Port of Seattle
Lora Lake Apartments Site

Remedial Investigation/ Feasibility Study

Volume II

Appendix H
1982 Dredged Material Containment Area Data Report

FINAL

Table of Contents

List of Tables

List of Figures

List of Attachments

List of Abbreviations and Acronyms

Abbreviation/ Acronym	Definition
AO	Agreed Order
ARI	Analytical Resources, Inc.
bgs	Below ground surface
BTEX	Benzene, toluene, ethylbenzene, and xylenes
cPAH	Carcinogenic polycyclic aromatic hydrocarbon
1,2-DCA	1,2-Dichloroethane
trans-1,2-DCE	trans-1,2-Dichloroethene
cis-1,2-DCE	cis-1,2-Dichloroethene
DMCA	Dredged Material Containment Area
LCS/LCSD	Laboratory control sample/laboratory control sample duplicate
LL	Lora Lake
MS/MSD	Matrix spike/matrix spike duplicate
MTCA	Model Toxics Control Act
NTU	Nephelometric turbidity unit
PCE	Tetrachloroethene
PCOC	Preliminary contaminant of concern
PCP	Pentachlorophenol
PID	Photoionization detector
Port	Port of Seattle
QC	Quality control
RI/FS	Remedial Investigation/Feasibility Study
RPD	Relative percent difference
STIA	Seattle-Tacoma International Airport
TCE	Trichloroethene
TEQ	Toxic equivalency quotient
TPH	Total petroleum hydrocarbons
USEPA	U.S. Environmental Protection Agency
VOC	Volatile organic compound
WAC	Washington Administrative Code
WSDOE	Washington State Department of Ecology

This page left intentionally blank.

1.0 Introduction

This data report presents the results of data collection activities conducted according to the Remedial Investigation/Feasibility Study (RI/FS) Work Plan (Floyd|Snider 2010) and the 1982 Dredged Material Containment Area Characterization Technical Memorandum (Floyd|Snider 2011) for the Lora Lake Apartments Site (Site). The Site is located at 15001 Des Moines Memorial Drive in Burien, Washington (Figure H.1), near the northwest corner of Seattle-Tacoma International Airport (STIA). The Site, as defined by the Model Toxics Control Act (MTCA) 173-340-200, includes the Lora Lake Apartments Parcel (LL Apartments Parcel), and areas beyond the property boundary where contamination may have come to be located. Separate phases of remedial investigation work were conducted at the LL Apartments Parcel and at the Lora Lake Parcel (LL Parcel), which are described in the Lora Lake Apartments Site RI/FS Report (Appendices F and G, respectively).

The Port of Seattle (Port) and the Washington State Department of Ecology (WSDOE) entered into Agreed Order (AO) No. DE 6703 for the Site on July 10, 2009 (WSDOE 2009). The AO Scope of Work requires the Port to prepare an RI/FS Work Plan, conduct a Remedial Investigation (RI) and Feasibility Study (FS), and prepare a RI/FS Report pursuant to Washington Administrative Code (WAC) 173-340-350 in a manner that complies with requirements of the MTCA cleanup regulation, Chapter 173-340 WAC (WSDOE 2007).

Prior to 1982, a King County stormwater outfall discharged into the northwest corner of Lora Lake. In response to citizen complaints regarding excessive siltation of the lake caused by this discharge, the King County Department of Public Works (KCDPW), hydraulically dredged approximately 4 feet of sediment from the lake bottom at its deepest point. The county arranged to place the dredge spoils in a specifically-constructed facility located on Port property to the northeast. This facility is referred to in this document as the 1982 Dredged Material Containment Area (DMCA; Figure H.2).

The DMCA is currently owned by the Port and occupies an approximately 120,000-square-foot area underlying the Approach Lighting System for the Seattle-Tacoma International Airport (STIA) 3rd Runway. The DMCA is bounded to the north by State Route 518 (SR 518), to the east and west by STIA stormwater mitigation areas, and to the south by a paved STIA access road (Figure H.2). Prior to stockpiling, the DMCA was an unoccupied vegetated area.

The DMCA remedial investigation described in this data report was designed to obtain necessary data from the DMCA to supplement the LL Apartments Parcel remedial investigation and to determine if contamination from the dredged materials from Lora Lake and potentially associated with the LL Apartments Parcel has come to lie within the DMCA. All data collection activities were conducted in accordance with the RI/FS Work Plan and Sampling and Analysis Plan/Quality Assurance Project Plan (SAP/QAPP; Floyd|Snider 2010).

