD-PER101 (2015); total PCB EF of 1.3	x	x	a	x	-	-	-	-	-

Location ID	Grid Cell	RM	Tidal Category	Interval Type[1]				Recovery Category	In FNC?	Shoaling Area	Potential Vessel Scour Area	Mudline Elevation (ft MLLW)	Bathy-metry Survey Year[2]	Rationale			Notes	Analytes for Surface Sample[3]				Analytes for Subsurface Sample[3]				
				0-10 cm	0-45 cm	0-60 cm	Shoal							Grid Coverage	Bounding	Reoccupation		PCBs	Arsenic	Dioxins/ Furans	Other Benthic Risk Drivers	PCBs	Arsenic	cPAHs	Dioxins/ Furans	Other Benthic Risk Drivers
1173	31F	2.5	subtidal	x		x		1	No	-	Yes	-9.7	2021	x				x	x	a	x	x	x	-	a	x
1174	31F	2.5	subtidal	x				1	No	-	Yes	-11.1	2021			x	Reoccupy LDW-SS2035-U (2011); PAH EFs up to 1.3	x	x	a	x	-	-	-	-	-
1175	31F	2.5	subtidal	x				1	No	-	Yes	-7.9	2021		x		Additional sample adjacent to possible upland source	x	x	a	x	-	-	-	-	-
1176	32B	2.5	subtidal	x		x		3	No	-	Yes	no data	-	x	x			x	x	x	x	x	-	-	-	-
1177	32C	2.5	subtidal	x			x	3	Yes	Yes	No	-15.6	2003	x				x	x	a	x	x	x	-	a	x
1178	32E	2.5	subtidal	x		x		1	No	-	Yes	-16.9	2021	x				x	x	a	x	x	x	-	a	x
1179	32F	2.5	subtidal	x		x		1	No	-	Yes	-9.1	2021	x				x	x	a	x	x	x	-	a	x
1180	33A	2.5	intertidal	x	x			3	No	-	No	no data	-	x				x	x	a	x	x	x	x	a	-
1181	33B	2.5	intertidal	x	x			2	No	-	No	-1.7	2021	x				x	x	a	x	x	x	x	a	-
1182	33C	2.5	subtidal	x				2	No	-	Yes	-9.8	2021	x				x	x	a	x	-	-	-	-	-
1183	33C	2.5	subtidal				x	3	Yes	Yes	No	-11.3	2021	x			Subsurface sample outside 50 ft circle to avoid sunken barge and target shoal	-	-	-	-	x	x	-	a	x
1184	33D	2.5	subtidal	x			x	3	Yes	Yes	No	-19.3	2021	x				x	x	a	x	x	x	-	a	x
1185	33E	2.6	subtidal	x		x		1	No	-	Yes	-16.1	2021	x				x	x	a	x	x	x	-	a	x
1186	33F	2.6	subtidal			x		1	No	-	Yes	-5.4	2021	x				-	-	-	-	x	x	-	x	x
1187	33F	2.6	subtidal	a				1	No	-	Yes	-5.8	2021		x	x	Reoccupy LDW-SS2037-A/LDW-SS2037-D (2011); benzoic acid EFs of 1.4 and 1.5 (samples located approximately 12 ft apart, so a single sample will be collected at the midpoint between these 2011 samples); analysis of this Tier 2 sample dependent on the results of the adjacent Tier 1 samples	a	a	a	a	-	-	-	-	-
1188	33F	2.5	subtidal	x		x		1	No	-	Yes	-7.2	2021		x		Additional sample adjacent to possible upland source; collect as close as possible to the pier face	x	x	a	x	x	x	-	a	x
1189	34B	2.6	intertidal	x	x			3	No	-	No	2.7	2021	x				x	x	a	x	x	x	x	a	-
1190	34C	2.6	subtidal			x		3	No	-	Yes	-8.8	2021	x				-	-	-	-	x	-	-	-	-
1191	34D	2.6	subtidal	x			x	3	Yes	Yes	No	-17.7	2021	x				x	x	x	x	x	x	-	x	x
1192	34E	2.6	subtidal			x		1	No	-	Yes	-16.3	2021	x				-	-	-	-	x	x	-	a	x
1193	34E	2.6	subtidal	x				1	No	-	Yes	-8.2	2021			x	Reoccupy LDW-PILOT8A-SS1 (2014) in area with > 1.5 ft of deepening	x	x	a	x	-	-	-	-	-
1194	34F	2.6	intertidal		x			3	No	-	No	-2.1	2021	x				-	-	-	-	x	x	x	x	-
1195	34F	2.6	intertidal	a				3	No	-	No	-1.2	2021			x	Reoccupy LDW-SS2039-D (2011); total PCB EF of 1.1; analysis of this Tier 2 sample dependent on the results of the adjacent Tier 1 samples	a	a	a	a	-	-	-	-	-
1196	34F	2.6	intertidal	a				3	No	-	No	1.3	2021			x	Reoccupy LDW-PILOT8A-SS2 (2014); total PCB EF of 1.2; analysis of this Tier 2 sample dependent on the results of the adjacent Tier 1 samples	a	a	a	a	-	-	-	-	-
1197	35B	2.6	intertidal		x			3	No	-	No	1.1	2003	x				-	-	-	-	x	x	x	a	-

Location ID	Grid Cell	RM	Tidal Category	Interval Type[1]				Recovery Category	In FNC?	Shoaling Area	Potential Vessel Scour Area	Mudline Elevation (ft MLLW)	Bathy-metry Survey Year[2]	Rationale			Notes	Analytes for Surface Sample[3]				Analytes for Subsurface Sample[3]				
				0-10 cm	0-45 cm	0-60 cm	Shoal							Grid Coverage	Bounding	Reoccupation		PCBs	Arsenic	Dioxins/ Furans	Other Benthic Risk Drivers	PCBs	Arsenic	cPAHs	Dioxins/ Furans	Other Benthic Risk Drivers
1198	35C	2.6	subtidal			x		3	No	-	Yes	-11.3	2021	x				-	-	-	-	x	-	-	-	-
1199	35D	2.6	subtidal	x			x	3	Yes	Yes	No	-18.8	2021	x				x	x	a	x	x	x	-	a	x
1200	35E	2.6	subtidal	x		x		1	No	-	Yes	-14.5	2021	x				x	x	a	x	x	x	-	a	x
1201	35F	2.6	intertidal		x			3	No	-	No	2.5	2021	x				-	-	-	-	x	x	x	a	-
1202	36A	2.7	intertidal	x	x			3	No	-	No	no data	-	x				x	x	x	x	x	x	x	x	-
1203	36B	2.7	subtidal	x		x		2	No	-	Yes	-5.3	2021	x				x	x	x	x	x	-	-	-	-
1204	36C	2.7	subtidal	x		x		3	No	-	Yes	-13.4	2021	x				x	x	a	x	x	-	-	-	-
1205	36D	2.7	subtidal	x			x	3	Yes	Yes	No	-19.2	2021	x				x	x	a	x	x	x	-	a	x
1206	36E	2.7	subtidal			x		1	No	-	Yes	-13.1	2021	x				-	-	-	-	x	x	-	a	x
1207	36E	2.7	subtidal	x				1	No	-	Yes	-10.8	2021	x		x	Reoccupy LDW-PILOT8B-SS4 (2014) in area with > 1.5 ft of deepening	x	x	a	x	-	-	-	-	-
1208	36E	2.6	subtidal	x				1	No	-	Yes	-13.2	2021			x	Reoccupy LDW-SS89 (2005 RI/FS sample with PCB EF of 29) in area with > 1.5 ft of deepening	x	x	a	x	-	-	-	-	-
1209	36F	2.7	intertidal	x	x			3	No	-	No	2.1	2021	x				x	x	a	x	x	x	x	x	-
1210	36F	2.7	intertidal		x			1	No	-	No	-2.2	2021		x		Additional sample adjacent to possible upland source	-	-	-	-	x	x	x	a	x
1211	37A	2.7	intertidal	x				3	No	-	No	no data	-		x	x	Reoccupy LDW-SS530 (2009 RI/FS sample); total PCB EF of 4.6 and PAH EFs up to 2.4	x	x	x	x	-	-	-	-	-
1212	37B	2.7	subtidal	x		x		1	No	-	Yes	-8.3	2003	x				x	x	x	x	x	x	-	x	x
1213	37C	2.7	subtidal	x		x		1	No	-	Yes	-14.2	2003	x				x	x	a	x	x	x	-	a	x
1214	37D	2.7	subtidal	x			x	3	Yes	Yes	No	-19.0	2021	x				x	x	a	x	x	x	-	a	x
1215	37E	2.7	subtidal	x		x		1	No	-	Yes	-13.0	2021	x				x	x	x	x	x	x	-	x	x
1216	37F	2.7	intertidal		x			3	No	-	No	2.6	2021	x	x			-	-	-	-	x	x	x	a	-
1217	37F	2.7	intertidal		x			1	No	-	No	-3.0	2021		x		Additional sample adjacent to possible upland source	-	-	-	-	x	x	x	x	x
1218	37F	2.7	intertidal	x	x			3	No	-	No	no data	-		x		Additional sample in bank area adjacent to assumed active remedy	x	x	a	x	x	x	x	a	-
1219	38B	2.7	subtidal	x				1	No	-	Yes	-9.8	2003	x	x			x	x	a	x	-	-	-	-	-
1220	38C	2.7	subtidal	x		x		1	No	-	Yes	-13.4	2022	x				x	x	a	x	x	x	-	a	x
1221	38D	2.7	subtidal	x			x	3	Yes	Yes	No	-18.5	2021	x	x			x	x	a	x	x	x	-	a	x
1222	38E	2.7	subtidal	x		x		1	No	-	Yes	-12.9	2021	x				x	x	x	x	x	x	-	x	x
1223	38F	2.8	intertidal	x	x			2	No	-	No	no data	-		x		Additional sample in bank area adjacent to assumed active remedy	x	x	x	x	x	x	x	x	-
1224	39B	2.8	intertidal	x	x			1	No	-	No	0.1	2021	x				x	x	a	x	x	x	x	a	x
1225	39C	2.8	subtidal	x		x		1	No	-	Yes	-13.0	2022	x				x	x	a	x	x	x	-	a	x
1226	39D	2.8	subtidal	x			x	3	Yes	Yes	No	-18.7	2021	x				x	x	x	x	x	x	-	x	x
1227	39E	2.8	subtidal			x		1	No	-	Yes	-13.9	2021	x				-	-	-	-	x	x	-	a	x
1228	39E	2.8	subtidal	x				1	No	-	Yes	-14.1	2021	x		x	Reoccupy DENW6721-SSED-15A-2014 (2014) in area with > 1.5 ft of deepening	x	x	x	x	-	-	-	-	-
1229	39E	2.8	subtidal	x				1	No	-	Yes	-5.1	2021			x	Reoccupy DENW6721-SSED-13A-2014 (2014) in area with > 1.5 ft of deepening	x	x	a	x	-	-	-	-	-

Location ID	Grid Cell	RM	Tidal Category	Interval Type[1] 0-10 cm	0-45 cm	0-60 cm	Shoal	Recovery Category	In FNC?	Shoaling Area	Potential Vessel Scour Area	Mudline Elevation (ft MLLW)	Bathy-metry Survey Year[2]	Rationale: Grid Coverage	Bounding	Reoccupation	Notes	Analytes for Surface Sample[3]: PCBs	Arsenic	Dioxins/ Furans	Other Benthic Risk Drivers	Analytes for Subsurface Sample[3]: PCBs	Arsenic	cPAHs	Dioxins/ Furans	Other Benthic Risk Drivers
1230	39E	2.8	subtidal	a				3	Yes	Yes	No	-18.6	2021			x	Reoccupy DENW6721-SSED-18A-2014 (2014); analysis of this Tier 2 sample dependent on the results of the adjacent Tier 1 samples	a	a	a	a	-	-	-	-	-
1231	39F	2.8	intertidal	x	x			2	No	-	No	3.9	2003	x				x	x	a	x	x	x	x	x	-
1232	39F	2.8	intertidal	x				2	No	-	No	-2.0	2021			x	Reoccupy DENW6721-SSED-09-2014 (2014); total PCB EF of 1.0	x	x	a	x	-	-	-	-	-
1233	39F	2.8	intertidal	x	x			2	No	-	No	no data	-		x		Additional sample in bank area adjacent to assumed active remedy	x	x	a	x	x	x	x	a	-
1234	39F	2.8	subtidal			x		1	No	-	Yes	-8.6	2021		x		Additional bounding sample near assumed active remedy	-	-	-	-	x	x	-	a	x
1235	40B	2.8	intertidal	x	x			3	No	-	No	1.9	2021	x				x	x	a	x	x	x	x	x	-
1236	40C	2.8	subtidal	x		x		3	No	-	Yes	-12.0	2022	x				x	x	a	x	x	-	-	-	-
1237	40C	2.8	subtidal	x				3	No	-	Yes	-9.6	2003			x	Reoccupy LDW-SS2106-D (2011); 1,4-dichlorobenzene EF of 1.1	x	x	a	x	-	-	-	-	-
1238	40D	2.8	subtidal	x				3	Yes	No	Yes	-17.6	2022	x		x	Reoccupy SD-PER201 (2015); total PCB EF of 1.4	x	x	a	x	-	-	-	-	-
1239	40E	2.8	subtidal	x		x		1	No	-	Yes	-17.5	2021	x				x	x	a	x	x	x	-	a	x
1240	40E	2.8	subtidal	x				1	No	-	Yes	-14.6	2021			x	Reoccupy DENW6721-SSED-17A-2014 (2014); total PCB EF of 0.92	x	x	a	x					
1241	40F	2.8	subtidal			x		1	No	-	Yes	-12.1	2021	x				-	-	-	-	x	x	-	x	x
1242	40F	2.8	subtidal	x				1	No	-	Yes	-13.1	2021	x		x	Reoccupy DENW6721-SSED-11-2014 (2014); total PCB EF of 1.3	x	x	a	x	-	-	-	-	-
1243	40F	2.8	subtidal	a				1	No	-	Yes	-9.6	2021			x	Reoccupy DENW6721-SSED-10-2014 (2014); total PCB EF of 1.1; analysis of this Tier 2 sample dependent on the results of the adjacent Tier 1 samples	a	a	a	a	-	-	-	-	-
1244	40G	2.8	subtidal			x		2	No	-	Yes	-8.9	2021	x				-	-	-	-	x	-	-	-	-
1245	40G	2.8	subtidal	x				2	No	-	Yes	-9.6	2021			x	Reoccupy SD-PER518 (2015) to evaluate PCB trends in Slip 4; total PCB EF of 1.8[4]	x	a	a	a	-	-	-	-	-
1246	41B	2.8	intertidal		x			3	No	-	No	-0.7	2021	x				-	-	-	-	x	x	x	a	-
1247	41C	2.9	subtidal	x		x		1	No	-	Yes	-10.9	2022	x	x			x	x	a	x	x	x	-	a	x
1248	41D	2.9	subtidal	x		x		3	Yes	No	Yes	-17.5	2021	x				x	x	a	x	x	-	-	-	-
1249	41E	2.9	subtidal	x		x		1	No	-	Yes	-12.8	2021	x				x	x	a	x	x	x	-	a	x
1250	41F	2.9	subtidal	x		x		1	No	-	Yes	-12.2	2021	x				x	x	a	x	x	x	-	a	x
1251	41F	2.8	subtidal	x				1	No	-	Yes	-14.0	2021			x	Reoccupy SD-PER507 (2015); total PCB EF of 1.7	x	x	a	x	-	-	-	-	-
1252	42A	2.8	subtidal			x		2	No	-	Yes	-14.2	2021	x				-	-	-	-	x	-	-	-	-
1253	42A	2.8	subtidal	x				2	No	-	Yes	-12.1	2021			x	Reoccupy SD-PER515 (2015) to evaluate PCB trends in Slip 4; total PCB EF of 0.92[4]	x	a	a	a	-	-	-	-	-
1254	42A	2.8	subtidal	x				2	No	-	Yes	-14.6	2021			x	Reoccupy SD-PER516 (2015) to evaluate PCB trends in Slip 4; total PCB EF of 0.58[4]	x	a	a	a	-	-	-	-	-
1255	42A	2.8	subtidal	x				2	No	-	Yes	-14.5	2021			x	Reoccupy SD-PER517 (2015) to evaluate PCB trends in Slip 4; total PCB EF of 0.73[4]	x	a	a	a	-	-	-	-	-

Location ID	Grid Cell	RM	Tidal Category	Interval Type[1] 0-10 cm	0-45 cm	0-60 cm	Shoal	Recovery Category	In FNC?	Shoaling Area	Potential Vessel Scour Area	Mudline Elevation (ft MLLW)	Bathy-metry Survey Year[2]	Rationale: Grid Coverage	Bounding	Reoccupation	Notes	Analytes for Surface Sample[3]: PCBs	Arsenic	Dioxins/ Furans	Other Benthic Risk Drivers	Analytes for Subsurface Sample[3]: PCBs	Arsenic	cPAHs	Dioxins/ Furans	Other Benthic Risk Drivers
1256	42B	2.8	subtidal			x		2	No	-	Yes	-11.2	2021	x				-	-	-	-	x	-	-	-	-
1257	42B	2.8	subtidal	x				2	No	-	Yes	-11.5	2021			x	Reoccupy SD-PER513 (2015) to evaluate PCB trends in Slip 4; total PCB EF of 4.2[4]	x	a	a	a	-	-	-	-	-
1258	42B	2.8	subtidal	x				2	No	-	Yes	-11.0	2021			x	Reoccupy SD-PER510 (2015) to evaluate PCB trends in Slip 4; total PCB EF of 2.3[4]	x	a	a	a	-	-	-	-	-
1259	42B	2.9	subtidal	x				2	No	-	Yes	-10.8	2021			x	Reoccupy SD-PER511 (2015) to evaluate PCB trends in Slip 4; total PCB EF of 1.3[4]	x	a	a	a	-	-	-	-	-
1260	42B	2.9	subtidal	x				2	No	-	Yes	-11.4	2021			x	Reoccupy SD-PER514 (2015) to evaluate PCB trends in Slip 4; total PCB EF of 0.83[4]	x	a	a	a	-	-	-	-	-
1261	42C	2.8	subtidal			x		2	No	-	Yes	-10.6	2021	x				-	-	-	-	x	-	-	-	-
1262	42C	2.8	subtidal	x				2	No	-	Yes	-10.3	2021			x	Reoccupy SD-PER509 (2015) to evaluate PCB trends in Slip 4; total PCB EF of 2.3[4]	x	a	a	a	-	-	-	-	-
1263	42C	2.8	subtidal	x				2	No	-	Yes	-8.9	2021			x	Reoccupy SD-PER508 (2015) to evaluate PCB trends in Slip 4; total PCB EF of 0.83[4]	x	a	a	a	-	-	-	-	-
1264	43B	2.9	intertidal	x	x			3	No	-	No	-1.6	2021	x				x	x	x	x	x	x	x	x	-
1265	43C	2.9	subtidal	x		x		1	No	-	Yes	-14.3	2022	x				x	x	a	x	x	x	-	a	x
1266	43D	2.9	subtidal	x		x		1	Yes	No	Yes	-17.9	2022	x				x	x	a	x	x	x	-	a	x
1267	43D	2.9	subtidal	x				3	Yes	No	Yes	-16.8	2021			x	Reoccupy SD-PER202 (2015); total PCB EF of 1.0	x	x	a	x	-	-	-	-	-
1268	44B	2.9	intertidal		x			3	No	-	No	-1.3	2021	x				-	-	-	-	x	x	x	a	-
1269	44B	2.9	intertidal	a	x			3	No	-	No	-0.1	2021		x		Additional sample adjacent to possible upland source; Tier 2 surface sediment sample will be analyzed if 0-45 cm samples is below RALs. A split sample from the 0-10 cm interval will also be collected (one 8-oz jar).	a	a	a	a	x	x	x	a	-
1270	44C	2.9	subtidal	x		x		1	No	-	Yes	-14.4	2022	x				x	x	a	x	x	x	-	a	x
1271	44D	2.9	subtidal	x		x		1	Yes	No	Yes	-16.8	2021	x				x	x	a	x	x	x	-	a	x
1272	45B	3	intertidal	x	x			3	No	-	No	0.2	2021	x				x	x	a	x	x	x	x	x	-
1273	45B	3	subtidal	a				3	No	-	Yes	-8.3	2003			x	Reoccupy LDW18-SS-118 (2018); total PCB EF of 1.0; analysis of this Tier 2 sample dependent on the results of the adjacent Tier 1 samples	a	a	a	a	-	-	-	-	-
1274	45B	3	intertidal	a				3	No	-	No	-3.0	2021			x	Reoccupy SD-PER206 (2015); total PCB EF of 1.5; analysis of this Tier 2 sample dependent on the results of the adjacent Tier 1 samples	a	a	a	a	-	-	-	-	-
1275	45B	3	intertidal	a	x			3	No	-	No	1.3	2021		x		Additional sample adjacent to possible upland source; Tier 2 surface sediment sample will be analyzed if 0-45 cm samples is below RALs. A split sample from the 0-10 cm interval will also be collected (one 8-oz jar).	a	a	a	a	x	x	x	a	-
1276	45C	3	subtidal	x		x		1	No	-	Yes	-13.9	2022	x				x	x	a	x	x	x	-	a	x
1277	45D	3	subtidal	x		x		1	Yes	No	Yes	-17.7	2021	x				x	x	a	x	x	x	-	a	x

Notes:

1. An "x" indicates Tier 1 samples. An "a" indicates Tier 2 (archive) samples.
2. Bathymetry data from the 2003 survey was used when data from the 2021 survey and 2022 reconnaissance were not available. Mudline elevations based on the 2003 bathymetry have a higher level of uncertainty. For locations for which bathymetry data are not available (i.e., data were not collected in 2003, 2021, or 2022 because of obstructions), information—including tidal category and whether a location is a shoaling area or potential vessel scour area—was estimated based on surrounding areas.
3. The columns indicating analytes by sample type use green shading to show that sample intervals will be collected. In green-shaded cells, an x indicates a Tier 1 analysis, an "a" indicates an archive sample for potential tier 2 analysis, and a dash (-) indicates that the RAL is not applicable for that sample (e.g., for cPAHs in the subsurface sample for location 1259 in grid 45C). A single dash (-) without green shading indicates that a sample will not be collected in a given interval (e.g., no subsurface sample will be collected at location 1258 in grid 45B). The analytes in this table reflect applicable RALs for each sample; however, sediment will be archived to allow for potential analysis of additional RC1 analytes at all locations that may be affected by the recovery category review following the resolution of the bathymetry data gaps. See Table D-3 for rationale regarding samples selected for Tier 1 dioxin/furan analysis.
4. To assess current conditions in Slip 4 (grids 40G and 42ABC), 10 Boeing Plant 2 perimeter monitoring stations (508, 509, 510, 511, 513, 514, 515, 516, 517, and 518) will be re-occupied early in the Phase I field effort (Map 4c). At these stations, 0- to 10-cm samples will be collected and analyzed for PCBs. Based on the results, either additional Phase I sampling and analysis will be conducted in these four grid cells, or the area will be designated as an active remedy area for further characterization during Phase II

a: archive (Tier 2 sample to be collected and archived for potential analysis)
BEHP: bis(2-ethylhexyl) phthalate
COC: contaminant of concern
cPAH: carcinogenic polycyclic aromatic hydrocarbon
EF: exceedance factor
FNC: Federal Navigation Channel
MLLW: mean lower low water
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
RAL: remedial action level
RM: river mile
x: Tier 1 sample to be collected and analyzed

Table D-3
Rationale for Selected Tier 1 Dioxin/Furan Samples

Location ID	Grid Cell	RM	Tidal Category	Recovery Category	Dioxin/Furan Sample Interval Type[1]				Rationale for Selected Tier 1 Dioxin/Furan Sample
					0–10 cm	0–45 cm	0–60 cm	Shoal	
1004	1F	1.6	subtidal	1	x		x		spatial coverage
1023	5D	1.7	subtidal	3	x			x	spatial coverage
1028	6A	1.7	subtidal	1			x		spatial coverage
1031	7A	1.7	subtidal	1	x				spatial coverage
1035	8B	1.7	intertidal	3	x	x			spatial coverage
1037	9B	1.8	subtidal	2	x		na (no RAL)[2]		targeted sampling – adjacent to area with pre-dredging dioxin/furan RAL exceedances (no subsurface dioxin/furan RAL)
1043	9G	1.8	intertidal	3	a (Tier 2)	x			spatial coverage (subsurface only; have existing dioxin/furan surface sediment data in grid 5H)
1045	10B	1.8	subtidal	1	x		x		targeted sampling – adjacent to area with pre-dredging dioxin/furan RAL exceedances
1046	10C	1.8	subtidal	3				x	targeted sampling – adjacent to area with dioxin/furans > 20 ng/kg
1051	11A	1.9	intertidal	3	x	x			targeted sampling – adjacent to area with pre-dredging dioxin/furan RAL exceedances
1052	11B	1.9	subtidal	2	x		na (no RAL)[2]		targeted sampling – adjacent to area with pre-dredging dioxin/furan RAL exceedances and dioxin/furans > 20 ng/kg (no subsurface dioxin/furan RAL)
1053	11D	1.9	subtidal	3	x			x	targeted sampling – adjacent to area with dioxin/furans > 20 ng/kg
1059	12C	1.9	subtidal	3	x			x	targeted sampling – adjacent to area with dioxin/furans > RAL
1060	12D	1.9	subtidal	3	x			x	targeted sampling – adjacent to area with dioxin/furans > RAL
1064	13C	1.9	subtidal	3	x			x	targeted sampling – adjacent to area with dioxin/furans > RAL
1065	13D	1.9	subtidal	3	x			x	targeted sampling – adjacent to area with dioxin/furans > RAL
1066	13E	1.9	subtidal	3	x		na (no RAL)[2]		targeted sampling – adjacent to area with dioxin/furans > RAL (no subsurface dioxin/furan RAL)
1070	14C	2	subtidal	1	x			x	targeted sampling – adjacent to area with dioxin/furans > RAL
1071	14F	2	intertidal	3	x	x			targeted sampling – adjacent to area with dioxin/furans > RAL
1075	15D	2	subtidal	1			x		targeted sampling – adjacent to area with dioxin/furans > RAL
1077	15F	2	subtidal	3	x		na (no RAL)[2]		spatial coverage (surface only; no subsurface dioxin/furan RAL)
1086	17A'''	2.1	intertidal	3	a (Tier 2)	x			spatial coverage (subsurface only; have existing dioxin/furan surface sediment data in grid 17A'')
1089	17A	2.1	intertidal	3	x	x			spatial coverage
1095	18B	2.1	subtidal	3	x		na (no RAL)[2]		spatial coverage (no subsurface dioxin/furan RAL)
1097	18D	2.1	intertidal	2	x	x			targeted sampling – adjacent to area with dioxin/furans > RAL
1105	20D	2.1	subtidal	2	x				targeted sampling – adjacent to area with dioxin/furans > RAL
1114	23A	2.2	intertidal	3	x	a (Tier 2)			spatial coverage (surface only; have existing dioxin/furan subsurface sediment data in this grid)
1127	25A	2.2	intertidal	2	x	x			spatial coverage
1135	26A	2.3	intertidal	2	x	x			targeted sampling – adjacent to area with dioxin/furans > RAL
1136	26B	2.3	intertidal	2	x	x			targeted sampling – adjacent to area with dioxin/furans > RAL
1142	27B	2.3	intertidal	2	x	x			targeted sampling – adjacent to area with dioxin/furans > RAL
1143	27C	2.3	subtidal	3	x			x	spatial coverage
1148	28B	2.4	intertidal	2		x			targeted sampling – adjacent to area with dioxin/furans > RAL
1154	28H	2.4	intertidal	3	x	x			targeted sampling – adjacent to area with dioxin/furans > RAL (2005 RI/FS sample)
1160	29G	2.4	intertidal	1	x	x			targeted sampling – adjacent to area with dioxin/furans > RAL (2005 RI/FS sample)
1162	30C	2.4	subtidal	3	x			x	spatial coverage
1167	31A	2.5	intertidal	3	x	x			targeted sampling – adjacent to area with dioxin/furans > RAL
1168	31B	2.5	subtidal	2	x		na (no RAL)[2]		targeted sampling – adjacent to area with dioxin/furans > RAL (no subsurface dioxin/furan RAL)
1176	32B	2.5	subtidal	3	x		na (no RAL)[2]		targeted sampling – adjacent to area with dioxin/furans > RAL (no subsurface dioxin/furan RAL)

Location ID	Grid Cell	RM	Tidal Category	Recovery Category	Dioxin/Furan Sample Interval Type[1]				Rationale for Selected Tier 1 Dioxin/Furan Sample
					0–10 cm	0–45 cm	0–60 cm	Shoal	
1186	33F	2.6	subtidal	1			x		spatial coverage (subsurface only; have existing dioxin/furan surface sediment data in this grid)
1191	34D	2.6	subtidal	3	x			x	spatial coverage
1194	34F	2.6	intertidal	3		x			spatial coverage
1202	36A	2.7	intertidal	3	x	x			targeted sampling – adjacent to area with dioxin/furans > RAL (2009 RI/FS sample)
1203	36B	2.7	subtidal	2	x		na (no RAL)[2]		targeted sampling – adjacent to area with dioxin/furans > RAL (2009 RI/FS sample) (no subsurface dioxin/furan RAL)
1209	36F	2.7	intertidal	3	a (Tier 2)	x			spatial coverage (subsurface only; have existing dioxin/furan surface sediment data in this grid)
1211	37A	2.7	intertidal	3	x				targeted sampling – reoccupying 2009 RI/FS sample with dioxin/furans > RAL
1212	37B	2.7	subtidal	1	x		x		targeted sampling – adjacent to area with dioxin/furans > RAL (2009 RI/FS sample)
1215	37E	2.7	subtidal	1	x		x		targeted sampling – adjacent to Beach 6 area with dioxin/furans > RAL
1217	37F	2.7	intertidal	1		x			targeted sampling – adjacent to Beach 6 area with dioxin/furans > RAL (subsurface only; have existing dioxin/furan surface sediment data in this grid)
1222	38E	2.7	subtidal	1	x		x		targeted sampling – adjacent to Beach 6 area with dioxin/furans > RAL
1223	38F	2.8	intertidal	2	x	x			targeted sampling (bank area sample) – adjacent to Beach 6 area with dioxin/furans > RAL
1226	39D	2.8	subtidal	1	x			x	targeted sampling – adjacent to Beach 6 area with dioxin/furans > RAL
1228	39E	2.8	subtidal	1	x				targeted sampling – adjacent to Beach 6 area with dioxin/furans > RAL
1231	39F	2.8	intertidal	2	a (Tier 2)	x			targeted sampling – adjacent to Beach 6 area with dioxin/furans > RAL (subsurface only; have existing dioxin/furan surface sediment data in this grid)
1235	40B	2.8	intertidal	3	a (Tier 2)	x			spatial coverage (subsurface only; have existing dioxin/furan surface sediment data in grid 41B)
1241	40F	2.8	subtidal	1			x		targeted sampling – south of Beach 6 area and Slip 4 structure with dioxin/furans > RAL
1264	43B	2.9	intertidal	3	x	x			spatial coverage
1272	45B	3	intertidal	3	a (Tier 2)	x			spatial coverage (subsurface only; have existing dioxin/furan surface sediment data in grid 44B)
Under-structure samples									
1804	-	1.7	subtidal	3	x		na (no RAL)[2]		targeted sampling – adjacent to area with pre-dredging dioxin/furan RAL exceedances (no subsurface dioxin/furan RAL)
1815	-	2.7	subtidal	3	x		na (no RAL)[2]		targeted sampling – adjacent to area with dioxin/furans > RAL (no subsurface dioxin/furan RAL)
1816	-	2.8	subtidal	3	x		na (no RAL)[2]		targeted sampling – adjacent to area with dioxin/furans > 20 ng/kg (no subsurface dioxin/furan RAL)
1818	-	2.8	subtidal	3	x		na (no RAL)[2]		targeted sampling – adjacent to area with dioxin/furans > RAL (no subsurface dioxin/furan RAL)
1819	-	2.8	subtidal	3	x		na (no RAL)[2]		targeted sampling – adjacent to area with dioxin/furans of approximately 20 ng/kg (no subsurface dioxin/furan RAL)

Notes:
1. An "x" indicates Tier 1 dioxin/furan samples. An "a" indicates Tier 2 (archive) dioxin/furan samples.
2. A Tier 1 sample is being collected at this location for PCBs analysis, but there is no applicable RAL for dioxins/furans at this location.
a: archive (Tier 2 sample to be collected and archived for potential analysis)
FS: feasibility study
ID: identification
na: not applicable
PCB: polychlorinated biphenyl
RAL: remedial action level
RI: remedial investigation
RM: river mile
x: Tier 1 sample to be collected and analyzed

Table D-4
Sample Location Details

Location ID	Grid Cell	RM	Tidal Category	Interval Type				Sample Notes (Reoccupation for Surface Sample or Target RAL Area for Subsurface Sample)	In the FNC?	Authorized FNC Depth (ft MLLW)	Mudline Elevation (ft MLLW)	Bathymetry Survey Year[1]	Est. Shoal Thickness	Expected Tier 1 Shoaling Interval (Total No. of Intervals[2])	Target Coordinates			
				0-10 cm	0-45 cm	0-60 cm	Shoal								X	Y	Longitude	Latitude
1000	1B	1.6	subtidal	x				-	No	-	-34.3	2003			1268493	203320	-122.339406	47.547414
1001	1C	1.6	subtidal	x				-	Yes	-30	-30.3	2021			1268588	203352	-122.339024	47.547506
1002	1D	1.6	subtidal	x			x	shoal (elevation above -30 ft MLLW)	Yes	-30	-27.8	2021	2.2 ft (66 cm)	-30 to -32 ft (3)	1268704	203391	-122.338558	47.547621
1003	1E	1.6	subtidal	x		x		RC1 in subtidal area	No	-	-24.1	2021			1268778	203415	-122.338261	47.547691
1004	1F	1.6	subtidal	x		x		RC1 in subtidal area	No	-	-7.1	2021			1268873	203447	-122.337879	47.547783
1005	2B	1.6	subtidal	x				-	No	-	-33.6	2003			1268557	203130	-122.339134	47.546898
1006	2C	1.6	subtidal	x			x	shoal (elevation above -30 ft MLLW)	Yes	-30	-29.4	2021	0.6 ft (17 cm)	surface to -32 ft (2)	1268652	203162	-122.338752	47.546990
1007	2D	1.6	subtidal	x			x	shoal (elevation above -30 ft MLLW)	Yes	-30	-27.3	2021	2.7 ft (82 cm)	-30 to -32 ft (3)	1268767	203201	-122.338287	47.547104
1008	2E	1.6	subtidal	x		x		RC1 in subtidal area	No	-	-25.0	2021			1268841	203225	-122.337990	47.547174
1009	2F	1.6	subtidal			x		potential vessel scour area	No	-	-11.4	2021			1268936	203257	-122.337608	47.547266
1010	3B	1.7	subtidal	x				-	No	-	-32.9	2003			1268620	202941	-122.338862	47.546382
1011	3C	1.7	subtidal	x			x	shoal (elevation above -30 ft MLLW)	Yes	-30	-29.3	2021	0.8 ft (23 cm)	surface to -32 ft (2)	1268715	202972	-122.338481	47.546474
1012	3D	1.7	subtidal	x			x	shoal (elevation above -30 ft MLLW)	Yes	-30	-28.1	2021	1.9 ft (58 cm)	-30 to -32 ft (3)	1268831	203012	-122.338015	47.546588
1013	3E	1.7	subtidal	x		x		RC1 in subtidal area	No	-	-32.7	2003			1268905	203036	-122.337718	47.546658
1014	3F	1.7	subtidal	x		x		potential vessel scour area	No	-	no data	-			1269000	203068	-122.337336	47.546750
1015	4B	1.7	subtidal	x				-	No	-	-33.0	2003			1268684	202751	-122.338590	47.545865
1016	4C	1.7	subtidal	x			x	shoal (elevation above -30 ft MLLW)	Yes	-30	-29.7	2021	0.4 ft (11 cm)	surface to -32 ft (2)	1268778	202783	-122.338209	47.545957
1017	4D	1.7	subtidal	x			x	shoal (elevation above -30 ft MLLW)	Yes	-30	-28.3	2021	1.7 ft (51 cm)	-30 to -32 ft (3)	1268894	202822	-122.337743	47.546071
1018	4E	1.7	subtidal	x		x		RC1 in subtidal area	No	-	-33.4	2003			1268968	202846	-122.337446	47.546141
1019	4F	1.7	subtidal			x		RC1 in subtidal area	No	-	-12.1	2021			1269063	202878	-122.337065	47.546233
1020	4G	1.7	subtidal	x		x		RC1 in subtidal area	No	-	-10.3	2021			1269166	202901	-122.336649	47.546302
1021	5B	1.7	subtidal	x				-	No	-	-31.0	2003			1268747	202561	-122.338318	47.545349
1022	5C	1.7	subtidal	x			x	shoal (elevation above -30 ft MLLW)	Yes	-30	-29.2	2021	0.8 ft (25 cm)	surface to -32 ft (2)	1268842	202593	-122.337937	47.545441
1023	5D	1.7	subtidal	x			x	shoal (elevation above -30 ft MLLW)	Yes	-30	-28.6	2021	1.4 ft (42 cm)	-30 to -32 ft (3)	1268937	202625	-122.337555	47.545533
1024	5E	1.7	subtidal	x		x		RC1 in subtidal area	No	-	-22.7	2021			1269050	202663	-122.337100	47.545644
1025	5F	1.7	subtidal	x		x		RC1 in subtidal area	No	-	-17.3	2021			1269126	202688	-122.336793	47.545717
1026	5G	1.7	subtidal	x		x		RC1 in subtidal area	No	-	-11.6	2021			1269221	202720	-122.336411	47.545809
1027	5H	1.8	intertidal		x			intertidal	No	-	no data	-			1269318	202721	-122.336021	47.545816
1028	6A	1.7	subtidal			x		RC1 in subtidal area	No	-	-13.4	2021			1269277	202996	-122.336207	47.546570
1029	6B	1.7	subtidal	x		x		RC1 in subtidal area	No	-	-12.6	2021			1269376	203125	-122.335816	47.546928
1030	6C	1.7	subtidal	x		x		potential vessel scour area	No	-	-9.7	2021			1269523	203309	-122.335236	47.547439
1031	7A	1.7	subtidal	x				-	No	-	-17.8	2021			1269332	202961	-122.335984	47.546477
1032	7B	1.7	subtidal	x		x		RC1 in subtidal area	No	-	-15.0	2021			1269426	203097	-122.335613	47.546854
1033	7C	1.7	subtidal	x		x		potential vessel scour area	No	-	-6.0	2021			1269586	203247	-122.334977	47.547275
1034	8A	1.7	intertidal	x	x			intertidal	No	-	0.1	2021			1269436	202879	-122.335556	47.546255
1035	8B	1.7	intertidal	x	x			intertidal	No	-	3.3	2021			1269542	203046	-122.335140	47.546720
1036	9A	1.8	subtidal	x		x		potential vessel scour area	No	-	-19.5	2003			1268716	202340	-122.338428	47.544740
1037	9B	1.8	subtidal	x		x		potential vessel scour area	No	-	-21.8	2021			1268790	202364	-122.338128	47.544811
1038	9C	1.8	subtidal	x			x	shoal (elevation above -30 ft MLLW)	Yes	-30	-28.6	2021	1.4 ft (44 cm)	-30 to -32 ft (3)	1268905	202403	-122.337665	47.544925
1039	9D	1.8	subtidal	x			x	shoal (elevation above -30 ft MLLW)	Yes	-30	-26.7	2021	3.3 ft (100 cm)	-30 to -32 ft (4)	1269000	202435	-122.337284	47.545017
1040	9E	1.8	subtidal			x		potential vessel scour area	No	-	-21.9	2021			1269095	202467	-122.336902	47.545109
1041	9F	1.8	intertidal	x	x			intertidal	No	-	-2.2	2021			1269203	202488	-122.336469	47.545173
1042	9F	1.8	intertidal	a	x			intertidal	No	-	no data	-			1269252	202429	-122.336262	47.545013
1043	9G	1.8	intertidal	x	x			intertidal	No	-	no data	-			1269285	202530	-122.336139	47.545293

