Remedial Investigation Work Plan – Phase I

Port of Port Angeles Terminals 5, 6, and 7

Prepared for
Port of Port Angeles

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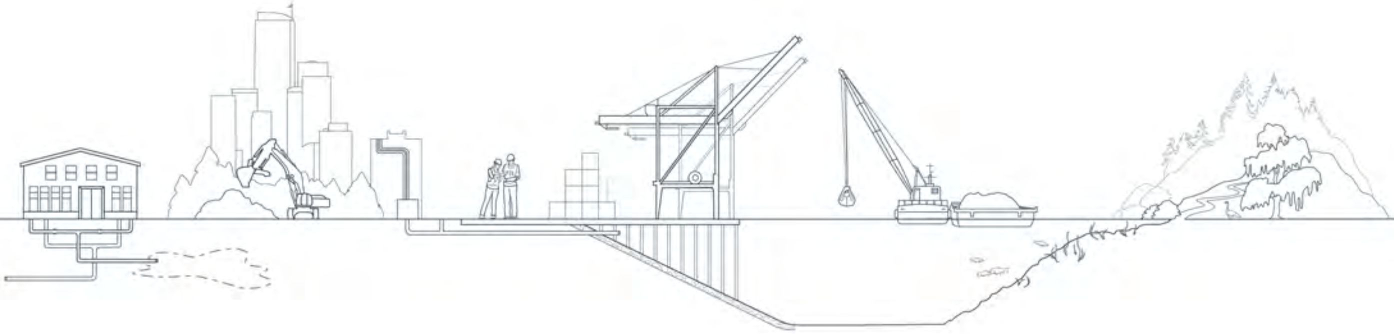

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The interpretations and conclusions contained in this report are based in part on site characterization data collected by others. Floyd|Snider cannot assure the accuracy of this information.

Table of Contents

List of Tables

List of Figures

List of Appendices

List of Abbreviations

Abbreviation	Definition
AO	Agreed Order
ARAR	Applicable or Relevant and Appropriate Requirement
AST	Aboveground storage tank
bgs	Below ground surface
BTEX	Benzene, toluene, ethylbenzene, and xylenes
City	City of Port Angeles
COC	Chemical of concern
COI	Chemical of interest
COPC	Contaminant of potential concern
cPAH	Carcinogenic polycyclic aromatic hydrocarbon
CSM	Conceptual site model

Abbreviation	Definition
CUL	Cleanup level
DAHP	Washington State Department of Archaeology and Historic Preservation
DQO	Data quality objective
Ecology	Washington State Department of Ecology
GPS	Global positioning system
IHS	Indicator hazardous substance
LEKT	Lower Elwha Klallam Tribe
LiDAR	Light detection and ranging
M&R	Merrill & Ring
MCL	Maximum contaminant level
µg/L	Micrograms per liter
mg/kg	Milligrams per kilogram
MTCA	Model Toxics Control Act
NAPL	Non-aqueous phase liquid
Nippon	Nippon Paper Industries USA Co.
PAH	Polycyclic aromatic hydrocarbon
Paraffine	Paraffine Companies, Inc.
PCB	Polychlorinated biphenyl
PCP	Pentachlorophenol
Port	Port of Port Angeles
PSL	Preliminary screening level
QA/QC	Quality assurance/quality control
QAPP	Quality Assurance Project Plan
RAL	Remedial action level
RAO	Remedial Action Objective
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
SAP	Sampling and Analysis Plan
SCO	Sediment Cleanup Objective

Abbreviation	Definition
SMS	Sediment Management Standards
SVOC	Semivolatile organic compound
TeCP	Tetrachlorophenol
TEE	Terrestrial ecological evaluation
TEQ	Toxic equivalent
TPH	Total petroleum hydrocarbons
UST	Underground storage tank
VOC	Volatile organic compound
WAC	Washington Administrative Code
Work Plan	Remedial Investigation Work Plan – Phase I
WPAH	Western Port Angeles Harbor
WSDOT	Washington State Department of Transportation

1.0 Introduction

This Remedial Investigation (RI) Work Plan – Phase I (Work Plan) was prepared by Floyd|Snider at the request of the Port of Port Angeles (Port) in accordance with the Washington State Model Toxics Control Act (MTCA; Washington Administrative Code [WAC] 173-340). This Work Plan documents the scope, technical approach, and implementation details for completing Phase I of the RI within the uplands of Port Terminals 5, 6, and 7 located in Port Angeles, Washington. In July 2021, the Washington State Department of Ecology (Ecology) listed the four tax parcels (063000190090, 063099190025, 063099190035, 063000505520) that comprise Terminals 5, 6, and 7 on their list of confirmed and suspected contaminated sites. The parcels are collectively referred to as the Terminals 5, 6, and 7 Uplands on the list and were assigned Cleanup Site ID 15440. This Work Plan is presented as an exhibit to Agreed Order (AO) No. 21560 between the Port and Ecology, described in Section 1.2.1. The Port shall implement this Work Plan to satisfy the requirements the AO. For these parcels, the scope of work presented in this Work Plan is intended to conduct the first phase of the assessment required by AO No. DE 9781 (Paragraph VI.B, pp. 10–11) for the Western Port Angeles Harbor (WPAH) to identify ongoing upland sources of contamination that have the potential to result in sediment recontamination at levels greater than prospective sediment cleanup standards.

Per MTCA, the term “Site” is defined as where hazardous substances have come to be located. The Site boundary will be defined as part of the RI – Phase I work to the extent possible and will be documented in an RI – Phase I Summary Report. Section 1.3 describes constraints to the investigation that may limit the ability to fully delineate the Site boundary. For the purposes of this Work Plan, a Study Area has been established to encompass the parcels under Port ownership and the adjacent bank of Port Angeles Harbor. AO No. 21560 requires investigation activities to perform the first phase of investigation work to characterize the nature and extent of contamination within the Study Area; inform the scope of any potential future remedial actions to be performed at the Study Area, including interim actions; and determine where the Port may need to implement source control measures to prevent contamination or recontamination of sediment in WPAH from sources within the Study Area. The Study Area includes the four tax parcels identified by Ecology, generally located at 1313, 1417, and 1608 Marine Drive and the adjacent bank of the WPAH. Figure 1.1 presents the geographic location of the Study Area.

1.1 PURPOSE OF THE REMEDIAL INVESTIGATION WORK PLAN – PHASE I

The purpose of this Work Plan is to describe the investigation activities that will be completed to characterize the nature and extent of contamination in designated areas in order to provide information to evaluate potential interim cleanup actions consistent with the Remedial Action Objectives (RAOs) for the Study Area. This Work Plan incorporates existing information collected as part of previous environmental investigation efforts at the Study Area to the extent feasible. This Work Plan includes a Sampling and Analysis Plan (SAP) and 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

1.2.1 Toxics Cleanup Program

When the Port and other WPAH Group entities entered into the AO with Ecology for a remedial investigation/feasibility study (RI/FS) for the WPAH, the following language was included regarding definition of the Western Port Angeles Harbor Site (AO No. DE 9781, Paragraph VI.B, pp. 10–11.):

> The facility, known as the Western Port Angeles Harbor Site (Site), is defined by the extent of contamination caused by the release of hazardous substances at the Site and will be further identified and delineated as described in the Work Plan (Exhibit B). This Order requires investigation of sediments and identification of ongoing upland sources of contamination that have the potential to result in sediment recontamination at levels greater than prospective sediment cleanup standards. Any such upland sources identified under this Order will be addressed under separate actions, agreements, permits or orders. Based upon all factors known to Ecology, a “release” or “threatened release” of “hazardous substance(s)” as defined in RCW 70.105D.020(25) and RCW 70.105D.020(10), respectively, has occurred at the Site.

As described above, this Work Plan is presented as an exhibit to AO No. 21560 between the Port and Ecology. This is a separate order by Ecology to collect, develop, and evaluate sufficient information within the Study Area to select interim cleanup actions and to identify ongoing upland sources of contamination that have the potential to result in sediment recontamination at levels greater than prospective sediment cleanup standards. Ecology has determined that contaminants related to former saw, shingle, and planing mill and boxboard milling operations in the Study Area are likely present at concentrations exceeding applicable soil and groundwater cleanup levels (CULs) and these exceedances have the potential to result in sediment contamination at levels greater than prospective sediment cleanup standards. Ecology named the Port a Potentially Liable Person as the property owner of Terminals 5, 6, and 7. Under the AO, the Port is obligated to conduct an RI – Phase I for the Study Area and conduct interim actions, if required. Additional RI phases, if needed, and development of a feasibility study and a preliminary cleanup action plan, if warranted, would be performed under subsequent amendments to the AO.

The RI will evaluate ongoing sources from the Study Area that have the potential to result in sediment recontamination at levels greater than remedial action levels (RALs) developed for the WPAH Site. As described in the WPAH RI/FS (WPAH Group 2020), if surface sediments exceed CULs or RALs developed in the RI/FS process, pathways to that area will be considered. These pathways will be considered for the Study Area, given the proximity of adjacent sediment exceeding RALs. Bank erosion has been identified as a potential concern in several areas, including Terminals 5, 6, and 7 (refer to Appendix E of the WPAH RI/FS; WPAH Group 2020). The WPAH Site is described in further detail in Section 2.1.1.

The scope of work in the AO describes the RI work to be included in this Work Plan. The AO also describes submittal of an RI – Phase I Summary Report once the investigation is complete, which will present RI data, evaluation, and proposed next steps, which may include an RI Work Plan – Phase II.

1.2.2 Water Quality

The Port's operations on Terminals 5, 6, and 7 are covered by an Industrial Stormwater General Permit (WAR-000314), issued to the Port most recently on January 1, 2020, by Ecology's Water Quality Program.

Stormwater discharges from Terminal 7 triggered Level 2 and Level 3 Corrective Action under permit conditions S8.D. On August 3, 2015, the Water Quality Program issued Administrative Order No. 12801 to the Port, to install an Ecology-approved stormwater treatment system to achieve water quality standards for discharges to the harbor. On November 11, 2017, and October 14, 2020, the Port submitted Requests for Modification of Permit Coverage to Ecology, seeking an extension of time to meet corrective action requirements. Ecology reviewed the requests and issued Administrative Order No. 15818 on May 11, 2018, and Amended Order No. 19449 on November 13, 2020, conditionally granting an extension of time for Level 3 Corrective Actions to December 31, 2023.

In 2017, the Port completed design, received permits, and awarded a contract to construct the first phase of Terminal 7 stormwater conveyance improvements. However, prior to construction, the Port completed an archaeological resource survey. The results of the survey indicated that archaeological resources were present on Terminal 7 and could be disturbed if the project proceeded as designed. The Port terminated the project and during 2017–2019 the Port collaborated with the Lower Elwha Klallam Tribe (LEKT) over project design, engineering, and mitigation and developed very detailed protocols around potential discovery. In 2020, a thorough archaeological resource survey of the project site was completed that included 169 test pits. The results of survey informed the design and construction methods to avoid or minimize project-related archaeological resource impacts. Design and mitigation discussion are ongoing.

1.3 TRIBAL RESOURCES

Historically, much of the northern Olympic Peninsula and southern Vancouver Island was territory of the Klallam Tribe, and more than 30 Klallam villages were scattered throughout this region. Today the Klallam Tribe is divided into three federally recognized tribes: the Port Gamble S'Klallam Tribe, the Jamestown S'Klallam Tribe, and the LEKT. The LEKT is the tribal community in Port Angeles (Oldham 2007). The Study Area is located within the traditional territory of the LEKT.

The harbor area was historically inhabited by two major Klallam villages sites: I'e'nis and Tse-whit-zen villages (NewFields 2012). I'e'nis was located on the east side of the harbor, at the mouth of Ennis Creek. Tse-whit-zen village was located in the western portion of the harbor at the base of Ediz Hook, including the Study Area. Beginning over 2,000 years ago, the LEKT utilized

Tse-whit-zen village in the traditional practices of sea mammal hunting, ocean fishing, and the burial of its members (WPAH Group 2020).

In 2003, the Washington State Department of Transportation (WSDOT) began construction of a graving yard and dock on Terminal 5 in support of the replacement and refurbishment of concrete pontoons for the Hood Canal Bridge. During excavation of the site, remains of 335 individuals and over 100,000 artifacts were recovered. Artifact deposits underlying historical fill identified included middens containing shell, stone, and bone artifacts, projectile points, and lithic debitage (Oldham 2007). The discovery of these unique archaeological resources and ancestral remains led to the abandonment of the graving dock project.

In 2006, a 4-Party Settlement Agreement was reached by the LEKT, the State of Washington, the Port, and the City of Port Angeles (City) that led to the transfer of ownership of the project site to the LEKT. The 4-Party Settlement Agreement requires consultation with the LEKT if ground-disturbing work is to occur in an archaeologically sensitive area with the goal of developing a proposed mitigation plan acceptable to all parties. For the purposes of the 4-Party Settlement Agreement, "ground-disturbing" is defined as "operations, such as digging, trenching, boring, excavating, and drilling, that cause physical penetration of the surface of the ground by tools or equipment." The 4-Party Settlement Agreement includes basic protocols for monitoring and reporting discoveries of archaeological resources and/or human remains. The parties to the 4-Party Settlement Agreement agreed these or comparable protocols will be used during future investigation and remediation activities that have the potential to disturb artifact-bearing middens and human remains. Based on the long history of tribal presence in the harbor, there is a high probability that archaeological materials will be encountered during any ground-disturbing activities at Terminal 5 and surrounding properties, including the Terminals 6 and 7 properties.

During the development of this Work Plan, Ecology engaged in consultation with the LEKT regarding investigation activities and the complexities related to the registered archaeological Tse-whit-zen site (45CA523), which is in proximity to portions of Terminals 5, 6, and 7. The outcome of the consultation is that Ecology decided to proceed with a phased approach to limit the ground-disturbing activities until more information is gathered to determine if contaminants are migrating into the harbor. Ground-disturbing activities will proceed within the fill areas along the Study Area shoreline, as described in the sections that follow, in order to identify potential ongoing upland sources of contamination that are discharging to the harbor and contributing to sediment contamination at concentrations greater than sediment CULs.

1.4 WORK PLAN ORGANIZATION

The remainder of this Work Plan is organized as follows:

- **Section 2.0—Study Area Description:** Provides information on the location, adjacent cleanup sites, geological and hydrogeological setting, ownership, and historical and current land use in the Study Area.

- **Section 3.0—Summary of Previous Investigations:** Summarizes the scope and findings of previous environmental investigations conducted within the Study Area between 1988 and 2002.
- **Section 4.0—Chemicals of Interest and Preliminary Screening Level Development:** Identifies the chemicals of interest (COIs) related to the Study Area history and operations, potential exposure pathways and receptors, and applicable regulatory requirements; and establishes preliminary screening levels (PSLs) protective of the exposure pathways.
- **Section 5.0—Preliminary Conceptual Site Model:** Presents the known and potential contaminant release and migration mechanisms, media of concern, and exposure pathways.
- **Section 6.0—Summary of Data Gap and Proposed Remedial Investigation:** Establishes data quality objectives (DQOs), identifies data gaps related to the DQOs and presents the proposed Phase I investigation to fulfill data gaps.
- **Section 7.0—Schedule:** Describes the anticipated schedule for implementation of the RI – Phase I and preparation of the Preliminary Data Evaluation and Interim Action Assessment and RI – Phase I Summary Report.
- **Section 8.0—References:** Cites the supporting documents used to develop this Work Plan.

Documentation supporting this Work Plan is provided in the following appendices:

- **Appendix A—Study Area Data Reports:** Includes copies of the reports that present the findings of previous environmental investigations in the Study Area.
- **Appendix B—Sampling and Analysis Plan/Quality Assurance Project Plan:** Presents the field sampling and laboratory analytical procedures and data quality assurance/quality control (QA/QC) criteria.
- **Appendix C—Health and Safety Plan:** Presents site-specific safety procedures to address the proposed scope of work and anticipated hazards in the Study Area.
- **Appendix D—Port of Port Angeles, Terminals 5, 6, & 7 Uplands, Monitoring Protocols:** Establishes policies, states responsibilities and chain of command, and provides procedures to ensure that any archaeological resources or human remains encountered during work in the Study Area are properly identified and appropriately treated.

2.0 Study Area Description

The Study Area is located along the industrial waterfront area of the harbor in Port Angeles, Washington, and consists of three properties owned by the Port, now commonly referred to as Terminals 5, 6, and 7. The Study Area is a total of 32.4 acres and is currently used for log yard operations and lay berth by the Port. The Port has also leased a portion of Terminal 7 for debarking operations and trailer storage. A map of the Study Area is shown on Figure 2.1. The Study Area's geographic, geologic, and hydrogeologic settings, as well as historical and current uses, are described in further detail in the following sections. Figure 2.2 depicts a summary of the historical operations in the Study Area. These key historical Study Area operations are described in Table 2.1.

2.1 STUDY AREA LOCATION AND ADJACENT PROPERTIES

The Study Area is bounded by McKinley Paper Company to the west, the harbor to the north, the POPA Boat Haven to the east, and Marine Drive and the LEKT property to the south. Terminals 5 and 6 are the westernmost parcels in the Study Area (Tax Parcels No. 063099190025 and 063099190035) on approximately 12 acres. They are located at 1608 Marine Drive and 1417 Marine Drive, respectively, but are treated by the Port as a combined property. Terminals 5 and 6 are bounded to the southwest by McKinley Paper Company, the south by the LEKT and WSDOT properties, and the east by the Terminal 7 property. Prior to the transfer of the Terminal 5 property to the LEKT and WSDOT in 2006, Terminals 5 and 6 encompassed approximately 31 acres. Terminal 7 is the easternmost property in the Study Area. It is located at 1313 Marine Drive (Tax Parcels No. 063000505520 and No. 063000190090) on 20 acres. Terminal 7 is bounded to the west by the LEKT/WSDOT properties, to the east by the POPA Boat Haven, and to the south by Marine Drive.

2.1.1 Western Port Angeles Harbor Sediments

The harbor is a natural deepwater harbor located on the northern coast of Washington's Olympic Peninsula and along the southern shoreline of the Strait of Juan de Fuca in Port Angeles, Washington. The harbor has been identified as a priority environmental cleanup and restoration project by Ecology. An RI/FS was prepared under a 2013 Agreed Order No. DE 9781 between the WPAH Group and Ecology, addressing sediments in the western portion of the harbor, defined as the WPAH Sediment Cleanup Unit (Figure 2.1). The WPAH RI/FS was approved by Ecology in November 2020.

The RI/FS showed that indicator hazardous substances (IHSs) in the harbor include metals (cadmium, mercury, and zinc), carcinogenic polycyclic aromatic hydrocarbon (cPAH) toxic equivalent (TEQ), and total TEQ.[1] Generally, IHS concentrations were greatest in the inner harbor, which includes a portion of the shoreline along Terminal 6. The remedy selected in the RI/FS

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[1] Total TEQ is the combined dioxin/furan TEQ and polychlorinated biphenyls (PCBs) congener TEQ. Ecology established this IHS in order to implement a sediment CUL representative of the combined regional background levels of dioxins/furans and PCB congeners. Total TEQ as a combined IHS applies to the harbor sediments only.

includes subtidal capping along a portion of the Terminal 6 shoreline and placement of an Enhanced Monitored Natural Recovery layer along Terminal 5 and 7. Offsets without active remediation are proposed around Terminals 5 and 7. The offsets will be evaluated during engineering design on a structure-by-structure basis and reduced as much as practicable informed by geotechnical and structural analyses, considering variability of site conditions, the type of structure, the use, and level of protection needed.

2.1.2 LEKT and WSDOT Properties

As described in Section 1.3, WSDOT began construction of a graving yard and dock on Terminal 5 in 2003. At that time, WSDOT completed an archaeological resources survey for the project area, which documented broken shells but did not identify intact archaeological deposits. Two weeks into construction, workers removing a concrete slab identified a shell midden, and human remains were discovered shortly thereafter associated with the Tse-whit-zen site, a large and important Klallam village and cemetery site. The historic cemetery was located within the general vicinity of the former lumber mill. In March 2004, WSDOT and the tribe signed a Memorandum of Understanding for construction to continue and provided funding and land to the tribe for the reburial of remains. However, other intact burials were then discovered. WSDOT, at the request of the LEKT, cancelled construction of the graving yard and dock to prevent further disturbance of the site. As part of the 4-Party Settlement Agreement, the LEKT received the central 13.3 acres of the property and a lease and funding from WSDOT to construct a cultural center on an additional 5.5 acres (State of Washington 2006). The properties are currently the location of the office and storage space for the LEKT staff archaeologist.

2.2 GEOLOGY AND HYDROGEOLOGY

The Study Area is situated along the shoreline of the harbor, which is characterized by beach deposits of unconsolidated fine to coarse sand with variable amounts of silt and gravel and interbeds of silt and fine sand. Much of the shoreline area in the vicinity has been artificially filled to support industrial waterfront land use, with fill consisting primarily of dredge spoils with variable materials from upland sources. Fill in the Study Area has been observed during previous investigations and consists of sand with silt and gravel with varying amounts of bark and wood debris, coarse gravel, and imported angular riprap used as a structural fill material (Hart Crowser 1998). The fill thickness is expected to be greatest along the shoreline, where it has been encountered down to depths of 15 to 20 feet, and thin to approximately 5 feet or less toward the uplands.

Underlying the native beach deposits are glacial drift deposits including Vashon till and outwash, consisting of stratified sand, gravel, silt, clay, and till. These drift deposits extend inland, where they are presumed to form the base of a wave-cut bluff of glacially consolidated sediments to the south of the Study Area. The drift deposits are overlain by glaciofluvial sand deposits in the bluff area, with a total thickness of glacially deposited sediments ranging up to 300 feet in the vicinity (Landau 1997; DNR 2004).

The bedrock underlying the glacial deposits in the Port Angeles area is believed to be the upper member of the Twin River Formation (late Eocene to early Miocene). This formation consists of olive gray to greenish gray, poorly indurated and poorly sorted massive mudstone, claystone, and siltstone, with thin beds of calcareous claystone and sandstone. The depth to the Twin River Formation or its thickness in the Port Angeles area is unknown (Landau 1997).

A shallow, unconfined aquifer is present beneath the Study Area that first occurs in the dredged fill and beach deposits and was observed at depths between 3.5 and 7 feet below ground surface (bgs) during previous investigations. Groundwater elevation is expected to be highly variable along the shoreline due to tidal effects, and tidal influence on the potentiometric surface in monitoring wells has been measured as far as 150 feet inland from the shoreline during previous hydrogeologic studies in the Study Area (CH2M Hill 1989). The shallower aquifer is thought to be recharged by groundwater from transmissive portions of the glacial deposits upgradient of the shoreline area to the south, and infiltrating precipitation. The overall flow direction in shallow groundwater is to the north, discharging to the harbor.

2.3 HISTORICAL OWNERSHIP AND OPERATIONS WITHIN STUDY AREA

The Study Area was historically divided into two main ownership and operational areas, the upland area at Terminals 5 and 6 (1417 and 1608 Marine Drive) and the upland area at Terminal 7 (1313 Marine Drive). Historical ownership and operations within these two upland areas are summarized in this section and are based on available historical records and information that has been compiled by the Port. Figure 2.2 shows the locations of some of the key historical operational areas and fill areas that were in these upland areas and are described in this section.

2.3.1 Terminals 5 and 6 Upland Area

Between approximately 1914 and 1929, a saw, shingle, and planing mill operated on the Terminals 5 and 6 upland area, with these mill operations performed by Puget Sound Mills & Timber Company and Charles Nelson Co (Aldwell 1950, Martin and Brady 1983). During the 1930s, the mill structures remained but no operations occurred in this upland area while under the ownership of Charles Nelson Co (CH2M Hill 1989). In 1940, the former mill was condemned, and the mill's wood structures were demolished using a controlled fire (CH2M Hill 1989, Port Angeles Evening News 1940).

In 1942, under Charles Nelson Co.'s ownership, the Olympic Shipbuilders of Port Angeles constructed and operated a shipyard on this upland area to build wood barges for the U.S. Maritime Commission for use during World War II. The first barge was launched in 1943; however, only six barges were ultimately constructed and less than a year later, the shipyard was dismantled and sold for salvage (Aldwell 1950, Martin and Brady 1983).

In 1945, the Port purchased the Charles Nelson Co. property comprising the Terminals 5 and 6 upland area, covering approximately 27 acres at the time. The Port owned this entire upland area until 2004, when the Port sold approximately 20 acres of this property to WSDOT (State of Washington 2006). The Port retained and currently owns approximately 12 acres located along the shoreline of the Terminals 5 and 6 upland area. The Port's tenants and their operations on the Terminals 5 and 6 upland area between 1945 and 2014 are summarized below:

- **Port Angeles Forest Products and Joe Cecil Lumber Co.** operated a sawmill that manufactured and finished fir and cedar lumber on the northern portion of this upland area between 1948 and 1956 (POPA Port Commission 1950 and 1953; Environmental Data Resources 2012). Structures associated with their operations in addition to the sawmill included a log way, a planer shed, machinery, a steel refuse burner, and lumber storage areas (Environmental Data Resources 2012).
- **Merrill & Ring (M&R)** operated a lumber mill on approximately 27 acres of this upland area between 1955 and 1988 (CH2M Hill 1989). The M&R mill produced wood chips used for paper production, remanufactured lumber, and treated wood. Some of M&R's main structures within this upland area during their operations included a sawmill, a green chain lumber conveyor, a planer mill (referred to as the old planer mill), a sawing building, a sorter and stacker building, a machine shop, a lumber and log handling pier, a chip barge pier, hog fuel boilers, and a dry kiln (CH2M Hill 1989; Environmental Data Resources 2012; Fenton, Conger, and Ballaine 1968; Kendall 1977). The locations of M&R's sawmill and green chain lumber conveyor, the old planer mill, and hog fuel boilers on the Terminals 5 and 6 upland area are shown on Figure 2.2.

  In the late 1960s, M&R filled approximately 4 acres of the harbor area located adjacent to the Terminals 5 and 6 upland area within a bulkhead and retaining wall (refer to Figure 2.2; M&R 1967; M&R 1970; CH2M Hill 1989). This filling expanded the size of the Terminals 5 and 6 upland area to approximately 31 acres. The source of this fill material used by M&R is unknown. At the same time, M&R also constructed a large lumber and log-handling pier, as well as two small chip barge piers/berths on the north end of this upland area (M&R 1972).

  In 1977, M&R expanded their operations onto the southern portion of the Terminals 5 and 6 upland area (to an area previously operated on by Port Angeles Hardwood Co.) and constructed hog fuel boilers and a dry kiln in this area (Kendall 1977).

  According to employees who worked for M&R, Permatox 180[2] was a chemical used to treat wood for a period of at least 15 to 20 years at their mill (CH2M Hill 1989). M&R used Permatox 180 in a dip tank at the green chain lumber conveyor and in a spray booth located southwest of the green chain lumber conveyor. In 1973, a fire severely damaged M&R's old planer mill, located in the northeast corner of this upland area (M&R 1973). An unknown number of barrels containing undiluted Permatox 180 were in the building and burned during the fire. It was also around this time that M&R's practice of applying Permatox 180 to wood was discontinued by

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[2] Permatox 180 is a concentrate fungicide used for the control of blue stain and mold in fresh cut lumber and timber. Active ingredients include potassium 2,3,4,6-tetrachlorophenate and potassium pentachlorophenate, which quantify analytically as PCP and tetrachlorophenol (TeCP). Permatox 180 was manufactured by Chapman Chemical Company.

M&R in the Terminals 5 and 6 upland area (CH2M Hill 1989). Additionally, M&R had a pentachlorophenol (PCP) tank that was located west of the green chain lumber conveyor (Hart Crowser 1988).

Multiple transformers were present at the M&R facility, located both on the portion of their facility located in the Terminals 5 and 6 upland area and on the portion of their facility located on the adjacent Terminal 7 upland area (refer to Section 2.3.2; Hart Crowser 1988). In 1982, transformer oil samples from four M&R transformers were tested and these samples either did not contain PCBs or had a trace amount of PCBs present (Hart Crowser 1988). These transformers were determined to be non-PCB-containing transformers. The specific locations of these transformers at the M&R facility are not known. Stained soil samples were collected adjacent to former M&R transformers and analyzed for total PCBs in a 1988 investigation (refer to Section 3.2.2.1 for additional information).

- **Peninsula Shingle, Angeles Shake & Shingle Co., Levaque Co., and P.A. Shingle** were companies that operated a cedar shake and shingle mill on approximately 2 acres (along the southern boundary of the Terminals 5 and 6 upland area) between 1959 and 1996 (CH2M Hill 1989; Environmental Data Resources 2012; Fenton, Conger, and Ballaine 1968). Materials listed as being stored at this mill in 1993 included propane, diesel, hydraulic fluid, and oil. Four transformers were present in this area in 1993. There is no information on if these transformers contained PCBs.

- **Port Angeles Hardwood Co.** operated an alder and hardwood sawmill and dry kiln on the southern portion of the Terminals 5 and 6 upland area between 1964 and 1977 (CH2M Hill 1989; Environmental Data Resources 2012). Mill structures associated with operations included a planing mill, sorting shed, kilns, and a planer (Environmental Data Resources 2012; Fenton, Conger, and Ballaine 1968). M&R expanded their operations to this area in 1977.

- **Daishowa America Co. (Daishowa)** leased the Terminals 5 and 6 upland area formerly operated on by M&R between 1988 and 2002. Daishowa used the property as a log storage yard (Daishowa 1993). All the former M&R buildings had been removed from this area by 1990.

- **WSDOT** purchased approximately 19 acres of the Terminals 5 and 6 upland property from the Port and began construction of a graving yard and dock in 2003, but due to the discovery of the Tse-whit-zen village, this construction was terminated (refer to Section 2.1.2 for further information; Wilma and Oldham 2005). WSDOT, subsequently conveyed 13.3 acres of this property and leased the remaining 5.5 acres to the LEKT in 2006.

- **Green Crow** leased approximately 3 acres of the Port's property between 2004 and 2011 for log operations.

- **Lakeside Industries and Allen Logging** each leased a 1-acre portion of the Port's property between 2002 and 2014. Allen Logging used the property for wood chip loading and export operations on Terminal 5. Lakeside Industries used their lease area for gravel and rock import operations at the bulkhead area just west of Terminal 6.

Refer to Section 2.4.1 for a summary of the Port's current operations at Terminals 5 and 6.

2.3.2 Terminal 7 Upland Area

Historical operations in the Terminal 7 Upland Area were primarily performed by Fibreboard (or an earlier related entity), M&R, and Daishowa.

Fibreboard Operations. In approximately 1918, Paraffine Companies, Inc. (Paraffine) constructed and began operating a boxboard mill, known as the Crescent Boxboard Company, on the Terminal 7 Upland Area (Martin and Brady 1983; Sadin and Vogel 2011). Boxboard, also known as fiberboard, was used to make cartons for food products. In 1927, Paraffine and Crown Zellerbach formed Fibreboard, which continued to operate this mill until 1970 (Martin and Brady 1983; Port Angeles Evening News 1970). By 1945, Fibreboard owned the property on which their facility was located, covering approximately 12 acres (POPA Port Commission 1945). Ownership of the Terminal 7 Upland Area prior to 1945 is uncertain.

The Fibreboard mill produced groundwood pulp, sulfite pulp, repulped waste pulp, boxboard, and wood chips (Aldwell 1950; CH2M Hill 1989; US Department of the Interior 1967). Feedstocks used to manufacture these products included aqueous ammonia, alum, resin, fuel oil, wastepaper, and sulfur (CH2M Hill 1989). Between 1935 and 1955, the Fibreboard facility consisted of two large mill buildings, as well as several smaller buildings including a chipping mill, cutoff mill, and soda and sulfur storage building (Aldwell 1950; Environmental Data Resources 2012; Fibreboard 1964). One of the large mill buildings included areas for pulp wood grinding, digesters, acid tanks, pulp tanks, areas for sulfite manufacturing, an engine room, a fuel area, and a paper warehouse. The second large mill building contained an area for pulp beaters, a paper machine room, and a finishing and packing room. The approximate location of the two large Fibreboard mill buildings are shown on Figure 2.2. There were also various conveyors connecting the mill buildings and stockpile areas, including a hog fuel storage area, and a 175-foot-tall smokestack located adjacent to the boiler house. Fibreboard used a hog fuel boiler that burned salt-laden wood (NewFields 2013). The mill facility also had two piers, including a smaller pier that was installed in the 1920s and was removed from the property by 1970 and a larger pier with a dock that was constructed in 1928 and remains in place today at Terminal 7 (Environmental Data Resources 2012; Fibreboard 1964; M&R 1974). During Fibreboard's operations, the larger pier had a conveyor or trestle-mounted pipeline that connected the dock to the main upland facility. During the mid-1960s this conveyor structure had an oil line and ammonia line connected to it (Fibreboard 1964). A large fuel oil aboveground storage tank (AST) was present in the northwest corner of the mill facility by 1949. Between 1958 and 1964, a large ammonia AST was added adjacent to the large fuel oil AST (Environmental Data Resources 2012; Fibreboard 1964). Other additions to the mill facility in the mid-1960s included various storage, stock, and settling tanks, as well the addition of a bleach plant building (Environmental Data Resources 2012). Fibreboard performed chlorine-based bleaching (NewFields 2013).

Between 1958 and 1959, the Terminal 7 upland area was expanded by approximately 3 acres along the eastern portion of the former shoreline and surrounding the base of the larger Fibreboard pier (refer to Figure 2.2). This area, as well as the adjacent harbor area to the southeast, was filled in with dredged sediment from the construction of the western half of the adjacent Port's Boat Haven marina (POPA Port Commission 1957 and 1958; USACE 1959).

Fibreboard discharged waste sulfite liquor and pulp mill waste directly into the Port Angeles Harbor (WPCC 1957). It was estimated that the average waste volume from the Fibreboard facility was approximately 4.2 million gallons per day. These waste discharges (concentrated sulfite waste liquors and settleable solids) from Fibreboard resulted in sludge deposits accumulating in Port Angeles Harbor in the vicinity of the Fibreboard property (US Department of the Interior 1967).

M&R's Operations. In 1972, Fibreboard sold the Terminal 7 upland area to M&R. M&R owned and operated on the Terminal 7 upland area from 1972 to 1988. During this period, M&R was also operating on the adjacent Terminals 5 and 6 upland area (refer to Section 2.3.1).

M&R removed many of Fibreboard's mill structures and constructed a new planer mill in the Terminal 7 upland area to replace their former planer mill on the Terminals 5 and 6 upland area that was destroyed in a 1973 fire (refer to Section 2.3.1). The new planer mill location is shown on Figure 2.2. This new planer mill included a spray booth to treat lumber with Permatox 180, and later NP-1[3] (CH2M Hill 1989). This spray booth was reported to be a totally enclosed system with overspray and drippings recycled into a containment tank, and with sludge from the bottom of this tank disposed of as solid waste. Part of M&R's operations in the Terminal 7 upland area also included an upland alder chipping facility, a chip loading facility, and truck maintenance shop (CH2M Hill 1989). M&R used the former Fibreboard dock to load finished lumber onto steamships (Ecology 1973). Additionally, M&R replaced the trestle-mounted pipeline that extended out to this dock with an alder chip transmission pipeline support structure (M&R 1974, 1980).

As noted in Section 2.3.1, multiple transformers were present at the M&R facility located both on the Terminals 5 and 6 upland area and the Terminal 7 upland area. Four of the M&R transformers were tested for PCBs and were determined to be non-PCB-containing transformers, but the exact locations of these tested transformers in these upland areas are not known. Some stained soil samples were collected adjacent to former M&R transformers and analyzed for total PCBs in a 1988 investigation (refer to Section 3.2.2.1 for additional information).

In the late 1970s, M&R expanded the Terminal 7 upland area by filling in some of the harbor area along the northern portion of the shoreline (M&R 1974, 1980). This filling expanded the size of the Terminal 7 upland area to approximately 20 acres. The source of majority of this fill used by M&R is unknown; however, a portion of the fill was dredged material from the Port's dredging

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[3] NP-1 Sapstain Control Chemical aids in the control of blue stain and mold in fresh-cut lumber. Active ingredients include didecyl dimethyl ammonium chloride and 3-iodo-2-propynyl butyl carbamate.

that occurred at Terminals 1 and 3 around this timeframe (POPA Port Commission 1978). The property's shoreline extent has not changed significantly since this filling event occurred.

Daishowa's Operations. Daishowa (later Nippon Paper Industries USA Co. [Nippon]) owned and operated on the Terminal 7 upland area from 1988 until 2004 (Gawley 2004). Daishowa removed many of the M&R buildings once they acquired the property and their facility included a chipping plant, chip loading/unloading area and storage area, and a truck wash area (Daishowa 1993). Daishowa's facility was designed to receive and debark logs and load ships of alder chips for export. In 2004, Nippon sold the Terminal 7 upland area to the Port, but Nippon continued to use a portion of the Terminal 7 upland area as a storage area (warehousing, truck scales, and vehicles) between 2004 and 2014 under a lease with the Port.

Refer to Section 2.4.1 for a summary of the Port's current operations at Terminal 7.

2.4 CURRENT OWNERSHIP AND OPERATIONS WITHIN STUDY AREA

The Terminals 5 and 6 upland area currently consists of four parcels covering approximately 31 acres. Two of these parcels, referred to as Terminals 5 and 6, are currently owned by the Port and cover approximately 12 acres. The other two parcels located within the Terminals 5 and 6 upland area are owned by the LEKT and WSDOT.

The Terminal 7 upland area contains two parcels covering approximately 20 acres, both of which are currently owned by the Port.

2.4.1 Port Operations

2.4.1.1 Terminals 5 and 6

The existing pier at Terminal 6 (located on the north end of the property and formerly used by M&R for chip loading operations) is in poor condition and has not been in use since 2006. The Port currently has a month-to-month lease with Legacy Contracting, Inc. for work float storage on a 3,600-square-foot area of the property located approximately 600 feet from the shoreline southwest of Terminal 6. The remaining Terminals 5 and 6, property owned by the Port, is currently not being leased by other parties. The Port currently uses the Terminals 5 and 6 upland area for log and wood chip storage and handling. A log ramp and cofferdam barge facility for moving logs between the harbor and the upland area is located just southeast of Terminal 5. The Port uses its own employees and equipment for these operations. The site surface is a mixture of asphalt paving and compacted gravel surfacing.

Stormwater on Terminals 5 and 6 is currently collected in a surface impoundment and catch basins and discharged via outfall LY3 (Refer to Figure 2.1).

2.4.1.2 Terminal 7

At Terminal 7, the Port had some of the chip mill equipment removed from the property in 2005, including the removal of chips and sawdust containing petroleum hydrocarbons. In 2006, the

Terminal 7 log ramp was constructed by the Port. The Port currently uses the Terminal 7 dock as a lay berth and the upland area as a Port-operated log yard and associated mechanic shop. Structures currently present on the property include a mechanic shop/warehouse building in the southeastern corner of the property, a small warehouse building in the central portion of the property, and the former Fibreboard pier and dock. A log ramp is located near the northwestern corner of the property. The entire site surface is described as a mixture of asphalt and concrete surfacing partially covered by debris.

Stormwater at Terminal 7 is primarily collected in catch basins and routed through a chitosan-enhanced sand filtration system before discharging via outfall LY5. A small portion of Terminal 7 uplands immediately adjacent to the dock is collected in one catch basin and discharged via outfall LY7.

2.4.2 City Stormwater Conveyance Easement

A gravity-fed stormwater conveyance pipe approximately 985 feet in length, which is owned by the City, enters the Study Area from Marine Drive in the northwestern portion of Terminal 7 and discharges to outfall LY4 extending approximately 165 feet into the harbor (refer to Figure 2.1). The storm drain is presumed to be subject to an easement conveyed to the City per a Land Status Record obtained by the Port. The stormwater conveyance is reported by the City (City of Port Angeles 2021) to be constructed from a 16-inch diameter concrete pipe across approximately 580 feet of the shoreward portion of the Study Area, and transitions to a 24-inch-diameter steel pipe for the last 405 feet in the waterward half of the Study Area and extending into the harbor. The pipe was reportedly constructed in 1936 and most recently surveyed in 2018 according to City records. The City has additionally provided limited video survey images of the pipe, collected in 2013, to the Port. The approximate depth of the pipe is 5.4 feet bgs where it enters the Study Area and is estimated to slope downward to a depth of approximately 10.3 feet bgs at the shoreline of the Study Area.

3.0 Summary of Previous Investigations

This section provides a summary of environmental investigations that have been completed on the Study Area to date, which resulted in the collection of surface and subsurface soil data and groundwater data. Limited sediment and surface water data were also collected in the vicinity of the Study Area but are not described in detail in this Work Plan, as future investigations will be focused on uplands properties only. The objectives and field activities for each of the investigations, and an overall summary of soil and groundwater quality, are presented in the following sections. Sample locations are shown on Figure 3.1 and monitoring well completion details are presented in Table 3.1. The data reports for all of the investigations are included as Appendix A.

3.1 OVERVIEW OF INVESTIGATIONS

Previous investigations have been primarily focused on evaluation of potential impacts from M&R operations and activities at Terminals 5, 6, and 7, and potential impacts to graving dock construction from former wood processing operations at Terminal 5. M&R Property investigations are discussed in Section 3.1.1 and graving dock investigations are discussed in Section 3.1.2.

3.1.1 M&R Property Investigations

Two investigations were performed to evaluate impacts from M&R operations, described in the following reports:

- *Preliminary Environmental Site Evaluation and Focused Pentachlorophenol Explorations, Merrill and Ring, Inc.* (Hart Crowser 1988)
- *Focused Site Investigation of the Former Merrill & Ring Property* (CH2M Hill 1989)

The scope of each investigation is described in the following sections.

3.1.1.1 Terminals 5, 6, and 7 investigations (1988)

In March through June 1988, Hart Crowser, on behalf of M&R, completed phased investigations on Terminals 5, 6, and 7 to evaluate whether the M&R property was potentially contaminated due to M&R operations and site activities. The investigations were conducted as part of a due diligence process for purchase by Daishowa and expansion of Daishowa mill operations. Sampling locations were generally targeted to potential Study Area source areas and are discussed below by media. In addition to field investigations, historical research, regulatory agency file review, and underground storage tank (UST) inspections were conducted.

Surface Soil

Surface soil samples included the following:

- In May 1988, two surface soil samples (SS-02-Phase 1 and SS-03-Phase 1) were collected in the vicinity of the new planer mill and near the Terminal 7 shoreline and analyzed for phenols (i.e., PCP, TeCP, sodium tetrachlorophenate, and sodium pentachlorophenate).
- In May 1988, five surface soil samples (TR-01 through TR-05) were collected in the vicinity of transformers and analyzed for total PCBs as Aroclors.
- In June 1988, 11 surface soil samples were collected near the old planer mill (SS-01 through SS-11) and analyzed for PCP and TeCP.
- In September 1988, five surface samples (VI-SS-200 through VI-SS-204) were collected near the old and new planer mills and the truck maintenance shop and analyzed for PCP and TeCP.

Subsurface Soil and Monitoring Wells

A number of subsurface soil borings were advanced, most of which were converted to monitoring wells. These borings included the following:

- In May 1988, six subsurface soil borings (B-03 through B-08) were advanced. Composite soil samples were collected, and borings were converted to monitoring wells (MW-03A, MW-04A, MW-05A, MW-06A, MW-07, and MW-08) for collection of groundwater samples. Borings were advanced at potential source areas including two suspected wood treatment areas near the new and old planer mills and in the vicinity of the two former ASTs and two USTs. Seven soil samples and six groundwater samples were collected and analyzed for at least one of benzene, toluene, ethylbenzene, and xylenes (BTEX), phenanthrene, PCP, and TeCP.
- On June 2, 1988, four subsurface soil borings (B-11 through B-14) were advanced. Composite soil samples were collected, and borings were converted to monitoring wells (MW-11 through MW-14) for collection of groundwater samples. Borings were advanced in the vicinity of the former ASTs, the historical truck maintenance shop, and the former Fibreboard mill. Four soil samples were collected and analyzed for volatile organic compounds (VOCs) and phenanthrene, and four groundwater samples were collected and analyzed for BTEX and phenanthrene.
- Between June 9 and 12, 1988, seven subsurface soil borings (B-15 through B-19, MW-21, MW-22) were advanced near the old planer mill. Soil samples were collected, and borings were converted to monitoring wells (MW-15, MW-16A, MW-18, MW-19, MW-21, MW-22) for collection of groundwater samples. A total of 64 soil samples were collected and analyzed for PCP and TeCP. Additionally, 15 groundwater samples were collected from newly installed and previously installed monitoring wells and analyzed for PCP, TeCP, and total hydrocarbons (MW-16 only).

- On June 11 and 12, 1988, six shallow subsurface hand augur locations were advanced (HA-1 through HA-6) and one monitoring well was installed (MW-20) near the new planer mill. A total of 19 soil samples and one groundwater sample were collected and analyzed for PCP and TeCP.
- On June 12, 1988, three dioxin/furan samples were collected from two locations near the old planer mill (MW-15 and MW-16) and on Terminal 7 (BG-1, intended to serve as a background soil sample). One groundwater sample (MW-16A) was also collected.

Surface Water and Sediments

- Six surface water (OSW-1 through OSW-6) and six surface sediment samples (OSS-1 through OSS-6) were collected adjacent to the old planer mill from four locations and analyzed for PCP and TeCP.

3.1.1.2 Daishowa Terminal 5 investigation (1988)

In August through November 1988, CH2M Hill, on behalf of Daishowa, completed a focused investigation on Terminal 5 to evaluate whether the M&R property was potentially contaminated due to M&R operations and site activities. The site investigation was focused on a 2-acre area with the main objective to evaluate the magnitude and extent of PCP and TeCP potentially released to soil, groundwater, and sediments by M&R. The investigation included the following activities:

- Twelve subsurface soil borings were advanced. Soil samples were collected, and borings were converted to monitoring wells for collection of groundwater samples. Locations included MW-06B, MW-06C, MW-08B, MW-16B, B-16C, MW-23, MW-24A, MW-24B, MW-25A, MW-25B, MW-26, and B-28. A total of 60 soil samples were collected and analyzed for PCP and TeCP. Additionally, 29 soil samples were analyzed for mercury, and 17 samples were analyzed for semivolatile organic compounds (SVOCs).
- Forty-four groundwater samples were collected from 19 newly installed and previously installed monitoring wells and analyzed for PCP and TeCP. Additionally, three groundwater samples were analyzed for SVOCs.
- Five surface sediment samples (MS-01 through MS-05) were collected adjacent to Terminal 5 and analyzed for PCP and TeCP. One sample was analyzed for SVOCs.

3.1.2 WSDOT Graving Dock Investigations (2002)

Two investigations were performed to evaluate impacts to construction related to former wood processing operations. In August and November 2002, WSDOT completed preliminary and supplemental environmental investigations in the Study Area. At the time of the investigation, WSDOT was considering Terminal 5 as a possible graving dock, as described in Section 2.1.2. The purpose was to evaluate the potential impacts from past uses as wood processing facilities that might impact the construction of the graving dock. The investigations included the following activities:

- In September 2002, five subsurface soil borings (HC-NE-PA, HC-SE-PA, HC-C-PA, HC-NW-PA, and HC-SW-PA) were advanced. Three of these were located on the LEKT property. Soil samples were collected, and borings were converted to monitoring wells for collection of groundwater samples. Thirteen soil samples and five groundwater samples were collected and analyzed for metals, SVOCs, select VOCs, diesel-range and oil-range total petroleum hydrocarbons (TPH), and dinoseb.
- In October 2002, seven geotechnical borings (H-1 through H-7) were advanced as deep as 90 feet bgs. Nine soil samples were collected in the top 10 feet of the boring and analyzed for metals, SVOCs, and diesel-range and oil-range TPH.

The results of these investigations were summarized in two letter reports to WSDOT: *Port of Port Angeles Graving Yard Environmental Investigation Results* (Hart Crowser 2002a) and *Port of Port Angeles Graving Yard Supplemental Environmental Investigation Results* (Hart Crowser 2002b).

3.1.3 WPAH Source Control Evaluation

As part of the WPAH RI/FS (WPAH Group 2020), a shoreline survey to evaluate areas of potential nearshore bank soil erosion was completed in February 2014. During the survey, all banks accessible by foot were observed during low water conditions to determine the presence/absence of riprap, bulkheads, exposed soils, and outfalls. Appendix E of the WPAH RI/FS presents a figure of the shoreline survey extent, which includes all of the Study Area, and photographs of the shoreline. During the shoreline survey, areas of the shoreline with the potential for bank erosion were noted, including relatively steep slopes and banks where erosion was observed. These areas are generally exposed, non-vegetated soil that are not constrained or restricted by rocks, riprap, or other structures. Further investigation of the shoreline has not been conducted, and analytical results are not available. The areas identified as potentially erosional during the shoreline survey are presented in Figure 2.1.

3.2 ANALYTICAL RESULTS SUMMARY

A brief summary of existing groundwater and soil data is presented below. It is important to note that reporting limits at the time of analysis were greater than groundwater and soil quality criteria currently applied at shoreline sites. Therefore, non-detect results from the historical dataset cannot be used to draw conclusions about the presence or absence of chemicals. Groundwater and soil quality criteria for use in future data evaluation are presented in Section 4.3.

3.2.1 Groundwater

Due to the age of the groundwater data (collected 32 years ago) and limited investigation scope and analytical results, few conclusions can be drawn relative to groundwater quality. Existing groundwater data will not be used in the groundwater dataset for the RI; however, Table 3.2 presents groundwater analytical results for completeness.

Generally, PCP and TeCP were historically detected in groundwater at concentrations as great as 14,000 and 10,000 micrograms per liter (µg/L), respectively, at locations near or immediately downgradient of suspected wood treatment areas on Terminal 5 (MW-06A, MW-06C, MW-16A) and one downgradient well adjacent to the shoreline (MW-19). The lowest concentrations of PCP and TeCP were detected in MW-19, with concentrations ranging from non-detect (reporting limit of 10 µg/L) to 15 µg/L and non-detect (5 µg/L) to 350 µg/L, respectively. On Terminals 5 and 6, the majority of chemicals aside from PCP and TeCP (metals, SVOCs, VOCs, and TPH) were frequently not detected or, if detected, were not obviously associated with known historical activities. Dioxins/furans were analyzed for at MW-16A, immediately downgradient of the suspected wood treatment areas, and were not detected at a detection limit for dioxin/furan TEQ of 6.0×10^{-5} µg/L.

Limited historical groundwater data are available on Terminal 7. The existing wells on Terminal 7 (MW-03A, MW-04A, MW-11, MW-13, MW-14, and MW-20) were analyzed for phenanthrene, BTEX, PCP, and TeCP, with only low-level detections of phenanthrene at three locations in the central, upland portion of Terminal 7 (MW-04A, MW-13, and MW-14) and total xylenes at one location (MW-04A). Historical groundwater data are not available along the shoreline at Terminal 7.

3.2.2 Soil

3.2.2.1 Surface Soil

Twenty-five surface soil samples have been collected in the Study Area. Table 3.3 presents analytical results for surface soils. The majority of samples were analyzed for PCP and TeCP, with detections observed near the old planer mill (SS-01 through SS-04, and SS-08) in the vicinity of the PCP- and TeCP-contaminated groundwater area. One TeCP detection was also observed in the eastern corner of the Study Area, near the former Fibreboard mill. PCP and TeCP were not detected, with reporting limits ranging from 0.05 to 2.5 milligrams per kilograms (mg/kg), in soil samples collected downgradient of the old planer mill along the Terminal 5 shoreline or on Terminal 7, away from suspected wood treatment areas.