1.1 PHYSICAL SETTING

Historical dredging contract documents referenced in the DMCA History Memorandum for the 1982 Lora Lake dredging work indicate that a total of 16,000 cubic yards of material was dredged, then stockpiled and dewatered on Port property (Stirling Consulting 2011; Appendix C of the RI/FS Report). Though no documentation of the actual berm construction dimensions or thickness of dredge material is available, historical project plans show a dewatering area inside an approximately 120,000-square-foot area surrounded by a constructed soil berm. This berm was designed to be 15 feet wide surrounding the southeast corner of the disposal area and narrowing to 6 feet wide along the north and south sides (Stirling Consulting 2011; Appendix C of the RI/FS Report). Project plans also stated that decanted water from the dredge spoils would be routed via pipeline from an outlet at the southeast corner of the disposal area back to Lora Lake, and that after dewatering the DMCA land surface would be graded to drain southeast at a slope of approximately 1:115.

In 2006, the Port regraded the western portion of the DMCA to prepare for construction of the Approach Lighting System for the STIA 3rd Runway. Project plans from 2002 indicate that the existing topography was altered to allow a west-to-east drainage outlet from the SR 518 stormwater pond (located to the west of the DMCA) to the central portion of the DMCA (Figure H.2). Current grading matches this plan; however, the outlet from the SR 518 pond could not be located in the field. The SR 518 stormwater pond is located immediately west of the DMCA, and the eastern edge of the SR 518 pond is visible on the left side of Figure H.2. Dredged material appears to have been moved from the center of the DMCA to the northwest and southwest to accommodate this outlet, but it is not known whether any additional imported fill materials were used during regrading activities. Proposed pre- and post-grading contours from the project plans for the regrading work are shown on Figure H.2. A 2-foot-wide berm and silt fence were constructed around the regraded area and are present today (HNTB 2005). Figure H.2 shows the location of the silt fence.

Although the original soil berm for the dredge area is visible in older aerial photographs, the current extents and condition of the berm are less clear. Between 1988 and 1993, aerial photographs show six pathways approximately 10 feet wide crossing the DMCA from north to south and east to west (Stirling Consulting 2011; Appendix C of the RI/FS Report). These pathways, however, appear to be the result of vegetation-clearing activity and historical photographs do not show evidence of significant earthwork prior to 2006.

1.2 OVERVIEW OF FIELD INVESTIGATION ACTIVITIES

The purpose of the DMCA investigation is to evaluate the soil and groundwater conditions of the area in order to assess potential soil and groundwater contamination resulting from placement of dredge material from Lora Lake in the DMCA. This field investigation was performed to supplement the LL Apartments Parcel remedial investigation and to determine if contamination from the dredged materials from Lora

Lake and potentially associated with the LL Apartments Parcel has come to lie within the DMCA. Specific activities completed as part of this field effort included the following:

- Excavation of six test pits to collect soil samples and visually identify dredge material
- Collection of groundwater samples from three monitoring wells on the perimeter of the DMCA

The test pit soil and groundwater sampling locations are shown on Figure H.3.

1.3 REPORT ORGANIZATION

The remaining sections of this report are organized as follows:

- **Section 2.0, Soil Investigation Procedures.** Description of field methods, documentation procedures, and minor work plan deviations for soil investigation activities.
- **Section 3.0, Soil Analytical Results.** Description of laboratory analytical methods and requirements, data quality objectives and compliance, and a summary of soil analytical results.
- **Section 4.0, Groundwater Investigation Procedures.** Description of field methods, procedures, and minor work plan deviations for groundwater investigation activities.
- **Section 5.0, Groundwater Analytical Results.** Description of laboratory analytical methods and requirements, data quality objectives and compliance, and a summary of groundwater analytical results.
- **Section 6.0, Site Survey Methods and Results.** Description of survey activities completed for soil and groundwater investigation locations.
- **Section 7.0, Investigation-derived Waste Management.** Summary of investigation-derived waste handling and disposal.
- **Section 8.0, References.** Provides reference information for materials cited in this document.

This page intentionally left blank.

2.0 Soil Investigation Procedures

Soil investigation activities on the DMCA included the collection and analysis of both surface and subsurface soil samples collected from area test pits. These test pit and the soil field investigation activities are described in detail below. The chemical analyses performed on these soil samples and the results of these analyses are discussed in Section 3.0.