Location ID	Grid Cell	RM	Tidal Category	Interval Type				Sample Notes (Reoccupation for Surface Sample or Target RAL Area for Subsurface Sample)	In the FNC?	Authorized FNC Depth (ft MLLW)	Mudline Elevation (ft MLLW)	Bathymetry Survey Year[1]	Est. Shoal Thickness	Expected Tier 1 Shoaling Interval (Total No. of Intervals[2])	Target Coordinates			
				0-10 cm	0-45 cm	0-60 cm	Shoal								X	Y	Longitude	Latitude
1044	10A	1.8	subtidal	x		x		RC1 in subtidal area	No	-	-15.7	2003			1268779	202150	-122.338156	47.544224
1045	10B	1.8	subtidal	x		x		RC1 in subtidal area	No	-	-19.8	2021			1268874	202182	-122.337774	47.544316
1046	10C	1.8	subtidal				x	shoal (elevation above -30 ft MLLW)	Yes	-30	-25.2	2021	4.8 ft (145 cm)	-30 to -32 ft (4)	1268969	202214	-122.337393	47.544408
1047	10D	1.8	subtidal	x			x	shoal (elevation above -30 ft MLLW)	Yes	-30	-24.1	2021	5.9 ft (181 cm)	-30 to -32 ft (4)	1269064	202245	-122.337012	47.544500
1048	10E	1.8	subtidal	x		x		potential vessel scour area	No	-	-15.4	2021			1269159	202277	-122.336630	47.544592
1049	10F	1.8	intertidal	x	x			intertidal	No	-	no data	-			1269246	202314	-122.336281	47.544698
1050	10F	1.8	intertidal	a	x			intertidal	No	-	no data	-			1269238	202232	-122.336307	47.544473
1051	11A	1.9	intertidal	x	x			intertidal (or RC1 in subtidal area if intertidal is not sampleable)	No	-	no data	-			1268818	201974	-122.337985	47.543744
1052	11B	1.9	subtidal	x		x		potential vessel scour area	No	-	-18.0	2003			1268946	201998	-122.337468	47.543815
1053	11D	1.9	subtidal	x			x	shoal (elevation above -30 ft MLLW)	Yes	-30	-26.1	2021	3.9 ft (120 cm)	-30 to -32 ft (4)	1269127	202056	-122.336740	47.543984
1054	11E	1.9	subtidal	x		x		potential vessel scour area	No	-	-16.9	2021			1269222	202088	-122.336358	47.544076
1055	11F	1.9	intertidal	x	x			intertidal	No	-	0.1	2021			1269288	202132	-122.336094	47.544200
1056	11F	1.9	subtidal	a				reoccupation	No	-	no data	-			1269292	202053	-122.336072	47.543985
1057	12A	1.9	subtidal			x		potential vessel scour area	No	-	-6.8	2021			1269040	201818	-122.337072	47.543328
1058	12B	1.9	subtidal			x		potential vessel scour area	No	-	-14.6	2021			1269131	201762	-122.336701	47.543179
1059	12C	1.9	subtidal	x			x	shoal (elevation above -30 ft MLLW)	Yes	-30	-24.0	2021	6 ft (183 cm)	-30 to -32 ft (4)	1269205	201830	-122.336408	47.543368
1060	12D	1.9	subtidal	x			x	shoal (elevation above -30 ft MLLW)	Yes	-30	-22.2	2021	7.8 ft (237 cm)	-30 to -32 ft (4)	1269278	201897	-122.336115	47.543557
1061	12E	1.9	subtidal	x		x		potential vessel scour area	No	-	no data	-			1269370	201953	-122.335750	47.543716
1062	13A	2	intertidal	x	x			intertidal	No	-	3.2	2021			1269259	201531	-122.336163	47.542551
1063	13B	1.9	subtidal	a				reoccupation	No	-	-11.8	2021			1269191	201668	-122.336451	47.542924
1064	13C	1.9	subtidal	x			x	shoal (elevation above -30 ft MLLW)	Yes	-30	-25.4	2021	4.6 ft (141 cm)	-30 to -32 ft (4)	1269340	201682	-122.335849	47.542971
1065	13D	1.9	subtidal	x			x	shoal (elevation above -30 ft MLLW)	Yes	-30	-23.6	2021	6.4 ft (195 cm)	-30 to -32 ft (4)	1269422	201720	-122.335520	47.543079
1066	13E	1.9	subtidal	x		x		potential vessel scour area	No	-	no data	-			1269499	201803	-122.335214	47.543311
1067	13E	1.9	intertidal	a	x			intertidal	No	-	no data	-			1269446	201909	-122.335436	47.543598
1068	14A	2	intertidal	x	x			intertidal	No	-	4.0	2003			1269321	201457	-122.335909	47.542353
1069	14B	2	subtidal			x		potential vessel scour area	No	-	-7.2	2021			1269401	201467	-122.335584	47.542385
1070	14C	2	subtidal	x			x	shoal (elevation above -30 ft MLLW)	Yes	-30	-27.8	2021	2.2 ft (68 cm)	-30 to -32 ft (3)	1269484	201543	-122.335256	47.542598
1071	14F	2	intertidal	x	x			intertidal	No	-	no data	-			1269674	201718	-122.334499	47.543086
1072	15A	2	intertidal	x	x			intertidal	No	-	1.5	2021			1269495	201275	-122.335187	47.541864
1073	15B	2	subtidal	x		x		potential vessel scour area	No	-	-6.5	2021			1269518	201337	-122.335101	47.542035
1074	15C	2	subtidal	x		x		RC1 in subtidal area	Yes	-20	-26.9	2021			1269619	201396	-122.334698	47.542201
1075	15D	2	subtidal			x		RC1 in subtidal area	Yes	-20	-28.1	2021			1269684	201455	-122.334439	47.542366
1076	15E	2	subtidal	x		x		potential vessel scour area	No	-	-12.7	2021			1269758	201552	-122.334148	47.542636
1077	15F	2	subtidal	x		x		potential vessel scour area	No	-	-6.8	2021			1269831	201590	-122.333853	47.542744
1078	15G	2	intertidal	x	x			intertidal	No	-	1.2	2003			1269930	201603	-122.333453	47.542785
1079	16A'	2.1	intertidal	x	x			intertidal	No	-	no data	-			1269538	201037	-122.334996	47.541212
1080	16A	2.1	intertidal		x			intertidal	No	-	no data	-			1269598	201105	-122.334760	47.541402
1081	16B	2.1	intertidal	x	x			intertidal	No	-	-2.5	2021			1269647	201144	-122.334564	47.541511
1082	16C	2.1	subtidal	x		x		RC1 in subtidal area	Yes	-20	-25.1	2021			1269761	201256	-122.334111	47.541825
1083	16D	2.1	subtidal	x		x		RC1 in subtidal area	Yes	-20	-27.4	2021			1269819	201307	-122.333880	47.541969
1084	16E	2.1	subtidal	x		x		RC1 in subtidal area	No	-	-21.9	2021			1269867	201348	-122.333690	47.542083
1085	16F	2.1	subtidal	x		x		potential vessel scour area	No	-	-14.5	2021			1269966	201442	-122.333294	47.542347
1086	17A'''	2.1	intertidal	x	x			intertidal	No	-	no data	-			1269571	200635	-122.334831	47.540112
1087	17A''	2.1	intertidal		x			intertidal	No	-	no data	-			1269585	200822	-122.334787	47.540627
1088	17A'	2.1	intertidal	x	x			intertidal	No	-	no data	-			1269659	200890	-122.334494	47.540816
1089	17A	2.1	intertidal	x	x			intertidal	No	-	3.2	2003			1269733	200957	-122.334201	47.541005

FINAL

Location ID	Grid Cell	RM	Tidal Category	Interval Type 0-10 cm	0-45 cm	0-60 cm	Shoal	Sample Notes (Reoccupation for Surface Sample or Target RAL Area for Subsurface Sample)	In the FNC?	Authorized FNC Depth (ft MLLW)	Mudline Elevation (ft MLLW)	Bathymetry Survey Year[1]	Est. Shoal Thickness	Expected Tier 1 Shoaling Interval (Total No. of Intervals[2])	Target Coordinates X	Y	Longitude	Latitude
1090	17B	2.1	subtidal	x		x		potential vessel scour area	No	-	-10.2	2021			1269807	201025	-122.333908	47.541194
1091	17C	2.1	subtidal	x			x	shoal (elevation above -20 ft MLLW)	Yes	-20	-18.0	2021	2 ft (62 cm)	-20 to -22 ft (3)	1269880	201092	-122.333615	47.541383
1092	17E	2.1	subtidal	x				-	No	-	-19.4	2021			1270028	201227	-122.333029	47.541761
1093	17E	2.1	subtidal			x		potential vessel scour area	No	-	-19.4	2021			1270052	201248	-122.332932	47.541818
1094	17F	2.1	subtidal	x		x		potential vessel scour area	No	-	-15.3	2021			1270102	201295	-122.332735	47.541951
1095	18B	2.1	subtidal	x		x		potential vessel scour area	No	-	-8.5	2021			1270314	201633	-122.331902	47.542888
1096	18C	2.1	subtidal	x		x		potential vessel scour area	No	-	-5.0	2021			1270498	201654	-122.331158	47.542955
1097	18D	2.1	intertidal	x	x			intertidal	No	-	3.2	2003			1270750	201632	-122.330137	47.542909
1098	19A	2.1	subtidal	x		x		potential vessel scour area	No	-	-9.0	2021			1270097	201571	-122.332777	47.542707
1099	19B	2.1	subtidal	x		x		potential vessel scour area	No	-	-12.0	2021			1270297	201569	-122.331968	47.542713
1100	19C	2.1	subtidal	x		x		potential vessel scour area	No	-	-13.9	2021			1270497	201568	-122.331158	47.542719
1101	19D	2.1	subtidal			x		potential vessel scour area	No	-	-11.5	2021			1270696	201566	-122.330350	47.542726
1102	20A	2.1	subtidal	x		x		potential vessel scour area	No	-	-13.7	2021			1270096	201471	-122.332773	47.542433
1103	20B	2.1	subtidal	x		x		potential vessel scour area	No	-	-13.0	2021			1270296	201470	-122.331963	47.542439
1104	20C	2.1	subtidal	x		x		potential vessel scour area	No	-	-16.2	2003			1270496	201468	-122.331154	47.542445
1105	20D	2.1	subtidal	x				-	No	-	-15.8	2003			1270695	201466	-122.330346	47.542452
1106	21B	2.1	subtidal	x		x		potential vessel scour area	No	-	-14.2	2021			1270256	201348	-122.332113	47.542105
1107	21C	2.1	subtidal	x		x		potential vessel scour area	No	-	-15.0	2021			1270456	201343	-122.331304	47.542101
1108	22B	2.1	subtidal	x		x		potential vessel scour area	No	-	no data	-			1269942	200877	-122.333349	47.540797
1109	22C	2.1	subtidal	x			x	shoal (elevation above -20 ft MLLW)	Yes	-20	-18.1	2021	1.9 ft (57 cm)	-20 to -22 ft (3)	1270015	200945	-122.333056	47.540986
1110	22D	2.1	subtidal	x				-	Yes	-20	-24.7	2021			1270089	201012	-122.332763	47.541175
1111	22E	2.1	subtidal	x		x		potential vessel scour area	No	-	-18.7	2003			1270184	201098	-122.332385	47.541415
1112	22F	2.1	subtidal	x				-	No	-	-15.2	2003			1270237	201148	-122.332177	47.541554
1113	22F	2.1	subtidal	a				reoccupation	No	-	no data	-			1270299	201075	-122.331919	47.541358
1114	23A	2.2	intertidal	x	x			intertidal	No	-	-1.5	2003			1270016	200683	-122.333034	47.540269
1115	23B	2.2	subtidal			x		potential vessel scour area	No	-	-14.4	2003			1270077	200730	-122.332791	47.540400
1116	23D	2.2	subtidal	x				-	Yes	-20	-23.5	2021			1270224	200865	-122.332205	47.540778
1117	23E	2.2	subtidal	x		x		potential vessel scour area	No	-	-17.6	2021			1270298	200933	-122.331911	47.540968
1118	23F	2.2	subtidal	x		x		potential vessel scour area	No	-	no data	-			1270372	201000	-122.331618	47.541157
1119	23F	2.2	subtidal	a				reoccupation	No	-	no data	-			1270315	201060	-122.331853	47.541318
1120	24A	2.2	intertidal	x	x			intertidal	No	-	no data	-			1270142	200543	-122.332513	47.539891
1121	24A	2.2	intertidal		x			intertidal	No	-	no data	-			1270220	200469	-122.332191	47.539692
1122	24B	2.2	subtidal	x		x		potential vessel scour area	No	-	-11.7	2003			1270212	200582	-122.332232	47.540003
1123	24C	2.2	subtidal	x			x	shoal (elevation above -20 ft MLLW)	Yes	-20	-17.5	2021	2.5 ft (75 cm)	-20 to -22 ft (3)	1270286	200650	-122.331939	47.540192
1124	24D	2.2	subtidal	x				-	Yes	-20	-22.4	2021			1270359	200718	-122.331646	47.540381
1125	24E	2.2	subtidal	x		x		potential vessel scour area	No	-	-15.5	2003			1270433	200785	-122.331353	47.540571
1126	24F	2.2	intertidal	x	x			intertidal	No	-	-1.7	2021			1270491	200823	-122.331121	47.540677
1127	25A	2.2	intertidal	x	x			intertidal	No	-	-2.9	2003			1270270	200394	-122.331981	47.539490
1128	25B	2.2	subtidal	x		x		potential vessel scour area	No	-	-12.2	2003			1270347	200435	-122.331674	47.539606
1129	25B	2.3	subtidal	x				reoccupation	No	-	-7.9	2021			1270418	200366	-122.331381	47.539421
1130	25C	2.2	subtidal	x			x	shoal (elevation above -20 ft MLLW)	Yes	-20	-17.7	2021	2.3 ft (69 cm)	-20 to -22 ft (3)	1270421	200503	-122.331381	47.539795
1131	25D	2.2	subtidal	x				-	Yes	-20	-22.1	2021			1270495	200570	-122.331087	47.539984
1132	25E	2.2	subtidal	x		x		potential vessel scour area	No	-	-12.7	2003			1270568	200638	-122.330794	47.540174
1133	25F	2.2	intertidal	x	x			intertidal	No	-	-2.7	2021			1270616	200683	-122.330606	47.540301
1134	25F	2.2	intertidal	x	x			intertidal	No	-	-2.3	2021			1270560	200750	-122.330837	47.540482
1135	26A	2.3	intertidal	x	x			intertidal	No	-	3.4	2021			1270397	200278	-122.331460	47.539178
1136	26B	2.3	intertidal	x	x			intertidal	No	-	-1.5	2021			1270480	200257	-122.331123	47.539126

Location ID	Grid Cell	RM	Tidal Category	Interval Type				Sample Notes (Reoccupation for Surface Sample or Target RAL Area for Subsurface Sample)	In the FNC?	Authorized FNC Depth (ft MLLW)	Mudline Elevation (ft MLLW)	Bathymetry Survey Year[1]	Est. Shoal Thickness	Expected Tier 1 Shoaling Interval (Total No. of Intervals[2])	Target Coordinates			
				0-10 cm	0-45 cm	0-60 cm	Shoal								X	Y	Longitude	Latitude
1137	26C	2.3	subtidal	x			x	shoal (elevation above -20 ft MLLW)	Yes	-20	-15.8	2021	4.2 ft (127 cm)	-20 to -22 ft (4)	1270556	200355	-122.330822	47.539398
1138	26D	2.3	subtidal	x				-	Yes	-20	-21.7	2021			1270630	200423	-122.330529	47.539588
1139	26E	2.3	subtidal	x		x		potential vessel scour area	No	-	-12.5	2021			1270703	200490	-122.330236	47.539777
1140	26F	2.3	intertidal	x	x			intertidal	No	-	-1.8	2021			1270757	200536	-122.330024	47.539905
1141	26F	2.3	intertidal	x	x			intertidal	No	-	-2.1	2021			1270693	200602	-122.330286	47.540083
1142	27B	2.3	intertidal	x	x			intertidal	No	-	-0.8	2021			1270602	200127	-122.330617	47.538776
1143	27C	2.3	subtidal	x			x	shoal (elevation above -20 ft MLLW)	Yes	-20	-14.4	2021	5.6 ft (171 cm)	-20 to -22 ft (4)	1270691	200208	-122.330263	47.539001
1144	27D	2.3	subtidal	x				-	Yes	-20	-21.4	2021			1270765	200275	-122.329970	47.539191
1145	27E	2.3	subtidal	x		x		potential vessel scour area	No	-	-14.2	2022			1270838	200343	-122.329677	47.539380
1146	27F	2.3	intertidal	x	x			intertidal	No	-	-1.3	2021			1270912	200396	-122.329385	47.539529
1147	28A	2.4	intertidal	x	x			intertidal	No	-	no data	-			1270705	199947	-122.330188	47.538287
1148	28B	2.4	intertidal		x			intertidal	No	-	-1.3	2021			1270757	199988	-122.329981	47.538402
1149	28B	2.4	intertidal	x				reoccupation	No	-	1.1	2021			1270730	199950	-122.330085	47.538297
1150	28C	2.4	subtidal	x			x	shoal (elevation above -20 ft MLLW)	Yes	-20	-14.7	2021	5.3 ft (162 cm)	-20 to -22 ft (4)	1270826	200060	-122.329705	47.538604
1151	28E	2.4	subtidal	x		x		RC1 in subtidal area	No	-	-14.7	2021			1270974	200195	-122.329119	47.538983
1152	28F	2.4	subtidal	x		x		RC1 in subtidal area	No	-	-8.4	2021			1271047	200263	-122.328826	47.539172
1153	28G	2.4	subtidal			x		RC1 in subtidal area	No	-	-5.2	2021			1271121	200330	-122.328532	47.539361
1154	28H	2.4	intertidal	x	x			reoccupation	No	-	-2.5	2021			1271173	200382	-122.328326	47.539505
1155	29B	2.4	subtidal	x		x		RC1 in subtidal area	No	-	no data	-			1270888	199845	-122.329439	47.538018
1156	29C	2.4	subtidal	x			x	shoal (elevation above -20 ft MLLW)	Yes	-20	-17.1	2021	2.9 ft (87 cm)	-20 to -22 ft (3)	1270961	199913	-122.329146	47.538207
1157	29D	2.4	subtidal	x				-	Yes	-20	-21.0	2021			1271035	199980	-122.328853	47.538397
1158	29E	2.4	subtidal	x		x		RC1 in subtidal area	No	-	-16.2	2021			1271109	200048	-122.328560	47.538586
1159	29F	2.4	subtidal	x		x		RC1 in subtidal area	No	-	-9.7	2022			1271173	200116	-122.328307	47.538777
1160	29G	2.4	intertidal	x	x			intertidal	No	-	-3.7	2021			1271247	200292	-122.328022	47.539262
1161	30B	2.4	subtidal	x		x		RC1 in subtidal area	No	-	no data	-			1271023	199698	-122.328881	47.537621
1162	30C	2.4	subtidal	x			x	shoal (elevation above -20 ft MLLW)	Yes	-20	-18.5	2021	1.5 ft (45 cm)	-20 to -22 ft (3)	1271096	199765	-122.328588	47.537811
1163	30D	2.4	subtidal	x				-	Yes	-20	-20.5	2021			1271170	199833	-122.328295	47.538000
1164	30E	2.4	subtidal	x		x		RC1 in subtidal area	No	-	-16.9	2021			1271244	199900	-122.328002	47.538189
1165	30F	2.4	subtidal			x		RC1 in subtidal area	No	-	-9.2	2021			1271318	199968	-122.327709	47.538378
1166	30F	2.4	subtidal	x				reoccupation	No	-	-6.5	2021			1271354	199962	-122.327561	47.538364
1167	31A	2.5	intertidal	x	x			intertidal	No	-	no data	-			1271132	199470	-122.328419	47.537003
1168	31B	2.5	subtidal	x		x		potential vessel scour area	No	-	no data	-			1271158	199550	-122.328322	47.537224
1169	31C	2.5	subtidal				x	shoal (elevation above -20 ft MLLW)	Yes	-20	-15.9	2022	4.1 ft (125 cm)	-20 to -22 ft (4)	1271231	199618	-122.328029	47.537414
1170	31D	2.5	subtidal	x			x	shoal (elevation above -20 ft MLLW)	Yes	-20	-19.9	2022	0.1 ft (4 cm)	surface to -22 ft (2)	1271289	199672	-122.327800	47.537565
1171	31E	2.5	subtidal	x		x		RC1 in subtidal area	No	-	-20.0	2021			1271379	199753	-122.327443	47.537792
1172	31E	2.5	subtidal	x				reoccupation	No	-	-14.3	2021			1271449	199742	-122.327159	47.537766
1173	31F	2.5	subtidal	x		x		RC1 in subtidal area	No	-	-9.7	2021			1271453	199820	-122.327150	47.537981
1174	31F	2.5	subtidal	x				reoccupation	No	-	-11.1	2021			1271507	199743	-122.326924	47.537771
1175	31F	2.5	subtidal	x				-	No	-	-7.9	2021			1271397	199895	-122.327383	47.538182
1176	32B	2.5	subtidal	x		x		potential vessel scour area	No	-	no data	-			1271286	199410	-122.327792	47.536846
1177	32C	2.5	subtidal	x			x	shoal (elevation above -20 ft MLLW)	Yes	-20	-15.6	2003	4.4 ft (134 cm)	-20 to -22 ft (4)	1271367	199470	-122.327471	47.537017
1178	32E	2.5	subtidal	x		x		RC1 in subtidal area	No	-	-16.9	2021			1271514	199605	-122.326885	47.537395
1179	32F	2.5	subtidal	x		x		RC1 in subtidal area	No	-	-9.1	2021			1271581	199665	-122.326619	47.537562
1180	33A	2.5	intertidal	x	x			intertidal	No	-	no data	-			1271393	199202	-122.327345	47.536282
1181	33B	2.5	intertidal	x	x			intertidal	No	-	-1.7	2021			1271428	199255	-122.327205	47.536430
1182	33C	2.5	subtidal	x				-	No	-20	-9.8	2021			1271480	199302	-122.326999	47.536561
1183	33C	2.5	subtidal				x	shoal (elevation above -20 ft MLLW)	Yes	-20	-11.3	2021	8.7 ft (264 cm)	-20 to -22 ft (5)	1271457	199390	-122.327099	47.536801

Location ID	Grid Cell	RM	Tidal Category	Interval Type 0-10 cm	0-45 cm	0-60 cm	Shoal	Sample Notes (Reoccupation for Surface Sample or Target RAL Area for Subsurface Sample)	In the FNC?	Authorized FNC Depth (ft MLLW)	Mudline Elevation (ft MLLW)	Bathymetry Survey Year[1]	Est. Shoal Thickness	Expected Tier 1 Shoaling Interval (Total No. of Intervals[2])	Target Coordinates X	Y	Longitude	Latitude
1184	33D	2.5	subtidal	x			x	shoal (elevation above -20 ft MLLW)	Yes	-20	-19.3	2021	0.7 ft (21 cm)	surface to -22 ft (2)	1271575	199390	-122.326619	47.536809
1185	33E	2.6	subtidal	x		x		RC1 in subtidal area	No	-	-16.1	2021			1271649	199458	-122.326326	47.536998
1186	33F	2.6	subtidal			x		RC1 in subtidal area	No	-	-5.4	2021			1271723	199526	-122.326033	47.537187
1187	33F	2.6	subtidal	a				reoccupation	No	-	-5.8	2021			1271755	199471	-122.325898	47.537039
1188	33F	2.6	subtidal	x		x		RC1 in subtidal area (located as close to structure as possible)	No	-	-7.2	2021			1271657	199593	-122.326306	47.537369
1189	34B	2.6	intertidal	x	x			intertidal	No	-	2.7	2021			1271560	199094	-122.326659	47.535995
1190	34C	2.6	subtidal			x		potential vessel scour area	No	-	-8.8	2021			1271627	199153	-122.326391	47.536160
1191	34D	2.6	subtidal	x			x	shoal (elevation above -20 ft MLLW)	Yes	-20	-17.7	2021	2.3 ft (71 cm)	-20 to -22 ft (3)	1271694	199227	-122.326125	47.536366
1192	34E	2.6	subtidal			x		RC1 in subtidal area	No	-	-16.3	2021			1271762	199301	-122.325859	47.536573
1193	34E	2.6	subtidal	x				reoccupation	No	-	-8.2	2021			1271862	199274	-122.325450	47.536505
1194	34F	2.6	intertidal		x			intertidal	No	-	-2.1	2021			1271829	199375	-122.325593	47.536780
1195	34F	2.6	intertidal	a				reoccupation	No	-	-1.2	2021			1271829	199405	-122.325594	47.536862
1196	34F	2.6	intertidal	a				reoccupation	No	-	1.3	2021			1271902	199313	-122.325292	47.536614
1197	35B	2.6	intertidal		x			intertidal	No	-	1.1	2003			1271708	198944	-122.326047	47.535593
1198	35C	2.6	subtidal			x		potential vessel scour area	No	-	-11.3	2021			1271775	199018	-122.325781	47.535799
1199	35D	2.6	subtidal	x			x	shoal (elevation above -20 ft MLLW)	Yes	-20	-18.8	2021	1.2 ft (37 cm)	-20 to -22 ft (3)	1271842	199092	-122.325515	47.536006
1200	35E	2.6	subtidal	x		x		RC1 in subtidal area	No	-	-14.5	2021			1271910	199167	-122.325249	47.536213
1201	35F	2.6	intertidal		x			intertidal	No	-	2.5	2021			1271977	199241	-122.324983	47.536419
1202	36A	2.7	intertidal	x	x			intertidal	No	-	no data	-			1271826	198752	-122.325555	47.535071
1203	36B	2.7	subtidal	x		x		potential vessel scour area	No	-	-5.3	2021			1271856	198810	-122.325437	47.535233
1204	36C	2.7	subtidal	x		x		potential vessel scour area	No	-	-13.4	2021			1271923	198884	-122.325171	47.535439
1205	36D	2.7	subtidal	x			x	shoal (elevation above -20 ft MLLW)	Yes	-20	-19.2	2021	0.8 ft (24 cm)	surface to -22 ft (2)	1271991	198958	-122.324905	47.535646
1206	36E	2.7	subtidal			x		RC1 in subtidal area	No	-	-13.1	2021			1272058	199032	-122.324639	47.535852
1207	36E	2.7	subtidal	x				reoccupation	No	-	-10.8	2021			1272062	199059	-122.324624	47.535926
1208	36E	2.6	subtidal	x				reoccupation	No	-	-13.2	2021			1272011	199091	-122.324833	47.536011
1209	36F	2.7	intertidal	x	x			intertidal	No	-	2.1	2021			1272125	199106	-122.324373	47.536059
1210	36F	2.7	intertidal		x			intertidal (in RC1 area)	No	-	-2.2	2021			1272166	199015	-122.324201	47.535812
1211	37A	2.7	intertidal	x				reoccupation	No	-	no data	-			1271917	198658	-122.325179	47.534819
1212	37B	2.7	subtidal	x		x		RC1 in subtidal area	No	-	-8.3	2003			1272004	198676	-122.324827	47.534872
1213	37C	2.7	subtidal	x		x		RC1 in subtidal area	No	-	-14.2	2003			1272072	198750	-122.324561	47.535079
1214	37D	2.7	subtidal	x			x	shoal (elevation above -20 ft MLLW)	Yes	-20	-19.0	2021	1 ft (29 cm)	surface to -22 ft (2)	1272139	198824	-122.324295	47.535285
1215	37E	2.7	subtidal	x		x		RC1 in subtidal area	No	-	-13.0	2021			1272206	198898	-122.324029	47.535492
1216	37F	2.7	intertidal		x			intertidal	No	-	2.6	2021			1272273	198972	-122.323762	47.535699
1217	37F	2.7	intertidal		x			intertidal (in RC1 area)	No	-	-3.0	2021			1272314	198880	-122.323591	47.535448
1218	37F	2.7	intertidal	x	x			intertidal (bank)	No	-	no data	-			1272335	198950	-122.323509	47.535641
1219	38B	2.7	subtidal	x				-	No	-	-9.8	2003			1272153	198541	-122.324217	47.534512
1220	38C	2.7	subtidal	x		x		RC1 in subtidal area	No	-	-13.4	2022			1272220	198615	-122.323950	47.534718
1221	38D	2.7	subtidal	x			x	shoal (elevation above -20 ft MLLW)	Yes	-20	-18.5	2021	1.5 ft (46 cm)	-20 to -22 ft (3)	1272287	198689	-122.323684	47.534925
1222	38E	2.7	subtidal	x		x		RC1 in subtidal area	No	-	-12.9	2021			1272354	198764	-122.323418	47.535132
1223	38F	2.8	intertidal	x	x			intertidal (bank)	No	-	no data	-			1272515	198811	-122.322771	47.535272
1224	39B	2.8	intertidal	x	x			intertidal	No	-	0.1	2021			1272301	198407	-122.323606	47.534151
1225	39C	2.8	subtidal	x		x		RC1 in subtidal area	No	-	-13.0	2022			1272354	198495	-122.323396	47.534394
1226	39D	2.8	subtidal	x			x	shoal (elevation above -20 ft MLLW)	Yes	-20	-18.7	2021	1.3 ft (38 cm)	-20 to -22 ft (3)	1272435	198555	-122.323074	47.534565
1227	39E	2.8	subtidal			x		RC1 in subtidal area	No	-	-13.9	2021			1272502	198629	-122.322808	47.534771
1228	39E	2.8	subtidal	x				reoccupation	No	-	-14.1	2021			1272475	198647	-122.322920	47.534819
1229	39E	2.8	subtidal	x				reoccupation	No	-	-5.1	2021			1272481	198703	-122.322900	47.534973

				Interval Type											Target Coordinates			
Location ID	Grid Cell	RM	Tidal Category	0-10 cm	0-45 cm	0-60 cm	Shoal	Sample Notes (Reoccupation for Surface Sample or Target RAL Area for Subsurface Sample)	In the FNC?	Authorized FNC Depth (ft MLLW)	Mudline Elevation (ft MLLW)	Bathymetry Survey Year[1]	Est. Shoal Thickness	Expected Tier 1 Shoaling Interval (Total No. of Intervals[2])	X	Y	Longitude	Latitude
1230	39E	2.8	subtidal	a				reoccupation	Yes	-20	-18.6	2021			1272468	198598	-122.322945	47.534684
1231	39F	2.8	intertidal	x	x			intertidal	No	-	3.9	2003			1272569	198703	-122.322542	47.534978
1232	39F	2.8	intertidal	x				reoccupation	No	-	-2.0	2021			1272634	198649	-122.322277	47.534833
1233	39F	2.8	intertidal	x	x			intertidal (bank)	No	-	no data	-			1272535	198750	-122.322684	47.535104
1234	39F	2.8	subtidal			x		RC1 in subtidal area	No	-	-8.6	2021			1272595	198619	-122.322433	47.534749
1235	40B	2.8	intertidal	x	x			intertidal	No	-	1.9	2021			1272449	198273	-122.322996	47.533792
1236	40C	2.8	subtidal	x		x		potential vessel scour area	No	-	-12.0	2022			1272516	198347	-122.322729	47.533998
1237	40C	2.8	subtidal	x				reoccupation	No	-	-9.6	2003			1272554	198261	-122.322570	47.533765
1238	40D	2.8	subtidal	x				reoccupation	Yes	-15	-17.6	2022			1272557	198392	-122.322568	47.534124
1239	40E	2.8	subtidal	x		x		RC1 in subtidal area	No	-	-17.5	2021			1272651	198495	-122.322197	47.534411
1240	40E	2.8	subtidal	x				reoccupation	No	-	-14.6	2021			1272617	198546	-122.322337	47.534549
1241	40F	2.8	subtidal			x		RC1 in subtidal area	No	-	-12.1	2021			1272718	198569	-122.321931	47.534618
1242	40F	2.8	subtidal	x				reoccupation	No	-	-13.1	2021			1272739	198546	-122.321844	47.534556
1243	40F	2.8	subtidal	a				reoccupation	No	-	-9.6	2021			1272735	198600	-122.321864	47.534704
1244	40G	2.8	subtidal			x		potential vessel scour area	No	-	-8.9	2021			1272785	198615	-122.321663	47.534746
1245	40G	2.8	subtidal	x				reoccupation	No	-	-9.6	2021			1272812	198601	-122.321552	47.534710
1246	41B	2.8	intertidal		x			intertidal	No	-	-0.7	2021			1272579	198149	-122.322462	47.533459
1247	41C	2.9	subtidal	x		x		RC1 in subtidal area	No	-	-10.9	2022			1272656	198180	-122.322149	47.533548
1248	41D	2.9	subtidal	x		x		potential vessel scour area	Yes	-15	-17.5	2021			1272739	198294	-122.321824	47.533865
1249	41E	2.9	subtidal	x		x		RC1 in subtidal area	No	-	-12.8	2021			1272811	198373	-122.321538	47.534085
1250	41F	2.9	subtidal	x		x		RC1 in subtidal area	No	-	-12.2	2021			1272866	198435	-122.321321	47.534258
1251	41F	2.8	subtidal	x				reoccupation	No	-	-14.0	2021			1272779	198477	-122.321676	47.534369
1252	42A	2.8	subtidal			x		potential vessel scour area	No	-	-14.2	2021			1272935	198576	-122.321054	47.534649
1253	42A	2.8	subtidal	x				reoccupation	No	-	-12.1	2021			1272977	198642	-122.320888	47.534832
1254	42A	2.8	subtidal	x				reoccupation	No	-	-14.6	2021			1272915	198572	-122.321133	47.534636
1255	42A	2.8	subtidal	x				reoccupation	No	-	-14.5	2021			1272881	198541	-122.321269	47.534550
1256	42B	2.8	subtidal			x		potential vessel scour area	No	-	-11.2	2021			1273081	198712	-122.320471	47.535030
1257	42B	2.8	subtidal	x				reoccupation	No	-	-11.5	2021			1273052	198705	-122.320589	47.535008
1258	42B	2.8	subtidal	x				reoccupation	No	-	-11.0	2021			1273120	198769	-122.320319	47.535187
1259	42B	2.9	subtidal	x				reoccupation	No	-	-10.8	2021			1273145	198697	-122.320212	47.534991
1260	42B	2.9	subtidal	x				reoccupation	No	-	-11.4	2021			1273065	198632	-122.320531	47.534809
1261	42C	2.8	subtidal			x		potential vessel scour area	No	-	-10.6	2021			1273228	198848	-122.319887	47.535410
1262	42C	2.8	subtidal	x				reoccupation	No	-	-10.3	2021			1273228	198834	-122.319887	47.535371
1263	42C	2.8	subtidal	x				reoccupation	No	-	-8.9	2021			1273194	198870	-122.320027	47.535468
1264	43B	2.9	intertidal	x	x			intertidal	No	-	-1.6	2021			1272747	197991	-122.321767	47.533036
1265	43C	2.9	subtidal	x		x		RC1 in subtidal area	No	-	-14.3	2022			1272813	198078	-122.321509	47.533277
1266	43D	2.9	subtidal	x		x		RC1 in subtidal area	Yes	-15	-17.9	2022			1272877	198149	-122.321255	47.533475
1267	43D	2.9	subtidal	x				reoccupation	Yes	-15	-16.8	2021			1272926	198121	-122.321054	47.533401
1268	44B	2.9	intertidal		x			intertidal	No	-	-1.3	2021			1272894	197870	-122.321165	47.532710
1269	44B	2.9	intertidal	a	x			intertidal	No	-	-0.1	2021			1272813	197913	-122.321495	47.532826
1270	44C	2.9	subtidal	x		x		RC1 in subtidal area	No	-	-14.4	2022			1272961	197944	-122.320899	47.532917
1271	44D	2.9	subtidal	x		x		RC1 in subtidal area	Yes	-15	-16.8	2021			1273025	198015	-122.320645	47.533115
1272	45B	3	intertidal	x	x			intertidal	No	-	0.2	2021			1273042	197735	-122.320555	47.532350
1273	45B	3	subtidal	a				reoccupation	No	-	-8.3	2003			1273061	197784	-122.320481	47.532484
1274	45B	3	intertidal	a				reoccupation	No	-	-3.0	2021			1273136	197707	-122.320171	47.532277
1275	45B	3	intertidal	a	x			intertidal			1.3	2021			1272963	197782	-122.320876	47.532475
1276	45C	3	subtidal	x		x		RC1 in subtidal area	No	-	-13.9	2022			1273109	197809	-122.320289	47.532557

Location ID	Grid Cell	RM	Tidal Category	Interval Type				Sample Notes (Reoccupation for Surface Sample or Target RAL Area for Subsurface Sample)	In the FNC?	Authorized FNC Depth (ft MLLW)	Mudline Elevation (ft MLLW)	Bathymetry Survey Year[1]	Est. Shoal Thickness	Expected Tier 1 Shoaling Interval (Total No. of Intervals[2])	Target Coordinates			
				0-10 cm	0-45 cm	0-60 cm	Shoal								X	Y	Longitude	Latitude
1277	45D	3	subtidal	x		x		RC1 in subtidal area	Yes	-15	-17.7	2021			1273176	197884	-122.320023	47.532763

Notes:
1. Bathymetry data from the 2003 survey were used when data from the 2021 survey and 2022 reconnaissance were not available. Mudline elevations based on the 2003 bathymetry survey have a higher level of uncertainty.
2. The estimated total number of intervals is based on the estimated mudline elevation (Figure 4-1 of the QAPP). The count of samples includes samples containing shoaled material, over-dredge material, and the z-layer interval.
a: archive (Tier 2 sample to be collected and archived for potential analysis)
FNC: Federal Navigation Channel
MLLW: mean lower low water
QAPP: quality assurance project plan
RAL: remedial action level
RC1: Recovery Category 1
RM: river mile
x: Tier 1 sample to be collected and analyzed

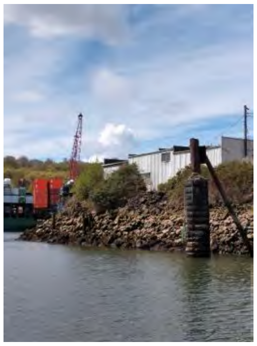
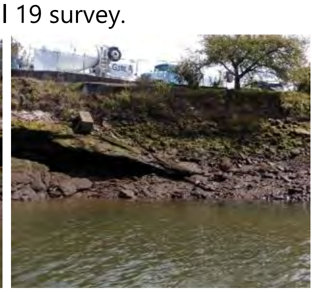
Table D-5
Details Regarding Under-structure Samples

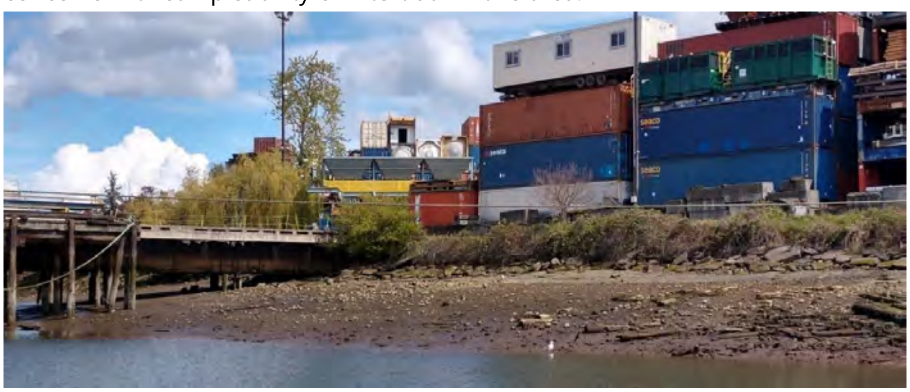
Structure	Location ID	RM	Expected Tidal Category[1]	Interval Type			Recovery Category	Surface Sample Analytes[1]				Subsurface Sample Analytes[1]					Target Coordinates			
				0–10 cm	0–45 cm	0–60 cm		PCBs	Arsenic	Dioxins/ Furans	Other Benthic Risk Drivers	PCBs	Arsenic	Dioxins/ Furans	cPAHs	Other Benthic Risk Drivers	X	Y	Longitude	Latitude
Northland North Wharf (Terminal 115)	1800	1.6	subtidal	x		x	3	x	x	a	x	x	-	-	-	-	1268399	203288	-122.339787	47.547323
	1801	1.6	subtidal	x		x	3	x	x	a	x	x	-	-	-	-	1268456	203083	-122.339539	47.546762
	1802	1.7	subtidal	x		x	3	x	x	a	x	x	-	-	-	-	1268516	202906	-122.339283	47.546282
	1803	1.7	subtidal	x		x	3	x	x	a	x	x	-	-	-	-	1268589	202719	-122.338972	47.545773
	1804	1.7	subtidal	x		x	3	x	x	x	x	x	-	-	-	-	1268652	202529	-122.338699	47.545257
Certainteed Wharf	1805	1.7	intertidal	x	x		3	x	x	a	x	x	x	a	x	x	1268997	203168	-122.337356	47.547024
Samson Tug	1806	1.8	intertidal	x	x		3	x	x	a	x	x	x	a	x	x	1269258	202625	-122.336253	47.545551
Muckleshoot Tribes Marina	1807	2.0	intertidal	x	x		3	x	x	a	x	x	x	a	x	x	1270049	201579	-122.332972	47.542725
SeaTac Marine	1808	2.1	subtidal	x		x	3	x	x	a	x	x	-	-	-	-	1270183	201232	-122.332402	47.541781
	1809	2.1	subtidal	x		x	3	x	x	a	x	x	-	-	-	-	1270306	201101	-122.331891	47.541430
	1810	2.2	subtidal	x		x	3	x	x	a	x	x	-	-	-	-	1270431	200967	-122.331375	47.541068
Alaska Marine Lines Yard No 2	1811	2.1	subtidal	x		x	3	x	x	a	x	x	-	-	-	-	1269893	200813	-122.333540	47.540618
Seattle Iron & Metals Wharves	1812	2.4	subtidal	x		x	3	x	x	a	x	x	-	-	-	-	1271224	200119	-122.328101	47.538787
	1813	2.4	subtidal	x		x	3	x	x	a	x	x	-	-	-	-	1271284	200051	-122.327851	47.538603
Boyer Alaska Barge Line Seattle Main Wharf	1814	2.5	subtidal	x		x	3	x	x	a	x	x	-	-	-	-	1271090	199548	-122.328598	47.537214
Pacific Pile and Marine Wharf	1815	2.7	subtidal	x		x	3	x	x	x	x	x	-	-	-	-	1271990	198568	-122.324878	47.534575
8th Avenue Terminal Wharf	1816	2.8	subtidal	x		x	3	x	x	x	x	x	-	-	-	-	1272814	198631	-122.321547	47.534792
	1817	2.8	subtidal	x		x	3	x	x	a	x	x	-	-	-	-	1272940	198669	-122.321040	47.534903
	1818	2.8	subtidal	x		x	3	x	x	x	x	x	-	-	-	-	1273060	198777	-122.320564	47.535207
	1819	2.8	subtidal	x		x	3	x	x	x	x	x	-	-	-	-	1273160	198867	-122.320165	47.535458
Silver Bay Logging 8th Ave Wharf	1820	2.9	intertidal	x	x		3	x	x	a	x	x	x	a	x	x	1272673	198057	-122.322071	47.533212

Notes:
1. Selected analytes are based on whether there is an applicable RAL for a given sample. See Table D-3 for rationale regarding samples selected for Tier 1 dioxin/furan analysis. All RAL categories will be verified once the bathymetric surveys are completed and at the time of sampling.
a: archive (Tier 2 sample to be collected and archived for potential analysis)
cPAH: carcinogenic polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
RAL: remedial action level
RM: river mile
.
x: Tier 1 sample to be collected and analyzed

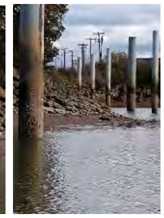
Table D-6
Summary of Shoreline Reconnaissance Survey Conducted on April 19, 2022

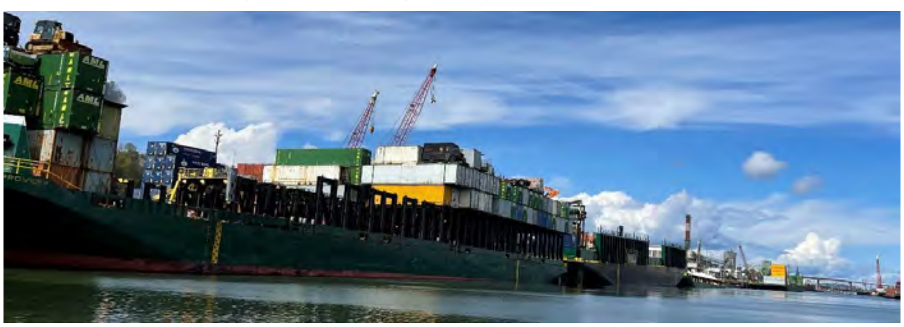
Grid(s)	Notes from April 19 Reconnaissance Survey	Recommended Sample Type to Target
East Shoreline Survey		
1F	No exposed intertidal sediment observed during April 19 survey; steep riprap bank. First area of exposed intertidal observed during the survey is located north of grid 1F boundary. Review of bathymetry layer supports these observations.  Tidal elevation of approximately -2 ft MLLW when photograph was taken.	Subtidal
2F	No exposed intertidal sediment observed during April 19 survey; steep riprap bank. Review of bathymetry layer supports these observations.  Tidal elevation of approximately -2 ft MLLW when photograph was taken.	Subtidal
3F, 4F	No exposed intertidal sediment observed during April 19 survey. May be some pockets of sediment between riprap, but area is primarily a steep riprap slope. Review of bathymetry layer supports these observations.  Tidal elevation of approximately -2 ft MLLW when photograph was taken.	Subtidal

Grid(s)	Notes from April 19 Reconnaissance Survey	Recommended Sample Type to Target
4G, 6A, 6B	North side of Slip 2 is a steep riprap bank. No exposed intertidal sediment observed during April 19 survey. Review of bathymetry layer supports these observations.    Tidal elevation of approximately -2 ft MLLW when photograph was taken.	Subtidal
6C	Head of Slip 2 (NE corner). Small band of exposed sediment at the head of the slip in this grid, but area primarily appears to be subtidal.   Tidal elevation of approximately -2 ft MLLW when photograph was taken.	Subtidal
7C	Head of Slip 2 (SE corner). Bank is made up of riprap/concrete slabs; no sampleable intertidal was observed during the April 19 survey.    Tidal elevation of approximately -2 ft MLLW when photograph was taken.	Subtidal