Stained soil and sawdust samples were collected adjacent to former transformers and analyzed for total PCBs. Transformers were generally located on concrete pads, with leakage and staining on the pads and surrounding soils and sawdust observed during the reconnaissance conducted by Hart Crowser in 1988. Sample TR-05 was collected by scraping leaking oil from the side of the transformer located near the Terminal 7 shoreline, with a reported total PCB concentration of 4.8 mg/kg. Samples were also collected near the old planer mill on Terminal 5 (TR-02), near the kiln on the LEKT property (TR-03) and near the new planer mill on Terminal 7 (TR-04). Total PCBs were not detected in these samples; however, reporting limits were elevated (2.4 mg/kg).

3.2.2.2 Subsurface Soil

A total of 166 subsurface soil samples have been collected in the Study Area. The majority of samples were analyzed for PCP and TeCP, with a subset of samples additionally analyzed for metals, TPH (diesel- and oil- range), polycyclic aromatic hydrocarbons (PAHs), and other SVOCs, selected VOCs or dioxins/furans. Tables 3.4 and 3.5 present analytical results for PCP and TeCP in subsurface soils and all other analytes in subsurface soils, respectively.

PCP and TeCP were detected in subsurface soil in the vicinity of and immediately downgradient of the historical wood treatment areas on Terminal 5 (i.e., at B-06, B-15, B-16, B-16A, B-16C, B-17, B-18, B-19, B-24, and HA-1). The greatest concentrations of PCP were detected in the 10 to 11.5 feet bgs interval at B-16 and B-16A, immediately to the north of the old planer mill. PCP was detected in soil at a maximum depth of approximately 30 feet bgs at B-17 and B-18 downgradient of the historical wood treatment area, and 36.5 feet at B-24 west of the planer mill. The maximum detected depth of PCP in soil at B-16 and B-16A closer to the planer mill was approximately 20 feet bgs. TeCP was generally collocated with and present at lesser concentrations than PCP.

Scattered detections of metals, including primarily chromium and mercury, were noted within the Study Area. Detected chromium concentrations ranged from 5 to 30 mg/kg compared to the Puget Sound natural background concentration for chromium of 48 mg/kg (Ecology 1994). Detected mercury concentrations ranged from 0.048 to 0.29 mg/kg compared to the Puget Sound natural background concentration of 0.07 mg/kg. A slightly elevated lead concentration (140 mg/kg) relative to natural background (24 mg/kg) was detected in shallow soil (3 to 4 feet bgs) at H-4 in the northeastern portion of Terminals 5 and 6. The greatest mercury concentrations were detected at depths ranging from 0 to 6.5 feet bgs at B-06, B-24B, and B-25B in the vicinity of the old planer mill. The slightly elevated lead and mercury concentrations were detected in soil presumed to be fill.

TPH was generally not detected, except for diesel-range organics detections slightly greater than the reporting limit in shallow soil (between 3 and 9 feet bgs) at H-3-02 and HC-SE-PA near the southern boundary of Terminal 5 and 6 on the LEKT property and an oil-range organics detection at a concentration of 640 mg/kg at H-4-02 (3 to 4 feet bgs) approximately 150 feet from the Terminal 5 and 6 shoreline.

PAHs were generally not detected at reporting limits ranging from 0.1 to 1.3 mg/kg, except for scattered detections of phenanthrene in composite samples including B-05 on LEKT property and B-04, B-11, B-13, and B-14 in the upland areas of Terminal 7. cPAHs were not detected in any subsurface soil samples. Other SVOCs detected included 2,4,5-trichlorophenol, 4-methylphenol, and phenol, which were each detected once in soil samples from the vicinity of the old planer mill. For the non-detect results, reporting limits for those compounds ranged from 0.1 to 3.2 mg/kg. Scattered detections of di-n-butyl phthalate were also noted in four locations in the vicinity of the old planer mill and on the LEKT property (B-06, B-23, B-24, and B-26) with concentrations ranging from 0.051 to 0.26 mg/kg. For the non-detect results, reporting limits for those compounds ranged from 0.1 to 1.3 mg/kg.

For VOCs, methylene chloride was detected at concentrations ranging from 0.005 to 0.17 mg/kg in composite soil samples from B-12 on the LEKT property and B-13 and B-14 in the upland area of Terminal 7. BTEX compounds were not detected in the six samples analyzed, with the exception of two detections of total xylenes at concentrations of 0.024 and 0.034 mg/kg in composite soil samples from B-04 in the upland area of Terminal 7 and B-05 on the LEKT property. Reporting limits for BTEX compounds ranged from 0.001 to 0.012 mg/kg.

Dioxins/furans were analyzed only in samples collected from the vicinity of the old planer mill, including surface samples from B-15 and B-16 and the 10 to 11.5 feet bgs sample from B-16A, where the greatest concentration of PCP was detected (PCP was also detected at lesser concentrations in the two surface samples analyzed). Dioxins/furans were detected in all three samples, with the greatest dioxin/furan TEQ concentration detected in the sample collected from B-16A, which is also the sample most impacted by PCP.

4.0 Chemicals of Interest and Preliminary Screening Level Development

This section provides a summary of the process used to select COIs in groundwater and soil. COIs are chemicals identified for further evaluation in groundwater and soil based on Study Area history and IHSs associated with the adjacent harbor sediments. With COIs identified, PSLs for the COIs in each medium are selected based on Applicable or Relevant and Appropriate Requirements (ARARs) and the potential exposure pathways, described as part of the preliminary conceptual site model (CSM) in Section 5.0. The outcome of this section is a list of COIs and applicable PSLs for various pathways in both groundwater and soil.[4]

4.1 IDENTIFICATION OF CHEMICALS OF INTEREST

COIs have been determined based on the following criteria:

- Known historical usage
- Potential association with Study Area fill
- Previously established IHSs for WPAH sediments

COIs for potentially impacted media, including groundwater and soil, are described in the following sections.

4.1.1 Groundwater

COIs in groundwater include contaminants that may impact surface water or sediment quality via discharge of groundwater to the harbor. Groundwater COIs include contaminants related to historical operations which may have leached to groundwater, including PCP and TeCP, petroleum constituents (including the most soluble and mobile BTEX fraction of petroleum), PCBs, and dioxins/furans. COIs associated with adjacent harbor sediments, which are of concern for sediment quality, include the WPAH IHSs: metals (cadmium, mercury, and zinc), cPAH TEQ, and total TEQ (the sum of PCB dioxin-like congeners and dioxin/furan congeners). Additionally, metals that may be of concern for surface water quality and have the potential to leach from fill material (arsenic, cadmium, chromium, copper, lead, mercury, silver, and zinc) are identified as groundwater COIs.

The combined list of COIs in groundwater includes:

- Metals (arsenic, cadmium, chromium, copper, lead, mercury, silver, and zinc)
- Petroleum constituents (gasoline-range TPH, diesel-range TPH, oil-range TPH, and BTEX)

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[4] Note that due to the presence of two buildings on Terminal 7, indoor air is considered to be a media of concern. COIs and PSLs have not been developed for air in this Work Plan. However, PSLs protective of indoor air have been derived for groundwater and soil. Those PSLs will be used as a screening tool for future evaluation of potential risk posed by the indoor air exposure pathway.

- cPAHs
- PCP and TeCP
- PCBs
- Dioxins/furans

Additionally, the observation of oil sheen or non-aqueous phase liquid (NAPL) on groundwater is a condition of interest, as sheens are of concern for surface water and sediment quality.

4.1.2 Soil

COIs in soil include contaminants that may pose direct contact risk, impact surface water/sediment quality through various mechanisms dependent on the location of the soil at the ground surface, in the subsurface at the point of discharge to surface water, or in bank areas adjacent to the harbor.

In surface soil, the primary mechanisms of concern are overland flow of stormwater to surface water/sediments and direct contact. Therefore, the COIs for surface soil include the persistent contaminants associated with historical operations that have the potential to remain at the ground surface (TPH, PCP and TeCP, PCBs, dioxins/furans), the WPAH IHSs, and other metals potentially associated with shallow fill material that may be of concern for surface water quality.

In subsurface soil, the primary mechanisms of concern are leaching to groundwater at the point of discharge to surface water/sediments and direct contact. The potential presence of archaeological resources limits any ground-disturbing activities in the Study Area unless specific project consultation occurs with the LEKT. A DAHP permit is required for ground-disturbing activities within the registered Tse-whit-zen site boundaries. Subsurface soils extending to the shallow saturated zone in the shoreline areas where groundwater discharges to the harbor are primarily composed of fill. Therefore, the COIs for fill soil include the historical contaminants, WPAH IHSs, and other metals potentially associated with fill that may be of concern for surface water quality. In bank soil, the primary mechanisms of concern are direct contact, erosion to sediments, and erosion to surface water. Therefore, the list of COIs for bank soil include the historical contaminants, WPAH IHSs, and other metals potentially associated with fill material that may be of concern for surface water quality. The combined list of COIs for soil includes:

- Metals (arsenic, cadmium, chromium, copper, lead, mercury, silver, and zinc)
- Petroleum constituents (gasoline-range TPH, diesel-range TPH, and oil-range TPH, as well as BTEX in subsurface soils)
- cPAHs
- PCP and TeCP
- PCBs
- Dioxins/furans

Additionally, the observation of soils that produce oil sheen is a condition of interest, as sheens are of concern for surface water/sediment quality and direct contact.

4.2 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Compliance with ARARs is a MTCA threshold requirement. Under WAC 173-340-350 and 173-340-710, the term “applicable requirements” refers to regulatory cleanup standards; standards of control; and other environmental requirements, criteria, or limitations established under state or federal law that specifically address a chemical of concern (COC), remedial action, location, or other circumstance at the Study Area. The relevant and appropriate requirements are regulatory requirements or guidance that do not apply to the Study Area under law but have been determined to be appropriate for use by Ecology to address problems or situations sufficiently similar to those encountered at the Study Area so that their use is well suited to the particular Study Area.

ARARs are often categorized as chemical-specific, location-specific, or action-specific. Chemical-specific ARARs include regulatory CULs for the relevant COCs. Location-specific ARARs include any regulations or guidance relevant to a specific location at the Study Area. Action-specific ARARs include regulations or guidance governing any activities proposed to remediate a site. Chemical-, location-, and action-specific ARARs that may be directly relevant to the development and evaluation of remedial alternatives will be presented in the RI/FS report.

4.3 DEVELOPMENT OF PRELIMINARY SCREENING LEVELS BY MEDIA

The primary cleanup regulations (chemical-specific ARARs) that apply to this Site are MTCA, Sediment Management Standards (SMS; WAC 173-204), federal and state drinking water quality ARARs (40 CFR 141 and WAC 246-290), Water Quality Standards for Surface Waters of the State of Washington (WAC 173-201A), and federal (CWA §304(a)) surface water quality ARARs for protection of the adjacent groundwater receiving waterbody, the harbor. Based on these ARARs, PSLs have been developed. The basis for the selection of PSLs is presented below.

PSLs are useful for several purposes, including establishing appropriate analytical detection limits for RI data analyses and evaluating COIs to determine which constituents should be retained as contaminants of potential concern (COPCs) and COCs. Laboratory methods (presented in Appendix B) were chosen such that analytical practical quantitation limits for the samples collected during the RI should be set low enough to allow evaluation of the results relative to the PSLs.

4.3.1 Preliminary Screening Level Development for Groundwater

Table 4.1 presents the PSLs for groundwater for each of the potential exposure pathways for all COIs identified in Section 4.1, and the most stringent PSL is identified for each chemical. Groundwater is considered unlikely to be potable in the Study Area since tidal influence has been observed (CH2M Hill 1989); however, the drinking water exposure pathway has been considered for the development of PSLs in absence of a site-specific potability determination. The exposure pathways considered in developing the PSLs for groundwater are presented below.

- **Protection of Surface Water.** Groundwater in the Study Area has the potential to migrate to the shoreline and discharge into the harbor. 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 Drinking Water.** A site-specific potability determination has not been made; therefore, ARARs protective of drinking water quality apply. These include maximum contaminant levels (MCLs) from the National Primary Drinking Water Regulations (40 CFR 141) and Washington State (WAC 246-290), 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 Sediment.** Sediment quality must be protected at the point where groundwater is discharged to the marine sediment. A modified MTCA three-phase model was used to calculate the groundwater concentration protective of sediments, using assumptions about theoretical partitioning between soil to groundwater and then theoretical groundwater partitioning to sediments. The sediment CULs in the WPAH RI/FS and SMS Sediment Cleanup Objectives (SCOs) were identified as target sediment concentrations protective of potential benthic and human health effects. These target sediment concentrations were used to back-calculate a groundwater concentration protective of these sediments.
- **Protection of Indoor Air.** Volatile contaminants in shallow groundwater have the potential to volatilize, rise through the soil column, and discharge to ambient air. PSLs for this pathway are based on the MTCA Method C values for industrial land use published in Ecology's *Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action* (Ecology 2018). There are two structures currently in the Study Area, in the central portion and southeast corner of Terminal 7.

4.3.2 Preliminary Screening Level Development for Soil

Table 4.2 presents the PSLs for soil for each of the potential exposure pathways for all COIs identified in Section 4.1, 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.** As discussed in Section 2.1, the Study Area consists of marine terminals in active use in an area zoned for industrial use. PSLs based on industrial use are applied in this Work Plan.
- **Protection of Terrestrial Ecological Receptors.** The terrestrial ecological evaluation (TEE) PSL is the Ecological Indicator Concentration protective of wildlife, plants, and

soil biota in the site-specific TEE (MTCA Table 749-3) in accordance with WAC 173-340-7493(2)(a)(i).

- **Protection of Groundwater Quality.** Contaminants within both the saturated and vadose soil have the potential for leaching to the groundwater. PSLs that are protective of contaminants leaching from soil to groundwater were calculated using the fixed parameter three-phase partitioning model, MTCA Equation 747-1. PSLs were developed to protect drinking water, discharge to surface water, discharge to sediments, and indoor air. The basis of the groundwater PSLs used in the calculation is described in Section 4.3.1.
- **Protection of Sediment Quality.** While much of the shoreline has been stabilized by riprap and bulkheads, a portion of the Study Area shoreline is not stabilized and has the potential to erode into adjacent sediments. PSLs for this pathway were based on the CULs established in the WPAH RI/FS (WPAH Group 2020) and SMS (WAC 173-204) SCOs for those COIs that did not have established CULs in the WPAH RI/FS.

Additionally, natural background was considered in establishing PSLs. Some COIs at the Study Area are naturally occurring in the environment, and it is inappropriate to establish a PSL lower than the 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) 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 natural background.

5.0 Preliminary Conceptual Site Model

The preliminary CSM was developed for the Study Area based on information about historical operations and findings from previous investigations. The preliminary CSM has been used to identify data gaps 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 selection of appropriate cleanup actions for the Study Area.

5.1 PHYSICAL SETTING, GEOLOGY, AND HYDROGEOLOGY

The Study Area is located along the waterfront of the harbor. Shallow soils, which are of primary concern for the presence and migration of contamination, consist of primarily sand and gravel structural and dredge fill underlain by native beach deposits. The thickness of the fill is presumed to be at least 5 feet thick in most of the Study Area, and to thicken in the identified fill areas toward the shoreline where it is present at depths of up to 15 to 20 feet.

Groundwater in the Study Area is first encountered in a shallow water table aquifer, which flows northward to discharge to the harbor and is likely to share considerable hydraulic connection with the waterway as demonstrated by tidal studies at other sites in the vicinity. The shallow water table aquifer is encountered primarily in fill and the uppermost native sandy soils and is the primary water bearing zone of concern for contamination via leaching from contaminated soils.

5.2 ARCHAEOLOGICAL RESOURCES

The Study Area is within the location of the Tse-whit-zen site. Previous construction activities, as discussed in Sections 1.3 and 2.1.2, encountered extensive human remains associated with this settlement immediately below existing structures and pavement in the Terminal 5 uplands. Consequently, it is assumed that all native beach deposits in the Study Area are extremely likely to contain sensitive archaeological resources. Fill soils, which are primarily dredge spoils, are somewhat less likely to contain intact archaeological resources because they originate from subtidal areas but may still reasonably be assumed to have the potential to contain archaeological materials. As described in Section 1.3, the presence of archaeological resources will limit the extent of sampling within the upland areas of the Study Area.

5.3 POTENTIAL MEDIA OF CONCERN

The primary potential media of concern, in which historical releases of contaminants have been documented, include groundwater and soil. Secondary potential media of concern include those media that may be impacted by the primary media of concern now or in the future. Stormwater is a potential secondary media of concern, as it may be affected by contaminants in soil or groundwater infiltrating the City stormwater conveyance and being transported to the harbor or by entrainment of soil where overland flow to the harbor occurs. Air is a potential secondary media of concern at Terminal 7 under current conditions because two enclosed buildings are present and vapors from subsurface volatile contamination have the potential to accumulate. Air may also be a potential future medium of concern elsewhere in the Study Area (i.e., if additional buildings are built in the Study Area).

5.4 RELEASE MECHANISMS AND CONTAMINANT DISTRIBUTION

5.4.1 Known Historical Contaminant Sources

The historical usage and storage of wood treatment products in the vicinity of the M&R green chain lumber conveyor and old planer mill at Terminal 5 is a known source of contamination to soil and groundwater. Historically, products containing PCP and TeCP were applied via a dip tank and spray booth. Releases likely occurred to the unpaved ground surface and may have been caused by leaks from the dip tank or spray equipment, spills during transfer of wood treatment products, drips during transfer of wet treated wood, overspray, and leakage from fire-damaged barrels during the burning of the old planer mill.

PCP and TeCP migrated downward from surface releases to subsurface soil to depths as great as 36.5 feet bgs. Elevated PCP and TeCP concentrations in groundwater are encountered in areas within and immediately downgradient of soil contamination and are attributed to infiltration through contaminated soil via the unpaved ground surface as well as leaching of contaminated soils in the saturated zone.

Dioxins/furans are also often produced as a biproduct of the manufacturing process for chlorinated phenol wood preservatives, and therefore have the potential to be present at lesser concentrations in areas with PCP and TeCP contamination.

5.4.2 Potential Historical Sources Related to Study Area Operations

Additional potential sources of contaminants related to Study Area operations include the use of transformers and hog fuel burners and historical fuel storage and usage.

<u>Transformers</u>: Transformers were historically present at several locations on Terminal 5 and Terminal 7, including near the old planer mill on Terminal 5, near the kiln on the LEKT property, at the southern boundary of Terminals 5 and 6, near the new planer mill on Terminal 7, and along the shoreline at Terminal 7. Samples collected from the transformers indicated that the dielectric fluid did not contain PCBs; however, PCBs were detected in one sample of oil seeping from the surface of a transformer near the Terminal 7 shoreline, indicating that PCBs may have been used in some transformers during historical operations. Significant releases from transformers have not been documented in the Study Area, and PCBs, if present, are expected to be limited to incidental releases to shallow soil.

<u>Hog fuel burners</u>: Hog fuel burners were used to fire boilers at the former M&R facility at Terminal 5 and 6 (currently on LEKT property) and at the Fibreboard mill at Terminal 7. In at least one instance at Terminal 7, the hog fuel burners were documented to have burned salt-laden wood. Burning hydrocarbons at high temperatures in the presence of chlorine (i.e., sodium chloride) may produce dioxins/furans, which may be present in the Study Area as surface-deposited ash originating from air emissions from the historical hog fuel burners. Demolition of

hog fuel burners may also have resulted in releases of ash containing dioxins/furans to air and/or the ground surface. Additionally, use of ash from hog fuel burners as fill was a common historical practice, though this has not been documented in the Study Area. Observations of ash layers have not been noted in logs of previous borings collected in the Study Area.

Fuel storage and usage: Historical fuel storage areas include the diesel and fuel oil storage area at the former cedar siding and shake facility at the southern boundary of Terminal 5 and 6 and the fuel oil AST at Terminal 7. Historical releases to the unpaved ground surface from these areas may have occurred during transfer to or from tanks or minor leaks. Significant spills from the petroleum storage areas in the Study Area have not been documented. Incidental releases of petroleum products to the ground surface, such as leaks from vehicles, may also have occurred during the regular course of industrial operations.

5.4.3 Potential Historical Sources Not Related to Study Area Operations

The primary potential historical source of contaminants not related to a specific operation, such as metals and PAHs, is the fill that was placed throughout the Study Area, including the locations where dredge fill was likely used to create additional upland areas in the 1950s and 1960s, and other shallow structural fill encountered throughout the Study Area.

5.5 POTENTIAL MIGRATION PATHWAYS AND TRANSPORT

- **Soil to Groundwater.** Releases of contamination to the surface and subsurface that occurred during historical Study Area operations could result in a continued release, or leaching, of contaminants entrained in soil to groundwater. This pathway is currently considered complete in vadose zone and saturated zone soils throughout the majority of the Study Area, which is not currently paved. Leaching is a pathway of greater concern for the most soluble COIs in soil (i.e., metals and lighter petroleum constituents) and lesser concern for the least soluble COIs (i.e., PCBs and dioxins/furans).
- **Soil to Surface Water/Sediments.** Soil has the potential to reach surface water/sediments via three transport pathways, all currently considered complete:
    - Bank erosion. While much of the shoreline has been stabilized by riprap and bulkheads, a portion of the Study Area shoreline is not stabilized or is in disrepair and has the potential to erode into adjacent sediments.
    - Overland flow. Because the Study Area is not currently paved, stormwater has the potential to flow overland and entrain soil, which then discharges to surface water.
    - Infiltration into stormwater conveyance. The condition of the City stormwater conveyance to the harbor that runs through Terminal 7 is unknown, but due to its age, may be in poor condition (i.e., cracks and breaks). Soil has the potential to infiltrate into the stormwater conveyance and be transported to the harbor via stormwater flow. Soil may also migrate into other decommissioned stormwater

structures in the Study Area and has the potential to be transported to the harbor if historical conveyances were not plugged at the time of decommissioning.

- **Groundwater to Surface Water/Sediments.** The Study Area is located adjacent to the harbor. Contaminated groundwater beneath the Study Area has the potential to migrate through groundwater flow or through a preferential pathway in the City stormwater conveyance to the harbor. This pathway is considered complete.
- **Soil/Groundwater to Indoor Air.** Vapors from subsurface contamination currently have the potential to accumulate within the two existing structures at Terminal 7 (the warehouse building, and mechanic shop located in the central and southeastern portions of Terminal 7, respectively). In the remainder of the Study Area, this pathway is not currently complete because no other structures are present but could be complete in the future if an enclosed building is planned to be constructed.

5.6 POTENTIAL EXPOSURE PATHWAYS AND RECEPTORS

The following are potential exposure pathways.

- **Human Exposure via Direct Contact.** Workers may be exposed to contaminants primarily in surface soil and when performing ground-disturbing work in fill or bank soil in the Study Area. This pathway is complete at the ground surface of unpaved portions of the Study Area and in areas along the shoreline that have been landfilled with dredge fill soil. The presence of archaeological resources associated with the Tse-whit-zen site precludes any ground-penetrating work activities in the upland portion of the Study Area unless specific project consultation occurs; however, until an environmental covenant is in place to control worker exposure to subsurface contamination, this pathway is complete with a low potential for exposure.
- **Human Exposure via Seafood Consumption**. This pathway evaluates the ingestion by humans of aquatic species (seafood) that may have accumulated toxic chemicals during their life cycle. The primary concern is the presence of persistent contamination in harbor sediments that can accumulate in organisms over a long period of time. Chemical discharge to the harbor has the potential to pose health effects to humans via seafood consumption.
- **Human Exposure via Indoor Air.** Workers may be exposed to contaminants volatilizing from the subsurface and accumulating in the existing structures on Terminal 7; therefore, this pathway is complete within those structures. If buildings are constructed in the future within the Study Area, a vapor intrusion assessment may be required at that time.
- **Aquatic Receptor Exposure via Groundwater Discharge or Bank Erosion to Surface Water.** Contamination has the ability to be transported via groundwater or erodible soils to discharge to the harbor. Chemical discharge to the harbor has the potential to expose aquatic species in surface water to acute or chronic health effects.

- **Benthic Receptor Exposure via Groundwater Discharge or Bank Erosion to Sediment.** Contamination has the ability to be transported via groundwater or erodible soils to discharge to the harbor. Chemical discharge to the harbor has the potential to expose benthic species in sediments to acute or chronic health effects.
- **Terrestrial Receptor Exposure via Direct Contact.** Terrestrial receptors may contact surface soils in unpaved areas of the Study Area.

6.0 Summary of Data Gaps and Proposed Remedial Investigation

The purpose of this Work Plan is to identify DQOs and data gaps related to risks to human health and the environment posed by the potential contaminant exposure pathways identified in Section 5.6, and to define the data collection necessary to fulfill the data gaps. DQOs for evaluating the potential risks related to these exposures, and contaminant migration pathways that may result in these exposures, were developed as presented in Table 6.1. These objectives include assessment of the quality of Study Area Media, described as follows.

- Groundwater:
  - At the point of discharge at the shoreline, including any preferential pathways for groundwater migration and discharge
  - Where upgradient sources of contaminants in groundwater have the potential to affect the quality of groundwater discharges to surface water
- Fill soil:
  - Leaching to groundwater at the point of discharge to surface water
  - For direct contact with human and ecological receptors
- Surface soil:
  - Eroding from unpaved areas by overland flow to surface water
  - For direct contact with human and ecological receptors in unpaved areas
- Bank soil:
  - Where bank soil has the potential to erode into the harbor
  - For direct contact with human and ecological receptors

6.1 DATA GAPS EVALUATION

Existing data from the Study Area were evaluated to determine whether they adequately fulfill the DQOs, and data gaps were identified where existing data are not sufficient to fulfill the DQOs.

First the usability of existing data was evaluated. Existing data are considered usable if they are reasonably representative of current conditions and can be compared to the PSLs. As a general rule, existing soil samples were considered to be reasonably representative of current conditions where there has not been remediation or other work that would remove or alter these soils subsequent to the investigation. Due to the transient nature of groundwater, however, samples greater than 5 years old were not considered to be representative. All of the existing groundwater data were collected 30 or more years ago, therefore while these data were used to inform the preliminary CSM and selection of COIs they are not included in the dataset for the RI.

Generally, the DQOs are pertinent to their respective media where they are present throughout the Study Area whereas previous investigations have focused on specific operational areas for sample collection. Therefore, spatial data gaps exist in the existing data sets for fill and surface soil (where impacts may be present due to surface releases and/or due to initial fill quality) and the existing network of groundwater monitoring wells. Specific sample locations to fulfill spatial data gaps for each media are discussed in the proposed RI – Phase I scope presented below in Section 6.2. The presence and current condition of existing monitoring wells is also a data gap given the time that has elapsed between the most recent sampling and preparation of this Work Plan.

Additionally, the presence of preferential pathways for migration due to subsurface structures has not been evaluated. The locations of active subsurface structures are well-documented, and the City stormwater pipe that traverses the Study Area has been identified as a structure with the potential to create a preferential pathway for contaminated groundwater or soil to migrate to the harbor due to its position and depth. The current condition of the pipe is not well-known, however, and evaluation to determine whether contaminated media may infiltrate to the pipe is a data gap. Historical stormwater conveyance structures that were decommissioned may also exist in the Study Area. It is not known whether such structures have the potential to create preferential migration pathways for soil or groundwater.

For bank soils, only a brief visual survey has been completed to identify preliminary erosional areas. A more rigorous quantitative analysis of stability is needed to determine where bank erosion is a potential pathway of concern due to erodible soils at the bank surface or seeps to surface water through bank soils. Bank soils quality has not been assessed previously, and the quality of bank soils in areas identified as erosional is also a data gap.

For stormwater, existing stormwater monitoring conducted at Terminal 7 indicates that stormwater may pose a risk to surface water due to turbidity caused by the unpaved ground surface. This pathway is being addressed by the Port under Ecology’s Water Quality Program, as described in Section 1.2.2, and is not considered a data gap. There are also multiple unpaved areas on Terminal 5 and 6. The potential for surface soil quality in other unpaved areas to impact stormwater, however, has not been evaluated and remains a data gap.

6.2 PROPOSED REMEDIAL INVESTIGATION

The proposed Phase I of the RI will be performed in order to fulfill the Port’s goal to characterize the nature and extent of contamination within designated areas within the Study Area and identify potential future interim cleanup actions to control sources of contaminant discharge to the harbor. After implementation of this Work Plan, if additional data collection is warranted to support these goals, an RI Work Plan – Phase II will be developed.

A detailed description of sample collection procedures, laboratory analyses, and QA/QC criteria is presented in the SAP/QAPP (Appendix B). Work activities will additionally be conducted in accordance with the Health and Safety Plan presented in Appendix C. During all ground-disturbing activities associated with the RI, monitoring for archaeological resources will be performed in accordance with the Port of Port Angeles, Terminals 5, 6, & 7 Uplands, Monitoring Protocols (Appendix D).

6.2.1 Remedial Investigation – Phase I Objectives

The RI is intended to fulfill key data gaps related to source control to the harbor and evaluation of contaminant migration within the Study Area. The RI will additionally gather data about the physical condition of portions of the Study Area that will inform supplemental investigation as necessary to develop a Feasibility Study for the Site. The proposed data collection during Phase I of the RI will fulfill the following objectives:

- Assessment of groundwater quality at the point of discharge to surface water to provide a baseline for comparison for future monitoring.
- Evaluation of the magnitude, and potential sources of upgradient contamination that may be impacting groundwater quality at the shoreline if existing groundwater wells are able to be located and are suitable for use.
- Assessment of surface soil quality during monitoring well installation to evaluate potential impacts to surface water/sediments from overland flow of stormwater and to humans and ecological receptors posed by direct contact.
- Assessment of fill soil quality to determine potential influence on groundwater quality due to infiltration and risks to human health and ecological receptors.
- Assessment of the potential erodibility of the banks within the Study Area using topographic and visual surveys and visual assessment of pavement conditions in the uplands of the Study Area to inform potential areas of focus for additional characterization to determine potential impacts to surface water/sediments. If erodible bank areas or seeps are observed, evaluation of bank soil and seep quality to determine potential influence on sediment quality due to erosion and risks to human health and ecological receptors. Assessment of uplands pavement will additionally inform the potential for surface water infiltration in the Study Area.
- Assessment of upstream stormwater pipe condition to determine whether this pipe may be a potential pathway for migration of contaminated media, and mitigation measures that may be implemented in coordination with the City to improve overall quality of discharges to surface water. Evaluation of the potential for contaminated media to enter the pipe and discharge to the harbor if damage to the City stormwater pipe is observed.

6.2.2 Proposed Remedial Investigation – Phase I Activities

6.2.2.1 Groundwater Monitoring Well Installation and Sampling

The proposed groundwater monitoring locations will be evenly spaced approximately every 200 feet along the shoreline. The shoreline monitoring network includes 10 proposed monitoring wells to be installed in the shoreline fill areas (MW-27 to MW-36) within the Study Area and three existing shoreline wells (MW-15, MW-18, and MW-19) on Terminal 5, as shown on Figure 6.1. The proposed well network includes one well in the vicinity of the former shoreline transformer at Terminal 7. If the existing shoreline wells are not found, or found to be damaged and unusable, they will be reinstalled adjacent to their historical locations.

Additionally, attempts will be made to locate and assess the condition of the other existing, upgradient wells within the Study Area shown on Figure 6.1. Well location protocols are presented in detail in the SAP/QAPP (Appendix B Section 2.1.1).

Wells will be screened to span the groundwater table which has been encountered between 3.5 and 7 feet bgs, in order to sample the shallow saturated zone, which is of primary concern for dissolved contaminants resulting from leaching of contaminated soils and for discharge to surface water. The existing wells are screened within the same zone as the proposed wells. The wells will be constructed with a 10-foot screened interval, to a maximum depth of 15 feet bgs, above the anticipated depth of contact with native beach deposits. Adjustments may be made to the well construction based on field conditions, at the direction of the field geologist.

All wells will be installed and developed in accordance with the procedures specified in the SAP/QAPP (refer to Appendix B), and existing shoreline wells that are determined to be usable will also be redeveloped. The horizontal coordinates and top of casing elevation will be surveyed for all wells in the Study Area. The shoreline wells will be allowed to equilibrate for a minimum of 2 weeks after development before sampling.

Samples will be collected during low tide from the shoreline during four quarterly monitoring events, following the procedures for low-flow groundwater sampling presented in Appendix B. Groundwater elevation will additionally be measured in all Study Area wells during monitoring events. Samples will be analyzed for the groundwater COIs, in accordance with the analytical methods presented in Appendix C.

The quality of groundwater discharging to the harbor will be evaluated using the data starting after the second of four quarterly monitoring events. This evaluation will include assessment of groundwater conditions that will inform the need for additional investigation, including observations of NAPL on groundwater and indications of the possible presence of any upgradient source that is causing a COI to exceed its PSL in the shoreline of the Study Area.

6.2.2.2 Fill Soil Sampling

Fill soil samples will be collected from the proposed monitoring well borings shown on Figure 6.1. Soils will be logged continuously in accordance with the procedures presented in Appendix B and any changes in fill composition will be noted, as will the presence of debris such as ash, sandblast grit, or other anthropogenic materials. Soils will additionally be screened for field indications of contamination such as odor, sheen, staining, or elevated headspace volatiles concentrations measured with a photoionization detector.

A surface soil sample (4 inches bgs) will be collected from all shoreline monitoring well borings. If distinct fill strata are observed, a composite sample for analysis will be collected across the depth interval of each distinct layer. If observed, discrete intervals with ash debris, sandblast grit, or field indications of contamination will also be sampled. If the composition of the fill is uniform throughout the boring, the material will be separated into approximately equal increments no more than 5 feet in length for compositing and sampling.

Fill soil samples will be analyzed for the soil COIs in accordance with the analytical methods presented in Appendix B.

6.2.2.3 Topographic and Visual Surveys

Bank angles along the length of the WPAH shoreline to the top of bank will be mapped with a vessel-based light detection and ranging (LiDAR) survey to determine any steep slope areas (i.e., slope angles greater than 60 degrees) that may affect slope stability. The LiDAR survey is further described in Appendix B. The LiDAR survey will be conducted when the harbor has a maximum tidal elevation of 0 feet mean lower low water.

Additionally, a detailed visual survey will be performed to identify areas of the bank where conditions may cause bank erosion. Conditions that may lead to erosion include a lack of armoring or anchoring vegetation, evidence of sliding or slumping of bank materials, materials or structures protruding from the bank, and poor condition of, or damage to, overwater structures. The banks will also be inspected for the presence of obvious groundwater seeps or apparent historical stormwater outfalls and their condition noted.

The visual bank survey will be conducted in 100-foot transects across the shoreline of the Study Area during low tide, and within each transect any observed conditions that may affect erodibility, seeps, or apparent outfalls will be photographed and its position will be recorded via survey or relative to permanent site features. The elevations of any identified outfalls will be surveyed by a licensed surveyor in order to determine whether the buried pipe may be below the elevation of the water table in the Study Area. Survey procedures are presented in Appendix B.

In the upland portion of the Study Area, pavement conditions will be assessed to gather information about the types of pavement, approximate thickness, and evidence of degradation such as excessive cracks and breaches or missing areas. Pavement assessment will incorporate existing information available from the Port and visual survey according to the procedures presented in Appendix B.

6.2.2.4 Bank Soil Sampling

Targeted erodible areas and seep areas for bank soil sampling, if present, will be identified using the results of the visual survey and LiDAR survey data. If erodible areas are present, bank soil sampling will consist of hand grab or hand auger samples collected from the uppermost erodible intervals of soil in these areas from the bank surface to 4 inches below the bank surface and from 4 to 12 inches below the bank surface. The proposed locations of bank soil samples will be presented in an addendum to this Work Plan. Bank soil samples will be analyzed for the soil COIs.

6.2.2.5 City Stormwater Investigation

City Stormwater Conveyance Investigation

The City stormwater pipe, shown on Figure 2.1, will be investigated via a camera survey to determine its current condition. It is anticipated that the pipe diameter of 12 inches or larger will accommodate a crawler-type remote-controlled vehicle equipped with a video camera. A video recording of the camera survey will be collected, with the distance along the pipe measured using a GPS, or by distance traveled by a push rod (if using) throughout the recording in order to interpolate the position of any observed damage or deterioration. The positions of any potential lateral connections to the pipe will also be noted. The video survey will be completed from the manhole location at the southern boundary of the Study Area, adjacent to Marine Drive, to the riverbank—an estimated distance of 820 feet.

If any additional outfalls are identified that are suspected to be potential preferential pathways to soil or groundwater migration, the condition of these outfalls may additionally be camera surveyed via a push rod or crawler-type remote camera.

City Stormwater Sampling

The results of the stormwater pipe camera survey will determine whether there are areas of damaged or deteriorating pipe that may allow contaminated media to enter the pipe and discharge to the harbor. If such areas are identified, stormwater sampling from the stormwater conveyance structures will be proposed in order to determine whether downstream stormwater quality is potentially impacted by contaminated media present on Terminal 7.

It is presumed that stormwater sampling will consist of grab sample collection and potentially inline solids sampling, if determined necessary, at the closest manhole upstream of the Study Area and at the location of the outfall at the shoreline of the Study Area. Specific sample locations and media, if determined to be necessary, will be proposed in an addendum to this Work Plan. Samples will be analyzed for groundwater COIs.

7.0 Reporting and Schedule

Data will be gathered as part of the RI – Phase I to characterize shoreline groundwater, shoreline soil, and bank soil conditions to fill the data gaps defined in Section 6.0. The Study Area characterization outlined in Section 6.0 will inform development of an updated CSM, identification of potential areas of concern relative to harbor source control efforts, and assessment of future data needs and potential interim and cleanup actions. The reporting and schedule for this effort is described in the following sections.

7.1 REPORTING

An RI – Phase I work plan addendum, presenting proposed locations of bank soil sampling, will be submitted if the bank survey identifies areas of erodible bank or seeps. An RI – Phase I work plan addendum, presenting proposed location and type of media sampling, will be submitted if areas of broken or damaged stormwater pipe are identified. These addendums may be combined.

A technical memorandum presenting a preliminary data evaluation and interim action assessment will be submitted after well installation and the first two groundwater monitoring events. This technical memorandum will include the following elements:

- A summary of new shoreline soil and groundwater data collection and comparison to the PSLs established in Section 4.3. If available at the time of reporting, bank soil, stormwater, and inline solids data will also be presented.
- An evaluation of groundwater quality at the shoreline to determine whether discharges are of concern relative to harbor source control efforts for any portion of the shoreline area
- A preliminary assessment of interim action alternatives for their potential applicability and benefit for harbor source control and feasibility of implementation. An interim action would focus on the priority source control pathway of releases to surface water/sediments without precluding future site-wide evaluation or cleanup.

Additional Ecology coordination is anticipated for selection of an interim action, if required.

After completing all four rounds of sampling, an RI – Phase I Summary Report will be submitted summarizing the data collected during Phase I of the RI and proposing next steps. If additional data collection is found to be warranted, additional RI sampling will be proposed in an RI Work Plan – Phase II.

7.2 SCHEDULE

The schedule presented below provides anticipated submittal dates for field investigation activities and major deliverables associated with the RI – Phase I. 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.

Deliverable/Milestone	Due Date
RI – Phase I Field Work	Commence within 90 calendar days after the effective date of the AO.
Draft Bank Soil and/or City Stormwater Sampling Work Plan Addendum, if necessary	Due 30 days following completion of the bank and City stormwater surveys.
Final Bank Soil and/or City Stormwater Sampling Work Plan Addendum, if necessary	15 days after receipts of Ecology's comments on Draft Bank Soil and/or City Stormwater Sampling Work Plan Addendum.
Agency Review Draft Preliminary Data Evaluation and Interim Action Assessment	45 calendar days after completion of two quarters of groundwater monitoring data and receipt of final data validation package.
Final Preliminary Data Evaluation and Interim Action Assessment	30 calendar days after receipt of Ecology comments on the Agency Review Draft Preliminary Data Evaluation and Interim Action Assessment.
Agency Review Draft RI – Phase I Summary Report	45 calendar days after completion of four quarters of groundwater monitoring data and receipt of final data validation package.
Final RI – Phase I Summary Report	30 calendar days after receipt of Ecology comments on the Agency Review Draft RI – Phase I Summary Report.
Agency Review Draft Interim Action Work Plan (if required)	If required by Ecology or if proposed by the Port and approved by Ecology, the Port will submit by a date agreed on by the parties.
Public Review Draft Interim Action Work Plan (if required)	Within 60 days of receipt of Ecology's comments on the Agency Review Draft Interim Action Work Plan.
Final Interim Action Work Plan (if required)	Within 30 days of receipt of Ecology's comments after the public comment period.
Implement Interim Action Work Plan (if required)	According to the schedule in the approved Interim Action Work Plan.
Agency Review Draft Interim Action Report (if required)	Within 90 days of completion of Interim Action Work Plan implementation.
Final Interim Action Report (if required)	Within 60 days after receiving Ecology's comments on the Agency Review Draft Interim Action Report.
Quarterly Progress Reports	Due quarterly on the 10th of the month after the reporting period. Reporting periods shall be January through March, April through June, July through September, and October through December. Submit first report on the 10th of the month after end of the reporting period in which the AO becomes effective and continue reporting through the AO.

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Remedial Investigation Work Plan – Phase I

Port of Port Angeles Terminals 5, 6, and 7

Tables

Table 2.1
Key Historical Study Area Operations

Operator	Terminal Location	Years	Operations
Charles Nelson/ Puget Sound Mills & Timber	Terminal 5	1914 to 1929	• Saw, shingle, and planing mill
Fibreboard	Terminal 7	1918 to 1970	• Boxboard/fiberboard, pulp, and woodchip production
Port Angeles Forest Products/ Joe Cecil Lumber Co.	Terminal 5	1948 to 1956	• Sawmill
Merrill & Ring (M&R)	Terminals 5/6 Terminal 7	1955 to 1988 1972 to 1988	• Remanufactured lumber and treated wood • Chipping facility/chip loading • Truck maintenance shop
Various shake/shingle mill operators	Terminal 5	1959 to 1996	• Shake and shingle mill
Daishowa/ Nippon Paper Industries USA (NPIUSA)	Terminal 5 Terminal 7	1988 to 2002 1988 to 2014	• Log storage • Chipping facility/chip loading • Warehousing/storage • Truck washing facility
Port of Port Angeles	Terminals 5/6 Terminal 7	2002 to current 2004 to current	• Log yard and storage • Mechanic shop • Lay berth • Leased portions of T5/T6 for log operations, chip loading, gravel/rock import by others

Table 3.1
Monitoring Well Completion Details

Well ID	Completion Date	Well Depth (feet bgs)	Diameter (inches)	Screened interval (feet bgs)	Screen Type	Well Status
MW-03A	5/9/1988	17	2	5–15	0.020-inch slotted PVC	Active (1)
MW-04A	5/11/1988	14	2	3–13	0.020-inch slotted PVC	Active (1)
MW-05A	5/11/1988	14	2	4–14	0.020-inch slotted PVC	Active (1)
MW-06A	5/13/1988	14	2	4–14	0.020-inch slotted PVC	Active (1)
MW-06B	8/30/1988	55.5	9 5/8 (2)	40–50	0.010-inch slotted PVC	Active
MW-06C	10/6/1988	17.5	9 5/8 (2)	4.5–14.5	0.010-inch slotted PVC	Active
MW-07	5/16/1988	13.5	2	3–13	0.020-inch slotted PVC	Active (1)
MW-08	5/16/1988	14	2	4–14	0.020-inch slotted PVC	Active (1)
MW-08B	9/12/1988	53	9 5/8 (2)	39.5–49.5	0.010-inch slotted PVC	Active
MW-11	6/2/1988	16.5	2	5–15	0.020-inch slotted PVC	Active (1)
MW-12	6/2/1988	15	2	5–15	0.020-inch slotted PVC	Active (1)
MW-13	6/2/1988	15	2	5–15	0.020-inch slotted PVC	Active (1)
MW-14	6/3/1988	14	2	3–13	0.020-inch slotted PVC	Active (1)
MW-15	6/9/1988	16.5	2	5–15	0.020-inch slotted PVC	Active (1)
MW-16A	6/12/1988	16.5	2	6–16	0.020-inch slotted PVC	Active (1)
MW-16B	9/8/1988	53	9 5/8 (2)	40–50	0.010-inch slotted PVC	Active
MW-18	6/10/1988	20	2	9–19	0.020-inch slotted PVC	Active (1)
MW-19	6/11/1988	17.5	2	7–17	0.020-inch slotted PVC	Active (1)
MW-20	6/11/1988	14	2	3–13	0.020-inch slotted PVC	Active (1)
MW-21	6/11/1988	16.5	2	6–16	0.020-inch slotted PVC	Active (1)
MW-22	6/12/1988	15	2	3–13	0.020-inch slotted PVC	Active (1)
MW-23	8/29/1988	17.5	9 5/8 (2)	4–14	0.010-inch slotted PVC	Active
MW-24A	9/1/1988	20	9 5/8 (2)	5–15	0.010-inch slotted PVC	Active
MW-24B	9/6/1988	53	9 5/8 (2)	40–50	0.010-inch slotted PVC	Active
MW-25A	9/15/1988	17	9 5/8 (2)	4–14	0.010-inch slotted PVC	Active
MW-25B	9/14/1988	53	9 5/8 (2)	40–50	0.010-inch slotted PVC	Active
MW-26	9/19/1988	17.5	9 5/8 (2)	4.5–14.5	0.010-inch slotted PVC	Active
HC-C-PA	9/10/2002	25	6 5/8 (3)	5–25	unknown	Active
HC-NE-PA	9/10/2002	25	6 5/8 (3)	5–25	unknown	Active
HC-NW-PA	9/10/2002	15	6 5/8 (3)	5–15	unknown	Active
HC-SE-PA	9/10/2002	15	6 5/8 (3)	5–15	unknown	Active
HC-SW-PA	9/10/2002	15	6 5/8 (3)	13–23	unknown	Active

Notes:

1 CH2M 1989 Investigation noted that these wells installed by Hart Crowser in 1988 contained excessive amounts of formation sand and silt attributed to the larger screen slot size. Airlifting was attempted to redevelop the wells but was largely unsuccessful.

2 The well casing diameter is not known and the diameter of the borehole is provided. The casing is presumed to be at least 1 1/2 inches in diameter based on well development records and may be up to 5 inches in diameter as allowable by the Minimum Standards (WAC 173-160-450(2)).

3 The well casing diameter is not known and the diameter of the borehole is provided. The casing may be up to 2 inches in diameter as allowable by the Minimum Standards (WAC 173-160-450(2)).