2.1 FIELD PROCEDURES

A total of six test pits were excavated by Port personnel at the direction of Floyd|Snider field staff on April 19 and 20, 2011. Test pit locations were selected to provide a roughly even spatial distribution of data. Test pits were excavated using an excavator with a 2-foot-wide bucket and a 12-foot reach. Excavations were advanced to a depth of 1 foot below the groundwater table where possible, with final test pit depths between 2 and 7 feet below ground surface (bgs). Soils were observed and logged continuously throughout test pit excavation in accordance with the procedures described in the DMCA Characterization Technical Memorandum (Floyd|Snider 2011). Although surface fill gravels in locations under the STIA approach lighting area (TP-2, TP-3, and TP-5) were removed prior to excavation and sampling. Soils were described and classified according to the United Soil Classification System (USCS) and photographed.

Soil samples were collected from within each test pit for laboratory analytical testing in accordance with the sampling approach as described in the DMCA Characterization Technical Memorandum (Floyd|Snider 2011). Soil sample depth intervals varied depending on the presence and depth of native material at each test pit location, as well as soil characteristics and groundwater depth. Generally, soil samples were collected from the 1-foot interval below the groundwater table, the 1-foot interval immediately below the contact between dredge material and native material, where identifiable, and continuously in 2.5-foot increments from the dredge materials overlaying the native contact. If native materials were not identified, soils were sampled continuously in 2.5-foot increments to the water table, and from the 1-foot increments below the water table contact.

Field screening was conducted to identify areas of potential contamination according to the methods described in the LL Apartments RI/FS Work Plan (Floyd|Snider 2010). Soil samples were field screened to identify intervals potentially containing volatile contaminants using a photoionization detector (PID). PID screening involved placing soils into a sealed Ziploc bag and agitating the sample. The PID monitor was then placed in the sealed bag to measure volatile concentrations in the sample headspace. PID readings were recorded on the boring logs. Visual observations of contamination such as staining, as well as olfactory indications of contamination, were also monitored and documented on the boring logs.

Analytical soil sample collection followed the procedures outlined in the LL Apartments RI/FS Work Plan and DMCA Characterization Technical Memorandum (Floyd|Snider 2010, 2011). Soil was sampled from the excavator bucket or, where possible, from the side wall of the test pit with a decontaminated stainless steel spoon and placed into a decontaminated stainless steel bowl for homogenization. Following homogenization, the sample material was placed into laboratory-supplied glass sample containers, with the lid tightly sealed, labeled, and immediately placed in a cooler maintained at a temperature of approximately 4º C using crushed ice. Soil samples collected for volatile organic compound (VOC) analysis were collected directly from the excavator bucket using U.S. Environmental Protection Agency (USEPA) Method 5035A for VOC compounds prior to sample homogenization. Samples were delivered to Analytical Resources, Inc. (ARI) in Tukwila, Washington under standard chain-of-custody procedures.

Following sampling activities, test pit locations were backfilled with the excavated material and compacted first by the excavator bucket and then further compacted by driving the excavator vehicle repeatedly over the replaced material. Surface gravel, where present, was then replaced on top of the test pit excavation to minimize ground surface disturbance.

2.2 FIELD OBSERVATIONS AND DOCUMENTATION

Field observations were recorded on test pit logs, which are included in Attachment H.1. Generally, surface soils encountered in the DMCA were moist sands with abundant gravel and trace to moderate silt. TP-2, TP-3, and TP-5, which were located within the footprint of the 2006 regrading activities, were also overlain by approximately 1 to 1.5 feet of angular fill gravel (refer to Figure H.3). A 1- to 1.5-foot-thick layer of peaty, dark brown silty sand was observed below the sandy soils in all test pits except the easternmost, TP-6. Based on the historical use of Lora Lake for peat mining, it is assumed that this peaty layer likely represents the lake dredged material. Groundwater infiltration was observed in every test pit, with groundwater elevations ranging from approximately 275.5 feet (NGVD88) in the northernmost test pits (TP-1 and TP-4) to below 274 feet in the southernmost test pits (TP-3 and TP-6). This suggests a primarily north-northwest to south-southeast hydraulic gradient, consistent with earlier assumptions based on topography. Soils below the groundwater table generally consisted of coarse sand. Construction debris, including pieces of silt fence, was also encountered at 2 feet bgs in TP-1, indicating the use of fill material over the dredge material. Slight organic odors were present in the peaty layer, where present, and a maximum PID concentration of 16.3 parts per million was observed in this same layer in TP-5. No significant hydrocarbon odors or sheens were observed.