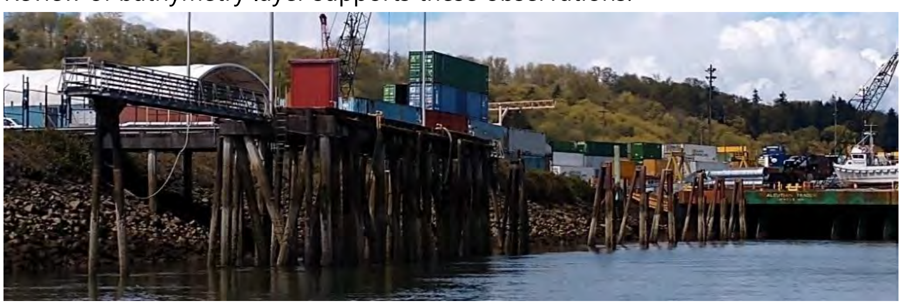
Grid(s)	Notes from April 19 Reconnaissance Survey	Recommended Sample Type to Target
8A, 8B, 5H	South side of Slip 2. Exposed intertidal mudflats observed during survey. No concerns with sampleability of intertidal in this area.  Tidal elevation of approximately -2 ft MLLW when photograph was taken.	Intertidal
9F, 9G, 10F	South side of Slip 2. Exposed intertidal mudflats observed during survey. No concerns with sampleability of intertidal in this area.  Tidal elevation of approximately -2 ft MLLW when photograph was taken.	Intertidal
11F	Reconnaissance limited by barge blocking view of this area. Significant amounts of riprap observed, but aerial photograph indicates that there is likely some sampleable intertidal. Target location placed based on review of aerial photo.	Intertidal
14F	No concerns with sampleability of intertidal in this area; exact placement of sample relative to riprap bank is uncertain and may need to be adjusted in the field.	Intertidal
15G	The majority of this grid is not sampleable, because of either the boat ramp or riprap slope along both sides of the boat ramp. The best target sample location is to the south of boat ramp in lower elevation portion of intertidal (outside of the 50-ft radius circle).	Intertidal

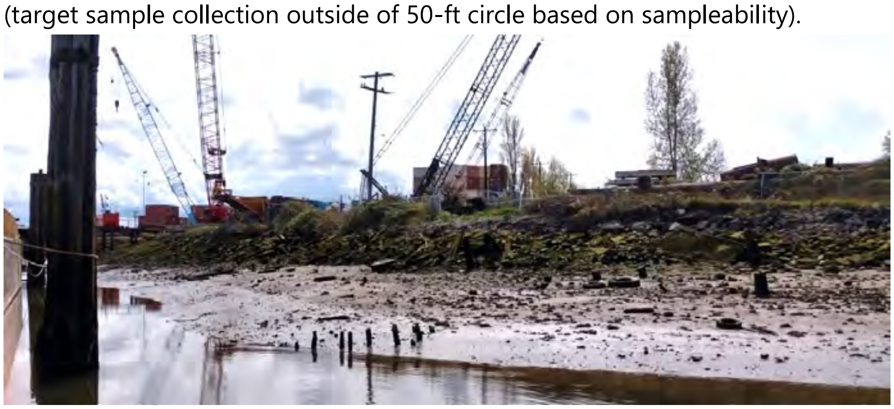
Grid(s)	Notes from April 19 Reconnaissance Survey	Recommended Sample Type to Target
18B, 18C	North side of Slip 3 is a steep riprap bank; no intertidal exposed intertidal sediment observed during April 19 survey. Review of bathymetry layer supports these observations. For grid 18B, target collection of subtidal sample in front of covered slip/boat house.   Tidal elevation of approximately -2 ft MLLW when photograph was taken.	Subtidal
18D, 19D, 20D	Head of Slip 3 is a riprap slope. April 19 survey indicates that there may be limited pockets of sediment in some areas between rocks and there may be sampleable intertidal in the lower portion of intertidal, but minimal exposed sediment was observed.    Tidal elevation of approximately -2 ft MLLW when photograph was taken.	Subtidal or Intertidal
24F, 25F	This area to the south of Slip 3 is a riprap slope. No exposed intertidal was observed during April 19 survey, but bathymetry indicates that lower elevation intertidal may be sampleable (this is consistent with observations just south of this stretch).   Tidal elevation of approximately -2 ft MLLW when photograph was taken.	Intertidal

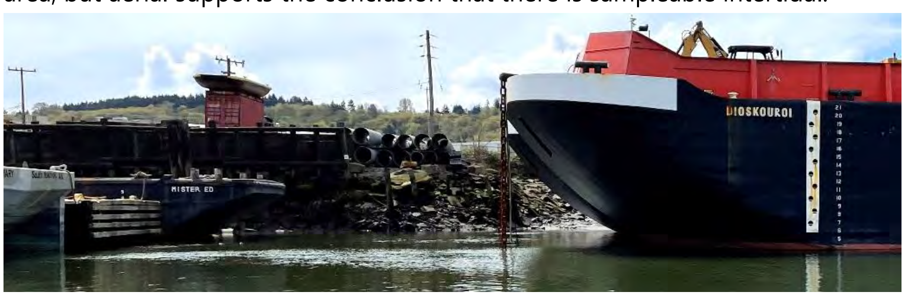
Grid(s)	Notes from April 19 Reconnaissance Survey	Recommended Sample Type to Target
26F, 27F	A thin band of exposed intertidal sediment below the riprap slope was observed during the April 19 survey. Bathymetry and observed sediment support collection of intertidal samples in these grids.    Tidal elevation of approximately -2 ft MLLW when photograph was taken.	Intertidal
28H	Areas of exposed sediment (particularly toward the head of the embayment) were observed at lower elevations below the riprap slope during the April 19 survey. Review of bathymetry layer supports the conclusion that the intertidal should be sampleable.  Tidal elevation of approximately -2 ft MLLW when photograph was taken.	Intertidal
29G	No exposed intertidal was observed during April 19 survey; riprap slope. However, review of the bathymetry layer indicates that lower elevation intertidal may be sampleable. See right side of photo for grid 28H.	Intertidal
30F	Shoreline is primarily riprap slope. Only area where exposed sediment was observed was a small area immediately south of wharf.	Subtidal
31F	No exposed intertidal was observed during April 19 survey; riprap slope. Review of bathymetry layer supports these observations.	Subtidal
34F-38F	No concerns with sampleability of intertidal in this area.	Intertidal
39F	Riprap slope and rocks at higher elevation; sampleable intertidal observed at lower elevation during the April 19 survey.  Tidal elevation of approximately -1.5 ft MLLW when photograph was taken.	Intertidal

Grid(s)	Notes from April 19 Reconnaissance Survey	Recommended Sample Type to Target
40G	Shoreline at the mouth of Slip 4 (north side) is a steep riprap slope; may be some intertidal here at lower elevation. Sampleable area is primarily subtidal.  Tidal elevation of approximately -1.5 ft MLLW when photograph was taken.	Subtidal
South side of Slip 4	South side of slip is mostly riprap slope. Area south of grid 42C with RI/FS samples with exceedances appears to be located at higher elevation on riprap slope. No exposed sediment observed during April 19 survey.  Tidal elevation of approximately -2 ft MLLW when photograph was taken.	No samples in this area.
West Shoreline Survey		
1B to 5B	No intertidal in front of Terminal 115 wharfs. 	Subtidal

FINAL

Grid(s)	Notes from April 19 Reconnaissance Survey	Recommended Sample Type to Target
11A	Minimal exposed intertidal observed during April 19 survey; steep riprap bank. May be small amount of intertidal sediment in SW corner of grid near outfalls. Review of bathymetry layer supports these observations.  Tidal elevation of approximately -2 ft MLLW when photograph was taken.	Intertidal (although sampleability is uncertain)
12A	Steep riprap bank; no sampleable intertidal observed during the April 19 survey. Review of bathymetry layer supports these observations.  Tidal elevation of approximately -2 ft MLLW when photograph was taken.	Subtidal
13A	Shoreline transitions from sampleable intertidal (south) to steep riprap slope (north). Target collection of sample in intertidal (outside of 50-ft circle).	Intertidal
14A	Riprap along most of shoreline in this area; target sample collection in northern half of grid with sampleable intertidal (outside of 50-ft circle).	Intertidal

Grid(s)	Notes from April 19 Reconnaissance Survey	Recommended Sample Type to Target
15A	Significant amounts of cobble/riprap observed during April 19 survey, but appear to be sampleable portions of the intertidal. Exact placement of sample relative to riprap bank is uncertain and may need to be adjusted in the field.  Tidal elevation of approximately -2 ft MLLW when photograph was taken.	Intertidal
16A-17A	Area under the 1st Ave S Bridge (includes 16A′, 17A′′′, 17A′′, and 17A′). No concerns with sampleability of intertidal in this area.	Intertidal
23A-25A	Numerous barges located in this area during reconnaissance. Based on the area that was visible during the April 19 survey, there appears to be a thin strip of intertidal that can be sampled in this area. Review of the bathymetry layer supports the conclusion there is sampleable intertidal in this area.	Intertidal
26A	A large portion of this grid is above MHHW and/or is a riprap bank. No concerns with sampleability of the lower elevation portion of the intertidal in this area (target sample collection outside of 50-ft circle based on sampleability).  Tidal elevation of approximately -1.5 ft MLLW when photograph was taken.	Intertidal
26B, 27B	No concerns with sampleability of intertidal in this area.	Intertidal

Grid(s)	Notes from April 19 Reconnaissance Survey	Recommended Sample Type to Target
28A, 28B	No concerns with sampleability of intertidal in this area. Target location for grid 28A has been shifted east to avoid riprap slope.  Tidal elevation of approximately -1.5 ft MLLW when photograph was taken.	Intertidal
29B, 30B	No reconnaissance possible during the April 19 survey because of numerous barges in this area. Area is not expected to have sampleable intertidal. No bathymetry information along the shoreline in this area, but aerial indicates that bank is a steep riprap slope.	Subtidal
31A	Area mostly blocked by a barge during the April 19 survey, but there appears to be sampleable intertidal. No bathymetry information along the shoreline in this area, but aerial supports the conclusion that there is sampleable intertidal.   Tidal elevation of approximately -2 ft MLLW when photographs were taken.	Intertidal
32B	Area mostly blocked by a barge during the April 19 survey. Shoreline is a riprap slope; no sampleable intertidal was observed.	Subtidal
33A	Appears to be mostly above MHHW and/or unsampleable because of the riprap slope. Target sample collection to the east in area with exposed sediment.	Intertidal
33B	No concerns with sampleability of intertidal in this area.	Intertidal
34B, 35B	No concerns with sampleability of intertidal in this area.	Intertidal

FINAL

<table>
<tr><th>Grid(s)</th><th>Notes from April 19 Reconnaissance Survey</th><th>Recommended Sample Type to Target</th></tr>
<tr><td>36A, 37A</td><td>No concerns with sampleability of intertidal in this area.</td><td>Intertidal</td></tr>
<tr><td>39B, 40B</td><td>No concerns with sampleability of intertidal in this area.

Tidal elevation of approximately -2 ft MLLW when photograph was taken.</td><td>Intertidal</td></tr>
<tr><td>41B</td><td>No concerns with sampleability of intertidal in this area.</td><td>Intertidal</td></tr>
<tr><td>43B</td><td>No concerns with sampleability of intertidal in this area.
 
Tidal elevation of approximately -1.5 ft MLLW when photograph was taken.</td><td>Intertidal</td></tr>
<tr><td>44B, 45B, 46B</td><td>No concerns with sampleability of intertidal in this area.

Tidal elevation of approximately -1.5 ft MLLW when photograph was taken.</td><td>Intertidal</td></tr>
</table>

Notes:

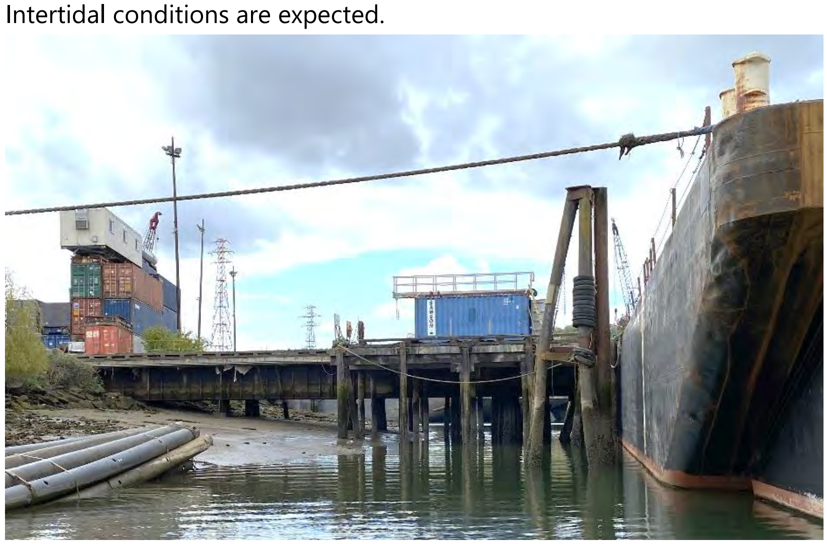
MHHW: mean higher high water

MLLW: mean lower low water

RI/FS: remedial investigation/feasibility study

Table D-7
Summary of Under-Structure Reconnaissance Survey Conducted on April 29, 2022

Structure	Notes from April 29 Reconnaissance Survey[1]
West Shoreline	
RM 1.6–RM 1.75 Northland North Wharf (Terminal 115)	No access issues are anticipated beyond coordination with site operations. Subtidal conditions are expected. 
RM 1.8 Northland South Pier (Terminal 115)	No Phase I sampling proposed at this location as structure is smaller than minimum target width for Phase I sampling.
RM 1.9 Seafreeze Pier (Terminal 115)	No Phase I sampling proposed at this location as structure is smaller than minimum target width for Phase I sampling.
RM 2.1 Alaska Marine Lines Yard No. 2	No access issues are anticipated beyond coordination with site operations. Surveys will be required to determine if water depth conditions are intertidal or subtidal.
RM 2.35 Boyer Alaska Barge Line North Lay Berth	No Phase I sampling proposed at this location as structure is smaller than minimum target width for Phase I sampling.
RM 2.45 Boyer Alaska Barge Line Seattle Main Wharf	No access issues are anticipated beyond coordination with site operations. Surveys will be required to determine if water depth conditions are intertidal or subtidal.
RM 2.6 Pacific Pile and Marine Mooring	No Phase I sampling proposed at this location as structure is smaller than minimum target width for Phase I sampling.

Structure	Notes from April 29 Reconnaissance Survey[1]
RM 2.75 Pacific Pile and Marine Wharf	The slope under the waterway side of the wharf is heavily armored and was observed to extend to within about 10 ft of the face of the structure. The distance between the toe of slope and north face of the wharf is assumed to be greater than 20 ft and can be accessed. Dive inspection will be required to confirm. 
RM 2.9 Silver Bay Logging Wharf	No access issues are anticipated beyond coordination with site operations. Surveys will be required to determine if water depth conditions are intertidal or subtidal.
East Shoreline	
RM 1.65 Certainteed Pier	No access issues are anticipated beyond coordination with site operations. Surveys will be required to determine if water depth conditions are intertidal or subtidal.
RM 1.7 Glacier Northwest Slip 2 Pier	No Phase I sampling proposed at this location as is smaller than minimum target width for Phase I sampling.
RM 1.8–RM 1.9 Samson Tug	No access issues are anticipated beyond coordination with site operations. Intertidal conditions are expected. 

Structure	Notes from April 29 Reconnaissance Survey[1]
RM 1.9–RM 2.0 Duwamish Marine Center	Sampling will occur as part of the primary grid plan described in Section 4.1.3. No access issues anticipated.
RM 2.05 Muckleshoot Tribe Marina	Intertidal area observed under southwest corner of main pier. May require sampling by foot or diver. No other access issues are anticipated beyond coordination with site operations. 
RM 2.1–RM 2.2 SeaTac Marine	The finger pier located in Slip 3 is narrow and covered by a precast concrete deck. The finger pier falls within the standard grid and sampling locations are located on both sides of the pier. Conditions under the finger pier are subtidal. Surveys will be required to determine if water depth conditions are intertidal or subtidal under the wharf located on the main waterway. No access issues are anticipated beyond coordination with site operations. 

Structure	Notes from April 29 Reconnaissance Survey[1]
RM 2.4–RM 2.55 Seattle Iron & Metals Wharves	Slope under north pier is armored and diver inspection is required to determine the location of the toe of armor. The south pier is in poor condition and is not safe to access (see photo). 
RM 2.8 8th Avenue Terminal Wharf	No access issues are anticipated beyond coordination with site operations. Surveys will be required to determine if water depth conditions are intertidal or subtidal.

Notes:

1. Tide elevations ranged from approximately +3 ft MLLW to +0.5 ft MLLW during the April 29 reconnaissance survey.

MHHW: mean higher high water

MLLW: mean lower low water

RM: river mile

Remedial Investigation/Feasibility Study Work Plan

Silver Bay Logging Site

Appendix C

Attachment C.3
Inadvertent Discovery Plan

I might implement the IDP if …

I see chipped stone artifacts.

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

I might implement the IDP if …

I 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

I might implement the IDP if …

I see bone or shell artifacts.

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

Bone Awls from Oregon and Bone Wedge from California

I might implement the IDP if …

I see bone or shell artifacts.

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

Tooth Pendant and Bone Pendants from Oregon and Washington

I might implement the IDP if …

I see fiber or wood artifacts.

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

Artifacts from Mud Bay, Olympia, Washington

I might implement the IDP if …

I see historic period artifacts.

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

I might implement the IDP if …

I see strange, different or interesting looking dirt, rocks, or shells

- 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 bone or artifacts
- Look for the “unusual” or out of place (e.g., rock piles or accumulations in areas with few rock)

I might implement the IDP if …

I see strange, different or interesting looking dirt, rocks, or shells

- “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

I might implement the IDP if …

I see strange, different or interesting looking dirt, rocks, or shells

- Often have a layered or "layer cake" appearance
- Often associated with black or blackish soil
- Often have very crush and compacted shell

I might implement the IDP if …

I see historic foundations or buried structures.

45KI924, In WSDOT ROW for SR 99 Tunnel

PLAN AND PROCEDURES FOR THE INADVERTENT DISCOVERY OF CULTURAL RESOURCES AND HUMAN SKELETAL REMAINS

SOUTH PARK WATER QUALITY FACILITY PROJECT, KING COUNTY WASHINGTON

1. INTRODUCTION

The Seattle Public Utilities (SPU) plans to construct the South Park Water Quality Facility project. The purpose of this project is to remove pollutants from stormwater prior to discharging into the Lower Duwamish Waterway. The following Inadvertent Discovery Plan (IDP) outlines procedures to follow, in accordance with state and federal laws, if archaeological materials or human remains are discovered.

2. RECOGNIZING CULTURAL RESOURCES

A cultural resource discovery could be prehistoric or historic. 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 (i.e. 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 other industrial materials.

When in doubt, assume the material is a cultural resource.

3. ON-SITE RESPONSIBILITIES

<u>STEP 1: STOP WORK.</u> If any SPU employee, contractor or subcontractor believes that he or she has uncovered a cultural resource at any point in the project, all work adjacent to the discovery must stop. The discovery location should be secured at all times.

<u>STEP 2: NOTIFY MONITOR.</u> If there is an archaeological monitor for the project, notify that person. If there is a monitoring plan in place, the monitor will follow its provisions.

<u>STEP 3: NOTIFY RECIPIENT PROJECT MANAGER.</u> Contact the SPU Project Manager or applicable contacts:

SPU Project Manager:

Christina Kapoi

206-775-4138

Christina.kapoi@seattle.gov

Cultural Resources Project Manager

Heather Walker-Taylor

206.233.3711

Cell: 206.643.4108

Heather.walker-taylor@seattle.gov

Assigned Alternates:

Project Engineer:

Joelle Torre

206-733-9507

Joelle.torre@seattle.gov

Alternate CR Specialist:

Clay Antieau

206.684.7413

Clayton.Antieau@seattle.gov

The Project Manager or alternate staff above will make all other 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 in place and to shield them from being photographed. **Do not call 911 or speak with the media.**

4. FURTHER CONTACTS AND CONSULTATION

A. Project Manager's Responsibilities:

- **Protect Find**: The SPU Project Manager is responsible for taking appropriate steps to protect the discovery site. All work will stop in an area adequate to provide for the total security, protection, and 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 On-site**: The SPU Project Manager may direct construction away from cultural resources to work in other areas prior to contacting the concerned parties. Construction in the discovery area may resume as described in Section 7.

- **<u>Contact Cultural Resources Program Manager</u>**: If the CR Program Manager has not yet been contacted, the Project Manager will do so.

B. Cultural Resources Program Manager's Responsibilities:

- **<u>Identify Find</u>**: The CR Program Manager (or a Cultural Resource Specialist if so delegated), will ensure that a qualified professional archaeologist examines the find to determine if it is archaeological.
    - If it is determined not archaeological, work may proceed with no further delay.
    - If it is determined to be archaeological, the CR Manager or Cultural Resource Specialist will continue with notification.
    - If the find may be human remains or funerary objects, CR Manager or Cultural Resource Specialist will ensure that a qualified physical anthropologist examines the find. **If it is determined to be human remains, the procedure described in Section 5 will be followed.**
- **<u>Notify DAHP</u>**: The CR Program Manager (or a Cultural Resource Specialist if so delegated) will contact the involved federal agencies (if any) and the Department of Archaeology and Historic Preservation (DAHP).
- **<u>Notify Tribes</u>**: If the discovery may relate to Native American interests, the Manager or Specialist will also contact the project's Tribal Liaison, or, if the project is not assigned a Liaison, the Executive Tribal Liaison.

General Contacts

Agencies included if permit, land ownership, or funding triggers inclusion.

<u>Washington State Department of Archaeology and Historic Preservation:</u>

Allyson Brooks
State Historic Preservation Officer
360-586-3066
Allyson.brooks@dahp.wa.gov

Rob Whitlam
State Archaeologist
360-586-3050
360.890.2615 cell
Rob.Whitlam@dahp.wa.gov

The Tribal Liaison, or CR Program Manager or Specialist, will contact the interested and affected Tribes. Tribes consulted on this project are:

Muckleshoot Tribe
Jaison Elkins
Chairman
253.939.3311
Jaison.Elkins@muckleshoot.nsn.us

Muckleshoot Tribe
Laura Murphy
Cultural Resource
253.876.3272
Laura.murphy@muckleshoot.nsn.us

Puyallup Tribe of Indians
Bill Sterud
Chairman
253.573.7815
Bill.sterud@puyalluptribe.com
counciloffices@puyalluptribe-nsn.gov

Puyallup Tribe of Indians
Brandon Reynon
Cultural Resources
253.573.7986
Brandon.reynon@puyalluptribe-nsn.gov
Historicpreservation@puyalluptribe-nsn.gov

Snoqualmie Tribe
Robert de los Angeles
Chairman
425.888.6551
bobde@snoqualmietribe.us

Snoqualmie Tribe
Steven Moses
Director of Archaeology and Historic Preservation
425.292.0249 x2010
steve@snoqualmietribe.us

Stillaguamish Tribe of Indians
Shawn Yanity
Chairman
360.652.7362 x228
syanity@stillaguamish.com

Stillaguamish Tribe of Indians
Kerry Lyste
Cultural Resources
360.657.3687 x14
klyste@stillaguamish.com

Suquamish Tribe
Leonard Forsman
Chairman
360.598.3311
lforsman@suquamish.nsn.us

Suquamish Tribe
Dennis Lewarch
Tribal Historic Preservation Officer
360.394.8529
dlewarch@suquamish.nsn.us

Tulalip Tribes
Teri Gobin
Chairwoman
360.716.4500

Tulalip Tribes
Richard Young
Cultural Resources
360.716.2652
425.239.0182 cell
ryoung@tulaliptribes-nsn.gov

C. Further Activities

- Archaeological discoveries will be documented as described in Section 6.
- Construction in the discovery area may resume as described in Section 7.

5. SPECIAL PROCEDURES FOR THE DISCOVERY OF HUMAN SKELETAL MATERIAL

Any human skeletal remains, regardless of antiquity or ethnic origin, will at all times be treated with dignity and respect.

If the project occurs on federal lands (e.g., national forest or park, military reservation) the provisions of the Native American Graves Protection and Repatriation Act of 1990 apply, and the responsible federal agency will follow its provisions. Note that state highways that cross federal lands are on an easement and are not owned by the state.

If the project occurs on non-federal lands, SPU will comply with applicable state and federal laws, and the following procedure:

A. Notify Law Enforcement Agency or Coroner's Office:

In addition to the actions described in Sections 3 and 4, the Project Manager will immediately notify the local law enforcement agency or coroner's office.

The medical examiner (with assistance of law enforcement personnel) will determine if the remains are human, whether the discovery site constitutes a crime scene, and will notify DAHP if the remains are determined to be non-forensic.

Richard Harruff, Chief Medical Examiner
King County Medical Examiner's Office
206.731.3232

Guy Tasa, State Physical Anthropologist
DAHP
360.586.3534
360.790.1633 cell
Guy.tasa@dahp.wa.gov

B. Participate in Consultation:

Per RCW 27.44.055, RCW 68.50, and RCW 68.60, DAHP will have jurisdiction over non-forensic human remains and will make a determination of whether the remains are Indian or not and notify all affected tribes. SPU personnel will participate in consultation.

C. Further Activities:

- 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.
- When consultation and documentation activities are complete, construction in the discovery area may resume as described in Section 7.

6. 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.

Cultural Resources Program staff will ensure the proper documentation and assessment of any discovered cultural resources in cooperation with the federal agencies (if any), DAHP, affected tribes, and a contracted consultant (if any).

All prehistoric and historic cultural material discovered during project construction will be recorded by a professional archaeologist on cultural resource site or isolate form using standard techniques. Site overviews, features, and artifacts will be photographed; stratigraphic profiles and soil/sediment descriptions will be prepared for 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 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 provenience.

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 include plan maps for each excavated level, and material type, number, and vertical provenience (depth below surface and stratum association where applicable) for all artifacts recovered from the level. A stratigraphic profile will be drawn for at least one wall of each test excavation unit.

Sediments excavated for purposes of cultural resources investigation will be screened through 1/8-inch mesh, unless soil conditions warrant ¼-inch mesh.

All 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 any), DAHP, and the affected tribes.

Within 90 days of concluding fieldwork, a technical report describing any and all monitoring and resultant archaeological excavations will be provided to the Project Manager, who will forward the report to the SPU Cultural Resources Program for review and delivery to the federal agencies (if any), SHPO, and the affected tribe(s).

If assessment activity exposes human remains (burials, isolated teeth, or bones), the process described in Section 5 above will be followed.

7. PROCEEDING WITH CONSTRUCTION

Project construction 100 feet outside the discovery location may continue while documentation and assessment of the cultural resources proceed. A SPU CR Specialist must determine the boundaries of the discovery location. In consultation with DAHP and affected tribes, Project Manager and Cultural Resources Program staff will determine the appropriate level of documentation and treatment of the resource. If federal agencies are involved, the agencies will make the final determinations about treatment and documentation.

Construction may continue at the discovery location only after the process outlined in this plan is followed and SPU (and the federal agencies, if any) determine that compliance with state and federal laws is complete.

Remedial Investigation/Feasibility Study Work Plan

Silver Bay Logging Site

Appendix D
Health and Safety Plan

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List of Abbreviations

Abbreviation	Definition
AO	Agreed Order
APP	Accident Prevention Plan
COC	Contaminant of concern
COI	Contaminant of Interest
cPAH	Carcinogenic polycyclic aromatic hydrocarbons
CVOC	Chlorinated volatile organic compound
DOSH	Division of Occupational Safety and Health
DRO	Diesel Range Organics
DQO	Data Quality Objective
EZ	Exclusion Zone
HASP	Health and Safety Plan
HSO/SS	Health and Safety Officer/Site Supervisor
LDW	Lower Duwamish Waterway
LDWG	LDW Group
MHHW	Mean higher high water
MTCA	Model Toxics Control Act

Abbreviation	Definition
ORO	Oil Range Organics
OSHA	Occupational Safety and Health Act
PM	Particulate matter
PCB	Polychlorinated biphenyl
PCE	Tetrachloroethene
PID	Photoionization detector
PPE	Personal protective equipment
ppm	Parts per million
ROW	Right of Way
SPU	Seattle Public Utilities
SSO	Site Safety Officer
SZ	Support Zone
TPH	Total petroleum hydrocarbons
USDOT	United States Department of Transportation
VOC	Volatile organic compound
XRF	X-ray fluorescent

1.0 Plan Objectives and Applicability

This Health and Safety Plan (HASP) has been written to comply with the standards prescribed by the Occupational Safety and Health Act (OSHA) and the Washington Industrial Safety and Health Act.

The purpose of this HASP is to establish site-specific protection standards and mandatory safe practices and procedures for all personnel involved with supplemental characterization of soil, groundwater and sediment at the Silver Bay Logging Site, in Seattle, Washington. It has been prepared as a supplement to Floyd|Snider's Accident Prevention Plan (APP; Attachment D.1).

This HASP establishes standard operating procedures and provides for contingencies that may be implemented during field work activities. This HASP consists of site and facility descriptions, a summary of work activities, the identification and evaluation of chemical and physical hazards, monitoring procedures, a description of Site zones, decontamination and disposal practices, and emergency procedures.

The provisions and procedures outlined in this HASP apply to all Floyd|Snider personnel onsite. Contractors, subcontractors, other oversight personnel, and all other persons involved in the field work activities described herein are required to develop and comply with their own HASP, or Job Safety Analysis but must also comply with the requirements of this HASP on job sites managed by Floyd|Snider. All Floyd|Snider staff conducting field activities are required to read this HASP and indicate that they understand its contents by signing the Health and Safety Officer/Site Supervisor's (HSO/SS's) copy of this plan prior to conducting field work activities. A copy of this plan must be maintained on site at all times by the HSO/SS.

This HASP is based on information that was available as of the date indicated on the title page. Additional hazards not specifically addressed by this HASP may exist at the work site or may be created as a result of site activities. Should project personnel identify a site condition that is not addressed by this HASP and have any questions or concerns about site conditions, they should immediately notify the HSO/SS, and work shall be paused to assess any new hazards. If any new hazards identified can be mitigated or controlled, work can proceed and the HASP will be revised, if appropriate.

The HSO/SS has field responsibility for ensuring that the HASP adequately protects worker health and safety and is properly implemented. In this capacity, the HSO/SS will conduct regular site inspections and has the authority to make health and safety decisions that may not be specifically outlined in this HASP based on site conditions. If the HSO/SS leaves the site while work is in progress, an alternate Site Safety Officer (SSO) will be designated. Personnel responsibilities are further described in the APP.

This HASP was reviewed by the Project Manager and the HSO/SS prior to commencement of work activities.

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2.0 Background Information

2.1 SITE BACKGROUND

This HASP was prepared to support the Remedial Investigation/Feasibility Study Work Plan prepared by Floyd|Snider and the combined technical team from Floyd|Snider and HDR, Inc. for the Seattle Public Utilities (SPU) South Park Water Quality Facility project (Water Quality Facility project, or project). The project is generally located at 816 S. Kenyon Street in Seattle, Washington (defined as the Property; refer to Figure D.1).

The Property is currently on the Washington State Department of Ecology's database of confirmed and suspected contaminated sites, listed as Independent Metals Plant 2 (aka, the Site). The Property additionally lies adjacent to the Lower Duwamish Waterway (LDW) and sediments in the adjacent waterway are within the middle reach of the LDW Superfund Site. The Property is currently occupied by American Gypsum, an active drywall recycling facility.

Figure D.1
Vicinity Map

The ground surface of the Property is generally flat and consists of a mixture of gravel, asphalt, and concrete areas. It is accessed by a security fence on 8th Avenue S at the intersection with S Chicago Street. To the east, the Property boundary is the LDW shoreline, which runs diagonally from the northwest to the southeast. Current features of the Property are shown on Figure D.2.

Figure D.2
Current Property Features

Several environmental investigations have been conducted at the Property. Also, several interim actions, such as focused excavations and removal of underground storage tanks, have been conducted. This field effort will help with further characterization and determine contaminants of concern (COCs). Previous investigations have confirmed the presence of the following contaminants at the Property:

- Metals (arsenic and lead), petroleum (diesel-range organics [DRO] and oil-range organics [ORO]) and chlorinated volatile organic compounds (CVOCs) in groundwater
- Metals (arsenic and lead), and petroleum (DRO and ORO) in soil

Other suspected contaminants have been identified at the Property based on previous operations, which included boat building/repair, metals recycling, a gasoline service station/battery shop, petroleum storage and handling, and log handling. Other key potential contaminants at the Property for development of this HASP include additional metals, gasoline-range organics; carcinogenic polycyclic aromatic hydrocarbons (cPAHs); pentachlorophenol and other phenols; benzene, toluene ethylbenzene and xylenes; dioxins/furans; and acetaldehyde.

Floyd|Snider will be conducting investigation activities at the Property, and adjacent riverbank and sediment areas.

2.2 SCOPE OF WORK

The purpose of the investigation is to characterize the nature and extent (both vertically and horizontally) of contamination in environmental media to provide sufficient information to evaluate and select cleanup actions. The investigation will consist of the following:

- Conducting a public and private utility locate.
- Screening of metal impacts along the riverbank metals through X-ray fluorescent (XRF) screening.
- Reconnaissance of existing monitoring wells.
- Advancing direct-push or hollow-stem auger to complete soil borings.
- Collecting and analyzing selected soil samples.
- Advancing hollow-stem auger borings to install new monitoring wells. If needed, reinstalling existing monitoring wells.
- Developing new and existing monitoring wells.
- Collecting groundwater samples from new and existing monitoring wells.
- Performing slug testing in designated wells.
- Conducting a top-of-casing and surface elevation survey of new and existing monitoring wells.
- Collecting sediment grab samples.

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3.0 Emergency Contacts and Information

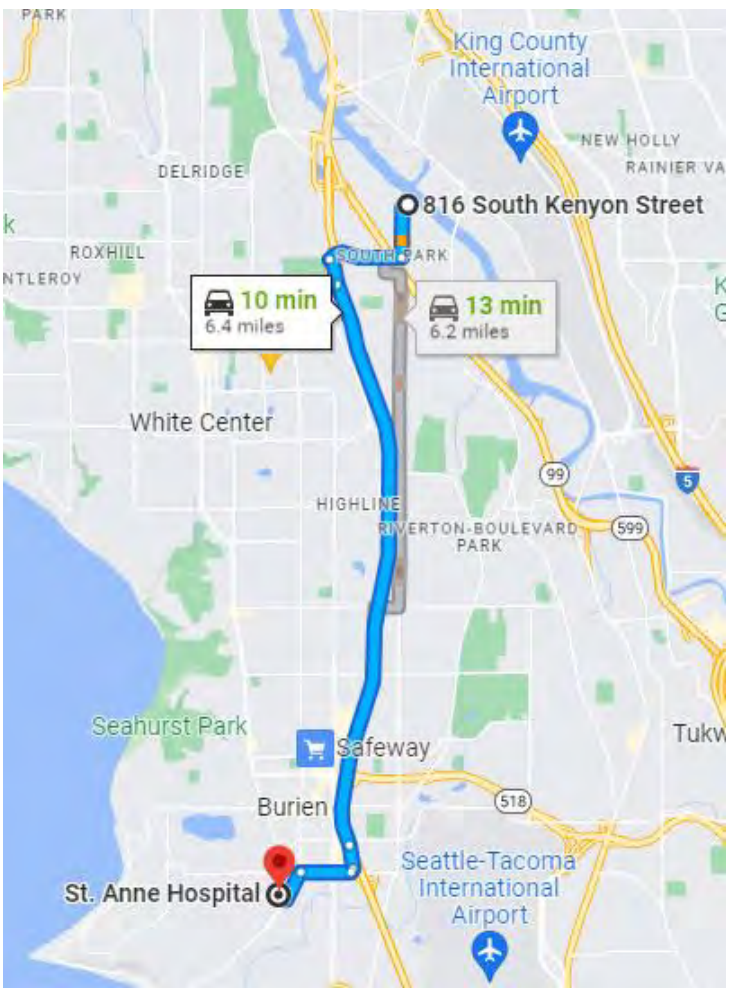
3.1 DIAL 911

In the event of an emergency, dial 911 to reach fire, police, and first aid.

3.2 HOSPITAL AND POISON CONTROL

Nearest Hospital Location and Telephone: (Refer to Figure D.3 for directions and map to the hospital.)	St. Anne Hospital 16251 Sylvester Rd SW Burien, WA 98166 (206) 244-9970
Washington Poison Control Center:	(800) 222-1222

Figure D.3
Hospital Directions



1. Get on WA-509 S from 8th Ave S and S Cloverdale St – 4 min (1.2 mi)
2. Follow WA-509 S to S 160th St in Burien. Exit from WA-509 S – 5 min (4.5 mi)
3. Follow S 160th St and Sylvester Rd SW to your destination – 3 min (0.7 mi)
4. Arrive at St. Anne Hospital

3.3 PROVIDE INFORMATION TO EMERGENCY PERSONNEL

All Floyd|Snider project personnel should be prepared to give the following information:

Information to give to Emergency Personnel	
Site Location: (Refer to Figure D.2)	Gypsum to Gypsum 816 S. Kenyon Street Seattle, WA 98108 This information is for the primary facility within the Study Area where most of the field work will be conducted. The facility is fenced and accessed by a security gate on 8th Avenue S at the intersection with S Chicago Street.
Number You Are Calling From:	This information can be found on the phone you are calling from.
Type of Accident or Type(s) of Injuries:	Describe accident and/or incident and number of individuals needing assistance.

3.4 UTILITY EMERGENCY CONTACTS

Additional entities that may need to be contacted in the event of an emergency involving damage to a utility include the following:

Seattle City Light Emergency Line (1):	(206) 684-3000
Puget Sound Energy Gas Emergency Line:	(888) 225-5773
Seattle Public Utilities Emergency Response Line (2)	(206) 386-1800

Notes:
1 In event a downed power line, call 911.
2 Emergencies for SPU notification include spills larger than 5 gallons, spills of unknown substances, and/or spills that threaten waterways, stormwater, or sewer systems.

3.5 PROJECT CONTACTS

After contacting emergency response crews as necessary, contact the Floyd|Snider PM, or a Principal, to report the emergency. The Floyd|Snider Project Manager may then contact SPU or direct the field staff to do so.

Floyd|Snider Emergency Contacts:

Contact	Office Phone Number	Cell Phone Number
Cheronne Oriero, Floyd| Snider HSO/SS	(206) 292-2078	(206) 334-4992
Kristin Anderson, Floyd|Snider alternate SSO		(206) 552-4241
Kate Snider, Floyd|Snider Principal		(206) 375-0762
Dan Hennessy, Floyd|Snider PM		(206) 491-0610
Lanelle Ezzard, HDR PM	(206) 826-4734	(206) 724-2209

Property Emergency Contacts:

Contact	Office Phone Number	Cell Phone Number
Christina Kapoi, SPU	--	(206) 775-4138
Chris Stapleton, Gypsum to Gypsum	(206) 826-4734	(206) 724-2209

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4.0 Hazard Evaluation and Risk Analysis

The typical fire, explosion, and physical hazards likely to be present on the job site, and procedures to control the mitigation of these hazards, are presented in the APP. This HASP presents additional information regarding site-specific hazards, including chemical exposure hazards associated with site COCs or the scope of field activities and analysis of the hazards associated with each site investigation task.

4.1 CHEMICAL EXPOSURE HAZARDS

This section describes potential chemical hazards associated with the field activities being conducted. Based on previous site data, elevated concentrations of the following chemicals may be encountered at the Site:

- Metals (arsenic and lead), TPH (DRO+ORO) and CVOCs (Tetrachloroethene [PCE] and volatile compounds) in groundwater
- Metals (arsenic and lead), and TPH (DRO+ORO) soil

Human health hazards associated with these chemicals are presented in the following table. This information covers potential toxic effects that might occur in the event of relatively significant acute and/or chronic exposure. Potential routes of exposure include inhalation, dermal contact, ingestion, and eye contact.

In general, the chemicals that may be encountered as part of this field investigation are not expected to be present at concentrations that could result in significant exposures. The types of planned work activities and use of monitoring procedures and protective measures will limit potential exposures at this Site. The use of appropriate personal protective equipment (PPE) and decontamination practices will assist in controlling exposure by means of all pathways to the contaminants listed in the following table.

Chemical Hazard	OSHA or DOSH-Permissible Exposure Limits (8-hour TWA/STEL)	Maximum Historical Concentration	Routes of Exposure	Potential Toxic Effects
Chlorinated Volatile Organic Compounds				
PCE	25 ppm / 38 ppm	0.75 mg/kg in soil, 6400 µg/L in groundwater	Inhalation, skin absorption, ingestion, skin/eye contact	Eye irritation; allergic dermatitis; chloracne; GI distress; liver, kidney damage; breast and other cancers.

Chemical Hazard	OSHA or DOSH-Permissible Exposure Limits (8-hour TWA/STEL)	Maximum Historical Concentration	Routes of Exposure	Potential Toxic Effects
Chlorinated Volatile Organic Compounds (cont.)				
TCE	50 ppm / 200 ppm	0.034 mg/kg in soil, 300 µg/L in groundwater	Inhalation	Dermatitis; bronchitis; lung, skin, and stomach cancer.
cis-1,2-DCE	200 ppm / 250 ppm	1,800 µg/L in groundwater	Inhalation, skin absorption, ingestion, skin/eye contact	Ulceration of nasal septum; dermatitis; GI disturbance; respiratory irritation; hyperpigmentation of skin; skin and lung cancer.
Vinyl Chloride	1 ppm / 5 ppm	280 µg/L in groundwater	Inhalation, skin/eye contact	Lassitude; abdominal pain, GI bleeding; enlarged liver; pallor or cyanosis of extremities; carcinogenic.
Metals				
Arsenic	0.002 mg/m^3 / 0.010 mg/m^3	180 µg/L in groundwater	Inhalation, skin absorption, ingestion, skin/eye contact	Ulceration of nasal septum; dermatitis; GI disturbances; peripheral neuropathy; respiratory irritation; hyperpigmentation of skin; carcinogenic.
Barium	None / 0.5 mg/m^3	2,400 µg/L in groundwater	Inhalation, ingestion, skin/eye contact	Irritation of eyes, skin, upper respiratory system; skin burns; gastroenteritis; muscle spasm; slow pulse, extrasystoles; hypokalemia.