Abbreviations:

bgs Below ground surface
PVC Polyvinyl chloride

Table 3.2
Groundwater Analytical Data

		Location Name	HC-C-PA	HC-NE-PA	HC-NW-PA	HC-SE-PA	HC-SW-PA	MW-03A		MW-04A		MW-05A	
		Sample Name	**MW-C-PA-091102**	**MW-NE-PA-091102**	**MW-NW-PA-091102**	**MW-SE-PA-091102**	**MW-SW-PA-091102**	**MW3A-051788**	**MW3A-061188**	**MW4A-051788**	**MW4A-061188**	**MW5A-051788**	**MW5A-060988**
		Sample Date	**9/11/2002**	**9/11/2002**	**9/11/2002**	**9/11/2002**	**9/11/2002**	**5/17/1988**	**6/11/1988**	**5/17/1988**	**6/11/1988**	**5/17/1988**	**6/9/1988**
Analyte	**CAS No.**	**Unit**											
Conventionals													
Alkalinity (as CaCO3)	--	mg-CaCO$_3$/L											
Chloride	16887-00-6	µg/L											
Conductivity	--	µohm/cm						320		910		710	
Nitrate	14797-55-8	µg/L											
pH	pH	pH						6.91		6.97		6.37	
Sulfate	14808-79-8	µg/L											
Temperature	--	°C						11		13		13	
Total Dissolved Solids	--	µg/L											
Total Suspended Solids	--	µg/L	190,000	250,000	100,000	59,000	1,100,000						
Metals													
Arsenic	7440-38-2	µg/L	9.9	2.5 U	2.5 U	10	31						
Barium	7440-39-3	µg/L	14	21	12	23	22						
Cadmium	7440-43-9	µg/L	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U						
Chromium	7440-47-3	µg/L	10 U	11	10 U	10 U	23						
Copper	7440-50-8	µg/L											
Lead	7439-92-1	µg/L	10 U	10 U	10 U	10 U	10 U						
Mercury	7439-97-6	µg/L	0.20 U	0.20 U	0.20 U	0.20 U	0.26						
Selenium	7782-49-2	µg/L	50 U	50 U	50 U	50 U	50 U						
Silver	7440-22-4	µg/L	10 U	10 U	10 U	10 U	10 U						
Vanadium	7440-62-2	µg/L											
Zinc	7440-66-6	µg/L											
Total Petroleum Hydrocarbons													
Diesel-range organics	DRO	µg/L	200 U	200 U	200 U	200 U	200 U						
Oil-range organics	ORO	µg/L	500 U	500 U	500 U	500 U	500 U						
Total DRO & ORO	T_DRO&ORO (U=0)	µg/L	500 U	500 U	500 U	500 U	500 U						
Total Petroleum Hydrocarbons	--	µg/L											
Polycyclic Aromatic Hydrocarbons													
Acenaphthene	83-32-9	µg/L	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U						
Acenaphthylene	208-96-8	µg/L	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U						
Anthracene	120-12-7	µg/L	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U						
Benzo(a)anthracene	56-55-3	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U						
Benzo(a)pyrene	50-32-8	µg/L	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U						
Benzo(b)fluoranthene	205-99-2	µg/L	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U						
Benzo(g,h,i)perylene	191-24-2	µg/L	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U						
Benzo(k)fluoranthene	207-08-9	µg/L	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U						
Chrysene	218-01-9	µg/L	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U						
cPAHs (MTCA TEQ-HalfND)	BaPEq (U=1/2)	µg/L	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U						
cPAHs (MTCA TEQ-ZeroND)	BaPEq (U=0)	µg/L	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U						
Dibenzo(a,h)anthracene	53-70-3	µg/L	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U						
Fluoranthene	206-44-0	µg/L	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U						
Fluorene	86-73-7	µg/L	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U						
Indeno(1,2,3-c,d)pyrene	193-39-5	µg/L	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U						
Naphthalene	91-20-3	µg/L	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U						
Phenanthrene	85-01-8	µg/L	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U			280		200 U	
Pyrene	129-00-0	µg/L	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U						

Table 3.2
Groundwater Analytical Data

		Location Name	**HC-C-PA**	**HC-NE-PA**	**HC-NW-PA**	**HC-SE-PA**	**HC-SW-PA**	**MW-03A**		**MW-04A**		**MW-05A**	
		Sample Name	**MW-C-PA-091102**	**MW-NE-PA-091102**	**MW-NW-PA-091102**	**MW-SE-PA-091102**	**MW-SW-PA-091102**	**MW3A-051788**	**MW3A-061188**	**MW4A-051788**	**MW4A-061188**	**MW5A-051788**	**MW5A-060988**
		Sample Date	**9/11/2002**	**9/11/2002**	**9/11/2002**	**9/11/2002**	**9/11/2002**	**5/17/1988**	**6/11/1988**	**5/17/1988**	**6/11/1988**	**5/17/1988**	**6/9/1988**
Analyte	**CAS No.**	**Unit**											
Semivolatile Organic Compounds													
2,3,4,6-Tetrachlorophenol	58-90-2	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U						
2,4,5-Trichlorophenol	95-95-4	µg/L	10 U	10 U	10 U	10 U	10 U						
2,4,6-Trichlorophenol	88-06-2	µg/L	10 U	10 U	10 U	10 U	10 U						
2,4-Dichlorophenol	120-83-2	µg/L	10 U	10 U	10 U	10 U	10 U						
2,4-Dimethylphenol	105-67-9	µg/L	10 U	10 U	10 U	10 U	10 U						
2,4-Dinitrophenol	51-28-5	µg/L	10 U	10 U	10 U	10 U	10 U						
2,6-Dichlorophenol	87-65-0	µg/L	10 U	10 U	10 U	10 U	10 U						
2-Chloronaphthalene	91-58-7	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U						
2-Chlorophenol	95-57-8	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U						
2-Methylphenol	95-48-7	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U						
2-Nitrophenol	88-75-5	µg/L	10 U	10 U	10 U	10 U	10 U						
3- & 4-Methylphenol	15831-10-4	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U						
4-Chloro-3-methylphenol	59-50-7	µg/L	10 U	10 U	10 U	10 U	10 U						
4-Nitrophenol	100-02-7	µg/L	10 U	10 U	10 U	10 U	10 U						
Bis(2-chloroethoxy)methane	111-91-1	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U						
Bis(2-ethylhexyl)phthalate	117-81-7	µg/L											
Butyl benzyl phthalate	85-68-7	µg/L	10 U	10 U	10 U	10 U	10 U						
Diethylphthalate	84-66-2	µg/L	10 U	10 U	10 U	10 U	10 U						
Dimethyl phthalate	131-11-3	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U						
Di-n-butyl phthalate	84-74-2	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U						
Di-n-octyl phthalate	117-84-0	µg/L	10 U	10 U	10 U	10 U	10 U						
Hexachlorobutadiene	87-68-3	µg/L	10 U	10 U	10 U	10 U	10 U						
Hexachlorocyclopentadiene	77-47-4	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U						
Hexachloropropene	1888-71-7	µg/L	10 U	10 U	10 U	10 U	10 U						
N-Nitrosodiphenylamine	86-30-6	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U						
Pentachlorophenol	87-86-5	µg/L	10 U	10 U	10 U	10 U	10 U	1.0 U	10 U		10 U		10 U
Phenol	108-95-2	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U						
Phenols (total)	--	µg/L											
Tetrachlorophenols (total)	25167-83-3	µg/L						1.0 U	10 U		10 U		10 U
Volatile Organic Compounds													
1,2,4-Trichlorobenzene	120-82-1	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U						
1,2-Dichlorobenzene	95-50-1	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U						
1,3-Dichlorobenzene	541-73-1	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U						
1,4-Dichlorobenzene	106-46-7	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U						
4-Chlorophenyl phenyl ether	7005-72-3	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U						
Benzene	71-43-2	µg/L								1.0 U		1.0 U	
Bis(2-chloroethyl)ether	111-44-4	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U						
Bis(2-chloroisopropyl)ether	39638-32-9	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U						
Ethylbenzene	100-41-4	µg/L								1.0 U		1.0 U	
Hexachlorobenzene	118-74-1	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U						
Pentachloroethane	76-01-7	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U						
Toluene	108-88-3	µg/L								1.0 U		1.0 U	
Xylene (total)	1330-20-7	µg/L								5.0		2.0	

Table 3.2
Groundwater Analytical Data

		Location Name	HC-C-PA	HC-NE-PA	HC-NW-PA	HC-SE-PA	HC-SW-PA	MW-03A		MW-04A		MW-05A	
		Sample Name	MW-C-PA-091102	MW-NE-PA-091102	MW-NW-PA-091102	MW-SE-PA-091102	MW-SW-PA-091102	MW3A-051788	MW3A-061188	MW4A-051788	MW4A-061188	MW5A-051788	MW5A-060988
		Sample Date	9/11/2002	9/11/2002	9/11/2002	9/11/2002	9/11/2002	5/17/1988	6/11/1988	5/17/1988	6/11/1988	5/17/1988	6/9/1988
Analyte	**CAS No.**	**Unit**											
Dioxins/Furans													
2,3,7,8-TCDD	1746-01-6	µg/L											
1,2,3,7,8-PeCDD	40321-76-4	µg/L											
1,2,3,4,7,8-HxCDD	39227-28-6	µg/L											
1,2,3,6,7,8-HxCDD	57653-85-7	µg/L											
1,2,3,7,8,9-HxCDD	19408-74-3	µg/L											
1,2,3,4,6,7,8-HpCDD	35822-46-9	µg/L											
OCDD	3268-87-9	µg/L											
2,3,7,8-TCDF	51207-31-9	µg/L											
1,2,3,7,8-PeCDF	57117-41-6	µg/L											
2,3,4,7,8-PeCDF	57117-31-4	µg/L											
1,2,3,4,7,8-HxCDF	70648-26-9	µg/L											
1,2,3,6,7,8-HxCDF	57117-44-9	µg/L											
1,2,3,7,8,9-HxCDF	72918-21-9	µg/L											
2,3,4,6,7,8-HxCDF	60851-34-5	µg/L											
1,2,3,4,6,7,8-HpCDF	67562-39-4	µg/L											
1,2,3,4,7,8,9-HpCDF	55673-89-7	µg/L											
OCDF	39001-02-0	µg/L											
Dioxin/Furans (MTCA TEQ-HalfND)	DF_TEQ (U=1/2)	µg/L											
Dioxin/Furans (MTCA TEQ-ZeroND)	DF_TEQ (U=0)	µg/L											
Pesticide-Herbicides													
Dinoseb	88-85-7	µg/L	10 U	10 U	10 U	10 U	10 U						

Notes:

Blank cells are intentional.

All results presented in this table are rounded to two significant figures, with the exception of those for the dioxin/furan TEQ, which are rounded to three significant figures.

-- Not available.

Abbreviations:

°C	Degrees Celsius	µg/L	Micrograms per liter
CAS	Chemical Abstracts Service	mg-CaCO3/L	Milligrams of calcium chloride per liter
CDD	Chlorodibenzo-dioxin	MTCA	Model Toxics Control Act
CDF	Chlorodibenzofuran	OCDD	Octachlorodibenzodioxin
cPAH	Carcinogenic polycyclic hydrocarbon	OCDF	Octachlorodibenzofuran
DRO	Diesel-range organics	ORO	Oil-range organics
HpCDD	Heptachlorodibenzo-p-dioxin	PeCDD	Pentachlorodibenzo-p-dioxin
HpCDF	Heptachlorodibenzofuran	PeCDF	Pentachlorodibenzofuran
HxCDD	Hexachlorodibenzo-p-dioxin	TCDF	Tetrachlorodibenzofuran
HxCDF	Hexachlorodibenzofuran	TEQ	Toxic Equivalent
µohm/cm	Microohms per centimeter	TCDD	Tetrachlorodibenzo-p-dioxin

Qualifiers:

J	Analyte is detected and the concentration is estimated.
JM	Concentration is estimated due to poor match to standard.
U	Analyte is not detected at the associated reporting limit.
UJ	Analyte is not detected at the associated reporting limit, which is an estimate.

Table 3.2
Groundwater Analytical Data

		Location Name	**MW-05A (cont.)**		**MW-06A**					**MW-06B**	
		Sample Name	**DSA-MW5-082888**	**DSA-MW5-100688**	**MW6A-051788**	**MW6A-060888**	**DSA-MW6A-082488**	**DSA-MW6A-100688**	**DSA-MW6A-101388**	**DSA-MW6B-092188**	**DSA-MW6B-101388**
		Sample Date	**8/28/1988**	**10/6/1988**	**5/17/1988**	**6/8/1988**	**8/24/1988**	**10/6/1988**	**10/13/1988**	**9/21/1988**	**10/13/1988**
Analyte	**CAS No.**	**Unit**									
Conventionals											
Alkalinity (as CaCO3)	--	mg-CaCO$_3$/L	352	256				900	913	2,200	2,210
Chloride	16887-00-6	µg/L	51,000	62,000				170,000	81,000	10,000,000	11,000,000
Conductivity	--	µohm/cm	960	825	1,740			2,380	1,175	41,000	32,000
Nitrate	14797-55-8	µg/L	500 U	500 U				2,500 U	500 U	500 U	5,000 U
pH	pH	pH	6.5	6.6	6.79			7.2	7.4	8.0	7.6
Sulfate	14808-79-8	µg/L	1,000 U	1,000 U				22,000	13,000	6,700	35,000
Temperature	--	°C			14						
Total Dissolved Solids	--	µg/L	510,000	530,000				1,300,000	1,600,000	20,000,000	20,000,000
Total Suspended Solids	--	µg/L									
Metals											
Arsenic	7440-38-2	µg/L									40
Barium	7440-39-3	µg/L									120
Cadmium	7440-43-9	µg/L									
Chromium	7440-47-3	µg/L									
Copper	7440-50-8	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									
Vanadium	7440-62-2	µg/L									
Zinc	7440-66-6	µg/L									
Total Petroleum Hydrocarbons											
Diesel-range organics	DRO	µg/L									
Oil-range organics	ORO	µg/L									
Total DRO & ORO	T_DRO&ORO (U=0)	µg/L									
Total Petroleum Hydrocarbons	--	µg/L									
Polycyclic Aromatic Hydrocarbons											
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									
cPAHs (MTCA TEQ-HalfND)	BaPEq (U=1/2)	µg/L									
cPAHs (MTCA TEQ-ZeroND)	BaPEq (U=0)	µg/L									
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								10 U	20 U
Phenanthrene	85-01-8	µg/L									
Pyrene	129-00-0	µg/L									

Table 3.2
Groundwater Analytical Data

		Location Name	**MW-05A (cont.)**		**MW-06A**					**MW-06B**	
		Sample Name	**DSA-MW5-082888**	**DSA-MW5-100688**	**MW6A-051788**	**MW6A-060888**	**DSA-MW6A-082488**	**DSA-MW6A-100688**	**DSA-MW6A-101388**	**DSA-MW6B-092188**	**DSA-MW6B-101388**
		Sample Date	**8/28/1988**	**10/6/1988**	**5/17/1988**	**6/8/1988**	**8/24/1988**	**10/6/1988**	**10/13/1988**	**9/21/1988**	**10/13/1988**
Analyte	**CAS No.**	**Unit**									
Semivolatile Organic Compounds											
2,3,4,6-Tetrachlorophenol	58-90-2	µg/L									
2,4,5-Trichlorophenol	95-95-4	µg/L								10 U	20 U
2,4,6-Trichlorophenol	88-06-2	µg/L									
2,4-Dichlorophenol	120-83-2	µg/L								10 U	20 U
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-Chloronaphthalene	91-58-7	µg/L									
2-Chlorophenol	95-57-8	µg/L									
2-Methylphenol	95-48-7	µg/L									
2-Nitrophenol	88-75-5	µg/L									
3- & 4-Methylphenol	15831-10-4	µg/L									
4-Chloro-3-methylphenol	59-50-7	µg/L									
4-Nitrophenol	100-02-7	µg/L									
Bis(2-chloroethoxy)methane	111-91-1	µg/L									
Bis(2-ethylhexyl)phthalate	117-81-7	µg/L								44 UJ	20 UJ
Butyl benzyl phthalate	85-68-7	µg/L									
Diethylphthalate	84-66-2	µg/L									
Dimethyl phthalate	131-11-3	µg/L									
Di-n-butyl phthalate	84-74-2	µg/L								10 U	20 U
Di-n-octyl phthalate	117-84-0	µg/L									
Hexachlorobutadiene	87-68-3	µg/L									
Hexachlorocyclopentadiene	77-47-4	µg/L									
Hexachloropropene	1888-71-7	µg/L									
N-Nitrosodiphenylamine	86-30-6	µg/L									
Pentachlorophenol	87-86-5	µg/L	5.0 U	5.0 U	5,700	100	3,100	510 J	2,100	5.0 U	5.0 U
Phenol	108-95-2	µg/L									
Phenols (total)	--	µg/L									
Tetrachlorophenols (total)	25167-83-3	µg/L	5.0 U	5.0 U	7,400	10	2,800	280 JM	1,400 J	10	5.0 U
Volatile Organic Compounds											
1,2,4-Trichlorobenzene	120-82-1	µg/L									
1,2-Dichlorobenzene	95-50-1	µg/L									
1,3-Dichlorobenzene	541-73-1	µg/L									
1,4-Dichlorobenzene	106-46-7	µg/L									
4-Chlorophenyl phenyl ether	7005-72-3	µg/L									
Benzene	71-43-2	µg/L									
Bis(2-chloroethyl)ether	111-44-4	µg/L									
Bis(2-chloroisopropyl)ether	39638-32-9	µg/L									
Ethylbenzene	100-41-4	µg/L									
Hexachlorobenzene	118-74-1	µg/L									
Pentachloroethane	76-01-7	µg/L									
Toluene	108-88-3	µg/L									
Xylene (total)	1330-20-7	µg/L									

Table 3.2
Groundwater Analytical Data

		Location Name	MW-05A (cont.)		MW-06A					MW-06B	
		Sample Name	DSA-MW5-082888	DSA-MW5-100688	MW6A-051788	MW6A-060888	DSA-MW6A-082488	DSA-MW6A-100688	DSA-MW6A-101388	DSA-MW6B-092188	DSA-MW6B-101388
		Sample Date	8/28/1988	10/6/1988	5/17/1988	6/8/1988	8/24/1988	10/6/1988	10/13/1988	9/21/1988	10/13/1988
Analyte	**CAS No.**	**Unit**									
Dioxins/Furans											
2,3,7,8-TCDD	1746-01-6	µg/L									
1,2,3,7,8-PeCDD	40321-76-4	µg/L									
1,2,3,4,7,8-HxCDD	39227-28-6	µg/L									
1,2,3,6,7,8-HxCDD	57653-85-7	µg/L									
1,2,3,7,8,9-HxCDD	19408-74-3	µg/L									
1,2,3,4,6,7,8-HpCDD	35822-46-9	µg/L									
OCDD	3268-87-9	µg/L									
2,3,7,8-TCDF	51207-31-9	µg/L									
1,2,3,7,8-PeCDF	57117-41-6	µg/L									
2,3,4,7,8-PeCDF	57117-31-4	µg/L									
1,2,3,4,7,8-HxCDF	70648-26-9	µg/L									
1,2,3,6,7,8-HxCDF	57117-44-9	µg/L									
1,2,3,7,8,9-HxCDF	72918-21-9	µg/L									
2,3,4,6,7,8-HxCDF	60851-34-5	µg/L									
1,2,3,4,6,7,8-HpCDF	67562-39-4	µg/L									
1,2,3,4,7,8,9-HpCDF	55673-89-7	µg/L									
OCDF	39001-02-0	µg/L									
Dioxin/Furans (MTCA TEQ-HalfND)	DF_TEQ (U=1/2)	µg/L									
Dioxin/Furans (MTCA TEQ-ZeroND)	DF_TEQ (U=0)	µg/L									
Pesticide-Herbicides											
Dinoseb	88-85-7	µg/L									

Notes:

Blank cells are intentional.

All results presented in this table are rounded to two significant figures, with the exception of those for the dioxin/furan TEQ, which are rounded to three significant figures.

-- Not available.

Abbreviations:

°C	Degrees Celsius	µg/L	Micrograms per liter
CAS	Chemical Abstracts Service	mg-CaCO3/L	Milligrams of calcium chloride per liter
CDD	Chlorodibenzo-dioxin	MTCA	Model Toxics Control Act
CDF	Chlorodibenzofuran	OCDD	Octachlorodibenzodioxin
cPAH	Carcinogenic polycyclic hydrocarbon	OCDF	Octachlorodibenzofuran
DRO	Diesel-range organics	ORO	Oil-range organics
HpCDD	Heptachlorodibenzo-p-dioxin	PeCDD	Pentachlorodibenzo-p-dioxin
HpCDF	Heptachlorodibenzofuran	PeCDF	Pentachlorodibenzofuran
HxCDD	Hexachlorodibenzo-p-dioxin	TCDF	Tetrachlorodibenzofuran
HxCDF	Hexachlorodibenzofuran	TEQ	Toxic Equivalent
µohm/cm	Microohms per centimeter	TCDD	Tetrachlorodibenzo-p-dioxin

Qualifiers:

J	Analyte is detected and the concentration is estimated.
JM	Concentration is estimated due to poor match to standard.
U	Analyte is not detected at the associated reporting limit.
UJ	Analyte is not detected at the associated reporting limit, which is an estimate.

Table 3.2
Groundwater Analytical Data

		Location Name	**MW-06C**			**MW-07**		**MW-08**				**MW-08B**	
		Sample Name	**DSA-MW6C-101388**	**DSA-MW6C-110188**	**DSA-MW6C-112188**	**MW7-051788**	**MW7-061188**	**MW8-051788**	**DSA-MW8-081788**	**DSA-MW8-082688**	**DSA-MW8A-100388**	**DSA-MW8B-092688**	**DSA-MW8B-100388**
		Sample Date	**10/13/1988**	**11/1/1988**	**11/21/1988**	**5/17/1988**	**6/11/1988**	**5/17/1988**	**8/17/1988**	**8/26/1988**	**10/3/1988**	**9/26/1988**	**10/3/1988**
Analyte	**CAS No.**	**Unit**											
Conventionals													
Alkalinity (as CaCO3)	--	mg-$CaCO_3$/L	924						431	433		706	759
Chloride	16887-00-6	µg/L	100,000						110,000	110,000		5,500,000	6,200,000
Conductivity	--	µohm/cm	2,000			770		1,092	1,400	1,250		16,500	15,500
Nitrate	14797-55-8	µg/L	500 U						500 U	500 U		3,300	500 U
pH	pH	pH	7.7			6.62		6.9	7.0	7.2		7.7	7.8
Sulfate	14808-79-8	µg/L	9,900						11,000	11,000		390,000	450,000
Temperature	--	°C				18		15					
Total Dissolved Solids	--	µg/L	1,500,000						700,000	920,000		9,900,000	11,000,000
Total Suspended Solids	--	µg/L											
Metals													
Arsenic	7440-38-2	µg/L											
Barium	7440-39-3	µg/L	190										
Cadmium	7440-43-9	µg/L											
Chromium	7440-47-3	µg/L	20										
Copper	7440-50-8	µg/L	13										
Lead	7439-92-1	µg/L	3.0										
Mercury	7439-97-6	µg/L											
Selenium	7782-49-2	µg/L											
Silver	7440-22-4	µg/L											
Vanadium	7440-62-2	µg/L	20										
Zinc	7440-66-6	µg/L	50										
Total Petroleum Hydrocarbons													
Diesel-range organics	DRO	µg/L											
Oil-range organics	ORO	µg/L											
Total DRO & ORO	T_DRO&ORO (U=0)	µg/L											
Total Petroleum Hydrocarbons	--	µg/L											
Polycyclic Aromatic Hydrocarbons													
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											
cPAHs (MTCA TEQ-HalfND)	BaPEq (U=1/2)	µg/L											
cPAHs (MTCA TEQ-ZeroND)	BaPEq (U=0)	µg/L											
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	77										
Phenanthrene	85-01-8	µg/L											
Pyrene	129-00-0	µg/L											

Table 3.2
Groundwater Analytical Data

		Location Name	MW-06C			MW-07		MW-08				MW-08B	
		Sample Name	DSA-MW6C-101388	DSA-MW6C-110188	DSA-MW6C-112188	MW7-051788	MW7-061188	MW8-051788	DSA-MW8-081788	DSA-MW8-082688	DSA-MW8A-100388	DSA-MW8B-092688	DSA-MW8B-100388
		Sample Date	10/13/1988	11/1/1988	11/21/1988	5/17/1988	6/11/1988	5/17/1988	8/17/1988	8/26/1988	10/3/1988	9/26/1988	10/3/1988
Analyte	**CAS No.**	**Unit**											
Semivolatile Organic Compounds													
2,3,4,6-Tetrachlorophenol	58-90-2	µg/L											
2,4,5-Trichlorophenol	95-95-4	µg/L	80 J										
2,4,6-Trichlorophenol	88-06-2	µg/L											
2,4-Dichlorophenol	120-83-2	µg/L	11 J										
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-Chloronaphthalene	91-58-7	µg/L											
2-Chlorophenol	95-57-8	µg/L											
2-Methylphenol	95-48-7	µg/L											
2-Nitrophenol	88-75-5	µg/L											
3- & 4-Methylphenol	15831-10-4	µg/L											
4-Chloro-3-methylphenol	59-50-7	µg/L											
4-Nitrophenol	100-02-7	µg/L											
Bis(2-chloroethoxy)methane	111-91-1	µg/L											
Bis(2-ethylhexyl)phthalate	117-81-7	µg/L	20 UJ										
Butyl benzyl phthalate	85-68-7	µg/L											
Diethylphthalate	84-66-2	µg/L											
Dimethyl phthalate	131-11-3	µg/L											
Di-n-butyl phthalate	84-74-2	µg/L	2.0 J										
Di-n-octyl phthalate	117-84-0	µg/L											
Hexachlorobutadiene	87-68-3	µg/L											
Hexachlorocyclopentadiene	77-47-4	µg/L											
Hexachloropropene	1888-71-7	µg/L											
N-Nitrosodiphenylamine	86-30-6	µg/L											
Pentachlorophenol	87-86-5	µg/L	14,000	270	160		10 U	1.0 U	5.0 U	5.0	5.0 U	5.0 U	5.0 U
Phenol	108-95-2	µg/L											
Phenols (total)	--	µg/L											
Tetrachlorophenols (total)	25167-83-3	µg/L	10,000 J	230	40		10 U	1.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Volatile Organic Compounds													
1,2,4-Trichlorobenzene	120-82-1	µg/L											
1,2-Dichlorobenzene	95-50-1	µg/L											
1,3-Dichlorobenzene	541-73-1	µg/L											
1,4-Dichlorobenzene	106-46-7	µg/L											
4-Chlorophenyl phenyl ether	7005-72-3	µg/L											
Benzene	71-43-2	µg/L				1.0 U							
Bis(2-chloroethyl)ether	111-44-4	µg/L											
Bis(2-chloroisopropyl)ether	39638-32-9	µg/L											
Ethylbenzene	100-41-4	µg/L				1.0 U							
Hexachlorobenzene	118-74-1	µg/L											
Pentachloroethane	76-01-7	µg/L											
Toluene	108-88-3	µg/L				1.0 U							
Xylene (total)	1330-20-7	µg/L				2.0							

Table 3.2
Groundwater Analytical Data

		Location Name	MW-06C			MW-07		MW-08				MW-08B	
		Sample Name	DSA-MW6C-101388	DSA-MW6C-110188	DSA-MW6C-112188	MW7-051788	MW7-061188	MW8-051788	DSA-MW8-081788	DSA-MW8-082688	DSA-MW8A-100388	DSA-MW8B-092688	DSA-MW8B-100388
		Sample Date	10/13/1988	11/1/1988	11/21/1988	5/17/1988	6/11/1988	5/17/1988	8/17/1988	8/26/1988	10/3/1988	9/26/1988	10/3/1988
Analyte	**CAS No.**	**Unit**											
Dioxins/Furans													
2,3,7,8-TCDD	1746-01-6	µg/L											
1,2,3,7,8-PeCDD	40321-76-4	µg/L											
1,2,3,4,7,8-HxCDD	39227-28-6	µg/L											
1,2,3,6,7,8-HxCDD	57653-85-7	µg/L											
1,2,3,7,8,9-HxCDD	19408-74-3	µg/L											
1,2,3,4,6,7,8-HpCDD	35822-46-9	µg/L											
OCDD	3268-87-9	µg/L											
2,3,7,8-TCDF	51207-31-9	µg/L											
1,2,3,7,8-PeCDF	57117-41-6	µg/L											
2,3,4,7,8-PeCDF	57117-31-4	µg/L											
1,2,3,4,7,8-HxCDF	70648-26-9	µg/L											
1,2,3,6,7,8-HxCDF	57117-44-9	µg/L											
1,2,3,7,8,9-HxCDF	72918-21-9	µg/L											
2,3,4,6,7,8-HxCDF	60851-34-5	µg/L											
1,2,3,4,6,7,8-HpCDF	67562-39-4	µg/L											
1,2,3,4,7,8,9-HpCDF	55673-89-7	µg/L											
OCDF	39001-02-0	µg/L											
Dioxin/Furans (MTCA TEQ-HalfND)	DF_TEQ (U=1/2)	µg/L											
Dioxin/Furans (MTCA TEQ-ZeroND)	DF_TEQ (U=0)	µg/L											
Pesticide-Herbicides													
Dinoseb	88-85-7	µg/L											

Notes:

Blank cells are intentional.

All results presented in this table are rounded to two significant figures, with the exception of those for the dioxin/furan TEQ, which are rounded to three significant figures.

-- Not available.

Abbreviations:

°C	Degrees Celsius	µg/L	Micrograms per liter
CAS	Chemical Abstracts Service	mg-CaCO3/L	Milligrams of calcium chloride per liter
CDD	Chlorodibenzo-dioxin	MTCA	Model Toxics Control Act
CDF	Chlorodibenzofuran	OCDD	Octachlorodibenzodioxin
cPAH	Carcinogenic polycyclic hydrocarbon	OCDF	Octachlorodibenzofuran
DRO	Diesel-range organics	ORO	Oil-range organics
HpCDD	Heptachlorodibenzo-p-dioxin	PeCDD	Pentachlorodibenzo-p-dioxin
HpCDF	Heptachlorodibenzofuran	PeCDF	Pentachlorodibenzofuran
HxCDD	Hexachlorodibenzo-p-dioxin	TCDF	Tetrachlorodibenzofuran
HxCDF	Hexachlorodibenzofuran	TEQ	Toxic Equivalent
µohm/cm	Microohms per centimeter	TCDD	Tetrachlorodibenzo-p-dioxin

Qualifiers:

J	Analyte is detected and the concentration is estimated.
JM	Concentration is estimated due to poor match to standard.
U	Analyte is not detected at the associated reporting limit.
UJ	Analyte is not detected at the associated reporting limit, which is an estimate.

Table 3.2
Groundwater Analytical Data

		Location Name	MW-11		MW-12		MW-13		MW-14		MW-15		
		Sample Name	MW11-060388	MW11-061188	MW12-060388	MW12-060988	MW13-060388	MW13-061188	MW14-060388	MW14-061188	MW15-060988	DSA-MW15-082488	DSA-MW15-100488
		Sample Date	6/3/1988	6/11/1988	6/3/1988	6/9/1988	6/3/1988	6/11/1988	6/3/1988	6/11/1988	6/9/1988	8/24/1988	10/4/1988
Analyte	**CAS No.**	**Unit**											
Conventionals													
Alkalinity (as CaCO3)	--	mg-CaCO$_3$/L										1,280	1,290
Chloride	16887-00-6	µg/L										7,900,000	6,400,000
Conductivity	--	µohm/cm										28,500	24,000
Nitrate	14797-55-8	µg/L										50,000 U	3,600
pH	pH	pH										7.0	6.9
Sulfate	14808-79-8	µg/L										430,000	330,000
Temperature	--	°C											
Total Dissolved Solids	--	µg/L										15,000,000	13,000,000
Total Suspended Solids	--	µg/L											
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											
Copper	7440-50-8	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											
Vanadium	7440-62-2	µg/L											
Zinc	7440-66-6	µg/L											
Total Petroleum Hydrocarbons													
Diesel-range organics	DRO	µg/L											
Oil-range organics	ORO	µg/L											
Total DRO & ORO	T_DRO&ORO (U=0)	µg/L											
Total Petroleum Hydrocarbons	--	µg/L											
Polycyclic Aromatic Hydrocarbons													
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											
cPAHs (MTCA TEQ-HalfND)	BaPEq (U=1/2)	µg/L											
cPAHs (MTCA TEQ-ZeroND)	BaPEq (U=0)	µg/L											
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	200 U		200 U		420		420				
Pyrene	129-00-0	µg/L											

Table 3.2
Groundwater Analytical Data

		Location Name	MW-11		MW-12		MW-13		MW-14		MW-15		
		Sample Name	MW11-060388	MW11-061188	MW12-060388	MW12-060988	MW13-060388	MW13-061188	MW14-060388	MW14-061188	MW15-060988	DSA-MW15-082488	DSA-MW15-100488
		Sample Date	6/3/1988	6/11/1988	6/3/1988	6/9/1988	6/3/1988	6/11/1988	6/3/1988	6/11/1988	6/9/1988	8/24/1988	10/4/1988
Analyte	**CAS No.**	**Unit**											
Semivolatile Organic Compounds													
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-Chloronaphthalene	91-58-7	µg/L											
2-Chlorophenol	95-57-8	µg/L											
2-Methylphenol	95-48-7	µg/L											
2-Nitrophenol	88-75-5	µg/L											
3- & 4-Methylphenol	15831-10-4	µg/L											
4-Chloro-3-methylphenol	59-50-7	µg/L											
4-Nitrophenol	100-02-7	µg/L											
Bis(2-chloroethoxy)methane	111-91-1	µg/L											
Bis(2-ethylhexyl)phthalate	117-81-7	µg/L											
Butyl benzyl phthalate	85-68-7	µg/L											
Diethylphthalate	84-66-2	µg/L											
Dimethyl phthalate	131-11-3	µg/L											
Di-n-butyl phthalate	84-74-2	µg/L											
Di-n-octyl phthalate	117-84-0	µg/L											
Hexachlorobutadiene	87-68-3	µg/L											
Hexachlorocyclopentadiene	77-47-4	µg/L											
Hexachloropropene	1888-71-7	µg/L											
N-Nitrosodiphenylamine	86-30-6	µg/L											
Pentachlorophenol	87-86-5	µg/L		10 U		10 U		10 U		10 U	10 U	9.0	5.0 U
Phenol	108-95-2	µg/L											
Phenols (total)	--	µg/L											
Tetrachlorophenols (total)	25167-83-3	µg/L		10 U		10 U		10 U		10 U	10 U	5.0 U	5.0 U
Volatile Organic Compounds													
1,2,4-Trichlorobenzene	120-82-1	µg/L											
1,2-Dichlorobenzene	95-50-1	µg/L											
1,3-Dichlorobenzene	541-73-1	µg/L											
1,4-Dichlorobenzene	106-46-7	µg/L											
4-Chlorophenyl phenyl ether	7005-72-3	µg/L											
Benzene	71-43-2	µg/L	1.0 U		1.0 U		1.0 U						
Bis(2-chloroethyl)ether	111-44-4	µg/L											
Bis(2-chloroisopropyl)ether	39638-32-9	µg/L											
Ethylbenzene	100-41-4	µg/L	1.0 U		1.0 U		1.0 U						
Hexachlorobenzene	118-74-1	µg/L											
Pentachloroethane	76-01-7	µg/L											
Toluene	108-88-3	µg/L	1.0 U		1.0 U		1.0 U						
Xylene (total)	1330-20-7	µg/L	1.0 U		1.0 U		1.0 U						

Table 3.2
Groundwater Analytical Data

		Location Name	MW-11		MW-12		MW-13		MW-14		MW-15		
		Sample Name	MW11-060388	MW11-061188	MW12-060388	MW12-060988	MW13-060388	MW13-061188	MW14-060388	MW14-061188	MW15-060988	DSA-MW15-082488	DSA-MW15-100488
		Sample Date	6/3/1988	6/11/1988	6/3/1988	6/9/1988	6/3/1988	6/11/1988	6/3/1988	6/11/1988	6/9/1988	8/24/1988	10/4/1988
Analyte	**CAS No.**	**Unit**											
Dioxins/Furans													
2,3,7,8-TCDD	1746-01-6	µg/L											
1,2,3,7,8-PeCDD	40321-76-4	µg/L											
1,2,3,4,7,8-HxCDD	39227-28-6	µg/L											
1,2,3,6,7,8-HxCDD	57653-85-7	µg/L											
1,2,3,7,8,9-HxCDD	19408-74-3	µg/L											
1,2,3,4,6,7,8-HpCDD	35822-46-9	µg/L											
OCDD	3268-87-9	µg/L											
2,3,7,8-TCDF	51207-31-9	µg/L											
1,2,3,7,8-PeCDF	57117-41-6	µg/L											
2,3,4,7,8-PeCDF	57117-31-4	µg/L											
1,2,3,4,7,8-HxCDF	70648-26-9	µg/L											
1,2,3,6,7,8-HxCDF	57117-44-9	µg/L											
1,2,3,7,8,9-HxCDF	72918-21-9	µg/L											
2,3,4,6,7,8-HxCDF	60851-34-5	µg/L											
1,2,3,4,6,7,8-HpCDF	67562-39-4	µg/L											
1,2,3,4,7,8,9-HpCDF	55673-89-7	µg/L											
OCDF	39001-02-0	µg/L											
Dioxin/Furans (MTCA TEQ-HalfND)	DF_TEQ (U=1/2)	µg/L											
Dioxin/Furans (MTCA TEQ-ZeroND)	DF_TEQ (U=0)	µg/L											
Pesticide-Herbicides													
Dinoseb	88-85-7	µg/L											

Notes:

Blank cells are intentional.

All results presented in this table are rounded to two significant figures, with the exception of those for the dioxin/furan TEQ, which are rounded to three significant figures.

-- Not available.

Abbreviations:

°C	Degrees Celsius	µg/L	Micrograms per liter
CAS	Chemical Abstracts Service	mg-CaCO3/L	Milligrams of calcium chloride per liter
CDD	Chlorodibenzo-dioxin	MTCA	Model Toxics Control Act
CDF	Chlorodibenzofuran	OCDD	Octachlorodibenzodioxin
cPAH	Carcinogenic polycyclic hydrocarbon	OCDF	Octachlorodibenzofuran
DRO	Diesel-range organics	ORO	Oil-range organics
HpCDD	Heptachlorodibenzo-p-dioxin	PeCDD	Pentachlorodibenzo-p-dioxin
HpCDF	Heptachlorodibenzofuran	PeCDF	Pentachlorodibenzofuran
HxCDD	Hexachlorodibenzo-p-dioxin	TCDF	Tetrachlorodibenzofuran
HxCDF	Hexachlorodibenzofuran	TEQ	Toxic Equivalent
µohm/cm	Microohms per centimeter	TCDD	Tetrachlorodibenzo-p-dioxin

Qualifiers:

J	Analyte is detected and the concentration is estimated.
JM	Concentration is estimated due to poor match to standard.
U	Analyte is not detected at the associated reporting limit.
UJ	Analyte is not detected at the associated reporting limit, which is an estimate.

Table 3.2
Groundwater Analytical Data

		Location Name	MW-16A				MW-16B			MW-18		
		Sample Name	**MW16A-061288**	**DSA-MW16-082888**	**DSA-MW16A-101488**	**DSA-MW16AD-101488**	**DSA-MW16B-092388**	**DSA-MW16BD-092388**	**DSA-MW16B-100488**	**MW18-061288**	**DSA-MW18-082488**	**DSA-MW18-100488**
		Sample Date	**6/12/1988**	**8/28/1988**	**10/14/1988**	**10/14/1988**	**9/23/1988**	**9/23/1988**	**10/4/1988**	**6/12/1988**	**8/24/1988**	**10/4/1988**
Analyte	**CAS No.**	**Unit**										
Conventionals												
Alkalinity (as CaCO3)	--	mg-$CaCO_3$/L		943	906		2,050		2,030		396	252
Chloride	16887-00-6	µg/L		180,000	190,000		10,000,000		11,000,000		14,000,000	15,000,000
Conductivity	--	µohm/cm		2,460	2,000		35,800		30,000		48,500	53,000
Nitrate	14797-55-8	µg/L		2,500 U	500 U		8,000		85,000		50,000 U	50,000 U
pH	pH	pH		7.2	7.1		7.3		7.1		6.6	6.6
Sulfate	14808-79-8	µg/L		5,000 U	5,200		16,000		1,000 U		1,600,000	2,400,000
Temperature	--	°C										
Total Dissolved Solids	--	µg/L		1,300,000	1,300,000		20,000,000		20,000,000		25,000,000	29,000,000
Total Suspended Solids	--	µg/L										
Metals												
Arsenic	7440-38-2	µg/L					14					
Barium	7440-39-3	µg/L					190					
Cadmium	7440-43-9	µg/L										
Chromium	7440-47-3	µg/L										
Copper	7440-50-8	µg/L										
Lead	7439-92-1	µg/L					22					
Mercury	7439-97-6	µg/L										
Selenium	7782-49-2	µg/L										
Silver	7440-22-4	µg/L										
Vanadium	7440-62-2	µg/L										
Zinc	7440-66-6	µg/L										
Total Petroleum Hydrocarbons												
Diesel-range organics	DRO	µg/L										
Oil-range organics	ORO	µg/L										
Total DRO & ORO	T_DRO&ORO (U=0)	µg/L										
Total Petroleum Hydrocarbons	--	µg/L	4,000									
Polycyclic Aromatic Hydrocarbons												
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										
cPAHs (MTCA TEQ-HalfND)	BaPEq (U=1/2)	µg/L										
cPAHs (MTCA TEQ-ZeroND)	BaPEq (U=0)	µg/L										
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				2.0 J						
Phenanthrene	85-01-8	µg/L										
Pyrene	129-00-0	µg/L										

Table 3.2
Groundwater Analytical Data

		Location Name	**MW-16A**				**MW-16B**			**MW-18**		
		Sample Name	**MW16A-061288**	**DSA-MW16-082888**	**DSA-MW16A-101488**	**DSA-MW16AD-101488**	**DSA-MW16B-092388**	**DSA-MW16BD-092388**	**DSA-MW16B-100488**	**MW18-061288**	**DSA-MW18-082488**	**DSA-MW18-100488**
		Sample Date	**6/12/1988**	**8/28/1988**	**10/14/1988**	**10/14/1988**	**9/23/1988**	**9/23/1988**	**10/4/1988**	**6/12/1988**	**8/24/1988**	**10/4/1988**
Analyte	**CAS No.**	**Unit**										
Semivolatile Organic Compounds												
2,3,4,6-Tetrachlorophenol	58-90-2	µg/L										
2,4,5-Trichlorophenol	95-95-4	µg/L				20 U						
2,4,6-Trichlorophenol	88-06-2	µg/L										
2,4-Dichlorophenol	120-83-2	µg/L				20 U						
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-Chloronaphthalene	91-58-7	µg/L										
2-Chlorophenol	95-57-8	µg/L										
2-Methylphenol	95-48-7	µg/L										
2-Nitrophenol	88-75-5	µg/L										
3- & 4-Methylphenol	15831-10-4	µg/L										
4-Chloro-3-methylphenol	59-50-7	µg/L										
4-Nitrophenol	100-02-7	µg/L										
Bis(2-chloroethoxy)methane	111-91-1	µg/L										
Bis(2-ethylhexyl)phthalate	117-81-7	µg/L				20 UJ						
Butyl benzyl phthalate	85-68-7	µg/L										
Diethylphthalate	84-66-2	µg/L										
Dimethyl phthalate	131-11-3	µg/L										
Di-n-butyl phthalate	84-74-2	µg/L				20 U						
Di-n-octyl phthalate	117-84-0	µg/L										
Hexachlorobutadiene	87-68-3	µg/L										
Hexachlorocyclopentadiene	77-47-4	µg/L										
Hexachloropropene	1888-71-7	µg/L										
N-Nitrosodiphenylamine	86-30-6	µg/L										
Pentachlorophenol	87-86-5	µg/L	590	52	5.0 U	64	5.0 U	5.0 U	5.0 U	10 U	6.0	5.0 U
Phenol	108-95-2	µg/L										
Phenols (total)	--	µg/L	1,000 U									
Tetrachlorophenols (total)	25167-83-3	µg/L	10 U	110 JM	6.0 JM	92 J	5.0 U	5.0 U	5.0 U	10 U	5.0 U	5.0 U
Volatile Organic Compounds												
1,2,4-Trichlorobenzene	120-82-1	µg/L										
1,2-Dichlorobenzene	95-50-1	µg/L										
1,3-Dichlorobenzene	541-73-1	µg/L										
1,4-Dichlorobenzene	106-46-7	µg/L										
4-Chlorophenyl phenyl ether	7005-72-3	µg/L										
Benzene	71-43-2	µg/L										
Bis(2-chloroethyl)ether	111-44-4	µg/L										
Bis(2-chloroisopropyl)ether	39638-32-9	µg/L										
Ethylbenzene	100-41-4	µg/L										
Hexachlorobenzene	118-74-1	µg/L										
Pentachloroethane	76-01-7	µg/L										
Toluene	108-88-3	µg/L										
Xylene (total)	1330-20-7	µg/L										

Table 3.2
Groundwater Analytical Data

		Location Name	MW-16A				MW-16B			MW-18		
		Sample Name	**MW16A-061288**	**DSA-MW16-082888**	**DSA-MW16A-101488**	**DSA-MW16AD-101488**	**DSA-MW16B-092388**	**DSA-MW16BD-092388**	**DSA-MW16B-100488**	**MW18-061288**	**DSA-MW18-082488**	**DSA-MW18-100488**
		Sample Date	**6/12/1988**	**8/28/1988**	**10/14/1988**	**10/14/1988**	**9/23/1988**	**9/23/1988**	**10/4/1988**	**6/12/1988**	**8/24/1988**	**10/4/1988**
Analyte	**CAS No.**	**Unit**										
Dioxins/Furans												
2,3,7,8-TCDD	1746-01-6	µg/L	0.0000480 U									
1,2,3,7,8-PeCDD	40321-76-4	µg/L	0.0000600 U									
1,2,3,4,7,8-HxCDD	39227-28-6	µg/L	0.0000750 U									
1,2,3,6,7,8-HxCDD	57653-85-7	µg/L	0.0000700 U									
1,2,3,7,8,9-HxCDD	19408-74-3	µg/L	0.0000920 U									
1,2,3,4,6,7,8-HpCDD	35822-46-9	µg/L	0.000205 U									
OCDD	3268-87-9	µg/L	0.000960 U									
2,3,7,8-TCDF	51207-31-9	µg/L	0.0000300 U									
1,2,3,7,8-PeCDF	57117-41-6	µg/L	0.0000400 U									
2,3,4,7,8-PeCDF	57117-31-4	µg/L	0.0000430 U									
1,2,3,4,7,8-HxCDF	70648-26-9	µg/L	0.0000370 U									
1,2,3,6,7,8-HxCDF	57117-44-9	µg/L	0.0000330 U									
1,2,3,7,8,9-HxCDF	72918-21-9	µg/L	0.0000600 U									
2,3,4,6,7,8-HxCDF	60851-34-5	µg/L	0.0000480 U									
1,2,3,4,6,7,8-HpCDF	67562-39-4	µg/L	0.0000880 U									
1,2,3,4,7,8,9-HpCDF	55673-89-7	µg/L	0.000123 U									
OCDF	39001-02-0	µg/L	0.000638 U									
Dioxin/Furans (MTCA TEQ-HalfND)	DF_TEQ (U=1/2)	µg/L	0.0000600 U									
Dioxin/Furans (MTCA TEQ-ZeroND)	DF_TEQ (U=0)	µg/L	0.0000600 U									
Pesticide-Herbicides												
Dinoseb	88-85-7	µg/L										

Notes:

Blank cells are intentional.

All results presented in this table are rounded to two significant figures, with the exception of those for the dioxin/furan TEQ, which are rounded to three significant figures.

-- Not available.

Abbreviations:

°C	Degrees Celsius	µg/L	Micrograms per liter
CAS	Chemical Abstracts Service	mg-CaCO3/L	Milligrams of calcium chloride per liter
CDD	Chlorodibenzo-dioxin	MTCA	Model Toxics Control Act
CDF	Chlorodibenzofuran	OCDD	Octachlorodibenzodioxin
cPAH	Carcinogenic polycyclic hydrocarbon	OCDF	Octachlorodibenzofuran
DRO	Diesel-range organics	ORO	Oil-range organics
HpCDD	Heptachlorodibenzo-p-dioxin	PeCDD	Pentachlorodibenzo-p-dioxin
HpCDF	Heptachlorodibenzofuran	PeCDF	Pentachlorodibenzofuran
HxCDD	Hexachlorodibenzo-p-dioxin	TCDF	Tetrachlorodibenzofuran
HxCDF	Hexachlorodibenzofuran	TEQ	Toxic Equivalent
µohm/cm	Microohms per centimeter	TCDD	Tetrachlorodibenzo-p-dioxin

Qualifiers:

J	Analyte is detected and the concentration is estimated.
JM	Concentration is estimated due to poor match to standard.
U	Analyte is not detected at the associated reporting limit.
UJ	Analyte is not detected at the associated reporting limit, which is an estimate.

Table 3.2
Groundwater Analytical Data

		Location Name	MW-19			MW-20	MW-21			MW-22		
		Sample Name	MW19-061288	DSA-MW19-082688	DSA-MW19-101588	MW20-061288	MW21-061288	DSA-MW21-082488	DSA-MW21-100588	MW22-061288	DSA-MW22-082888	DSA-MW22-100588
		Sample Date	6/12/1988	8/26/1988	10/15/1988	6/12/1988	6/12/1988	8/24/1988	10/5/1988	6/12/1988	8/28/1988	10/5/1988
Analyte	**CAS No.**	**Unit**										
Conventionals												
Alkalinity (as CaCO3)	--	mg-$CaCO_3$/L		411	352			882	881		766	793
Chloride	16887-00-6	µg/L		15,000,000	16,000,000			96,000	1,200,000		120,000	110,000
Conductivity	--	µohm/cm		57,300	52,500			1,920	1,770		1,990	1,780
Nitrate	14797-55-8	µg/L		100,000 U	50,000 U			500 U	500 U		500 U	500 U
pH	pH	pH		6.6	6.5			7.4	7.4		7.3	7.7
Sulfate	14808-79-8	µg/L		2,000,000	2,000,000			4,400	1,000 U		41,000	25,000
Temperature	--	°C										
Total Dissolved Solids	--	µg/L		28,000,000	29,000,000			1,100,000	1,200,000		1,100,000	1,100,000
Total Suspended Solids	--	µg/L										
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										
Copper	7440-50-8	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										
Vanadium	7440-62-2	µg/L										
Zinc	7440-66-6	µg/L										
Total Petroleum Hydrocarbons												
Diesel-range organics	DRO	µg/L										
Oil-range organics	ORO	µg/L										
Total DRO & ORO	T_DRO&ORO (U=0)	µg/L										
Total Petroleum Hydrocarbons	--	µg/L										
Polycyclic Aromatic Hydrocarbons												
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										
cPAHs (MTCA TEQ-HalfND)	BaPEq (U=1/2)	µg/L										
cPAHs (MTCA TEQ-ZeroND)	BaPEq (U=0)	µg/L										
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										

Table 3.2
Groundwater Analytical Data

		Location Name	MW-19			MW-20	MW-21			MW-22		
		Sample Name	**MW19-061288**	**DSA-MW19-082688**	**DSA-MW19-101588**	**MW20-061288**	**MW21-061288**	**DSA-MW21-082488**	**DSA-MW21-100588**	**MW22-061288**	**DSA-MW22-082888**	**DSA-MW22-100588**
		Sample Date	**6/12/1988**	**8/26/1988**	**10/15/1988**	**6/12/1988**	**6/12/1988**	**8/24/1988**	**10/5/1988**	**6/12/1988**	**8/28/1988**	**10/5/1988**
Analyte	**CAS No.**	**Unit**										
Semivolatile Organic Compounds												
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-Chloronaphthalene	91-58-7	µg/L										
2-Chlorophenol	95-57-8	µg/L										
2-Methylphenol	95-48-7	µg/L										
2-Nitrophenol	88-75-5	µg/L										
3- & 4-Methylphenol	15831-10-4	µg/L										
4-Chloro-3-methylphenol	59-50-7	µg/L										
4-Nitrophenol	100-02-7	µg/L										
Bis(2-chloroethoxy)methane	111-91-1	µg/L										
Bis(2-ethylhexyl)phthalate	117-81-7	µg/L										
Butyl benzyl phthalate	85-68-7	µg/L										
Diethylphthalate	84-66-2	µg/L										
Dimethyl phthalate	131-11-3	µg/L										
Di-n-butyl phthalate	84-74-2	µg/L										
Di-n-octyl phthalate	117-84-0	µg/L										
Hexachlorobutadiene	87-68-3	µg/L										
Hexachlorocyclopentadiene	77-47-4	µg/L										
Hexachloropropene	1888-71-7	µg/L										
N-Nitrosodiphenylamine	86-30-6	µg/L										
Pentachlorophenol	87-86-5	µg/L	10 U	15		10 U	10 U	21	5.0 U	10 U	25	5.0 U
Phenol	108-95-2	µg/L										
Phenols (total)	--	µg/L										
Tetrachlorophenols (total)	25167-83-3	µg/L	10 U	5.0 U	350 J	10 U	10 U	5.0 U	5.0 U	10 U	5.0 U	5.0 U
Volatile Organic Compounds												
1,2,4-Trichlorobenzene	120-82-1	µg/L										
1,2-Dichlorobenzene	95-50-1	µg/L										
1,3-Dichlorobenzene	541-73-1	µg/L										
1,4-Dichlorobenzene	106-46-7	µg/L										
4-Chlorophenyl phenyl ether	7005-72-3	µg/L										
Benzene	71-43-2	µg/L										
Bis(2-chloroethyl)ether	111-44-4	µg/L										
Bis(2-chloroisopropyl)ether	39638-32-9	µg/L										
Ethylbenzene	100-41-4	µg/L										
Hexachlorobenzene	118-74-1	µg/L										
Pentachloroethane	76-01-7	µg/L										
Toluene	108-88-3	µg/L										
Xylene (total)	1330-20-7	µg/L										

Table 3.2
Groundwater Analytical Data

		Location Name	MW-19			MW-20	MW-21			MW-22		
		Sample Name	**MW19-061288**	**DSA-MW19-082688**	**DSA-MW19-101588**	**MW20-061288**	**MW21-061288**	**DSA-MW21-082488**	**DSA-MW21-100588**	**MW22-061288**	**DSA-MW22-082888**	**DSA-MW22-100588**
		Sample Date	**6/12/1988**	**8/26/1988**	**10/15/1988**	**6/12/1988**	**6/12/1988**	**8/24/1988**	**10/5/1988**	**6/12/1988**	**8/28/1988**	**10/5/1988**
Analyte	**CAS No.**	**Unit**										
Dioxins/Furans												
2,3,7,8-TCDD	1746-01-6	µg/L										
1,2,3,7,8-PeCDD	40321-76-4	µg/L										
1,2,3,4,7,8-HxCDD	39227-28-6	µg/L										
1,2,3,6,7,8-HxCDD	57653-85-7	µg/L										
1,2,3,7,8,9-HxCDD	19408-74-3	µg/L										
1,2,3,4,6,7,8-HpCDD	35822-46-9	µg/L										
OCDD	3268-87-9	µg/L										
2,3,7,8-TCDF	51207-31-9	µg/L										
1,2,3,7,8-PeCDF	57117-41-6	µg/L										
2,3,4,7,8-PeCDF	57117-31-4	µg/L										
1,2,3,4,7,8-HxCDF	70648-26-9	µg/L										
1,2,3,6,7,8-HxCDF	57117-44-9	µg/L										
1,2,3,7,8,9-HxCDF	72918-21-9	µg/L										
2,3,4,6,7,8-HxCDF	60851-34-5	µg/L										
1,2,3,4,6,7,8-HpCDF	67562-39-4	µg/L										
1,2,3,4,7,8,9-HpCDF	55673-89-7	µg/L										
OCDF	39001-02-0	µg/L										
Dioxin/Furans (MTCA TEQ-HalfND)	DF_TEQ (U=1/2)	µg/L										
Dioxin/Furans (MTCA TEQ-ZeroND)	DF_TEQ (U=0)	µg/L										
Pesticide-Herbicides												
Dinoseb	88-85-7	µg/L										

Notes:

Blank cells are intentional.