2.3 MINOR WORK PLAN DEVIATIONS

All test pits were excavated in accordance with the DMCA Characterization Technical Memorandum (Floyd|Snider 2011). Due to groundwater infiltration at shallower depths

than anticipated, all test pits were sampled within the water table regardless of the presence of native material. Otherwise, all soil samples were collected and archived in accordance with the DMCA Characterization Technical Memorandum (Floyd|Snider 2011) with one exception. In TP-1, the soil interval above native contact was divided from 0 to 3 feet and 3 to 4.5 feet, rather than evenly in half, in order to capture a layer with a slight organic odor and potential higher organic content beginning at 3 feet bgs.

This page intentionally left blank.

3.0 Soil Analytical Results

3.1 ANALYTICAL METHODS

The soil samples collected for the DMCA Investigation were analyzed for all of the following chemicals by the methods indicated below, in accordance with the DMCA Characterization Technical Memorandum (Floyd|Snider 2011):

- Arsenic and lead by USEPA Method 6010
- Total petroleum hydrocarbons (TPH; diesel range and oil range) by NWTPH-Dx
- TPH (gasoline range) by NWTPH-G
- Carcinogenic polycyclic aromatic hydrocarbons (cPAHs) by USEPA Method 8270D
- Pentachlorophenol (PCP) by USEPA Method 8041
- Tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), trans-1,2-dichloroethene (trans-1,2-DCE), and 1,2-dichloroethane (1,2-DCA) by USEPA Method 8260C
- Benzene, toluene, ethlybenzene, xylenes (BTEX) by USEPA Method 8021
- Dioxins/furans by USEPA Method 1613

These samples were also analyzed for total organic carbon (TOC) by the Plumb 1981 method. The chemical analyses were performed by ARI with Frontier Analytical Laboratory performing the dioxin/furan analyses.

Analytical results for the soil samples are presented in Table H.1 and detected concentrations of the preliminary contaminants of concern (PCOCs) are presented in Figure H.4. The laboratory analytical data reports, including Chain-of-Custody Forms, are presented in Attachment H.2.

3.2 DATA QUALITY

A Level III Data Quality Review (Summary Validation) was performed on all analytical data, except the dioxin/furan data. A Level IV, Tier III Data Quality Review (Full Validation) was performed on the dioxin/furan data. All data validation was performed by EcoChem, Inc. of Seattle, Washington. Refer to Attachment H.3 for the complete EcoChem, Inc. Data Validation Report.

Data validation was based on the quality control (QC) criteria as recommended in the methods identified in the LL Apartments RI/FS Work Plan (Floyd|Snider 2010) and in the National Functional Guidelines for Organic and/or Inorganic Data Review (USEPA 2008 and 2004). The dioxin/furan data were also evaluated using the

USEPA National Functional Guidelines for Chlorinated Dioxin/Furan Data Review (USEPA 2005).

As determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable, as demonstrated by the surrogate, laboratory control sample (LCS), and matrix spike/matrix spike duplicate (MS/MSD) recoveries. Precision was also acceptable as demonstrated by the MS/MSD, LCS/LCSD, and field duplicate relative percent difference (RPD) values. No additional data were qualified and all data, as reported, are determined to be acceptable for use.

3.3 ANALYTICAL RESULTS

3.3.1 Metals

Arsenic and lead were analyzed in all 15 soil samples, with arsenic detected in all but 3 samples—from 2 to 3 feet bgs in TP-2, from 1.5 to 2 feet bgs in TP-4, and from 2 to 3 feet bgs in TP-5. Lead detections followed a similar pattern, with one additional detection in the 1.5- to 2-foot bgs interval of TP-4. Detected arsenic concentrations ranged from 6 mg/kg in the sample intervals from 0 to 0.5 feet bgs in TP-6 and from 4.5 to 5.5 feet bgs in TP-1, to 60 mg/kg measured in the 0- to 1.5-foot bgs interval of TP-6. Detected lead concentrations ranged from 2 mg/kg in the sample interval from 1.5 to 2 feet bgs in TP-4 to 165 mg/kg in the 3- to 4-foot bgs interval of TP-3.