Chemical Hazard	OSHA or DOSH-Permissible Exposure Limits (8-hour TWA/STEL)	Maximum Historical Concentration	Routes of Exposure	Potential Toxic Effects
Metals (cont.)				
Cadmium	0.005 mg / 0.5 mg/m^3	6 µg/L in groundwater	Inhalation, ingestion	Pulmonary edema, dyspnea, cough, chest tight, substernal pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia, emphysema, proteinuria, mild anemia; carcinogenic.
Chromium	None / 0.5 mg/m^3	930 µg/L in groundwater	Inhalation, ingestion, skin/eye contact	Irritation of eyes; sensitization dermatitis.
Lead	0.05 mg/m^3 / action level of 0.03 mg/m^3	380 µg/L in groundwater	Inhalation, ingestion, skin/eye contact	Weakness, insomnia, facial pallor, weight loss, constipation, abdominal pain, anemia, tremors, eye irritation, hypotension, central nervous system deficits, reproductive system effects.
Total Petroleum Hydrocarbons				
Diesel-Range and Heavy Oil-Range Organics	None established	2,400 mg/kg in soil; 720 µg/L in groundwater	Inhalation, skin/eye contact	Irritation of eyes, reduction in pulmonary function, and effects to central nervous system.

Chemical Hazard	OSHA or DOSH-Permissible Exposure Limits (8-hour TWA/STEL)	Maximum Historical Concentration	Routes of Exposure	Potential Toxic Effects
Total Petroleum Hydrocarbons (cont.)				
Gasoline Range Hydrocarbons	300 ppm / 500 ppm	1,800 mg/kg in soil	Inhalation, skin absorption, ingestion, skin/eye contact	Irritation of eyes, skin, mucus membranes; headache; fatigue; blurred vision; dizziness; slurred speech; confusion; convulsions; liver, kidney damage.
Benzene	1 ppm / 5 ppm	6 mg/kg in soil; 13 µg/L in groundwater	Inhalation, skin absorption, ingestion, skin/eye contact	Irritation to eyes, skin, mucus membranes; headache; fatigue; blurred vision; dizziness; convulsions; liver, kidney damage; carcinogenic.
Toluene	100 ppm / 150 ppm	4.84 µg/L in groundwater	Inhalation, skin absorption, ingestion, skin/eye contact	Irritation to eyes, nose; lassitude, confusion, euphoria, dizziness, headache; dilated pupils, lacrimation; anxiety, muscle fatigue, insomnia; paresthesia; dermatitis; liver, kidney damage.
Ethylbenzene	100 ppm / 125 ppm	12 mg/kg in soil	Inhalation, ingestion, skin/eye contact	Irritation to eyes, skin, mucus membranes; headache; dermatitis; narcosis, coma.

Chemical Hazard	OSHA or DOSH-Permissible Exposure Limits (8-hour TWA/STEL)	Maximum Historical Concentration	Routes of Exposure	Potential Toxic Effects
Total Petroleum Hydrocarbons (cont.)				
Xylenes	100 ppm / 150 ppm	11.51 mg/kg in soil	Inhalation, skin absorption, ingestion, skin/eye contact	Irritation to eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis.
Others				
PCBs	0.5 mg/m^3	6.7 mg/kg in soil	Inhalation, skin absorption, ingestion, skin/eye contact	Carcinogen, irritation of the nose and lungs, skin irritations, and eye irritation
cPAHs (as coal tar volatiles)	0.2 mg/m^3 (TWA)	2.1 mg/kg in soil	Inhalation, skin/eye contact	Dermatitis; respiratory system irritation; carcinogen
Pentachlorophenol	0.5 mg/m^3 (TWA)	No data available	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation to eyes, nose, throat; weakness/exhaustion; sweating; headache; dizziness; nausea/vomiting; difficulty breathing; chest pain; high fever
Dioxins/furans (as 2,3,7,8,-TCDD)	None	No data available	Inhalation, absorption, ingestion, dermal contact	Irritation to eyes; dermatitis or chloracne; gastrointestinal disturbance; carcinogen

Chemical Hazard	OSHA or DOSH-Permissible Exposure Limits (8-hour TWA/STEL)	Maximum Historical Concentration	Routes of Exposure	Potential Toxic Effects
Others (cont.)				
Acetaldehyde	200 ppm (TWA)	No data available	Inhalation, ingestion, dermal contact	Irritation to eyes, nose, throat; skin burns; cough; central nervous system depression
Laboratory Preservatives (hydrochloric acid, methanol, sodium bisulfate, nitric acid)	Not applicable	Not applicable	Dermal contact, eye contact	Irritation to skin or eyes. Avoid contact by proper use of PPE during sample handling and collection.
Gypsum Dust (Environmental)	15 mg/m^3 (total) 5 mg/m^3 (respirable)	Not applicable	Inhalation, Ingestion	irritation eyes, skin, mucous membrane, upper respiratory system; cough, sneezing, rhinorrhea

Abbreviations:

GI	Gastrointestinal
mg/kg	Milligrams per kilogram
µg/L	Micrograms per liter
mg/m3	Milligrams per cubic meter
ppm	Parts per million
STEL	Short-term exposure limit
TWA	Time-weighted average

4.2 JOB HAZARD ANALYSIS

This section identifies potential hazards associated with each task listed in Section 2.2 of this HASP. Tasks have been grouped according to the types of potential hazards associated with them.

Work Task	Potential Hazards	Actions to Control Hazards
General equipment loading and mobilization, demobilization	Damage or injury from unsecured cargo	Ensure that all cargo is secured when packing equipment in or out. Prevent movement of equipment while vehicle is in operation.
	Musculoskeletal injuries (strain, sprain, broken bones, etc.) from lifting/moving tools and equipment	Use proper lifting techniques and mechanical devices where appropriate. The proper lifting procedure first involves testing the weight of the load by tipping it. If in doubt, ask for help. Do not attempt to lift a heavy load alone. Take a good stance and plant your feet firmly with legs apart, one foot farther back than the other. Make sure you stand on a level area with no slick spots or loose gravel. Use as much of your hands as possible. Push up with your leg muscles. Keep your back straight, almost vertical. Bend at the knees, not at the waist and keep load centered around feet as much as possible. Avoid quick, jerky movements and twisting motions. Never try to lift more than you are accustomed to.
Installing monitoring wells via drill rig and collecting sediment samples	Head strike, falling and/or sharp objects, bumping hazards	All personnel will wear hard hats at all times when overhead hazards exist, such as during drilling activities and around heavy or large equipment. All project personnel will make eye contact with the operator and obtain a clear “OK” before approaching or working within the swing radius of heavy equipment, staying clear of the swing radius.
Site surveying and moving between sample stations along uneven ground	Foot/ankle twist, crush, or slip/trip/fall; Sharp objects, dropped objects, uneven and/or slippery surfaces	Steel-toed boots must be worn onsite at all times while heavy equipment is present. Pay attention to footing on uneven or wet terrain and do not run. Keep work areas organized and free from unmarked trip hazards.

Work Task	Potential Hazards	Actions to Control Hazards
Sample collection using hand tools	Hand cuts, splinters, and/or chemical irritation/ burns; fingers pinched or crushed	Nitrile safety gloves will be worn to protect the hands from dust and chemicals. Leather or cotton outer gloves will be used when handling sharp-edged rough materials or equipment. Refer to preventive measures for mechanical hazards below.
Collecting samples of environmental media and sample homogenization	Sharp objects, poor lighting, flying debris or splashes	Wear safety glasses at all times while onsite. If a pressure washer is used to decontaminate heavy equipment, a face shield will be worn over safety glasses or goggles. Care will be taken during decontamination procedures and groundwater sampling to avoid splashing or dropping equipment into decontamination water.
Work around electrical lines or powered sampling equipment	Electrical hazards from underground utilities, overhead utilities; electrical cord hazards, such as well-development pumps	Utility locator service will be used to locate all underground utilities prior to excavation. Visual inspection of work areas will be conducted prior to starting work. Whenever possible, avoid working under overhead high-voltage lines. Make sure that no damage to extension cords occurs. If an extension cord is used, make sure it is the proper size for the load that is being served and rated SJOW or STOW (an “-A” extension is acceptable for either) and inspected for defects prior to use. The plug connection on each end should be of good integrity. Insulation must be intact and extend to the plugs at either end of the cord. All portable power tools will be inspected for defects before use and must be either a double-insulated design or grounded with a ground-fault circuit interrupter (GFCI).

Work Task	Potential Hazards	Actions to Control Hazards
Work in roadways or Property drive aisles	Traffic collision hazards; risk of crushing injuries from equipment	Ensure the use of competent operators, backup alarms, regular maintenance, daily mechanical checks, and proper guards. When working in or near the right of way (ROW; sidewalks, roadway, and crosswalks), orange cones and/or flagging will be placed around the work area. Safety vests will be worn at all times while conducting outdoor work. Multiple field staff will work together (buddy system) and spot traffic for each other. Avoid working with your back to traffic whenever possible. Work within the roadway will be avoided whenever possible due to direct traffic hazards by moving drilling locations within planters, empty lots, or sidewalks. If work requires being within a roadway, efforts will be made to minimize the time within the roadway. A ROW permit will be obtained if required and traffic control will be implemented in accordance with the permit. If and when traffic control is required for ROW work or at all times while working within a ROW, an American National Standards Institute (ANSI) class 2 compliant safety vest or garment must be worn. Ensure that all personnel have reviewed and understand the traffic control plan if applicable. All work within the ROW will be coordinated with the City Vehicles and equipment shall be positioned such that the equipment is between traffic and the personnel and never such that personnel are between traffic and equipment.

Work Task	Potential Hazards	Actions to Control Hazards
Concrete and metal coring and drilling	Noise/ hearing damage	Wear earplugs or protective ear covers when heavy equipment is operating and when a conversational level of speech is difficult to hear at a distance of 3 feet; when in doubt, a sound level meter may be used onsite to document noise exposure.
Working in the active gypsum facility	Inhalation of respirable particles, coughing, skin, eye, and respiratory irritation	Monitor dust levels, voluntary respirator use for nuisance dust levels utilize engineering controls.
In-water sediment and riverbank sampling	Drowning risk	Use caution on slippery, uneven work, when working in water use PFD and work in pairs. Obey all crew instructions when working on vessels; wear a hardhat when working on vessels with overhead hazards.
Xray (XFR) equipment usage	Xray exposure, skin, eye damage	Complete XRF safety training course provided by manufacturer, ensure proper use of equipment at all times.

5.0 Site Controls and Monitoring

The following sections describe site controls and monitoring that will be implemented during site field activities. The HSO/SS, or a designated alternate (SSO), is responsible for inspecting the work area daily and identifying additional hazards. Personnel responsibilities are further described in the APP.

5.1 DAILY SAFETY MEETINGS

A safety meeting will be conducted by the HSO/SS or designated SSO daily prior to the start of work. Additional safety briefings or safety checks should also be performed when switching tasks or whenever new hazards are identified. Safety meetings topics and attendance will be recorded on the Daily Tailgate Safety Meeting and Debrief Form provided in Attachment D.2.

Any near-misses or incidents that occur on the job site will be recorded on the Near Miss and Incident Reporting Form provided in Attachment D.3.

5.2 EMERGENCY MUSTER POINT

A muster point of refuge (that is clear of adjacent hazards and not located downwind of site investigation activities) will be identified by the HSO/SS and communicated to the field team each day. Based on activities onsite, particularly industrial activities at the gypsum facility, the HSO/SS will determine safe muster point. In an emergency, all field personnel and visitors will evacuate to the muster point for roll call. It is important that all persons onsite understand their role in an emergency and that they remain calm and act efficiently to ensure everyone’s safety.

The APP describes required emergency equipment and procedures to be followed in the case of medical emergency; release of a hazardous substance; or other emergencies such as a thunderstorm, vehicle collision, fire, or earthquake.

5.3 PERSONAL PROTECTIVE EQUIPMENT

Work will proceed in standard Level D as described in the APP, which shall include a hard hat, steel-toed boots, hearing protection (if equipment generates noises that make conventional levels of speech difficult to hear from 3 feet), eye protection, gloves (when working with sharp tools), and sturdy and removable outer work clothing. PPE should be inspected for defects before each use. Field staff will use clean, disposable nitrile gloves when handling sample material.

All personnel will be properly fitted and trained in the use of PPE. The level of protection will be upgraded by the HSO/SS whenever warranted by conditions in the work area. The HSO/SS will periodically inspect equipment such as gloves and hard hats for defects.

For all work involving potential exposure to soil or groundwater, workers will wear nitrile gloves and Level D PPE. High-visibility vests will be worn when working around heavy equipment and on road shoulders. ANSI class 2 high-visibility vests or garments are required for work within ROWs.

Personnel will wear rain gear and/or insulated garments on windy, cold, and rainy days to prevent cold stress-related illness.

5.4 WORK AREAS

An exclusion zone will be established when working with contaminated materials. The exclusion zone will be delineated and controlled with the use of cones, caution tape, barricades, flagging, or other equivalent traffic control measures. Unauthorized personnel will not be allowed in the work areas. Access to the work site will be restricted to designated personnel. The purpose of site control is to minimize potential exposure to site hazards, and access by unauthorized persons. If unauthorized personnel enter the work area, field staff will stop work until the individuals have left the work area.

A contaminant reduction zone will be set up at the entry/exit point of the exclusion zone. The contaminant reduction zone will contain the necessary elements to perform personnel and equipment decontamination as described in Section 5.5. Work area controls and decontamination areas will be provided to limit the potential for chemical exposure associated with the Property's tenant and field activities and the transfer of contaminated media from one area of the Study Area to another.

The support zone (SZ) will consist of all areas outside the work area and decontamination areas. An exclusion zone/contamination reduction zone (EZ/CRZ) will be set up for each boring and/or well location. Only authorized personnel shall be permitted access to the EZ/CRZs. Floyd|Snider staff will decontaminate all equipment and gear as necessary prior to exiting the CRZ. Decontamination areas will be constructed with plastic sheeting on the ground to reduce potential transport of contaminated soils from the EZ to the SZ.

5.5 SITE CONTROLS FOR AIRBORNE DISEASE

At the time of the preparation of this HASP, workplaces in the State of Washington are under restrictions designed to mitigate the spread of COVID-19. These restrictions include requirements to stay home when sick, maintain distance between workers, and wear face coverings. Detailed protocols for the known best practices regarding COVID-19 safety are presented in Attachment D.4. These best practices will be implemented as applicable at the time that the work is conducted. Work areas and work practices will also be designed to comply with any additional state and facility operational requirements, if established, at the time of work.

5.6 DECONTAMINATION AND WASTE DISPOSAL

Field staff should always follow the best practices for prevention of contamination detailed in the APP.

Sampling equipment will be decontaminated in accordance with the Sampling and Analysis Plan and Quality Assurance Project Plan. A majority of field and sampling activities are expected to be conducted using Level D PPE. Decontamination procedures for both PPE and field equipment will be strictly followed to prevent off-site spread of contaminated soil or water. The HSO/SS will assess the effectiveness of decontamination procedures by visual inspection. Hands must be thoroughly washed before leaving the Site to eat, drink, or use tobacco.

Floyd|Snider and its subcontractors will use safe and prudent waste collection and housekeeping practices to minimize the spread of contamination beyond the work zone and the amount of investigation-derived waste (IDW). The Floyd|Snider HSO/SS will work with site personnel to ensure the proper collection, packaging, and identification of waste materials so that waste materials will be properly disposed of.

Disposable PPE and sampling equipment will be collected in bags and disposed as municipal solid waste. Excess sample material, such as soil and purge water, and equipment wash water will be containerized in United States Department of Transportation (USDOT)-approved drums and disposed at an approved disposal facility.

5.7 AIR MONITORING

Air monitoring using a photoionization detector (PID) will be performed if personnel are likely to be exposed to volatile contaminants. Should the PID read a sustained concentration of total VOCs above 5 parts per million (ppm) for 5 minutes, the HSO/SS will stop work and evacuate the area until vapor concentrations return to background levels. As needed, actions may be taken to reduce exposure to vapor concentrations in the work area by covering exposed soil or drilling cuttings, and leaving the work area until odor dissipates.

Visual monitoring for dust using a meter capable of measuring particulate matter (PM) 2.5 (respirable dust) and PM 10 (total dust) will be conducted during dry conditions when gypsum piles are uncovered and during any gypsum handling activities at the Property. If visible dust is present in the work area, work will cease, and the area will be cleared until the dust settles. Water may be used to suppress any dust clouds generated during work activities.

The HSO/SS will visually inspect the work site at least daily to identify any new potential hazards. If new potential hazards are identified, immediate measures will be taken to eliminate or reduce the risks associated with these hazards.

Monitoring Equipment	VOC Concentration	Action
PID	Less than 1ppm (TWA) PEL; less than 5ppm (STEL) for no longer than 15 minutes	Continue operations in Level D PPE. Work upwind of excavation area when possible.
	Greater than 1ppm (TWA) PEL; less than 5ppm (STEL) intermittent	Leave work area and allow vapor to dissipate; use engineering controls if necessary. Monitor VOC concentration every 5 minutes; resume work once concentrations are less than [lowest TWA] for 15 minutes.
	Greater than 5ppm STEL	Stop operations and evacuate area. Do not resume work until engineering controls are able to maintain VOC concentrations less than [lowest TWA] in breathing space are in place.
Gypsum dust	Less than 5mg/m^3 Respirable (PM 2.5) or 15mg/m^3 total dust (PM10)	Continue operations in Level D PPE. Work upwind of excavation area when possible, voluntary Respirator usage
	Greater than 10mg/m^3 (inhalable PM 2.5)	Stop operations and evacuate area. Do not resume work until engineering controls are able to maintain concentrations less than [10 mg/m^3 PM 2.5 in breathing space

Abbreviations:
ACGIH American Conference of Governmental Hygienists
ppmv Parts per million by volume
STEL Short term exposure limit
TWA Time-weighted average

5.8 HEALTH AND SAFETY PLANS FOR OTHER OVERSIGHT PERSONNEL

It is anticipated that portions of the field data collection will be performed or assisted by HDRHDR. HDR field personnel will be subject to HDR's Health and Safety Plan, which is provided in Attachment D.5.

6.0 Approvals

Project Manager	Date
Project Health & Safety Officer	Date

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7.0 Signature Page

I have read this Health and Safety Plan and understand its contents. I agree to abide by its provisions and will immediately notify the HSO/SS if site conditions or hazards not specifically designated herein are encountered.

Name (Print)	Signature	Date	Company/Affiliation

Remedial Investigation/Feasibility Study Work Plan

Silver Bay Logging Site

Appendix D

Attachment D.1
Accident Prevention Plan

Accident Prevention Plan

June 2022

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List of Abbreviations

Acronym/ Abbreviation	Definition
AED	Automated external defibrillator
APP	Accident Prevention Plan
AQI	Air quality index
COPD	Chronic obstructive pulmonary disease
CPR	Cardiopulmonary resuscitation
°F	Degrees Fahrenheit
FFR	Filtering facepiece respirator
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HSO/SS	Health and Safety Officer/Site Supervisor
JHA	Job Hazard Analysis
JSA	Job Safety Analysis
L&I	Washington State Department of Labor & Industries
MTCA	Model Toxics Control Act
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Act
PEL	Permissible exposure limit
PM	Project Manager

Acronym/ Abbreviation	Definition
PPE	Personal protective equipment
RPP	Respiratory Protection Program
SDS	Safety Data Sheet
SSO	Site Safety Officer
USEPA	U.S. Environmental Protection Agency
WAC	Washington Administrative Code
WISHA	Washington Industrial Safety and Health Act

1.0 Plan Objectives and Applicability

This Accident Prevention Plan (APP) describes the policies and best practices established by Floyd|Snider to ensure the safety of employees to the maximum extent possible when performing their work duties. Employee safety is Floyd|Snider's highest priority. Employees are encouraged to use the Health and Safety Department as a resource in identifying potential hazards and the appropriate precautions to address them. While additional safety precautions may impact project schedules and costs, Floyd|Snider will ultimately benefit as accidents are avoided.

This APP has been written to comply with the standards of the Occupational Safety and Health Act (OSHA) and Washington Industrial Safety and Health Act (WISHA) as they pertain to work activities performed by Floyd|Snider.

This APP applies to all employees of Floyd|Snider. It consists of the following components:

- A description of the roles and responsibilities of all Floyd|Snider personnel in ensuring worker safety,
- General safety policies for the office and the field job site,
- Procedures to follow in an emergency,
- Information on common hazards and steps that should be taken to mitigate these hazards,
- A description of the basic safety controls that should be implemented on all field job sites,
- Training requirements for field staff, and
- Safety record keeping and reporting requirements and procedures.

2.0 Roles and Responsibilities

All staff members share responsibility for safety. The roles and responsibilities for Floyd|Snider staff in ensuring company safety are described in the following sections.

2.1 BOARD OF DIRECTORS

The Floyd|Snider board of directors consists of the elected senior officers of Floyd|Snider who establish the company's culture of safety. These individuals set policy for the company, including safety policy. The Management Committee, which consists of the Board of Directors and additional shareholder representatives, is also responsible for enforcement of this APP.

2.2 HEALTH AND SAFETY COMMITTEE

The Health and Safety Committee is composed of field and management staff, who meet on a quarterly basis or more frequently if needed to review and update the Floyd|Snider Health and Safety Program. The Health and Safety Committee is responsible for making updates to this APP as approved by the Management Committee. Health and Safety Committee meeting minutes are recorded and made accessible on Floyd|Snider's Health and Safety department page on SharePoint.

2.3 HEALTH AND SAFETY ADMINISTRATOR

The Health and Safety Administrator receives, organizes, and reviews reports of near misses and incidents in the workplace. The Health and Safety Administrator is responsible for the administration of benefits, working with managers to identify OSHA-reportable incidents, and managing the OSHA reporting process. The Health and Safety Administrator is also responsible for documentation of Health and Safety Committee meeting minutes and employee training record keeping. The Health and Safety Administrator is supported by the Board of Directors and the Health and Safety Committee, who are responsible for taking corrective actions when near misses, incidents, and other safety issues identified in this plan occur.

2.4 PROJECT MANAGERS

Project Managers (PMs) reinforce the Floyd|Snider safety culture. During all phases of projects, PMs review health and safety issues and will have authority to allocate resources and personnel to safely accomplish project work.

PMs direct the field personnel at a job site. PMs coordinate with the project Health and Safety Officer/Site Supervisor (HSO/SS) to ensure that the scope of the project and site conditions are accurately documented in all project safety materials and that all Floyd|Snider personnel on site have received the required safety training and understand the procedures to follow should an incident occur on site. PMs review safety documentation materials with the HSO/SS at intervals determined prior to the start of field events and report near misses and incidents to the Health and Safety Administrator.

2.5 FIELD HEALTH AND SAFETY OFFICER AND SITE SUPERVISOR

The HSO/SS prepares and/or approves the site Health and Safety Plan (HASP) and any amendments thereof and is responsible for full implementation of all elements of the HASP.

The HSO/SS will advise the PM and project personnel on all potential health and safety issues of the field investigation activities to be conducted at a site. The HSO/SS will specify required exposure monitoring to assess site health and safety conditions, modify the site HASP based on field assessment of health and safety accidents and/or incidents, and recommend corrective action if needed. The HSO/SS will report all accidents and/or incidents to the PM. If the HSO/SS observes unsafe working conditions by Floyd|Snider personnel or any contractor personnel, the HSO/SS will suspend all work until the hazard has been addressed.

The HSO/SS is responsible for conducting tailgate safety meetings daily before the start of field work. Tailgate safety meetings should identify the work to be completed, safety hazards likely to be encountered, and the appropriate work practices needed to minimize exposure to these hazards. Tailgate safety meeting forms are included in the HASP documents.

2.6 FIELD SITE SAFETY OFFICER

The field Site Safety Officer (SSO) may be a person dedicated to this task, to assist the HSO/SS during field work activities. The SSO will ensure that all personnel have appropriate personal protective equipment (PPE) on site and that PPE is properly used. The SSO will assist the HSO/SS in field observation of Floyd|Snider personnel safety. If a health or safety hazard is observed, the SSO shall suspend all work activity. The SSO will conduct onsite safety meetings daily before work commences. All health and safety equipment will be calibrated daily and records kept in the daily field logbook. The SSO may perform exposure monitoring if needed and will ensure that equipment is properly maintained.

2.7 FLOOR WARDENS

Floor Wardens are Floyd|Snider staff members who have volunteered to coordinate Floyd|Snider's response in case of an emergency at Union Square. Floor Wardens are responsible for ensuring that all staff have evacuated the building if an evacuation order is issued by building management and accounting for staff at the emergency muster point. Floor Wardens also post and update emergency evacuation routes and maintain maintenance records for fire extinguishers located at the office. The names of current Floor Wardens are posted in the office above fire extinguishers and on the Floyd|Snider SharePoint home page.

2.8 EQUIPMENT MANAGER

The Equipment Manager is responsible for ensuring that all field equipment, including the company vehicle, is in safe working order and for keeping records of equipment maintenance. Employees must report any issues with the company vehicle or field equipment to the Equipment Manager. The Equipment Manager will designate an alternate for days when the manager will not be available to assist field staff with urgent equipment or vehicle issues.

2.9 FLOYD|SNIDER PERSONNEL

All Floyd|Snider project personnel will take precautions to prevent accidents and/or incidents from occurring to themselves and others. Employees must read, understand, and sign this APP. Employees will report all incidents and near misses to their PM, HSO/SS, or SSO and inform of any physical conditions that could impact their ability to perform their work.

2.10 EMERGENCY CONTACTS

All Floyd|Snider staff must designate a person outside of the company who may be contacted in case of an emergency in which a staff member requires medical care. Emergency contacts are responsible for making decisions regarding medical treatment in the event that the staff member is incapacitated, or for contacting the individual who has been designated authority by the staff person to make such decisions if they do not have that authority.

Emergency contact information will be provided to the Health and Safety Administrator and updated as needed, at a minimum frequency of once per year. The Health and Safety Administrator is responsible for maintaining emergency contact information in the Floyd|Snider firm contact database and making this information available on the Floyd|Snider SharePoint home page.

3.0 Safety Policies

The safety policies presented in this section have been developed to ensure the safety of all staff. They should be considered the minimum requirements to maintain a safe workplace; staff should be vigilant at all times and take the needed actions to identify and correct unsafe situations.

3.1 GENERAL OFFICE SAFETY

This section describes the policies that have been developed to keep staff safe in all work scenarios, including at the office and on the job site.

3.1.1 Injury Prevention

In office areas, trips and falls are the primary cause of acute injury, and they can be easily prevented. There are many different ways to prevent injury, including, but not limited to:

- Keep all work areas, aisles, and hallways clear at all times.
- Make sure all exits are accessible, clearly marked, and properly illuminated.
- Keep all work and storage areas in a sanitary condition; floors shall be clean and, as much as possible, kept in a dry condition. If floors are wet, they should be marked with signage to notify others.
- Pile or store materials in a stable manner, so that they will not be subject to falling.
- Keep walkways and work areas free of electrical cords.
- Never make repairs to light fixtures unless authorized to do so by a supervisor.
- Use a stepstool when reaching overhead objects.
- Do not lift equipment and materials weighing more than 20 pounds by yourself; ask for help and/or use a handtruck.
- When carrying loads, exercise care to avoid overexertion and strain. Use proper lifting and reaching techniques.
- Use adjustable desk chairs to reduce musculoskeletal injuries; ask for assistance if you are unfamiliar with proper ergonomic adjusts for your desk, computer, and chair.
- Report all unsafe conditions and symptoms of injury to the Health and Safety Administrator.
- Exercise caution in moving about the office.

3.1.2 Administration of First Aid and Cardiopulmonary Resuscitation

First aid and cardiopulmonary resuscitation (CPR) should only be administered by individuals with the appropriate training. Floyd|Snider makes First Aid and CPR/automated external defibrillator (AED) training to available to all staff members and requires this training for all field staff members. At least one person on a field site must be trained and have current certification in

First Aid and CPR. First aid kits compliant with the ANSI Z308.1-2015 Class B standard will be available at the Floyd|Snider office and at all field sites. First aid kits for field sites additionally include basic medications (aspirin and diphenhydramine), tweezers, a clotting sponge, potable water, outdoor skin cleanser, super glue, adhesive moleskin pads, safety pins, sunblock, insect repellant, medical masks and a printed field staff emergency contact list.

3.1.3 New Employee Orientation

All new employees receive an orientation to the Floyd|Snider Health and Safety Program from a member of the Health and Safety Committee. This orientation is arranged by the assigned mentor for the new employee and includes a review of the materials available on the Health and Safety department home page (APP, HASP templates, near miss and incident forms, training resources, etc.) as appropriate to the employee's role at Floyd|Snider, office and field safety policies, and training and documentation requirements for field and office safety.

3.1.4 Workplace Hostility

Floyd|Snider intends to provide a work environment that is free from intimidation, hostility, or other offenses that are inappropriate. Harassment of any sort—verbal, physical, or visual—will not be tolerated.

Harassment can take many forms. It may be, but is not limited to, words, signs, jokes, pranks, physical or verbal intimidation, physical contact, or violence. Harassment is not necessarily sexual in nature, although these prohibitions against harassment specifically include all forms of sexual harassment.

It is the company's policy to regard sexual harassment and other forms of harassment, as well as the threat of such harassment, as very serious matters and to prohibit them in the workplace by any person and in any form. All staff are required to complete harassment training. Floyd|Snider also makes bystander intervention training available to all staff.

3.2 FIELD SAFETY

This section describes the additional policies developed to keep field staff safe on the job site.

3.2.1 Stop Work Authority

All staff members have Stop Work Authority. Stop Work could be a temporary pause in work for a few minutes or a full shutdown of work until unsafe work conditions can be addressed. If unsafe work conditions are encountered and cannot be immediately addressed by the staff on-site, the HSO/SS should report immediately to the PM. Safety hazards may include physical site conditions or dangerous work practices by subcontractors or other workers. The PM will help the field staff to make modifications to the work practices to mitigate the hazard if possible. If the unsafe conditions cannot be mitigated, field staff have the authority to stop all work until the conditions can be properly addressed.

3.2.2 Health and Safety Plan

A site-specific HASP must be prepared and made available to field staff at job sites. A site-specific HASP is required for any activities where field staff may contact contaminated material; activities such as a site visit or oversight where no contact with contaminated material or physical hazards may occur can be completed without a HASP, if approved by the PM. The HASP should address both potential physical and chemical hazards on-site and steps taken to mitigate those hazards.

3.2.3 Tailgate Safety Meetings

The HSO/SS is responsible for conducting tailgate safety meetings daily before the start of field work. Tailgate safety meetings should identify the work to be completed, safety hazards likely to be encountered, and the appropriate work practices needed to minimize exposure to these hazards. Tailgate safety meetings must always cover the site-specific procedures to follow in case of an emergency.

When performing field work, staff should maintain awareness of new or changing hazards at the job site. Staff should always assess then reassess the hazards when changing between tasks or changing the manner in which a task is performed and document meetings and assessments on the tailgate safety meeting form.

3.2.4 Buddy System

Floyd|Snider employs the buddy system for work at job sites meaning employees are never alone in the field. The buddy system ensures that employees can get help in case of an emergency. Working in the field without another Floyd|Snider employee present may be permissible in the following scenarios:

- When the site is occupied, you are not performing an activity with high risk of injury (e.g., not working in traffic, not entering small spaces or lifting heavy objects), and you are in close proximity of other people capable of responding if you call for help.
- If you are accompanied by a teaming partner or subconsultant who may act as your buddy.
- IF FOR ANY REASON YOU ARE NOT COMFORTABLE WITH THE ASSIGNMENT OR THE CONDITIONS, DISCUSS IT WITH YOUR PM AND ASK FOR A BUDDY.

3.2.5 Check-in Procedure

All employees in the field, whether in groups or alone, will follow the check-in procedure detailed below:

- Notify front desk or your PM when you are leaving for field work. Notification can be by email, phone, or in person.
- Provide an estimated completion time of when you think you will return to the office or head home.

- At the end of the field day, before leaving the site, call the office and let the front desk or your PM (the same person you notified at the beginning of the day) know you are returning to the office or heading home. Ask to be transferred to the PM to discuss how things went.
- <u>If you will not be finished with field work by 5:00 p.m.,</u> call the office and let the front desk know you are still in the field and that you will check in with the PM when fieldwork is finished.
- Communicate with the PM when you are finished with work and leaving the site (after 5:00 p.m.).
- If you are in a group of Floyd|Snider employees doing this field work, one person can do this check-in process on behalf of the group.
- If you fail to check in and cannot be reached by cell phone, someone from the office may be sent to locate you, or local authorities may be notified.

3.2.6 Personal Protective Equipment

Field staff must wear the appropriate PPE required in the site-specific HASP. Floyd|Snider provides employees with all required PPE such as steel-toed boots, reflective vest/jacket, hardhat, safety glasses, gloves, ear protection, and first aid kits. Field staff are responsible for wearing the appropriate PPE in accordance with the HASP, keeping their PPE in good condition, and replacing it as needed.

All work will proceed in Level D PPE, which shall include hard hat, protective footwear, hearing protection, eye protection, gloves, and sturdy outer work clothing. Protective footwear must be compliant with ASTM F2413 or the former ANSI Z41 (repealed) standard, with oil- and chemical-resistant soles, and must be securely laced without signs of excessive tread wear. For all work involving potential exposure to soil and groundwater, workers will wear nitrile gloves and Level D PPE. Personal floatation devices will be worn at all times during work in the vicinity of surface water. When working in a remote location, all teams must carry a field first aid kit. The contents of a field first aid kit include basic medications (aspirin and diphenhydramine), sterile dressings, adhesive bandages and tape, wound-cleansing towelettes, sting-relief wipes, antibiotic ointment, butterfly bandages, tweezers, safety pins, and a printed field staff emergency contact list.

All field personnel will be properly fitted for PPE and trained in the use of PPE during initial 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training (refer to Section 7.0 for additional training information). The level of protection will be upgraded by the HSO/SS whenever warranted by conditions present in the work area. The HSO/SS will ensure that field staff know how to properly use PPE and periodically inspect equipment such as gloves and hard hats for defects.

3.2.7 Confined Spaces

Floyd|Snider field staff are not trained in confined space entry and may not enter permit-required confined spaces. It is considered entry if your head/face breaks the plane of the confined space opening.

Confined spaces are defined as a spaces that have limited or restricted means for entry or exit and are not designed for continuous occupancy. Confined spaces commonly encountered at field sites may include vaults, manholes, pits, and tanks. OSHA designates confined spaces as "permit-required confined spaces" if they exhibit one or more of the following characteristics:

- Contains or has the potential to contain a hazardous atmosphere
- Contains material that has the potential to engulf an entrant
- Has walls that converge inward or floors that slope downward and taper into a smaller area that could trap or asphyxiate an entrant
- Contains any other recognized safety or health hazard (e.g., unguarded machinery, exposed wires, extreme heat)

In accordance with OSHA regulations, only personnel with specialized confined space training may enter a permit-required confined space under a confined space entry plan.

3.3 RESPIRATORY PROTECTION PROGRAM

The goals of the Respiratory Protection Program (RPP) are to protect employees from potential exposure to respiratory hazards and to ensure compliance with applicable occupational safety and health standards regarding respiratory hazards. Additionally, the RPP provides requirements for the proper selection and use of respiratory protection equipment.

On July 16, 2021, the Washington State Department of Labor & Industries (L&I) adopted an emergency rule to protect workers who are exposed to harmful levels of wildfire smoke (WAC 296-62-085). This RPP conforms to the Washington Administrative Code (WAC) standards for WAC 296-841 Airborne Contaminants and WAC 296-842 Respirators, as well as draft rule WAC 296-65-085 Wildfire Smoke.

3.3.1 Applicability

This RPP applies to respiratory protection used in the field due to impaired ambient air quality when respirator use is not required but may be preferred for comfort. This applies to impaired ambient air quality due to chemical hazards or wildfire smoke. Employees will not be required to perform site work when airborne substances (i.e., site contaminants) are present at concentrations exceeding their OSHA permissible exposure limits (PELs) or if air quality due to wildfire smoke exceeds the Stop Work action threshold and respiratory protection would be required to safely complete the work. Employees may additionally elect to use respirators for comfort purposes to control non-hazardous substances such as nuisance odors.

If there is the potential to exceed a PEL or wildfire smoke action threshold at a site, engineering and administrative controls will be implemented to mitigate the hazard. Project work that cannot be altered by using engineering or administrative controls must be approved by the Management Committee in advance of the scheduled fieldwork.

The RPP is intended to help employees identify conditions that may warrant the voluntary use of a respirator and to support the selection and maintenance (if applicable) of an appropriate respirator. The RPP should be implemented when employees are working in conditions where respiratory hazards may be encountered, such as when working in conditions with wildfire smoke.

3.3.2 Administrator and Employee Responsibility

The RPP administrator is the Health and Safety Committee chair. The RPP administrator oversees the development, execution, and evaluation of the RPP and will ensure procedures are followed, respirator use is monitored, and respirators provide adequate protection when job conditions change. The RPP administrator will ensure appropriate respirators and the associated supplies are provided to employees for voluntary use at no cost to the employee.

Employees voluntarily using respirators have the following responsibilities:

1. Participate in the Floyd|Snider medical monitoring program in accordance with Section 7.1.
2. Use the respirator only for the specific tasks that it was issued for.
3. Seek medical help if wearing a respirator creates negative health effects such as difficulty breathing, dizziness, or anxiety.
4. Care for and maintain respirators as instructed, including following the manufacturer's specific cartridge change-out or respirator replacement schedule.
5. Notify the supervisor of any problems associated with using a respirator. This includes a respiratory hazard that needs further evaluation, if the respirator is not providing adequate protection, and any concerns with the RPP.
6. Monitor air quality while wearing a respirator and calling Stop Work if PELs are exceeded or if the Stop Work action level for wildfire smoke is exceeded.

3.3.3 Use of Respirators

Respirator use by Floyd|Snider employees is done on a voluntary basis and may be done at any time when the use of an approved respirator may increase comfort or provide additional protection when air quality conditions are still within a level considered to be safe for work. Voluntary use of respirators applies only when it has been determined that:

- Such respirator use will not in itself create a hazard.
- Airborne occupational exposures to hazardous chemicals will not exceed applicable PELs.
- Exposure to fine particles called PM2.5 in wildfire smoke does not exceed the Stop Work action level (refer to Table 3.1).
- No airborne biological hazard is present.
- No specification standards require the mandatory use of respirators.

3.3.4 Wildfire Smoke Exposure Control Plan

The Wildfire Smoke Exposure Control Plan is intended to address risks to employees working outside from potential exposure to wildfire smoke. This plan will be in effect whenever wildfires are present in the region (in Washington State, surrounding states, or British Columbia, Canada) and will continue to be implemented until such a time that wildfire smoke is no longer a health risk as determined by the air quality index (AQI). The greatest risk of wildfire coincides with the dry season from approximately mid-May through mid-October; however, fires can also occur outside of the typical dry season.

Smoke from wildfires contains chemicals, gases, and fine particles that can be harmful to human health. Breathing in smoke can cause immediate health effects such as coughing, trouble breathing, stinging eyes, a scratchy throat, runny nose, irritated sinuses, wheezing and shortness of breath, chest pain, headaches, an asthma attack, tiredness, and fast heartbeat (CDC 2013). The smallest and most harmful particulate matter in wildfire smoke and other air pollutants are PM2.5. PM2.5 are particles that are 2.5 micrometers or less in width. Increases in daily PM2.5 exposure has been linked to premature death in people with heart or lung disease and nonfatal heart attacks (USEPA 2020). Long-term exposure to PM2.5 is associated with increased rates of lung cancer and heart disease.

Those at increased risk for adverse health effects from wildfire smoke include the following:

- People with lung diseases such as asthma or chronic obstructive pulmonary disease (COPD), including bronchitis and emphysema, and those who smoke
- People with respiratory infections, such as pneumonia, acute bronchitis, bronchiolitis, colds, or flu, or those with or recovering from COVID-19
- People with existing heart or circulatory problems, such as irregular heartbeat, congestive heart failure, coronary artery disease, or angina, and those who have had a heart attack or stroke
- Adults over age 65 and pregnant women

- People with diabetes
- People with other medical or health conditions that can be exacerbated by exposure to wildfire smoke as determined by a physician

Program elements and protocols for wildfire smoke have been developed in accordance with emergency rule WAC 196-62-085 and additionally consider Cal/OSHA Title 8 California Code of Regulations Section 5141.1 regarding Wildfire Smoke.

The Wildfire Smoke Program includes the following elements:

1. Identification of Harmful Exposures (WAC 296-62-08530):

   When wildfire smoke is present, the site-specific HSO will monitor the AQI before each shift and periodically thereafter using U.S. Environmental Protection Agency's (USEPA's) AirNow,[1] available at www.airnow.gov, or a similar state or federal AQI modeling service. The HSO can also monitor real-time air quality using an air quality detector capable of measuring $PM_{2.5}$. The HSO will take actions consistent with the action levels presented in Table 3.1.

2. Hazard Communication (WAC 296-62-08540):

   The HSO will communicate wildfire smoke hazards to employees during the tailgate safety meeting and will record the AQI or $PM_{2.5}$ concentration on the tailgate meeting form when wildfire smoke is present in the air. The HSO will communicate available measures for employees to mitigate wildfire smoke exposure and the symptoms of smoke exposure.

3. Information and Training (WAC 296-62-08550):

   Employees will be trained in the information presented in this RPP (refer to Section 3.3.9), consistent with mandatory information presented in WAC 296-62-08590, prior to conducting work in the presence of wildfire smoke.

4. Exposure Symptom Response (WAC 296-62-08560):

   Employees displaying adverse symptoms of wildfire smoke exposure must be monitored to determine whether medical attention is necessary and may not be penalized for seeking medical treatment. Symptoms of wildfire smoke exposure most often include persistent coughing, difficulty breathing, and aggravation of existing respiratory conditions such as asthma. Provisions for prompt medical treatment will be established for each job site and reviewed during the tailgate safety meetings.

[1] AirNow reports air quality using the official U.S. AQI, a color-coded index designed to communicate whether air quality is healthy or unhealthy. AirNow is a partnership of the USEPA; National Oceanic and Atmospheric Administration; National Park Service; National Aeronautics and Space Administration; Centers for Disease Control and Prevention; and tribal, state, and local air quality agencies.

5. Exposure Controls (WAC 296-62-08560):

   Floyd|Snider will reduce workers' exposure to wildfire smoke by using the hierarchy of controls. Controls are encouraged whenever the ambient air concentration of PM2.5 is greater than 20.5 micrograms per cubic meter (µg/m^3; AQI 69) and required when the concentration of PM2.5 is greater than 55.5 µg/m^3 (AQI 151).

   A. Engineering controls will be implemented where feasible. Such controls include providing enclosed buildings, structures, or vehicles where the air is adequately filtered.

   B. If engineering controls are not sufficient to reduce exposure, Floyd|Snider will implement administrative controls. Such controls include relocating work to a location with a lower ambient air concentration of PM 2.5, changing work schedules to a time where the ambient air concentration of PM 2.5 is less, reducing work intensity, and providing additional rest periods.

   C. In addition to the standards provided in the emergency regulation (WAC 296-62-085), Floyd|Snider has developed action levels for wildfire smoke exposure to be followed at job sites. Table 3.1 shows the AQI categories, equivalent $PM_{2.5}$ measurement in micrograms per cubic meter, the level of health concern, and the action required. The HSO will stop work if the AQI for $PM_{2.5}$ is greater than 301 or if it is not possible to conduct field activities safely due to discomfort or decreased visibility.