All results presented in this table are rounded to two significant figures, with the exception of those for the dioxin/furan TEQ, which are rounded to three significant figures.

-- Not available.

Abbreviations:

°C	Degrees Celsius	µg/L	Micrograms per liter
CAS	Chemical Abstracts Service	mg-CaCO3/L	Milligrams of calcium chloride per liter
CDD	Chlorodibenzo-dioxin	MTCA	Model Toxics Control Act
CDF	Chlorodibenzofuran	OCDD	Octachlorodibenzodioxin
cPAH	Carcinogenic polycyclic hydrocarbon	OCDF	Octachlorodibenzofuran
DRO	Diesel-range organics	ORO	Oil-range organics
HpCDD	Heptachlorodibenzo-p-dioxin	PeCDD	Pentachlorodibenzo-p-dioxin
HpCDF	Heptachlorodibenzofuran	PeCDF	Pentachlorodibenzofuran
HxCDD	Hexachlorodibenzo-p-dioxin	TCDF	Tetrachlorodibenzofuran
HxCDF	Hexachlorodibenzofuran	TEQ	Toxic Equivalent
µohm/cm	Microohms per centimeter	TCDD	Tetrachlorodibenzo-p-dioxin

Qualifiers:

J	Analyte is detected and the concentration is estimated.
JM	Concentration is estimated due to poor match to standard.
U	Analyte is not detected at the associated reporting limit.
UJ	Analyte is not detected at the associated reporting limit, which is an estimate.

Table 3.2
Groundwater Analytical Data

		Location Name	MW-23		MW-24A		MW-24B		MW-25A		
		Sample Name	**DSA-MW23-090188**	**DSA-MW23-100688**	**DSA-MW24A-091388**	**DSA-MW24A-100388**	**DSA-MW24B-091388**	**DSA-MW24BD-091388**	**DSA-MW25A-092688**	**DSA-MW25A-100488**	**DSA-MW25AD-100488**
		Sample Date	**9/1/1988**	**10/6/1988**	**9/13/1988**	**10/3/1988**	**9/13/1988**	**9/13/1988**	**9/26/1988**	**10/4/1988**	**10/4/1988**
Analyte	**CAS No.**	**Unit**									
Conventionals											
Alkalinity (as CaCO3)	--	mg-CaCO$_3$/L	461	501	1,820	1,980	890		542	545	
Chloride	16887-00-6	µg/L	97,000	99,000	11,000,000	12,000,000	78,000		92,000	97,000	
Conductivity	--	µohm/cm	1,120	1,250	43,700	32,000	2,250		1,300	1,430	
Nitrate	14797-55-8	µg/L	500 U	500 U	13,000	50,000 U	500 U		500 U	500 U	
pH	pH	pH	6.9	6.9	7.4	7.4	7.8		6.7	7.7	
Sulfate	14808-79-8	µg/L	5,200	3,600	16,000	100,000 U	8,500		51,000	44,000	
Temperature	--	°C									
Total Dissolved Solids	--	µg/L	660,000	740,000	21,000,000	21,000,000	1,200,000		890,000	1,000,000	
Total Suspended Solids	--	µg/L									
Metals											
Arsenic	7440-38-2	µg/L									
Barium	7440-39-3	µg/L			16						
Cadmium	7440-43-9	µg/L									
Chromium	7440-47-3	µg/L									
Copper	7440-50-8	µg/L			8.0						
Lead	7439-92-1	µg/L			3.0						
Mercury	7439-97-6	µg/L									
Selenium	7782-49-2	µg/L									
Silver	7440-22-4	µg/L									
Vanadium	7440-62-2	µg/L			10						
Zinc	7440-66-6	µg/L			20						
Total Petroleum Hydrocarbons											
Diesel-range organics	DRO	µg/L									
Oil-range organics	ORO	µg/L									
Total DRO & ORO	T_DRO&ORO (U=0)	µg/L									
Total Petroleum Hydrocarbons	--	µg/L									
Polycyclic Aromatic Hydrocarbons											
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									
cPAHs (MTCA TEQ-HalfND)	BaPEq (U=1/2)	µg/L									
cPAHs (MTCA TEQ-ZeroND)	BaPEq (U=0)	µg/L									
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									

Table 3.2
Groundwater Analytical Data

		Location Name	**MW-23**		**MW-24A**		**MW-24B**		**MW-25A**		
		Sample Name	**DSA-MW23-090188**	**DSA-MW23-100688**	**DSA-MW24A-091388**	**DSA-MW24A-100388**	**DSA-MW24B-091388**	**DSA-MW24BD-091388**	**DSA-MW25A-092688**	**DSA-MW25A-100488**	**DSA-MW25AD-100488**
		Sample Date	**9/1/1988**	**10/6/1988**	**9/13/1988**	**10/3/1988**	**9/13/1988**	**9/13/1988**	**9/26/1988**	**10/4/1988**	**10/4/1988**
Analyte	**CAS No.**	**Unit**									
Semivolatile Organic Compounds											
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-Chloronaphthalene	91-58-7	µg/L									
2-Chlorophenol	95-57-8	µg/L									
2-Methylphenol	95-48-7	µg/L									
2-Nitrophenol	88-75-5	µg/L									
3- & 4-Methylphenol	15831-10-4	µg/L									
4-Chloro-3-methylphenol	59-50-7	µg/L									
4-Nitrophenol	100-02-7	µg/L									
Bis(2-chloroethoxy)methane	111-91-1	µg/L									
Bis(2-ethylhexyl)phthalate	117-81-7	µg/L									
Butyl benzyl phthalate	85-68-7	µg/L									
Diethylphthalate	84-66-2	µg/L									
Dimethyl phthalate	131-11-3	µg/L									
Di-n-butyl phthalate	84-74-2	µg/L									
Di-n-octyl phthalate	117-84-0	µg/L									
Hexachlorobutadiene	87-68-3	µg/L									
Hexachlorocyclopentadiene	77-47-4	µg/L									
Hexachloropropene	1888-71-7	µg/L									
N-Nitrosodiphenylamine	86-30-6	µg/L									
Pentachlorophenol	87-86-5	µg/L	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	45 U	5.0 U	5.0 U
Phenol	108-95-2	µg/L									
Phenols (total)	--	µg/L									
Tetrachlorophenols (total)	25167-83-3	µg/L	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	45 JM	5.0 U	5.0 U
Volatile Organic Compounds											
1,2,4-Trichlorobenzene	120-82-1	µg/L									
1,2-Dichlorobenzene	95-50-1	µg/L									
1,3-Dichlorobenzene	541-73-1	µg/L									
1,4-Dichlorobenzene	106-46-7	µg/L									
4-Chlorophenyl phenyl ether	7005-72-3	µg/L									
Benzene	71-43-2	µg/L									
Bis(2-chloroethyl)ether	111-44-4	µg/L									
Bis(2-chloroisopropyl)ether	39638-32-9	µg/L									
Ethylbenzene	100-41-4	µg/L									
Hexachlorobenzene	118-74-1	µg/L									
Pentachloroethane	76-01-7	µg/L									
Toluene	108-88-3	µg/L									
Xylene (total)	1330-20-7	µg/L									

Table 3.2
Groundwater Analytical Data

		Location Name	MW-23		MW-24A		MW-24B		MW-25A		
		Sample Name	**DSA-MW23-090188**	**DSA-MW23-100688**	**DSA-MW24A-091388**	**DSA-MW24A-100388**	**DSA-MW24B-091388**	**DSA-MW24BD-091388**	**DSA-MW25A-092688**	**DSA-MW25A-100488**	**DSA-MW25AD-100488**
		Sample Date	**9/1/1988**	**10/6/1988**	**9/13/1988**	**10/3/1988**	**9/13/1988**	**9/13/1988**	**9/26/1988**	**10/4/1988**	**10/4/1988**
Analyte	**CAS No.**	**Unit**									
Dioxins/Furans											
2,3,7,8-TCDD	1746-01-6	µg/L									
1,2,3,7,8-PeCDD	40321-76-4	µg/L									
1,2,3,4,7,8-HxCDD	39227-28-6	µg/L									
1,2,3,6,7,8-HxCDD	57653-85-7	µg/L									
1,2,3,7,8,9-HxCDD	19408-74-3	µg/L									
1,2,3,4,6,7,8-HpCDD	35822-46-9	µg/L									
OCDD	3268-87-9	µg/L									
2,3,7,8-TCDF	51207-31-9	µg/L									
1,2,3,7,8-PeCDF	57117-41-6	µg/L									
2,3,4,7,8-PeCDF	57117-31-4	µg/L									
1,2,3,4,7,8-HxCDF	70648-26-9	µg/L									
1,2,3,6,7,8-HxCDF	57117-44-9	µg/L									
1,2,3,7,8,9-HxCDF	72918-21-9	µg/L									
2,3,4,6,7,8-HxCDF	60851-34-5	µg/L									
1,2,3,4,6,7,8-HpCDF	67562-39-4	µg/L									
1,2,3,4,7,8,9-HpCDF	55673-89-7	µg/L									
OCDF	39001-02-0	µg/L									
Dioxin/Furans (MTCA TEQ-HalfND)	DF_TEQ (U=1/2)	µg/L									
Dioxin/Furans (MTCA TEQ-ZeroND)	DF_TEQ (U=0)	µg/L									
Pesticide-Herbicides											
Dinoseb	88-85-7	µg/L									

Notes:

Blank cells are intentional.

All results presented in this table are rounded to two significant figures, with the exception of those for the dioxin/furan TEQ, which are rounded to three significant figures.

-- Not available.

Abbreviations:

°C	Degrees Celsius	µg/L	Micrograms per liter
CAS	Chemical Abstracts Service	mg-CaCO3/L	Milligrams of calcium chloride per liter
CDD	Chlorodibenzo-dioxin	MTCA	Model Toxics Control Act
CDF	Chlorodibenzofuran	OCDD	Octachlorodibenzodioxin
cPAH	Carcinogenic polycyclic hydrocarbon	OCDF	Octachlorodibenzofuran
DRO	Diesel-range organics	ORO	Oil-range organics
HpCDD	Heptachlorodibenzo-p-dioxin	PeCDD	Pentachlorodibenzo-p-dioxin
HpCDF	Heptachlorodibenzofuran	PeCDF	Pentachlorodibenzofuran
HxCDD	Hexachlorodibenzo-p-dioxin	TCDF	Tetrachlorodibenzofuran
HxCDF	Hexachlorodibenzofuran	TEQ	Toxic Equivalent
µohm/cm	Microohms per centimeter	TCDD	Tetrachlorodibenzo-p-dioxin

Qualifiers:

J	Analyte is detected and the concentration is estimated.
JM	Concentration is estimated due to poor match to standard.
U	Analyte is not detected at the associated reporting limit.
UJ	Analyte is not detected at the associated reporting limit, which is an estimate.

Table 3.2
Groundwater Analytical Data

		Location Name	MW-25B		MW-26	
		Sample Name	DSA-MW25B-092688	DSA-MW25B-100488	DSA-MW26-092688	DSA-MW26-100588
		Sample Date	9/26/1988	10/4/1988	9/26/1988	10/5/1988
Analyte	**CAS No.**	**Unit**				
Conventionals						
Alkalinity (as CaCO3)	--	mg-$CaCO_3$/L	1,160	1,130	292	313
Chloride	16887-00-6	µg/L	7,300,000	6,900,000	71,000	66,000
Conductivity	--	µohm/cm	18,900	17,000	890	890
Nitrate	14797-55-8	µg/L	2,700	3,900	500 U	500 U
pH	pH	pH	8.0	8.1	6.6	6.7
Sulfate	14808-79-8	µg/L	25,000	100,000	2,000	3,400
Temperature	--	°C				
Total Dissolved Solids	--	µg/L	12,000,000	12,000,000	580,000	930,000
Total Suspended Solids	--	µg/L				
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				
Copper	7440-50-8	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				
Vanadium	7440-62-2	µg/L				
Zinc	7440-66-6	µg/L				
Total Petroleum Hydrocarbons						
Diesel-range organics	DRO	µg/L				
Oil-range organics	ORO	µg/L				
Total DRO & ORO	T_DRO&ORO (U=0)	µg/L				
Total Petroleum Hydrocarbons	--	µg/L				
Polycyclic Aromatic Hydrocarbons						
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				
cPAHs (MTCA TEQ-HalfND)	BaPEq (U=1/2)	µg/L				
cPAHs (MTCA TEQ-ZeroND)	BaPEq (U=0)	µg/L				
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				

Table 3.2
Groundwater Analytical Data

		Location Name	MW-25B		MW-26	
		Sample Name	DSA-MW25B-092688	DSA-MW25B-100488	DSA-MW26-092688	DSA-MW26-100588
		Sample Date	9/26/1988	10/4/1988	9/26/1988	10/5/1988
Analyte	**CAS No.**	**Unit**				
Semivolatile Organic Compounds						
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-Chloronaphthalene	91-58-7	µg/L				
2-Chlorophenol	95-57-8	µg/L				
2-Methylphenol	95-48-7	µg/L				
2-Nitrophenol	88-75-5	µg/L				
3- & 4-Methylphenol	15831-10-4	µg/L				
4-Chloro-3-methylphenol	59-50-7	µg/L				
4-Nitrophenol	100-02-7	µg/L				
Bis(2-chloroethoxy)methane	111-91-1	µg/L				
Bis(2-ethylhexyl)phthalate	117-81-7	µg/L				
Butyl benzyl phthalate	85-68-7	µg/L				
Diethylphthalate	84-66-2	µg/L				
Dimethyl phthalate	131-11-3	µg/L				
Di-n-butyl phthalate	84-74-2	µg/L				
Di-n-octyl phthalate	117-84-0	µg/L				
Hexachlorobutadiene	87-68-3	µg/L				
Hexachlorocyclopentadiene	77-47-4	µg/L				
Hexachloropropene	1888-71-7	µg/L				
N-Nitrosodiphenylamine	86-30-6	µg/L				
Pentachlorophenol	87-86-5	µg/L	5.0 U	5.0 U		
Phenol	108-95-2	µg/L				
Phenols (total)	--	µg/L				
Tetrachlorophenols (total)	25167-83-3	µg/L	5.0 U	5.0 U		
Volatile Organic Compounds						
1,2,4-Trichlorobenzene	120-82-1	µg/L				
1,2-Dichlorobenzene	95-50-1	µg/L				
1,3-Dichlorobenzene	541-73-1	µg/L				
1,4-Dichlorobenzene	106-46-7	µg/L				
4-Chlorophenyl phenyl ether	7005-72-3	µg/L				
Benzene	71-43-2	µg/L				
Bis(2-chloroethyl)ether	111-44-4	µg/L				
Bis(2-chloroisopropyl)ether	39638-32-9	µg/L				
Ethylbenzene	100-41-4	µg/L				
Hexachlorobenzene	118-74-1	µg/L				
Pentachloroethane	76-01-7	µg/L				
Toluene	108-88-3	µg/L				
Xylene (total)	1330-20-7	µg/L				

Table 3.2
Groundwater Analytical Data

		Location Name	MW-25B		MW-26	
		Sample Name	DSA-MW25B-092688	DSA-MW25B-100488	DSA-MW26-092688	DSA-MW26-100588
		Sample Date	9/26/1988	10/4/1988	9/26/1988	10/5/1988
Analyte	CAS No.	Unit				
Dioxins/Furans						
2,3,7,8-TCDD	1746-01-6	µg/L				
1,2,3,7,8-PeCDD	40321-76-4	µg/L				
1,2,3,4,7,8-HxCDD	39227-28-6	µg/L				
1,2,3,6,7,8-HxCDD	57653-85-7	µg/L				
1,2,3,7,8,9-HxCDD	19408-74-3	µg/L				
1,2,3,4,6,7,8-HpCDD	35822-46-9	µg/L				
OCDD	3268-87-9	µg/L				
2,3,7,8-TCDF	51207-31-9	µg/L				
1,2,3,7,8-PeCDF	57117-41-6	µg/L				
2,3,4,7,8-PeCDF	57117-31-4	µg/L				
1,2,3,4,7,8-HxCDF	70648-26-9	µg/L				
1,2,3,6,7,8-HxCDF	57117-44-9	µg/L				
1,2,3,7,8,9-HxCDF	72918-21-9	µg/L				
2,3,4,6,7,8-HxCDF	60851-34-5	µg/L				
1,2,3,4,6,7,8-HpCDF	67562-39-4	µg/L				
1,2,3,4,7,8,9-HpCDF	55673-89-7	µg/L				
OCDF	39001-02-0	µg/L				
Dioxin/Furans (MTCA TEQ-HalfND)	DF_TEQ (U=1/2)	µg/L				
Dioxin/Furans (MTCA TEQ-ZeroND)	DF_TEQ (U=0)	µg/L				
Pesticide-Herbicides						
Dinoseb	88-85-7	µg/L				

Notes:

Blank cells are intentional.

All results presented in this table are rounded to two significant figures, with the exception of those for the dioxin/furan TEQ, which are rounded to three significant figures.

-- Not available.

Abbreviations:

°C	Degrees Celsius	µg/L	Micrograms per liter
CAS	Chemical Abstracts Service	mg-CaCO3/L	Milligrams of calcium chloride per liter
CDD	Chlorodibenzo-dioxin	MTCA	Model Toxics Control Act
CDF	Chlorodibenzofuran	OCDD	Octachlorodibenzodioxin
cPAH	Carcinogenic polycyclic hydrocarbon	OCDF	Octachlorodibenzofuran
DRO	Diesel-range organics	ORO	Oil-range organics
HpCDD	Heptachlorodibenzo-p-dioxin	PeCDD	Pentachlorodibenzo-p-dioxin
HpCDF	Heptachlorodibenzofuran	PeCDF	Pentachlorodibenzofuran
HxCDD	Hexachlorodibenzo-p-dioxin	TCDF	Tetrachlorodibenzofuran
HxCDF	Hexachlorodibenzofuran	TEQ	Toxic Equivalent
µohm/cm	Microohms per centimeter	TCDD	Tetrachlorodibenzo-p-dioxin

Qualifiers:

J	Analyte is detected and the concentration is estimated.
JM	Concentration is estimated due to poor match to standard.
U	Analyte is not detected at the associated reporting limit.
UJ	Analyte is not detected at the associated reporting limit, which is an estimate.

Table 3.3
Surface Soil Analytical Data

		Location Name	SS-01	SS-02	SS-03	SS-04	SS-05	SS-06	SS-07	SS-08	SS-09	SS-10		SS-11	VI-SS-200
		Sample Name	SS1-0-0.25	SS2-0-0.25	SS3-0-0.25	SS4-0-0.25	SS5-0-0.25	SS6-0-0.25	SS7-0-0.25	SS8-0-0.25	SS9-0-0.25	SS10-0-0.25	SS10-0-0.25D	SS11-0-0.25	VI-SS-200
		Sample Date	6/10/1988	6/10/1988	6/10/1988	6/10/1988	6/10/1988	6/10/1988	6/10/1988	6/10/1988	6/10/1988	6/10/1988	6/10/1988	6/10/1988	9/22/1988
		Sample Depth	0–0.25 ft	0–0.25 ft	0–0.25 ft	0–0.25 ft	0–0.25 ft	0–0.25 ft	0–0.25 ft	0–0.25 ft	0–0.25 ft	0–0.25 ft	0–0.25 ft	0–0.25 ft	0–0.25 ft
Analyte	**CAS No.**	**Unit**													
Total Petroleum Hydrocarbons															
Total Petroleum Hydrocarbons	--	mg/kg													3,400
Polycyclic Aromatic Hydrocarbons															
Phenanthrene	85-01-8	mg/kg													
Pyrene	129-00-0	mg/kg													
Other Semivolatile Organic Compounds															
Pentachlorophenol	87-86-5	mg/kg	0.64	0.35	0.090	0.67		0.050 U	0.050 U	0.060	0.050 U	0.050 U	0.050 U	0.050 U	1.8 U
Tetrachlorophenols (total)	25167-83-3	mg/kg	0.44	0.62	0.10	0.090	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	2.2
Polychlorinated Biphenyls (PCBs)															
PCBs (Total, Aroclors)	T_PCB (U=0)	mg/kg													
Dioxins/Furans															
2,3,7,8-TCDD	1746-01-6	mg/kg													
1,2,3,7,8-PeCDD	40321-76-4	mg/kg													
1,2,3,4,7,8-HxCDD	39227-28-6	mg/kg													
1,2,3,6,7,8-HxCDD	57653-85-7	mg/kg													
1,2,3,7,8,9-HxCDD	19408-74-3	mg/kg													
1,2,3,4,6,7,8-HpCDD	35822-46-9	mg/kg													
OCDD	3268-87-9	mg/kg													
2,3,7,8-TCDF	51207-31-9	mg/kg													
1,2,3,7,8-PeCDF	57117-41-6	mg/kg													
2,3,4,7,8-PeCDF	57117-31-4	mg/kg													
1,2,3,4,7,8-HxCDF	70648-26-9	mg/kg													
1,2,3,6,7,8-HxCDF	57117-44-9	mg/kg													
1,2,3,7,8,9-HxCDF	72918-21-9	mg/kg													
2,3,4,6,7,8-HxCDF	60851-34-5	mg/kg													
1,2,3,4,6,7,8-HpCDF	67562-39-4	mg/kg													
1,2,3,4,7,8,9-HpCDF	55673-89-7	mg/kg													
OCDF	39001-02-0	mg/kg													
Dioxins/Furans (MTCA TEQ-HalfND)	DF_TEQ (U=1/2)	mg/kg													
Dioxins/Furans (MTCA TEQ-ZeroND)	DF_TEQ (U=0)	mg/kg													

Notes:

Blank cells are intentional.

All results presented in this table are rounded to two significant figures, with the exception of those for the dioxin/furan TEQ, which are rounded to three significant figures.

All results presented on a dry-weight basis.

-- Not available.

1 Historical data did not provide dry weight result, or measurement basis unknown.

Abbreviations:

CAS	Chemical Abstracts Service	HxCDD	Hexachlorodibenzo-p-dioxin	PeCDD	Pentachlorodibenzo-p-dioxin
CDD	Chlorodibenzo-dioxin	HxCDF	Hexachlorodibenzofuran	PeCDF	Pentachlorodibenzofuran
CDF	Chlorodibenzofuran	mg/kg	Milligrams per kilogram	TCDF	Tetrachlorodibenzofuran
ft	Feet	MTCA	Model Toxics Control Act	TEQ	Toxic Equivalent
HpCDD	Heptachlorodibenzo-p-dioxin	OCDD	Octachlorodibenzodioxin	TCDD	Tetrachlorodibenzo-p-dioxin
HpCDF	Heptachlorodibenzofuran	OCDF	Octachlorodibenzofuran		

Qualifiers:

J Analyte is detected and the concentration is estimated.

U Analyte is not detected at the associated reporting limit.

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

Table 3.3
Surface Soil Analytical Data

Location Name			VI-SS-201	VI-SS-202	VI-SS-203	VI-SS-204	SS-02-Phase1	SS-03-Phase1	TR-02	TR-03	TR-04	TR-05	BG-01
Sample Name			VI-SS-201	VI-SS-202	VI-SS-203	VI-SS-204	SS02-0-0.25	SS03-0-0.25	TR02-0-0.25	TR03-0-0.25	TR04-0-0.25	TR05-0-0.25	BG1-0.0-0.5
Sample Date			9/22/1988	9/22/1988	9/22/1988	9/22/1988	5/10/1988	5/10/1988	5/10/1988	5/10/1988	5/10/1988	5/10/1988	6/12/1988
Sample Depth			0–0.25 ft	0–0.25 ft	0–0.25 ft	0–0.25 ft	0–0.25 ft	0–0.25 ft	0–0.25 ft	0–0.25 ft	0–0.25 ft	0–0.25 ft	0–0.5 ft
Analyte	**CAS No.**	**Unit**											
Total Petroleum Hydrocarbons													
Total Petroleum Hydrocarbons	--	mg/kg											
Polycyclic Aromatic Hydrocarbons													
Phenanthrene	85-01-8	mg/kg						2,400					
Pyrene	129-00-0	mg/kg											
Other Semivolatile Organic Compounds													
Pentachlorophenol	87-86-5	mg/kg	2.5 U	1.2 U	1.9 U	1.5 U	270						0.050 U (1)
Tetrachlorophenols (total)	25167-83-3	mg/kg	2.5 U	1.2 U	1.9 U	1.5 U	40						0.050 U (1)
Polychlorinated Biphenyls (PCBs)													
PCBs (Total, Aroclors)	T_PCB (U=0)	mg/kg							2.4 U	2.4 U	2.4 U	4.8	
Dioxins/Furans													
2,3,7,8-TCDD	1746-01-6	mg/kg											0.0000080 U
1,2,3,7,8-PeCDD	40321-76-4	mg/kg											0.000010 U
1,2,3,4,7,8-HxCDD	39227-28-6	mg/kg											0.000030 UJ
1,2,3,6,7,8-HxCDD	57653-85-7	mg/kg											0.000282
1,2,3,7,8,9-HxCDD	19408-74-3	mg/kg											0.000104
1,2,3,4,6,7,8-HpCDD	35822-46-9	mg/kg											0.0123
OCDD	3268-87-9	mg/kg											0.0815
2,3,7,8-TCDF	51207-31-9	mg/kg											0.000013
1,2,3,7,8-PeCDF	57117-41-6	mg/kg											0.0000080 U
2,3,4,7,8-PeCDF	57117-31-4	mg/kg											0.000019
1,2,3,4,7,8-HxCDF	70648-26-9	mg/kg											0.000098
1,2,3,6,7,8-HxCDF	57117-44-9	mg/kg											0.000066
1,2,3,7,8,9-HxCDF	72918-21-9	mg/kg											0.000010 U
2,3,4,6,7,8-HxCDF	60851-34-5	mg/kg											0.000116
1,2,3,4,6,7,8-HpCDF	67562-39-4	mg/kg											0.00274
1,2,3,4,7,8,9-HpCDF	55673-89-7	mg/kg											0.000192 UJ
OCDF	39001-02-0	mg/kg											0.00638
Dioxins/Furans (MTCA TEQ-HalfND)	DF_TEQ (U=1/2)	mg/kg											0.000262 J
Dioxins/Furans (MTCA TEQ-ZeroND)	DF_TEQ (U=0)	mg/kg											0.00025 J

Notes:

Blank cells are intentional.

All results presented in this table are rounded to two significant figures, with the exception of those for the dioxin/furan TEQ, which are rounded to three significant figures.

All results presented on a dry-weight basis.

-- Not available.

1 Historical data did not provide dry weight result, or measurement basis unknown.

Abbreviations:

CAS	Chemical Abstracts Service	HxCDD	Hexachlorodibenzo-p-dioxin	PeCDD	Pentachlorodibenzo-p-dioxin
CDD	Chlorodibenzo-dioxin	HxCDF	Hexachlorodibenzofuran	PeCDF	Pentachlorodibenzofuran
CDF	Chlorodibenzofuran	mg/kg	Milligrams per kilogram	TCDF	Tetrachlorodibenzofuran
ft	Feet	MTCA	Model Toxics Control Act	TEQ	Toxic Equivalent
HpCDD	Heptachlorodibenzo-p-dioxin	OCDD	Octachlorodibenzodioxin	TCDD	Tetrachlorodibenzo-p-dioxin
HpCDF	Heptachlorodibenzofuran	OCDF	Octachlorodibenzofuran		

Qualifiers:

J Analyte is detected and the concentration is estimated.

U Analyte is not detected at the associated reporting limit.

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

Table 3.4
Subsurface Soil Analytical Data for PCP and TeCP

			Analyte	Pentachlorophenol	Tetrachlorophenols (total)	2,3,4,6-Tetrachlorophenol
			CAS No.	87-86-5	25167-83-3	58-90-2
			Unit	mg/kg	mg/kg	mg/kg
Location Name	Sample Name	Sample Date	Sample Depth			
H-1-02	HC1-9.0-10.0	10/30/2002	9–10 ft	0.50 U		0.10 U
H-3-02	HC3-3.0-4.0	10/30/2002	3–4 ft	0.50 U		0.10 U
	HC3-8.0-9.0	10/30/2002	8–9 ft	0.50 U		0.10 U
H-4-02	HC4-3.0-4.0	10/30/2002	3–4 ft	0.50 U		0.10 U
	HC4-13.0-14.0	10/31/2002	13–14 ft	0.50 U		0.10 U
H-6-02	HC6-9.0-10.0	10/30/2002	9–10 ft	0.50 U		0.10 U
H-7-02	HC7-3.0-4.0	10/30/2002	3–4 ft	0.50 U		0.10 U
HC-C-PA	HC-C-PA-5.0-6.5	9/10/2002	5–6.5 ft	0.50 U		0.10 U
	HC-C-PA-25.0-26.5	9/10/2002	25–26.5 ft	0.50 U		0.10 U
	HC-NE-PA-20.0-21.5	9/10/2002	20–21.5 ft	0.50 U		0.10 U
HC-NW-PA	HC-NW-PA-10.0-11.5	9/10/2002	10–11.5 ft	0.50 U		0.10 U
	HC-NW-PA-25.0-26.5	9/10/2002	25–26.5 ft	0.50 U		0.10 U
HC-SE-PA	HC-SE-PA-0.0-1.0	9/10/2002	0–1 ft	0.50 U		0.10 U
	HC-SE-PA-5.0-6.5	9/10/2002	5–6.5 ft	0.50 U		0.10 U
	HC-SE-PA-7.5-9.0	9/10/2002	7.5–9 ft	0.50 U		0.10 U
	HC-SE-PA-10.0-11.5	9/10/2002	10–11.5 ft	0.50 U		0.10 U
	HC-SE-PA-20.0-21.5	9/10/2002	20–21.5 ft			
	HC-SW-PA-5.0-6.5	9/10/2002	5–6.5 ft	0.50 U		0.10 U
	HC-SW-PA-15.0-16.5	9/10/2002	15–16.5 ft	0.50 U		0.10 U
B-03	B3-COMP	5/9/1988	2.5–13.5 ft	0.025 U	0.025 U	
	B3-15.0-16.5	5/9/1988	15–16.5 ft	0.025 U	0.025 U	
B-06	B6-COMP	5/13/1988	--	11	3.6	
MW-06B	B6B-2.5-4.0	8/30/1988	2.5–4 ft	1.0 U (1)	1.0 U (1)	
	B6B-7.5-9.0	8/30/1988	7.5–9 ft	1.0 U (1)	1.0 U (1)	
	B6B-5.0-6.5	8/30/1988	5–6.5 ft	1.0 U (1)	1.0 U (1)	
	B6B-30.0-31.5	8/30/1988	30–31.5 ft	1.0 U (1)	1.4 JM (1)	
	B6B-50.0-51.5	8/30/1988	50–51.5 ft	1.0 U (1)	1.0 U (1)	
MW-06C	B6C-2.5-4.0	10/6/1988	2.5–4 ft	1.1 U	1.1 U	
	B6C-5.0-6.5	10/6/1988	5–6.5 ft	1.3 U	1.3 U	
	B6C-7.5-9.0	10/6/1988	7.5–9 ft	1.2 U	1.2 U	
	B6C-17.5-19.0	10/6/1988	17.5–19 ft	1.2 U	1.2 U	
B-08	B8-COMP	5/16/1988	--	0.025 U	0.025 U	
MW-08B	B8B-2.5-4.0	9/12/1988	2.5–4 ft	1.1 U	1.1 U	
	B8B-2.5-4.0D	9/12/1988	2.5–4 ft	1.1 U	1.1 U	
	B8B-5.0-6.5	9/12/1988	5–6.5 ft	1.2 U	1.2 U	
	B8B-7.5-9.0	9/12/1988	7.5–9 ft	1.1 U	1.1 U	
	B8B-30.0-31.5	9/12/1988	30–31.5 ft	1.3 U	1.3 U	
	B8B-50.0-51.5	9/12/1988	50–51.5 ft	1.4 U	1.4 U	
B-15	B15-0.0-1.5	6/9/1988	0–1.5 ft	0.25	0.75	
	B15-5.0-6.5	6/9/1988	5–6.5 ft	0.23	0.050 U	
	B15-7.5-9.0	6/9/1988	7.5–9 ft	0.18	0.050 U	
	B15-10.0-11.5	6/9/1988	10–11.5 ft	0.15	0.19	
	B15-12.5-14.0	6/9/1988	12.5–14 ft	0.12	0.050 U	
	B15-15.0-16.5	6/9/1988	15–16.5 ft	0.20	0.050 U	
B-16	B16-0.0-1.5	6/9/1988	0–1.5 ft	2.7	2.7	
	B16-2.5-4.0	6/9/1988	2.5–4 ft	0.48	0.18	
	B16-5.0-6.5	6/9/1988	5–6.5 ft	3.0	1.9	
	B16-7.5-9.0	6/9/1988	7.5–9 ft	1.8	2.1	
	B16-10.0-11.5	6/9/1988	10–11.5 ft	34	4.5	
	B16-12.5-14.0	6/9/1988	12.5–14 ft	3.1	0.41	
	B16-12.5-14.0D	6/10/1988	12.5–14 ft	3.8	0.10 U	
	B16-15.0-16.5	6/10/1988	15–16.5 ft	6.3	0.10 U	
	B16-17.5-19.0	6/10/1988	17.5–19 ft	4.8	0.10 U	
	B16-20.0-21.5	6/9/1988	20–21.5 ft	1.6	0.13	
MW-16A	B16A-10.0-11.5	6/12/1988	10–11.5 ft	36	0.10 U	
	B16A-15.0-16.5	6/12/1988	15–16.5 ft	3.2	0.10 U	
MW-16B	B16B-2.5-4.0	9/8/1988	2.5–4 ft	1.0 U	1.0 U	
	B16B-30.0-31.5	9/8/1988	30–31.5 ft	1.3 U	1.3 U	
	B16B-5.0-6.5	9/8/1988	5–6.5 ft	1.1 U	1.1 U	
	B16B-7.5-9.0	9/8/1988	7.5–9 ft	1.2 U	1.2 U	
	B16B-50.0-51.5	9/8/1988	50–51.5 ft	1.4 U	1.4 U	
	B16B-50.0-51.5D	9/8/1988	50–51.5 ft	1.4 U	1.4 U	
B-16C	B16C-9.0-14.0	11/16/1988	9–14 ft	1.3 U		
	B16C-9.0-14.0D	11/16/1988	9–14 ft	24 (1)		
B-17	B17-0.0-1.5	6/10/1988	0–1.5 ft	0.12	0.050 U	
	B17-0.0-1.5D	6/10/1988	0–1.5 ft	0.050 U	0.050 U	
	B17-2.5-4.0	6/10/1988	2.5–4 ft	0.28	0.050 U	
	B17-5.0-6.5	6/10/1988	5–6.5 ft	0.33	0.050 U	
	B17-7.5-9.0	6/10/1988	7.5–9 ft	0.18	0.080	
	B17-10.0-11.5	6/10/1988	10–11.5 ft	0.12	0.050 U	
	B17-12.5-14.0	6/9/1988	12.5–14 ft	6.8	0.45	
	B17-12.5-14.0D1	6/9/1988	12.5–14 ft	1.9	0.33	
	B17-12.5-14.0D2	6/12/1988	12.5–14 ft	0.62		
	B17-15.0-17.5	6/10/1988	15–17.5 ft	0.050 U	0.050 U	
	B17-17.5-19.0	6/10/1988	17.5–19 ft	0.050 U	0.050 U	
	B17-20.0-21.5	6/10/1988	20–21.5 ft	0.050 U	0.050 U	
	B17-22.5-24.0	6/10/1988	22.5–24 ft	0.050 U	0.050 U	
	B17-22.5-24.0D	6/10/1988	22.5–24 ft	0.090	0.090	
	B17-25.0-26.5	6/10/1988	25–26.5 ft	0.090	0.13	
	B17-27.5-29.0	6/10/1988	27.5–29 ft	0.080	0.050 U	
	B17-30.0-31.5	6/10/1988	30–31.5 ft	0.11	0.050 U	
B-18	B18-0.0-1.5	6/10/1988	0–1.5 ft	0.23	0.050 U	
	B18-2.5-4.0	6/10/1988	2.5–4 ft	0.18	0.050 U	
	B18-5.0-6.5	6/10/1988	5–6.5 ft	0.090	0.050 U	
	B18-7.5-9.0	6/10/1988	7.5–9 ft	0.11	0.050 U	
	B18-10.0-11.5	6/10/1988	10–11.5 ft	0.070	0.050 U	
	B18-12.5-14.0	6/10/1988	12.5–14 ft	0.62	0.060	
	B18-17.5-19.0	6/10/1988	17.5–19 ft	0.27	0.050 U	
	B18-20.0-21.5	6/10/1988	20–21.5 ft	0.10	0.050 U	
	B18-22.5-24.0	6/10/1988	22.5–24 ft	0.12	0.050 U	
	B18-25.0-26.5	6/10/1988	25–26.5 ft	0.35	0.050 U	
	B18-27.5-29.0	6/10/1988	27.5–29 ft	0.050	0.050 U	

Table 3.4
Subsurface Soil Analytical Data for PCP and TeCP

			Analyte	Pentachlorophenol	Tetrachlorophenols (total)	2,3,4,6-Tetrachlorophenol
			CAS No.	87-86-5	25167-83-3	58-90-2
			Unit	mg/kg	mg/kg	mg/kg
Location Name	Sample Name	Sample Date	Sample Depth			
MW-19	B19-0.0-1.5	6/11/1988	0–1.5 ft	0.050 U	0.050 U	
	B19-2.5-4.0	6/11/1988	2.5–4 ft	0.050 U	0.050 U	
	B19-5.0-6.5	6/11/1988	5–6.5 ft	0.060	0.050 U	
	B19-7.5-9.0	6/11/1988	7.5–9 ft	0.050 U	0.050 U	
	B19-10.0-11.5	6/11/1988	10–11.5 ft	0.090	0.050 U	
	B19-12.5-14.0	6/11/1988	12.5–14 ft	0.060	0.050 U	
	B19-15.0-16.5	6/11/1988	15–16.5 ft	0.050 U	0.050 U	
	B19-15.0-16.5D	6/11/1988	15–16.5 ft	0.050 U	0.050 U	
	B19-17.5-19.0	6/11/1988	17.5–19 ft	0.11	0.050 U	
	B19-17.5-19.0D	6/11/1988	17.5–19 ft	0.050 U	0.050 U	
	B19-20.0-21.5	6/11/1988	20–21.5 ft	0.050 U	0.050 U	
	B19-22.5-24.0	6/11/1988	22.5–24 ft	0.050 U	0.050 U	
MW-20	B20-0.0-1.5	6/16/1988	0–1.5 ft	0.050 U	0.050 U	
	B20-2.5-4.0	6/16/1988	2.5–4 ft	0.050 U	0.050 U	
	B20-5.0-6.5	6/16/1988	5–6.5 ft	0.050 U	0.050 U	
	B20-7.5-9.0	6/16/1988	7.5–9 ft	0.050 U	0.050 U	
	B20-10.0-11.5	6/16/1988	10–11.5 ft	0.050 U	0.050 U	
	B20-12.5-14.0	6/16/1988	12.5–14 ft	0.050 U	0.050 U	
	B20-12.5-14.0D	6/16/1988	12.5–14 ft	0.050 U	0.050 U	
MW-21	B21-0.0-1.5	6/12/1988	0–1.5 ft	0.050 U	0.050 U	
	B21-2.5-4.0	6/12/1988	2.5–4 ft	0.050 U	0.050 U	
	B21-5.0-6.5	6/12/1988	5–6.5 ft	0.20 U		
	B21-7.5-9.0	6/12/1988	7.5–9 ft	0.10	0.050 U	
	B21-10.0-11.5	6/12/1988	10–11.5 ft	0.20	0.050 U	
	B21-12.5-14.0	6/12/1988	12.5–14 ft	0.10	0.050 U	
	B21-15.0-16.5	6/12/1988	15–16.5 ft	0.050 U	0.050 U	
MW-22	B22-0.0-1.5	6/12/1988	0–1.5 ft	0.050 U	0.050 U	
	B22-2.5-4.0	6/12/1988	2.5–4 ft	0.050 U	0.050 U	
	B22-5.0-6.5	6/12/1988	5–6.5 ft	0.050 U	0.050 U	
	B22-7.5-9.0	6/12/1988	7.5–9 ft	0.050 U	0.050 U	
	B22-10.0-11.5	6/12/1988	10–11.5 ft	0.050 U	0.050 U	
	B22-12.5-14.0	6/12/1988	12.5–14 ft	0.050 U	0.050 U	
	B22-12.5-14.0D	6/12/1988	12.5–14 ft	0.050 U	0.050 U	
	B22-15.0-16.5	6/12/1988	15–16.5 ft	0.050 U	0.050 U	
MW-23	B23-2.5-4.0	8/29/1988	2.5–4 ft	1.0 U (1)	1.0 U (1)	
	B23-5.0-6.5	8/29/1988	5–6.5 ft	1.0 U (1)	1.0 U (1)	
	B23-7.5-9.0	8/29/1988	7.5–9 ft	1.0 U (1)	1.0 U (1)	
	B23-10.0-11.5	8/29/1988	10–11.5 ft	1.0 U (1)	1.0 U (1)	
	B23-17.5-19.0	8/29/1988	17.5–19 ft	1.0 U (1)	1.0 U (1)	
MW-24A	B24-2.5-4.0	9/1/1988	2.5–4 ft	1.1 U	1.1 U	
	B24-5.0-6.5	9/1/1988	5–6.5 ft	1.2 U	4.6 JM	
	B24-7.5-9.0	9/1/1988	7.5–9 ft	1.1 U	3.8 JM	
	B24-20.0-21.5	9/1/1988	20–21.5 ft	1.3 U	1.3 U	
MW-24B	B24B-12.5-14.0	9/6/1988	12.5–14 ft	1.4 U	1.4 U	
	B24B-2.5-4.0	9/6/1988	2.5–4 ft	1.2 U	2.7 JM	
	B24B-7.5-9.0	9/6/1988	7.5–9 ft	2.8 J	1.4 JM	
	B24B-35.0-36.5	9/6/1988	35–36.5 ft	2.2 JM	1.3 U	
	B24B-50.0-51.5	9/6/1988	50–51.5 ft	1.4 U	1.4 U	
	B24B-50.0-51.5D	9/6/1988	50–51.5 ft	1.4 U	1.4 U	
MW-25A	B25A-2.5-4.0	9/15/1988	2.5–4 ft	1.1 U	1.1 U	
	B25A-5.0-6.5	9/15/1988	5–6.5 ft	1.1 U	1.1 U	
	B25A-7.5-9.0	9/15/1988	7.5–9 ft	1.2 U	1.2 U	
	B25A-17.0-18.5	9/15/1988	17–18.5 ft	1.3 U	1.3 U	
	B25A-17.0-18.5D	9/15/1988	17–18.5 ft	1.3 U	1.3 U	
MW-25B	B25B-0.0-1.5	9/14/1988	0–1.5 ft	1.1 U	1.1 U	
	B25B-2.5-4.0	9/14/1988	2.5–4 ft	1.1 U	1.1 U	
	B25B-5.0-6.5	9/14/1988	5–6.5 ft	1.1 U	1.1 U	
	B25B-5.0-6.5D	9/14/1988	5–6.5 ft	1.1 U	1.1 U	
	B25B-30.0-31.5	9/14/1988	30–31.5 ft	1.3 U	1.3 U	
	B25B-50.0-51.5	9/14/1988	50–51.5 ft	1.5 U	1.5 U	
MW-26	B26-2.5-4.0	9/19/1988	2.5–4 ft	1.6 U (1)		
	B26-5.0-6.5	9/19/1988	5–6.5 ft	1.6 U (1)		
	B26-17.0-18.5	9/19/1988	17–18.5 ft	1.6 U (1)		
HA-01	HA1-0.5-1.0	6/11/1988	0.5–1 ft	0.25	0.60	
	HA1-1.0-2.0	6/11/1988	1–2 ft	0.10	0.050 U	
	HA1-2.0-2.5	6/11/1988	2–2.5 ft	0.060	0.050 U	
HA-02	HA2-0.5-1.0	6/11/1988	0.5–1 ft	0.050 U	0.050 U	
	HA2-1.0-2.0	6/11/1988	1–2 ft	0.050 U	0.050 U	
HA-03	HA3-0.33-1.0	6/12/1988	0.33–1 ft	0.050 U	0.050 U	
	HA3-1.0-2.0	6/12/1988	1–2 ft	0.050 U	0.050 U	
	HA3-2.0-2.5	6/12/1988	2–2.5 ft	0.050 U	0.050 U	
HA-04	HA4-0.5-1.0	6/11/1988	0.5–1 ft	0.050 U	0.050 U	
	HA4-1.0-2.0	6/11/1988	1–2 ft	0.050 U	0.050 U	
HA-05	HA5-0.5-1.0	6/12/1988	0.5–1 ft	0.050 U	0.050 U	
HA-06	HA6-0.5-1	6/12/1988	0.5–1 ft	0.050 U	0.050 U	
	HA6-1-2	6/12/1988	1–2 ft	0.050 U	0.050 U	

Notes:

Blank cells are intentional.
All results presented on a dry-weight basis and rounded to two significant figures.
-- Not available.
1 Historical data did not provide dry weight result, or measurement basis unknown.

Abbreviations:

CAS Chemical Abstracts Service
ft Feet
mg/kg Milligrams per kilogram
PCP Pentachlorophenol
TeCP Tetrachlorophenol

Qualifiers:

J Analyte is detected and the concentration is estimated.
JM Concentration is estimated due to poor match to standard.
U Analyte is not detected at the associated reporting limit.