   D. Where overnight stays are required in areas that do not have filtered indoor air, additional Floyd|Snider policies apply. If the AQI is forecasted to be greater than 301 overnight, or if the AQI exceeds 500 for several hours, the HSO, Floyd|Snider PM, and client PM will coordinate and decide whether demobilization to an off-site location is necessary.

6. Respiratory Protection (WAC 296-62-08570):

   Floyd|Snider will provide respirators at no cost to all employees for voluntary use in accordance with WAC 296-842 Safety Standards for Respirators. Employees are encouraged to use respirators any time the PM2.5 concentration is greater than 20.2 µg/m^3 (AQI 69), and especially when the PM2.5 concentration is 55.5 µg/m^3 (AQI 151) or greater.

Table 3.1
Action Levels for Wildfire Smoke

AQI Categories for PM2.5	PM2.5 ($\mu g/m^3$)	Levels of Health Concern	Action [1]
0 to 50	0 to 12.0	Good	• Monitor air quality if wildfire smoke is present. • Stop work if employees have symptoms of smoke exposure.[2] All employees have Stop Work authority.
51 to 68	12.1 to 20.1	Moderate	• Monitor air quality. • Stop work if employees have symptoms of smoke exposure.[2] All employees have Stop Work authority. • Implement administrative and engineering controls.
69 to 150	20.2 to 55.4	Unhealthy for Sensitive Groups	• Monitor air quality. • Stop work if employees have symptoms of smoke exposure.[2] All employees have Stop Work authority. • Implement administrative and engineering controls. • Respirator provided for voluntary use; respirator use is strongly encouraged. • Take frequent breaks in an indoor space with filtered air.
151 to 200	55.5 to 150.4	Unhealthy	• Monitor air quality. • Stop work if employees have symptoms of smoke exposure.[2] All employees have Stop Work authority. • Implement administrative and engineering controls. • Respirator provided for voluntary use; respirator use is strongly encouraged. • Provide for frequent breaks—at least once per hour—in an indoor space with filtered air; stop work if an indoor space with filtered air is not available. • Accommodations must have filtered air for multi-day and overnight field events.
201 to 300	150.5 to 250.4	Very Unhealthy	• Monitor air quality. • Stop work if employees have symptoms of smoke exposure.[2] All employees have Stop Work authority. • Implement administrative and engineering controls. • Respirator provided for voluntary use; respirator use is strongly encouraged. • Take breaks at least once per hour in an indoor space with filtered air; stop work if an indoor space with filtered air is not available. • Accommodations must have filtered air for multi-day and overnight field events. • Reduce work hours; limit workday to no more than 8 hours on-site.
301 to 500	250.5 to 500.4	Hazardous	• **Stop work.** • Demobilize to an off-site work location if necessary.

Notes:
(1) Respirators can be worn at lower AQI levels based on personal preference. Respirators are provided at no cost to employees for use during any air quality conditions.
(2) Symptoms of wildfire smoke exposure most often include persistent coughing, difficulty breathing, and aggravation of existing respiratory conditions such as asthma.

3.3.5 Selection of Respirators

Employees can voluntarily use a respirator based on personal preference. Floyd|Snider will provide respirators at no cost to all employees for voluntary use in accordance with WAC 296-842 Safety Standards for Respirators. PPE is the last line of defense and should be considered after engineering and administrative controls are implemented.

The only approved respirator types to be used without fit testing are filtering facepiece respirators (FFRs), also known as N95 dust masks. Per WAC 296-842-10200, FFRs are any tight-fitting, half-facepiece, negative-pressure, particulate air purifying respirator with the facepiece composed mainly of filter material. These respirators do not use cartridges or canisters and may have sealing surfaces composed of rubber, silicone, or other plastic-like materials. Employees may elect to use respirators for other voluntary uses such as to control nuisance odors and may additionally elect to use respirators other than FFRs for protection from wildfire smoke if the respirator provides protection from PM2.5 equivalent to or greater than an FFR. Use of respirators other than FFRs is subject to fit testing requirements in accordance with the manufacturer specifications. Fit testing, if required for the selected respirator, is provided by Floyd|Snider at no cost to employees.

The National Institute for Occupational Safety and Health (NIOSH) of the Centers for Disease Control and Prevention certifies N95 respirators including FFRs. A label or statement of certification by NIOSH should appear on the respirator or respirator packaging. KN95 respirators, which are filtering facepiece respirators manufactured to the Chinese particulate filtration standard equivalent to N95, are approved for respiratory protection by the U.S. Food and Drug Administration and may also be used if an adequate supply of NIOSH-approved respirators is not available.

Any employee who experiences any difficulties while wearing a respirator must immediately inform their supervisor. If an employee requests to wear a respirator other than an FFR, they must contact their supervisor to ensure the respirator is appropriate and properly fitted for the user.

3.3.6 Medical Evaluations

All Floyd|Snider field staff participate in a medical monitoring program and are evaluated biennially. This evaluation includes respiratory clearance and accomplishes the goal of medical clearance for this program on a voluntary use basis per WAC 296-842-11005. Workers with breathing problems such as asthma, COPD, or chronic heart and lung disease should communicate these conditions to their doctor to determine whether it is safe for them to voluntarily wear an FFR or other type of protection at work. Respirators restrict breathing and can put stress on the heart and lungs, which may worsen health symptoms.

3.3.7 Respirator Fit and Seal Check

Proper fit is necessary to get the most protection from a respirator. Fit testing is not required for FFRs, so employees are not required to participate in fit testing; however, fit testing can be provided at employee request. Note that facial hair, piercings, or facial abnormalities may disqualify an employee from using certain types of tight-fitting respirators. Shaving facial hair is recommended, but not required, for voluntary FFR or use. Employees who choose to use a tight-fitting elastomeric respirator (half- or full-face respirators) will require fit testing and additional training, which Floyd|Snider will provide at no cost to employees.

FFRs should fit according to the manufacturer's instructions. Elastic straps, a moldable nosepiece, or adhesive may be used to aid in sealing. A seal check should be performed after fitting the respirator to the face, using the following procedure:

1. Cover the respirator with both hands and exhale. If air leaks where the respirator seals against the face, readjust the respirator and nosepiece and try again. When a proper fit is achieved, the respirator should bulge from the face and not leak around the seal.
2. Cover the respirator with both hands and inhale. If air leaks where the respirator seals against the face, readjust the respirator and nosepiece and try again. When a proper fit is achieved, the respirator should collapse slightly and not leak around the seal.

The following video provides additional demonstration of fitting the respirator to the face and performing a seal check: https://www.youtube.com/watch?v=GmJxzGXeIvo

3.3.8 Respirator Replacement, Maintenance, and Storage

FFRs are disposable and generally designed for single use (i.e., one 8-hour day); however, the total hours of use may vary by manufacturer. Employees will replace respirators according to the manufacturer-recommended schedule, or a minimum of once per work day if not specified. Disposable respirators should also be immediately discarded if, at any time during use, they become damaged, deformed, dirty, or difficult to breathe through. The number of times an FFR is doffed and donned should be limited whenever possible. Respirators other than FFRs will be maintained or replaced (in full or in part, such as in the case of respirators with detachable cartridges) according to the manufacturer specification. Respirators will be given to a specific employee and may not be shared among employees.

Before donning, respirators will be inspected by the user for damage, deterioration, or improper functioning before use. FFRs will also be checked for proper sealing using the seal check procedures described in Section 3.3.7.

Respirators will be stored in a clean, dry, and sealed area in the field room, field vehicle, or a designated clean area on the job site.

3.3.9 Training

Training will be provided to all employees who voluntarily wear respirators. At a minimum, the training will cover the following information:

- Identification of the hazard (i.e., wildfire smoke)
- Floyd|Snider's policy on hazard communication and how to obtain current information regarding the AQI
- Potential health affects as a result of exposure to the hazard
- Employee rights regarding medical treatment for exposures
- Mitigation measures for smoke exposure
- Employer requirements to provide respirators under the L&I emergency rule
- The respirator's capabilities and limitations
- Proper fit, use, and maintenance of respirators

3.3.10 Record Keeping

As per WAC 296-842-11010, voluntary use of respirators does not require record keeping; however, all employees are required to read and sign this APP, and Floyd|Snider will retain a copy of the signature page and any additional relevant training materials.

3.4 BUILDING SECURITY

For security purposes, Union Square is equipped with an access card system. Computerized proximity cards let you enter the building on your own, any time, but prevent unauthorized access to the building.

To help maintain the integrity of this system:

- Do not let others follow you into the building when exiting and entering when entrances to the building are locked.
- Notify Tenant Services of lost access cards.
- Notify the company when transferring ownership of access cards.

General regular building hours are defined as the time between 6:00 a.m. and 6:30 p.m. After-hours are defined as the time between 6:30 p.m. and 6:00 a.m. During this time period, One and Two Union Square are in after-hours mode and will require an after-hours access card for entry into the buildings.

There is a security guard desk in the main lobby where any security-related incidents should be reported. The security guards are also available to escort employees to their vehicles if they are feeling unsafe for any reason or can provide access to the office (after verifying your employment status by calling a Principal) if you do not have your access card or keys with you.

3.5 VEHICLE SAFETY

Floyd|Snider maintains a company vehicle for use during field work and to attend meetings. Personal vehicles and/or rental vehicles may be used if additional transportation is needed for a specific task. General vehicle safety and Floyd|Snider vehicle-specific procedures when driving for business purposes are described in the following sections.

3.5.1 General Vehicle Safety

Before driving a vehicle, always perform a safety check:

- Walk around and look for damage such as broken reflectors, damaged mirrors, windshield cracks, missing wiper blades, obviously low tire pressure or damage to tires, new dents, or scratches. Report new damage to the Equipment Manager. Do not drive a vehicle with obvious tire damage or an unrepaired windshield crack. Also note collision hazards in the immediate area.
- Check the vehicle emergency kit for the following items: first aid kit, potable water, eye wash, fire extinguisher, Mylar blanket, road flares, and collapsible traffic cones.
- Ensure that all items stored inside the vehicle are secure and will not slide or tumble during transport. Do not drive with unsecured loads.
- Start the vehicle and check that safety systems are working: headlights, turn signals, emergency flashers, headlights, brake lights, and windshield wipers. Check for dashboard warning lights and address any critical safety warnings (low tire pressure, low oil pressure, high engine temperature, antilock brake system, battery) immediately.

When driving a vehicle for business purposes, all traffic laws must be obeyed. Obey speed limits and all posted signs. Minimize distractions and stay aware of your surroundings. In addition to your safety, you are also a representative of the company behind the wheel and should not conduct any behaviors that would put you or Floyd|Snider in a negative light.

The following safety violations will not be tolerated by Floyd|Snider and will cause revocation of your driving privileges for company business purposes (even if they occur after business hours):

- Texting/cell phone use while driving (hands-free device permitted)
- Citations for reckless driving
- Use of alcohol or drugs before or while driving
- Carrying more passengers than available seatbelts

In the event of an accident, call 911 and follow the procedures in Section 4.3. In the event of a breakdown, call roadside assistance if possible in the area where you are located. If roadside assistance is not available, staff may perform basic tasks (such as addressing a flat tire) in order to be able to return to the office safely only if they are trained and feel comfortable to do so. If you are stuck, call your PM to arrange for emergency assistance.

In the event of a multi-day field effort or a late-night finish, all field equipment (high-dollar-value items) must be stored in a locked garage or other locked storage area for the night and should not be left in the vehicle.

3.5.2 Floyd|Snider Vehicle Safety

The Floyd|Snider vehicle is not equipped with 4-wheel drive, so no off-road driving should be attempted. If the project site is especially muddy or has limited access, an appropriate vehicle should be rented. No one other than Floyd|Snider employees (except for emergency personnel in case of emergency or qualified repair personnel) should be allowed to drive the company vehicle. Do not smoke in the company vehicle.

A first aid kit and fire extinguisher will be kept in the vehicle at all times. A checklist of supplies is kept in the vehicle bulkhead vertical file area and inside the door to the field room for reference. Additional safety supplies that are stocked in the vehicle include nitrile and work gloves, hearing protection, safety glasses, and basic decontamination equipment including Alconox solution, distilled water, disinfectant spray/wipes, and paper towels. If you have used these items, please notify the Health and Safety Committee so they can be replenished. The vehicle is also equipped with basic maintenance supplies including a jack, air pump, and spare tire. The gas tank should always be left at least half full before returning the company vehicle to the garage. The vehicle engine has a minimum octane rating and should be filled with premium gasoline.

Report vehicle warning lights immediately to the Equipment Manager or a designated alternate in the event that the Equipment Manager is not available. The Equipment Manager will work with you to determine a plan to safely address the warning light. If you cannot use the field vehicle safely, notify your PM to assist you with arranging an alternate vehicle. Tire pressure warning lights should be addressed immediately using the pump stored in the van or at a service station if a station is readily available—never drive a vehicle with insufficient tire pressure.

The Equipment Manager will be responsible for making sure the following routine maintenance is performed (but please notify them immediately if you notice any other problems):

- Oil changes and periodic routine maintenance per dealer schedule
- Monthly walk-around check (tires, lights, damage, etc.)
- Detailing when needed

3.6 CONTROLLED SUBSTANCE ABUSE

Floyd|Snider has a strong commitment to provide a safe and drug-free workplace for its employees.

Drug or alcohol testing of current employees may be performed where (a) there are reasonable grounds to believe an employee is under the influence of or suspected of consuming alcohol or using marijuana during work hours or using illegal drugs at any time; (b) as a follow-up to a rehabilitative program; or (c) on a random basis when health and safety requirements for clients or projects necessitate testing.

If the alcohol or drug test reveals positive results, the employee may be suspended pending evaluation of the situation by management.

An employee who voluntarily seeks assistance on a timely basis for an alcohol- or drug-related problem, prior to the company identifying the problem, may do so without jeopardizing their employment status, provided the prescribed treatment is followed and work performance is acceptable. In some cases, temporary reassignment may be necessary.

If an employee is undergoing a prescribed medical treatment with a substance that may alter physical or mental capacity, the employee must report this to the Health and Safety Administrator, particularly if they will be conducting field work. The Health and Safety Administrator will coordinate with the Board of Directors, who will determine how to manage the affected employee’s work load.

Any manager who observes or receives a report of alcohol or drug use must promptly investigate the allegations in a confidential manner. The Board of Directors should also be notified immediately. Any other employee who observes or has knowledge of a violation, whether by an employee or others, has an obligation to promptly report this to their immediate supervisor. If an employee’s immediate supervisor is suspected of violating the company’s drug and alcohol policy, the report should be made directly to the Board of Directors.

In any instance where there exists an imminent threat to the safety of persons or property, an employee shall immediately contact a Principal.

4.0 Emergency Procedures

This section defines the emergency procedures for Floyd|Snider. Reasonably foreseeable emergency situations include medical emergencies; accidental release of hazardous materials or hazardous waste; and general emergencies such as vehicle accident, fire, thunderstorm, and earthquake.

A muster point should be designated for all personnel. The Floyd|Snider office emergency muster point is at the Paramount Theatre, on the corner of Pine Street and 9th Avenue. A map of the office evacuation route and a map of the locations of first aid kits, fire extinguishers, and AEDs is posted in all communal office spaces including kitchens and conference rooms, is available on the Floyd|Snider SharePoint home page. On a job site, the SSO should designate a muster point that is clear of adjacent hazards and not located downwind of site activities and communicate this location to the field team each day. In an emergency, all personnel and visitors will evacuate to the muster point for roll call.

It is important that each person understand their role in an emergency and that they remain calm and act efficiently to ensure everyone's safety. Expected actions for potential emergency situations are outlined in the following sections.

4.1 MEDICAL EMERGENCIES

In the event of a medical emergency, the following procedures should be used:

- Stop any imminent hazard if you can safely do so.
- Remove ill, injured, or exposed persons from immediate danger if moving them will clearly not cause them harm and no hazards exist to the rescuers.
- Evacuate other personnel from the immediate vicinity until the ill, injured, or exposed persons have been evacuated and it is safe for work to resume.
- If serious injury or a life-threatening condition exists, call 911 for paramedics, fire department, and police. When in doubt, contact emergency services; do not drive a seriously ill or injured person to the hospital unless emergency services cannot be summoned (for example, if phone service is out or there is not an ambulance that can reach the location).
- Clearly describe the location, injury, and conditions to the dispatcher. Designate a person to go to the site entrance and direct emergency equipment to the injured persons. Provide the responders with information about any chemical hazards that might be present on a job site.
- Trained personnel may provide first aid/CPR if it is necessary and safe to do so. Remove contaminated clothing and PPE only if this can be done without endangering the injured person.

- Once more highly trained personnel (i.e., emergency services) have taken over care of the person experiencing the medical emergency, immediately contact the staff member's designated emergency contact person.
- If you are in the field, notify your PM and HSO/SS.
- If a person experiencing a medical emergency is taken to the hospital, another staff member should accompany whenever possible and remain at the hospital until a designated emergency contact person arrives.
- Immediately implement steps to prevent recurrence of the accident.

4.2 ACCIDENTAL RELEASE OF HAZARDOUS MATERIALS OR WASTES

In the event of a release of a hazardous material or waste:

1. Evacuate all personnel to the designated emergency muster point until it is safe for work to resume.
2. If you are in the field, instruct a designated person to contact the PM or HSO/SS and confirm a response. If a release occurs in the office, the Floor Wardens will contact building security.
3. Contain the spill, if it is a known material, is possible, and can be done safely.
4. If the release is not stopped, contact 911 to alert the fire department.
5. Contact the Washington State Emergency Response Commission at 1 (800) 258-5990 to report the release.
6. Initiate the cleanup process. Cleanup must be performed by professionals trained in cleanup response for the type of material released.
7. Submit a written report to the Washington State Department of Ecology in the event of a reportable release of hazardous materials or wastes.

4.3 OTHER EMERGENCIES AND NATURAL DISASTERS

Vehicle Accident

In the event of an accident:

- Check yourself and your passengers and, if safe to do so, any other persons involved in the accident for serious injuries. If anyone is seriously injured, call 911 and wait for emergency personnel.
- If the vehicle can be moved, move to the shoulder or side of the road out of the way of traffic before calling 911. Do not leave the scene of the accident, and avoid engaging in conversation with other persons involved, aside from confirming injury status.
- If the vehicle cannot be moved, get yourself and your passengers to safety if possible. If the vehicle is disabled in a place with fast moving traffic (such as a multi-lane freeway), it may be safest to wait in the vehicle. Use your best judgment.

- If you are able to move the vehicle to the shoulder, use road flares (located in the vehicle emergency kit) to warn oncoming drivers.
- Wait for police to arrive and fill out an accident report.
- Call your PM or HSO/SS to report the accident. In the case of a minor accident, the PM or HSO/SS will consult with the Equipment Manager to determine whether the vehicle should be driven back to the office or towed to a repair facility. Contact roadside assistance if towing is needed.

Fire

During the incipient phase of a fire, the available fire extinguisher may be used by persons trained in putting out fires, if it is safe for them to do so.

If a fire is identified in the office building (either by smell or by the fire alarm), walk to the nearest emergency exit and walk down the stairs (do not use the elevator). Walk to the emergency muster point. Use common sense during a fire to avoid injury if areas are inaccessible.

In the case of a fire in a job site, work shall be halted and all onsite personnel will be immediately evacuated to the emergency muster point, if the fire cannot be extinguished. The local police/fire department shall be notified if the emergency poses a continuing hazard by calling 911.

Thunderstorm

A thunderstorm may present danger of lightning strike any time that visible lightning or audible thunder are present.

In the event of a thunderstorm, seek shelter inside a building if possible. Avoid concrete walls and floors, corded phones, and puddles. When a thunderstorm is accompanied by high winds, also avoid windows. If sheltering in a building is not possible, shelter inside your vehicle, and avoid direct contact with any metal objects in contact with the frame of the vehicle.

Do not resume work activities outdoors until at least 30 minutes have elapsed since the last thunder or lightning was observed.

Earthquake

If you are inside a building during an earthquake, the area near the exterior wall of a building is the most dangerous place to be. Windows, facades, and architectural details are often the first parts of the building to collapse. To stay away from this danger zone, stay inside if you are inside and outside if you are outside. In a high-rise: drop, cover, and hold on. Face away from windows and other hazards. Do not use elevators. Do not be surprised if sprinkler systems or fire alarms activate. Once the earthquake is over, be alert for aftershocks that might occur, follow instructions of your Floor Warden or building security, take your emergency kit or emergency supplies, proceed to the emergency exit, and walk down the stairs. Walk to the emergency muster point. The above are general guidelines and are not meant to apply to every situation, so please use common sense during an earthquake to avoid injury. Additional office safety precautions for earthquakes are posted in the Production Room of the Floyd|Snider office and posted to the Health and Safety department page on SharePoint.

If you are on a jobsite when an earthquake occurs, move away from buildings, overhead power lines, and any other structures that may collapse. Get down low and stay down until the shaking stops to avoid injury. If you are in a moving vehicle, stop as quickly and safely as possible. Move to the shoulder or curb, away from utility poles, overhead wires, and under- or overpasses. Stay in the car and set the parking brake. Turn on the radio for emergency broadcast information. A vehicle may jiggle violently on its springs, but it is a good place to stay until the shaking stops. If a power line falls on the vehicle, stay inside until a trained person removes the wire. After the shaking stops, take your emergency supplies and proceed to the emergency muster point if it is safe to do so. Call your PM or HSO/SS when it is safe to do so.

4.4 EMERGENCY COMMUNICATIONS

Emergencies at Union Square will be communicated by building security using the public address system. If an emergency announcement is made, pause what you are doing and listen to the entire message. Emergencies involving the Floyd|Snider office only may be communicated over the office telephone system.

In the case of a job site emergency, signals may vary by site and should be discussed at daily tailgate meetings so all personnel on-site are aware of the site-specific signals and alarms. In general, horns (vehicle or airhorns) are used as needed to signal the emergency. One long (5-second) blast will be given as the emergency/stop work signal. If horns are not working, waving of arms is typically used to signal an emergency. In any emergency, all personnel will evacuate to the designated muster point and await further instruction.

After an emergency is resolved, the involved personnel or management will meet and debrief on the incident—the purpose is not to fix blame, but to improve the planning and response to future emergencies. The debriefing will review the sequence of events, what was done well, and what can be improved. The debriefing will be documented in a written format and filed by the Health and Safety Administrator.

4.5 EMERGENCY EQUIPMENT

The following minimum emergency equipment will be readily available in the office and at all job sites and functional at all times:

- First Aid Kit: Contents approved by the HSO/SS, including two blood-borne pathogen barriers. First aid kits are located in the company vehicle; a personal vehicle kit is located in the field room and should be used when field staff drive personal or rental vehicles; and in the office, first aid kits are located at each fire extinguisher location in the north hall, west hall, main kitchen, and large conference room. The location of first aid kits and fire extinguishers will also be posted on maps kept in communal office spaces (kitchens and conference rooms).

- Portable fire extinguishers are included in the field first aid/safety kits and are also located in the office in the north hall, west hall, main kitchen south entrance, and Cedar Conference room.
- A copy of the HASP if on a job site.
- A binder of Safety Data Sheets (SDSs) for commonly encountered chemicals and all potential contaminants of concern that may be present on a job site. This binder is kept in the document organizer compartment of the company vehicle and an additional copy is kept in the field room.

4.6 INCLEMENT WEATHER

Occasionally, there are weather conditions, like snow, that make travel difficult. If the Seattle Public Schools are closed for the day due to hazardous road conditions, then the office will also be closed out of concern for your safety. Any field work scheduled during an office closure due to inclement weather should also be postponed.

4.7 CATASTROPHIC EVENTS

Floyd|Snider has formed an Emergency Planning Committee to develop preparation, communication, and safety plans to implement if a catastrophic event occurs. A catastrophic event is an event that disrupts or destroys critical infrastructure, such as a large-scale earthquake or other natural disaster.

Emergency Kits

Each staff member is provided one emergency kit backpack in case of emergencies that disrupt transportation or utilities. These backpacks include a map with critical structures, contact list and work plan, 32-ounce water bottle (to be filled and replaced every 6 months by the employee), additional 14-ounce water bottle and Platypus water container, water purification tablets, food bars, magnesium firestarter and matches, a multi-purpose tool, an LED flashlight and extra batteries, an emergency radio, an emergency (heat reflective) blanket, rags, nylon rope, a tarp and trash bags, duct tape, hand cleanser, Super Glue, and a hiker's first aid kit. Employees should provide their own raingear, extra socks, walking/hiking shoes, family plan, sunscreen, and 3-day supply of critical medicines. Not all packs are exactly the same, but all should include the items listed above. The Emergency Planning Committee will send regular reminders to check emergency kits and replace expired items.

Staff members should keep their emergency contact card up to date, listing phone numbers for whom to contact if they are unable to make calls themselves. Emergency contact cards should be kept in the front pocket of the backpack, where they can be easily located by others.

Staff should familiarize themselves with the contents of the emergency backpack to make sure all necessary items are included and that they are operational. The Emergency Planning Committee will remind staff every 6 months to check and update backpack contents (replace water in water containers, check the expiration date on the nutrient bars, update contact list if it is not current, etc.). Staff are responsible for keeping the employee contact list updated and having a sensible pair of shoes available in the office.

WhatsApp Emergency Contact Group

The purpose of our WhatsApp group is for group coordination needs during periods of emergency. It will be an easy way for management to communicate next steps back to the entire group, such as the status of the office/IT and expected timelines for returning to work. It also serves as an additional way to check in and communicate that staff and family are safe. Remember, immediately after an emergency, the initial call to check in with Jessi should still be made. Join the Floyd|Snider group on WhatsApp:

1. Download the WhatsApp app on to your phone and setup your account
2. Join the "F|S Emergency Contact" group by following the instructions on the Health & Safety Department site: https://floydsnider.sharepoint.com/Dept/Safety/SitePages/Emergencies.aspx#emergency-coordination-whatsapp

At the 6-month check-in time for backpack contents, employees should also confirm that they are still connected and included in the WhatsApp group. If an employee has been removed from the group (which can occur during software updates, etc.), the employee should notify the Emergency Planning Committee to have the group invitation resent so they can rejoin the group.

What to Do if You Are <u>in</u> the Office When a Disaster Occurs

If you are in the office when an emergency occurs, first and foremost is to remain safe. Wait until the building gives instructions over the PA system, then take your emergency kit and exit the building safely and quickly to meet at the Floyd|Snider muster point at the Paramount Theatre, on the corner of Pine Street and 9^{th} Avenue. Once you have checked in with other Floyd|Snider staff there, you should find your way home safely to check on family and property. Jessi Massingale has been identified as the Disaster Contact. One person from the muster point will contact Jessi once all employees have been safely evacuated. Floyd|Snider will use the WhatsApp group to communicate next steps, as well as email (if available). WhatsApp is described in more detail above.

What to Do if You Are <u>Not in</u> the Office When a Disaster Occurs

If you are not in the office when an emergency occurs, the first thing to do after ensuring your safety and the safety of your family and property, is to text Jessi or Matt Massingale in Bend, Oregon. Report that you are okay and await further instructions. Other management team members can also be contacted if needed. Floyd|Snider will use the WhatsApp group to communicate next steps, as well as email (if available).

In Emergency, Text Jessi/Matt in Bend		
Jessi	206.683.4307 (cell)	
Matt	206.255.2799 (cell)	541.241.6255 (work)
Management Team Numbers		
Allison	206.722.2460 (cell)	206.842.4484 (home)
Kate	206.375.0762 (cell)	206.781.7682 (home)
Tiffany	206.779.2806 (cell)	

Building Access

Depending on the severity of the disaster, Union Square may be closed for inspection, bus routes may be disrupted, and cell phone service may be limited. The nature and likely duration of the emergency aftermath will affect decision-making around working at the office during this time. Floyd|Snider will send out communications via WhatsApp and/or email with information on when to resume work and when it is safe to return to the office.

5.0 Hazard Awareness and Mitigation

In general, there are three broad hazard categories that may be encountered on the job: chemical exposure hazards, fire and explosion hazards, and physical hazards. Sections 5.1 through 5.3 discuss the specific hazards that fall within each of these broad categories and ways to mitigate these hazards.

Additional hazard analysis for specific chemicals present or tasks to be performed at a job site should be detailed in the HASP for the site.

5.1 CHEMICAL EXPOSURE HAZARDS

Potential toxic effects can occur from significant acute or chronic exposure to hazardous chemicals.

Hazardous products used in the office or on the job site should be sealed and stored in places where they cannot be easily spilled. Always follow manufacturer instructions for storage and use of hazardous chemicals. Discard chemicals no longer in use in accordance with manufacturer's instructions, and discard chemicals if containers are damaged, corroded, or otherwise leaking. Consider nontoxic alternatives to cleaning and other products when possible. Consider use of gloves or eye protection when handling or using chemicals with the potential to irritate eyes or skin if contacted.

On contaminated sites and on work sites where hazardous chemicals are used, chemical exposure hazards, monitoring procedures, and decontamination procedures should be detailed in the site HASP.

5.2 FIRE AND EXPLOSION HAZARDS

When storage of material posing a fire and explosion hazards is necessary, such material will be stored in containers approved by the Washington State Department of Transportation in a location not exposed to strike hazards and provided with secondary containment. A minimum 2A:20B fire extinguisher will be located within 25 feet of the storage location and where refueling occurs. Any subcontractors bringing flammable and combustible liquid hazards to a job site are responsible for providing appropriate material for containment and spill response, which should be addressed in their respective HASP, Job Hazard Analysis (JHA), or Job Safety Analysis (JSA). Transferring of flammable liquids (e.g., gasoline) will occur in areas with containment to capture any spillage, and only after making positive metal-to-metal connection between the containers, which may be achieved by using a bonding strap. Storage of ignition and combustible materials will be kept away from fueling operations.

5.3 PHYSICAL HAZARDS

When working in or around any hazardous or potentially hazardous substances or situations, all personnel should plan all activities before starting any task. Personnel shall identify health and safety hazards involved with the work planned. If you have concerns or uncertainty about the safety of a given task, always consult with your PM or, if in the field, with your HSO/SS to determine how the task can be performed in the safest manner.

All field personnel will adhere to general safety rules including wearing appropriate PPE—hard hats, steel-toed boots, high-visibility vests, safety glasses, gloves, and hearing protection, as appropriate. Eating, drinking, and/or use of tobacco or cosmetics will be restricted in all work areas. Personnel will prevent splashing of liquids containing chemicals and minimize dust emissions.

The following table summarizes a variety of physical hazards that may be encountered during work activities. For convenience, these hazards have been categorized into several general groupings with recommended preventative measures.

Hazard	**Cause**	**Prevention**
Head strike	Falling and/or sharp objects, bumping hazards	Hard hats will be worn by all personnel at all times when overhead hazards exist.
Foot/ankle twist, crush, slip/trip/fall	Sharp objects, dropped objects, uneven and/or slippery surfaces	Steel-toed boots must be worn at all times on site while heavy equipment is present. Pay attention to footing on uneven or wet terrain and do not run. Keep work areas organized and free from unmarked trip hazards.
Hand cuts, splinters, and chemical contact	Hands or fingers pinched or crushed; chemical hazards; cut or splinters from handling sharp/rough objects and tools	Nitrile safety gloves will be worn to protect the hands from dust and chemicals. Leather or cotton outer gloves will be used when handling sharp-edged rough materials or equipment. Refer to preventive measures for mechanical hazards below.
Eye damage from flying materials, or splash hazards	Sharp objects, poor lighting, exposure due to flying debris or splashes	Safety glasses will be worn at all times on a job site. If a pressure washer is used to decontaminate heavy equipment, a face shield will be worn over safety glasses or goggles. Care will be taken during decontamination procedures to avoid splashing or dropping equipment into decontamination water.

Hazard	Cause	Prevention
Electrical hazards	Electrical cord hazards	Make sure that no damage to extension cords occurs. If an extension cord is used, make sure it is the proper size for the load that is being served and rated SJOW or STOW (an "-A" extension is acceptable for either) and inspected prior to use for defects. The plug connection on each end should be of good integrity. Insulation must be intact and extend to the plugs at either end of the cord. All portable power tools will be inspected for defects before use and must be either double-insulated or grounded with a ground-fault circuit interrupter.
Mechanical hazards	Heavy equipment such as drilling machine	Ensure the use of competent operators, backup alarms, "kill" switches, regular maintenance, daily mechanical checks on all hoses and cables, and proper guards. Verify that "whip checks" or similar securing devices are installed on "quick-connections," where the failure of high-pressure connections could lead to the whipping of hoses. Discuss the need for plastic sheeting or other methods to contain drips (hydraulic oil, motor oil, etc.) to determine if measures are needed to prevent releases to the ground. Subcontractors will supply their own JHA, HASP, or JSA. All personnel will make eye contact with operator and obtain a clear OK before approaching or working within a hazardous radius of the heavy equipment.
Noise damage to hearing	Machinery creating more than 85 decibels time-weighted average, less than 115 decibels continuous noise, or peak at less than 140 decibels	Wear earplugs or protective ear covers when a conversational level of speech is difficult to hear at a distance of 3 feet or if an employee must shout to be heard by nearby coworkers; when in doubt, a sound level meter may be used on site to document noise exposure.

Hazard	Cause	Prevention
Strains from improper lifting	Injury due to improper lifting techniques, overreaching/ overextending, lifting overly heavy objects	Use proper lifting techniques and mechanical devices where appropriate. The proper lifting procedure first involves testing the weight of the load by tipping it. If in doubt, ask for help. Do not attempt to lift a heavy load alone. Take a good stance and plant your feet firmly with legs apart, one foot farther back than the other. Make sure you stand on a level area with no slick spots or loose gravel. Use as much of your hands as possible, not just your fingers. Keep your back straight, almost vertical. Bend at the hips, holding load close to your body. Keep the weight of your body over your feet for good balance. Use large leg muscles to lift. Push up with one foot positioned in the rear as you start to lift. Avoid quick, jerky movements and twisting motions. Turn the forward foot and point it in the direction of the eventual movement. Never try to lift more than you are accustomed to lifting.
Traffic hazards	Vehicle traffic and hazards when working near active operations	When working in or near the right-of-way, orange cones and/or flagging will be placed around the work area. Safety vests will be worn at all times while conducting work in or near the right-of-way. Multiple staff will work together (buddy system) and spot traffic for each other. Avoid working with your back to traffic whenever possible.
Cold stress	Cold temperatures and related exposure	Workers will ensure appropriate clothing, stay dry, and take breaks in a heated environment when working in cold temperatures. Further detail on cold stress is provided in Section 5.3.1.
Heat exposure	High temperatures exacerbated by PPE, dehydration	Workers will ensure adequate hydration, shade, and breaks when temperatures are elevated. Further detail on heat stress is provided in Section 5.3.2.
Accidents due to inadequate lighting	Improper illumination	Work will proceed during daylight hours only or under sufficient artificial light.
Drowning hazards	Work in or near water	Wear a personal flotation device at all times when working in or near water. Be aware of surroundings including head strike and trip hazards that could cause a fall into water.

Hazard	Cause	Prevention
Slip, trip, and fall hazards	Working in vegetated areas, areas with uneven ground surface, or areas with obstructions	Watch your step when walking and minimize distractions. Establish a path free of obstructions before mobilizing equipment.

5.3.1 Cold Stress

Exposure to moderate levels of cold can cause the body's internal temperature to drop to a dangerously low level, causing hypothermia. Symptoms of hypothermia include slow, slurred speech, mental confusion, forgetfulness, memory lapses, lack of coordination, and drowsiness.

To prevent hypothermia, stay dry and avoid exposure. On a job site, personnel will have access to a warm, dry area, such as a vehicle, to take breaks from the cold weather and warm up. Site personnel will be encouraged to wear sufficient clothing in layers such that outer clothing is wind- and waterproof and inner layers retain warmth (wool or polypropylene), if applicable. Site personnel will keep hands and feet well protected at all times. The signs and symptoms and treatment for hypothermia are summarized below.

Signs and Symptoms

- Mild hypothermia (body temperature of 98–90 degrees Fahrenheit [°F])
    - Shivering
    - Lack of coordination, stumbling, fumbling hands
    - Slurred speech
    - Memory loss
    - Pale, purplish gray, or dusky and cold skin
- Moderate hypothermia (body temperature of 90–86 °F)
    - Shivering stops
    - Unable to walk or stand
    - Confused and irrational
- Severe hypothermia (body temperature of 86–78 °F)
    - Severe muscle stiffness
    - Very sleepy or unconscious
    - Ice cold skin
    - Death

Treatment of Hypothermia—Proper Treatment Depends on the Severity of the Hypothermia

- Mild hypothermia
  - Move to warm area.
  - Stay active.
  - Remove wet clothes, replace with dry clothes or blankets, and cover the head.
  - Drink warm (not hot) sugary drinks.
- Moderate hypothermia
  - All of the above, plus:
    - Call 911 for an ambulance.
    - Cover all extremities completely.
    - Place very warm objects such as hot packs or water bottles on the victim's head, neck, chest, and groin.
- Severe hypothermia
  - Call 911 for an ambulance.
  - Treat the victim very gently.
  - Do not attempt to re-warm—the victim should receive treatment in a hospital.

Frostbite

Frostbite occurs when the skin actually freezes and loses water. In severe cases, amputation of the frostbitten area may be required. Although frostbite usually occurs when the temperatures are 30 °F or lower, wind chill factors can allow frostbite to occur in above-freezing temperatures. Frostbite typically affects the extremities, particularly the feet and hands. Frostbite symptoms include cold, tingling, stinging, or aching feeling in the frostbitten area followed by numbness and skin discoloration: Paler skin may change from red to purple, then to white or very pale, and darker skin may become more pale, dusky, or purplish. Frostbitten skin will be waxy and firm while still frozen and may redden, swell, or blister when thawed. Should any of these symptoms be observed, wrap the area in soft cloth, do not rub the affected area, and seek medical assistance. Call 911 if the condition is severe.

Protective Clothing

Wearing the right clothing is the most important way to avoid cold stress. The type of fabric also makes a difference. Cotton loses its insulation value when it becomes wet. Wool, on the other hand, retains its insulation even when wet. The following are recommendations for working in cold environments:

- Wear at least three layers of clothing.
  - An outer layer to break the wind and allow some ventilation (like Gortex or nylon)

  - A middle layer of down or wool to absorb sweat and provide insulation even when wet
  - An inner layer of cotton or synthetic weave to allow ventilation
- Wear a hat—up to 40 percent of body heat can be lost when the head is left exposed.
- Wear insulated boots or other footwear.
- Keep a change of dry clothing available in case work clothes become wet.
- Do not wear tight clothing—loose clothing allows better ventilation.

Work Practices

- Drinking—Drink plenty of liquids, avoiding caffeine and alcohol. It is easy to become dehydrated in cold weather.
- Work Schedule—If possible, heavy work should be scheduled during the warmer parts of the day. Take breaks out of the cold in heated vehicles.
- Buddy System—Work in pairs to keep an eye on each other and watch for signs of cold stress.

5.3.2 Heat Stress

To avoid heat-related illness, current regulations in WAC 296-62-095 through 296-62-09570 will be followed during all outdoor work activities. These regulations apply to any outdoor work environment from May 1 through September 30 when workers are exposed to temperatures greater than 89 °F when wearing breathable clothing, greater than 77 °F when wearing double-layered woven clothing (such as jackets or coveralls), or greater than 52 °F when wearing non-breathing clothing such as chemical resistant suits or Tyvek. Floyd|Snider will identify and evaluate temperature, humidity, and other environmental factors associated with heat-related illness including, but not limited to, the provision of rest breaks that are adjusted for environmental factors and encourage frequent consumption of drinking water. Drinking water will be provided and made readily accessible in sufficient quantity to provide at least 1 quart per employee per hour. All Floyd|Snider personnel performing outdoor work will be informed and trained for responding to signs or symptoms of possible heat-related illness and accessing medical aid.

Employees showing signs or demonstrating symptoms of heat-related illness must be relieved from duty and provided with a sufficient means to reduce body temperature, including rest areas or temperature-controlled environments (i.e., air conditioned vehicle). Any employee showing signs or demonstrating symptoms of heat-related illness must be carefully evaluated to determine whether it is appropriate to return to work or whether medical attention is necessary.

Any incidence of heat-related illness must be immediately reported to the employer directly through the HSO/SS.

The signs, symptoms, and treatment of heat stress include the following:

Condition	Signs/Symptoms	Treatment
Heat cramps	Painful muscle spasms and heavy sweating	Increase water intake, rest in shade/cool environment.
Heat syncope	Brief fainting and blurred vision	Increase water intake, rest in shade/cool environment.
Dehydration	Fatigue, reduced movement, headaches	Increase water intake, rest in shade/cool environment.
Heat exhaustion	Pale and/or clammy skin, possible fainting, weakness, fatigue, nausea, dizziness, heaving sweating, blurred vision, body temperature slightly elevated	Lie down in cool environment, water intake, loosen clothing, and call 911 for ambulance transport if symptoms continue once in cool environment.
Heat stroke	Cessation of sweating, skin hot and dry, red or flushed face, high body temp, unconsciousness, collapse, convulsions, confusion or erratic behavior; life-threatening condition	**Medical Emergency!! Call 911** for ambulance transport. Move victim to shade and immerse in water.

If site temperatures are forecast to exceed 85 °F and physically demanding site work will occur in impermeable clothing, the HSO/SS will promptly consult with a certified industrial hygienist and a radial pulse monitoring method will be implemented to ensure that heat stress is properly managed among the affected workers. The following heat index chart indicates the relative risk of heat stress.

Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	106	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution Extreme Caution Danger Extreme Danger

5.3.3 Allergies and Biohazards

Allergens capable of triggering a severe reaction may be present in the office environment or the job site. Outdoor work presents additional biohazards such as bees and other insects and wildlife.

Staff with severe allergies should make these allergies known to Floyd|Snider and maintain appropriate preventative medications (EpiPen, Benadryl, etc.) as directed by their physician in a location that can be easily accessed in case of emergency. The locations of these medications should be shared with the Floor Wardens, along with instructions for delivery if needed.

In the field, persons with allergies to bees or other insects will make the HSO/SS aware of their allergies and will avoid areas where bees/insects are identified. Controls such as repellents, hoods, nettings, masks, or other personal protection may be used. Report any insect bites or stings to the HSO/SS and seek first aid, if necessary. Especially when working during the summer months, staff should monitor the work area for evidence of insect nests of stinging insects. A nest may be nearby if multiple flying insects are observed in the area, or if flying insects appear to be entering and leaving the same locations. Nests may be buried underground, located in vegetated areas, or in structures such as well monuments, vaults, and buildings.

Inspect the work area for hazardous plants, medical waste (syringes and similar items), and indications of hazardous organisms, and avoid such areas if possible. On job sites, personnel will maintain a safe distance from any urban wildlife encountered, including stray dogs, raccoons, and rodents, to preclude a bite from a sick or injured animal.

A severe allergic reaction, or anaphylaxis, is a rapid immune response that may be fatal if untreated. Persons experiencing anaphylaxis require medical care beyond preventative medication or first aid. The signs of anaphylaxis may include the following:

- Extensive skin rashes, itching, or hives
- Swelling of the lips, tongue, or throat
- Shortness of breath, trouble breathing, or wheezing
- Dizziness and/or fainting
- Stomach pain, bloating, vomiting, or diarrhea
- Uterine cramps
- Feelings of panic or dread

5.3.4 Fatigue

Worker fatigue can impair judgment and increase the risk of injuries on the job site. Fatigue may be caused by physical exertion from difficult tasks, extended working hours, and environmental challenges, including exposure and extreme weather. Fatigue can be caused by working extended hours for a duration of 1 week or more (including overtime work, consecutive long shifts, and extended work weeks) or by extremely physically and mentally demanding work of any duration. Tasks should be assessed individually for risk of fatigue. Variable weather conditions (high and low temperatures, sustained strong winds) can place additional physical and mental strain on field personnel.

5.3.4.1 Fatigue Symptoms and Self-Monitoring

Signs and symptoms of fatigue may present similarly to inebriation and can include:

- Reduced fine motor skills and coordination (e.g., tripping or dropping items)
- Impaired concentration
- Poor communication
- Poor judgment
- Mood swings or irritation

The above are typical symptoms of fatigue, but individuals can also experience or present fatigue in other ways that may be less obvious to an observer. The HSO/SS should additionally check in with staff members to ensure they are not experiencing any symptoms of fatigue that may impair their judgment or coordination in the field.

5.3.4.2 Managing Fatigue

Fatigue should be managed by limiting working hours and implementing rest days. Signs and symptoms of fatigue and fatigue management should be discussed, when applicable, at the daily tailgate and debrief meetings.

Potential actions to minimize fatigue include the following:

- Plan to get 7 to 9 hours of sleep each night
- Take a lunch break inside, or out of the weather
- Take snack and hydration breaks throughout the day
- Take a late start, half-day, or rest day during the field event

5.3.4.3 Fatigue Response Actions

In job situations where fatigue is likely, the HSO/SS should monitor employee fatigue using the following guide.

If the answer is yes to any of the following questions, the HSO/SS should consider implementing a shortened work day, light duty, or a day off for the affected employee.

- Do environmental factors pose an additional fatigue load (e.g., exposure to extreme hot/cold weather or wind)?
- Has the team member exhibited signs of fatigue?
- Has the team member worked on a physically intense task?

- Has the team member worked through the day without taking regular breaks to eat, stay hydrated, and rest?
- Has the team member had less than 6 hours of sleep in the past 24 hours?
- Did the team member work more than 12.5 hours in the past day?

If the answer is yes to either of the following questions, the HSO/SS will implement a day off for the affected employee.

- Did the team member work more than 75-80 hours in the past week?
- By the end of the shift, has the team member been awake for more than 17 hours?

Employees should also self-monitor for signs of fatigue and immediately report to the HSO/SS if fatigue becomes a concern.

If fatigue becomes a team-wide safety issue on the job site, the HSO/SS should coordinate with the PM to determine the actions that will be taken at the project level to manage fatigue. Actions may include adding team members, changing work practices, and/or adjusting the work schedule.

6.0 Job Site Controls

This section describes the best practices to be implement on a field job site to protect personnel and the environment. These best practices are considered the minimum controls for any job site, and additional site-specific protocols should be detailed in the site-specific HASP.

- All site work should be completed in teams when possible. Teams should establish a primary means of communication on-site and with offsite contacts (generally via cell phones or radios on-site). An agreed-upon system of alerting via air horns and/or vehicle horns may be used around heavy equipment to signal an emergency if shouting is ineffective.
- Work area perimeter controls should be established to ensure that members of the public do not enter the work area and limit the potential for chemical exposure associated with site activities when hazardous materials may be present. These work areas include a support zone, a contaminant reduction zone (decontamination area), and an exclusion zone.
- Staff will take precautions to prevent contamination:
  - Inspect all PPE prior to entering the exclusion zone.
  - Avoid walking through puddles or areas of known or obvious surface soil contamination.
  - Do not carry unnecessary items into the exclusion zone.
  - Take care to limit contact with heavy equipment and vehicles.
  - Protect the ground surface when processing samples and wipe down or sweep surfaces frequently to minimize the amount of potential contaminated material that may be spread during site work.
- Staff will decontaminate all equipment and gear as necessary during field events. Decontamination procedures will be strictly followed to prevent offsite spread of contaminated materials. Decontamination procedures should be detailed in the site-specific HASP but at a minimum will include cleaning equipment to a visually debris-free surface. The HSO/SS will assess the effectiveness of decontamination procedures by visual inspection.
- Hands must be thoroughly washed before leaving the Site to eat, drink, or use tobacco or cosmetics.
- Visual monitoring for fugitive dust and soil track-out by vehicles leaving the job site should be conducted by the HSO/SS or a dedicated member of the field staff. If visible dust leaving the work area or track-out are observed, immediate action should be taken to correct the issue.
- The HSO/SS will ensure the proper collection, packaging, and identification of waste materials so that waste materials will be properly disposed of.

7.0 Training Requirements

All Floyd|Snider field personnel must comply with applicable regulations specified in WAC Chapter 296-843, Hazardous Waste Operations, and WISHA (WAC Chapter 296-800). WISHA states that personnel who may come into contact with hazardous materials must have current HAZWOPER certification and participate in an employer-sponsored medical monitoring program. Therefore, these sections apply to any employee at Floyd|Snider who performs work where they have the potential to come in to contact with hazardous or dangerous substances. Additionally, when doing site work, at least one person on-site must be trained in CPR/First Aid. In order to maintain compliance with the regulation, **employees whose medical clearance or HAZWOPER certification are expired may not conduct field work unless their medical examination or refresher course is scheduled to occur within 30 days of their previous certification expiration date.**

7.1 MEDICAL MONITORING

In accordance with state medical surveillance regulations, field staff employees must participate in the medical monitoring program, which benefits both the employees and Floyd|Snider by evaluating the overall health of each individual in connection with the work to be performed, as well as monitoring workplace health and safety initiatives. Employees who will be working on-site are required to participate in a baseline examination and biennial examinations, as well as completion of an exit exam should an employee no longer conduct onsite work requiring medical monitoring.

The purpose of the Floyd|Snider examination program is to:

- Provide a baseline of health information for an employee, which can be used for comparison in related future examinations;
- Detect any adverse health effect that might be a result of workplace exposures;
- Detect any underlying medical condition that may place an employee at higher risk for medical problems related to workplace activities; and
- Ensure that an employee is able to function safely while performing their essential job functions at Floyd|Snider.

When an employee is no longer participating in fieldwork and wishes to unenroll from the Floyd|Snider medical monitoring program, the employee should contact the Health and Safety Administrator for approval and to begin the medical monitoring program exit process described in Section 7.5.

7.2 HAZWOPER TRAINING

HAZWOPER training and certification are required for all staff on-site at sites regulated by the Model Toxics Control Act (MTCA) or the USEPA more than 30 days per year. This training typically includes an initial 40-hour HAZWOPER certification and annual 8-hour refresher courses. Field staff who have the potential to contact contaminated materials must have 40-hour HAZWOPER certification and attend annual 8-hour refresher courses. HAZWOPER certification may also be necessary on a project-specific basis for PMs who are not active in the field safety training and medical monitoring program. Field staff who do not have the potential to contact contaminated material, and are not in a supervisory field role, may require fewer hours of HAZWOPER training, to be determined on a case-by-case basis. These employees will also be required to attend annual 8-hour refresher courses.

7.3 JOB-SPECIFIC TRAINING

In addition to the 40-hour classroom training required by HAZWOPER, all field staff must complete 24 hours of job-specific training. This training is conducted on-site in the field under direct supervision of a skilled supervisor who is another Floyd|Snider employee. These training hours can occur on one or multiple field events and can cover an array of standard field activities. Once the 24-hours of training is complete, job-specific training forms (available on Floyd|Snider's Health and Safety department page on SharePoint) must be completed and signed by the trainer and submitted to the Health and Safety Administrator.

Additional site-specific training should be conducted to cover onsite hazards; PPE requirements, use, and limitations; decontamination procedures; and emergency response information as outlined in the HASP for the site.

7.4 CPR/FIRST AID

When conducting field work, at least one person on-site must be trained in CPR/First Aid, with a current certification. All employees who are on-site at MTCA- or USEPA-regulated sites more than 30 days per year are required to have current CPR/First Aid certification. This training is also provided by the company to any interested employees, including those who do not do field work.

7.5 EXITING THE FIELD STAFF SAFETY TRAINING AND MEDICAL MONITORING PROGRAM

This section presents the protocols to be followed in the event that an employee must exit the field staff safety training and medical monitoring program due to termination of their employment or transition to a different role at Floyd|Snider.

7.5.1 Termination of Employment

Washington's medical surveillance regulations require Floyd|Snider to schedule an exit exam for an employee upon termination of employment. Upon termination, employees will be notified of the appointment date and time and will be given information to reschedule the appointment if needed. The exit exam will be provided at Floyd|Snider's sole expense, and it is strongly recommended, in the best interest of your health, that you attend the appointment.

Floyd|Snider reserves the right to withhold payment of any severance package offered until confirmation of the exam is received.

7.5.2 Transition of Role

Floyd|Snider is a company of versatile employees with technical expertise who collaborate effectively to meet client and project needs; because of this collaborative approach, we do not employ full-time field technicians who exclusively fill a sampling role. Therefore, to ensure that client needs are met even during our busiest times and spread workload equitably across the firm, it is essential that all staff involved in field data collection, including in a supervisory capacity, maintain current field safety certification and medical clearance.

However, under certain limited circumstances, an employee may transition roles at the company such that field certifications are no longer needed. An employee who wishes to exit the field staff safety training and medical monitoring program must:

- Document that employee has performed fewer than 30 partial or full days of field work for each of the past 2 calendar years; and
- Obtain approval from the Management Committee, by coordinating with the Health and Safety Administrator.

If an employee’s exit from the program is approved, the employee is required by WISHA to complete a medical monitoring exit exam. Failure to complete an exit exam may result in withholding any bonus pay and a delay in annual pay increases.

A letter to document the date and reason for an employee’s rationale for terminating participation in the field staff safety training and medical monitoring program, signed by the employee and a Principal, must be maintained in the employee’s personnel file.

8.0 Record Keeping and Reporting

Prompt and accurate recording and reporting is essential for continuing to improve the Floyd|Snider health and safety program and comply with the safety regulations.

8.1 RECORD KEEPING

Records should be kept of all employee training, safety meetings including Health and Safety Committee meetings and daily tailgate safety meetings conducted in the field, and near misses and incidents. Forms for on-the-job employee training, daily tailgate safety meetings, and near misses and incidents are available on the company's Health and Safety department page on SharePoint.

The minutes of Health and Safety Committee meetings are recorded by the Health and Safety Administrator and maintained on Floyd|Snider's Health and Safety department page on SharePoint.

The HSO/SS, or a designated alternate, will be responsible for conducting daily tailgate safety meetings and recording the meeting on a daily tailgate safety meeting form. The form, which must be appended to all HASPs, lists the hazards discussed and is signed by all personnel present at the meeting. The HSO/SS will manage the administration of job-specific training. Job-specific training forms must be completed and signed by the trainer.

Daily tailgate safety meeting and job-specific training forms must be reviewed with the PM after completion of the field event. After PM review, scans of the forms should be saved to the appropriate project folder, and the original copies of the forms will be submitted to the Health and Safety Administrator. The PM and the Health and Safety Administrator will determine whether any issues identified on tailgate safety meeting forms require further review or follow-up actions.

8.2 REPORTING

Near misses and incidents should be recorded on a Near Miss and Incident Reporting Form. The form gathers information regarding the circumstances of the near miss or incident, consequences, and corrective actions implemented. Near misses and incident report forms may be filled out by any Floyd|Snider staff. If a near miss or incident occurs in the field, the form must be reviewed and signed by the HSO/SS and the PM. This form must be appended to all site-specific HASPs.

Near Miss and Incident Reporting Forms will be maintained by the Health and Safety Administrator and made accessible to all staff for review after information that may identify specific individuals is redacted. In the event that an injury occurs in the workplace, the Health and Safety Administrator will coordinate with the PM or Management Committee to determine whether the injury is OSHA-reportable and implement follow-up reporting.

9.0 Signature Page

I have read this Accident Prevention Plan and understand its contents. I agree to abide by its provisions and will immediately notify the Health and Safety Administrator or Board of Directors if conditions or hazards not specifically designated herein are encountered.

Name (Print)	Signature	Date

Remedial Investigation/Feasibility Study Work Plan

Silver Bay Logging Site

Appendix D

Attachment D.2
Daily Tailgate Safety Meeting and Debrief Form

DAILY TAILGATE SAFETY MEETING AND DEBRIEF FORM

Instructions: To be completed by the Site Safety Officer prior to beginning of work each day, when changes in work procedures occur, or when additional hazards are present. Review with your Project Manager at the conclusion of your event and file with your field notes.

PROJECT NAME AND ADDRESS:	WORK COMPLETED/TOOLS USED:

TOPICS/HAZARDS DISCUSSED:

Chemicals of concern:
Slip, trip, fall:
Heat or cold stress:
Required PPE:
Other Potential Hazards (Biological, Physical, Environmental, etc.):
Decontamination:

SPECIAL SITE CONSIDERATIONS:

ATTENDEE NAME/SIGNATURE:

ADDITIONAL HAZARDS IDENTIFIED DURING WORKDAY:

Near Misses or Incidents? Complete Near Miss and Incident Reporting Form(s).

Site Safety Officer Signature/Date: ____

Project Manager Review (Initial) __________

Remedial Investigation/Feasibility Study Work Plan

Silver Bay Logging Site

Appendix D

Attachment D.3
Near Miss and Incident Reporting Form

NEAR MISS AND INCIDENT REPORTING FORM

Instructions for Field Staff:

- Report near misses and incidents using this form and notify the Site Safety Officer or Field Lead.
- Notify the Project Manager immediately in the event of a serious incident such as an injury, damage to equipment, or an event that causes a work stoppage. For all other near misses or minor incidents, review this form with your Project Manager at the end of the workday or field event.
- Submit this form to the Health and Safety Program Administrator after review with the Project Manager. Report additional information (i.e., corrective action or medical updates) to the Health and Safety Program Administrator within 1 week of the near miss or incident.

Date:	**Project:**
Time:	**Site/Location:**
Incident Type: ☐ **Near Miss** ☐ **Incident**	

Employee(s) Involved (include witnesses)**:**

Description of Incident (include precise location, injuries, the task performed, equipment/ materials involved, equipment damaged, anomalies, deviations, and consequences)**:**

What Was the Cause of the Incident?

Describe Any First Aid or Medical Treatment:

Conditions During Incident (extreme weather, fatigue, visibility or lighting, etc.)**:**

Preparer's Signature:___________________________________ **Date:**___________________

SSO or Field Lead Signature:_____________________________ **Date:**___________________

INCIDENT REPORTING FOLLOW-UP FORM

Instructions for the Site Safety Officer or Project Manager:

- Complete this form following an incident.
- Submit this form with a copy of the completed Near Miss and Incident Reporting Form to the Health and Safety Program Administrator with copies to the Principal-in-Charge for the project within 24 hours of the incident.
- Any additional information (i.e., corrective action or medical updates) should be reported to the Health and Safety Program Administrator within one week of the incident.

Describe Any Follow-Up First Aid[1] or Medical Treatment:

Was This an OSHA-Reportable Incident[2]? Why?

What Was the Root Cause of the Incident Based on the 5 Why's Approach[3]?

Follow-Up Actions Taken (include dates)**:**

SSO or Field Lead Signature:______________________________ Date:____________________

Project Manager's Signature: ______________________________ Date:____________________

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[1] First Aid is defined as: using non-prescription medication at non-prescription strength, cleaning wounds on the skin surface, applying wound coverings (not sutures/staples), removing foreign bodies from the eye using irrigation or a swab, removing foreign bodies from elsewhere (not the eye) using tweezers, hot/cold therapy, drinking fluids to relieve heat stress, using finger guards or eye patches, using non-rigid means of support (such as bandages), using temporary immobilizing devices while transporting an injured person, administering tetanus immunizations. Care administered beyond these activities requires follow-up reporting by the Project Manager to the Health and Safety Program Administrator and Principal-in-Charge of the Project within 24 hours of the incident.

[2] Guidelines for determining what incidents are OSHA Reportable are available here: *https://www.osha.gov/recordkeeping/*.

[3] If the incident was an OSHA reportable incident, complete a Root Cause Analysis using the Five Why's Approach.

Remedial Investigation/Feasibility Study Work Plan

Silver Bay Logging Site

Appendix D

Attachment D.4
Floyd|Snider Standard Guideline: COVID-19 Health and Safety Guidelines

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strategy ▪ science ▪ engineering

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F|S STANDARD GUIDELINE

COVID-19 Health and Safety Field Guidelines

This Special Condition must be appended to all Floyd|Snider Standard Guidelines beginning immediately (March 26, 2020) and until such a time that the COVID-19 crisis is no longer a Washington health risk as determined by the Governor of the State of Washington.

Floyd|Snider is dedicated to helping our community during this unique time in history. Our work is essential to the continued protection of our community and the environment. As such, this special condition is to inform our staff on how to comply with the "Washington Ready" Order issued by the Washington Governor effective July 1, 2021, and the Department of Labor and Industries Division of Occupational Safety and Health's *General Coronavirus Prevention Under Stay Safe – Stay Healthy Order*, updated on September 15, 2021, as well as continue our business safely.

DATE/LAST UPDATE: March 2022

These procedures should be considered standard guidelines and are intended to provide useful guidance when in the field, but are not intended to be step-by-step procedures, as some steps may not be applicable to all projects.

All field staff should be sufficiently trained in the standard guidelines and special procedures for the sampling method they intend to use and should review and understand these procedures prior to going into the field. It is the responsibility of the field staff to review the standard guidelines and special conditions with the field manager or project manager and identify any deviations from these guidelines prior to field work. When possible, the project-specific Sampling and Analysis Plan should contain any expected deviations and should be referenced in conjunction with these standard guidelines and special conditions.

1.0 Special Condition Applicability

These guidelines apply to all field work and all field staff, including teaming partners. Some field events may need to be postponed due to the COVID-19 pandemic. Decisions regarding proceeding with field work or postponing will be made on an event-by-event basis by the Project Manager (PM), in consultation with Principals as necessary.

ALL field staff have stop work authority. Employee health and safety takes precedence over schedule and budget. Keep your PM informed of any concerns so the team can identify a solution.

2.0 Equipment and Supplies

The following is a list of additional equipment and supplies necessary to maintain health and safety during the COVID-19 pandemic.

- Masks
  - Masks must be worn in accordance with current masking requirements. The use of masks in public spaces and most workplace settings may be mandated by the Washington Governor and many other state agencies. Field staff must comply with the current requirements issued by the applicable state officials, or by the State of Washington, whichever is more stringent.
  - Masks should fit snugly over the nose, mouth, and chin with no large gaps on the outside of the face.
  - The most protective and preferred type of mask is a NIOSH- or FDA-approved filtering facepiece respirator (FFR; including N95, KN95, and KF94 designated masks). If an FFR is not available, the next-most protective mask type is a disposable surgical mask. Cloth masks are the least protective and must be constructed of a minimum of two layers of woven fabric.
- Hand cleaner, including soap and water or hand sanitizer containing at least 60% alcohol.
- Surface cleaner, including disinfection wipes or paper towels and spray disinfectant.
  - If using a household bleach solution, dilute at a ratio of 4 teaspoons per quart of water, spray to cover surfaces and allow to sit for at least 1 minute before drying with a disposable towel if needed. Note that bleach solutions must be prepared daily.
  - If using a 60% or greater isopropyl alcohol solution, spray directly on surfaces and allow to dry for at least 1 minute.

3.0 Special Condition Guidelines and/or Procedures

This special condition outlines Floyd|Snider's general requirements to keep employees safe including requirements regarding staying home when sick, considerations in determining if field work can proceed, additional field preparation requirements, and safety precautions to take while in the field. A copy of this Special Condition must be available on-site at all times.

3.1 FLOYD|SNIDER COVID-19 POLICY

Floyd|Snider employees must follow the Floyd|Snider COVID-19 Vaccination, Testing, Screening, and Masking Policy (Attachment 1). The policy applies to all Floyd Snider staff, except for employees who do not report to a workplace where other individuals are present. The policy defines Floyd|Snider's requirements for vaccinations, includes procedures for quarantine in the event of COVID-19 exposure or infection, and describes mask and COVID-19 testing requirements.

If you have cold or flu-like symptoms, have tested positive for COVID-19 within the past 10 days, or had a potential exposure to COVID-19 within the past 10 days, you must work from home (or call in sick). Review the COVID-19 Policy for details (Attachment 1).

3.2 PLANNING FOR FIELD WORK

The Health and Safety Officer (HSO) is responsible for ensuring that all field staff read, understand, and follow this Special Condition. The HSO is also responsible for completing the planning action items described below. If essential work activities are conducted under shutdown conditions, the HSO will be designated as the COVID-19 supervisor.

1. Consider the current conditions and risks associated with the COVID-19 pandemic. If the work will expose unvaccinated people or people at high risk of complications to potential COVID-19 infection, discuss rescheduling the event with the PM.
2. Identify backup field staff for the event (in case someone cannot report to work because of illness or exposure to COVID-19).
3. Coordinate with the client and/or facility manager to ensure that this Special Condition meets the COVID-19 safety requirements of that facility.
4. Contact teaming partners to confirm they have COVID-19 procedures in place for their and your protection. The HSO will review the procedures and will ensure that the policies are consistent with Floyd|Snider's policies before beginning field work. Contact the PM if the teaming partner's procedures are not sufficiently protective.
5. During the field kick-off meeting, discuss potential COVID-19 risk factors specific to the activities you will be conducting and discuss ways to mitigate those risk.
6. Prior to mobilization, coordinate with the client or local businesses to identify restroom and hand-washing facilities
   A. Consider renting portable restrooms and hand-washing stations for field events that do not have a restroom on-site.
   B. Request additional/increased sanitation (disinfecting) of portable toilets and hand-washing stations, at least twice per week, and ensure they are fully stocked.

3.3 ADDITIONAL PLANNING FOR OUT-OF-TOWN FIELD WORK

1. Consider commuting to the site from home rather than staying overnight to minimize potential exposure.

2. When sharing accommodations, or as requested by the HSO, take a COVID-19 test prior to mobilizing for field work. Unvaccinated staff should not share accommodations. Test results that will be accepted include the following:
   A. PCR test within 72 hours of fieldwork.
   B. If a PCR test is not available, take two antigen self-tests 24 hours apart, no sooner than 48 hours prior to fieldwork.

3.4 PERFORMING FIELD WORK

Mobilization

1. Each day, before mobilizing to the site, staff must complete the online pre-work screen health assessment, at https://preworkscreen.com/. If you cannot attend the field event, contact the HSO as soon as possible so a backup field person can be called in.
   A. If you have cold or flu-like symptoms, you must stay home.
   B. If you have you tested positive for COVID-19 within the past 10-days, you must stay home. Refer to the COVID-19 Policy for details (Attachment 1).
   C. If you have had a COVID-19 exposure within the past 10-days, you must stay home. Refer to the COVID-19 Policy for details (Attachment 1).
2. Each day, before mobilizing to the site, subcontractors must complete the pre-work screen health assessment included as Attachment 2. If you cannot attend the field event, contact the HSO as soon as possible.
3. Staff or subcontractors who show up for field work who have cold or flu-like symptoms, have tested positive for COVID-19, or have been exposed to COVID-19 will be sent home immediately and the PM will be notified.
4. Wear gloves during equipment and cooler loading.
5. Clean high touch surfaces in the field van or rental vehicle with sanitizing spray or wipes when you enter and exit the vehicle.
6. If carpooling to a site, wear a mask in accordance with current masking requirements unless everyone has had a negative COVID-19 test (per the criteria in Section 3.3). Open windows to increase airflow.

Daily Tailgate Meeting

1. The HSO will review the procedures in this Special Condition daily during tailgate safety meetings.
2. The HSO will confirm that staff and subcontractors have completed the pre-work screen health assessment and responded "No" to the questions. Additionally, the HSO

will confirm that no one has tested positive for COVID-19 within the past 10-days and no one has had a COVID-19 exposure within the past 10 days.

3. If the Daily Tailgate Meeting is held inside, wear masks in accordance with current masking requirements and maintain 6 feet of social distance.

Performing Field Work

1. If possible, conduct work outdoors or in large, well-ventilated spaces.
2. When possible, take breaks in shifts to aid in social distancing.
3. Minimize the number of people in shared indoors spaces and the time spent indoors.
4. Wear a mask in accordance with current masking requirements when working indoors, or outdoors where 6 feet of social distancing is not possible, unless everyone present has had a negative COVID-19 test per the test criteria in Section 3.3.
   A. Masks do not take the place of ventilation or social distancing, which should be implemented whenever possible.
   B. Use and dispose of masks in accordance with manufacturer’s instructions:
      i. For disposable masks, it is assumed that a mask can be worn for up to 8 hours.
      ii. It is not recommended to reuse masks; however, FFRs may be reused in times of PPE shortages. The CDC advises that an FFR that will be reused should be placed in a paper bag and left undisturbed for 5 days between uses, and that the useful life of a FFR is approximately 40 hours or 5 don/doff cycles.
      iii. Do not reuse surgical masks.
      iv. Immediately discard any mask that becomes dirty or more difficult to breathe through.
      v. Reusable cloth masks should be laundered and machine dried after each use. Place the mask in a sealed bag until it can be washed.
5. Practice good hygiene.
   A. Wash your hands often with soap and water for at least 20 seconds. If soap and water are unavailable, use an alcohol-based hand sanitizer that contains at least 60% alcohol.
   B. Wash or sanitize your hands before putting on a mask and avoid touching the surface of the mask.
   C. Routinely disinfect high-touch surfaces such as doorknobs, light switches, cell phones, toilets, faucets and sinks, and vehicle controls.
6. Implement “Take 5”s. Take 5 minutes between EACH task to identify new hazards, possible ways for unacceptable contact to occur, and methods to avoid those conditions.

7. If a possible COVID-19 exposure occurs at the jobsite, the HSO should notify the PM immediately and complete an incident report. On the incident report, include the number of people who may have been exposed and the circumstances of the possible exposure. Follow up with the PM if anyone else contracts COVID-19.

Response to Presumed COVID-19 Illness On-Site

1. If anyone is showing cold or flu-like symptoms on-site, have them wear a mask and send them home immediately. Limit contact with the person.
2. If the person cannot get home on their own, isolate them from other field staff. If necessary, call 911 for transport and notify the paramedics of any COVID-19 symptoms.
3. After the sick person has left, disinfect all equipment and surfaces they may have contacted.
4. Field staff who no longer feel safe working at the site after another person reports being ill may leave the site using PTO.
5. Field staff who have been exposed to the sick person should follow the COVID-19 Policy (Attachment 1). *An exposure is defined as unmasked contact closer than 6 feet for a cumulative time of 15 or more minutes within the past 48 hours.*

Demobilization

1. Wear gloves during equipment and cooler loading.
2. Clean high touch surfaces in the field van or rental vehicle with sanitizing spray or wipes when you enter and exit the vehicle.
3. If carpooling from a site, wear a mask in accordance with current masking guidance unless everyone has had a negative COVID-19 test (per the criteria in Section 3.3). Open windows to increase airflow.
4. Restock field vehicles with disinfecting wipes and hand sanitizer.
5. Coordinate contactless pickup or delivery of samples, rental equipment, and/or rental vehicles, if possible.

Attachments

Attachment 1 Floyd|Snider COVID-19 Vaccination, Testing, Screening, and Masking Policy

Attachment 2 Subcontractor Pre-Work Health Screen

Attachment 1
Floyd|Snider COVID-19 Vaccination, Testing, Screening, and Masking Policy

COVID-19 Vaccination, Testing, Screening, and Masking Policy

February 1, 2022

Purpose: Floyd Snider believes that COVID-19 vaccines are the best option we have when it comes to staying safe and slowing the spread. To protect the health and safety of Floyd Snider staff, our families, and our clients, we are instituting the following COVID-19 Vaccination, Testing, Screening, and Masking Policy, effective Monday, February 7.

Scope: This policy applies to all Floyd Snider staff, except for employees who do not report to a workplace where other individuals are present.

Policy:

Vaccinations and Testing

All Floyd Snider staff are required to be **fully vaccinated** by Monday, February 21 or follow the **alternate protocol** of taking their own FDA-approved molecular, antigen, or adaptive immune response COVID-19 tests weekly if in the office at least once a week or within seven days before returning to work if away from the office for a week or longer. Floyd Snider will not provide or reimburse COVID-19 tests for non-diagnostic purposes.

Staff are considered fully vaccinated:

- Fourteen days after your dose of an accepted single-dose vaccine
- Fourteen days after your second dose of an accepted two-dose series
- Fourteen days after you received the full series of an accepted COVID-19 vaccine (not placebo) in a clinical trial
- Fourteen days after you received two doses of any “mix-and-match” combination of accepted COVID-19 vaccines administered at least seventeen days apart

Floyd Snider’s definition of “fully vaccinated” may change at a future time to include additional doses. If this change occurs, Floyd Snider will provide employees with at least two weeks to comply and submit updated proof of vaccination.

Beginning Tuesday, February 1, staff may bill up to 1 hour of time to “Field/In-House Training” for Covid-19 vaccination appointments.

Some staff may be required to have or obtain a COVID-19 vaccination as a term and condition of their work at Floyd Snider due to project specific requirements, such as a city or state vaccination mandate. Staff who are subject to mandatory vaccination requirements may be granted reasonable accommodation based on medical or religious reasons. Exempt staff must follow all relevant COVID-19 procedures in this policy and may be subject to additional safety requirements.

All Floyd Snider staff must submit their **proof of vaccination** by Monday, February 21. Staff can upload proof of vaccination directly to the Pre-Work Screen portal or send a copy of the document to HR. Examples of acceptable documents proving vaccination status include:

- Record of immunization from a health care provider or pharmacy
- A copy of the COVID-19 Vaccination Record Card

- A copy of medical records documenting the vaccination
- A copy of immunization records from a public health, state, or tribal immunization information system
- A copy of any other official documentation that contains the type of vaccine administered, date(s) of administration, and the name of the health care professional(s) or clinic site(s) administering the vaccine(s)

Proof of vaccination should include the employee's name, date of vaccine administered, type of vaccine administered, and the name of the health care professional(s) or clinic site(s) that administered the vaccine. If any staff have lost vaccine documents, they should contact the provider who administered the vaccine for records or contact the WA State Board of Health for assistance. If any staff are unable to produce one of the above forms of proof of vaccination after attempting the methods listed above, they will be required to provide a signed and dated statement attesting to their vaccination status.

Testing Positive for COVID-19

Staff who test positive for COVID-19 must promptly notify HR upon receiving a positive COVID-19 test or becoming diagnosed with COVID-19. Staff confirmed as having COVID-19 shall not return to the office until they meet the following requirements for returning to work:

- If an employee tests positive for Covid-19 and has cold or flu symptoms, they shall self-isolate and not return to the office until ten days have passed since symptoms first appeared, they have had no fever or used fever-reducing medication for at least 24 hours, and other symptoms of COVID-19 are improving.
- If an employee tests positive for COVID-19 but has no symptoms, they shall self-isolate and not return to the office until ten days have passed since the date of their last positive test.
- An employee may return to the office sooner than ten days after symptoms first appeared or a positive COVID-19 test if they have not had symptoms for 48 hours and receive a negative COVID-19 test. Test results that will be accepted for returning to work include the following:
    - One negative PCR test administered at least five days after the onset of infection
    - Two negative rapid antigen tests administered 24 hours apart, with the first of the two tests administered at least five days after infection

An employee may have COVID-19 if they have any of the following symptoms:

- Fever greater than 100.4 degrees Fahrenheit
- Chills
- Cough
- Shortness of breath or difficulty breathing
- Fatigue
- Muscle or body aches
- Headache
- Sore throat
- New loss of sense, taste, or small
- Congestion or runny nose

- Nausea or vomiting
- Diarrhea

Presumed Exposure to COVID-19

Staff have had a presumed exposure to Covid-19 if they have had unmasked contact with someone with Covid-19, or who may have Covid-19, that is closer than six feet for a cumulative time of fifteen or more minutes within the last 48 hours. If an employee has had a presumed exposure to Covid-19, they must work from home until ten days have passed or they or the person they were exposed to receives a negative test result. Test results that will be accepted for returning to work include the following:

- One negative PCR test administered at least five days after the exposure
- Two negative rapid antigen tests administered 24 hours apart, with the first of the two tests administered at least five days after the exposure

Floyd Snider will provide COVID-19 tests to staff for diagnostic purposes only, with exceptions for project-specific requirements. Diagnostic purposes include testing because of symptoms or exposure. If an employee needs a COVID-19 test for diagnostic purposes, they should contact anyone on the Health and Safety Committee to obtain a test without entering a workplace where other individuals are present.

Screening

All staff entering the Floyd Snider office, regardless of vaccination status, are required to fill out the Pre-Work Screen Health Self-Screening before entering the office. The Pre-Work Screen Health Assessment can be completed online here: https://auth.preworkscreen.com, by scanning the QR code at the front door or by using the Pre-Work Screen App. If you do not pass the screening, you should not enter the office.

Masking

All staff in the Floyd Snider office, regardless of vaccination status, are required to wear masks while in the office. All staff are required to wear masks when occupying a vehicle with other Floyd Snider staff unless all staff are vaccinated and have had either a negative PCR test or two negative rapid antigen tests administered 24 hours apart). Masks should fit snugly over the nose, mouth, and chin with no large gaps on the outside of the face. Employees may remove their mask when alone in their office, and for a limited time while eating or drinking.

The most protective and preferred type of mask is a NIOSH- or FDA-approved filtering facepiece respirator (FFR; including N95, KN95, and KF94 designated masks). If an FFR is not available, the next-most protective mask type is a disposable surgical mask with the ear loops knotted together where they attach to the mask, and with the resulting extra mask material tucked in and flattened to minimize the side gaps. Cloth masks are the least protective and must be constructed of a minimum of two layers of woven fabric if used.

Staff who fail to follow Floyd Snider's COVID-19 Vaccination, Testing, Screening, and Masking Policy, outlined above, will be subject to discipline that may include unpaid leave or termination.

New Hires: All new employees are required to comply with the vaccination, testing, screening, and masking requirements outlined in this policy as soon as practicable. Potential candidates for employment will be notified of the requirements of this policy prior to the start of employment.

Confidentiality and Privacy: All medical information collected from individuals, including vaccination information, test results, and any other information obtained because of testing is stored confidentially using the Pre-Work Screen application, separate from personnel files.

Questions: Please direct any questions regarding this policy to Amanda Johnson, Payroll and Human Resources Specialist.

Attachment 2
Subcontractor Pre-Work Health Screen

Name:

Date:

Pre-Work Health Screen Questionnaire

Please respond to the following questionnaire. If you answer "Yes" to any of the questions below, have cold or flu-like symptoms, have tested positive for Covid-19 within the last 10-days, or had a potential exposure to Covid-19 within the last 10 days, you must contact the HSO and work from home (or call-in sick). Review the Covid-19 Policy for details (Attachment 1).

---

1 **Have you had any of the following COVID-19 symptoms since your last day at work or the last time you were here? When responding do not consider any of these symptoms that may be due to an allergy condition**

1.1 Cough?

☐ Yes ☐ No

1.2 Shortness of breath or difficulty breathing?

☐ Yes ☐ No

1.3 Fever or Chills?

☐ Yes ☐ No

1.4 Headache?

☐ Yes ☐ No

1.5 Muscle or body aches?

☐ Yes ☐ No

1.6 Sore throat?

☐ Yes ☐ No

1.7 New loss of taste or smell?

☐ Yes ☐ No

Next

1.8 Fatigue?

- [ ] Yes
- [ ] No

1.9 Congestion or runny nose?

- [ ] Yes
- [ ] No

1.10 Nausea or vomiting?

- [ ] Yes
- [ ] No

1.11 Diarrhea?

- [ ] Yes
- [ ] No

1.12 Persistent pain or pressure in the chest?

- [ ] Yes
- [ ] No

1.13 New confusion?

- [ ] Yes
- [ ] No

1.14 Inability to wake or stay awake?

- [ ] Yes
- [ ] No

1.15 Bluish lips or face?

- [ ] Yes
- [ ] No

End

Remedial Investigation/Feasibility Study Work Plan

Silver Bay Logging Site

Appendix D

Attachment D.5
HDR Inc Health and Safety Plan

Site Specific Health and Safety Plan

SPU South Park WQF Project Support Services – Site Cleanup

Project Number 10328001

Seattle, Washington

November 29, 2022

Revision 1

Table of Contents

Forms/Permits/Checklists

Attachments

1.0 INTRODUCTION

1.1 Plan Development and Approval

The purpose of this site-specific Health and Safety Plan (HASP) is to define measures to be implemented to address worker safety, health, and the protection of the environment for field work associated with South Park WQF Project Support Services – Site Cleanup. This plan is in accordance with the requirements of OSHA 1910.120, *Hazardous waste operations and emergency response*.

A copy of this HASP will be posted at the jobsite and/or maintained in project vehicles.

Prepared By: ______________________ Date: __________

Approved By: ______________________ Date: __________

Project Manager Acknowledgment: ______________________ Date: __________

1.2 Modification Log

This HASP will be revised as applicable to address any changes in site conditions, assignments, and/or anticipated hazards, or when new information surfaces from a procedural failure or incident investigation. Revisions to this HASP will be distributed to affected parties through site safety meetings.

Change Number	Effective Date	Description of Change	Approval
1	11/29/2022	Modified to include entire HDR scope. Addresses HAZWOPER requirements.	

2.0 BACKGROUND

2.1 Scope of Work and Project Schedule

HDR is contracted with Seattle Public Utilities (SPU) to investigate hazardous contaminants and evaluate technologies to address these contaminants on the Silver Bay Logging property (Site). Previous studies have been conducted which revealed there is potentially hazardous contaminants in the Property.

The scope of work and schedule of activities are summarized below:

Task No	Task Description	Activities	Schedule
1	Project Management and Quality Assurance	Project Management; project controls; QA/QC; HASP	10/11/21 – 2/13/24
2	Site Cleanup Regulatory Strategy Development and Support	Develop the PPCD and MTCA grant funding strategy	11/1/21 – 6/10/22
3	Strategic Support and Coordination	Meetings with client, regulators, and stakeholders	11/16/21 – 1/8/25
4	Review and Summarize Existing Materials	Review and summarize available site information	10/11/21 – 7/1/22
5	Condition Assessments	Complete a hazardous materials survey, dock assessment, and structural assessment	1/1/22 – 4/15/22
6	RI/FS Work Plan	Develop RI/FS workplan	5/13/22 – 12/30/22
7	Pothole Plan Development and Execution	Identify and conduct potholing for potential underground obstructions	12/1/21 – 3/4/22
8	Remedial Investigation	Complete all field work to implement the RI/FS work plan including soil, groundwater, and sediment sampling	1/3/23 – 9/12/23
9	RI/FS Report and Cleanup Action Plan (CAP)	Develop the RI/FS Report and draft CAP	6/28/23 – 12/10/24
10	Permit Acquisition Plan and State Environmental Policy Act (SEPA)	Develop a permit acquisition plan, SEPA checklist, and cultural resources survey	5/27/22 – 10/1/24
11	Full Team Kick-Off and Collaboration	Conduct project visioning, Racial Equity toolkit, and other project planning activities	3/2/22 – 10/4/24

2.2 List of Field Activities

- Site Reconnaissance
- Utility Potholing
- Hazardous Material Survey
- Monitoring well installation

- Monitoring well development
- Groundwater depth measurement
- Groundwater sampling
- Surveying
- Soil borings
- Soil sample collection
- Sediment sample collection

2.3 Project Location and Site History

The 2.8 acre Site is located at the Silver Bay Logging property at 816 and 836 S. Kenyon St, 803 and 811 S. Chicago St, and 7760 and 7808 8th Ave S., Seattle, Washington (Figure 1). The Site is currently occupied by Gypsum to Gypsum which is an active drywall recycling facility. The Site can be accessed by a security fence on 8th Avenue South at the intersection with South Chicago Street, The Site is bounded by the Lower Duwamish Waterway (LDW) shoreline to the east which runs diagonally from the northwest to southeast, shown in Figure 2. Historically, the Site has had many uses including boat building and repair, metals recycling, a gasoline service station and battery shop, petroleum storage and handling, and log handling. The Site is currently on the Ecology's database of Confirmed and Suspected Contaminated Sites List (CSCSL), listed as Independent Metals Plant 2 under Facility/Site ID #16139 and Cleanup Site ID #12300.

Previous investigations on the property have confirmed the presence of arsenic, lead, diesel-range organics (DRO), oil-range organics (ORO), and chlorinated volatile organic compounds (CVOCs) in groundwater, and arsenic, lead, DRO, and ORO in soil. Due to the previous operations on the Property, it is suspected that additional metals, gasoline-range organics, carcinogenic polycyclic aromatic hydrocarbons (cPAHs), pentachlorophenol and other phenols, benzene, toluene ethylbenzene and xylenes, dioxins, furans, and acetaldehyde are also contaminating the site. Contaminated sediments in the adjacent waterway are in the middle reach of the LDW Superfund Site. The LDW Superfund Site remedial action addresses sediments that pose a risk to humans from potential exposure to polychlorinated biphenyls (PCBs), arsenic, cPAHs, and dioxins/furans, and to benthic invertebrates from exposure to PCBs and phthalates (USEPA 2014).

The primary area of focus for the environmental investigations includes the uplands portion of the Property above the elevation of mean higher high water (MHHW) and the adjacent vacated right-of-way (ROW) of S Chicago Street (referred to herein as S Chicago Street end), which bisects the western portion of the Property. Environmental investigation will additionally include adjacent areas (above and below MHHW) where contamination associated with the Property may have come to be located.

Figure 1: Reference Map

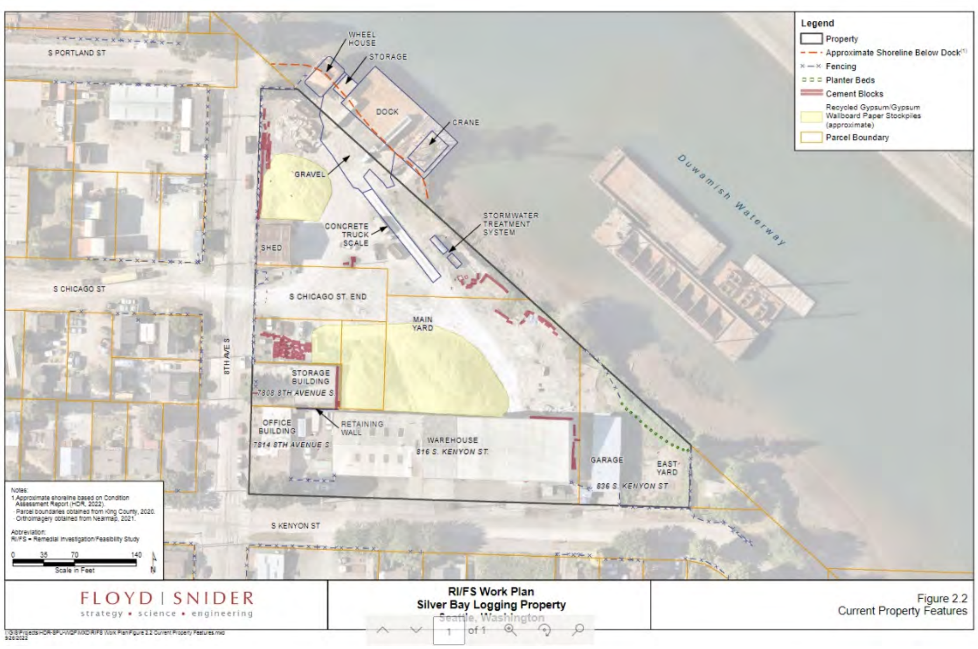


Figure 2: Layout of Property site.