Table 3.5
Subsurface Soil Analytical Data for Other Analytes

Location Name			H-1-02	H-2-02	H-3-02		H-4-02		H-5-02	H-6-02	H-7-02	HC-C-PA		HC-NE-PA
Sample Name			HC1-9.0-10.0	HC2-9.0-10.0	HC3-3.0-4.0	HC3-8.0-9.0	HC4-3.0-4.0	HC4-13.0-14.0	HC5-5.0-6.0	HC6-9.0-10.0	HC7-3.0-4.0	HC-C-PA-5.0-6.5	HC-C-PA-25.0-26.5	HC-NE-PA-10.0-11.5
Sample Date			10/30/2002	10/30/2002	10/30/2002	10/30/2002	10/30/2002	10/31/2002	10/30/2002	10/30/2002	10/30/2002	9/10/2002	9/10/2002	9/10/2002
Sample Depth			9–10 ft	9–10 ft	3–4 ft	8–9 ft	3–4 ft	13–14 ft	5–6 ft	9–10 ft	3–4 ft	5–6.5 ft	25–26.5 ft	10–11.5 ft
Analyte	**CAS No.**	**Unit**												
Conventionals														
Salinity	--	%	0.010	0.0050 U	0.050	0.50	0.030	0.0050	0.020	0.0050	0.020			
Metals														
Arsenic	7440-38-2	mg/kg	5.0 U		5.0 U		5.0 U	5.0 U		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Barium	7440-39-3	mg/kg	50 U		50 U		50 U	50 U		50 U	50 U	20 U	20 U	20 U
Beryllium	7440-41-7	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
Chromium	7440-47-3	mg/kg	6.0		5.0 U		5.0 U	5.0 U		7.0	7.0	5.0 U	5.0	10
Cobalt	7440-48-4	mg/kg												
Lead	7439-92-1	mg/kg	5.0 U		5.0 U		140	29 U		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Mercury	7439-97-6	mg/kg	0.50 U		0.50 U		0.50 U	0.50 U		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Nickel	7440-02-0	mg/kg												
Selenium	7782-49-2	mg/kg	50 U		50 U		50 U	50 U		50 U	50 U	50 U	50 U	50 U
Silver	7440-22-4	mg/kg	20 U		20 U		20 U	20 U		20 U	20 U	20 U	20 U	20 U
Vanadium	7440-62-2	mg/kg												
Zinc	7440-66-6	mg/kg												
Total Petroleum Hydrocarbons														
Diesel-range organics	DRO	mg/kg	20 U	20 U	73	54	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Oil-range organics	ORO	mg/kg	50 U	50 U	50 U	50 U	640	50 U	50 U	50 U	50 U	50 U	50 U	50 U
Total DRO & ORO	T_DRO&ORO (U=0)	mg/kg	50 U	50 U	73	54	640	50 U	50 U	50 U	50 U	50 U	50 U	50 U
Polycyclic Aromatic Hydrocarbons														
Acenaphthene	83-32-9	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
Acenaphthylene	208-96-8	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
Anthracene	120-12-7	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
Benzo(a)anthracene	56-55-3	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
Benzo(a)pyrene	50-32-8	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
Benzo(b)fluoranthene	205-99-2	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
Benzo(g,h,i)perylene	191-24-2	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
Benzo(k)fluoranthene	207-08-9	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
Chrysene	218-01-9	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
cPAHs (MTCA TEQ-HalfND)	BaPEq (U=1/2)	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
cPAHs (MTCA TEQ-ZeroND)	BaPEq (U=0)	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
Dibenzo(a,h)anthracene	53-70-3	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
Fluoranthene	206-44-0	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
Fluorene	86-73-7	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
Naphthalene	91-20-3	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
Phenanthrene	85-01-8	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
Pyrene	129-00-0	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
Semivolatile Organic Compounds														
2,4,5-Trichlorophenol	95-95-4	mg/kg	0.50 U		0.50 U	0.50 U	0.50 U	0.50 U		0.50 U	0.50 U	0.50 U	0.50 U	
2,4,6-Trichlorophenol	88-06-2	mg/kg	0.50 U		0.50 U	0.50 U	0.50 U	0.50 U		0.50 U	0.50 U	0.50 U	0.50 U	
2,4-Dichlorophenol	120-83-2	mg/kg	0.50 U		0.50 U	0.50 U	0.50 U	0.50 U		0.50 U	0.50 U	0.50 U	0.50 U	
2,4-Dimethylphenol	105-67-9	mg/kg	0.50 U		0.50 U	0.50 U	0.50 U	0.50 U		0.50 U	0.50 U	0.50 U	0.50 U	
2,4-Dinitrophenol	51-28-5	mg/kg	0.50 U		0.50 U	0.50 U	0.50 U	0.50 U		0.50 U	0.50 U	0.50 U	0.50 U	
2,6-Dichlorophenol	87-65-0	mg/kg	0.50 U		0.50 U	0.50 U	0.50 U	0.50 U		0.50 U	0.50 U	0.50 U	0.50 U	
2-Chloronaphthalene	91-58-7	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
2-Chlorophenol	95-57-8	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
2-Methylphenol	95-48-7	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	

Table 3.5
Subsurface Soil Analytical Data for Other Analytes

Location Name			H-1-02	H-2-02	H-3-02		H-4-02		H-5-02	H-6-02	H-7-02	HC-C-PA		HC-NE-PA
Sample Name			HC1-9.0-10.0	HC2-9.0-10.0	HC3-3.0-4.0	HC3-8.0-9.0	HC4-3.0-4.0	HC4-13.0-14.0	HC5-5.0-6.0	HC6-9.0-10.0	HC7-3.0-4.0	HC-C-PA-5.0-6.5	HC-C-PA-25.0-26.5	HC-NE-PA-10.0-11.5
Sample Date			10/30/2002	10/30/2002	10/30/2002	10/30/2002	10/30/2002	10/31/2002	10/30/2002	10/30/2002	10/30/2002	9/10/2002	9/10/2002	9/10/2002
Sample Depth			9–10 ft	9–10 ft	3–4 ft	8–9 ft	3–4 ft	13–14 ft	5–6 ft	9–10 ft	3–4 ft	5–6.5 ft	25–26.5 ft	10–11.5 ft
Analyte	**CAS No.**	**Unit**												
Semivolatile Organic Compounds (cont.)														
2-Nitrophenol	88-75-5	mg/kg	0.50 U		0.50 U	0.50 U	0.50 U	0.50 U		0.50 U	0.50 U	0.50 U	0.50 U	
3- & 4-Methylphenol	15831-10-4	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
4-Chloro-3-methylphenol	59-50-7	mg/kg	0.50 U		0.50 U	0.50 U	0.50 U	0.50 U		0.50 U	0.50 U	0.50 U	0.50 U	
4-Methylphenol	106-44-5	mg/kg												
4-Nitrophenol	100-02-7	mg/kg	0.50 U		0.50 U	0.50 U	0.50 U	0.50 U		0.50 U	0.50 U	0.50 U	0.50 U	
Benzoic acid	65-85-0	mg/kg												
Bis(2-chloroethoxy)methane	111-91-1	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg												
Butyl benzyl phthalate	85-68-7	mg/kg	0.50 U		0.50 U	0.50 U	0.50 U	0.50 U		0.50 U	0.50 U	0.50 U	0.50 U	
Dibenzofuran	132-64-9	mg/kg												
Diethylphthalate	84-66-2	mg/kg	0.50 U		0.50 U	0.50 U	0.50 U	0.50 U		0.50 U	0.50 U	0.50 U	0.50 U	
Dimethyl phthalate	131-11-3	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
Di-n-butyl phthalate	84-74-2	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
Di-n-octyl phthalate	117-84-0	mg/kg	0.50 U		0.50 U	0.50 U	0.50 U	0.50 U		0.50 U	0.50 U	0.50 U	0.50 U	
Hexachlorobutadiene	87-68-3	mg/kg	0.50 U		0.50 U	0.50 U	0.50 U	0.50 U		0.50 U	0.50 U	0.50 U	0.50 U	
Hexachlorocyclopentadiene	77-47-4	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
Hexachloropropene	1888-71-7	mg/kg	0.50 U		0.50 U	0.50 U	0.50 U	0.50 U		0.50 U	0.50 U	0.50 U	0.50 U	
N-Nitrosodiphenylamine	86-30-6	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
Phenol	108-95-2	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
Volatile Organic Compounds														
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												
1,2,4-Trichlorobenzene	120-82-1	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
1,2-Dichlorobenzene	95-50-1	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
1,2-Dichloroethane	107-06-2	mg/kg												
1,2-Dichloropropane	78-87-5	mg/kg												
1,3-Dichlorobenzene	541-73-1	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
1,4-Dichlorobenzene	106-46-7	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
2-Chloroethyl vinyl ether	110-75-8	mg/kg												
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
Benzene	71-43-2	mg/kg												
Bis(2-chloroethyl)ether	111-44-4	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
Bis(2-chloroisopropyl)ether	39638-32-9	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
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												
Chloroethane	75-00-3	mg/kg												
Chloroform	67-66-3	mg/kg												
Chloromethane	74-87-3	mg/kg												
cis-1,3-Dichloropropene	10061-01-5	mg/kg												
Dibromochloromethane	124-48-1	mg/kg												
Dichlorodifluoromethane	75-71-8	mg/kg												
Ethylbenzene	100-41-4	mg/kg												
Hexachlorobenzene	118-74-1	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	

Table 3.5
Subsurface Soil Analytical Data for Other Analytes

		Location Name	H-1-02	H-2-02	H-3-02		H-4-02		H-5-02	H-6-02	H-7-02	HC-C-PA		HC-NE-PA
		Sample Name	HC1-9.0-10.0	HC2-9.0-10.0	HC3-3.0-4.0	HC3-8.0-9.0	HC4-3.0-4.0	HC4-13.0-14.0	HC5-5.0-6.0	HC6-9.0-10.0	HC7-3.0-4.0	HC-C-PA-5.0-6.5	HC-C-PA-25.0-26.5	HC-NE-PA-10.0-11.5
		Sample Date	10/30/2002	10/30/2002	10/30/2002	10/30/2002	10/30/2002	10/31/2002	10/30/2002	10/30/2002	10/30/2002	9/10/2002	9/10/2002	9/10/2002
		Sample Depth	9–10 ft	9–10 ft	3–4 ft	8–9 ft	3–4 ft	13–14 ft	5–6 ft	9–10 ft	3–4 ft	5–6.5 ft	25–26.5 ft	10–11.5 ft
Analyte	**CAS No.**	**Unit**												
Volatile Organic Compounds (cont.)														
Methylene chloride	75-09-2	mg/kg												
Pentachloroethane	76-01-7	mg/kg	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	0.10 U	0.10 U	
Tetrachloroethene	127-18-4	mg/kg												
Toluene	108-88-3	mg/kg												
trans-1,2-Dichloroethene	156-60-5	mg/kg												
trans-1,3-Dichloropropene	10061-02-6	mg/kg												
Trichloroethene	79-01-6	mg/kg												
Trichlorofluoromethane	75-69-4	mg/kg												
Vinyl chloride	75-01-4	mg/kg												
Xylene (total)	1330-20-7	mg/kg												
Dioxins/Furans														
2,3,7,8-TCDD	1746-01-6	mg/kg												
1,2,3,7,8-PeCDD	40321-76-4	mg/kg												
1,2,3,4,7,8-HxCDD	39227-28-6	mg/kg												
1,2,3,6,7,8-HxCDD	57653-85-7	mg/kg												
1,2,3,7,8,9-HxCDD	19408-74-3	mg/kg												
1,2,3,4,6,7,8-HpCDD	35822-46-9	mg/kg												
OCDD	3268-87-9	mg/kg												
2,3,7,8-TCDF	51207-31-9	mg/kg												
1,2,3,7,8-PeCDF	57117-41-6	mg/kg												
2,3,4,7,8-PeCDF	57117-31-4	mg/kg												
1,2,3,4,7,8-HxCDF	70648-26-9	mg/kg												
1,2,3,6,7,8-HxCDF	57117-44-9	mg/kg												
1,2,3,7,8,9-HxCDF	72918-21-9	mg/kg												
2,3,4,6,7,8-HxCDF	60851-34-5	mg/kg												
1,2,3,4,6,7,8-HpCDF	67562-39-4	mg/kg												
1,2,3,4,7,8,9-HpCDF	55673-89-7	mg/kg												
OCDF	39001-02-0	mg/kg												
Dioxins/Furans (MTCA TEQ-HalfND)	DF_TEQ (U=1/2)	mg/kg												
Dioxins/Furans (MTCA TEQ-ZeroND)	DF_TEQ (U=0)	mg/kg												
Pesticide-Herbicides														
Dinoseb	88-85-7	mg/kg	0.50 U		0.50 U	0.50 U	0.50 U	0.50 U		0.50 U	0.50 U	0.50 U	0.50 U	

Notes:

Blank cells are intentional.

All results presented in this table are rounded to two significant figures, with the exception of those for the dioxin/furan TEQ, which are rounded to three significant figures.

All results presented on a dry-weight basis.

-- Not available.

1 Historical data did not provide dry weight result, or measurement basis unknown.

Abbreviations:

CAS	Chemical Abstracts Service
CDD	Chlorodibenzo-dioxin
CDF	Chlorodibenzofuran
cPAH	Carcinogenic polycyclic aromatic hydrocarbon
DRO	Diesel-range organics
ft	Feet
HpCDD	Heptachlorodibenzo-p-dioxin
HpCDF	Heptachlorodibenzofuran
HxCDD	Hexachlorodibenzo-p-dioxin
HxCDF	Hexachlorodibenzofuran
mg/kg	Milligrams per kilogram
MTCA	Model Toxics Control Act
OCDD	Octachlorodibenzodioxin
ORO	Oil-range organics
OCDF	Octachlorodibenzofuran
PeCDD	Pentachlorodibenzo-p-dioxin
PeCDF	Pentachlorodibenzofuran
TCDF	Tetrachlorodibenzofuran
TEQ	Toxic Equivalent
TCDD	Tetrachlorodibenzo-p-dioxin

Qualifiers:

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

Table 3.5
Subsurface Soil Analytical Data for Other Analytes

		Location Name	HC-NE-PA (cont.)	HC-NW-PA		HC-SE-PA					HC-SW-PA		B-04
		Sample Name	HC-NE-PA-20.0-21.5	HC-NW-PA-10.0-11.5	HC-NW-PA-25.0-26.5	HC-SE-PA-0.0-1.0	HC-SE-PA-5.0-6.5	HC-SE-PA-7.5-9.0	HC-SE-PA-10.0-11.5	HC-SE-PA-20.0-21.5	HC-SW-PA-5.0-6.5	HC-SW-PA-15.0-16.5	B4-COMP
		Sample Date	9/10/2002	9/10/2002	9/10/2002	9/10/2002	9/10/2002	9/10/2002	9/10/2002	9/10/2002	9/10/2002	9/10/2002	5/11/1988
		Sample Depth	20–21.5 ft	10–11.5 ft	25–26.5 ft	0–1 ft	5–6.5 ft	7.5–9 ft	10–11.5 ft	20–21.5 ft	5–6.5 ft	15–16.5 ft	--
Analyte	CAS No.	Unit											
Conventionals													
Salinity	--	%											
Metals													
Arsenic	7440-38-2	mg/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U		5.0 U		5.0 U	5.0 U	
Barium	7440-39-3	mg/kg	20 U	20 U	20 U	20 U	20 U		20 U		20 U	20 U	
Beryllium	7440-41-7	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	8.0	5.0	6.0	30	10		5.0		6.0	5.0	
Cobalt	7440-48-4	mg/kg											
Lead	7439-92-1	mg/kg	5.0 U	5.0 U	5.0 U	55	5.0 U		5.0 U		5.0 U	5.0 U	
Mercury	7439-97-6	mg/kg	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U		0.50 U		0.50 U	0.50 U	
Nickel	7440-02-0	mg/kg											
Selenium	7782-49-2	mg/kg	50 U	50 U	50 U	50 U	50 U		50 U		50 U	50 U	
Silver	7440-22-4	mg/kg	20 U	20 U	20 U	20 U	20 U		20 U		20 U	20 U	
Vanadium	7440-62-2	mg/kg											
Zinc	7440-66-6	mg/kg											
Total Petroleum Hydrocarbons													
Diesel-range organics	DRO	mg/kg	20 U	20 U	20 U	20 U	37	20 U	20 U	20 U	20 U	20 U	
Oil-range organics	ORO	mg/kg	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	
Total DRO & ORO	T_DRO&ORO (U=0)	mg/kg	50 U	50 U	50 U	50 U	37	50 U	50 U	50 U	50 U	50 U	
Polycyclic Aromatic Hydrocarbons													
Acenaphthene	83-32-9	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	
Acenaphthylene	208-96-8	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	
Anthracene	120-12-7	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	
Benzo(a)anthracene	56-55-3	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	
Benzo(a)pyrene	50-32-8	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	
Benzo(b)fluoranthene	205-99-2	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	
Benzo(g,h,i)perylene	191-24-2	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	
Benzo(k)fluoranthene	207-08-9	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	
Chrysene	218-01-9	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	
cPAHs (MTCA TEQ-HalfND)	BaPEq (U=1/2)	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	
cPAHs (MTCA TEQ-ZeroND)	BaPEq (U=0)	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	
Dibenzo(a,h)anthracene	53-70-3	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	
Fluoranthene	206-44-0	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	
Fluorene	86-73-7	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	
Naphthalene	91-20-3	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	
Phenanthrene	85-01-8	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	9.7
Pyrene	129-00-0	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	
Semivolatile Organic Compounds													
2,4,5-Trichlorophenol	95-95-4	mg/kg	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U		0.50 U	0.50 U	
2,4,6-Trichlorophenol	88-06-2	mg/kg	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U		0.50 U	0.50 U	
2,4-Dichlorophenol	120-83-2	mg/kg	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U		0.50 U	0.50 U	
2,4-Dimethylphenol	105-67-9	mg/kg	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U		0.50 U	0.50 U	
2,4-Dinitrophenol	51-28-5	mg/kg	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U		0.50 U	0.50 U	
2,6-Dichlorophenol	87-65-0	mg/kg	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U		0.50 U	0.50 U	
2-Chloronaphthalene	91-58-7	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	
2-Chlorophenol	95-57-8	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	
2-Methylphenol	95-48-7	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	

Table 3.5
Subsurface Soil Analytical Data for Other Analytes

		Location Name	HC-NE-PA (cont.)	HC-NW-PA		HC-SE-PA					HC-SW-PA		B-04
		Sample Name	HC-NE-PA-20.0-21.5	HC-NW-PA-10.0-11.5	HC-NW-PA-25.0-26.5	HC-SE-PA-0.0-1.0	HC-SE-PA-5.0-6.5	HC-SE-PA-7.5-9.0	HC-SE-PA-10.0-11.5	HC-SE-PA-20.0-21.5	HC-SW-PA-5.0-6.5	HC-SW-PA-15.0-16.5	B4-COMP
		Sample Date	9/10/2002	9/10/2002	9/10/2002	9/10/2002	9/10/2002	9/10/2002	9/10/2002	9/10/2002	9/10/2002	9/10/2002	5/11/1988
		Sample Depth	20–21.5 ft	10–11.5 ft	25–26.5 ft	0–1 ft	5–6.5 ft	7.5–9 ft	10–11.5 ft	20–21.5 ft	5–6.5 ft	15–16.5 ft	--
Analyte	**CAS No.**	**Unit**											
Semivolatile Organic Compounds (cont.)													
2-Nitrophenol	88-75-5	mg/kg	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U		0.50 U	0.50 U	
3- & 4-Methylphenol	15831-10-4	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	
4-Chloro-3-methylphenol	59-50-7	mg/kg	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U		0.50 U	0.50 U	
4-Methylphenol	106-44-5	mg/kg											
4-Nitrophenol	100-02-7	mg/kg	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U		0.50 U	0.50 U	
Benzoic acid	65-85-0	mg/kg											
Bis(2-chloroethoxy)methane	111-91-1	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg											
Butyl benzyl phthalate	85-68-7	mg/kg	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U		0.50 U	0.50 U	
Dibenzofuran	132-64-9	mg/kg											
Diethylphthalate	84-66-2	mg/kg	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U		0.50 U	0.50 U	
Dimethyl phthalate	131-11-3	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	
Di-n-butyl phthalate	84-74-2	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	
Di-n-octyl phthalate	117-84-0	mg/kg	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U		0.50 U	0.50 U	
Hexachlorobutadiene	87-68-3	mg/kg	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U		0.50 U	0.50 U	
Hexachlorocyclopentadiene	77-47-4	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	
Hexachloropropene	1888-71-7	mg/kg	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U		0.50 U	0.50 U	
N-Nitrosodiphenylamine	86-30-6	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	
Phenol	108-95-2	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	
Volatile Organic Compounds													
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											
1,2,4-Trichlorobenzene	120-82-1	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	
1,2-Dichlorobenzene	95-50-1	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	
1,2-Dichloroethane	107-06-2	mg/kg											
1,2-Dichloropropane	78-87-5	mg/kg											
1,3-Dichlorobenzene	541-73-1	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	
1,4-Dichlorobenzene	106-46-7	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	
2-Chloroethyl vinyl ether	110-75-8	mg/kg											
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	
Benzene	71-43-2	mg/kg											0.012 U
Bis(2-chloroethyl)ether	111-44-4	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	
Bis(2-chloroisopropyl)ether	39638-32-9	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	
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											
Chloroethane	75-00-3	mg/kg											
Chloroform	67-66-3	mg/kg											
Chloromethane	74-87-3	mg/kg											
cis-1,3-Dichloropropene	10061-01-5	mg/kg											
Dibromochloromethane	124-48-1	mg/kg											
Dichlorodifluoromethane	75-71-8	mg/kg											
Ethylbenzene	100-41-4	mg/kg											0.012 U
Hexachlorobenzene	118-74-1	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	

Table 3.5
Subsurface Soil Analytical Data for Other Analytes

		Location Name	HC-NE-PA (cont.)	HC-NW-PA		HC-SE-PA					HC-SW-PA		B-04
		Sample Name	HC-NE-PA-20.0-21.5	HC-NW-PA-10.0-11.5	HC-NW-PA-25.0-26.5	HC-SE-PA-0.0-1.0	HC-SE-PA-5.0-6.5	HC-SE-PA-7.5-9.0	HC-SE-PA-10.0-11.5	HC-SE-PA-20.0-21.5	HC-SW-PA-5.0-6.5	HC-SW-PA-15.0-16.5	B4-COMP
		Sample Date	9/10/2002	9/10/2002	9/10/2002	9/10/2002	9/10/2002	9/10/2002	9/10/2002	9/10/2002	9/10/2002	9/10/2002	5/11/1988
		Sample Depth	20–21.5 ft	10–11.5 ft	25–26.5 ft	0–1 ft	5–6.5 ft	7.5–9 ft	10–11.5 ft	20–21.5 ft	5–6.5 ft	15–16.5 ft	--
Analyte	**CAS No.**	**Unit**											
Volatile Organic Compounds (cont.)													
Methylene chloride	75-09-2	mg/kg											
Pentachloroethane	76-01-7	mg/kg	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U	0.10 U	
Tetrachloroethene	127-18-4	mg/kg											
Toluene	108-88-3	mg/kg											0.012 U
trans-1,2-Dichloroethene	156-60-5	mg/kg											
trans-1,3-Dichloropropene	10061-02-6	mg/kg											
Trichloroethene	79-01-6	mg/kg											
Trichlorofluoromethane	75-69-4	mg/kg											
Vinyl chloride	75-01-4	mg/kg											
Xylene (total)	1330-20-7	mg/kg											0.024
Dioxins/Furans													
2,3,7,8-TCDD	1746-01-6	mg/kg											
1,2,3,7,8-PeCDD	40321-76-4	mg/kg											
1,2,3,4,7,8-HxCDD	39227-28-6	mg/kg											
1,2,3,6,7,8-HxCDD	57653-85-7	mg/kg											
1,2,3,7,8,9-HxCDD	19408-74-3	mg/kg											
1,2,3,4,6,7,8-HpCDD	35822-46-9	mg/kg											
OCDD	3268-87-9	mg/kg											
2,3,7,8-TCDF	51207-31-9	mg/kg											
1,2,3,7,8-PeCDF	57117-41-6	mg/kg											
2,3,4,7,8-PeCDF	57117-31-4	mg/kg											
1,2,3,4,7,8-HxCDF	70648-26-9	mg/kg											
1,2,3,6,7,8-HxCDF	57117-44-9	mg/kg											
1,2,3,7,8,9-HxCDF	72918-21-9	mg/kg											
2,3,4,6,7,8-HxCDF	60851-34-5	mg/kg											
1,2,3,4,6,7,8-HpCDF	67562-39-4	mg/kg											
1,2,3,4,7,8,9-HpCDF	55673-89-7	mg/kg											
OCDF	39001-02-0	mg/kg											
Dioxins/Furans (MTCA TEQ-HalfND)	DF_TEQ (U=1/2)	mg/kg											
Dioxins/Furans (MTCA TEQ-ZeroND)	DF_TEQ (U=0)	mg/kg											
Pesticide-Herbicides													
Dinoseb	88-85-7	mg/kg	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U		0.50 U	0.50 U	

Notes:

Blank cells are intentional.

All results presented in this table are rounded to two significant figures, with the exception of those for the dioxin/furan TEQ, which are rounded to three significant figures.

All results presented on a dry-weight basis.

-- Not available.

1 Historical data did not provide dry weight result, or measurement basis unknown.

Abbreviations:

CAS	Chemical Abstracts Service
CDD	Chlorodibenzo-dioxin
CDF	Chlorodibenzofuran
cPAH	Carcinogenic polycyclic aromatic hydrocarbon
DRO	Diesel-range organics
ft	Feet
HpCDD	Heptachlorodibenzo-p-dioxin
HpCDF	Heptachlorodibenzofuran
HxCDD	Hexachlorodibenzo-p-dioxin
HxCDF	Hexachlorodibenzofuran
mg/kg	Milligrams per kilogram
MTCA	Model Toxics Control Act
OCDD	Octachlorodibenzodioxin
ORO	Oil-range organics
OCDF	Octachlorodibenzofuran
PeCDD	Pentachlorodibenzo-p-dioxin
PeCDF	Pentachlorodibenzofuran
TCDF	Tetrachlorodibenzofuran
TEQ	Toxic Equivalent
TCDD	Tetrachlorodibenzo-p-dioxin

Qualifiers:

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

Table 3.5
Subsurface Soil Analytical Data for Other Analytes

		Location Name	B-05	B-06					B-07	B-08B/MW-08B				B-11	B-12	B-13
		Sample Name	B5-COMP	B6B-2.5-4.0	B6B-7.5-9.0	B6B-5.0-6.5	B6B-30.0-31.5	B6B-50.0-51.5	B7-COMP	B8B-2.5-4.0	B8B-2.5-4.0D	B8B-5.0-6.5	B8B-50.0-51.5	B11-COMP	B12-COMP	B13-COMP
		Sample Date	5/12/1988	8/30/1988	8/30/1988	8/30/1988	8/30/1988	8/30/1988	5/16/1988	9/12/1988	9/12/1988	9/12/1988	9/12/1988	6/2/1988	6/2/1988	6/2/1988
		Sample Depth	--	2.5–4 ft	7.5–9 ft	5–6.5 ft	30–31.5 ft	50–51.5 ft	--	2.5–4 ft	2.5–4 ft	5–6.5 ft	50–51.5 ft	2.5–9 ft	2.5–14 ft	2.5–14 ft
Analyte	**CAS No.**	**Unit**														
Conventionals																
Salinity	--	%														
Metals																
Arsenic	7440-38-2	mg/kg														
Barium	7440-39-3	mg/kg														
Beryllium	7440-41-7	mg/kg														
Cadmium	7440-43-9	mg/kg														
Chromium	7440-47-3	mg/kg														
Cobalt	7440-48-4	mg/kg														
Lead	7439-92-1	mg/kg														
Mercury	7439-97-6	mg/kg		0.26	0.070	0.29	0.039 U	0.043 U		0.050 U	0.050 U	0.060 U	0.070 U			
Nickel	7440-02-0	mg/kg														
Selenium	7782-49-2	mg/kg														
Silver	7440-22-4	mg/kg														
Vanadium	7440-62-2	mg/kg														
Zinc	7440-66-6	mg/kg														
Total Petroleum Hydrocarbons																
Diesel-range organics	DRO	mg/kg														
Oil-range organics	ORO	mg/kg														
Total DRO & ORO	T_DRO&ORO (U=0)	mg/kg														
Polycyclic Aromatic Hydrocarbons																
Acenaphthene	83-32-9	mg/kg				0.66 U (1)				0.33 U (1)		0.33 U (1)				
Acenaphthylene	208-96-8	mg/kg														
Anthracene	120-12-7	mg/kg				0.66 U (1)				0.33 U (1)		0.33 U (1)				
Benzo(a)anthracene	56-55-3	mg/kg				0.66 U (1)				0.33 U (1)		0.33 U (1)				
Benzo(a)pyrene	50-32-8	mg/kg				0.66 U (1)				0.33 U (1)		0.33 U (1)				
Benzo(b)fluoranthene	205-99-2	mg/kg				0.66 U (1)				0.33 U (1)		0.33 U (1)				
Benzo(g,h,i)perylene	191-24-2	mg/kg				0.66 UJ (1)				0.33 U (1)		0.33 U (1)				
Benzo(k)fluoranthene	207-08-9	mg/kg				0.66 UJ (1)				0.33 U (1)		0.33 U (1)				
Chrysene	218-01-9	mg/kg				0.66 U (1)				0.33 U (1)		0.33 U (1)				
cPAHs (MTCA TEQ-HalfND)	BaPEq (U=1/2)	mg/kg				0.66 UJ (1)				0.33 UJ (1)		0.33 UJ (1)				
cPAHs (MTCA TEQ-ZeroND)	BaPEq (U=0)	mg/kg				0.66 UJ (1)				0.33 UJ (1)		0.33 UJ (1)				
Dibenzo(a,h)anthracene	53-70-3	mg/kg														
Fluoranthene	206-44-0	mg/kg				0.66 U (1)				0.33 U (1)		0.33 U (1)				
Fluorene	86-73-7	mg/kg				0.66 U (1)				0.33 U (1)		0.33 U (1)				
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg				0.66 U (1)				0.33 UJ (1)		0.33 UJ (1)				
Naphthalene	91-20-3	mg/kg				0.66 U (1)				0.33 U (1)		0.33 U (1)				
Phenanthrene	85-01-8	mg/kg	4.7			0.66 U (1)				0.33 U (1)		0.33 U (1)		16	3.0 U	4.5
Pyrene	129-00-0	mg/kg				0.66 U (1)				0.33 U (1)		0.33 U (1)				
Semivolatile Organic Compounds																
2,4,5-Trichlorophenol	95-95-4	mg/kg				3.2 U (1)				1.6 U (1)		1.6 U (1)				
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-Chloronaphthalene	91-58-7	mg/kg														
2-Chlorophenol	95-57-8	mg/kg														
2-Methylphenol	95-48-7	mg/kg														

Table 3.5

Subsurface Soil Analytical Data for Other Analytes

		Location Name	B-05	B-06					B-07	B-08B/MW-08B				B-11	B-12	B-13
		Sample Name	B5-COMP	B6B-2.5-4.0	B6B-7.5-9.0	B6B-5.0-6.5	B6B-30.0-31.5	B6B-50.0-51.5	B7-COMP	B8B-2.5-4.0	B8B-2.5-4.0D	B8B-5.0-6.5	B8B-50.0-51.5	B11-COMP	B12-COMP	B13-COMP
		Sample Date	5/12/1988	8/30/1988	8/30/1988	8/30/1988	8/30/1988	8/30/1988	5/16/1988	9/12/1988	9/12/1988	9/12/1988	9/12/1988	6/2/1988	6/2/1988	6/2/1988
		Sample Depth	--	2.5–4 ft	7.5–9 ft	5–6.5 ft	30–31.5 ft	50–51.5 ft	--	2.5–4 ft	2.5–4 ft	5–6.5 ft	50–51.5 ft	2.5–9 ft	2.5–14 ft	2.5–14 ft
Analyte	**CAS No.**	**Unit**														
Semivolatile Organic Compounds (cont.)																
2-Nitrophenol	88-75-5	mg/kg														
3- & 4-Methylphenol	15831-10-4	mg/kg														
4-Chloro-3-methylphenol	59-50-7	mg/kg														
4-Methylphenol	106-44-5	mg/kg				0.66 U (1)				0.33 U (1)		0.33 U (1)				
4-Nitrophenol	100-02-7	mg/kg														
Benzoic acid	65-85-0	mg/kg				3.2 U (1)				1.6 U (1)		1.6 U (1)				
Bis(2-chloroethoxy)methane	111-91-1	mg/kg														
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg				0.66 UJ (1)				0.33 UJ (1)		0.33 UJ (1)				
Butyl benzyl phthalate	85-68-7	mg/kg														
Dibenzofuran	132-64-9	mg/kg				0.66 U (1)				0.33 U (1)		0.33 U (1)				
Diethylphthalate	84-66-2	mg/kg														
Dimethyl phthalate	131-11-3	mg/kg														
Di-n-butyl phthalate	84-74-2	mg/kg				0.098 J (1)				0.33 UJ (1)		0.33 UJ (1)				
Di-n-octyl phthalate	117-84-0	mg/kg														
Hexachlorobutadiene	87-68-3	mg/kg														
Hexachlorocyclopentadiene	77-47-4	mg/kg														
Hexachloropropene	1888-71-7	mg/kg														
N-Nitrosodiphenylamine	86-30-6	mg/kg														
Phenol	108-95-2	mg/kg				0.66 U (1)				0.33 U (1)		0.33 U (1)				
Volatile Organic Compounds																
1,1,1-Trichloroethane	71-55-6	mg/kg													0.012 U	0.012 U
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg													0.012 U	0.012 U
1,1,2-Trichloroethane	79-00-5	mg/kg													0.012 U	0.012 U
1,1-Dichloroethane	75-34-3	mg/kg													0.012 U	0.012 U
1,1-Dichloroethene	75-35-4	mg/kg													0.012 U	0.012 U
1,2,4-Trichlorobenzene	120-82-1	mg/kg														
1,2-Dichlorobenzene	95-50-1	mg/kg													0.012 U	0.012 U
1,2-Dichloroethane	107-06-2	mg/kg													0.012 U	0.012 U
1,2-Dichloropropane	78-87-5	mg/kg													0.012 U	0.012 U
1,3-Dichlorobenzene	541-73-1	mg/kg													0.012 U	0.012 U
1,4-Dichlorobenzene	106-46-7	mg/kg													0.012 U	0.012 U
2-Chloroethyl vinyl ether	110-75-8	mg/kg													1.2 U	1.2 U
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg														
Benzene	71-43-2	mg/kg	0.012 U						0.012 U					0.0010 U	0.0010 U	0.0010 U
Bis(2-chloroethyl)ether	111-44-4	mg/kg														
Bis(2-chloroisopropyl)ether	39638-32-9	mg/kg														
Bromodichloromethane	75-27-4	mg/kg													0.012 U	0.012 U
Bromoform	75-25-2	mg/kg													0.058	0.058
Bromomethane	74-83-9	mg/kg													0.12 U	0.12 U
Carbon tetrachloride	56-23-5	mg/kg													0.012 U	0.012 U
Chlorobenzene	108-90-7	mg/kg													0.012 U	0.012 U
Chloroethane	75-00-3	mg/kg													0.12 U	0.12 U
Chloroform	67-66-3	mg/kg													0.012 U	0.012 U
Chloromethane	74-87-3	mg/kg													0.12 U	0.12 U
cis-1,3-Dichloropropene	10061-01-5	mg/kg													0.012 U	0.012 U
Dibromochloromethane	124-48-1	mg/kg													0.012 U	0.012 U
Dichlorodifluoromethane	75-71-8	mg/kg													1.2 U	1.2 U
Ethylbenzene	100-41-4	mg/kg	0.012 U						0.012 U					0.0010 U	0.0010 U	0.0010 U
Hexachlorobenzene	118-74-1	mg/kg														

Table 3.5
Subsurface Soil Analytical Data for Other Analytes

		Location Name	B-05	B-06					B-07	B-08B/MW-08B				B-11	B-12	B-13
		Sample Name	B5-COMP	B6B-2.5-4.0	B6B-7.5-9.0	B6B-5.0-6.5	B6B-30.0-31.5	B6B-50.0-51.5	B7-COMP	B8B-2.5-4.0	B8B-2.5-4.0D	B8B-5.0-6.5	B8B-50.0-51.5	B11-COMP	B12-COMP	B13-COMP
		Sample Date	5/12/1988	8/30/1988	8/30/1988	8/30/1988	8/30/1988	8/30/1988	5/16/1988	9/12/1988	9/12/1988	9/12/1988	9/12/1988	6/2/1988	6/2/1988	6/2/1988
		Sample Depth	--	2.5–4 ft	7.5–9 ft	5–6.5 ft	30–31.5 ft	50–51.5 ft	--	2.5–4 ft	2.5–4 ft	5–6.5 ft	50–51.5 ft	2.5–9 ft	2.5–14 ft	2.5–14 ft
Analyte	**CAS No.**	**Unit**														
Volatile Organic Compounds (cont.)																
Methylene chloride	75-09-2	mg/kg													0.14	0.17
Pentachloroethane	76-01-7	mg/kg														
Tetrachloroethene	127-18-4	mg/kg													0.012 U	0.012 U
Toluene	108-88-3	mg/kg	0.012 U						0.012 U					0.0010 U	0.0010 U	0.0010 U
trans-1,2-Dichloroethene	156-60-5	mg/kg													0.012 U	0.012 U
trans-1,3-Dichloropropene	10061-02-6	mg/kg													0.012 U	0.012 U
Trichloroethene	79-01-6	mg/kg													0.012 U	0.012 U
Trichlorofluoromethane	75-69-4	mg/kg													0.058 U	0.058 U
Vinyl chloride	75-01-4	mg/kg													0.12 U	0.12 U
Xylene (total)	1330-20-7	mg/kg	0.034						0.012 U					0.0010 U	0.0010 U	0.0010 U
Dioxins/Furans																
2,3,7,8-TCDD	1746-01-6	mg/kg														
1,2,3,7,8-PeCDD	40321-76-4	mg/kg														
1,2,3,4,7,8-HxCDD	39227-28-6	mg/kg														
1,2,3,6,7,8-HxCDD	57653-85-7	mg/kg														
1,2,3,7,8,9-HxCDD	19408-74-3	mg/kg														
1,2,3,4,6,7,8-HpCDD	35822-46-9	mg/kg														
OCDD	3268-87-9	mg/kg														
2,3,7,8-TCDF	51207-31-9	mg/kg														
1,2,3,7,8-PeCDF	57117-41-6	mg/kg														
2,3,4,7,8-PeCDF	57117-31-4	mg/kg														
1,2,3,4,7,8-HxCDF	70648-26-9	mg/kg														
1,2,3,6,7,8-HxCDF	57117-44-9	mg/kg														
1,2,3,7,8,9-HxCDF	72918-21-9	mg/kg														
2,3,4,6,7,8-HxCDF	60851-34-5	mg/kg														
1,2,3,4,6,7,8-HpCDF	67562-39-4	mg/kg														
1,2,3,4,7,8,9-HpCDF	55673-89-7	mg/kg														
OCDF	39001-02-0	mg/kg														
Dioxins/Furans (MTCA TEQ-HalfND)	DF_TEQ (U=1/2)	mg/kg														
Dioxins/Furans (MTCA TEQ-ZeroND)	DF_TEQ (U=0)	mg/kg														
Pesticide-Herbicides																
Dinoseb	88-85-7	mg/kg														

Notes:

Blank cells are intentional.
All results presented in this table are rounded to two significant figures, with the exception of those for the dioxin/furan TEQ, which are rounded to three significant figures.
All results presented on a dry-weight basis.
-- Not available.
1 Historical data did not provide dry weight result, or measurement basis unknown.

Abbreviations:

CAS	Chemical Abstracts Service
CDD	Chlorodibenzo-dioxin
CDF	Chlorodibenzofuran
cPAH	Carcinogenic polycyclic aromatic hydrocarbon
DRO	Diesel-range organics
ft	Feet
HpCDD	Heptachlorodibenzo-p-dioxin
HpCDF	Heptachlorodibenzofuran
HxCDD	Hexachlorodibenzo-p-dioxin
HxCDF	Hexachlorodibenzofuran
mg/kg	Milligrams per kilogram
MTCA	Model Toxics Control Act
OCDD	Octachlorodibenzodioxin
ORO	Oil-range organics
OCDF	Octachlorodibenzofuran
PeCDD	Pentachlorodibenzo-p-dioxin
PeCDF	Pentachlorodibenzofuran
TCDF	Tetrachlorodibenzofuran
TEQ	Toxic Equivalent
TCDD	Tetrachlorodibenzo-p-dioxin

Qualifiers:

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

Table 3.5
Subsurface Soil Analytical Data for Other Analytes

		Location Name	B-14	B-15	B-16	B-16A/MW-16A	B-16B/MW-16B			B-16C	B-23/MW-23				
		Sample Name	**B14-COMP**	**B15-0.0-1.5**	**B16-0.0-1.5**	**B16A-10.0-11.5**	**B16B-2.5-4.0**	**B16B-5.0-6.5**	**B16B-50.0-51.5**	**B16C-9.0-14.0D**	**B23-2.5-4.0**	**B23-5.0-6.5**	**B23-7.5-9.0**	**B23-10.0-11.5**	**B23-17.5-19.0**
		Sample Date	**6/2/1988**	**6/9/1988**	**6/9/1988**	**6/12/1988**	**9/8/1988**	**9/8/1988**	**9/8/1988**	**11/16/1988**	**8/29/1988**	**8/29/1988**	**8/29/1988**	**8/29/1988**	**8/29/1988**
		Sample Depth	**2.5–14 ft**	**0–1.5 ft**	**0–1.5 ft**	**10–11.5 ft**	**2.5–4 ft**	**5–6.5 ft**	**50–51.5 ft**	**9–14 ft**	**2.5–4 ft**	**5–6.5 ft**	**7.5–9 ft**	**10–11.5 ft**	**17.5–19 ft**
Analyte	**CAS No.**	**Unit**													
Conventionals															
Salinity	--	%													
Metals															
Arsenic	7440-38-2	mg/kg													
Barium	7440-39-3	mg/kg													
Beryllium	7440-41-7	mg/kg													
Cadmium	7440-43-9	mg/kg													
Chromium	7440-47-3	mg/kg													
Cobalt	7440-48-4	mg/kg													
Lead	7439-92-1	mg/kg													
Mercury	7439-97-6	mg/kg					0.050 U	0.060 U	0.070 U		0.059	0.031 U	0.071	0.034 U	0.035 U
Nickel	7440-02-0	mg/kg													
Selenium	7782-49-2	mg/kg													
Silver	7440-22-4	mg/kg													
Vanadium	7440-62-2	mg/kg													
Zinc	7440-66-6	mg/kg													
Total Petroleum Hydrocarbons															
Diesel-range organics	DRO	mg/kg													
Oil-range organics	ORO	mg/kg													
Total DRO & ORO	T_DRO&ORO (U=0)	mg/kg													
Polycyclic Aromatic Hydrocarbons															
Acenaphthene	83-32-9	mg/kg					0.33 U (1)	0.33 U (1)		1.3 U (1)				0.33 U (1)	
Acenaphthylene	208-96-8	mg/kg													
Anthracene	120-12-7	mg/kg					0.33 U (1)	0.33 U (1)		1.3 U (1)				0.33 U (1)	
Benzo(a)anthracene	56-55-3	mg/kg					0.33 U (1)	0.33 U (1)		1.3 U (1)				0.33 U (1)	
Benzo(a)pyrene	50-32-8	mg/kg					0.33 U (1)	0.33 U (1)		1.3 U (1)				0.33 U (1)	
Benzo(b)fluoranthene	205-99-2	mg/kg					0.33 U (1)	0.33 U (1)		1.3 U (1)				0.33 U (1)	
Benzo(g,h,i)perylene	191-24-2	mg/kg					0.33 UJ (1)	0.33 UJ (1)		1.3 U (1)				0.33 UJ (1)	
Benzo(k)fluoranthene	207-08-9	mg/kg					0.33 UJ (1)	0.33 UJ (1)		1.3 U (1)				0.33 UJ (1)	
Chrysene	218-01-9	mg/kg					0.33 U (1)	0.33 U (1)		1.3 U (1)				0.33 U (1)	
cPAHs (MTCA TEQ-HalfND)	BaPEq (U=1/2)	mg/kg					0.33 UJ (1)	0.33 UJ (1)		1.3 U (1)				0.33 UJ (1)	
cPAHs (MTCA TEQ-ZeroND)	BaPEq (U=0)	mg/kg					0.33 UJ (1)	0.33 UJ (1)		1.3 U (1)				0.33 UJ (1)	
Dibenzo(a,h)anthracene	53-70-3	mg/kg													
Fluoranthene	206-44-0	mg/kg					0.33 U (1)	0.33 U (1)		1.3 U (1)				0.33 U (1)	
Fluorene	86-73-7	mg/kg					0.33 U (1)	0.33 U (1)		1.3 U (1)				0.33 U (1)	
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg					0.33 U (1)	0.33 U (1)		1.3 U (1)				0.33 U (1)	
Naphthalene	91-20-3	mg/kg					0.33 U (1)	0.33 U (1)		1.3 U (1)				0.33 U (1)	
Phenanthrene	85-01-8	mg/kg	46				0.33 U (1)	0.33 U (1)		1.3 U (1)				0.33 U (1)	
Pyrene	129-00-0	mg/kg					0.33 U (1)	0.33 U (1)		1.3 U (1)				0.33 U (1)	
Semivolatile Organic Compounds															
2,4,5-Trichlorophenol	95-95-4	mg/kg					1.6 U (1)	1.6 U (1)		2.3 J (1)				1.6 U (1)	
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-Chloronaphthalene	91-58-7	mg/kg													
2-Chlorophenol	95-57-8	mg/kg													
2-Methylphenol	95-48-7	mg/kg													

Table 3.5
Subsurface Soil Analytical Data for Other Analytes

Location Name			B-14	B-15	B-16	B-16A/MW-16A	B-16B/MW-16B			B-16C	B-23/MW-23				
Sample Name			B14-COMP	B15-0.0-1.5	B16-0.0-1.5	B16A-10.0-11.5	B16B-2.5-4.0	B16B-5.0-6.5	B16B-50.0-51.5	B16C-9.0-14.0D	B23-2.5-4.0	B23-5.0-6.5	B23-7.5-9.0	B23-10.0-11.5	B23-17.5-19.0
Sample Date			6/2/1988	6/9/1988	6/9/1988	6/12/1988	9/8/1988	9/8/1988	9/8/1988	11/16/1988	8/29/1988	8/29/1988	8/29/1988	8/29/1988	8/29/1988
Sample Depth			2.5–14 ft	0–1.5 ft	0–1.5 ft	10–11.5 ft	2.5–4 ft	5–6.5 ft	50–51.5 ft	9–14 ft	2.5–4 ft	5–6.5 ft	7.5–9 ft	10–11.5 ft	17.5–19 ft
Analyte	**CAS No.**	**Unit**													
Semivolatile Organic Compounds (cont.)															
2-Nitrophenol	88-75-5	mg/kg													
3- & 4-Methylphenol	15831-10-4	mg/kg													
4-Chloro-3-methylphenol	59-50-7	mg/kg													
4-Methylphenol	106-44-5	mg/kg					0.12 J	0.33 U (1)		1.3 U (1)				0.33 U (1)	
4-Nitrophenol	100-02-7	mg/kg													
Benzoic acid	65-85-0	mg/kg					1.6 U (1)	1.6 U (1)		6.4 U (1)				1.6 U (1)	
Bis(2-chloroethoxy)methane	111-91-1	mg/kg					0.33 UJ (1)	0.33 UJ (1)							
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg								1.3 UJ (1)				0.65 UJ (1)	
Butyl benzyl phthalate	85-68-7	mg/kg													
Dibenzofuran	132-64-9	mg/kg					0.33 U (1)	0.33 U (1)		1.3 U (1)				0.33 U (1)	
Diethylphthalate	84-66-2	mg/kg													
Dimethyl phthalate	131-11-3	mg/kg													
Di-n-butyl phthalate	84-74-2	mg/kg					0.33 UJ (1)	0.33 UJ (1)		1.3 U (1)				0.084 J (1)	
Di-n-octyl phthalate	117-84-0	mg/kg													
Hexachlorobutadiene	87-68-3	mg/kg													
Hexachlorocyclopentadiene	77-47-4	mg/kg													
Hexachloropropene	1888-71-7	mg/kg													
N-Nitrosodiphenylamine	86-30-6	mg/kg													
Phenol	108-95-2	mg/kg					0.33 U (1)	0.33 U (1)		1.3 U (1)				0.33 U (1)	
Volatile Organic Compounds															
1,1,1-Trichloroethane	71-55-6	mg/kg	0.0030 U												
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg	0.0090 U												
1,1,2-Trichloroethane	79-00-5	mg/kg	0.0030 U												
1,1-Dichloroethane	75-34-3	mg/kg	0.0030 U												
1,1-Dichloroethene	75-35-4	mg/kg	0.0030 U												
1,2,4-Trichlorobenzene	120-82-1	mg/kg													
1,2-Dichlorobenzene	95-50-1	mg/kg	0.0030 U												
1,2-Dichloroethane	107-06-2	mg/kg	0.0030 U												
1,2-Dichloropropane	78-87-5	mg/kg	0.0030 U												
1,3-Dichlorobenzene	541-73-1	mg/kg	0.0030 U												
1,4-Dichlorobenzene	106-46-7	mg/kg	0.0030 U												
2-Chloroethyl vinyl ether	110-75-8	mg/kg	0.0030 U												
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg													
Benzene	71-43-2	mg/kg													
Bis(2-chloroethyl)ether	111-44-4	mg/kg													
Bis(2-chloroisopropyl)ether	39638-32-9	mg/kg													
Bromodichloromethane	75-27-4	mg/kg	0.0030 U												
Bromoform	75-25-2	mg/kg	0.0030 U												
Bromomethane	74-83-9	mg/kg	0.0030 U												
Carbon tetrachloride	56-23-5	mg/kg	0.0030 U												
Chlorobenzene	108-90-7	mg/kg	0.0090 U												
Chloroethane	75-00-3	mg/kg	0.0090 U												
Chloroform	67-66-3	mg/kg	0.0030 U												
Chloromethane	74-87-3	mg/kg	0.0030 U												
cis-1,3-Dichloropropene	10061-01-5	mg/kg	0.0090 U												
Dibromochloromethane	124-48-1	mg/kg	0.0090 U												
Dichlorodifluoromethane	75-71-8	mg/kg	0.030 U												
Ethylbenzene	100-41-4	mg/kg													
Hexachlorobenzene	118-74-1	mg/kg													

Table 3.5
Subsurface Soil Analytical Data for Other Analytes

		Location Name	B-14	B-15	B-16	B-16A/MW-16A	B-16B/MW-16B			B-16C	B-23/MW-23				
		Sample Name	B14-COMP	B15-0.0-1.5	B16-0.0-1.5	B16A-10.0-11.5	B16B-2.5-4.0	B16B-5.0-6.5	B16B-50.0-51.5	B16C-9.0-14.0D	B23-2.5-4.0	B23-5.0-6.5	B23-7.5-9.0	B23-10.0-11.5	B23-17.5-19.0
		Sample Date	6/2/1988	6/9/1988	6/9/1988	6/12/1988	9/8/1988	9/8/1988	9/8/1988	11/16/1988	8/29/1988	8/29/1988	8/29/1988	8/29/1988	8/29/1988
		Sample Depth	2.5–14 ft	0–1.5 ft	0–1.5 ft	10–11.5 ft	2.5–4 ft	5–6.5 ft	50–51.5 ft	9–14 ft	2.5–4 ft	5–6.5 ft	7.5–9 ft	10–11.5 ft	17.5–19 ft
Analyte	**CAS No.**	**Unit**													
Volatile Organic Compounds (cont.)															
Methylene chloride	75-09-2	mg/kg	0.0050												
Pentachloroethane	76-01-7	mg/kg													
Tetrachloroethene	127-18-4	mg/kg	0.0030 U												
Toluene	108-88-3	mg/kg													
trans-1,2-Dichloroethene	156-60-5	mg/kg	0.0030 U												
trans-1,3-Dichloropropene	10061-02-6	mg/kg	0.0090 U												
Trichloroethene	79-01-6	mg/kg	0.0030 U												
Trichlorofluoromethane	75-69-4	mg/kg	0.0030 U												
Vinyl chloride	75-01-4	mg/kg	0.0030 U												
Xylene (total)	1330-20-7	mg/kg													
Dioxins/Furans															
2,3,7,8-TCDD	1746-01-6	mg/kg		0.0000050 U	0.000030	0.000273									
1,2,3,7,8-PeCDD	40321-76-4	mg/kg		0.0000080 U	0.0000080 U	0.000020 U									
1,2,3,4,7,8-HxCDD	39227-28-6	mg/kg		0.000061 UJ	0.0000080 U	0.000028 U									
1,2,3,6,7,8-HxCDD	57653-85-7	mg/kg		0.000149	0.000014 UJ	0.000025 U									
1,2,3,7,8,9-HxCDD	19408-74-3	mg/kg		0.000188 UJ	0.000010 U	0.000033 U									
1,2,3,4,6,7,8-HpCDD	35822-46-9	mg/kg		0.00499	0.000156 UJ	0.000045 U									
OCDD	3268-87-9	mg/kg		0.0635	0.00125 UJ	0.00043									
2,3,7,8-TCDF	51207-31-9	mg/kg		0.0000030 U	0.0000030 U	0.000013 U									
1,2,3,7,8-PeCDF	57117-41-6	mg/kg		0.0000050 U	0.0000050 U	0.000015 U									
2,3,4,7,8-PeCDF	57117-31-4	mg/kg		0.0000050 U	0.0000050 U	0.000015 U									
1,2,3,4,7,8-HxCDF	70648-26-9	mg/kg		0.000018	0.0000050 U	0.000015 U									
1,2,3,6,7,8-HxCDF	57117-44-9	mg/kg		0.000012	0.0000030 U	0.000013 U									
1,2,3,7,8,9-HxCDF	72918-21-9	mg/kg		0.0000050 U	0.0000080 U	0.000025 U									
2,3,4,6,7,8-HxCDF	60851-34-5	mg/kg		0.000024 UJ	0.0000050 U	0.000020 U									
1,2,3,4,6,7,8-HpCDF	67562-39-4	mg/kg		0.00118	0.000174	0.000028 U									
1,2,3,4,7,8,9-HpCDF	55673-89-7	mg/kg		0.000036	0.000010 U	0.000037 U									
OCDF	39001-02-0	mg/kg		0.00274	0.000166 UJ	0.000073 U									
Dioxins/Furans (MTCA TEQ-HalfND)	DF_TEQ (U=1/2)	mg/kg		0.000121 J	4.04E-05 J	0.000295									
Dioxins/Furans (MTCA TEQ-ZeroND)	DF_TEQ (U=0)	mg/kg		9.99E-05 J	3.17E-05 J	0.000273									
Pesticide-Herbicides															
Dinoseb	88-85-7	mg/kg													

Notes:

Blank cells are intentional.

All results presented in this table are rounded to two significant figures, with the exception of those for the dioxin/furan TEQ, which are rounded to three significant figures.

All results presented on a dry-weight basis.

-- Not available.

1 Historical data did not provide dry weight result, or measurement basis unknown.

Abbreviations:

CAS Chemical Abstracts Service
CDD Chlorodibenzo-dioxin
CDF Chlorodibenzofuran
cPAH Carcinogenic polycyclic aromatic hydrocarbon
DRO Diesel-range organics
ft Feet
HpCDD Heptachlorodibenzo-p-dioxin
HpCDF Heptachlorodibenzofuran
HxCDD Hexachlorodibenzo-p-dioxin
HxCDF Hexachlorodibenzofuran
mg/kg Milligrams per kilogram
MTCA Model Toxics Control Act
OCDD Octachlorodibenzodioxin
ORO Oil-range organics
OCDF Octachlorodibenzofuran
PeCDD Pentachlorodibenzo-p-dioxin
PeCDF Pentachlorodibenzofuran
TCDF Tetrachlorodibenzofuran
TEQ Toxic Equivalent
TCDD Tetrachlorodibenzo-p-dioxin

Qualifiers:

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

Table 3.5
Subsurface Soil Analytical Data for Other Analytes

		Location Name	B-24/MW-24A				B-24B/MW-24B			B-25A/MW-25A		B-25B/MW-25B		
		Sample Name	B24-2.5-4.0	B24-5.0-6.5	B24-7.5-9.0	B24-20.0-21.5	B24B-2.5-4.0	B24B-7.5-9.0	B24B-50.0-51.5	B25A-2.5-4.0	B25A-5.0-6.5	B25B-0.0-1.5	B25B-2.5-4.0	B25B-30.0-31.5
		Sample Date	9/1/1988	9/1/1988	9/1/1988	9/1/1988	9/6/1988	9/6/1988	9/6/1988	9/15/1988	9/15/1988	9/14/1988	9/14/1988	9/14/1988
		Sample Depth	2.5–4 ft	5–6.5 ft	7.5–9 ft	20–21.5 ft	2.5–4 ft	7.5–9 ft	50–51.5 ft	2.5–4 ft	5–6.5 ft	0–1.5 ft	2.5–4 ft	30–31.5 ft
Analyte	**CAS No.**	**Unit**												
Conventionals														
Salinity	--	%												
Metals														
Arsenic	7440-38-2	mg/kg												
Barium	7440-39-3	mg/kg												
Beryllium	7440-41-7	mg/kg												
Cadmium	7440-43-9	mg/kg												
Chromium	7440-47-3	mg/kg												
Cobalt	7440-48-4	mg/kg												
Lead	7439-92-1	mg/kg												
Mercury	7439-97-6	mg/kg	0.071	0.060 U	0.048	0.070 U	0.15	0.050 U	0.070 U			0.18	0.060 U	0.070 U
Nickel	7440-02-0	mg/kg												
Selenium	7782-49-2	mg/kg												
Silver	7440-22-4	mg/kg												
Vanadium	7440-62-2	mg/kg												
Zinc	7440-66-6	mg/kg												
Total Petroleum Hydrocarbons														
Diesel-range organics	DRO	mg/kg												
Oil-range organics	ORO	mg/kg												
Total DRO & ORO	T_DRO&ORO (U=0)	mg/kg												
Polycyclic Aromatic Hydrocarbons														
Acenaphthene	83-32-9	mg/kg	0.33 U (1)		0.33 U (1)	0.33 U (1)				0.33 U (1)	0.33 U (1)	0.33 U (1)	0.33 U (1)	
Acenaphthylene	208-96-8	mg/kg												
Anthracene	120-12-7	mg/kg	0.33 U (1)		0.33 U (1)	0.33 U (1)				0.33 U (1)	0.33 U (1)	0.33 U (1)	0.33 U (1)	
Benzo(a)anthracene	56-55-3	mg/kg	0.33 U (1)		0.33 U (1)	0.33 U (1)				0.33 U (1)	0.33 U (1)	0.33 U (1)	0.33 U (1)	
Benzo(a)pyrene	50-32-8	mg/kg	0.33 U (1)		0.33 U (1)	0.33 U (1)				0.33 U (1)	0.33 U (1)	0.33 U (1)	0.33 U (1)	
Benzo(b)fluoranthene	205-99-2	mg/kg	0.33 U (1)		0.33 U (1)	0.33 U (1)				0.33 U (1)	0.33 U (1)	0.33 U (1)	0.33 U (1)	
Benzo(g,h,i)perylene	191-24-2	mg/kg	0.33 UJ (1)		0.33 UJ (1)	0.33 UJ (1)				0.33 U (1)	0.33 U (1)	0.33 U (1)	0.33 U (1)	
Benzo(k)fluoranthene	207-08-9	mg/kg	0.33 UJ (1)		0.33 UJ (1)	0.33 UJ (1)				0.33 U (1)	0.33 U (1)	0.33 U (1)	0.33 U (1)	
Chrysene	218-01-9	mg/kg	0.33 U (1)		0.33 U (1)	0.33 U (1)				0.33 U (1)	0.33 U (1)	0.33 U (1)	0.33 U (1)	
cPAHs (MTCA TEQ-HalfND)	BaPEq (U=1/2)	mg/kg	0.33 UJ (1)		0.33 UJ (1)	0.33 UJ (1)				0.33 U (1)	0.33 U (1)	0.33 U (1)	0.33 U (1)	
cPAHs (MTCA TEQ-ZeroND)	BaPEq (U=0)	mg/kg	0.33 UJ (1)		0.33 UJ (1)	0.33 UJ (1)				0.33 U (1)	0.33 U (1)	0.33 U (1)	0.33 U (1)	
Dibenzo(a,h)anthracene	53-70-3	mg/kg												
Fluoranthene	206-44-0	mg/kg	0.18 J (1)		0.33 U (1)	0.33 U (1)				0.33 U (1)	0.33 U (1)	0.33 U (1)	0.043 J (1)	
Fluorene	86-73-7	mg/kg	0.11 J (1)		0.33 U (1)	0.33 U (1)				0.33 U (1)	0.33 U (1)	0.33 U (1)	0.33 U (1)	
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg	0.33 U (1)		0.33 U (1)	0.33 U (1)				0.33 U (1)	0.33 U (1)	0.33 U (1)	0.33 U (1)	
Naphthalene	91-20-3	mg/kg	0.33 U (1)		0.33 U (1)	0.33 U (1)				0.33 U (1)	0.33 U (1)	0.33 U (1)	0.33 U (1)	
Phenanthrene	85-01-8	mg/kg	0.47 J (1)		0.33 U (1)	0.33 U (1)				0.33 U (1)	0.33 U (1)	0.33 U (1)	0.040 J (1)	
Pyrene	129-00-0	mg/kg	0.14 J (1)		0.33 U (1)	0.33 U (1)				0.30 U (1)	0.33 U (1)	0.33 U (1)	0.054 J (1)	
Semivolatile Organic Compounds														
2,4,5-Trichlorophenol	95-95-4	mg/kg	3.2 U (1)		1.6 U (1)	1.6 U (1)				1.6 U (1)	1.6 U (1)	1.6 U (1)	1.6 U (1)	
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-Chloronaphthalene	91-58-7	mg/kg												
2-Chlorophenol	95-57-8	mg/kg												
2-Methylphenol	95-48-7	mg/kg												

Table 3.5
Subsurface Soil Analytical Data for Other Analytes

		Location Name	B-24/MW-24A				B-24B/MW-24B			B-25A/MW-25A		B-25B/MW-25B		
		Sample Name	B24-2.5-4.0	B24-5.0-6.5	B24-7.5-9.0	B24-20.0-21.5	B24B-2.5-4.0	B24B-7.5-9.0	B24B-50.0-51.5	B25A-2.5-4.0	B25A-5.0-6.5	B25B-0.0-1.5	B25B-2.5-4.0	B25B-30.0-31.5
		Sample Date	9/1/1988	9/1/1988	9/1/1988	9/1/1988	9/6/1988	9/6/1988	9/6/1988	9/15/1988	9/15/1988	9/14/1988	9/14/1988	9/14/1988
		Sample Depth	2.5–4 ft	5–6.5 ft	7.5–9 ft	20–21.5 ft	2.5–4 ft	7.5–9 ft	50–51.5 ft	2.5–4 ft	5–6.5 ft	0–1.5 ft	2.5–4 ft	30–31.5 ft
Analyte	**CAS No.**	**Unit**												
Semivolatile Organic Compounds (cont.)														
2-Nitrophenol	88-75-5	mg/kg												
3- & 4-Methylphenol	15831-10-4	mg/kg												
4-Chloro-3-methylphenol	59-50-7	mg/kg												
4-Methylphenol	106-44-5	mg/kg	0.66 U (1)		0.33 U (1)	0.33 U (1)				0.33 U (1)	0.33 U (1)	0.33 U (1)	0.33 U (1)	
4-Nitrophenol	100-02-7	mg/kg												
Benzoic acid	65-85-0	mg/kg	3.2 U (1)		1.6 U (1)	1.6 U (1)				1.6 U (1)	1.6 U (1)	1.6 U (1)	1.6 U (1)	
Bis(2-chloroethoxy)methane	111-91-1	mg/kg												
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	0.33 UJ (1)		0.33 UJ (1)	0.33 UJ (1)				0.33 UJ (1)	0.33 UJ (1)	0.33 UJ (1)	0.33 UJ (1)	
Butyl benzyl phthalate	85-68-7	mg/kg												
Dibenzofuran	132-64-9	mg/kg	0.33 U (1)		0.33 U (1)	0.33 U (1)				0.33 U (1)	0.33 U (1)	0.33 U (1)	0.33 U (1)	
Diethylphthalate	84-66-2	mg/kg												
Dimethyl phthalate	131-11-3	mg/kg												
Di-n-butyl phthalate	84-74-2	mg/kg	0.21 J (1)		0.26 J (1)	0.15 J (1)				0.33 UJ (1)	0.33 UJ (1)	0.33 UJ (1)	0.33 U (1)	
Di-n-octyl phthalate	117-84-0	mg/kg												
Hexachlorobutadiene	87-68-3	mg/kg												
Hexachlorocyclopentadiene	77-47-4	mg/kg												
Hexachloropropene	1888-71-7	mg/kg												
N-Nitrosodiphenylamine	86-30-6	mg/kg												
Phenol	108-95-2	mg/kg	0.90 (1)		0.33 U (1)	0.33 U (1)				0.33 U (1)	0.33 U (1)	0.33 U (1)	0.33 U (1)	
Volatile Organic Compounds														
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												
1,2,4-Trichlorobenzene	120-82-1	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-Dichlorobenzene	541-73-1	mg/kg												
1,4-Dichlorobenzene	106-46-7	mg/kg												
2-Chloroethyl vinyl ether	110-75-8	mg/kg												
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg												
Benzene	71-43-2	mg/kg												
Bis(2-chloroethyl)ether	111-44-4	mg/kg												
Bis(2-chloroisopropyl)ether	39638-32-9	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												
Chloroethane	75-00-3	mg/kg												
Chloroform	67-66-3	mg/kg												
Chloromethane	74-87-3	mg/kg												
cis-1,3-Dichloropropene	10061-01-5	mg/kg												
Dibromochloromethane	124-48-1	mg/kg												
Dichlorodifluoromethane	75-71-8	mg/kg												
Ethylbenzene	100-41-4	mg/kg												
Hexachlorobenzene	118-74-1	mg/kg												

Table 3.5
Subsurface Soil Analytical Data for Other Analytes

		Location Name	B-24/MW-24A				B-24B/MW-24B			B-25A/MW-25A		B-25B/MW-25B		
		Sample Name	B24-2.5-4.0	B24-5.0-6.5	B24-7.5-9.0	B24-20.0-21.5	B24B-2.5-4.0	B24B-7.5-9.0	B24B-50.0-51.5	B25A-2.5-4.0	B25A-5.0-6.5	B25B-0.0-1.5	B25B-2.5-4.0	B25B-30.0-31.5
		Sample Date	9/1/1988	9/1/1988	9/1/1988	9/1/1988	9/6/1988	9/6/1988	9/6/1988	9/15/1988	9/15/1988	9/14/1988	9/14/1988	9/14/1988
		Sample Depth	2.5–4 ft	5–6.5 ft	7.5–9 ft	20–21.5 ft	2.5–4 ft	7.5–9 ft	50–51.5 ft	2.5–4 ft	5–6.5 ft	0–1.5 ft	2.5–4 ft	30–31.5 ft
Analyte	**CAS No.**	**Unit**												
Volatile Organic Compounds (cont.)														
Methylene chloride	75-09-2	mg/kg												
Pentachloroethane	76-01-7	mg/kg												
Tetrachloroethene	127-18-4	mg/kg												
Toluene	108-88-3	mg/kg												
trans-1,2-Dichloroethene	156-60-5	mg/kg												
trans-1,3-Dichloropropene	10061-02-6	mg/kg												
Trichloroethene	79-01-6	mg/kg												
Trichlorofluoromethane	75-69-4	mg/kg												
Vinyl chloride	75-01-4	mg/kg												
Xylene (total)	1330-20-7	mg/kg												
Dioxins/Furans														
2,3,7,8-TCDD	1746-01-6	mg/kg												
1,2,3,7,8-PeCDD	40321-76-4	mg/kg												
1,2,3,4,7,8-HxCDD	39227-28-6	mg/kg												
1,2,3,6,7,8-HxCDD	57653-85-7	mg/kg												
1,2,3,7,8,9-HxCDD	19408-74-3	mg/kg												
1,2,3,4,6,7,8-HpCDD	35822-46-9	mg/kg												
OCDD	3268-87-9	mg/kg												
2,3,7,8-TCDF	51207-31-9	mg/kg												
1,2,3,7,8-PeCDF	57117-41-6	mg/kg												
2,3,4,7,8-PeCDF	57117-31-4	mg/kg												
1,2,3,4,7,8-HxCDF	70648-26-9	mg/kg												
1,2,3,6,7,8-HxCDF	57117-44-9	mg/kg												
1,2,3,7,8,9-HxCDF	72918-21-9	mg/kg												
2,3,4,6,7,8-HxCDF	60851-34-5	mg/kg												
1,2,3,4,6,7,8-HpCDF	67562-39-4	mg/kg												
1,2,3,4,7,8,9-HpCDF	55673-89-7	mg/kg												
OCDF	39001-02-0	mg/kg												
Dioxins/Furans (MTCA TEQ-HalfND)	DF_TEQ (U=1/2)	mg/kg												
Dioxins/Furans (MTCA TEQ-ZeroND)	DF_TEQ (U=0)	mg/kg												
Pesticide-Herbicides														
Dinoseb	88-85-7	mg/kg												

Notes:

Blank cells are intentional.

All results presented in this table are rounded to two significant figures, with the exception of those for the dioxin/furan TEQ, which are rounded to three significant figures.

All results presented on a dry-weight basis.

-- Not available.

1 Historical data did not provide dry weight result, or measurement basis unknown.

Abbreviations:

CAS	Chemical Abstracts Service
CDD	Chlorodibenzo-dioxin
CDF	Chlorodibenzofuran
cPAH	Carcinogenic polycyclic aromatic hydrocarbon
DRO	Diesel-range organics
ft	Feet
HpCDD	Heptachlorodibenzo-p-dioxin
HpCDF	Heptachlorodibenzofuran
HxCDD	Hexachlorodibenzo-p-dioxin
HxCDF	Hexachlorodibenzofuran
mg/kg	Milligrams per kilogram
MTCA	Model Toxics Control Act
OCDD	Octachlorodibenzodioxin
ORO	Oil-range organics
OCDF	Octachlorodibenzofuran
PeCDD	Pentachlorodibenzo-p-dioxin
PeCDF	Pentachlorodibenzofuran
TCDF	Tetrachlorodibenzofuran
TEQ	Toxic Equivalent
TCDD	Tetrachlorodibenzo-p-dioxin

Qualifiers:

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

Table 3.5
Subsurface Soil Analytical Data for Other Analytes

		Location Name	B-26/MW-26			B-28
		Sample Name	B26-2.5-4.0	B26-5.0-6.5	B26-17.0-18.5	B28-1.5
		Sample Date	9/19/1988	9/19/1988	9/19/1988	9/20/1988
		Sample Depth	2.5–4 ft	5–6.5 ft	17–18.5 ft	1.5–1.5 ft
Analyte	**CAS No.**	**Unit**				
Conventionals						
Salinity	--	%				
Metals						
Arsenic	7440-38-2	mg/kg				3.4
Barium	7440-39-3	mg/kg				12
Beryllium	7440-41-7	mg/kg				0.20
Cadmium	7440-43-9	mg/kg				
Chromium	7440-47-3	mg/kg				16
Cobalt	7440-48-4	mg/kg				6.0
Lead	7439-92-1	mg/kg				5.1
Mercury	7439-97-6	mg/kg				
Nickel	7440-02-0	mg/kg				16
Selenium	7782-49-2	mg/kg				
Silver	7440-22-4	mg/kg				
Vanadium	7440-62-2	mg/kg				34
Zinc	7440-66-6	mg/kg				36
Total Petroleum Hydrocarbons						
Diesel-range organics	DRO	mg/kg				
Oil-range organics	ORO	mg/kg				
Total DRO & ORO	T_DRO&ORO (U=0)	mg/kg				
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	83-32-9	mg/kg	0.33 U (1)	0.33 U (1)	0.33 U (1)	
Acenaphthylene	208-96-8	mg/kg				
Anthracene	120-12-7	mg/kg	0.33 U (1)	0.33 U (1)	0.33 U (1)	
Benzo(a)anthracene	56-55-3	mg/kg	0.33 U (1)	0.33 U (1)	0.33 U (1)	
Benzo(a)pyrene	50-32-8	mg/kg	0.33 U (1)	0.33 U (1)	0.33 U (1)	
Benzo(b)fluoranthene	205-99-2	mg/kg	0.33 U (1)	0.33 U (1)	0.33 U (1)	
Benzo(g,h,i)perylene	191-24-2	mg/kg	0.33 UJ (1)	0.33 UJ (1)	0.33 UJ (1)	
Benzo(k)fluoranthene	207-08-9	mg/kg	0.33 U (1)	0.33 U (1)	0.33 U (1)	
Chrysene	218-01-9	mg/kg	0.33 U (1)	0.33 U (1)	0.33 U (1)	
cPAHs (MTCA TEQ-HalfND)	BaPEq (U=1/2)	mg/kg	0.33 U (1)	0.33 U (1)	0.33 U (1)	
cPAHs (MTCA TEQ-ZeroND)	BaPEq (U=0)	mg/kg	0.33 U (1)	0.33 U (1)	0.33 U (1)	
Dibenzo(a,h)anthracene	53-70-3	mg/kg				
Fluoranthene	206-44-0	mg/kg	0.33 U (1)	0.33 U (1)	0.33 U (1)	
Fluorene	86-73-7	mg/kg	0.33 U (1)	0.33 U (1)	0.33 U (1)	
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg	0.33 U (1)	0.33 U (1)	0.33 U (1)	
Naphthalene	91-20-3	mg/kg	0.33 U (1)	0.33 U (1)	0.33 U (1)	
Phenanthrene	85-01-8	mg/kg	0.33 U (1)	0.33 U (1)	0.33 U (1)	
Pyrene	129-00-0	mg/kg	0.33 U (1)	0.33 U (1)	0.33 U (1)	
Semivolatile Organic Compounds						
2,4,5-Trichlorophenol	95-95-4	mg/kg	1.6 U (1)	1.6 U (1)	1.6 U (1)	
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-Chloronaphthalene	91-58-7	mg/kg				
2-Chlorophenol	95-57-8	mg/kg				
2-Methylphenol	95-48-7	mg/kg				

Table 3.5
Subsurface Soil Analytical Data for Other Analytes

		Location Name	B-26/MW-26			B-28
		Sample Name	B26-2.5-4.0	B26-5.0-6.5	B26-17.0-18.5	B28-1.5
		Sample Date	9/19/1988	9/19/1988	9/19/1988	9/20/1988
		Sample Depth	2.5–4 ft	5–6.5 ft	17–18.5 ft	1.5–1.5 ft
Analyte	**CAS No.**	**Unit**				
Semivolatile Organic Compounds (cont.)						
2-Nitrophenol	88-75-5	mg/kg				
3- & 4-Methylphenol	15831-10-4	mg/kg				
4-Chloro-3-methylphenol	59-50-7	mg/kg				
4-Methylphenol	106-44-5	mg/kg	0.33 U (1)	0.33 U (1)	0.33 U (1)	
4-Nitrophenol	100-02-7	mg/kg				
Benzoic acid	65-85-0	mg/kg	1.6 U (1)	0.040 J (1)	1.6 U (1)	
Bis(2-chloroethoxy)methane	111-91-1	mg/kg				
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	0.33 UJ (1)	0.44 UJ (1)	0.33 UJ (1)	
Butyl benzyl phthalate	85-68-7	mg/kg				
Dibenzofuran	132-64-9	mg/kg	0.33 U (1)	0.33 U (1)	0.33 U (1)	
Diethylphthalate	84-66-2	mg/kg				
Dimethyl phthalate	131-11-3	mg/kg				
Di-n-butyl phthalate	84-74-2	mg/kg	0.33 U (1)	0.33 U (1)	0.051 J (1)	
Di-n-octyl phthalate	117-84-0	mg/kg				
Hexachlorobutadiene	87-68-3	mg/kg				
Hexachlorocyclopentadiene	77-47-4	mg/kg				
Hexachloropropene	1888-71-7	mg/kg				
N-Nitrosodiphenylamine	86-30-6	mg/kg				
Phenol	108-95-2	mg/kg	0.33 U (1)	0.33 U (1)	0.33 U (1)	
Volatile Organic Compounds						
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				
1,2,4-Trichlorobenzene	120-82-1	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-Dichlorobenzene	541-73-1	mg/kg				
1,4-Dichlorobenzene	106-46-7	mg/kg				
2-Chloroethyl vinyl ether	110-75-8	mg/kg				
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg				
Benzene	71-43-2	mg/kg				
Bis(2-chloroethyl)ether	111-44-4	mg/kg				
Bis(2-chloroisopropyl)ether	39638-32-9	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				
Chloroethane	75-00-3	mg/kg				
Chloroform	67-66-3	mg/kg				
Chloromethane	74-87-3	mg/kg				
cis-1,3-Dichloropropene	10061-01-5	mg/kg				
Dibromochloromethane	124-48-1	mg/kg				
Dichlorodifluoromethane	75-71-8	mg/kg				
Ethylbenzene	100-41-4	mg/kg				
Hexachlorobenzene	118-74-1	mg/kg				

Table 3.5
Subsurface Soil Analytical Data for Other Analytes

		Location Name	B-26/MW-26			B-28
		Sample Name	B26-2.5-4.0	B26-5.0-6.5	B26-17.0-18.5	B28-1.5
		Sample Date	9/19/1988	9/19/1988	9/19/1988	9/20/1988
		Sample Depth	2.5–4 ft	5–6.5 ft	17–18.5 ft	1.5–1.5 ft
Analyte	**CAS No.**	**Unit**				
Volatile Organic Compounds (cont.)						
Methylene chloride	75-09-2	mg/kg				
Pentachloroethane	76-01-7	mg/kg				
Tetrachloroethene	127-18-4	mg/kg				
Toluene	108-88-3	mg/kg				
trans-1,2-Dichloroethene	156-60-5	mg/kg				
trans-1,3-Dichloropropene	10061-02-6	mg/kg				
Trichloroethene	79-01-6	mg/kg				
Trichlorofluoromethane	75-69-4	mg/kg				
Vinyl chloride	75-01-4	mg/kg				
Xylene (total)	1330-20-7	mg/kg				
Dioxins/Furans						
2,3,7,8-TCDD	1746-01-6	mg/kg				
1,2,3,7,8-PeCDD	40321-76-4	mg/kg				
1,2,3,4,7,8-HxCDD	39227-28-6	mg/kg				
1,2,3,6,7,8-HxCDD	57653-85-7	mg/kg				
1,2,3,7,8,9-HxCDD	19408-74-3	mg/kg				
1,2,3,4,6,7,8-HpCDD	35822-46-9	mg/kg				
OCDD	3268-87-9	mg/kg				
2,3,7,8-TCDF	51207-31-9	mg/kg				
1,2,3,7,8-PeCDF	57117-41-6	mg/kg				
2,3,4,7,8-PeCDF	57117-31-4	mg/kg				
1,2,3,4,7,8-HxCDF	70648-26-9	mg/kg				
1,2,3,6,7,8-HxCDF	57117-44-9	mg/kg				
1,2,3,7,8,9-HxCDF	72918-21-9	mg/kg				
2,3,4,6,7,8-HxCDF	60851-34-5	mg/kg				
1,2,3,4,6,7,8-HpCDF	67562-39-4	mg/kg				
1,2,3,4,7,8,9-HpCDF	55673-89-7	mg/kg				
OCDF	39001-02-0	mg/kg				
Dioxins/Furans (MTCA TEQ-HalfND)	DF_TEQ (U=1/2)	mg/kg				
Dioxins/Furans (MTCA TEQ-ZeroND)	DF_TEQ (U=0)	mg/kg				
Pesticide-Herbicides						
Dinoseb	88-85-7	mg/kg				

Notes:

Blank cells are intentional.

All results presented in this table are rounded to two significant figures, with the exception of those for the dioxin/furan TEQ, which are rounded to three significant figures.

All results presented on a dry-weight basis.

-- Not available.

1 Historical data did not provide dry weight result, or measurement basis unknown.

Abbreviations:

CAS	Chemical Abstracts Service
CDD	Chlorodibenzo-dioxin
CDF	Chlorodibenzofuran
cPAH	Carcinogenic polycyclic aromatic hydrocarbon
DRO	Diesel-range organics
ft	Feet
HpCDD	Heptachlorodibenzo-p-dioxin
HpCDF	Heptachlorodibenzofuran
HxCDD	Hexachlorodibenzo-p-dioxin
HxCDF	Hexachlorodibenzofuran
mg/kg	Milligrams per kilogram
MTCA	Model Toxics Control Act
OCDD	Octachlorodibenzodioxin
ORO	Oil-range organics
OCDF	Octachlorodibenzofuran
PeCDD	Pentachlorodibenzo-p-dioxin
PeCDF	Pentachlorodibenzofuran
TCDF	Tetrachlorodibenzofuran
TEQ	Toxic Equivalent
TCDD	Tetrachlorodibenzo-p-dioxin

Qualifiers:

J Analyte is detected and the concentration is estimated.

U Analyte is not detected at the associated reporting limit.

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

Table 4.1
Groundwater Preliminary Screening Levels (1)

Analyte	CAS No.	Protection of Drinking Water (2)	Protection of Surface Water (3)	Protection of Sediment (4)	Protection of Indoor Air (5)	Natural Background (6)	Most Stringent PSL (7)
Metals							
Arsenic	7440-38-2	5.8E-01	1.4E-01	1.9E+03	--	8.0E+00	8.0E+00
Cadmium	7440-43-9	5.0E+00	7.9E+00	7.3E+02	--	--	5.0E+00
Chromium, total (8)	7440-47-3	2.4E+04	2.7E+01	--	--	--	2.7E+01
Copper	7440-50-8	6.4E+02	3.1E+00	1.7E+04	--	--	3.1E+00
Lead	7439-92-1	1.5E+01	5.6E+00	4.5E+01	--	--	5.6E+00
Mercury, inorganic	7439-97-6	2.0E+00	2.5E-02	7.8E+00	1.1E+00	--	2.5E-02
Silver	7440-22-4	8.0E+01	1.9E+00	7.1E+02	--	--	1.9E+00
Zinc	7440-66-6	4.8E+03	8.1E+01	6.6E+03	--	--	8.1E+01
Total Petroleum Hydrocarbons							
Gasoline-range TPH	TPHG	8.0E+02	8.0E+02	--	--	--	8.0E+02
Total diesel-range and oil-range TPH	TPHDO	5.0E+02	5.0E+02	--	--	--	5.0E+02
Volatile Organic Compounds							
Benzene	71-43-2	5.0E+00	1.6E+00	--	2.4E+00	--	1.6E+00
Ethylbenzene	100-41-4	7.0E+02	2.1E+01	--	2.8E+03	--	2.1E+01
Toluene	108-88-3	6.4E+02	1.0E+02	--	1.5E+04	--	1.0E+02
Total xylenes	1330-20-7	1.6E+03	1.1E+02	--	3.2E+02	--	1.1E+02
Semivolatile Organic Compounds							
Pentachlorophenol	87-86-5	1.0E+00	2.0E-03	4.1E+02	--	--	2.0E-03
2,3,4,5-Tetrachlorophenol	4901-51-3	--	--	--	--	--	--
2,3,4,6-Tetrachlorophenol	58-90-2	4.8E+02	--	--	--	--	4.8E+02
Benzo(a)anthracene	56-55-3	--	1.6E-04	7.3E-02	--	--	1.6E-04
Benzo(b)fluoranthene	205-99-2	--	1.6E-04	--	--	--	1.6E-04
Benzo(k)fluoranthene	207-08-9	--	1.6E-03	--	--	--	1.6E-03
Benzo(a)pyrene	50-32-8	2.0E-01	1.6E-05	3.3E-02	--	--	1.6E-05
Chrysene	218-01-9	--	1.6E-02	1.5E-01	--	--	1.6E-02
Dibenz(a,h)anthracene	53-70-3	--	1.6E-05	2.6E-03	--	--	1.6E-05
Indeno(1,2,3-cd)pyrene	193-39-5	--	1.6E-04	6.2E-03	--	--	1.6E-04
Total cPAH TEQ	CPAHTEQ	2.3E-02	9.7E-03	1.3E-03	--	--	1.3E-03
Polychlorinated Biphenyls (PCBs)							
Total PCB Aroclors	1336-36-3	2.2E-01	7.0E-06	3.3E-02	--	--	7.0E-06
Total PCB congeners	PCBCON	2.2E-01	7.0E-06	--	--	--	7.0E-06
Total PCB TEQ	PCBTEQ	3.4E-07	4.4E-09	--	--	--	4.4E-09
Dioxins/Furans							
Total dioxin/furan TEQ	DFTEQ	3.4E-07	2.8E-08	--	--	--	2.8E-08

Notes:

-- Not available.

1 Concentrations are presented in µg/L. PSLs have been rounded to two significant digits.

2 The PSL for protection of drinking water is based on the lowest of the ARARs for site groundwater, which include MTCA Method B groundwater cleanup levels (WAC 173-340-720) and state (WAC 246-290) Maximum Contaminant Levels, adjusted downward if not sufficiently protective in accordance with WAC 173-340-720(7)(b).

3 The PSL for protection of surface water is based on the lowest of the ARARs for site groundwater, which include federal [CWA §304(a)] and state (WAC 173-210A) marine surface water concentrations protective of aquatic life and human health from consumption of seafood.

4 The PSL for protection of sediment was calculated with a modified MTCA three-phase model using assumptions about theoretical partitioning between soil to groundwater and then theoretical groundwater partitioning to sediments. The sediment cleanup levels in the WPAH RI/FS and the SMS SCO were identified as target sediment concentrations.

5 Groundwater PSLs for vapor intrusion were calculated per Ecology's 2018 guidance, as updated (Appendix B of Ecology 2018).

6 Background for arsenic as established in the MTCA Method A Table 720-1 (WAC 173-340-900).

7 The PSL is based on lowest of the groundwater ARARs for the Study Area as listed in this table, adjusted for natural background in accordance with WAC 173-340-705(6).

8 Hexavalent chromium has not been detected at the Site; therefore, the groundwater PSL for total chromium considers only those ARARs based on trivalent chromium toxicity.

Abbreviations:

ARAR	Applicable or Relevant and Appropriate Requirement
CAS	Chemical Abstracts Service
cPAH	Carcinogenic polycyclic aromatic hydrocarbon
CWA	Clean Water Act
µg/L	Micrograms per liter
MTCA	Model Toxics Control Act
PSL	Preliminary screening level
RI/FS	Remedial Investigation/Feasibility Study
SMS SCO	Sediment Management Standards Sediment Cleanup Objective
TEQ	Toxic equivalent
TPH	Total petroleum hydrocarbons
WAC	Washington Administrative Code
WPAH	Western Port Angeles Harbor

Table 4.2
Soil Preliminary Screening Levels (1,2)

Analyte	CAS No.	Protection of Direct Contact (2)	Protection of Ecological Receptors (3)	Protection of Leaching to Groundwater (4)	Protection of Bank Erosion (5)	Natural Background (6,7)	Most Stringent PSL (8)
Metals							
Arsenic	7440-38-2	6.7E-01	7.0E+00	2.3E-01	5.7E+01	7.3E+00	7.3E+00
Cadmium	7440-43-9	8.0E+01	4.0E+00	3.5E-02	5.1E+00	7.7E-01	7.7E-01
Chromium, total	7440-47-3	--	4.2E+01	--	2.6E+02	4.8E+01	4.8E+01
Copper	7440-50-8	3.2E+03	5.0E+01	6.9E-02	3.9E+02	3.6E+01	3.6E+01
Lead	7439-92-1	2.5E+02	5.0E+01	5.6E+01	4.5E+02	2.4E+01	5.0E+01
Mercury, inorganic	7439-97-6	--	1.0E-01	1.3E-03	1.3E-01	7.0E-02	7.0E-02
Silver	7440-22-4	4.0E+02	2.0E+00	1.6E-02	6.1E+00	--	1.6E-02
Zinc	7440-66-6	2.4E+04	8.6E+01	5.0E+00	4.1E+02	8.5E+01	8.5E+01
Total Petroleum Hydrocarbons							
Gasoline-range TPH	TPHG	--	1.2E+02	--	--	--	1.2E+02
Total diesel-range and oil-range TPH	TPHDO	--	2.6E+02	--	--	--	2.6E+02
Volatile Organic Compounds							
Benzene	71-43-2	1.8E+01	--	5.6E-04	--	--	5.6E-04
Ethylbenzene	100-41-4	8.0E+03	--	1.0E-02	--	--	1.0E-02
Toluene	108-88-3	6.4E+03	2.0E+02	4.4E-02	--	--	4.4E-02
Total xylenes	1330-20-7	1.6E+04	--	5.5E-02	--	--	5.5E-02
Semivolatile Organic Compounds							
Pentachlorophenol	87-86-5	2.5E+00	3.0E+00	1.8E-06	3.6E-01	--	1.8E-06
2,3,4,5-Tetrachlorophenol	4901-51-3	--	--	--	--	--	--
2,3,4,6-Tetrachlorophenol	58-90-2	2.4E+03	--	--	--	--	2.4E+03
Benzo(a)anthracene	56-55-3	--	--	5.7E-05	1.3E+00	--	5.7E-05
Benzo(b)fluoranthene	205-99-2	--	--	9.6E-05	na	--	9.6E-05
Benzo(k)fluoranthene	207-08-9	--	--	9.4E-04	na	--	9.4E-04
Benzo(a)pyrene	50-32-8	1.9E-01	1.2E+01	1.6E-05	1.6E+00	--	1.6E-05
Chrysene	218-01-9	--	--	2.9E-03	1.4E+00	--	2.9E-03
Dibenz(a,h)anthracene	53-70-3	--	--	2.9E-05	2.3E-01	--	2.9E-05
Indeno(1,2,3-c,d)pyrene	193-39-5	--	--	3.1E-04	6.0E-01	--	3.1E-04
Total cPAH TEQ	CPAHTEQ	1.9E-01	1.2E+01	1.3E-03	6.4E-02	--	1.3E-03
Polychlorinated Biphneyls (PCBs)							
Total PCB Aroclors	1336-36-3	1.0E+00	6.5E-01	5.5E-07	1.3E-01	--	5.5E-07
Total PCB congeners	PCBCON	1.0E+00	6.5E-01	5.5E-07	--	--	5.5E-07
Total PCB TEQ	PCBTEQ	1.3E-05	--	3.5E-10	--	--	3.5E-10
Dioxins/Furans							
Total dioxin/furan TEQ	DFTEQ	1.3E-05	--	6.9E-09	--	5.2E-06	5.2E-06
Total chlroinated dioxins	DIOX	--	2.0E-06	--	--	--	2.0E-06
Total chlorinated furans	FUR	--	2.0E-06	--	--	--	2.0E-06
Total TEQ							
Total TEQ	TTEQ	1.3E-05	--	6.9E-09	5.2E-06	5.2E-06	5.2E-06

Notes:

-- Not available.

1 Concentrations are presented in mg/kg. PSLs have been rounded to two significant digits.

2 PSL is the lower of the MTCA Method B cancer and non-cancer cleanup levels.

3 PSL is the lowest of the wildlife, plants, and biota Ecological Indicator Concentrations in MTCA Table 449-3 (WAC 173-340-900).

4 Calculated concentrations are protective of groundwater as drinking water and as marine surface water and calculated based on groundwater PSLs using the MTCA three-phase model.

5 PSL is based on the sediment cleanup levels in the WPAH RI/FS and the SMS SCO.

6 Metals background values (Puget Sound Region 90th percentile values) are from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

7 Background for dioxins/furans from Natural Background for Dioxins/Furans in WA Soils (Ecology 2010).

8 The PSL is based on lowest of the soil ARARs for the Study Area as listed in this table, adjusted for natural background in accordance with WAC 173-340-705(6).

Abbreviations:

ARAR	Applicable or Relevant and Appropriate Requirement
CAS	Chemical Abstracts Service
cPAH	Carcinogenic polycyclic hydrocarbon
Ecology	Washington State Department of Ecology
mg/kg	Milligrams per kilogram
MTCA	Model Toxics Control Act
PSL	Preliminary screening level
RI/FS	Remedial Investigation/Feasibility Study
SCO	Sediment Cleanup Objective
SMS	Sediment Management Standards
TEQ	Toxic equivalent
TPH	Total petroleum hydrocarbons
WAC	Washington Administrative Code
WPAH	Western Port Angeles Harbor

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
1	Shoreline Groundwater Quality: A shoreline groundwater monitoring well network is needed to assess the quality of groundwater discharging to the harbor and the potential for groundwater to pose a recontamination risk to sediment or a risk to surface water, or indoor air.	Establish a network of shoreline monitoring wells along the length of the Terminal 5–7 shoreline to identify potential areas of contaminated groundwater discharge to the harbor or to indoor air.	Existing groundwater data may inform which existing wells are appropriate to sample.	Geographic area: upland areas within 50 feet of the approximately 2,700-foot shoreline of Terminals 5–7. Sample type: groundwater samples collected with low-flow methods.	Groundwater samples will be collected from new and existing shoreline monitoring wells (if suitable) and analyzed for the identified groundwater Chemicals of Interest (COIs). If observed, the thickness of non-aqueous phase liquid (NAPL) will be measured. Groundwater COI list includes: • Pentachlorophenol (PCP) and tetrachlorophenol (TeCP) based on known contamination and usage; gasoline-, diesel-, and oil-range total petroleum hydrocarbons (TPH) and benzene, toluene, ethylbenzene, and xylenes (BTEX) based on historical fuel use and potential for fuel releases migrating in dissolved phase • Western Port Angeles Harbor (WPAH) Site indicator hazardous substances (IHSs; cadmium, mercury, zinc, carcinogenic polycyclic aromatic hydrocarbons [cPAHs], polychlorinated biphenyls [PCBs], dioxins/furans) • Other metals potentially associated with fill materials (arsenic, chromium, copper, lead, silver)	Field sample and laboratory results acceptance criteria are described in Appendix B.	The proposed groundwater monitoring well installation plan is described in Section 6.2.2.1 and Appendix B.
2	Upgradient Groundwater Quality: Evaluation of groundwater quality in the uplands, upgradient of the shoreline, is needed to assess potential "hot spot" (i.e., NAPL) areas with groundwater impacts from historical sources of contamination.	Collect groundwater samples from existing upgradient wells, if located.	Existing groundwater samples were collected at least 10 years prior to the study and are not considered to be representative of current conditions.	Geographic area: Within 200 feet of shoreline. Media: groundwater collected from existing monitoring wells, if located.	Groundwater samples will be collected and analyzed for the groundwater COIs. If observed, the thickness of NAPL will be measured.	Field sample and laboratory results acceptance criteria are described in Appendix B.	The proposed groundwater monitoring well sampling plan is described in Section 6.2.2.1 and Appendix B.

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	Fill Quality: evaluation of the quality of fill material used to create the majority of the Terminal 5–7 shoreline is needed to assess the potential for fill to pose a risk to human and ecological receptors via direct contact and contribute to groundwater contamination discharging to the harbor.	Identify the presence of fill material and determine whether the soil COIs are present in the fill at concentrations of concern for the direct contact and groundwater leaching pathways.	Information about fill source for portions of the shoreline is not available. Existing sample collected from fill soil have had scattered detections of metals and PAHs suggesting that these COIs might be present in the fill in areas not associated with known historical releases. Soil samples will be collected from fill identified during installation of monitoring well borings.	Geographic area: approximate fill areas as shown on the figure summarizing historical operations. The depth of fill will be verified in the field. Media: soil collected via drilling methodology.	Representative samples of fill material will be analyzed for soil COIs. Soil COI list includes: • PCP and TeCP based on known contamination and usage • Gasoline-, diesel- and oil-range TPH based on historical fuel use • WPAH IHSs (cadmium, mercury, zinc, cPAHs, PCBs, dioxins/furans) • Other metals potentially associated with fill materials (arsenic, chromium, copper, lead, silver)	Field sample and laboratory results acceptance criteria are described in Appendix B.	The proposed fill soil sampling plan is described in Section 6.2.2.2 and Appendix B.
4	Bank erodibility: An evaluation is needed to determine the erosion potential of the Terminal 5–7 shoreline to the harbor.	Complete a rigorous topographic and visual survey to accurately identify erodible bank areas.	A preliminary shoreline conditions survey was completed in 2015 as part of the WPAH Remedial Investigation/Feasibility Study (RI/FS) process. This visual survey identified preliminary areas that are considered erodible. Bank angles will be mapped with a vessel-based LiDAR survey to determine any steep slope areas that may affect slope stability. Additional detailed visual assessment will be completed to assess other factors related to bank erodibility.	Geographic area: the shoreline of Terminals 5 to 7, from the top of bank to the mean lower low water (MLLW) mark of the harbor.	Laboratory analyses are not proposed for this study. Information inputs will be evaluated qualitatively and quantitatively, as appropriate, using geospatial imaging software.	Field precision and data acceptance criteria are described in Appendix B.	The proposed bank erodibility assessment plan is described in Section 6.2.2.3 and Appendix B.

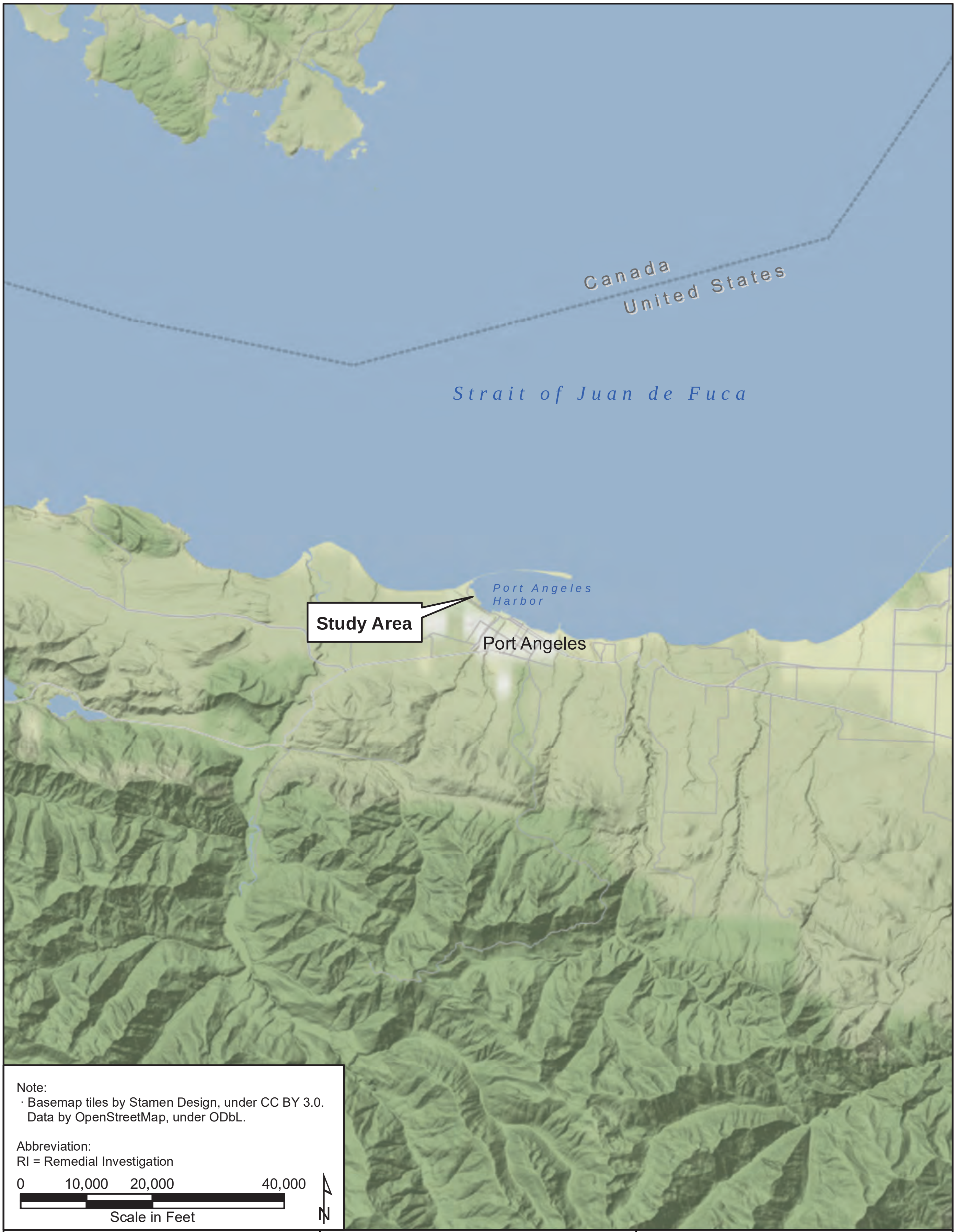
Table 6.1
Data Quality Objectives

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 soil quality: if erodible soils are identified, evaluation of the quality of bank soil is needed to assess the potential for bank soil to pose a recontamination risk to harbor sediments.	Evaluate bank soil quality and determine whether bank soil COIs are present at concentrations of concern for sediment recontamination.	Erodible bank areas will be determined by the bank erodibility survey described in Data Quality Objective (DQO) 3.	Geographic area: the shoreline of Terminals 5 to 7, from the top of bank to MLLW mark. Media: soil collected by hand-sampling methodology.	Representative samples of bank surface soil that is determined to be erodible will be analyzed for WPAH IHSs.	Field sample and laboratory results acceptance criteria are described in Appendix B.	The proposed bank soil sampling plan will be described in an RI Work Plan – Phase I Addendum.
6	Stormwater conveyance line condition: an evaluation of the City stormwater line condition, and potential presence and condition of historical outfalls, is needed to identify if stormwater conveyance serve as a preferential pathway for contaminated soil and groundwater discharge to the harbor.	Complete a camera survey of stormwater conveyance line(s) to determine current conditions and the position of any observed damage or deterioration.	Information on the condition of the City stormwater conveyance line is not available. Information regarding the original date of installation, pipe diameter and construction materials, and approximate depth were obtained from City records. Historical records suggest that other stormwater conveyance may be present in the Study Area, but the depth and construction of these lines is not well documented.	Geographic area: the length of the conveyance line from the southern property boundary to the harbor.	Laboratory analyses are not proposed for this study. Information inputs will be evaluated qualitatively and quantitatively, as appropriate, using the video survey.	Acceptance criteria are described in Appendix B.	The proposed video survey procedure is described in Section 6.2.2.4.
7	Stormwater quality: if damaged or deteriorated stormwater lines are identified, an evaluation of stormwater is needed to assess the potential for stormwater to pose a recontamination risk to harbor sediments.	Evaluate stormwater quality and determine whether COIs are present at concentrations of concern for sediment recontamination.	The need for stormwater and inline solids sampling will be determined by the stormwater conveyance line survey described in DQO 6.	Geographic area: the closest manhole upstream of the Study Area and at the location of the outfall at the shoreline of the Study Area.	Representative samples of stormwater and potentially inline solids will be analyzed for groundwater COIs.	Field sample and laboratory results acceptance criteria are described in Appendix B.	The proposed stormwater and inline solids sampling plan will be described in an RI Work Plan – Phase I Addendum.

Remedial Investigation Work Plan – Phase I

Port of Port Angeles Terminals 5, 6, and 7

Figures



Note:
· Basemap tiles by Stamen Design, under CC BY 3.0. Data by OpenStreetMap, under ODbL.

Abbreviation:
RI = Remedial Investigation

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RI Work Plan – Phase I
Port of Port Angeles
Terminals 5, 6, and 7
Port Angeles, Washington

Figure 1.1
Study Area Vicinity Map

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10/18/2022

Notes:
1. Erosional areas were defined during a visual survey from the bank conducted as part of the WPAH RI/FS process. Areas will be refined as part of this RI Work Plan – Phase I.
- Bathymetry is from 2001 to 2008 and provided by the Lower Elwha Klallam Tribe.
- Orthoimagery obtained from NAIP, 2015.

Abbreviations:
CESF = Chitosan-enhanced sand filtration
MLLW = Mean Lower Low Water
RI = Remedial Investigation
RI/FS = Remedial Investigation/Feasibility Study
WPAH = Western Port Angeles Harbor

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RI Work Plan – Phase I
Port of Port Angeles Terminals 5, 6, and 7
Port Angeles, Washington

Figure 2.1
Study Area Map

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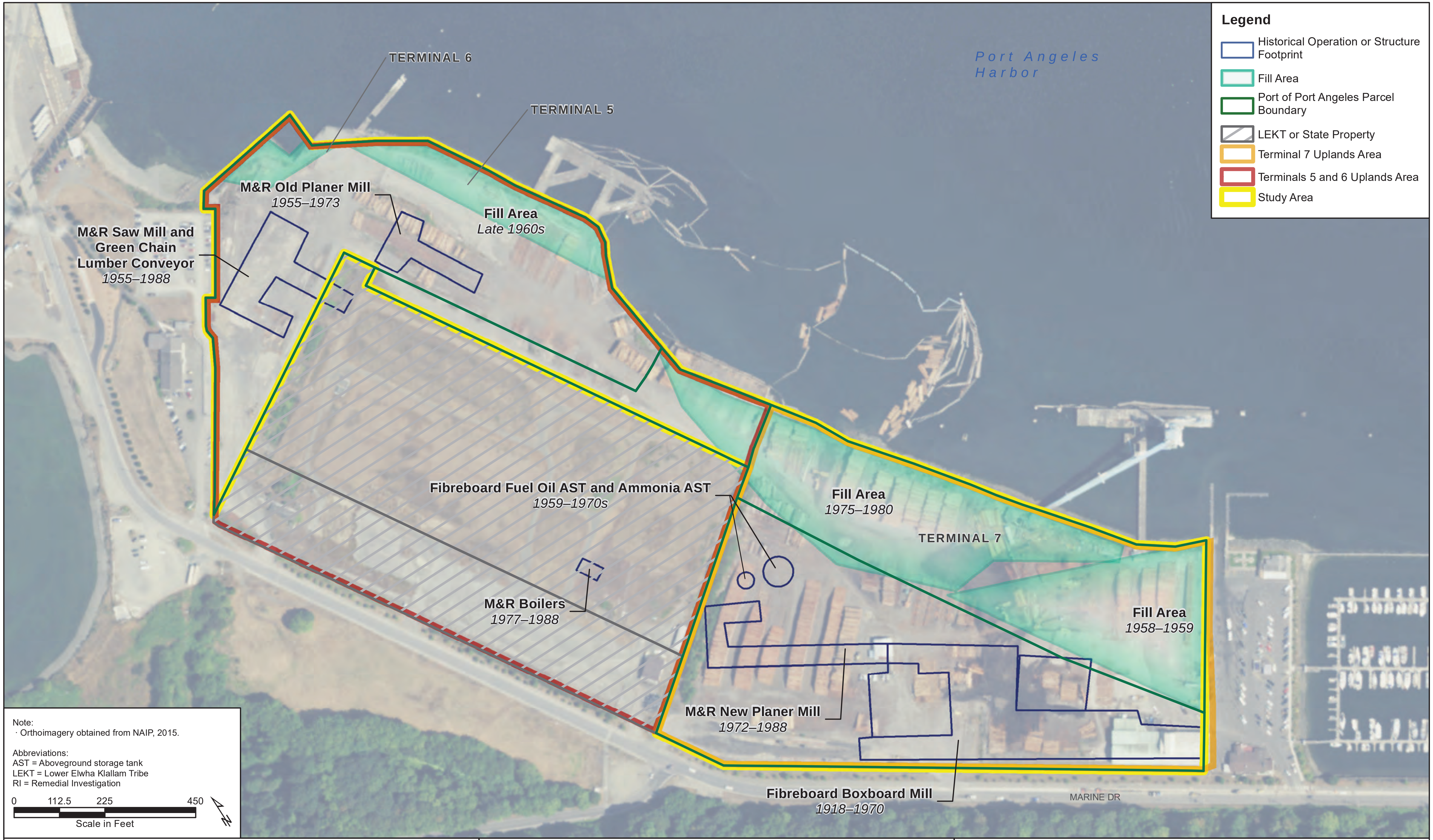
10/18/2022



Note:
· Orthoimagery obtained from NAIP, 2015.