3.0 ORGANIZATION

The following HDR personnel and subconsultants have principal responsibility for the implementation and maintenance of health and safety measures during field work.

Contact	Contact	Assigned Role
Lanelle Ezzard, HDR	206-826-4734 (O) 206-724-2209 (C)	Project Manager
Cheronne Oriero, Floyd Snider*	206-292-2078 (O) 206-334-4992 (C)	Site Health and Safety Officer (HSO)/Site Controller
David Braungardt, EHS-International	206-381-1128 (O)	Hazardous material survey
Jordan Furlan, Collins Engineering, Inc.	312-704-9300 (O)	Dock inspection
Kate Snider, Floyd Snider	206-292-2078 (O) 206-375-0762 (C)	Remedial Investigation

*Remaining field work is focused on Task 8, Remedial Investigation. This task is led by subcontractor Floyd Snider. Their HASP is included in Attachment B.

The following personnel have principal responsibility for the implementation and maintenance of health and safety measures during field work.

1. Project Manager
   a. Overall responsibility for project schedule;
   b. Develop cost estimates for work identified.
   c. Identify scope of work and estimate schedule for work;
   d. Determine the technical/field team;
2. Site Coordinator/Site HSO (reports to “1” when “1” is on-site, otherwise in charge)
   a. Maintain daily field log book and a health and safety file for the project;
   b. Conduct safety meetings.
   c. Monitor on-site hazards and conditions;
   d. Serve as the facilitator of communications in emergencies
   e. Enforce safety procedures and disciplinary action when unsafe acts or practices occur;
   f. Designate facilities, and equipment for health and safety;
   g. Select, dispense, and ensure availability of Personal Protective Equipment (PPE);
   h. Maintain copies of instrument operation manuals and maintain records of usage and calibration;
   i. Periodically inspect PPE and ensure proper storage and maintenance;
   j. Monitor for heat and cold stress;
   k. Set up decontamination lines, control decontamination, prepare decontamination solutions, and monitor;

l. Train employees on emergency procedures and evacuation routes;

m. Grant permission for site access (including visitors, see Appendix C);

n. Control entry and exit at the Access Control Points;

o. Confirm an employee's suitability for work based on the physician's recommendation.

3.1 Responsibilities and Lines of Authority

3.1.1 Project Manager and On-Site Health and Safety Representative

The Project Manager serves as the primary point of contact and is responsible for SH&E implementation and enforcement of safe work practices. When the Project Manager is not on-site, he/she will delegate an on-site SH&E Representative to take on the following responsibilities. If the SH&E Representative needs to leave the site or is not available, the Project Manager will assign an alternate team member to fill the role (any field team member competent in the responsibilities below can serve as the SH&E Representative).

- Oversee SH&E implementation in the field and enforce safe work practices.
- Assign mentors for short service employees.[1]
- Conduct and document daily safety briefings.
- Monitor on-site hazards and conditions and document safety inspections.
- Enforce safe work practices.
- Ensure availability and use of PPE.
- Maintain SH&E equipment/instrument operation manuals and records of use and calibration.
- Monitor field team for heat and cold stress.
- Confirm employees' suitability for work based on physician recommendations for assignments requiring medical clearance (for example, hazardous waste work, rope access, exposure to noise, asbestos).
- Ensure reporting of all incidents in accordance with HDR reporting procedures, including contact to WorkCare for non-emergency injuries/illnesses and submittal of incident reports in the IndustrySafe reporting system (https://industrysafe.com/hdrinc).
- Provide oversight for site access for visitors and conducting visitor orientations.
- Serve as the facilitator of communications in emergencies.
- Immediately contact the Director of SH&E regarding any regulatory visits, audits, or inspections (for example, OSHA inspections).

3.1.2 Field Team Members

Field team members must be continually conscious of safety hazards and are expected to:

[1] An SSE is an employee with less than 6 months experience in his/her present job or with his/her present employer. A single-person assignment cannot be given to an SSE (that is, an SSE may not work alone) and field teams of less than five shall have no more than one SSE. Assigned mentors must be on site with their SSE and are responsible for monitoring them for health and safety awareness at the job site and SH&E compliance. As applicable based on client requirements, SSEs must wear uniquely colored hard hats or another type of visual identifier. Prior to job mobilization, the PM is to notify the client through the client project coordinator, contractor contact, and/or on-site supervisor of all jobs containing SSEs and the method that will be used to identify SSEs. HDR subcontractors must manage their SSEs in accordance with these same requirements.

- Plan, organize, and perform each facet of work in the safest manner possible.
- Be constantly alert and report any unsafe act or condition, injury, incident, and safety infraction to a supervisor, the Project Manager, or the SH&E Representative so treatment can be obtained and/or corrective action taken them immediately.
- Actively participate in all safety training programs relevant to the work which they are performing
- Attend and actively participate in HDR trainings, meetings, and briefings.
- Use and maintain assigned equipment in a safe and responsible manner.
- Follow the procedures and processes specified in this Plan.

4.0 SH&E MEETINGS AND BRIEFINGS

4.1 Pre-Entry Briefing/Orientation

The contents of this Plan will be transmitted to field team members (including subcontractors and client representatives as applicable) via verbal discussion at a documented orientation meeting prior to initial field work to ensure that employees understand the plan contents. New hires and transfers who join the team after this meeting must be provided this same orientation before going to the field. Documentation of all orientation meetings shall be included in the project file (see attached Project Safety Orientation Form).

4.2 Daily Safety Meetings/Briefings

The SH&E Representative shall conduct daily safety briefings at the project site at the beginning of each shift. Documentation of daily briefings (see attached Job-Site SH&E Meeting Form) shall include the names of employees present and the topics discussed which could include the following:

- Assigned duties and tasks for the day
- Anticipated site conditions (access, weather, etc.)
- Anticipated site hazards and control measures
- Environmental compliance (control of stormwater, hazardous materials management, spill response, etc.)
- Lessons learned from reported near miss and injury/illness incidents from this project or from any other projects that may be beneficial or applicable to this project
- Revisions/updates to the Site-Specific SH&E Plan and/or safe work procedures

In the event that field team members are unable to attend the briefing, the SH&E Representative shall conduct a separate briefing with these personnel before they will be allowed to begin work.

5.0 HAZARD ANALYSIS

This HASP contains information regarding site-specific hazards, including chemical exposure hazards associated with the scope of field activities and analysis of the hazards associated with each site investigation task. This HASP also includes additional fire, explosion, and physical hazards likely to be on the job site.

Chemical Exposure Hazards

Based on previous site investigation activities and contaminants of concern at the adjacent LDW Superfund Site, hazardous contaminants may be encountered. These contaminants are characterized in the following table:

Contaminants	Potentially Impacted Media	Routes of Exposure	Potential Effects	Exposure Limits (8-hour TWA/STEL)	Maximum Historic Concentrations[2]
Arsenic	Groundwater	Inhalation, skin absorption, ingestion, skin/eye contact	Ulceration of nasal septum; dermatitis; GI disturbances; peripheral neuropathy; respiratory irritation; hyperpigmentation of skin; carcinogenic.	0.002 mg/m^3 / 0.010 mg/m^3	180 ug/L
Barium	Groundwater	Inhalation, ingestion, skin/eye contact	Irritation of eyes, skin, upper respiratory system; skin burns; gastroenteritis; muscle spasm; slow pulse, extrasystoles; hypokalemia.	None / 0.5 mg/m^3	2,400 ug/L
Cadmium	Groundwater	Inhalation, ingestion	Pulmonary edema, dyspnea, cough, chest tight, substernal pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia, emphysema, proteinuria, mild anemia; carcinogenic.	0.005 mg / 0.5 mg/m^3	6 ug/L
Chromium	Groundwater	Inhalation, ingestion, skin/eye contact	Irritation of eyes; sensitization dermatitis.	None / 0.5 mg/m^3	930 ug/L
Lead	Groundwater	Inhalation, ingestion, skin/eye contact	Weakness, insomnia, facial pallor, weight loss, constipation, abdominal pain, anemia, tremors, eye irritation, hypotension, central nervous system deficits, reproductive system effects.	0.05 mg/m^3 /action level of 0.03 mg/m^3	380 ug/L
DRO and ORO	Groundwater and soil	Inhalation, skin/eye contact	Irritation of eyes, reduction in pulmonary function, and effects to central nervous system.	None established	720 ug/L (GW); 2,400 mg/kg (soil)
Gasoline Range Hydrocarbons	Soil	Inhalation, skin absorption,	Irritation of eyes, skin, mucus membranes; headache; fatigue;	300 ppm / 500 ppm	1,800 mg/kg

[2] Concentrations presented reflect maximum concentrations observed at the Site. Many of these constituents are currently observed at lower concentrations based on source removal actions completed to date.

Contaminants	Potentially Impacted Media	Routes of Exposure	Potential Effects	Exposure Limits (8-hour TWA/STEL)	Maximum Historic Concentrations[2]
		ingestion, skin/eye contact	blurred vision; dizziness; slurred speech; confusion; convulsions; liver, kidney damage.		
Benzene	Groundwater and soil	Inhalation, skin absorption, ingestion, skin/eye contact	Irritation to eyes, skin, mucus membranes; headache; fatigue; blurred vision; dizziness; convulsions; liver, kidney damage; carcinogenic.	1 ppm / 5 ppm	13 ug/L (GW); 6 mg/kg (soil)
Toluene	Groundwater	Inhalation, skin absorption, ingestion, skin/eye contact	Irritation to eyes, nose; lassitude, confusion, euphoria, dizziness, headache; dilated pupils, lacrimation; anxiety, muscle fatigue, insomnia; paresthesia; dermatitis; liver, kidney damage.	100 ppm / 150 ppm	4.84 ug/L
Ethylbenzene	Soil	Inhalation, ingestion, skin/eye contact	Irritation to eyes, skin, mucus membranes; headache; dermatitis; narcosis, coma.	100 ppm / 125 ppm	12 mg/kg
Xylenes	Soil	Inhalation, skin absorption, ingestion, skin/eye contact	Irritation to eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis.	100 ppm / 150 ppm	11.51 m/kg
PCE	Groundwater and soil	Inhalation, skin absorption, ingestion, skin/eye contact	Eye irritation; allergic dermatitis; chloracne; GI distress; liver, kidney damage; breast and other cancers.	25 ppm / 38 ppm	6,400 ug/L (GW), 0.75 mg/kg (soil)
TCE	Groundwater and soil	Inhalation, skin absorption, ingestion, skin/eye contact	Dermatitis; bronchitis; lung, skin, and stomach cancer.	50 ppm / 200 ppm	300 ug/L (GW); 0.034 mg/kg (soil)
cis-1,2-DCE	Groundwater	Inhalation, skin absorption, ingestion, skin/eye contact	Ulceration of nasal septum; dermatitis; GI disturbance; respiratory irritation; hyperpigmentation of skin; skin and lung cancer.	200 ppm / 250 ppm	1,800 ug/L

Contaminants	Potentially Impacted Media	Routes of Exposure	Potential Effects	Exposure Limits (8-hour TWA/STEL)	Maximum Historic Concentrations[2]
Vinyl Chloride	Groundwater	Inhalation, skin absorption, ingestion, skin/eye contact	Lassitude; abdominal pain, GI bleeding; enlarged liver; pallor or cyanosis of extremities; carcinogenic.	1 ppm / 5 ppm	280 ug/L
PCBs	Soil	Inhalation, skin absorption, ingestion, skin/eye contact	Carcinogen, irritation of the nose and lungs, skin irritations, and eye irritation	0.5 mg/m^3	6.7 mg/kg
cPAHs	Soil and sediment	Inhalation, skin/eye contact	Dermatitis; respiratory system irritation; carcinogen	0.2 mg/m^3 (TWA)	2.1 mg/kg (soil)
Dioxans/Furans	Sediment	Inhalation, absorption, ingestion, dermal contact	Irritation to eyes; dermatitis or chloracne; gastrointestinal disturbance; carcinogen	None	No data available
Pentachlorophenol and other phenols	Soil and sediment	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation to eyes, nose, throat; weakness/exhaustion; sweating; headache; dizziness; nausea/vomiting; difficulty breathing; chest pain; high fever	0.5 mg/m^3 (TWA)	No data available
Acetaldehyde	Soils	Inhalation, ingestion, dermal contact	Irritation to eyes, nose, throat; skin burns; cough; central nervous system depression	200 ppm (TWA)	No data available
Gypsum Dust	Structures, Debris	Inhalation, ingestion	Irritation eyes, skin, mucous membrane, upper respiratory system; cough, sneezing, rhinorrhea	15 mg/m3 (total), 5 mg/m3 (respirable)	N/A

In general, the chemicals that may be encountered as part of field investigation tasks are not expected to be present at concentrations that could result in significant exposures. The types of planned work activities and use of monitoring procedures and protective measures will limit potential exposures at this Site.

Biological Hazards

Insects and arachnids, including spiders, scorpions, mites, and ticks could be encountered on the site. To prevent a bite or sting, field workers should avoid wearing perfumes or colognes when performing field activities. For field workers with a history of severe allergic reactions to insect bites or stings should carry an epinephrine auto injector (EpiPen) and should wear a medical identification bracelet or necklace stating their allergy. Use insect repellent containing 20-30% DEET on exposed skin in accordance with product label instructions and reapply as directed.

Physical Hazards

Since elements of the field work for this project are planned for both the winter and summer months, field workers are subject to cold related and heath related illnesses, dependent on the moth. Cold-related illnesses at temperatures of stress- including hypothermia, frostbite, Raynaud's Disease, and Immersion Foot. Field workers working in temperatures of 80 degrees Fahrenheit or above, performing extended services in the proximity of radiant heat sources, or workers wearing semi-permeable/permeable clothing in temperatures of 69.8 degrees Fahrenheit or above are subject to heat illness. A Heat Illness Prevention Plan will be completed when such conditions are applicable.

5.1 Job Hazard Analysis and Risk Assessment

All field team members and subcontractors are responsible for being actively involved in the HDR hazard analysis and risk assessment process, which involves the identification, assessment, and prioritization of risks and measures to eliminate, minimize, monitor, and/or control them. Consideration is given to the safety, health, and security of workers, the public, and the environment.

Job hazard analysis (JHA) forms are used to document the process and identify the sequence of work, specific hazards anticipated, and control measures to be implemented to eliminate or minimize each hazard. The JHA form also lists the necessary equipment and training required to perform the task safely.

A initial JHA for Task 8, Remedial Investigation, is included in Attachment B. Prior to initiating Task 8 field activities, the field team must confirm the JHA is complete and adequately identify and control associated hazard. If there is a change in the scope of the work, if work conditions change, if new hazards are identified, or the controls prove inadequate or ineffective, the field team must revise the JHA as necessary, review with the team, and have each team member sign it before any work is conducted. Revisions can be handwritten on the form.

5.2 JHA Record Retention

All HDR field team members involved in the task must sign the JHA form in the field to acknowledge completion of the review and concurrence with the job steps, hazards, and controls described in the JHA. The SH&E Representative shall keep completed JHAs in a binder at the job site until the work is complete. After the work is complete, the electronic version of the initial JHA will be updated to include improvements that were identified in the field to assure better planning and a safer work experience the next time the task is performed. A copy will be forwarded to Corporate SH&E for inclusion in the JHA library.

5.3 SH&E Training

List potential training, certifications, and competency requirements for each task is listed in following table .

Training	Doug Prindle	Tim Chan	Vince Carsillo	Lacey Lancaster
HDR University eLearning – *Biological Hazards: Insects*	1/3/22	12/28/21	[enter date]	11/28/22
HDR University eLearning – *Biological Hazards: Arachnids*	1/3/22	12/28/21	[enter date]	11/28/22
HDR University eLearning – *Cold Stress*	12/30/21	12/28/21	[enter date]	[enter date]

Training	Doug Prindle	Tim Chan	Vince Carsillo	Lacey Lancaster
HDR University eLearning – *Fall Hazard Awareness*	12/30/21	12/28/21	[enter date]	[enter date]
HDR University eLearning – *Noise and Hearing Conservation* (annual requirement)	12/30/21	12/28/21	[enter date]	[enter date]
HDR University eLearning – *Safe Design – Stairways, Ladders*	7/1/11	N/A	N/A	N/A
HDR University eLearning – *Slip, Trip, and Fall Prevention*	1/7/22	12/28/21	N/A	N/A
HDR University eLearning – *Traffic Safety Awareness*	1/7/22	12/28/21	N/A	N/A
HAZWOPER	N/A	N/A	9/2/2022	[enter date]

5.4 SH&E Equipment and Supplies

5.4.1 Personal Protective Equipment (PPE)

- A Class E hard hat meeting ANSI Z89.1-1997 (or later) design requirements shall be worn at all times when in a construction environment and where overhead hazards exist.
- A Class II reflective safety vest (or Class II rain jacket) meeting ANSI-ISEA 107-2004 (or later) design requirements shall be worn at all times when in a construction environment and when in the vicinity of moving traffic and/or mobile equipment.
- Safety glasses with rigid side shields meeting ANSI Z87.1-1989 (or later) design requirements shall be worn at all times when in a construction environment and in any area where eye hazards exist.
- Mid-ankle or higher lace-up safety-toed boots meeting ASTM F2413-2005 (or later) design requirements shall be worn by all workers in a construction environment or on railroad property and in areas where there is a danger of foot injuries due to falling, rolling, or piercing objects or when an employee's feet are exposed to electrical hazards.
- Hearing protection shall be worn when exposures exceed 85 dBA and employees shall be enrolled in HDR's Hearing Conservation Program as applicable.
- U.S. Coast Guard-approved personal flotation device (PFD) shall be worn for all sediment sampling work conducted on a boat.
- Gloves appropriate to the task shall be worn.
- Long pants and shirts with sleeves (no tank tops) shall be worn for all field work.

5.4.2 Other Equipment and Supplies

Biological Hazards Protection

Insect Repellent

Emergency Response Equipment and Supplies

First Aid Kit

Fire extinguisher

Emergency Eyewash/Shower (Gypsum to Gypsum facility)

Lighting (flashlight, extra batteries)

Food/Water

Heat Stress/Sun Safety

Sunscreen (UVA/UVB)

Personal Protective Equipment

Safety Glasses

Hard Hat

Reflective Vest

Safety-toed boots

Gloves

Traffic Safety

Traffic cones/barricades

Water/Boating Safety

Personal Flotation Device (Type III or V)

Ring Buoy (minimum 90' of line)

Waders

5.5 Medical Clearance/Vaccination

HAZWOPER medical clearance is required for Task 8 field staff.

5.6 Exposure Monitoring Plan

Air monitoring using a photoionization detector (PID) will be performed if personnel are likely to be exposed to volatile contaminants (see action levels in Section 5.7).

Visual monitoring for dust using a meter capable of measuring PM 2.5 (respirable dust) and PM 10 (total dust) will be conducted during dry conditions when gypsum piles are uncovered and during any gypsum handling activities at the Site (see action levels in Section 5.7).

The HSO/SS will visually inspect the work site at least daily to identify any new potential hazards. If new potential hazards are identified, immediate measures will be taken to eliminate or reduce the risks associated with these hazards.

5.7 Action Levels for Personal Protection Equipment

Contaminant	Activity	Monitoring Device	Frequency of Monitoring Breathing Zone	Action Level	Action
Organic Vapors	Environmental Sampling	PID	Start of shift; prior to excavation entry; every 30 to 60 minutes and in event of odors	Background from 0 to 5 ppm in breathing zone	Level D PPE
				Exceeds 5 to 25 ppm continuously for a 5-minute period in the breathing zone	Leave area or Upgrade to Level C PPE

				> 25 ppm in breathing zone	Stop work and evacuate the area. Contact Health and Safety Manager for guidance.
Dust Particulates; Respirable dust	Gypsum debris handling or debris removal	MiniRam or device capable of measuring PM 2 5 and PM 10	Start of shift; prior to excavation entry; every 30 to 60 minutes	<7.5 mg/m3, total <2.5 mg/m3, respirable	Level D PPE
				>7.5 mg/m^3, total >2.5 mg/m^3, respirable	Leave area or Upgrade to Level C PPE

6.0 SITE LOGISTICS AND CONTROL

6.1 Work Zones

An exclusion zone (EZ) will be established when working with contaminated materials. The EZ zone will be delineated and controlled with the use of cones, caution tape, barricades, flagging, or other equivalent traffic control measures. A contaminant reduction zone (CRZ) will be set up at the entry/exit point of the exclusion zone. The CRZ will contain the necessary elements to perform personnel and equipment decontamination as described in Section 6.1.2. The support zone (SZ) will consist of all areas outside the EZ and CRZ.

An EZ/CRZ will be set up for each boring and/or well location. Only authorized personnel shall be permitted access to the EZ/CRZs. Field staff will decontaminate all equipment and gear as necessary prior to exiting the CRZ. Decontamination areas will be constructed with plastic sheeting on the ground to reduce potential transport of contaminated soils from the EZ to the SZ.

6.1.1 Site Access and Security

The site can be accessed by a security fence on 8th Avenue South at the intersection with South Chicago Street. HDR field workers will be given security access from Gypsum to Gypsum.

6.1.2 Decontamination

Sampling Equipment Decontamination Procedures: Sampling equipment will be decontaminated in the EZ in accordance with the Sampling and Analysis Plan and Quality Assurance Project Plan.

PPE removal and decontamination: Field activities are expected to be conducted using Level D PPE. Disposal gloves will be removed in the CRZ and deposited in an heavyweight garbage bags or other appropriate containers for disposal. If visible dust is present on hard hats, safety boots, and safety vests, water will be provided from the Gypsum to Gypsum facility for equipment rinsing before leaving the CRZ. Hands must be thoroughly washed in the Gypsum to Gypsum facility washroom before leaving the Site to eat, drink, or use tobacco.

6.1.3 Waste Disposal

Disposable personal protective equipment including coveralls, gloves, paper towels, plastic sheeting, and other waste material generated during sampling will be placed in heavyweight garbage bags or other appropriate containers and placed in normal refuse containers for disposal at a solid waste landfill.

Any groundwater and soil remaining after processing and decontamination, including intervals not sampled, will be collected in U.S. Department of Transportation-approved drums, provided by HDR or a subconsultant, pending characterization and disposed of at an appropriate Resource Conservation and Recovery Act (RCRA)-licensed facility in accordance with the offsite shipment requirements specified in the client's Unilateral Administrative Order. For sediment grabs, all remaining sediment after processing and phosphate-free detergent-bearing liquid wastes from decontamination of the sampling equipment will be washed overboard. All other waste material generated at upland sample processing stations will be containerized in drums pending disposal. Solvents used for equipment decontamination will be collected and containerized in drums for disposal. Decontamination waters with sheen will additionally be containerized for characterization and disposal.

Samples of bulk investigation-derived waste (IDW) will be collected by HDR or a subcontractor at the frequency specified by the selected RCRA-licensed disposal facility, which is presumed to be a minimum frequency of one sample per three 55-gallon drums. Bulk IDW samples will be analyzed for the contaminants of concern regulated under the Comprehensive Environmental Response, Compensation, and Liability Act and RCRA.

6.2 Drinking Water and Sanitary Provisions

Drinking water will be provided by HDR. HDR will be permitted to use Gypsum to Gypsum facilities for wash room and hand washing.

6.3 On-Site Documentation and Postings

A copy of this Plan, including emergency contacts, WorkCare contact information, route maps to emergency and non-emergency medical facilities, Job Hazard Analysis (JHA) forms, and chemical safety data sheets (SDSs) will be kept in a safety binder in project vehicles and in a commonly accessed area used by on-site workers. The SH&E information will be continually maintained and updated.

6.4 Illumination

To ensure that employees have enough light to do their work safely, employees working outdoors are to commence work no earlier than 15 minutes after sunrise and conclude no later than 15 minutes prior to sunset.

7.0 EMERGENCY ACTION PLAN

This Emergency Action Plan has been prepared to define the responsibilities, resources and actions necessary to respond to incidents and emergency situations.

7.1 Communication Methods

All communications at the site will be conducted using staff cellular phones.

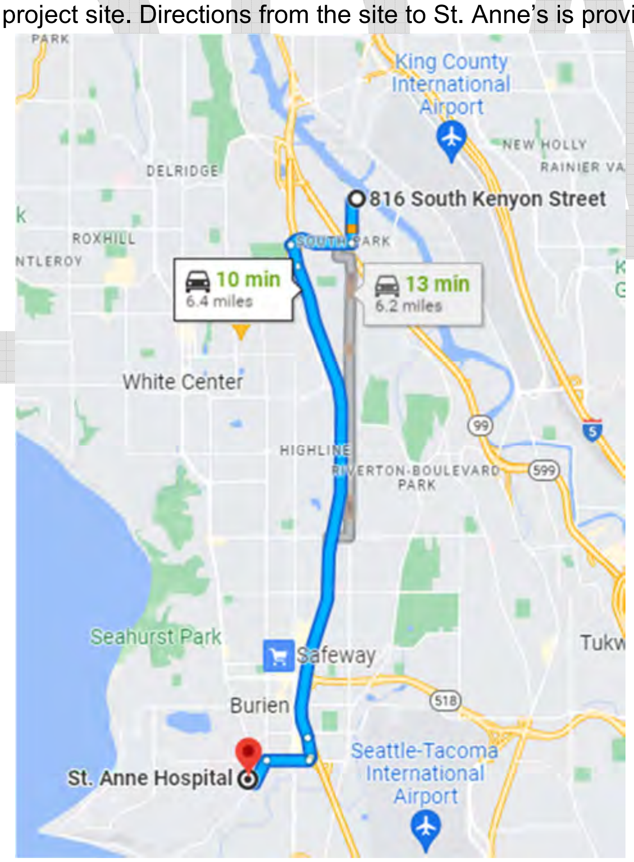
7.2 Contact Numbers

Contact	Name/Address	Phone Number
Emergency Contacts		
Medical, Fire, and Police Emergency		911
Medical Facility for Emergency Care	St. Anne Hospital 16251 Sylvester Road SW	(206) 244-9970

	Burien, WA 98166	
Washington Poison Control Center		800-222-1222
Non-Emergency Contacts		
Roadside Assistance	Guardian Towing	206-762-1010
WorkCare (non-emergency injury/illness consultation)		888-449-7787
Medical Facility for Non-Emergency Care	Sea Mar Medical 1040 S Henderson St Seattle, WA 98108	206-767-2648
HDR Project Management and SH&E Contacts		
Project Manager	Lanelle Ezzard	206-724-2209
Local Safety Coordinator	Lynessa Dobbins	425-450-6342
SH&E Regional Manager	David Clemens	907-947-3431
Director of SH&E	Jeff Kleinfelter	760-450-6497

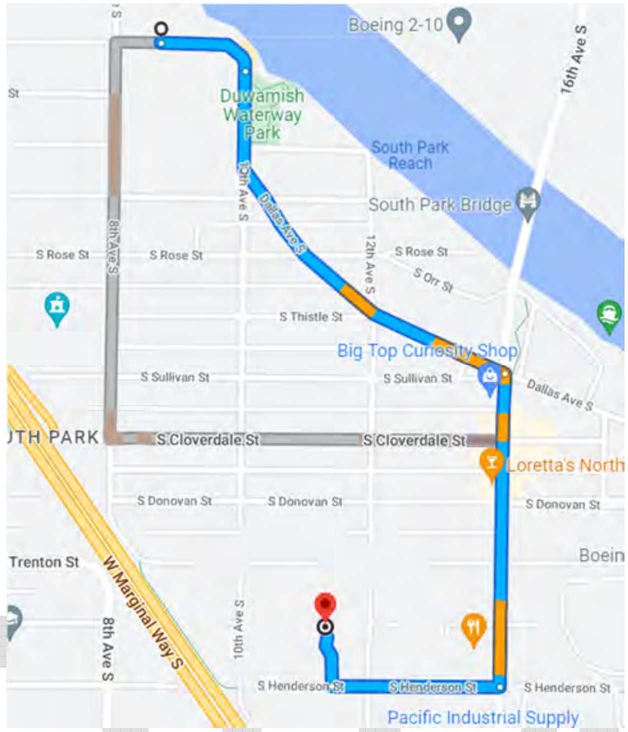
7.3 Medical Facility Maps and Driving Directions

For emergency medical care, team members are to drive to St. Anne Hospital in Burien from the project site. Directions from the site to St. Anne's is provided below:



- Get on WA-509 S from 8th Ave S and S Cloverdale St - 1.2 miles
- Follow WA-509 S to S 160th St in Burien. Exit from WA-509 S - 4.5 miles
- Follow S 160th St and Sylvester Rd SW to your destination - 0.7 mile
- Arrive at St. Anne Hospital

In the case that non-emergency medical care is required, the closest urgent care facility is Sea Mar Medical in Seattle. Directions to Sea Mar are provided below:



- Head east on South Kenyon Street and continue on 10th Avenue South. Turn left on Dallas Avenue South. – 0.5 mile
- Continue on Dallas Avenue South and turn right onto 14th Avenue South – 0.3 mile
- Continue on 14th Avenue South and turn right onto South Henderson Street – 0.5 mile
- Arrive at Sea Mar Medical.

7.4 Emergency Equipment

- Fire extinguishers
  - Portable fire extinguishers are located at the Gypsum to Gypsum office building.
  - Only those trained in the use and limitations of portable fire extinguishers are allowed to use them.
  - All portable fire extinguishers will be visually inspected by the on-site SH&E Representative monthly to confirm they are fully charged and operable.
- First Aid Kits
  - First aid kits will be carried by the field team. Additional first aid kits will be kept in the Gypsum to Gypsum office building.
  - First aid kits will be checked daily by the on-site SH&E Representative during field operations to ensure they are full, in good condition, and that contents that have expiration dates have not expired.
- Emergency Shower/Eyewash
  - Emergency shower/eyewash are located in the Gypsum to Gypsum office building.
- Weather Radio
  - The on-site SH&E Representative will have access to a weather phone app that delivers alerts and warnings.
- Spill Control and Containment
  - All IDW will be collected in U.S. Department of Transportation-approved 55 gallon drums pending characterization and disposed of at an appropriate RCRA-licensed facility. 55 gallon drums will be provided in the EZ and CRZ for IDW disposal.

7.5 Evacuation Routes/Procedures

An emergency assembly point (that is clear of adjacent hazards and not located downwind of site investigation activities) will be identified by the on-site SH&E representative and communicated to the field team each day. Based on activities on site, particularly industrial activities at the gypsum facility, the on-site SH&E will determine an emergency assembly point. In an emergency, all field personnel and visitors will evacuate to the emergency assembly point for roll call.

7.6 Inclement Weather

Inclement weather may occur while on the project site or during travel to and from the project. The on-site SH&E Representative will monitor the weather and weather forecasts on their phone's weather application for conditions that may require the field team to stop work or evacuate the site, including but not limited to high winds, heavy rain, lightning, fog, snow and ice, or other weather events that pose a risk to safety onsite. Daily meetings and briefings led by the SH&E Representative will include discussion of any anticipated inclement weather conditions that may impact the field team and the proper actions to take if facing these conditions. As appropriate, these discussions will include stop work and communication procedures, evacuation routes and shelter locations in the case of remote project work.

7.7 Safe Driving and Journey Management

Vehicle drivers must complete HDR's Safe Driving course on HDR University and must meet the driver eligibility criteria specified in HDR's Vehicle Use Policy and Procedures. Vehicles must meet the insurance, use, and maintenance requirements specified in HDR's Vehicle Use Policy and Procedures.

A journey management plan (see attached form) must be developed for all high-risk vehicle travel that cannot be avoided to reach the job site (i.e., the trip cannot be eliminated or combined with another, the trip cannot be performed by a 3rd party contractor, there is not a safer way to travel (air, rail), etc.). The purpose of journey management planning is to identify hazards and ensure project management and others are aware of a driver's itinerary and route for emergency/security reasons.

Prior to executing the journey, the driver must be fully briefed about the journey and the associated risks and the Journey Management Plan must be reviewed with all affected employees.

8.0 CONFINED SPACES

There are no confined spaces on the project site.

9.0 SPILL CONTAINMENT

All IDW will be collected in U.S. Department of Transportation-approved 55 gallon drums pending characterization and disposed of at an appropriate RCRA-licensed facility.

55 gallon drums will be provided in the EZ, co-located with soil and groundwater sampling activities, to containerize all groundwater and soil remaining after processing. Solvents used for soil and groundwater sampling equipment decontamination will be collected and containerized in drums for disposal. Decontamination waters with sheen will additionally be containerized for characterization and disposal. For sediment grabs, all remaining sediment and sampling equipment liquid decontamination wastes will be washed overboard.

Samples of IDW will be collected by HDR or a subcontractor at the frequency specified by the selected RCRA-licensed disposal facility. Bulk IDW samples will be analyzed for the contaminants of concern regulated under the Comprehensive Environmental Response, Compensation, and Liability Act and RCRA.

10.0 SUBCONTRACTOR SAFETY

Subcontractors working under our direction must be informed of all aspects of the site-safety and health plan, all emergency response procedures, and any potential fire, explosion, health, safety, or other hazards presented by the operations within our scope of work.

For any field work performed by HDR subcontractors, each subcontractor must develop their own Site-Specific SH&E Plan (including applicable JHAs and the name(s) of project qualified and/or competent safety personnel) related to their scope of work and specific on-site activities and submit to HDR 10 days prior to the commencement of services in the field. The subcontractor's Site-Specific SH&E Plans must be at least as comprehensive as this Plan as it relates to the subcontractor's services and shall comply with all applicable laws and requirements of the Prime Agreement. Unless otherwise agreed upon in writing, each subcontractor is responsible for providing all safety equipment and safety training for their employees.

HDR is not responsible for approval of the subcontractor's plans or the means and methods set forth by the subcontractor; our obligation is to verify the subcontractor's plan exists and is applicable and relevant to the work to be performed.

11.0 STANDARD ON-SITE PROTOCOLS

11.1 Incident Reporting and Investigation

In the event of an incident, the most important immediate action is to provide medical assistance to those that may need it and to ensure the safety of others that may be affected.

11.1.1 Incident Reporting

All work-related near miss, injury, illness, damage, environmental, and security incidents involving HDR employees, subcontractors, and/or other parties at HDR work sites must be reported and investigated as soon as possible following occurrence.

Employees involved in or witness to an incident:

1. All Incidents
    a. Notify Supervisor to arrange for post-incident drug and alcohol testing (if applicable)
    b. Notify Project Manager for client reporting
    c. Submit Incident Report in IndustrySafe
2. Non-Emergency Injury/Illness Incidents
    a. Contact WorkCare (888-449-7787) for medical consultation
3. Serious Incidents (incidents involving death, hospitalization, amputation, loss of an eye, significant damage, and/or environmental impact)
    a. Notify Director of SH&E or Regional SH&E Manage for regulatory reporting

11.1.2 Incident Investigation

All incidents will be investigated by the Regional SH&E Manager with assistance from the on-site SH&E representative, project manager, and/or local safety coordinator and documented in IndustySafe.

11.2 Stop Work Authority

Personal safety takes priority over all project deadlines, demands, and any other considerations. At all times and on all sites, it is HDR's policy, practice, and responsibility to provide a place of employment where HDR employees can conduct project-related activities in a safe and healthy environment. HDR strives to ensure the health and safety of its employees by identifying and mitigating recognized hazards to avoid or eliminate potential for injury or illness.

HDR employees need to be conscious for the safety of other project personnel and are expected to promote safe work habits. HDR employees are encouraged and empowered by HDR to maintain a safe workplace and only work when the hazards have been removed, controlled, or mitigated. No HDR employee is expected or obligated to perform work they consider unsafe or damaging to the environment.

Employees are to immediately report safety, health, and environmental (SH&E) concerns to their local Safety Coordinator, supervisor, and/or Project Manager. In addition, **Stop Work Authority (SWA) allows any HDR employee to stop work conducted by HDR or HDR subcontractors where there is a serious hazard or imminent danger**. Once invoked, the activity in question will be stopped and reviewed by those performing the work and their immediate supervisors. Work will not resume until all stop work issues and concerns have been adequately addressed. There will be no retribution for invoking SWA.

11.3 Unsafe Condition Reporting

Although HDR is not responsible for the health and safety or means and methods of other employer's work, when HDR employees (or HDR subcontractors) could be exposed to unsafe conditions/practices created by another contractor, or when observed unsafe conditions/practices pose a risk of serious injury or death to those exposed (regardless of company affiliation), the observing employee is obligated to notify someone who can take appropriate corrective action.

11.3.1 Exposure to HDR/HDR Subcontractors

If an HDR employee identifies an unsafe condition/practice by another contractor that impacts the ability of HDR or HDR subcontractors to conduct project activities in a safe manner, the employee is to:

- Move away from the unsafe condition/practice to prevent exposure.
- Notify HDR supervision for reporting to the creating/controlling contractor's senior management.
- Document the notification in the project field logbook, daily report, or other records based on contract requirements.
- Take reasonable alternative protective measures to prevent exposure to HDR employees and HDR subcontractors until the unsafe condition/practice is corrected or a reasonable explanation is provided as to why no real hazard exists.

11.3.2 Exposure to Others (Non-HDR Employees/Non-HDR Subcontractors)

If an HDR employee observes an unsafe condition/practice by another contractor (not contracted with HDR) to which HDR/HDR subcontractors are not exposed but, in the employee's judgment, poses a serious hazard or imminent danger to others that could be exposed, the employee is to:

- Immediately warn those in imminent danger, regardless of company affiliation.
- Immediately notify HDR supervision for reporting to the creating/controlling contractor's senior management.

- When describing the serious hazard or imminent danger observation, do not provide any means or methods or specific remedies for correction. Our obligation is strictly limited to informing site supervision of the observation.
- Make it clear that our notification is advisory only and should not be construed as a direction or a stop-work order - the non-HDR contractor is solely responsible for determining and implementing the necessary corrective action.
- Document the notification in the project field logbook, daily report, or other records based on contract requirements.

11.4 Regulatory Inspection Protocols

It is our expectation that all employees will follow the requirements set forth in this Plan as well as all regulations that apply to their work location. HDR is committed to cooperating with regulatory and/or compliance inspection personnel as applicable on our project sites. HDR does not authorize any HDR employee to prohibit a properly identified representative from prompt admittance to any work area. Therefore, we will not require warrants for occupational SH&E officials' entry into any project location where HDR is engaged. We will cooperate with all inspectors in accordance with local regulatory requirements.

Guidelines for HDR actions during the inspection are summarized as follows.

Activity	HDR Action
Arrival of Inspector(s)	HDR project personnel are to contact their Regional SH&E Manager if an occupational SH&E inspector appears onsite to conduct an investigation involving HDR personnel.
Meeting with Site Representative	All HDR project sites require designation of an on-site SH&E Representative. The SH&E Representative is responsible for interaction with the inspector(s) and must be summoned immediately upon arrival of an inspector(s) at the site.
Credential Verification	Immediately upon arrival of the inspector(s), the SH&E Representative is to request and document the inspector's identification. If the Inspector is missing his/her Identification card, or the identity of the inspector(s) is in question, a call to his/her home office is an acceptable practice to verify authenticity of credentials and inspection authorization.

Activity	HDR Action
Inspection	The SH&E Representative is to accompany the Inspector(s) at all times during the visit. HDR should attempt to replicate all photos, samples, or notes collected by the inspector(s), paying special attention to where the Inspector(s) goes, who is talked to, what sampling is done, which instruments are used, and any specific comments that are made. Site personnel are to conduct themselves in a professional manner when interacting with regulatory officials. The following guidelines should be adhered to during the inspection. • Keep all responses short and to the point without elaboration. Personnel should not volunteer information not specifically asked for by the inspector and should avoid statements that might be construed as an admission of noncompliance. • Do not demonstrate any operations for the Inspector(s) that are not part of the daily normal planned activities. • If possible, immediately remedy any alleged violation(s) identified by the Inspector(s). If an employee violates a work rule during an inspection, the same remedial/disciplinary action will be taken as if the Inspector(s) was not present. Failure to correct a violation noticed during the inspection may itself result in a citation. • Regulations may require the maintenance of certain safety and health records. If the Inspector(s) requests to review records, grant access to the documents.

11.1 Drugs and Alcohol

The manufacture, distribution, possession, use, or being under the influence of drugs is prohibited while performing work for HDR. This includes the use or possession of prescription medications without a valid prescription.

Employees whom HDR management/supervision reasonably believes directly or indirectly caused a work-related injury or property damage will be required to undergo drug and alcohol impairment testing. Such testing will be conducted as soon as practicable, but not later than 32 hours after the incident for drugs and not later than six hours for alcohol.

11.2 Disciplinary Action

Should an employee commit an SH&E violation (any act contrary to the SH&E requirements set forth in this manual or those established by a client or governmental regulations), intentional or not, disciplinary action may result. Depending on the severity of the violation, the employee will typically be retrained to reinstruct the employee on the proper conduct expected. This retraining, and the circumstances necessitating it, will be documented and retained in the employee's personnel file.

For serious first-time violations and repeat violations in which an offending employee continues to exhibit a disregard for the same or similar SH&E procedures after retraining, the responsible manager shall consult with the Director of SH&E and the Director of Employee Relations. As appropriate to the situation, actions could include any one, or a combination, of the following forms of disciplinary action: verbal warning; written warning; probation; suspension; and/or discharge. This is not an all-inclusive list and, because HDR is an at-will employer, it reserves the right to terminate at will without prior disciplinary action.

PROJECT SAFETY, HEALTH, AND ENVIRONMENTAL ORIENTATION FORM

Project: ______________________________

Date: ______________________________

Location: ______________________________

Attendees: ______________________________

Topics

- ❑ Review assigned duties and tasks
- ❑ Discuss anticipated site conditions (access, weather, etc.)
- ❑ Review the Site-Specific SH&E Plan and Job Hazard Analysis (JHA) forms
- ❑ Confirm training, equipment/supplies, medical clearance, and vaccinations have been acquired for all field team members
- ❑ Review emergency procedures and reporting and investigation procedures for near miss, injury/illness, damage, and environmental incidents
- ❑ Discuss environmentally safe work practices (spill/release management, hazardous waste, solid waste, protected ecological/cultural resources, etc.)

Notes/Comments

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Team Member Signatures:
I have been briefed on and understand and agree to follow the requirements of the Site-Specific SH&E Plan and JHAs for this project.

____________	____________	____________
____________	____________	____________
____________	____________	____________
____________	____________	____________
____________	____________	____________

JOB-SITE SAFETY, HEALTH, AND ENVIRONMENTAL MEETING FORM

Project: ______________________________

Task: ______________________________

Date: ______________ Time: ______________

Location/Work Area: ______________________________

Attendees: ______________________________

Topics (check off list as completed):

- ❑ Review assigned duties and tasks for the day
- ❑ Discuss anticipated site conditions (access, weather, etc.)
- ❑ Review the Project-Specific SH&E Plan and Job Hazard Analysis (JHA) forms for the day's work
- ❑ Confirm team roles (on-site SH&E Representative, first aid/CPR responders, Short Service Employee mentors)
- ❑ Discuss emergency procedures and equipment (satellite phone, whistles, horns, etc.)
- ❑ Identify necessary medications and individual team member's medical situations/precautions (if staff is willing to share with team)
- ❑ Review lessons learned from any reported incidents and the status of any corrective actions
- ❑ Confirm everyone is comfortable with daily plan of action

Summary of Work Conducted and Planned:

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Attendees:

Name (print)	Signature	Name (print)	Signature

Meeting Conducted by:

______________________________ ______________________________

Name (printed) Signature

HAZARDOUS WASTE SITE OPERATIONS PRELIMINARY EVALUATION

The following information must be detailed before allowing employees to enter the site. Monitoring must be performed where there may be a question of employee exposure to hazardous concentrations of hazardous substances in order to assure proper selection of engineering controls, work practices, and personal protective equipment (PPE) so that employees are not exposed to levels which exceed PEL's, or other published exposure levels for hazardous substances.