Abbreviations:
AST = Aboveground storage tank
LEKT = Lower Elwha Klallam Tribe
RI = Remedial Investigation

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RI Work Plan – Phase I
Port of Port Angeles Terminals 5, 6, and 7
Port Angeles, Washington

Figure 2.2
Key Historical Operational Areas and Fill Areas

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10/18/2022

Legend

Historical Sampling Locations

- ● Surface Soil
- ● Subsurface Soil
- ◐ Groundwater

Other Features

- ☐ Historical Operation or Structure Footprint
- 🟩 Fill Area
- ☐ Port of Port Angeles Parcel Boundary
- ▨ LEKT or State Property
- ☐ Study Area

Note:
· Orthoimagery obtained from NAIP, 2015.

Abbreviations:
LEKT = Lower Elwha Klallam Tribe
RI = Remedial Investigation

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RI Work Plan – Phase I
Port of Port Angeles Terminals 5, 6, and 7
Port Angeles, Washington

Figure 3.1
Historical Groundwater and Soil Sampling Locations

I:\GIS\Projects\POPA AO T5,6,7\MXD\RIFS Work Plan-Phase 1\Figure 3.1 Historical Groundwater and Soil Sampling Locations.mxd
10/18/2022

Note:
· Orthoimagery obtained from NAIP, 2015.

Abbreviations:
LEKT = Lower Elwha Klallam Tribe
RI = Remedial Investigation

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RI Work Plan – Phase I
Port of Port Angeles Terminals 5, 6, and 7
Port Angeles, Washington

Figure 6.1
Proposed Sample Locations

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10/18/2022

Remedial Investigation Work Plan – Phase I

Port of Port Angeles Terminals 5, 6, and 7

Appendix A
Study Area Data Reports
(Available separately from Ecology)

Remedial Investigation Work Plan – Phase I

Port of Port Angeles Terminals 5, 6, and 7

Appendix B

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
cPAH	Carcinogenic polycyclic aromatic hydrocarbons
Ecology	Washington State Department of Ecology
FBI	Friedman & Bruya, Inc.
Frontier	Frontier Analytical Laboratory
HSA	Hollow-stem auger
LCS	Laboratory control sample
LCSD	Laboratory control sample duplicate
LEKT	Lower Elwha Klallam Tribe
LiDAR	Light detection and ranging
MS	Matrix spike
MSD	Matrix spike duplicate
MTCA	Model Toxics Control Act
NTU	Nephelometric turbidity units
OHW	Ordinary high water
PCB	Polychlorinated biphenyl
PCP	Pentachlorophenol
Port	Port of Port Angeles
PSL	Preliminary screening level
PVC	Polyvinyl chloride
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RI	Remedial Investigation
RPD	Relative percent difference
SAP	Sampling and Analysis Plan
TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TeCP	Tetrachlorophenol
TEF	Toxic equivalent factor
TEQ	Toxic equivalent
USCS	Unified Soil Classification System
USEPA	U.S. Environmental Protection Agency
Work Plan	Remedial Investigation Work Plan

1.0 Introduction

This Sampling and Analysis Plan/Quality Assurance Project Plan (SAP/QAPP) presents the proposed soil and groundwater sample collection and survey methods to fulfill data gaps in the uplands and adjacent bank of Port Angeles Harbor at the Port-owned parcels of Terminals 5, 6, and 7 (Study Area) for the purposes of preparing a Remedial Investigation (RI) and is provided as an appendix to the RI Work Plan – Phase I (Work Plan). The SAP/QAPP specifies field sample collection and laboratory analysis protocols, and field and laboratory quality assurance (QA) objectives.

It is important to note that, because the Study Area location is in an archaeologically sensitive area, any ground-disturbing activities require consultation with the Lower Elwha Klallam Tribe (LEKT), consistent with the 2006 4-Party Settlement Agreement between the LEKT, the State of Washington, the Port of Port Angeles (Port), and the City of Port Angeles. Per the 4-Party Settlement Agreement, ground-disturbing means “operations, such as digging, trenching, boring, excavating, and drilling, that cause physical penetration of the surface of the ground by tools or equipment.” An Archaeological Site Alteration and Excavation Permit through the Department of Archaeology and Historic Preservation is required if ground-disturbing activity occurs within the registered Tse-whit-zen site boundaries (45CA523).

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2.0 Sampling and Analysis Plan

The investigation will involve collecting subsurface soil and groundwater samples for laboratory analyses at the locations shown on Figure 6.1 of the Work Plan, with sampling procedures described in the following section, including field methodology, sample nomenclature, and sample handling and custody documentation. Sampling and analytical programs are summarized in the following sections and are presented in detail in Table B.1.

2.1 GROUNDWATER SAMPLE COLLECTION AND ANALYSIS

As described in Section 6.2.1.1 of the Work Plan, groundwater samples will be collected from 10 proposed monitoring wells to be installed in the shoreline fill areas within the Study Area (MW-27 to MW-36) and three existing shoreline wells (MW-15, MW-18, and MW-19) on Terminal 5. If the existing wells are not found, or found to be damaged and unusable, they will be reinstalled adjacent to their historical locations.

Attempts will also be made to locate and assess the condition of the other existing wells. The Study Area monitoring well network will be developed prior to sampling (refer to Section 2.1.1). Groundwater sampling locations and the other existing wells are shown on Figure 6.1 of the main text.

2.1.1 Monitoring Well Location and Assessment

Available monitoring well construction details for existing wells, including monument types, survey information, and notes about current surface conditions, are summarized in Table B.1. Most well location coordinates are approximate; horizontal survey data were largely not recorded, and the horizontal position of most wells was plotted by georeferencing historical data report maps relative to current site features. Thus, the accuracy of horizontal survey data presented in Table B.1 is dependent on the accuracy of the historical report drawings and may diverge significantly (potentially as much as 30+ feet) from the true position of any wells still existent in the Study Area.

Changes in land use and ground surface cover may additionally have caused some well monuments to be buried beneath soil or pavement. Historical aerial photographs for the Study Area indicate that the ground surface was paved circa 2002–2003, and some wells are presumed to be buried beneath pavement placed after the wells were installed. Most wells in the Study Area were completed with aboveground monuments reported to be approximately 2 to 2.5 feet tall, and in some cases surrounded by 3-foot-by-3-foot concrete pads and protective bollards. Wells with aboveground completion would not be buried unless a significant upland fill placement event was completed after their installation. A review of permits obtained for the Study Area determined that shoreline filling was completed in 1938 (Port of Port Angeles 1946) and shoreline improvements including dock construction were most recently performed in 1972 (M. & R. Timber 1972). The ground surface has not been raised significantly since well installation in 1988; therefore, any wells with aboveground completion would be visible at the ground surface unless they have been destroyed or are currently covered by ephemeral materials (such as temporary log piles). Wells with aboveground monuments are more susceptible to being damaged or destroyed by vehicles and equipment than flush-mounted wells.

Wells MW-13, MW-14, HC-NE-PA, and HC-NW-PA were completed with flush mount monuments and are presumed to be buried based on existing data:

1. Existing field notes indicate that flush-mounted well MW-13 on the Terminal 7 property was installed in an unpaved area in 1988. The ground surface in the vicinity of MW-13 is currently concrete-paved, indicating that the well is covered by concrete pavement and potentially pavement subgrade material. The well log for MW-14 indicates that the ground surface was asphalt-paved at the time of installation, and this location is also currently concrete-paved; therefore, MW-14 is also presumed to be covered by pavement and potentially pavement subgrade material.
2. The ground surface beneath HC-NE-PA and HC-NW-PA on Terminals 5 and 6 was historically unpaved and remains so; however, log handling operations may have caused movement of surfacing gravel or log bark debris sufficient to cover these wells. The approximate ground surface elevation at the time of drilling relative to current ground surface suggests there is 0.3 to 0.4 feet of material covering these wells.

For wells with aboveground completion, the horizontal position of the well will be located using a handheld GPS programmed with the well coordinates. The horizontal positions of these wells are derived from georeferenced figures and considered approximate. A visual survey will be performed to locate the well monument, moving any objects or stockpiled materials within a 30-foot radius of the approximate well location that may be temporarily covering the well.

If any existing wells are located, their condition will be assessed during well location and again during redevelopment. Monitoring wells at active facilities are susceptible to damage, usually due to the protective surface monument being struck by equipment. A displaced monument can cause bending or breakage of the polyvinyl chloride (PVC) well casing which is not always visible from the ground surface; in more extreme instances a monument may be sheared off completely from the well, resulting in a bare well casing and compromised surface seal.

Wells will be assessed after being located to determine whether the well monument is intact, the surface seal remains in place, and the well is properly capped to prevent soil or debris from entering the casing. Any obvious damage will be noted, and any bare PVC casings will be temporarily protected until further condition assessment can be made.

During redevelopment, additional observations will be made to determine whether the well is suitable for sampling. A weighted tape will first be used to measure the total depth of the well. Wells with total depths below ground surface significantly shallower (i.e., 0.5 feet or more) than those indicated in Table B.1 will be further investigated to determine whether the depth discrepancy is due to internal damage blocking the well, hard or gravelly debris, or soft sediment. Internal blockage or gravelly debris indicate that the well has been compromised and must be properly decommissioned, whereas soft sedimentation may not indicate damage and is often successfully addressed by redevelopment.

Wells that are not determined to be compromised after depth sounding will be redeveloped using a pump or bailer with a diameter slightly smaller than the well casing. Difficulty lowering the pump or bailer down the well may be another indication of internal damage; however, provided the pump or bailer is still able to be used, attempts will be made to redevelop the well in accordance with the procedures in Attachment B.1. If excess turbidity remains after over-pumping or bailing and surging during development, this may be another indication that the well is damaged. Low productivity, evidenced by a well going dry during pumping or bailing at rates of approximately 0.5 gallon per minute, may indicate damage but may also be a product of a reversible process such as biofouling or a low conductivity “skin” of fine-grained soil formed during drilling. Surging and over-pumping or bailing are generally effective in mitigating low productivity due to reversible processes but cannot address low productivity due to well damage. If excess turbidity or low productivity are encountered, the well will be further observed during low-flow sampling to determine whether it is suitable for sampling (i.e., if low turbidity samples can be obtained and the well does not draw down excessively or go dry during sampling; refer to Section 2.1.3 for further detail regarding sampling) or must be abandoned in coordination with Ecology.

If any well with a missing or damaged monument or surface seal is determined to be suitable for sampling, repairs to the monument and seal will be performed by a licensed driller and in accordance with the procedures presented in Attachment B.1, without any additional ground-disturbing activities beyond replacement of well construction materials.

2.1.2 Monitoring 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 B.1). Wells will be installed using hollow-stem auger (HSA) drilling methods with an outer auger diameter of at least 6 inches. A 2-inch-diameter polyvinyl chloride (PVC) well with a 10-foot-long screen will be installed at the direction of the field geologist and set to intercept the water table which has been encountered between 3.5 and 7 feet below ground surface (bgs), to a maximum depth of 15 feet bgs along the shoreline of the Study Area. The length of the screened interval may be adjusted based on field conditions at the direction of the field geologist. Wells will be constructed of 0.010-inch slotted PVC, unless the field geologist indicates otherwise based on the grain size of material encountered in the subsurface. Wells will be fitted with watertight caps and completed with flush-mounted monuments.

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 in order to move water through the sand pack and surrounding soil formation. Wells will be developed until the purge water achieves visual clarity. Existing wells will also be redeveloped to remove accumulated fine-grained material. Purge water will be collected in 55-gallon drums and may require off-site disposal depending on groundwater analytical data.

After monitoring well installation, each location will be field located by taking field measurements from permanent features in the Study Area or in the vicinity. All locations will be surveyed for horizontal positioning and elevation by a licensed surveyor.

2.1.3 Groundwater Sampling Methodology

Groundwater sampling will be completed a minimum of 2 weeks following the development or redevelopment of the monitoring wells. All wells will be purged and sampled using low-flow procedures in accordance with the Floyd|Snider low-flow groundwater sample collection guidelines (Attachment B.2). Attachment B.3 presents a standard groundwater sampling field form. Table B.1 summarizes the container type used during sample collection, preservation method, and holding times for the analytes. Care will be taken to collect samples that are representative of dissolved-phase analyte concentrations, with the goal of purging to achieve sample turbidity of less than 5 nephelometric turbidity units (NTU). Groundwater samples to be analyzed for dissolved metals will be field-filtered with a 0.45 micrometer in-line disposable water filter and pumped with clean, polytetrafluoroethylene (Teflon)-lined tubing into the specified sample bottle. If turbidity of 5 NTU cannot be achieved during low-flow sampling, samples collected for analysis methods that do not require field preservation may be centrifuged at the laboratory to remove turbidity prior to analysis.

2.1.4 Groundwater Sample Nomenclature

The sample naming format that will be used for the groundwater samples is: “Groundwater well location number-month/day/year of collection.” For example, a groundwater sample collected from MW-15 on January 20, 2022, would be labeled MW-15-012022. QA/quality control (QC) samples, such as field duplicates, will be named according to the monitoring well location where they were collected; these locations will have “-D” appended to the sample ID.

2.2 SOIL SAMPLE COLLECTION AND ANALYSIS

As described in Section 6.2 of the Work Plan, samples will be collected from all monitoring well borings installed along the shoreline. The proposed monitoring well locations are shown on Figure 6.1 of the Work Plan. Floyd|Snider’s standard guidelines for soil sample collection (included as Attachment B.4) provide general details regarding field procedures, sample collection and processing, decontamination, and field documentation. Specific details regarding sample collection that are not described in Attachment B.4 are included in this section. All locations will be surveyed for horizontal positioning and elevation by a licensed surveyor.

2.2.1 Soil Sampling Methodology

Soil borings for monitoring well installation will be advanced using HSA to a depth of 15 feet bgs. Soil samples from the HSA will be collected for classification and laboratory analysis using an 18-inch-long split spoon.

A surface soil sample (4 inches bgs) will be collected from all monitoring well borings. Additionally, if distinct fill strata are observed, a composite sample for analysis will be collected across the depth interval of each distinct layer. If observed, discrete intervals with ash debris, sandblast grit, or field indications of contamination will also be sampled. If the composition of the fill is uniform throughout the boring, the material will be separated into approximately equal increments no more than 5 feet in length for compositing and sampling.

All soil sampling will be observed by a field technician, logged, classified according to the Unified Soil Classification System (USCS), and photographed. Soil sampling field forms are included in Attachment B.5. Any changes in soil composition will be noted, as will the presence of debris such as ash, sandblast grit, or other anthropogenic materials. Soils will additionally be screened for field indications of contamination such as odor, sheen, staining, or elevated headspace volatiles concentrations measured with a photoionization detector.

Samples 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. Table B.1 summarizes the container type, preservation method, and holding times for soil sample analyses.

2.2.2 Soil Sample Nomenclature

The sample naming format that will be used for the soil samples is: “Sample Location-sample depth interval in feet bgs.” For example, a soil sample collected from MW-27 in the 3-to 6-foot-bgs interval would be labeled MW-27-3-6. QA/QC samples, such as field duplicates, will be named according to the boring location where they were collected.

2.3 SAMPLE HANDLING AND CUSTODY DOCUMENTATION

Sample possession and handling must be traceable from the time of sample collection, through laboratory and data analysis, to the time sample results are reported. A sample log form or field logbook entry will be completed for each sample location.

To control the integrity of the samples during transit to the laboratory and during holding prior to analysis, established preservation and storage measures will be taken. The field lead will check all container labels, custody form entries, and logbook entries for completeness and accuracy at the end of each sampling day. Sample containers will be labeled at the time of sampling, clearly identifying the project name, project number, location name, sample number, sampler’s initials, date and time of collection, analysis to be performed, and preservative.

Technical field staff will be responsible for all sample tracking and custody procedures in the field, and chain-of-custody procedures will be strictly followed. The field lead will be responsible for final sample inventory and will maintain sample custody documentation. Prior to transport, the field technician will wrap sample containers and securely pack them inside the cooler with ice packs or crushed ice. Samples will be delivered to the laboratory under chain-of-custody protocol following completion of sampling activities on the day of sample collection or the following day, depending on the field sampling duration.

At the end of each day, and prior to transfer, Chain-of-Custody Form entries will be made for all samples. All Chain-of-Custody Forms will be completed in indelible ink. All sample information (i.e., sample names, sampling date/time, sample matrix, number of containers, etc.), including all required analyses, will be logged onto a Chain-of-Custody Form prior to formal transfer of sample containers to the analytical laboratory. The sampler will place the original form in a clear plastic bag inside the sample cooler with the samples.

The samples will be considered to be in custody if one of the following is maintained:

- The samples are in someone's physical possession.
- The samples are in someone's view.
- The samples are locked up, secured in a locked container or vehicle, or otherwise sealed so that any tampering would be evident.
- The samples are kept in a secured area, restricted to authorized personnel only.

Any time possession of the samples is transferred, the individuals relinquishing and receiving the samples will respectively sign, date, and note the time of transfer on the Chain-of-Custody Form. This form also documents the transfer of custody of samples from the sampler to the laboratory. Each delivery of sample coolers will be accompanied by Chain-of-Custody Forms. Copies of all forms will be retained as appropriate.

The designated sample receiver at the laboratory will accept custody of the samples and verify that the Chain-of-Custody Forms match the samples received. The laboratory sample receiver will ensure that the Chain-of-Custody Forms are properly signed upon receipt of the samples and will note questions or observations concerning sample integrity on the Chain-of-Custody Forms. Upon receipt, the laboratory will contact the Floyd|Snider Project Manager immediately if discrepancies are discovered between the Chain-of-Custody Forms and the sample shipment. The laboratory program manager, or designee, will specifically note any coolers that are not sufficiently cold upon receipt.

3.0 Survey Plan

3.1 BANK ERODIBILITY SURVEYS

Bank erodibility will be assessed using a combination of topographic survey and visual assessment of bank conditions.

3.1.1 Light Detection and Ranging Topographic Survey

The topography of the banks adjacent to the harbor will be collected using vessel-based light detection and ranging (LiDAR) survey.

Vessel-based LiDAR acquisition will be conducted during low tide levels. LiDAR data will be acquired at a density of 16 parts per million, along survey swaths overlapping by 50% to ensure full coverage of the bank area.

The target vertical accuracy of the survey is ±0.30 feet for areas with slope angles less than 20 degrees; ±0.50 feet for slopes 20 to 50 degrees; and ±1.35 feet for slopes greater than 50 degrees. Factors such as terrain roughness and vegetation, however, may lessen the vertical accuracy. Elevation contours may additionally need to be interpolated in areas of dense brush and blackberries if these areas cause limited return signal.

3.1.2 Visual Survey

Banks will be evaluated along the length of the Study Area shoreline. The visual survey will be completed from the top of bank, on the slope of the bank where accessible, or from a vessel if bank areas are not accessible. Bank areas will be surveyed for this information in transect approximately 100-foot-long transects. Transect start and endpoint coordinates will be collected with a handheld GPS unit. Photographic documentation shall include photos of each transect from accessible points while indicating the view direction and detail photos of any conditions of interest as noted here. Hand-drawn sketches may be included. The survey should be performed during low tides to ensure maximum accessibility.

The visual survey field form is presented in Attachment B.6. Field observations of erodibility hazard qualities to be recorded include the following:

- Bank angle: For the purpose of the evaluation for potential erosion, the relevant portion of the bank for determining bank angle is from the toe of the slope to the top of the bank. Steep slopes (i.e., slope angles greater than 60 degrees) may be of concern for erosion due to erosional forces of the Harbor, sloughing, or slope failure.
- Rooting depth and density: Rooting depth and density will be estimated by noting the presence, type, and size of vegetation and percentage of the slope area covered by vegetation. Areas of bare soil with minimal estimated root depth and density (i.e., lightly vegetated with small pioneering plants or bare soil) are likely of concern for

erosion from erosional forces of the Harbor below ordinary high water (OHW) and from stormwater runoff above OHW.

- Surface protection: The type and size of armoring (such as logs, embedded boulders, or placed rock or concrete armor or retaining walls); location of armoring relative to the toe of the slope, top of the bank, and OHW elevation; percentage of the bank surface covered by armoring; and general condition of armoring will be estimated. Unarmored areas or areas with partial, deteriorating, or improperly sized armoring may be subject to erosional forces of the Harbor or sloughing.
- Bank composition and bank material stratification: The soil types present in bank soil will be assessed where bare soil is exposed, and the percentage of coarse and fine-grained soils will be estimated. Soils will be characterized in accordance with the USCS as presented in the soil logging Standard Guideline (refer to Attachment B.4). Any apparent lenses or contiguous strata of granular sandy soils with minimum fine content and low cohesion, which are more susceptible to erosional forces of the Harbor, undermining, and slope failure, will be noted.
- Damaged or derelict structures: the condition of overwater structures will be assessed for visual indications of damage or likely instability that may indicate a potential future risk of slope erosion due to structural failures.
- Seeps: the presence and position of water seeping from the bank areas will be noted and assessed for quality (i.e., presence of sheen or odor) and discharge rate.
- Outfalls: the presence and position of any apparent historical outfalls will be noted, along with the pipe composition (if discernable), condition of bank surrounding the apparent outfall, and whether any water or sediment appears to be discharging, including whether any excess sedimentation is present on the bank beneath the apparent outfall.

Areas identified with increased susceptibility for erosion based on the criteria in this list will be marked in the field by taking field measurements from permanent features in the Study Area or in the vicinity. All locations will be surveyed for horizontal positioning and elevation by a licensed surveyor. Inaccessible areas of potential concern will be noted by estimating their position on a field map relative to observable site features and marking their locations for survey at the top of the bank or shoreline if possible. Any apparent historical outfall locations will be surveyed for position and elevation by a licensed surveyor. These locations of potential concern based on visual assessment will be combined with the bank angle information to determine targeted areas for soil quality sampling.

3.2 PAVEMENT SURVEY

Pavement coverage, thickness, and condition will be assessed along a grid of approximately 50-foot cells in the portions of the Study Area outside of planned stormwater improvements. The gridded Study Area map will first be provided to Port personnel. The Port retains confidential data from other subsurface explorations within the Study Area; however, observations about surface pavement collected during those explorations are not considered confidential. The Port will therefore provide information, where available, regarding the type, extent, thickness, and condition of pavement in each grid cell. Additional visual survey of the pavement at the ground surface will be conducted to fill gaps in spatial coverage after the Port has provided information resulting from confidential exploration data.

The pavement survey will be coordinated with Port maintenance, such that the survey can be completed immediately after mechanical broom sweeping. Recorded observations will include the following:

- Paved area perimeter: perimeter coordinates will be recorded using a handheld global positioning system receiver while walking the perimeter of the paved area.
- Type and thickness of pavement: the type of pavement (i.e., concrete or asphalt) will be noted for each area. Apparent thickness will be noted, if observable, such as at the pavement edges or at the edges of missing or broken pavement.
- Pavement condition: indications of damage such as cracks or missing areas will be noted. The approximate percentage of the paved area that is damaged will be estimated, and the approximate diameter of missing areas, if observed, will also be noted.

In the event that the edges of pavement are obscured by gravel or debris, ground penetrating radar may be used as an alternate method to locate the edges of pavement beneath the current ground surface and/or the presence of former equipment or building foundation slabs. Ground penetrating radar is useful for estimating the thickness of subsurface pavement but will not yield information about its condition. Ground-penetrating radar will be considered if data gaps remain in 3 or more consecutive grid cells after consultation with Port personnel and completion of the visual survey.

3.3 LAND SURVEYING

Following installation of monitoring wells, the x and y position, top of casing elevation, and ground surface elevation of each well will be recorded by a licensed surveyor. The existing wells that are able to be located will also be resurveyed. The casing elevation measuring point will be marked with a v-notch or indelible mark on the rim of the casing. The required survey precision is ± 0.1 foot for x and y coordinates and ± 0.01 inches for elevation measurements.

Other features that will be surveyed include soil sample locations and features of interest identified during the bank survey. Surveying for these features will include horizontal position and ground surface elevation (and/or pipe elevation).

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4.0 Quality Assurance Project Plan

This section describes the analytical program to be conducted for each sample selected for chemical analysis, and well as the laboratory QA objectives and QC procedures required to be met to achieve technically sound and useable data.

4.1 DATA QUALITY OBJECTIVES

The data collection described in the Work Plan is intended to ensure that a Phase I RI Summary Report can be prepared that presents the complete RI – Phase I dataset, data evaluation, and proposed next steps. If additional data collection is found to be warranted, additional RI sampling will be proposed in an RI Work Plan – Phase II. These objectives have been used to define the following data quality objectives:

- The data must be representative of the media and relevant to the objective listed; this data quality objective is addressed by the design of the Work Plan.
- The data must be sufficiently complete so as not to introduce unacceptable uncertainty. This will be addressed by multiple rounds of groundwater sampling and development of a RI Work Plan – Phase II to fill remaining data gaps after the Phase I investigation.
- The data analysis must be both sensitive and selective. Standard U.S. Environmental Protection Agency (USEPA) and Ecology methods are used for the analysis of soil and groundwater samples. These methods have been selected to ensure that reporting limits are sufficiently low, as feasible, to compare the resulting data to the appropriate screening levels.
- The analytical methods used to make the measurements must be selected to allow the data to be used in meeting the objectives. This data quality objective is addressed by using standardized USEPA methods.
- The analytical methods used to make measurements must be sufficiently sensitive to allow the objectives to be met. Specifically, the reporting limits of the selected methods are sufficiently low to allow the results to be distinguished from decision criteria.
- Data validation will be completed, and data will be reviewed to determine if the data are acceptable for their intended use based on project-specific decision criteria.

4.2 LABORATORY ANALYSES

Samples will be transported to Friedman & Bruya, Inc. (FBI), an accredited laboratory located in Seattle, Washington, for chemical analysis. Analysis for polychlorinated biphenyl (PCB) congeners and dioxin/furan analysis will be performed by Frontier Analytical Laboratory (Frontier), located in El Dorado Hills, California, and an accredited laboratory for high-resolution analyses. The samples collected will be analyzed for the following chemicals as indicated on Table B.2, by the methods for soil and groundwater indicated as follows:

- Total organic carbon by Standard Method 5310B
- Total and dissolved metals by USEPA Method 6020/1631E trace level (mercury only)
- Benzene, ethylbenzene, toluene, and xylenes by USEPA Method 8260D
- Gasoline-range total petroleum hydrocarbons by NWTPH-Gx
- Diesel-range and oil-range total petroleum hydrocarbons by NWTPH-Dx
- Semivolatile organic compounds (including pentachlorophenol [PCP], tetrachlorophenol [TeCP], and carcinogenic polycyclic aromatic hydrocarbons [cPAHs]) by USEPA Method 8270E/8270E SIM
- PCB congeners by USEPA Method 1668
- Dioxins/furans by USEPA Method 1613B

4.3 REPORTING LIMITS

The analytical methods identified in this SAP/QAPP result in method detection limits and reporting limits (or Practical Quantitation Limits) that are achievable with standard methodology. Table B.2 presents the target method detection and reporting limits for each analytical method as performed by FBI. These reporting limits are goals only, insofar as instances may arise where high sample concentrations, non-homogeneity of samples, or matrix interferences preclude achieving the desired reporting limit and associated QA/QC criteria. In such instances, the laboratory will report the reason for any deviation from these reporting limits.

4.4 SPECIFIC DIOXINS/FURANS AND PCB CONGENERS DATA ANALYSES

Dioxins/furans are generally present in the environment as a complex mixture of chemical congeners that differ in terms of the number and location of chlorine atoms. The most toxic and best-studied of the dioxins/furans congeners is 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). Because of the need to evaluate the risks associated with the mixture of congeners, the toxic equivalent factor (TEF) methodology is used. A TEF value is assigned to each congener relative to the toxicity of TCDD. The total toxic equivalent (TEQ) of a mixture is the sum of the products of the concentration of each congener in a sample and the congener's corresponding TEF value. The TEF values used to calculate the TEQs are those resulting from the World Health Organization re-evaluation of TEFs for dioxins/furans performed in 2005 (Van den Berg et al. 2006), as presented in Model Toxics Control Act (MTCA) Table 708-1 (Ecology 2007). The calculated TEQ value will be used to compare against the dioxin/furan TEQ preliminary screening level (PSL). Similarly, for the dioxin-like PCBs, the PCB TEQ value will be calculated and compared against the PCB TEQ PSL. TEFs for dioxin-like PCB congeners are presented in MTCA Table 708-4 (Ecology 2007).

4.5 LABORATORY QUALITY ASSURANCE/QUALITY CONTROL OBJECTIVES

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, and comparability) as defined in Ecology and USEPA guidance (Ecology 2004 and USEPA 2002). Data QA/QC criteria are presented in Table B.3 and are described in detail in the following sections.

4.5.1 Precision

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. Analytical precision is measured through matrix spike (MS), matrix spike duplicate (MSD) samples for organic analyses, through laboratory duplicate samples for inorganic analyses, and on samples from this project.

Analytical precision measurements will be carried out on project-specific samples at a minimum frequency of one per laboratory analysis group. Laboratory precision will be evaluated against quantitative relative percent difference (RPD) performance criteria.

Field precision will be evaluated by the collection of blind field duplicates. Currently, no performance criteria have been established for field duplicates. Field duplicate precision will, therefore, be screened against an RPD of 75% for all samples. However, no data will be qualified based solely on field duplicate precision.

Precision measurements can be affected by the nearness of a chemical concentration to the method detection limit, where the percent error (expressed as RPD) increases. The equation used to express precision is as follows:

$$\mathrm{RPD} = \frac{(C_1 - C_2) \times 100\%}{(C_1 + C_2)/2}$$

Where:
RPD = relative percent difference
C_1 = larger of the two observed values
C_2 = smaller of the two observed values

4.5.2 Accuracy

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 [LCSs], and/or MS) and measuring the percent recovery. Accuracy measurements on MS samples will be carried out at a minimum frequency of one per laboratory analysis group per matrix analyzed. Because MS/MSDs measure the effects of potential matrix interferences of a specific matrix, the laboratory will perform

MS/MSDs only on samples from this investigation and not from other projects. Surrogate recoveries will be determined for every sample analyzed for organics.

Laboratory accuracy will be evaluated against quantitative LCSs, MS, and surrogate spike recoveries using limits for each applicable analyte. Accuracy can be expressed as a percentage of the true or reference value, or as a percent recovery in those analyses where reference materials are not available and spiked samples are analyzed. The equation used to express accuracy is as follows:

$$\%R = 100\% \times (S-U)/C_{sa}$$

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

4.5.3 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 sample locations are properly selected, sufficient numbers of samples are collected to accurately reflect conditions at the location(s), and samples are representative of the sampling location(s). A sufficient volume of sample will be collected at each sampling location to minimize bias or errors associated with sample particle size and heterogeneity.

4.5.4 Comparability

Comparability is a qualitative parameter expressing the confidence with which one dataset can be compared to another. In order to ensure results are comparable, samples will be analyzed using standard USEPA methods and 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.

4.5.5 Completeness

Completeness is a measure of the amount of data that is determined to be valid in proportion to the amount of data collected. Completeness will be calculated as follows:

$$C = \frac{(\text{Number of acceptable data points}) \times 100}{(\text{Total number of data points})}$$

The QA/QC objectives for completeness for all components of this project is 95%. 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 were qualified as rejected will not be considered valid for the purpose of assessing completeness.

4.6 LABORATORY AND FIELD QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

The quality of analytical data generated is assessed by both the implementation of field QC procedures, and by the frequency and type of internal laboratory QA/QC checks developed for analysis type and method. Field QC is evaluated through the analysis of rinsate blanks and field duplicates. Rinsate blanks are collected at a frequency of 1 per sampling event or method (soil only) from non-disposable field equipment (i.e., stainless-steel bowl and spoon) to ensure field decontamination procedures are effective. Rinsate blanks should be analyzed for metals and polycyclic aromatic hydrocarbons only. Field duplicates are collected at a frequency of 1 in 20 samples to evaluate the efficiency of field decontamination procedures, variability from sample handling, and sample heterogeneity. Laboratory results will be evaluated by reviewing analytical results of method blanks, MS/MSD, field duplicate samples, LCS, calibrations, performance evaluation samples, and interference checks as specified by the specific analytical methods.

Results of the QA/QC samples from each laboratory analysis group will be reviewed by the laboratory analyst immediately after a laboratory analysis group has been analyzed. The QA/QC sample results will then be evaluated to determine whether control limits were exceeded. If control limits were exceeded in the laboratory analysis group, corrective action (e.g., method modifications followed by reprocessing the affected samples) will be initiated prior to processing a subsequent group of samples.

All primary chemical standards and standard solutions used in this project will be traceable to documented and reliable commercial sources. Standards will be validated to determine their accuracy by comparison with an independent standard. Any impurities identified in the standard will be documented.

The procedures that will be used to assess data quality throughout sample analysis are summarized as follows.

4.6.1 Laboratory Duplicates

Analytical duplicates provide information on the precision of the analysis and are useful in assessing potential sample heterogeneity and matrix effects. Analytical duplicates are subsamples of the original sample that are prepared and analyzed as a separate sample. A minimum of one duplicate will be analyzed per laboratory analysis group. When there are fewer than 20 samples, a laboratory duplicate will still be analyzed.

4.6.2 Matrix Spikes and Matrix Spike Duplicates

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. A minimum of one MS/MSD will be analyzed for laboratory analysis groups for which MS/MSD sample analysis is applicable per the approved method (cPAHs and PCP/TeCP). When feasible, MS/MSD analyses will be performed on project-specific samples. When there are fewer than 20 samples, a MS/MSD will still be analyzed.

4.6.3 Laboratory Control Samples and Laboratory Control Sample Duplicate

An LCS is a method blank sample carried throughout the same process as the samples to be analyzed, with a known amount of standard added. The blank spike compound recovery assesses analytical accuracy in the absence of any sample heterogeneity or matrix effects. All LCS and laboratory control sample duplicate (LCSD) data for metals and organic compounds will be reported. The LCS/LCSD will be performed once per laboratory analysis group.

4.6.4 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 laboratories; however, no sample result will be corrected for recovery using these values.

4.6.5 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 every extraction batch.

5.0 Data Reduction, Validation, and Reporting

Initial data reduction, evaluation, and reporting at the laboratory will be carried out as described in the appropriate analytical protocols and the laboratory QA/QA Manuals. QA/QC data resulting from methods and procedures described in this document will also be reported.

5.1 DATA REDUCTION AND LABORATORY REPORTING

The laboratory will be responsible for internal checks on data reporting and will correct errors identified during the QA review. Close contact will be maintained with the laboratory to resolve any QA/QC problems in a timely manner. The analytical laboratory will be required, where applicable, to report the following:

- **Project Narrative.** This summary, in the form of a cover letter, will discuss problems, if any, encountered during any aspect of analysis. This summary should discuss, but not be limited to, QA/QC, sample shipment, sample storage, and analytical difficulties. Any problems encountered (actual or perceived) and their resolutions will be documented in as much detail as necessary.
- **Sample Identification Codes.** Records will be produced that clearly match all blind duplicate QA/QC samples with laboratory sample identification codes.
- **Chain-of-Custody Records.** Legible copies of the custody forms will be provided as part of the data package. This documentation will include the time of receipt and condition of each sample received by the laboratory. Additional internal tracking of sample custody by the laboratory will also be documented.
- **Sample Results.** The data package will summarize the results for each sample analyzed. The summary will include the following information when applicable:
  - Field sample identification code and the corresponding laboratory identification code:
    - Sample matrix
    - Date of sample extraction
    - Date and time of analysis
    - Weight and/or volume used for analysis
    - Final dilution volumes or concentration factor for the sample
    - Percent moisture in solid samples
    - Identification of the instrument used for analysis
    - Method reporting and quantitation limits
  - Analytical results reported with reporting units identified
  - All data qualifiers and their definitions
  - Electronic data deliverables

- **QA/QC Summaries.** This section will contain the results of all QA/QC procedures. Each QA/QC sample analysis will be documented with the same information required for the sample results (refer to above). No recovery or blank corrections will be made by the laboratory. The required summaries are listed below; additional information may be requested.
    - **Method Blank Analysis.** The method blank analyses associated with each sample and the concentration of all compounds of interest identified in these blanks will be reported.
    - **Surrogate Spike Recovery.** All surrogate spike recovery data for organic compounds will be reported. The name and concentration of all compounds added, percent recoveries, and range of recoveries will be listed.
    - **MS Recovery.** All MS recovery data for metals and organic compounds will be reported. The name and concentration of all compounds added, percent recoveries, and range of recoveries will be listed. The RPDs for all duplicate analyses will be reported.
    - **Matrix Duplicate.** The RPDs for all matrix duplicate analyses will be reported.
    - **LCS and LCSDs.** All LCS/LCSD for metals and organic compounds will be reported. The RPDs for all duplicate analyses shall be reported.
    - **Blind Duplicates.** Blind duplicates will be reported in the same format as any other sample. RPDs will be calculated for duplicate samples and evaluated as part of the data quality review.

5.2 DATA VALIDATION

Floyd|Snider will conduct a QA2/Stage 2B Data Quality Review (Summary Validation) on all the analytical data. If dioxins/furans or PCB congeners are detected, a Stage 4 Data Quality Review (Full Validation) will be conducted by EcoChem, Inc., on these data.

All chemical data will be reviewed with regard to the following:

- Evaluation of package completeness
- Verification that sample numbers and analyses match those requested on the chain-of-custody form
- Review of method-specified preservation and sample holding times
- Verification that the required detection limits and reporting limits have been achieved
- Verification that the field duplicates, MSs/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

The full validation for dioxins/furans and PCB congeners will also include the following components:

- Evaluation of instrument performance and calibration
- Evaluation of compound identification and quantitation (transcription and calculation)

Data validation will be based on the QA/QC criteria as recommended in the methods identified in this SAP/QAPP and in the *National Functional Guidelines for Organic and/or Inorganic Superfund Methods Data Review* (USEPA 2020a and 2020b). The dioxin/furan and PCB congeners data will also be evaluated using the *USEPA National Functional Guidelines for High Resolution Superfund Methods Data Review* (USEPA 2020c).

Data usability, conformance with the QA/QC objectives, 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 and EcoChem (for dioxins/furans and PCB congeners) in consultation with the Floyd|Snider Project Manager and may include qualification or rejection of the data.

The data validation summary report(s) will be presented as an appendix to the RI.

5.3 DATA REPORTING

Validated chemical data will be tabulated and presented in tables containing soil sample and monitoring well locations, concentrations with qualifiers as appropriate, and comparison to relevant soil and groundwater screening levels. These data will be incorporated into the Study Area RI.

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6.0 Work Plan Implementation and Coordination

6.1 PROJECT ORGANIZATION AND RESPONSIBILITIES

The various management, laboratory, and field responsibilities of key project personnel are defined in this section.

6.1.1 Management Responsibilities

Amanda McKay, Floyd|Snider, is the Project Manager. She will lead project planning, technical analysis, and Ecology coordination necessary to produce an Interim Action Work Plan and the RI document in a manner consistent with the Agreed Order and Ecology requirements. She will have day-to-day responsibility for project implementation, maintaining QA on the project, and ensuring that the Work Plan objectives are met.

Allison Geiselbrecht, PhD, is the Principal-in-Charge and Coordinator for the project and is responsible for overall project implementation and Ecology coordination.

6.1.2 Quality Assurance Responsibilities

Floyd|Snider's data manager, Chell Black, will be responsible for the data validation of all sample results from the analytical laboratories, unless an external validator is used. Data validation responsibilities include reviewing laboratory reports, advising on data corrective action procedures, and performing QA/QC on analytical data reports. If dioxins/furans or PCB congeners are detected, EcoChem, Inc., will perform a Level IV, Tier III Data Quality Review (Full Validation) on dioxin/furan and PCB congener data.

Additionally, Chell will enter all of the data into Floyd|Snider's proprietary database, as well as Ecology's Environmental Information Management system, and perform data management and queries.

6.1.3 Laboratory Responsibilities

FBI, in Seattle, Washington, will perform analytical services in support of the RI activities and will be responsible for implementing specific requirements outlined in this SAP/QAPP. FBI will subcontract dioxin/furan and PCB congeners analysis to Frontier Analytical in El Dorado Hills, California.

6.1.4 Field Responsibilities

A Floyd|Snider geologist will be the Field Manager responsible for leading and coordinating the day-to-day activities in the field. They will report directly to the Project Manager and will provide overall direction for the field sampling in terms of logistics, personnel assignments, and field operations. They will supervise collection of the field samples and be responsible for: accurate sample positioning; recording sample locations, depths, and identification; ensuring conformance to sampling and handling requirements including field decontamination procedures; performing physical evaluation and logging of the samples; and ensuring chain-of-custody of the sample.

7.0 References

M.R. Timber. 1972. *Application of dredging permit and Shoreline Management permit*. Letter from Paul Hopkins, M. & R. Timber, Inc. to John B. Warder, City of Port Angeles. 10 August.

Port of Port Angeles. 1946. *Response to written request on July 16, 1946*. Letter from Theron D. Weaver, Colonel Corps of Engineers, to Puget Sound Bridge & Dredging Co., Portland, Oregon. 7 August.

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Van den Berg, M., L.S. Birnbaum, M. Denison, M. De Vito, W. Farland, M. Feeley, H. Fiedler, H. Hakansson, A. Hanberg, L. Haws, M. Rose, S. Safe, D. Schrenk, C. Tohyama, A. Tritscher, J. Tuomisto, M. Tysklind, N. Walker, and R.E. Peterson. 2006. “The 2005 World Health Organization Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds.” *Toxicological Sciences.* 93(2):223–241.

Washington State Department of Ecology (Ecology). 2004. *Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies.* Publication No. 04-03-030. Revision of Publication No. 01-03-003. July.

Remedial Investigation Work Plan – Phase I

Port of Port Angeles Terminals 5, 6, and 7

Appendix B

Tables

Table B.1
Existing Monitoring Well Construction Details

Well ID	Date Installed	Casing Diameter (inches)	Screened Interval (feet bgs)	Total Depth (feet bgs)	Surface Completion Type	Terminal	Historical Ground Surface Type (1)	Historical Ground Surface Elevation (feet NAVD 88)	Northing (feet)	Easting (feet)	Horizontal Survey Source	Horizontal Datum	Current Ground Surface Type	Current Ground Surface Elevation (feet NAVD 88)	Notes
MW-03A	5/9/1988	2	6-16	16	aboveground	7	asphalt	unknown	422964.4284	998708.731	georeferenced	WA SP N	unpaved	17.3	
MW-04A	5/11/1988	2	3-13	13	aboveground	7	unpaved	unknown	423061.9688	998892.4018	georeferenced	WA SP N	concrete	18.7	
MW-11	6/2/1988	2	5-15	15	aboveground	7	unpaved	unknown	423180.884	999006.9203	georeferenced	WA SP N	unpaved	16.5	
MW-13	6/2/1988	2	5-15	15	flush mount	7	unpaved	unknown	422231.4976	999496.1046	georeferenced	WA SP N	concrete	13.7	
MW-14	6/3/1988	2	3-13	13	flush mount	7	asphalt	unknown	422537.67	999302.375	georeferenced	WA SP N	concrete	12.1	Field notes indicate well was buried under wood chip pile as of Aug 1988.
HC-NE-PA	9/10/2002	2	4.5-24.5	24.5	flush mount	5/6	unpaved	14.5 (2)	423260.65	998890.13	well log	WA SP N	unpaved	14.8	Ground surface elevation noted as approximate on well log.
HC-NW-PA	9/10/2002	2	5-15	15	flush mount	5/6	unpaved	13.8 (2)	423798.58	998588.4	well log	WA SP N	unpaved	14.1	Ground surface elevation noted as approximate on well log.
MW-06A	5/13/1988	2	4-14	14	aboveground	5/6	unpaved	unknown	424119.719	998548.9075	georeferenced	WA SP N	unpaved	13	
MW-06B (3)	8/30/1988	2	40-50	53	aboveground	5/6	unpaved	unknown	424100.5779	998528.1007	georeferenced	WA SP N	unpaved	12	Aboveground monument surrounded by 3-foot x 3-foot concrete pad and steel bollards.
MW-06C (3)	10/6/1988	2	4.5-14.5	17.5	aboveground	5/6	unpaved	unknown	424119.3279	998529.1423	georeferenced	WA SP N	unpaved	12.4	Aboveground monument surrounded by 3-foot x 3-foot concrete pad and steel bollards.
MW-08	5/16/1988	2	4-14	14	aboveground	5/6	asphalt	unknown	424040.7862	998451.0037	georeferenced	WA SP N	unpaved	13.2	
MW-08B (3)	9/12/1988	2	39.5-49.5	52.5	aboveground	5/6	asphalt	unknown	424051.0684	998435.7945	georeferenced	WA SP N	unpaved	13.6	Aboveground monument surrounded by 3-foot x 3-foot concrete pad and steel bollards.
MW-15	6/9/1988	2	5-15	15	aboveground	5/6	unpaved	unknown	424217.1834	998734.1028	georeferenced	WA SP N	unpaved	13.7	
MW-16A	6/12/1988	2	6-16	16	aboveground	5/6	unpaved	unknown	424166.2285	998648.9466	georeferenced	WA SP N	concrete	12.7	
MW-16B (3)	9/8/1988	2	40-50	53	aboveground	5/6	unpaved	unknown	424150.5081	998640.3407	georeferenced	WA SP N	concrete	12.4	Aboveground monument surrounded by 3-foot x 3-foot concrete pad and steel bollards.
MW-18	6/10/1988	2	9-19	19	aboveground	5/6	unpaved	unknown	424440.4757	998558.093	georeferenced	WA SP N	unpaved	11.1	
MW-19	6/11/1988	2	7-17	17	aboveground	5/6	unpaved	unknown	424067.6174	998815.6132	georeferenced	WA SP N	unpaved	14	
MW-21	6/11/1988	2	6-16	16	aboveground	5/6	unpaved	unknown	424281.4195	998604.7625	georeferenced	WA SP N	concrete	13.5	
MW-22	6/12/1988	2	3-13	13	aboveground	5/6	unpaved	unknown	424048.8674	998707.2799	georeferenced	WA SP N	concrete	12.1	
MW-24A (3)	9/1/1988	2	5-15	18	aboveground	5/6	unknown	unknown	424250.5779	998455.184	georeferenced	WA SP N	unpaved	14.7	Aboveground monument surrounded by 3-foot x 3-foot concrete pad and steel bollards.
MW-24B (3)	9/6/1988	2	40-50	53	aboveground	5/6	unknown	unknown	424239.1196	998440.6007	georeferenced	WA SP N	unpaved	14.2	Aboveground monument surrounded by 3-foot x 3-foot concrete pad and steel bollards.
MW-25A (3)	9/15/1988	2	4-14	17	aboveground	5/6	unknown	unknown	424015.1613	998594.7673	georeferenced	WA SP N	unpaved	12.9	Aboveground monument surrounded by 3-foot x 3-foot concrete pad and steel bollards.
MW-25B (3)	9/14/1988	2	40-50	53	aboveground	5/6	unknown	unknown	424007.8696	998578.1007	georeferenced	WA SP N	unpaved	12.4	Aboveground monument surrounded by 3-foot x 3-foot concrete pad and steel bollards.

Notes:

1 For clustered wells where logs for additional wells were not available, the ground surface is assumed to be consistent with the log for the primary well (i.e., MW-06a, MW-08, MW-16A).
2 The ground surface was not reported and was calculated from the reported well casing elevation, assuming the casing was cut to approximately 0.4 feet bgs.
3 Well log not available; only construction details presented in investigation report narrative are presented.

Abbreviations:

bgs	Below ground surface
DAHP	Department of Archaeology and Historic Preservation
NA	Not applicable
NAVD 88	North American Vertical Datum of 1988
WA SP N	Washington State Plane North

Table B.2
Analytical Requirements, Methods, Preservation, Bottle Type, and Holding Times

Parameter	Method	Bottle Type	Preservative	Holding Time
Groundwater Samples				
Total and Dissolved Metals (As, Cd, Cr, Cu, Pb, Hg, Ag, Zn)	USEPA Methods 6020B/1631B – trace level	250 mL Poly	HNO_3 to pH<2 (dissolved metals field filtered)	Metals: 6 months Mercury: 28 days
Gasoline-range total petroleum hydrocarbons	NWTPH-Gx	Three tared 40-mL VOA	Cool to <6 °C, HCl to pH<2, no headspace	14 days
Diesel-range and oil-range total petroleum hydrocarbons	NWTPH-Dx	One 500-mL amber glass	None, cool to <6 °C	7 days to extract, then 40 days to analyze
VOCs (BTEX only)	USEPA Method 8260D	(sample volume taken from gasoline-range containers)	Cool to <6 °C, HCl to pH<2, no headspace	14 days
cPAHs	USEPA Methods 8270E SIM – trace level (1)	Two 1-liter amber glass	None, cool to <6 °C	7 days to extract, then 40 days to analyze
Pentachlorophenol and Tetrachlorophenols	USEPA 8270E Full Scan – trace level (1)	Two 1-liter amber glass	None, cool to <6 °C	7 days to extract, then 40 days to analyze
PCBs as Congeners	USEPA Method 1668	Two 1-liter amber glass	None, cool to <6 °C	None
Dioxins/Furans	USEPA Method 1613B	Two 1-liter amber glass	None, cool to <6 °C	1 year
Soil Samples				
Metals (As, Cd, Cr, Cu, Pb, Hg, Ag, Zn)	USEPA Methods 6020B/1631B – trace level	One 8-oz WMG	None	Metals: 6 months Mercury: 28 days
Gasoline-range total petroleum hydrocarbons	NWTPH-Gx	Four tared 40-mL VOA	None, cool to <6 °C, MeOH	48 hours to freeze at laboratory, 14 days to analyze

Table B.2
Analytical Requirements, Methods, Preservation, Bottle Type, and Holding Times

Parameter	Method	Bottle Type	Preservative	Holding Time
Soil Samples (cont.)				
Diesel-range and oil-range total petroleum hydrocarbons	NWTPH-Dx	One 4-oz WMG	None, cool to <6 °C	14 days to extract, then 40 days to analyze
VOCs (BTEX only)	USEPA Method 8260D	(sample volume taken from gasoline-range containers)	Cool to <6 °C, HCl to pH<2, no headspace	48 hours to freeze at laboratory, 14 days to analyze
cPAHs	USEPA Methods 8270E SIM – trace level (1)	One 8-oz WMG	None, cool to <6 °C	14 days to extract, then 40 days to analyze
Pentachlorophenol and Tetrachlorophenols	USEPA Method 8270E Full Scan – trace level (1)	One 8-oz WMG	None, cool to <6 °C	14 days to extract, then 40 days to analyze
PCBs as Congeners	USEPA Method 1668	One 8-oz WMG	None, cool to <6 °C	None
Dioxins/Furans	USEPA Method 1613B	One 4-oz WMG amber glass	None, cool to <6 °C	1 year
Total organic carbon	SM5310B	One 4-oz WMG	None, cool to <6 °C	28 days

Note:

1 Friedman & Bruya is accredited for USEPA Method 8270E analysis. The laboratory employs high-resolution tandem (SIM + Full Scan) acquisition for 8270E SIM, in which the GC/MS switches back and forth between acquisition modes at a high rate to collect both sets of data in a single injection. Compounds requiring trace-level detection limits (e.g., cPAHs) are reported with the SIM acquisition and the remaining semivolatile organic compounds are reported with the Full Scan acquisition. The results of high-resolution tandem acquisition are the lowest detection limits achievable with standard laboratory methods.

Abbreviations:

As	Arsenic
Ag	Silver
BTEX	Benzene, toluene, ethylbenzene, and xylene
°C	Degrees Celsius
Cd	Cadmium
Cr	Chromium
cPAH	Carcinogenic polycyclic aromatic hydrocarbon
Cu	Copper
GC	Gas chromatograph
HCl	Hydrogen chloride
Hg	Mercury
HNO_3	Nitric acid
MeOH	Methanol
mL	Milliliters
MS	Mass spectrometer
NWTPH	Northwest Total Petroleum Hydrocarbon
oz	Ounces
Pb	Lead
PCB	Polychlorinated biphenyl
USEPA	U.S. Environmental Protection Agency
VOA	Volatile organic analysis
VOC	Volatile organic compound
WMG	Wide-mouth glass jar
Zn	Zinc

Table B.3
Analytical Methods, Detection Limits, and Reporting Limits

Analyte	CAS No.	Unit	Preliminary Screening Level	Method	MDL	RL
Groundwater						
Metals (total and dissolved)						
Arsenic	7440-38-2	µg/L	8.0	USEPA Method 6020B	0.078	0.5
Cadmium	7440-43-9	µg/L	5.0		0.058	0.2
Chromium	7440-47-3	µg/L	27		0.28	0.5
Copper	7440-50-8	µg/L	3.1		0.17	0.5
Lead	7439-92-1	µg/L	5.6		0.057	0.2
Silver	7440-22-4	µg/L	1.9		0.13	0.2
Zinc	7440-66-6	µg/L	81		0.24	0.5
Mercury, inorganic	7439-97-6	µg/L	0.025	Method 1631E - trace level	0.0006	0.01
Total Petroleum Hydrocarbons						
Gasoline-range TPH	TPHDO	µg/L	800	NWTPH-Gx	47	100
Diesel-range range and oil-range TPH	TPHDO	µg/L	500	NWTPH-Dx	Diesel: 10 Oil: 57	Diesel: 50 Oil: 250
Volatile Organic Compounds						
Benzene	71-43-2	µg/L	1.6	USEPA Method 8260D	0.018	0.35
Ethylbenzene	100-41-4	µg/L	21		0.025	1
Toluene	108-88-3	µg/L	100		0.04	1
m,p-Xylene	179601-23-1	µg/L	--		0.048	2
o-Xylene	95-47-6	µg/L	--		0.019	1
Total xylenes	1330-20-7	µg/L	110		--	3
Semivolatile Organic Compounds						
Pentachlorophenol	87-86-5	µg/L	0.002	USEPA Method 8270E Full Scan - trace level	0.034	0.05
2,3,4,5 Tetrachlorophenol	4901-51-3	µg/L	--		0.067	0.1
2,3,4,6 Tetrachlorophenol	58-90-2	µg/L	480		0.034	0.05
Benzo(a)anthracene	56-55-3	µg/L	0.00016	USEPA Method 8270E SIM - trace level	0.003	0.005
Benzo(b)fluoranthene	205-99-2	µg/L	0.00016		0.004	0.005
Benzo(a)pyrene	50-32-8	µg/L	0.000016		0.002	0.005
Benzo(k)fluoranthene	207-08-9	µg/L	0.0016		0.004	0.005
Chrysene	218-01-9	µg/L	0.016		0.003	0.005
Dibenz(a,h)anthracene	53-70-3	µg/L	0.000016		0.004	0.005
Indeno(1,2,3-cd)pyrene	193-39-5	µg/L	0.00016		0.005	0.005
Polychlorinated Biphneyls (PCBs)						
PCBs as Congeners	1336-36-3	µg/L	0.000007	USEPA Method 1668	0.0000005 to 0.0000036	0.00002
Dioxins/Furans						
Dioxins/Furans	DFTEQ	µg/L	5.1E-09	USEPA Method 1613B	0.00000026 to 0.0000011	0.000005 to 0.00005
Soil						
Conventionals						
Total organic carbon	--	mg/kg	--	SM5310B	0.052	0.15
Metals						
Arsenic	7440-38-2	mg/kg	7.3	USEPA Method 6020B	0.13	0.2
Cadmium	7440-43-9	mg/kg	0.77		0.031	0.2
Chromium, trivalent	7440-47-3	mg/kg	48		0.28	0.5
Copper	7440-50-8	mg/kg	36		0.16	1
Lead	7439-92-1	mg/kg	50		0.049	0.2
Silver	7440-22-4	mg/kg	0.016		0.13	0.2
Zinc	7440-66-6	mg/kg	85		0.94	1
Mercury, inorganic	7439-97-6	mg/kg	0.07	Method 1631E - trace level	0.0128	0.025
Total Petroleum Hydrocarbons						
Gasoline-range TPH	TPHDO	mg/kg	120	NWTPH-Gx	0.8	2
Diesel-range and oil-range TPH	TPHDO	mg/kg	260	NWTPH-Dx	Diesel: 5 Oil: 32	Diesel: 50 Oil: 250
Volatile Organic Compounds						
Benzene	71-43-2	mg/kg	0.00056	USEPA Method 8260D	0.0003	0.001
Ethylbenzene	100-41-4	mg/kg	0.010		0.0006	0.001
Toluene	108-88-3	mg/kg	0.044		0.0008	0.001
m,p-Xylene	179601-23-1	mg/kg	--		0.001	0.002
o-Xylene	95-47-6	mg/kg	--		0.0004	0.001
Total xylenes	1330-20-7	mg/kg	0.055		--	0.003
Semivolatile Organic Compounds						
Pentachlorophenol	87-86-5	mg/kg	0.0000018	USEPA Method 8270E Full Scan - trace level	0.00068	0.0013
2,3,4,5 Tetrachlorophenol	4901-51-3	mg/kg	2,400		0.00046	0.0025
2,3,4,6 Tetrachlorophenol	58-90-2	mg/kg	2,400		0.00036	0.0013
Benzo(a)anthracene	56-55-3	mg/kg	0.000057	USEPA Method 8270E SIM - trace level	0.00007	0.0005
Benzo(b)fluoranthene	205-99-2	mg/kg	0.0002		0.00006	0.0005
Benzo(a)pyrene	50-32-8	mg/kg	0.000016		0.00005	0.0005
Benzo(k)fluoranthene	207-08-9	mg/kg	0.002		0.00007	0.0005
Chrysene	218-01-9	mg/kg	0.0064		0.00006	0.0005
Dibenz(a,h)anthracene	53-70-3	mg/kg	0.000029		0.00008	0.0005
Indeno(1,2,3-cd)pyrene	193-39-5	mg/kg	0.00056		0.0001	0.0005
Polychlorinated Biphneyls (PCBs)						
PCBs as Congeners	1336-36-3	mg/kg	0.0000022	USEPA Method 1668	0.00000007 to 0.00000042	0.000002
Dioxins/Furans						
Dioxins/Furans	DFTEQ	mg/kg	0.0000052	USEPA Method 1613B	0.000000027 to 0.00000017	0.0000005 to 0.000005

Notes:

Site-specific conditions such as high sample concentrations, matrix interference, sample dilution, or brackish groundwater may preclude achieving the targeted RL.

-- Not available.

Abbreviations:

CAS	Chemical Abstracts Service	mg/kg	Milligrams per kilogram
MDL	Method detection limit	RL	Reporting limit
µg/L	Micrograms per liter	TPH	Total petroleum hydrocarbons

Table B.4
Data Quality Assurance and Quality Control Criteria

Parameter	Reporting Limit [(1)]	Precision	Accuracy	Completeness	Reference
Groundwater Samples					
Total and dissolved metals (As, Cd, Cr, Cu, Pb, Hg, Ag, Zn)	0.2–1 µg/L; [(2)] 0.0–1 µg/L for mercury	± 30%	80–120%	95%	USEPA Method 6020B/ 1631E – trace level
Gasoline-range total petroleum hydrocarbons	100 µg/L	± 30%	65–135%	95%	NWTPH-Gx
Diesel-range and oil-range total petroleum hydrocarbons	50 µg/L diesel-range; 250 µg/L oil-range	± 30%	65–135%	95%	NWTPH-Dx
VOCs (BTEX only)	0.35–1.0 µg/L	± 30%	50–150%	95%	USEPA Method 8260D
cPAHs	0.005	± 30%	20–137%	95%	USEPA Method 8270E SIM – trace level
Pentachlorophenol and Tetrachlorophenols	PCP – 0.08 ug/L; TeCPs – 0.08 ug/L	± 30%	50–150%	95%	USEPA Method 8270E Full Scan – trace level
PCB as Congeners	0.00002 µg/L	± 30%	Varies per congener; refer to method limits	95%	USEPA Method 1668
Dioxins/Furans	0.000005 to 0.00005 µg/L	± 30%	Varies per congener; refer to method limits	95%	USEPA Method 1613B
Soil Samples					
Metals (As, Cd, Cr, Cu, Pb, Hg, Ag, Zn)	0.2–1 mg/kg; 0.01 mg/kg for mercury	± 20%	80–120%	95%	USEPA Method 6020/ 1631E - trace level
Gasoline-range total petroleum hydrocarbons	5.0 mg/kg	± 30%	65–135%	95%	NWTPH-Gx

Table B.4
Data Quality Assurance and Quality Control Criteria

Parameter	Reporting Limit [(1)]	Precision	Accuracy	Completeness	Reference
Soil Samples (cont.)					
Diesel-range and oil-range total petroleum hydrocarbons	50 mg/kg diesel-range; 200 mg/kg oil-range	± 30%	65–135%	95%	NWTPH-Dx
VOCs (BTEX only)		± 30%	50–150%	95%	USEPA Method 8260D
cPAHs	0.002 mg/kg	± 30%	50–150%	95%	USEPA Method 8270E SIM – trace level
Pentachlorophenol and Tetrachlorophenols	0.0013 mg/kg	± 30%	50–150%	95%	USEPA Method 8270E Full Scan – trace level
PCB as Congeners	0.000002 mg/kg	± 30%	50–145%	95%	USEPA Method 1668
Dioxins/Furans	0.0000005 to 0.000005 mg/kg	± 30%	50–150%	95%	USEPA Method 1613B
Total organic carbon	0.15 mg/kg	± 30%	75–125%	95%	SM5310B

Notes:

1 All reporting limits shown are method PQLs or LOQs from Friedman & Bruya, located in Seattle, Washington.

2 If groundwater is brackish, arsenic and copper reporting limits may be elevated.

Abbreviations:

As	Arsenic
Ag	Silver
BTEX	Benzene, toluene, ethylbenzene, and xylenes
Cd	Cadmium
cPAH	Carcinogenic polycyclic aromatic hydrocarbon
Cr	Chromium
Cu	Copper
Hg	Mercury
LOQ	Limit of quantitation
µg/L	Micrograms per liter
mg/kg	Milligrams per kilogram
Pb	Lead
PCB	Polychlorinated biphenyl
PCP	Pentachlorophenol
PQL	Practical quantitation limit
TeCP	Tetrachlorophenol
VOC	Volatile organic compound
Zn	Zinc

Remedial Investigation Work Plan – Phase I

Port of Port Angeles Terminals 5, 6, and 7

Appendix B

Attachment B.1
Standard Guideline for Monitoring Well Construction and Development

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.
2. 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

3. 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.

4. 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.

5. 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.
6. 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.

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:

Remedial Investigation Work Plan – Phase I

Port of Port Angeles Terminals 5, 6, and 7

Appendix B

Attachment B.2
Standard Guideline for Low-Flow Groundwater Sample Collection

FLOYD | SNIDER
strategy ▪ science ▪ engineering

Two Union Square
601 Union Street, Suite 600
Seattle, WA 98101
tel: 206.292.2078 fax: 206.682.7867

F|S STANDARD GUIDELINE

Low-Flow Groundwater Sample Collection

DATE/LAST UPDATE: August 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 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
- 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.

Remedial Investigation Work Plan – Phase I

Port of Port Angeles Terminals 5, 6, and 7

Appendix B

Attachment B.3
Groundwater 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 all 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:

Remedial Investigation Work Plan – Phase I

Port of Port Angeles Terminals 5, 6, and 7

Appendix B

Attachment B.4
Standard Guideline for Soil Sample Collection

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Two Union Square
601 Union Street, Suite 600
Seattle, WA 98101
tel: 206.292.2078 fax: 206.682.7867

F|S STANDARD GUIDELINE

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 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, 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.

Remedial Investigation Work Plan – Phase I

Port of Port Angeles Terminals 5, 6, and 7

Appendix B

Attachment B.5
Soil Sampling Field Form

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Boring ID:

Drill Date:
Logged By:
Drilled By:
Drill Type:
Sample Method:
Boring Diameter:
Boring Depth (ft bgs):
Groundwater ATD (ft bgs):

Coordinate System:
Ground Surface Elevation:
Latitude/Northing:
Longitude/Easting:
Boring Location:

Client:
Project:
Task:
Address:

Remarks:

PID (ppm)	OIL INDICAT.	SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
				0		
				1		
				2		
				3		
				4		
				5		
				6		
				7		
				8		
				9		
				10		
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		
				20		

Notes:
FT BGS = feet below ground surface
ppm = parts per million

--- Dashed contact line in soil description indicates a gradational contact
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Boring ID:

Drill Date:
Logged By:
Drilled By:

Coordinate System:
Ground Surface Elevation:
Latitude/Northing:
Longitude/Easting:
Boring Location:

Drill Type:
Sample Method:
Boring Diameter:
Boring Depth (ft bgs):
Groundwater ATD (ft bgs):

Client:
Project:
Task:
Address:

Remarks:

PID (ppm)	OIL INDICAT.	SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS
				20		
				21		
				22		
				23		
				24		
				25		
				26		
				27		
				28		
				29		
				30		
				31		
				32		
				33		
				34		
				35		
				36		
				37		
				38		
				39		
				40		

Notes:
FT BGS = feet below ground surface
ppm = parts per million

--- Dashed contact line in soil description indicates a gradational contact
USCS = Unified Soil Classification System
▼ = denotes groundwater table

Remedial Investigation Work Plan – Phase I

Port of Port Angeles Terminals 5, 6, and 7

Appendix B

Attachment B.6
Bank Survey Field Form

Bank Survey Field Form

Bank Area:

Date:

Field Personnel:

Weather:

Transect Number	Transect Lenth (feet)	Coordinates		Photos (note subject)	Time	Transect Description (surface conditions, soil types, vegetative cover, condition of structures)	Transsect accessibility (accessible, difficult or inacessible)	Erodobility (high, moderate, or low)	Over-steepened banks Y/N	Armor Rock Y/N	Seeps? (note position on transect in feet or NA)	Historical Outfalls? (note postion on transect in feet or NA)
		Start	Finish									

Notes:

Bank Survey Field Form

Remedial Investigation Work Plan – Phase I

Port of Port Angeles Terminals 5, 6, and 7

Appendix C
Health and Safety Plan

Table of Contents

List of Figures

List of Attachments

Attachment C.1	Accident Prevention Plan
Attachment C.2	Daily Tailgate Safety Meeting and Debrief Form
Attachment C.3	Near Miss and Incident Reporting Form
Attachment C.4	Floyd|Snider Standard Guideline: COVID-19 Health and Safety Guidelines

List of Abbreviations

Abbreviation	Definition
APP	Accident Prevention Plan
COC	Contaminant of concern
DOSH	Division of Occupational Safety and Health
Harbor	Port Angeles Harbor
HASP	Health and Safety Plan
HSO/SS	Health and Safety Officer/Site Supervisor
IDW	Investigation-derived waste
mg/kg	Milligrams per kilogram
mg/m^3	Milligrams per cubic meter
OSHA	Occupational Safety and Health Act
PID	Photoionization detector
PM	Project Manager
Port	Port of Port Angeles
PPE	Personal protective equipment
SSO	Site Safety Officer
STEL	Short-term exposure limit
Study Area	Upland Source Control Study Area
TWA	Time-weighted average

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 remedial investigation field activities at the Port of Port Angeles (Port) Terminal 5, 6, and 7 Upland Source Control Study Area (Study Area), in Port Angeles, Washington. It has been prepared as a supplement to Floyd|Snider's Accident Prevention Plan (APP; Attachment C.1).

This HASP establishes standard operating procedures and provides for contingencies that may be implemented during field work activities. This HASP consists of Study Area 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 on-site. 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, Health and Safety Plan, 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 Study Area 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 (PM) and the HSO/SS prior to commencement of work activities.

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2.0 Background Information

2.1 STUDY AREA BACKGROUND

The Study Area is located along the industrial waterfront area of the Port Angeles Harbor (Harbor) in Port Angeles, Washington, and consists of three properties owned by the Port, now commonly referred to as Terminals 5, 6, and 7. The Study Area is a total of 32.4 acres and currently is used for log yard operations and lay berth by the Port. The Port has also leased a portion of Terminal 7 for debarking operations and trailer storage. The ground surface of the Study Area is generally flat to slightly sloped toward the shoreline of the Harbor and is gravel-surfaced. The shoreline of the Study Area consists of landfilled areas (presumed to be dredge fill) with armored banks and overwater berth structures. It is accessed via several driveways situated along Marine Drive.

Figure C.1
Study Area Vicinity Location

The Study Area was formerly used for timber handling and processing operations including log sorting, debarking, sawmilling/planning, chipping, fiber board manufacturing, kiln drying, and chemical treatment. Timber processing operations continued in portions of the Study Area until approximately 2004. The Study Area is currently used for log storage and storage of other inert materials. Historically, hog fuel burners, petroleum storage tanks, and transformers were also present in the Study Area.

The Study Area is bounded by McKinley Paper Company to the west, the Harbor to the north, the POPA Boat Haven to the east, and Marine Drive and the Lower Elwha Klallam Tribe property to the south. The Study Area is bordered by Marine Drive, an arterial street that provides access to the waterfront properties of the Harbor. Marine Drive is heavily used by passenger vehicles and trucks and has a speed limit of 35 miles per hour.

The contaminants of concern (COCs) known or suspected to be present in the Study Area include chlorinated phenols associated with wood treatment, dioxins/furans associated with phenol or hog fuel burner use, petroleum associated with storage and handling, polychlorinated biphenyls (PCBs) associated with transformers, and metals and polycyclic aromatic hydrocarbons (PAHs) associated with dredge fill.

Floyd|Snider will be conducting investigation activities primarily along the shoreline of the Harbor, with a limited scope of work in the uplands throughout the Study Area.

2.2 SCOPE OF WORK

The purpose of the investigation is to address data gaps related to groundwater quality, surface and bank soil quality, and potential discharges to the Harbor in order to complete a Remedial Investigation and Feasibility Study. The investigation may consist of the following activities:

- Installation of monitoring wells and collection of subsurface soil samples via hollow-stem auger drilling with split-spoon soil sampling
- Development of monitoring wells using submersible pumps or bailers
- Visual surveying of bank areas from the top and toe of the bank
- Land surveying of Study Area features (monitoring wells etc.)
- Utility surveys via remote camera
- Bank soil sampling using hand sampling methodology
- Groundwater sample collection using low-flow methodology
- Stormwater system water or solids sampling

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 C.2 for directions and map to the hospital.)	Olympic Medical Center 939 Caroline Street Port Angeles, WA 98362 (360) 417-7000
Washington Poison Control Center:	(800) 222-1222

Figure C.2
Hospital Directions

1. Head southeast on Marine Drive for 1.1 miles.
2. Keep left to stay on Marine Drive, continue for 0.1 mile.
3. Continue straight onto W 1st Street, continue for 0.4 miles.
4. Continue straight onto US-101 E/E First Street, continue for 0.8 miles.
5. Turn left on N Washington Street, continue for 0.2 miles.
6. Turn right on S Caroline Street.
7. In 200 feet, turn left into Olympic Medical Center driveway.

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	
Study Area Location: (Refer to Figure C.1)	Port of Port Angeles Terminal 7 1313-1608 Marine Drive Port Angeles, Washington
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:

City of Port Angeles Utilities (electrical, water, and sewer utilities)	(360) 457-0411 (business hours)
	(360) 417-4745 (after-hours)

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 PM may then contact the Port of Port Angeles direct the field staff to do so.

Floyd|Snider Emergency Contacts:

Contact	Office Phone Number	Cell Phone Number
Amanda McKay, PM	(206) 292-2078	(707) 497-8819
Allison, Geiselbrecht, Principal		(360) 649-2811
Kristin Anderson, HSO/SS		(206) 552-4241

Port of Port Angeles Emergency Contacts:

Contact	Office Phone Number	Cell Phone Number
Jesse Waknitz	(360) 417-3422	(360) 460-1364
Chris Hartman	(360) 460-1364	(360) 460-3586

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 Study Area:

- Metals
- Petroleum hydrocarbons
- PAHs
- Chlorinated phenols
- PCBs
- Dioxins/furans

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 dermal contact, ingestion, and inhalation of vapor or dust containing contaminants. The primary exposure route of concern during site work is incidental contact or accidental ingestion during soil sample collection, or splashes during well development and groundwater sampling.

Chemical exposure is considered unlikely and highly preventable. In general, the chemicals that may be encountered in this Study Area 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 the Study Area. The use of appropriate personal protective equipment (PPE) and decontamination practices will assist in controlling exposure by means of all pathways to the COCs listed in the following table.

Chemical Hazard	OSHA or DOSH-Permissible Exposure Limits (8-hour TWA/STEL)	Routes of Exposure	Potential Toxic Effects	Maximum Historical Concentration
Arsenic	TWA 0.010 mg/m^3	inhalation, skin absorption, skin and/or eye contact, ingestion	ulceration of nasal septum; dermatitis; gastrointestinal disturbances; peripheral neuropathy, respiratory irritation; hyperpigmentation of skin; cancer	3.4 mg/kg
Cadmium	TWA 0.005 mg/m^3	inhalation, ingestion	pulmonary edema, breathing difficulty, cough, chest tightness/pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; loss of smell, emphysema, proteinuria, mild anemia; cancer	(not detected)
Chromium	TWA 0.5 mg/m^3	inhalation, ingestion, skin and/or eye contact	irritation of eyes; sensitization dermatitis	30 mg/kg
Copper	TWA 1 mg/m^3	inhalation, ingestion, skin and/or eye contact	irritation to eyes, nose, pharynx; nasal septum perforation; metallic taste; dermatitis	(not analyzed)
Lead	TWA 0.050 mg/m^3	inhalation, ingestion, skin and/or eye contact	muscle weakness or exhaustion; insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis of wrists or ankles; encephalopathy; kidney disease; irritation of eyes; hypertension	140 mg/kg

Chemical Hazard	OSHA or DOSH-Permissible Exposure Limits (8-hour TWA/STEL)	Routes of Exposure	Potential Toxic Effects	Maximum Historical Concentration
Mercury	TWA 0.1 mg/m^3	inhalation, ingestion, skin and/or eye contact	irritation of eyes or skin; cough, chest pain, breathing difficulty, bronchitis, pneumonitis; tremor, insomnia, irritability, indecision, headache, weakness/exhaustion; stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria	0.29 mg/kg
Silver	TWA 0.01 mg/m3	inhalation, ingestion, skin and/or eye contact	blue-gray eyes, nasal septum, throat, or skin; irritation, ulceration of skin; gastrointestinal disturbance	34 mg/kg
Zinc (as zinc oxide)	TWA 5 mg/m^3	inhalation	chills, muscle ache, nausea, fever, dry throat, cough; weakness/ exhaustion; metallic taste; headache; blurred vision; low back pain; vomiting; malaise; chest tightness; breathing difficulty, rales, decreased pulmonary function	36 mg/kg
Total petroleum hydrocarbons (as gasoline)	TWA 900 mg/m^3	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation of eyes, skin, mucous membranes; dermatitis; headache, weakness, exhaustion, blurred vision, dizziness, slurred speech, confusion, convulsions; aspiration of liquid; possible liver, kidney damage; potential carcinogen	3,400 mg/kg (total TPH)
Total petroleum hydrocarbons (as diesel)	None established	inhalation, skin and/or eye contact	eye irritation, pulmonary function changes; potential carcinogen	3,400 mg/kg (total TPH)

Chemical Hazard	OSHA or DOSH-Permissible Exposure Limits (8-hour TWA/STEL)	Routes of Exposure	Potential Toxic Effects	Maximum Historical Concentration
PAHs (as coal tar pitch volatiles)	TWA 0.2 mg/m^3	inhalation, skin and/or eye contact	dermatitis; bronchitis; carcinogen	0.040 mg/kg (phenanthrene)
Pentachlorophenol	TWA 0.5 mg/m^3 [skin]	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation of eyes, nose, throat; sneezing, cough; weakness/ exhaustion, anorexia, weight loss; sweating; headache, dizziness; nausea, vomiting; breathing difficulty, chest pain; high fever; dermatitis	270 mg/kg
Tetrachlorophenol	None established	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation of eyes, nose, throat; sneezing, cough; weakness/ exhaustion, anorexia, weight loss; sweating; headache, dizziness; nausea, vomiting; breathing difficulty, chest pain; high fever; dermatitis	40 mg/kg
PCBs (as Aroclor 1254)	TWA 0.5 mg/m^3 [skin]	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to eyes, chloracne; liver damage; reproductive effects; carcinogen	4.8 mg/kg (total PCB Aroclors)
Dioxins/furans (as 2,3,7,8-TCDD)	None established	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to eyes; allergic dermatitis, chloracne; porphyria; gastrointestinal disturbance; possible reproductive, teratogenic effects	0.000404 mg/kg (dioxin/furan TEQ)

Abbreviations:

DOSH	Division of Occupational Safety and Health
mg/kg	Milligrams per kilogram
mg/m^3	Milligrams per cubic meter
OSHA	Occupational Safety and Health Act
STEL	Short-term exposure limit
TCDD	Tetrachlorodibenzo-*p*-dioxin
TEQ	Toxic equivalent
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
Load, move, and transport equipment or materials (relevant to all tasks)	Damage or injury from unsecured cargo during transport	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.
Working in log handling areas (all work in log handling areas)	Traffic	Use spotters and traffic delineators when working in high traffic areas. Use a vehicle to shield workers. Monitor for traffic before leaving the work area.
	Hazards created by logs including trips and tumbling logs	Clear work area of trip hazards prior to work. Do not work adjacent to piles of logs in the direction that logs will roll if pile is destabilized.
Work on bank areas (all work on banks)	Slip-trip fall	Move slowly on uneven surfaces. Maintain three points of contact whenever possible.
	Falling objects	Do not move on the slope when you are above other workers.

Work Task	Potential Hazards	Actions to Control Hazards
	Drowning	Wear a personal flotation device when working near water. Always work facing the water to watch for waves when the work area is near the water level.
	Entrapment (armoring or structures)	Be aware of tide predictions to ensure that your work area does not become inundated. Inspect the condition of banks and overwater structures; do not work beneath structures that appear damaged.
Collection of soil samples via drilling	Overhead hazards	Stay clear of the radius of the drill rig tower. Get the attention of the drill rig operator or helper before approaching the rig.
	Noise	Wear appropriate ear protection. Get the attention of the rig operator or helper to stop the rig if needed to conduct conversations.
	Crushing by drill rods or rig tracks	Do not stand in the path of the rig when moving, or behind the rod loading rack when drilling. Get the attention of the drill rig operator or helper before approaching the rig.
	Lacerations from split spoons or tools	Wear appropriate work gloves when opening and re-assembling split spoons. Keep hands clear when using tools to open drilling equipment.
	Burns	Do not touch the drill rig exhaust system.
Collection of soil samples via hand sampling	Lacerations or abrasions from hand sampling equipment	Inspect equipment before use for sharp edges, damage or worn grips. Wear appropriate work gloves when using sample collection equipment.
Well development and stormwater system sampling	Electrical hazards (from submersible pumps)	Inspect equipment prior to use, paying close attention to worn connections or wire insulation; do not use damaged equipment. Use dedicated shielded clips to connect pump power supply to battery (if using).
	Splash hazards	Wear splash-proof goggles or face shield when transferring purge water.

Work Task	Potential Hazards	Actions to Control Hazards
Groundwater monitoring	Bite/sting from insects inside well monument	Visually check wells for insects or other biological hazards prior to opening. Wear long sleeves and gloves.
	Lacerations or abrasions from removing a well cap (especially if under pressure) or nearby vegetation	Clear work area of branches and trip hazards prior to setting up. Open well cap slowly to depressurize well casing. Stay out of line of fire above well cap.
Utility camera survey and stormwater system sampling	Confined spaces (manholes, etc.)	Do not break the plane of the confined space with any part of the body. Entry to confined spaces should be performed by properly trained workers using designated spotters and rescue equipment.

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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 C.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 C.3.

5.2 EMERGENCY MUSTER POINT

The emergency muster point for weather or other emergencies (other than chemical spills) is the Port warehouse building at the southeast corner of Terminal 7. During a chemical spill emergency, staff will muster upwind at the Terminal 7 dock.

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. PPE should be inspected for defects before each use. Field staff will use clean, disposable nitrile gloves when handling sample material.

Staff will additionally wear personal flotation devices when working near water and high-visibility gear when working in high-traffic areas. Cut-resistant gloves will be worn when opening or assembling split-spoon samplers and collecting soil samples using hand tools. Splash-resistant goggles or face shields will be worn when transferring purge water.

5.4 WORK AREAS

An exclusion zone will be established when working with potentially contaminated materials. The exclusion zone will be delineated with caution tape or other barriers.

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 5.6. Equipment decontamination will be performed within a designated area of the exclusion zone. The personnel decontamination station will consist of a trash receptacle for discarded PPE and brush/basin for dry boot decontamination to remove visible debris.

The support zone will consist of vehicles and break rooms/restrooms on Port property. The Study Area is a Port-owned facility and not used by members of the public.

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 C.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.

Large equipment and vehicle decontamination generally consists of brushing or pressure washing to remove visible debris; drill rods are additionally washed with soap and rinsed with potable water between drilling locations. Sampling equipment will be decontaminated in accordance with the Sampling and Analysis Plan and Quality Assurance Project Plan and will include rinsing with tap water to remove visible debris, scrubbing with soap solution, and a final rinse with distilled water. Personnel decontamination will include dry boot decontamination and removal of disposal gloves/other disposable PPE.

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 placed into trash bags and disposed as municipal solid waste. Excess sample material and equipment wash water will be containerizing in USDOT-approved drums pending characterization and disposal approval.

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 Work Plan – Phase I

Port of Port Angeles Terminals 5, 6, and 7

Appendix C

Attachment C.1
Accident Prevention Plan

Accident Prevention Plan

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Table of Contents

List of Tables

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.
- If you will not be finished with field work by 5:00 p.m., 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.

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[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 (μg/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 in 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 9th 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 Not in 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.

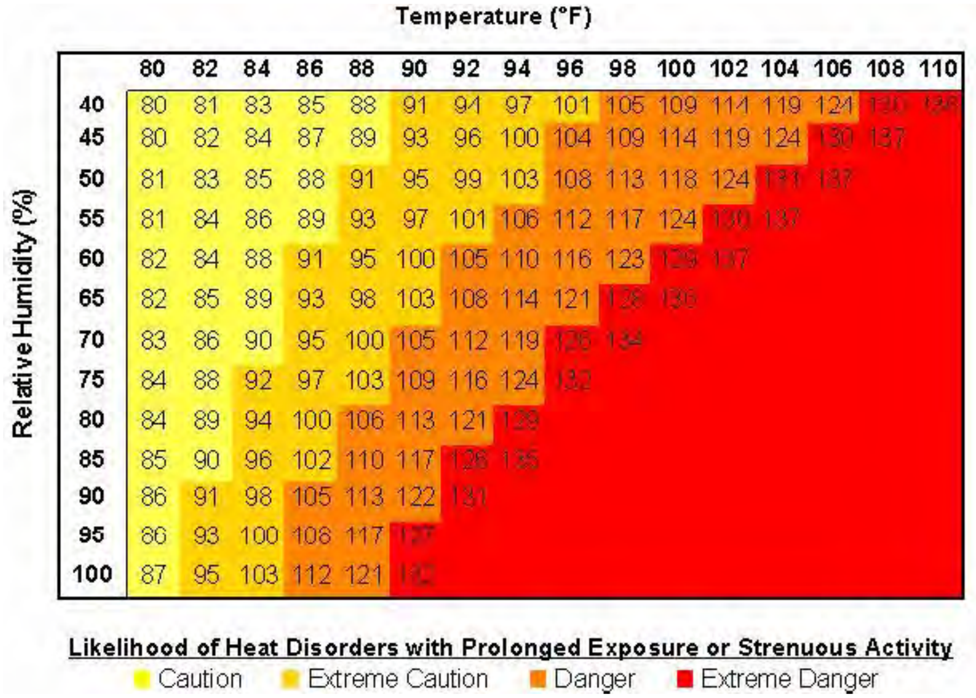
Employees showing signs or demonstrating symptoms of heat-related illness must be relieved from duty and provided with a sufficient means to reduce body temperature, including rest areas or temperature-controlled environments (i.e., air conditioned vehicle). Any employee showing signs or demonstrating 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	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

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 Work Plan – Phase I

Port of Port Angeles Terminals 5, 6, and 7

Appendix C

Attachment C.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 (PM) 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: ____

PM Review (Initial) __________

Remedial Investigation Work Plan – Phase I

Port of Port Angeles Terminals 5, 6, and 7

Appendix C

Attachment C.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 (PM) 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 PM at the end of the workday or field event.
- Submit this form to the Health and Safety Program Administrator after review with the PM. 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:___________________

---

[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 PM 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 Work Plan – Phase I

Port of Port Angeles Terminals 5, 6, and 7

Appendix C

Attachment C.4

Floyd|Snider Standard Guideline: COVID-19 Health and Safety Guidelines

FLOYD | SNIDER
strategy ▪ science ▪ engineering

Two Union Square
601 Union Street, Suite 600
Seattle, WA 98101
tel: 206.292.2078 fax: 206.682.7867

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).

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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 Work Plan – Phase I

Port of Port Angeles Terminals 5, 6, and 7

Appendix D
Port of Port Angeles, Terminals 5, 6, & 7 Uplands, Monitoring Protocols
(Last Revised April 2023)

Port of Port Angeles, Terminals 5, 6, & 7 Uplands, Monitoring Protocols

WA Department of Ecology Agreement No.: DE 21560

WA DAHP Project No.: not applicable at this time

The monitoring protocols for the Port of Port Angeles (Port) Phase 1 investigation, consisting of planned installation of ground water monitoring wells and fill soil and bank sampling at Terminals 5, 6, and 7, as outlined below. These protocols are a supplement to the Inadvertent Discovery Plan (IDP) that was prepared for the installation; both are being submitted to the Department of Ecology (Ecology) in advance of installation.[1] The IDP is attached to these protocols as Attachment A.

Any interim actions to address source control issues will require an additional workplan and modifications to these monitoring protocols and the IDP.

Project Description

The Project is located in Port Angeles, Washington, in Clallam County, in Section 04 of Township 30N, Range 06W of the Willamette Meridian. The Port is proposing to install ground water monitoring wells at the bulkheads at Terminals 5, 6, and 7 at their Log Yard in Port Angeles, Washington. The Project consists of groundwater monitoring well installation and fill soil and bank soil sampling, all of which constitute ground disturbing activities. As defined in the Section 9.3.1 of the Settlement Agreement, which was executed on August 14, 2006 between the State of Washington, Lower Elwha Klallam Tribe (LEKT), City of Port Angeles, and the Port, ground disturbing activities mean "operations such as digging, trenching, boring, excavating, and drilling that cause physical penetration of the surface of the ground by tools or equipment." These activities are described below.

Additional activities that are not expected to cause ground disturbance include investigation of the existing City stormwater pipe using a camera and topographic and visual surveys.

Groundwater Monitoring Well Installation & Sampling

- Ten (10) proposed monitoring wells to be installed in the shoreline fill areas to a maximum depth of 15 feet below ground surface (bgs), above the anticipated depth of contact with native beach deposits.
- Wells will be evenly spaced approximately every 200 feet along the shoreline. The proposed wells are shown in the Remedial Investigation Work Plan (Floyd Snider 2023).
- Adjustments may be made to the well construction based on field conditions, at the direction of the field geologist.
- Wells will measure about 2 inches in diameter.
- Fill soil samples will be collected from the proposed monitoring well borings.

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[1] These monitoring protocols refer to the term archaeological resources, consistent with the Revised Code of Washington (RCW) 27.53 (Archaeological Sites and Resources), 2006 Settlement Agreement, and Remedial Investigation Work Plan (Floyd Snider 2023).

- A surface soil sample (4 inches bgs) will be collected from all shoreline monitoring well borings.

Bank Soil Sampling

- If erodible areas are present along the shoreline, bank soil sampling will consist of hand grab or hand auger samples collected from the uppermost erodible intervals of soil in these areas from the bank surface to 4 inches below the bank surface and from 4 to 12 inches below the bank surface.

A professional archaeologist will monitor the ground disturbing activities associated with the installation of the ground water monitoring wells and sampling. The monitoring protocols are outlined below.

Cultural Background

The Project Area is classified as very high risk in the Department of Archaeology and Historic Preservation's (DAHP) Statewide Predictive Model for containing precontact and historic archaeological resources. Furthermore, there is a high probability for encountering human remains due to the proximity to the Tse-whit-zen village site, as described below.

Historically, much of the northern Olympic Peninsula and southern Vancouver Island was territory of the Klallam Tribe, and more than 30 Klallam villages were scattered throughout this region. Today, the Klallam Tribe is divided into three federally recognized Indian Tribes: the Port Gamble S'Klallam Tribe, the Jamestown S'Klallam Tribe, and the LEKT (Oldham 2007). The Project is located within the traditional territory of the LEKT.

The harbor area historically contained two major Klallam villages sites: I'e'nis and Tse-whit-zen villages (Colón et al. 2021). I'e'nis was located on the east side of the harbor, at the mouth of Ennis Creek. Tse-whit-zen village (45CA523) was in the western portion of the harbor at the base of Ediz Hook, including the Project area. The LEKT used Tse-whit-zen for many generations, extending as far back as 2,700 years or more (Lewarch et al. 2005). The village was also used as a cemetery, as well as for traditional practices of sea mammal hunting and ocean fishing.

In 2003, the Washington State Department of Transportation began construction of a graving yard and dock on Terminal 5 in support of the replacement and refurbishment of concrete pontoons for the Hood Canal Bridge. During excavation of the site, remains of 335 individuals and over 100,000 artifacts were recovered. Artifact deposits underlying historical fill identified included middens containing shell, stone, and bone artifacts, projectile points, and lithic debitage (Oldham 2007). Tse-whit-zen (45CA523) was listed in the National Register of Historic Places (NRHP) under Criteria for Evaluation D in 2014.

There are three historic archaeological sites located in the Project area including 45CA773 (railroad spur), 45CA796 (railroad spur), and 45CA797 (kiln stack/historic debris scatter) (Colón et al. 2021; Ferris and Scott 2019). All three sites were previously recommended not eligible for listing in the NRHP as they lack integrity and are not significant under any of the NRHP Criteria for Evaluation. To date, SHPO has not made a formal determination of NRHP eligibility for these three historic archaeological sites.

Personnel Qualifications and Communication Requirements

Archaeologist: Jennifer Ferris (HDR SOI-qualified archaeologist)

Monitor: HDR staff archaeologists

Port Project Manager: Chris Hartman

The archaeological monitor must be a professional archaeologist who is trained in archaeological field methods. The monitor will meet or will be supervised by an archaeologist who meets the Secretary of the Interior's (SOI) Professional Qualifications Standards for Archeology (36 CFR Part 61).

The Port Project Manager is the primary point of contact for the SOI-qualified archaeologist and monitor. The monitor will be responsible for notifying the SOI-qualified archaeologist of any significant or potentially significant archaeological discoveries. The SOI-qualified archaeologist is responsible for notifying the Port of any significant archaeological find during the borings. The Port, with assistance by the SOI-qualified archaeologist, is the primary contact for notifying Ecology of any significant archaeological find.

The monitor may communicate directly with the crew to determine the installation schedule. The monitor will observe the installation and may request that drillers temporarily halt sediment disposal to assess potential archaeological resources. The monitor will follow all safety policies and procedures during monitoring activities. The monitor will also be required to wear appropriate personal protective equipment (PPE) while on site.

At the commencement of installation, the monitor will orient the crew to the IDP (see pre-installation meeting below). At the start of each workday, the monitor will report to the site lead to receive daily safety and information briefings.

Consulting Party Involvement

The 2006 Settlement Agreement includes archaeology monitoring provisions in Section 9.6.3 that apply to the project area. The consulting parties will be notified in the event of an inadvertent discovery in accordance with the IDP. Contact information is listed in the IDP (Attachment A).

The SOI-qualified archaeologist will send email notification to all consulting parties with the installation and sampling schedule at least one week in advance, as feasible. As per standard Port protocol, the LEKT will be invited to observe the ground disturbing activities.

Pre-Construction Meeting

All contractor and subcontractor personnel will meet with the SOI-qualified archaeologist and/or monitor for IDP training and orientation prior to the start of ground disturbing activities. All crew members will be trained as to what constitutes archaeological resources and inadvertent finds. The meeting will also inform the crew what steps are to be taken in the event of an inadvertent discovery as outlined in the IDP. All personnel will be instructed to alert the monitor if they suspect an inadvertent discovery.

Confidentiality

Archaeological resources and human remains are of a sensitive nature and sites where archaeological resources are discovered can become targets of vandalism and illegal removal activities. All parties shall keep and maintain as confidential all information regarding any discovered archaeological resources, particularly the location of known or suspected human remains, and exempt all such information from public disclosure consistent with applicable state regulations (e.g., RCW 42.56.300) and Section 11 of the 2006 Settlement Agreement. All information indicating the location of known suspected archaeological resources or human remains from this Project shall be turned over to the DAHP. While any party is in possession of this confidential information, such party shall limit access to these records to authorized persons.

Monitoring Procedures

This section outlines the procedures for archaeological monitoring. The monitoring procedures follow the process outlined in the 2006 Settlement Agreement Section 9.6.3 (under Mitigation) and Section 10 (Disposition of Discovered Artifacts and Human Remains), as well as RCW 27.44 (Indian Graves and Records) and RCW 27.53 (Archaeological Sites and Resources).

1. Once the Port has a confirmed the installation and sampling schedule, the SOI-qualified archaeologist will notify the consulting parties of the schedule. The LEKT archaeologist will be invited to observe the installation and sampling.
2. The monitor will seek to identify potential buried surfaces, anthropogenic sediments, and previously unidentified archaeological features or artifact-bearing strata during ground disturbing activities. The monitor will inspect all disturbed areas, cores, and samples for indications of such archaeological resources.
3. The monitor will record the monitored activities on a Daily Record Form or field notebook. Overview photographs of the activities and any observed archaeological materials will be taken. If necessary, the monitor will prepare sketches/drawings of particular areas, artifacts, features, and/or soil profiles, if viewable. The locations of archaeological monitoring will be recorded on a field map for the project and reported in an archaeological resources survey report (see #9 below).
4. Archaeological monitoring will occur for all ground disturbing activities. The monitor will stand in close proximity to the drill and other equipment in order to view subsurface deposits as they are exposed, making all reasonable efforts to ensure safety and noninterference. The monitor will be in close communication with the site lead to ensure adequate opportunity for observation and documentation. The monitor will follow the protocols set forth in the on-site health and safety plan developed by the Port and/or contractor.
5. The Daily Record Form/notebook entry will be completed each day of monitoring and will be submitted to the SOI-qualified archaeologist so that it is available for review by all consulting parties, if requested. The Daily Record Forms/notebook entries will also be used to compile a brief status report that will be submitted in electronic form

(i.e., via email) to the consulting parties by the SOI-qualified archaeologist after installation is completed.

6. If during ground disturbing activities, the monitor, LEKT archaeologist (if present), or any member of the crew believes that they have encountered archaeological materials, the monitor, in coordination with the LEKT archaeologist (if present), will direct the crew to STOP WORK— at least temporarily—at that location to assess the potential archaeological resource. The monitor will immediately contact the Port and the SOI-qualified archaeologist to provide stop work notification in accordance with the IDP.
7. The SOI-qualified archaeologist will assist the Port in notifying Ecology and the LEKT of the discovery within 12 hours of the discovery.
8. If there is disagreement as to the stop work area, Section 10.7 of the Settlement Agreement will be followed. Section 10.7 states “that in the event those archaeologists or designees cannot collectively agree on initial stop work area within fourteen 14 days of the discovery, the City Archaeologist shall make the determination and the Parties shall defer to that determination unless inconsistent with generally accepted archaeological methods.”
9. The monitor will identify whether any observed archaeological material should be classified as an isolate, an intact archaeological deposit, disturbed artifact deposits, or other materials, and discussion between DAHP, Ecology, and the SOI-qualified archaeologist may occur. The procedures listed in the IDP will be followed.
10. If suspected human remains are observed during project activities, the procedures listed in the IDP will be followed.
11. The details and results of monitoring will be included in the archaeological resources survey report that will be prepared after monitoring is completed. The SOI-qualified archaeologist will provide the monitoring report to the Port and to Ecology.
12. If an archaeological resource is identified, a site or isolate inventory form will be completed and attached to the archaeological resources survey report. A recommendation of the resource’s eligibility for listing in the National Register of Historic Places will be included in the archeological resources survey report and the site/isolate inventory form, if such evaluation is feasible.
13. If further work or artifact collection is necessary for any discovered archaeological site, a DAHP site alteration and excavation permit and curation agreement may be required. Per the Section 10.1 of the Settlement Agreement, the Port will consult with the LEKT and DAHP “to ensure that cultural artifacts removed from government-owned lands are provided to the Tribe for appropriate curation or use.”

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Attachment A: Ecology IDP

INADVERTENT DISCOVERY PLAN

PLAN AND PROCEDURES FOR THE DISCOVERY OF CULTURAL RESOURCES AND HUMAN SKELETAL REMAINS

To request ADA accommodation, including materials in a format for the visually impaired, call Ecology at 360-407-6000 or visit https://ecology.wa.gov/accessibility. People with impaired hearing may call Washington Relay Service at 711. People with a speech disability may call TTY at 877-833-6341.

Site Name(s): Terminals 5 6 & 7 Uplands

Location: Marine Drive, Port Angeles, WA 98363

Project Lead/Organization: Port of Port Angeles

County: Clallam

If this Inadvertent Discovery Plan (IDP) is for multiple (batched) projects, ensure the location information covers all project areas.

1. INTRODUCTION

The IDP outlines procedures to perform in the event of a discovery of archaeological materials or human remains, in accordance with applicable state and federal laws. An IDP is required, as part of Agency Terms and Conditions for all grants and loans, for any project that creates disturbance above or below the ground. An IDP is not a substitute for a formal cultural resource review (Executive 21-02 or Section 106).

Once completed, **the IDP shall always be kept at the project site** during all project activities. All staff, contractors, and volunteers shall be familiar with its contents and know where to find it.

2. CULTURAL RESOURCE DISCOVERIES

A cultural resource discovery could be prehistoric or historic artifacts. Examples include (see images for further examples):

- An accumulation of shell, burned rocks, or other food related materials.
- Bones, intact or in small pieces.
- An area of charcoal or very dark stained soil with artifacts.
- Stone tools or waste flakes (for example, an arrowhead or stone chips).
- Modified or stripped trees, often cedar or aspen, or other modified natural features, such as rock drawings.
- Agricultural or logging materials that appear older than 50 years. These could include equipment, fencing, canals, spillways, chutes, derelict sawmills, tools, and many other items.
- Clusters of tin cans or bottles, or other debris that appear older than 50 years.
- Old munitions casings. ***Always assume these are live and never touch or move****.*
- Buried railroad tracks, decking, foundations, or other industrial materials.
- Remnants of homesteading. These could include bricks, nails, household items,

toys, food containers, and other items associated with homes or farming sites.

The above list does not cover every possible cultural resource. When in doubt, assume the material is a cultural resource.

3. ON-SITE RESPONSIBILITIES

If any employee, contractor, or subcontractor believes that they have uncovered cultural resources or human remains at any point in the project, take the following steps to ***Stop-Protect-Notify***. **If you suspect that the discovery includes human remains, also follow Sections 5 and 6.**

STEP A: Stop Work.

All work must stop immediately in the vicinity of the discovery.

STEP B: Protect the Discovery.

Leave the discovery and the surrounding area untouched and create a clear, identifiable, and wide boundary (30 feet or larger) with temporary fencing, flagging, stakes, or other clear markings. Provide protection and ensure integrity of the discovery until cleared by the Department of Archaeological and Historical Preservation (DAHP) or a licensed, professional archaeologist.

Do not permit vehicles, equipment, or unauthorized personnel to traverse the discovery site. Do not allow work to resume within the boundary until the requirements of this IDP are met.

STEP C: Notify Project Archaeologist (if applicable).

If the project has an archaeologist, notify that person. If there is a monitoring plan in place, the archaeologist will follow the outlined procedure.

Project Archaeologist

Name:	Jennifer Ferris
Organization:	HDR
Phone:	425-591-2613
Email:	jennifer.ferris@hdrinc.com

STEP D: Notify Project and Washington Department of Ecology (Ecology) contacts.

Project Lead Contacts

Primary Contact		Alternate Contact	
Name:	Chris Hartman	Name:	Jesse Waknitz
Organization:	Port of Port Angeles	Organization:	Port of Port Angeles
Phone:	360-417-3422	Phone:	360-417-3452
Email:	chrish@portofpa.com	Email:	jessew@portofpa.com

Ecology Contacts (completed by Ecology Project Manager)

Ecology Project Manager

Name: Connie Groven

Program: Toxics Cleanup Project Manager

Phone: 360-584-7037

Email: Connie.Groven@ecy.wa.gov

Alternate or Cultural Resource Contact

Name: Tavi Wise

Program: Toxics Cleanup Cultural Resources Contact

Phone: 360-999-3186

Email: Twis461@ecy.wa.gov

STEP E: Ecology will notify DAHP.

Once notified, the Ecology Cultural Resource Contact or the Ecology Project Manager will contact DAHP to report and confirm the discovery. To avoid delay, the Project Lead/Organization will contact DAHP if they are not able to reach Ecology.

DAHP will provide the steps to assist with identification. DAHP, Ecology, and Tribal representatives may coordinate a site visit following any necessary safety protocols. DAHP may also inform the Project Lead/Organization and Ecology of additional steps to further protect the site.

Do not continue work until DAHP has issued an approval for work to proceed in the area of, or near, the discovery.

DAHP Contacts:

Name: Rob Whitlam, PhD
Title: State Archaeologist
Cell: 360-890-2615
Email: Rob.Whitlam@dahp.wa.gov
Main Office: 360-586-3065

Human Remains/Bones:

Name: Guy Tasa, PhD
Title: State Anthropologist
Cell: 360-790-1633
Email: Guy.Tasa@dahp.wa.gov

4. TRIBAL CONTACTS

In the event cultural resources are discovered, the following tribes will be contacted. See Section 10 for Additional Resources.

Tribe: Lower Elwha Klallam Tribe
Name: Bill White
Title: Archaeologist, Cultural Resources
Phone: 360-460-1617
Email: bill.white@elwha.nsn.us

Tribe: Lower Elwha Klallam Tribe
Name: Matt Beirne
Title: Natural Resources Director
Phone: 360-461-2516
Email: matt.beirne@elwha.org

Tribe: Lower Elwha Klallam Tribe
Name: Frances Charles
Title: Chair
Phone: 360-452-8471 ext. 7411
Email: frances.charles@elwha.org

Tribe: Lower Elwha Klallam Tribe
Name: Sam Hough
Title: Tribal Attorney
Phone: 360-912-3687