Project Name:	SPU South Park Site Cleanup
Project Number:	10328001
Form Completed by:	Katherine Garufi
Date:	11/29/2022

Location and approximate size of the site	Location: 816 and 836 S. Kenyon St, 803 and 811 S> Chicago St, and 7760 and 7808 8th Ave S., Seattle Washington. Size: 2.8 acres along the western bank of the Duwamish River.
Description of the response activity and/or the job task to be performed	Remedial investigation activities including site reconnaissance, well installation, soil, groundwater, and sediment sampling
Duration of the planned employee activity	Field work not to exceed 3 months – conducted Monday – Friday.
Site topography and accessibility by air and roads	Site topography is relatively flat. Site can be accessed by South Chicago Street and 8th Avenue South.
Safety and health hazards expected at the site	Biological, chemical, and physical hazards are expected onsite. See HASP Section 5.0.
Pathways for hazardous substance dispersion	Improper management of IDW. Improper sample collection.
Present status and capabilities of emergency response teams that would provide assistance to hazardous waste clean-up site employees at the time of an emergency	Emergency response teams are available in close proximity to the site. King County Fire Protection District #2 has jurisdiction over the site and has capabilities for fire suppression, fire prevention, hazardous materials response, mutual aid response, and emergency medical services in cooperation with King County Medic One, the Valley Communications Center, and other related public services.
Hazardous substances and health hazards involved or expected at the site, and their chemical and physical properties	Refer to Section 5.
Exposures exceeding PEL or other published exposure limits	None.
Immediately dangerous to life and health (IDLH) concentrations	N/A.
Potential skin absorption and irritation sources	Refer to Section 5.

Potential eye irritation sources	Not applicable as employees will be wearing proper eye protection.
Explosion sensitivity and flammability ranges	N/A.
Oxygen deficiency	N/A.

Attachment A: Initial Job Hazard Analysis

JOB HAZARD ANALYSIS FORM – SPU SOUTH PARK WQF PROJECT SUPPORT SERVICES – SITE CLEANUP (TASK 8 – REMEDIAL INVESTIGATION)

Overall Risk Assessment Code (RAC) (Use highest code) | **L**

Project Name: SPU South Park WQF Project Support Services – Site Cleanup	**Risk Assessment Code (RAC) Matrix**					
Project Location: Seattle, Washington	E =Extremely High Risk H = High Risk M =Moderate Risk L =Low Risk	**Probability (P)**				
Project Number: 10328001		Frequent (F)	Likely (L)	Occasional (O)	Seldom (S)	Unlikely (U)
Prepared by (Name/Title): Lanelle Ezzard/Project Manager	**Severity (S)**					
Notes: (Field Notes, Review Comments, etc.):	Catastrophic (C)	E	E	H	H	M
	Critical (Cr)	E	H	H	M	L
	Marginal (M)	H	M	M	L	L
	Negligible (N)	M	L	L	L	L

RAC is developed after correctly identifying all hazards and fully implementing all controls.

Step 1: Review each "Hazard" with identified safety "Controls" and determine RAC

– P "Probability" is the likelihood to cause an incident, near miss, or accident.

– S "Severity" is the outcome if an incident, near miss, or accident did occur

Step 2: Identify RAC for each "Hazard" and indicate overall highest RAC at the top of JHA

Job Steps	Hazards	Controls	P	S	RAC
1. Arrival on site.	1.1 Unfamiliar with site lay out.	1.1.1 Verify site SH&E induction attended.	**S**	**M**	**L**
2. Set-up of drilling equipment.	2.1 Heavy equipment	2.1.1 Don't carry heavy load. Split the load. 2.1.2 Maintain correct posture while manually lifting a load. 2.1.3 Be familiar with the equipment and how it is set-up.	**U**	**M**	**L**
	2.2 Fatigue.	2.2.1 Regular rest breaks should be taken throughout the shift. Avoid overworking.	**S**	**M**	**L**
	2.3 Heat Stress or Cold Stress.	2.3.1 Heat: Reduce exposure time, conduct survey early morning or late afternoon. 2.3.2 Heat: Avoid dehydration. Drink water frequently in small amount. 2.3.3 Heat: Wear light clothing. 2.3.4 Cold: Provide shelter (enclosed, heated environment) to protect personnel during rest periods.	**S**	**M**	**L**

Job Steps	Hazards	Controls	P	S	RAC
		• Cold: Educate workers to recognize the symptoms of frostbite and hypothermia. • Cold: Have a dry change of clothing available.			
3. Drilling and Monitoring well installation (Driller responsible for site security)	3.1 Injury from cable breaking or pipe falling from drill rig	3.1.1 Driller will perform daily safety meetings 3.1.2 Minimize amount of time spent close to rig 3.1.3 Wear hardhat, safety glasses, and steel-toed boot at all times 3.1.4 No visitors allowed in work area without approved safety equipment.	U	M	L
	3.2 Head of body injury from protruding articles on pipe truck or other support vehicles	3.2.1 Wear hardhat 3.2.2 Place flagging on protruding articles	S	M	L
	3.3 Injury to foot, hand, finger, or back when connecting drill stem or auger flights	3.3.1 Use care and appropriate gloves when connecting drill stem or auger flights 3.3.2 Wear steel-toed boots and gloves 3.3.3 Use proper lifting technique 3.3.4 Driller will establish commands, signals, and procedures for handling augers, rods, samplers, and tools.	S	M	L
	3.4 Ear damage from noise of rig	3.4.1 Wear earmuff or plugs when close to rig or near the drill site for an extended period of time	S	M	L
	3.5 Lightning	3.5.1 Stop drilling and take cover when lightning is observed.	U	Cr	L
	3.6 Sun and heat exposure	3.6.1 Use sunscreen, wear hardhat, wear sunglasses when appropriate, and drink liquids. 3.6.2 Be knowledgeable of symptoms of heat exhaustion, heat stroke, and dehydration.	S	M	L
	3.7 Eye injury, bruises, and sprains form flying debris, gravel or rock fragments may be present during pressurized cleaning of drilling equipment.	3.7.1 Safety glasses, hardhat, steel-toed boot, gloves, and other protective equipment should be worn.	S	M	L
4. Soil sampling	4.1 Finger inquiry from jagged fragments	4.1.1 Wear gloves when handling samples	U	M	L

Job Steps	Hazards	Controls	P	S	RAC
5. Collecting and processing water samples	5.1 Contaminated water source	5.1.1 Wear appropriate gloves and safety glasses.	U	M	L
6. Sediment sampling	6.1 Slips, Trips, Falls Off Boat/Drowning Hazards	6.1.1 Be aware of potentially slippery surfaces and tripping hazards. 6.1.2 Wear footwear that has sufficient traction to reduce risk of slipping. 6.1.3 Wear U.S. Coast Guard-approved personal flotation device (PFD). 6.1.4 Be aware of any obstacles on boat deck.	S	M	L
	6.2 Heat stress or cold stress.	6.2.1 Heat: Reduce exposure time, conduct survey early morning or late afternoon. 6.2.2 Heat: Avoid dehydration. Drink water frequently in small amount. 6.2.3 Heat: Wear light clothing. 6.2.4 Cold: Provide shelter (enclosed, heated environment) to protect personnel during rest periods. 6.2.5 Cold: Educate workers to recognize the symptoms of frostbite and hypothermia. 6.2.6 Cold: Have a dry change of clothing available.	O	M	M
	6.3 Rain	6.3.1 Wear appropriate PPE (rain gear). 6.3.2 Be aware of slip hazards, puddles, and electrical hazards when working near water.	O	L	L
	6.4 Lightning	6.4.1 Do not begin or continue work until lightning subsides for 20 minutes. 6.4.2 Immediately head for shore if on the water and lightning is observed. 6.4.3 If you are not able to get to shore, disconnect and do not use or touch the major electronic equipment, including the radio, throughout the duration of the storm.	O	M	M

Equipment Requirements	Training Requirements	Inspection Requirements
Hard Hat Safety Glasses Safety footwear Safety Vest PFD Hearing equipment (if deemed necessary)	SH&E Orientation	Inspect PPE prior to use.

My signature confirms I have reviewed this task and I understand and concur with the job steps, hazards, and controls described in this JHA. (Signature is required of all field team members involved in the task).

Print Name	Signature	Date

Attachment B: Floyd Snider HASP

Remedial Investigation/Feasibility Study Work Plan

Silver Bay Logging Site

Appendix E
Data Management Plan

Table of Contents

List of Tables

List of Abbreviations

Abbreviation	**Definition**
bgs	Below ground surface
CAP	Cleanup Action Plan
CAS	Chemical Abstracts Service
CLARC	Cleanup Levels and Risk Calculation
cm	Centimeters
cPAH	Carcinogenic polycyclic aromatic hydrocarbon
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichlorethylene
DDT	Dichlorodiphenyltrichloroethane
DDx	Calculated as the sum of DDD, DDE, and DDT
DL	Detection limit
DMP	Data Management Plan
Ecology	Washington State Department of Ecology
EDD	Electronic data deliverable
EIM	Environmental Information Management

Abbreviation	Definition
FBI	Friedman & Bruya, Inc.
FS	Feasibility Study
HDR	HDR Engineering, Inc.
HPAH	High molecular weight polycyclic aromatic hydrocarbon
LDW	Lower Duwamish Waterway
LPAH	Low molecular weight polycyclic aromatic hydrocarbon
MDL	Method detection limit
MTCA	Model Toxics Control Act
NAD 83 (2011)	North American Datum of 1983, 2011 National Adjustment
NAVD 88	North American Vertical Datum of 1988
OC	Organic carbon
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
Property	Silver Bay Logging property
QA	Quality assurance
QC	Quality control
RGI	Riley Group, Inc.
RI	Remedial Investigation
RL	Reporting limit
RM	River Mile
Site	Silver Bay Logging Site
SMS	Sediment Management Standards
SPU	Seattle Public Utilities
SVOC	Semivolatile organic compound
TEF	Toxic equivalent factor
TEQ	Toxic equivalent
TPH	Total petroleum hydrocarbons
USEPA	U.S. Environmental Protection Agency
WAC	Washington Administrative Code

1.0 Purpose and Introduction

This Data Management Plan (DMP) prepared by Floyd|Snider is subject to the same quality control (QC) review criteria as required by the project. HDR Engineering, Inc. (HDR) performed a QC review of the DMP at a level of detail appropriate for the subconsultant's deliverable, including verification that the subconsultant's deliverable is complete and conforms to the subconsultant scope of services. In accordance with the HDR QC review process, email communication tracking QC review comments, response, and resolution has been filed in HDR's electronic project files.

This DMP documents procedures to assemble and manage the Project Dataset for use in the Remedial Investigation and Feasibility Study (RI/FS) for the Silver Bay Logging Site (Site) located at 816 S Kenyon Street, Seattle, Washington, King County Tax Parcels 732790-2520, -2480, -2490, -3645 (Property). All work is being performed under subcontract to HDR under their Seattle Public Utilities (SPU) Site Investigation for the South Park Water Quality Facility Project - Site Cleanup (Contract #: 21-047-S). This DMP is defined in the Contract Scope of Work under Task 4, the Existing Materials Summary Report. The DMP is a living document and revisions may be incorporated as the RI/FS Work Plan (Task 6) is developed.

The RI/FS for the Site is being conducted to fulfill an Agreed Order in accordance with the Model Toxics Control Act (MTCA) Regulation (Washington Administrative Code [WAC] 173-340) subject to Washington State Department of Ecology (Ecology) review and approval. Following completion of the RI/FS report, a remedial action will be selected by Ecology and documented in the Cleanup Action Plan (CAP) for the upland areas of the Site. All data management and analytical methodologies described in this DMP are consistent with MTCA requirements. Data collected by Floyd|Snider for the RI/FS and CAP will be provided to the Ecology Environmental Information Management (EIM) system manager. Floyd|Snider is not responsible for EIM submittal of historical site data acquired during due diligence.

Data will be standardized prior to use and subject to a comprehensive quality assurance (QA)/QC process to ensure that all data comprising the final dataset are appropriate to meet project objectives and in accordance with MTCA requirements, current Ecology guidance, and best practices.

The data management procedures that were used to develop this DMP, and are presented in documents developed by Ecology and U.S. Environmental Protection Agency (USEPA), include the following:

1. MTCA Regulation (WAC 173-340) and related Ecology (2013) guidance:
   A. 173-340-830 WAC - Analytical Procedures
   B. 173-340-840 WAC – General Submittal Requirements
   C. 173-340-850 WAC – Record Keeping Requirements
   D. 173-340-760 WAC and 173-240 WAC (Sediment Management Standards; SMS)

E. MTCA Cleanup Levels and Risk Calculation (CLARC; July 2021 updates) online resource page[1]

F. SMS Sediment Cleanup User's Manual (December 2021)

2. USEPA guidance documents include:

A. *National Functional Guidelines for Organic Superfund Methods Data Review* (USEPA 2020a)

B. *National Functional Guidelines for Inorganic Superfund Methods Data Review* (USEPA 2020b)

C. *National Functional Guidelines for High Resolution Superfund Methods Data Review* (USEPA 2020c)

1.1 DATA SOURCES

The current contents of the Project Dataset were compiled from Phase 1 and Phase 2 environmental investigations performed by Riley Group, Inc. (RGI), the consultants for the Property owner. The Property owner authorized the release of electronic data deliverable (EDD) files from the analytical laboratory used by RGI, Friedman & Bruya, Inc. (FBI). RGI's investigation reports and associated FBI EDDs were used to assemble the Project Dataset of upland soil and groundwater data. RGI also provided native Computer Aided Design and Drafting (CADD) files that were incorporated into the RI/FS basemap.

Recent EIM data (e.g., from 2011 or later) for, and in the vicinity of, the property from 8th Avenue South and South Kenyon Street into the middle of the adjacent Duwamish River include stormwater catch basin and in-line solids samples, sediment samples, and tissue samples. Sediment, surface water, tissue, and riverbank data developed by SPU as part of the Lower Duwamish Waterway (LDW) Superfund Site cleanup will be incorporated into the RI/FS Work Plan with consultation from SPU project managers and Ecology. EIM and/or SPU LDW data may be incorporated into the Project Dataset during the scoping of the RI/FS Work Plan. This DMP addresses the handling of all soil, groundwater, sediment, and stormwater sample results and supporting metadata. The DMP will be updated to address additional data types incorporated into the Project Dataset, as needed.

1.2 DATA QUALITY AND DATA USABILITY

Data comprising the Project Dataset are subject to exhaustive QA/QC checks to ensure the data met appropriate quality standards for use. Data are reviewed for completeness, consistency, accuracy, and integrity upon import.

[1] https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Contamination-clean-up-tools/CLARC

Section 2.0 describes data standardization and data management procedures associated with assembly of the raw dataset and manipulation prior to use in Floyd|Snider work products, including data validation and assignment of qualifiers.

Data are subjected to checks to verify conformance with Floyd|Snider database standards, including the following:

- Populated values for all required database fields;
- Use of consistent, appropriately defined values within database fields (e.g., all result values are numeric);
- Internal consistency checks (e.g., result units are appropriate for the media and analysis type; appropriate identification of laboratory replicates); and
- Uniqueness of entries for required database fields, including location names.

Sections 3.0 describes data handling and additional QA/QC checks specific to each database field and the data useability, including data identified during validation as not meeting conformance checks.

Section 4.0 provides summation rules for organic chemical criteria consisting of multiple analytes, such as polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), dioxins/furans, and some pesticides.

Section 5.0 provides the cited references.

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2.0 Data Standardization

2.1 GEOSPATIAL INFORMATION

Elevation datum, spatial coordinate, and depth information for each location and sample are reviewed for completeness prior to loading the data into the project database. QA/QC checks are performed to ensure that the total number of imported locations from each data source within the Property match the total number of locations shown in tables and figures associated with the data source. Additionally, as described in the sections that follow, all geospatial information is standardized to a consistent set of units, coordinates, or datum for data reporting.

2.1.1 Vertical Datum

Elevation data are recorded using the North American Vertical Datum of 1988 (NAVD 88). The Floyd|Snider database stores elevations for each sample location in the Property in NAVD 88. All elevations are rounded to the nearest one-tenth of a foot. Sample locations that are missing vertical elevation data were not resurveyed.

2.1.2 Horizontal Datum and Geospatial Characterization

All x and y location coordinates are stored in the horizontal North American Datum of 1983, 2011 National Adjustment (NAD 83 [2011]), Washington State Plane Coordinate System, North Zone (International Feet). Coordinates stored in other horizontal datums in the source dataset were converted to NAD 83 (2011) prior to storage in the database. Locations that are missing x and y coordinates in the source database or electronic data deliverable may be digitized from available figures showing the sampling location. The accuracy of digitized and standardized location coordinates is reviewed by comparing the plotted location coordinates stored in the database against figures showing sample locations in the original data source.

Latitude and longitude coordinates are also provided for each location using the World Geodetic System (WGS84) coordinate system, which facilitates the uploading of location information into Global Positioning System devices for use in the field.

Some locations in the database represent composite sample locations. Coordinates associated with these locations are equivalent to the centroid of the subsampling locations. More information is provided in the source documents associated with each sampling event.

2.1.3 Depth Characterization

Sample depth information for each sample result is reviewed for completeness. All uplands soil and groundwater sample depth information are retained in the project database. Sample depth is standardized by media.

Upland soil data are stored in units of feet below ground surface (bgs). Groundwater sample data are stored in units of feet bgs.

Sediment sample data are stored in units of centimeters (cm) below mudline. Riverbank soil data are stored in units of feet bgs.

Sample depths stored in feet bgs are rounded to one decimal place; sample depths stored in cm below mudline are rounded to the nearest cm.

2.1.4 Location Groups

To facilitate data reporting, comparison of data to criteria, and plotting data on figures, each location is assigned to one or more project-specific location groups.

The “River Area” field is used to identify groups of data relevant to the Property and includes sediment and uplands data proximate to, but outside of, the Property. Other location groups are media specific. The purpose and use of each location group is described in this section.

Sediment

- The “RiverSubArea” field is a text field that identifies sediment samples that fall within the Property boundary.
- The “InNavChannel” field is a binary field: sample locations within the navigation channel are assigned a value of “Yes”; samples outside the navigation channel are assigned a value of “No.”
- The “RecreationalBeach” field is a binary field: all sample locations within recreational beach areas designated in the RI/FS are assigned a value of “Yes”; samples outside beach areas are assigned a value of “No.” The location of a sample within a recreational beach is relevant to application of LDW cleanup levels.
- The “RiverMile” field designates the River Mile (RM) of each location to the nearest tenth of a mile. This field was populated in the source databases for most locations; Floyd|Snider populated null values using RM classifications of nearby samples. This field is useful in geographic queries, particularly in reference to performing site-specific elevation conversions.

Soil

- The “Riverbank Soil” field identifies soil sample locations collected from riverbanks (i.e., samples that were collected below the top of the bank and above mean higher high water level.
- The “RiverSubArea” field is a text field that identifies riverbank soil samples that fall within the Property boundary.

Groundwater

- The “ShorelineGW” location group is used to distinguish groundwater monitoring locations adjacent to the shoreline from more inland groundwater sampling locations.

Stormwater

- The “ComplianceMonPoint” location group stores the name of the outfall associated with the sampled conveyance system feature. It is common to sample water and solids in multiple catch basins within a stormwater basin. Use of this location group allows the user to easily identify the sampling point most similar to discharge from the outfall, which is the ultimate compliance point and most relevant for assessment of stormwater recontamination potential.

2.2 ANALYTE NOMENCLATURE

Analyte grouping and naming conventions are reviewed for completeness and standardized prior to loading the data in the database.

2.2.1 Analyte Groups

Each analyte is categorized into an analyte group in the database based on commonly accepted analyte groups for environmental media. Analyte groups take into account chemical structure and properties, and laboratory analysis and reporting method.

Project-specific analyte groups are further subcategorized by media to reflect analytes that were needed to perform sums for comparison of total results to criteria, analyte groups containing individual analytes with criteria, and “other” analyte groups containing analytes that do not have relevant criteria.

2.2.2 Analyte Nomenclature

For many analytes, the source datasets may contain results stored for the same analyte under various different analyte naming conventions. Differences in analyte naming conventions may include slight variations in analyte name for summed results, use of synonyms for the same analyte, and differences in presentation of analyte names for isomers and congener coelutions. To facilitate consistent data reporting, analyte names are standardized to Floyd|Snider standard analyte naming conventions.

Certain polychlorinated biphenyl (PCB) congeners coelute, and different analytical laboratories report the data in different ways. Analyte naming conventions for coeluting PCB congeners are standardized to report all coeluting congeners in a sample as a single analyte, with each coeluting congener included in the name.

2.2.3 Chemical Abstracts Service Numbers

Each analyte has a unique Chemical Abstracts Service (CAS) registry number that can be used in table lookups, rather than relying on matching using the analyte name. Some analytes, like calculated analyte totals or results that coelute, do not have an established CAS number. A project-specific CAS number is assigned to these analytes.

Project-specific CAS numbers assigned to summed analyte results indicate the treatment of non-detect results in the summation method by inclusion of a suffix.

Project-specific CAS numbers for summed analyte results are listed in Table E.1.

2.3 PRESENTATION OF RESULTS

2.3.1 Result Units and Significant Figures

Result units for each analyte class in each media are converted to a consistent set of units for comparison to criteria. The units selected for each analyte class match the criteria units as reported in MTCA sources, including CLARC. For chemicals with SMS sediment criteria that are organic carbon (OC) normalized, sediment results are also stored as an additional record with units that reflect the normalization (i.e., milligram per kilogram of OC).

Results for conventionals (e.g., grain size), field parameters, and other analyte classes that lack criteria are standardized to a consistent set of units within each media with consideration of Ecology conventions.

After completion of unit conversions and standardization, analytical results provided by the laboratory or presented in the source dataset are rounded to a consistent number of significant figures for presentation in figures and data tables. The original results are maintained in the database in the "Lab Result" field while the rounded result is presented by the "Use Result" field. Conventional results were rounded to four significant figures; high-resolution method results (i.e., dioxins/furans and PCB congeners) are rounded to three significant figures; and all other results are rounded to two significant figures. This is consistent with rounding rules applied in the dataset and is consistent with the level of accuracy of regulatory criteria.

2.3.2 Treatment of Non-Detects

Certain results that are measured at concentrations less than the reporting limit (RL) are modified for presentation in Floyd|Snider work products.

Results for chemicals that are detected at concentrations reported between the RL and the method detection limit (MDL) remain a detect but are qualified "JQ" to indicate they should be considered estimated due to the quantitation between the RL and MDL.

PCB congeners and dioxins/furans are reported down to the MDL or estimated detection level consistent with the project-specific reporting rules for the source dataset. Results for non-detect chemicals that are less than the RL, and that do not require sums, were used as presented in the source database or report, rather than reporting down to the MDL.

2.3.3 Definition and Propagation of Qualifiers

The database stores original laboratory qualifiers as well as interpreted qualifiers assigned following data validation. Certain interpreted qualifiers present in the source datasets had different definitions between datasets. Interpreted qualifiers were reviewed and standardized prior to storage and use.

Interpreted qualifiers in the Project Dataset are defined as follows:

- J = the chemical is positively identified; however, the associated numerical value is an estimated concentration. Interpreted qualifiers of J+ or J- (indicating the result may be biased high or low, respectively) were standardized to J.
- JB = the chemical is positively identified; however, the associated numerical value is an estimated concentration due to possible blank contamination.
- JQ = the chemical is positively identified; however, the associated numerical value is an estimated concentration due to the quantitation between the RL and MDL
- U = not detected at detection limit (DL) shown.
- UJ = not detected; sample DL is estimated.
- R = result rejected during data validation.
- R1 = result rejected in favor of a more appropriate result/analysis.
- CN = chromatogram/concentration note. This qualifier is typically used for total petroleum hydrocarbons (TPH) data to indicate that review of the chromatogram provides more detailed information about the nature of the TPH analytes present in the sample. It is also used to add notes to a result record.

Qualifiers are assigned as follows for calculated total and average results:

- If one or more of the results is qualified as estimated (J- or CN-flagged), then the calculated result is similarly qualified (J or CN flag).
- If all analyte results were qualified as non-detect, the calculated result is qualified as non-detect (U or UJ flag).
- If one or more of the results in an analyte group total are qualified as non-detect and one or more of the other results are detected, the calculated result is flagged as detected.
- Results qualified as R are not used in calculated results.

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3.0 Data Handling Procedures

This section describes manipulation of the raw data for presentation in tables and figures following data management rules consistent with MTCA requirements for establishing cleanup standards (173-340 WAC, Part VII – Cleanup Standards).

3.1 IDENTIFICATION OF PREFERRED RESULTS

This section describes identification of preferred results based on laboratory analysis performed on the sample, which results in a simple true/false categorization of results. Setting the "Preferred Result" field to "true" will identify results for chemicals that should be compared to criteria and used in data reporting. Data handling rules used to assign results into preferred and non-preferred categories are described in the sections that follow.

3.1.1 Metals Results in Water Media

In water, it is appropriate for the result fraction to match the regulated fraction in the applicable media. When both total and dissolved metals results are analyzed in a particular sample, the result fraction matching the regulated fraction in that medium is flagged as the preferred result. Otherwise, the result in the only reported fraction is retained as the preferred result.

Groundwater. The regulated fraction in groundwater is "total" for all metals except cadmium, copper, chromium, and chromium(VI).

Therefore, the preferred fraction for groundwater results is "total" for all metals except cadmium, chromium, and copper, where "dissolved" is the preferred fraction. For arsenic, some data are only available in the "dissolved" fraction. Therefore, both fractions are presented in tables for comparative purposes.

Stormwater. The regulated surface water fraction is "total" for all metals except zinc. Therefore, the preferred fraction for stormwater results is "total" for all metals except zinc, where "dissolved" is the preferred fraction.

3.1.2 Total Polychlorinated Biphenyls Results in All Media

When PCB analysis is performed using both Aroclor and congener analysis methods in a particular sample, the total PCB result associated with the congener method is assigned a preferred result flag of "true" and the total PCB result associated with Aroclor method was assigned a preferred result flag of "false."

3.1.3 Total Petroleum Hydrocarbons: Silica Gel-Treated Results in All Media

TPH results are often analyzed with and without a silica gel treatment to "clean up" results the sample extract before it is analyzed for TPH so that the extract contains primarily hydrocarbons, rather than including both hydrocarbons and nonhydrocarbons. When both silica gel-treated and non-silica gel-treated results are analyzed in a particular sample, the non-silica gel-treated result was flagged as the preferred result. If the non-silica gel-treated result is not reported, the silica gel-treated result was retained as the preferred result.

3.2 TREATMENT OF DUPLICATES

Duplicate samples are collected and analyzed in environmental datasets to ensure data meet the project's data quality objectives. This section describes the QA/QC review process duplicate samples are subjected to. It also describes data handing and reporting procedures relevant to duplicate sample results.

The "Preferred Result" field is set to "true" for data mapping and surface-weighted average analysis. For reporting of data in tables and statistical analysis, the "Preferred Result Comment" field should be used instead, such that individual sample results can be retained rather than the average of duplicate results. More information on treatment of duplicate results is provided in the following sections.

3.2.1 Laboratory Duplicates and Chemicals Analyzed by More than One Method

As standard practice, Floyd|Snider does not average laboratory duplicate results. Instead, the initial and subsequent laboratory result (e.g., the initial result and the result after reanalysis) are evaluated on a chemical-specific basis for each method, and the better result is selected as the preferred result for use in reporting and data analysis.

As an example, naphthalene is commonly reported in both volatile organic compound and semivolatile organic compound (SVOC) analysis methods. Naphthalene is a component analyte required for calculation of the total polycyclic aromatic hydrocarbons (PAH) sum. Therefore, the naphthalene result analyzed by the SVOC method (e.g., USEPA 8270 or USEPA 8270-SIM) is set as the preferred result when results by both methods are available for a sample.

3.2.2 Field Duplicates

Field duplicate and field replicate sample results that are retained as acceptable for use are averaged consistent with averaging rules developed by Ecology (173-340 WAC, Part VII – Cleanup Standards). The following averaging rules were applied when addressing these three general combinations of detected and non-detected results:

- If the analyte is detected in two or more samples, only the detected results are averaged (the non-detected results were ignored).
- If the analyte is detected in only one sample, the detected value is reported as the average (the non-detected results were ignored).
- If the analyte is not detected in any samples, the result with the lowest non-detect result is reported as the average regardless of qualifiers.

Qualifiers are assigned as described in Section 2.3.3.

The database stores calculated averages as “dummy” field sample that have the suffix "AVG”, with a preferred flag of “true”, and flagged the results used to create the average as non-preferred (preferred flag of “false”).

3.3 DATA QUALITY AND USABILITY REVIEW

Data are reviewed relative to data quality objectives of completeness, accuracy, and integrity as part of the data loading and QA review process described in Section 1.2 and throughout Sections 2.0 and 3.0. However, USEPA guidance indicates that data usability is also affected by temporal factors like natural attenuation, maintenance dredging events, and other factors unrelated to quality of the data at the time of sampling. These factors primarily affect groundwater, sediment, and riverbank soil data.

3.3.1 Replacement of Data

Replacement of data may be appropriate in some cases when data do not meet data quality objectives or are not representative of current conditions. The appropriateness of data replacement is determined on a site- and location-specific basis with consideration of trends over time. The following are considerations for data replacement:

- Presence of outliers
- Heterogeneity of the substrate
- Natural recovery occurrence
- Deposition
- Erosion/scour potential
- Sampling density/resolution
- Age of the data

Additionally, differences in sample dates and locations between sample pairs must be considered.

Any data that meet Ecology approval for replacement will be flagged in the database, using the preferred result flag and comment, and will be excluded from future RI/FS work.

Additionally, non-detect data with elevated DLs will be flagged as non-preferred and CN. These data are not useful for setting boundaries for remedy considerations because the actual chemical concentration within these samples is unknown.

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4.0 Summation Rules

This section describes summation rules used for calculation of total results for comparison to criteria applicable to each media. Summation rules are consistent with MTCA requirements (173-340 WAC, Part VII – Cleanup Standards).

4.1 SUMMED ANALYTE RESULTS

Total analyte results are calculated for each chemical with criteria for additive exposures (e.g., PCBs). General and analyte class-specific summation rules applicable to in-water media (i.e., sediment and riverbank soil) and uplands media (i.e., uplands soil, stormwater, and groundwater) are described in the sections that follow.

4.1.1 General Sum Rules

Calculation of results for summed analytes was performed consistent with the MTCA. In general, we note the following:

1. Calculated totals are the sum of all detected component analyte results.
2. If no component analytes are detected in a sample, the greatest DL is used as the result. The result is assigned a “U” qualifier and flagged as non-detect.
3. Analytes not detected within a dataset for a given medium are excluded from sums (assumed to be absent and treated as zero). Analytes that are assumed to be absent are still counted when determining the number of component analytes present in a sample.

Table E.2 lists the expected number of component analytes for calculating the summed analyte result for each summed analyte with criteria.

If the number of component analytes reported in a sample is less than the minimum number of analytes listed in Table E.2 for that medium, the total is not calculated.

4.1.2 Polychlorinated Biphenyls

The total PCB result for comparison to criteria can be calculated as either the sum of Aroclors or the sum of PCB congeners. Summation methods for each of these two calculations are described below.

4.1.2.1 Total Polychlorinated Biphenyls as Aroclors

The following summation procedure is followed to calculate the total PCB result for each sample analyzed for PCBs using an Aroclor analysis method. The total PCB result for each sample is calculated as the simple sum of concentrations of all detected Aroclor results. Qualifiers are assigned according to general sum rules.

4.1.2.2 Total Polychlorinated Biphenyls as Congeners

The following summation procedure was followed to calculate the total PCB result for each sample analyzed for PCBs using a congener analysis method.

Results for coeluting congeners are counted as a singular analyte result when performing the total PCB sum.

4.1.3 Dioxins/Furans

The following summation procedure is followed to calculate the total dioxin/furan toxic equivalent (TEQ) for each sample. Results for all 17 dioxin/furan congeners are multiplied by their toxic equivalent factors (TEFs)[2] to get a TEQ result for each congener. Dioxin/furan TEFs are listed in Table E.3. TEQ results for detected congeners were summed using simple addition. Non-detected congeners are not included. Qualifiers for the summed result are assigned following the general sum rules.

4.1.4 Polycyclic Aromatic Hydrocarbons

4.1.4.1 Carcinogenic Polycyclic Aromatic Hydrocarbons

The following summation procedure is followed to calculate the total carcinogenic polycyclic aromatic hydrocarbon (cPAH) TEQ for each sample. Results for all seven cPAHs are multiplied by their TEFs to get a TEQ result for each component analyte. cPAH TEFs are listed in Table E.3 Detected TEQ results are summed using simple addition. Non-detect results are not included. Qualifiers for the summed result are assigned following the general sum rules.

If none of the cPAH component analytes are detected in a sample, the DLs are multiplied by their respective TEFs and the maximum individual value is used as the cPAH TEQ result. A U qualifier is then added to the total, and the result is flagged as non-detect.

Results for benzo(b)fluoranthene and benzo(k)fluoranthene are used preferentially in cPAH TEQ calculations when available. Exceptions occurred when samples in the source dataset are missing results for benzo(b)fluoranthene and benzo(k)fluoranthene as individual component analytes:

- If the sample has results for total benzofluoranthenes, the total benzofluoranthenes result is multiplied by the TEF for benzo(b)fluoranthene and used in the sum. This approach is conservative, because the TEF for benzo(b)fluoranthene is greater than the TEF for benzo(k)fluoranthene.
- If the sample has results for benzo(j,k)fluoranthene (rather than benzo(k)fluoranthene), the result for benzo(j,k)fluoranthene is multiplied by the TEF for benzo(k)fluoranthene and used in the sum.

[2] Dioxin/furan TEF values are the 2005 World Health Organization consensus TEF values for mammals (Van den Berg et al. 2006).

4.1.4.2 Total Polycyclic Aromatic Hydrocarbons

Total PAHs is calculated as the sum of total low molecular weight PAHs (LPAHs) and total high molecular weight PAHs (HPAHs). If both HPAH and LPAH results were non-detect, the total PAHs result is also non-detect and given a “U” qualifier. In this case, the maximum individual value is used as the total PAH result.

Total LPAH is calculated as the sum of acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene. Total LPAH results were calculated and assigned qualifiers following the general sum rules.

Total HPAH is calculated as the sum of fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene. Summed results are calculated and assigned qualifiers following the general sum rules, with the following caveats:

- If results are reported as total benzofluoranthenes, rather than individual benzo(b)fluoranthene and benzo(k)fluoranthene results, the total benzofluoranthene result is used in the sum and is counted as two analytes when calculating the number of HPAH component analytes in the sample.
- If results are reported as benzo(j,k)fluoranthene, rather than benzo(k)fluoranthene, the benzo(j,k)fluoranthene result is used in the sum and counted as an analyte when calculating the number of HPAH component analytes in the sample.

4.1.5 Pesticides

Five analytes for which criteria are developed are the sum of individual component analytes: total chlordanes; dichlorodiphenyltrichloroethane (DDT) and its derivatives dichlorodiphenyldichloroethane (DDD) and dichlorodiphenyldichloroethylene (DDE); and the sum of DDE, DDD, and DDT, which is referred to as DDx. Summation methods for each of these two calculations are described below.

4.1.5.1 Total DDD, Total DDE, and Total DDT

Each of these three summed analytes is calculated as the sum of its isomer pairs. Total DDT, total DDD, and total DDE are calculated as the sum of 2,4’-DDT and 4,4’-DDT, 2,4’-DDD and 4,4’-DDD, and 2,4’-DDE and 4,4’-DDE, respectively. Sums and qualifiers are assigned using the general sum rules.

If results for a single isomer are reported in a sample, the total DDD, total DDE, or total DDT result is equivalent to the concentration reported for the isomer. The qualifier assigned to the total result is equivalent to the qualifier reported for the isomer.

4.1.5.2 Total DDx

Total DDx is calculated as the sum of six DDx isomers: 2,4’-DDD, 2,4’-DDE, 2,4’-DDT, 4,4’-DDD, 4,4’-DDE, and 4,4’-DDT.

4.1.5.3 Total Chlordanes

Total chlordanes is calculated as the sum of alpha- or *cis*-chlordane, gamma- or *trans*-chlordane, beta-chlordane, *cis*- and *trans*-chlordane, oxychlordane, *cis*-nonachlor, and *trans*-nonachlor. Technical chlordane results are not included in any sum and are not compared to criteria developed for total chlordanes.

5.0 References

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Remedial Investigation/Feasibility Study Work Plan

Silver Bay Logging Site

Appendix E

Tables

Table E.1
Project-Specific Chemical Abstracts Service Numbers for Summed Analytes

Analyte Class	Floyd|Snider Analyte Name [1]	Floyd|Snider CAS Number	Description
PCBs	Total PCB Aroclors (U=0)	T_PCB (U=0)	
	Total PCB Aroclors (U=0)	T_PCB (U=0)	Historical total PCB result; component analyte data not available.
	Total PCB Congeners (U=0)	T_PCBCg (U=0)	
	Total PCBs (U=0)	T_PCBCg (U=0) T_PCB (U=0)	Preferred total PCB result in each sample, consistent with preferred flags described in Appendix A Section 3.1.2.
Pesticides	Total Chlordanes (U=0)	T_Clrdn (U=0)	
	Total DDD (U=0)	T_DDD (U=0)	
	Total DDE (U=0)	T_DDE (U=0)	
	Total DDT (U=0)	T_DDT (U=0)	
	Total DDx (U=0)	T-DDx (U=0)	
PAHs	cPAH TEQ (U=0)	T_cPAH_TEQ (U=0)	
	Total HPAH (U=0)	T_HPAH (U=0)	
	Total LPAH (U=0)	T_LPAH (U=0)	
	Total PAH (U=0)	T_PAH (U=0)	
Dioxins/Furans	Dioxin/Furan TEQ (U=0)	T_DF_TEQ (U=0)	

Note:

1 Analyte names stored in Floyd|Snider database. For analytes with U=0 stored in the analyte name, results are reported as U=0 in data figures and tables.

Abbreviations:

CAS Chemical Abstracts Service
cPAH Carcinogenic polycyclic aromatic hydrocarbon
DDD Dichlorodiphenyldichloroethane
DDE Dichlorodiphenyldichloroethylene
DDT Dichlorodiphenyltrichloroethane
DDx Calculated as sum of DDD, DDE, and DDT
HPAH High molecular weight polycyclic aromatic hydrocarbon
LPAH Low molecular weight polycyclic aromatic hydrocarbon
PAH Polycyclic aromatic hydrocarbon
PCB Polychlorinated biphenyl
TEQ Toxic equivalent

Table E.2
Dioxin/Furan and Dioxin-Like PCB Congener Toxic Equivalent Factors [(1)]

Analyte Group	Compound	Toxic Equivalent Factor (TEF)
Dioxins/Furans	2,3,7,8-TCDD	1
	1,2,3,7,8-PeCDD	1
	1,2,3,4,7,8-HxCDD	0.1
	1,2,3,7,8,9-HxCDD	0.1
	1,2,3,6,7,8-HxCDD	0.1
	1,2,3,4,6,7,8-HpCDD	0.01
	OCDD	0.0003
	2,3,7,8-TCDF	0.1
	1,2,3,7,8-PeCDF	0.03
	2,3,4,7,8-PeCDF	0.3
	1,2,3,4,7,8-HxCDF	0.1
	1,2,3,7,8,9-HxCDF	0.1
	1,2,3,6,7,8-HxCDF	0.1
	2,3,4,6,7,8-HxCDF	0.1
	1,2,3,4,6,7,8-HpCDF	0.01
	1,2,3,4,7,8,9-HpCDF	0.01
	OCDF	0.0003
PCBs	3,3’,4,4’-TCB (PCB-77)	0.0001
	3,4,4',5-TCB (PCB-81)	0.0003
	2,3,3’,4,4’-PeCB (PCB-105)	0.00003
	2,3,4,4’,5-PeCB (PCB-114)	0.00003
	2,3’,4,4’,5-PeCB (PCB-118)	0.00003
	2’,3,4,4’,5-PeCB (PCB-123)	0.00003
	3,3’,4,4’,5-PeCB (PCB-126)	0.1
	2,3,3’,4,4’,5’-HxCB (PCB-156)	0.00003
	2,3,3’,4,4’,5-HxCB (PCB-157)	0.00003
	2,3’,4,4’,5,5’-HxCB (PCB-167)	0.00003
	3,3’,4,4’,5,5’-HxCB (PCB-169)	0.03
	2,3,3’,4,4’,5,5’-HpCB (PCB-189)	0.00003

Note:

1 World Health Organization 2005 TEF values for mammals (Van den Berg et al. 2006).

Abbreviations:

HpCB Heptachlorobiphenyl
HpCDD Heptachlorodibenzo-p-dioxin
HpCDF Heptachlorodibenzofuran
HxCB Hexachlorobiphenyl
HxCDD Hexachlorodibenzo-p-dioxin
HxCDF Hexachlorodibenzofuran
OCDD Octachlorodibenzodioxin
OCDF Octachlorodibenzofuran
PeCB Pentachlorobiphenyl
PeCDD Pentachlorodibenzo-p-dioxin
PeCDF Pentachlorodibenzofuran
PCB Polychlorinated biphenyl
TCB Tetrachlorobiphenyl
TCDD Tetrachlorodibenzo-p-dioxin
TCDF Tetrachlorodibenzofuran

Table E.3

Carcinogenic Polycyclic Aromatic Hydrocarbon Toxic Equivalent Factors [1]

Analyte	Toxic Equivalent Factor (TEF)
Benzo(a)anthracene	0.1
Benzo(a)pyrene	1
Benzo(b)fluoranthene [2]	0.1
Benzo(k)fluoranthene	0.1
Chrysene	0.01
Dibenzo(a,h)anthracene	0.1
Indeno(1,2,3-c,d)pyrene	0.1
Benzo(b+k)fluoranthene	0.1
Benzo(j+k)fluoranthene	0.1

Notes:

1 TEF values are based on those in Cal-EPA, 2005. Air Toxics Hot Spots Program Risk Assessment Guidelines, Part II Technical Support Document for Describing Available Cancer Potency Factors. Office of Environmental Health Hazard Assessment, California Environmental Protection Agency. May 2005.

2 If results are reported as total benzofluoranthenes rather than as individual isomers, the total benzofluoranthenes result is multiplied by the TEF for benzo(b)fluoranthene for use in calculating the total cPAH result.

Abbreviation:

cPAH Carcinogenic polycyclic aromatic hydrocarbon