3.3.2 Total Petroleum Hydrocarbons

The 15 soil samples were analyzed for TPH. Diesel range TPH was detected once each in TP-3 andTP-5, oil range TPH was detected at least once in TP-1, TP-2, TP-3, TP-4, and TP-5. Gasoline range TPH was detected once each in TP-2 and TP-5. Diesel range TPH concentrations ranged from 14 mg/kg in the 0- to 0.5-foot bgs interval of TP-4 to 21 mg/kg in the 1.5- to 2-foot bgs interval of TP-5. Detected motor oil range TPH concentrations ranged from 18 mg/kg in the 2- to 3-foot bgs interval of TP-3 to 120 mg/kg in the 1.5- to 2-foot bgs interval of TP-5. Detected gasoline range TPH concentrations ranged from 5.9 mg/kg in the 3- to 4-foot bgs interval of TP-2 to 23 mg/kg in the 1.5- to 2-foot bgs interval of TP-5.

3.3.3 Semivolatile Organic Compounds

The 15 soil samples were analyzed for cPAHs and PCP. Of the 15 samples analyzed, PCP was detected once at 24 µg/kg in the 3- to 4-foot bgs interval of TP-3 and once at 39 µg/kg in the 1.5- to 2-foot bgs interval of TP-5. cPAHs were detected in at least one interval in TP-1, TP-2, TP-3, TP-4, and TP-5. Detected cPAH toxicity equivalency quotients (TEQs) ranged from 3.2 µg/kg in the 1.5- to 3-foot bgs interval of TP-2 to 20.8 µg/kg in the 1.5- to 2-foot bgs interval of TP-5.

3.3.4 Volatile Organic Compounds

The 15 soil samples were analyzed for chlorinated VOCs and benzene, toluene, ethylbenzene, and xylenes (BTEX). Toluene was detected once each in TP-2, TP-3 and TP-5. Both toluene and ethylbenzene were detected in the 3- to 4.5-foot bgs interval of TP-1, with no other VOC detections. A maximum toluene concentration of 6,500 µg/kg occurred at 1.5 to 2 feet bgs in TP-5 and a single ethylbenzene concentration of 50 µg/kg occurred from 3 to 4.5 ft bgs in TP-1. Additional toluene detections ranged from 68 µg/kg to 5,200 µg/kg.

3.3.5 Dioxins/Furans

Dioxins/furans were analyzed in all 15 soils samples collected from the test pits. The maximum detected dioxin/furan TEQ concentrations were 71.9 pg/g in the 1.5- to 2-foot bgs interval of TP-5, 64.5 pg/g from 0 to 1.4 feet bgs in TP-4, and 41.4 pg/g in the 3- to 4-foot interval of TP-3. Remaining dioxin/furan TEQs ranged from 0.217 pg/g in the 1.5-to 2-foot bgs interval of TP-4 to 7.34 pg/g in the 2- to 3-foot bgs interval of TP-3. The highest dioxin/furan concentrations were measured in samples taken from the dark brown peaty layer assumed to represent dredged lake sediments. Dioxin/furan TEQ concentrations declined sharply in soil samples collected from the material underlying the peat layer, ranging from non-detect to 0.35 pg/g in TP-5, 0.22 pg/g in TP-4, and 0.25 pg/g in TP-3.

This page intentionally left blank.

4.0 Groundwater Investigation Procedures

Groundwater investigation activities on the DMCA included well development and collection and analysis of groundwater samples collected from existing monitoring wells. Three groundwater monitoring wells were previously installed surrounding the DMCA by Hart Crowser circa 2002 as part of the stormwater mitigation area construction activities (Hart Crowser 2000). These wells (HC00-B310, HC00-B311, and HC00-B312) are located to the southeast, south and west of the dredge area and represent the most likely downgradient groundwater flow directions based on area topography and the presence of current or historical water bodies in these areas (Figure H.3).

Well completion logs prepared by Hart Crowser show screened intervals in the most shallow aquifer, with screen depths ranging from 8 to 18 feet bgs in HC00-B310 and HC00-B311 and from 18 to 28 feet bgs in HC00-B312. Sampling history and monitoring well maintenance activities for these locations are unknown, therefore the existing wells were re-developed prior to sampling to remove water and fines that may have collected in the wells over time and to establish a hydraulic connection between each well and the surrounding water table. Each well was sampled to assess potential groundwater contamination downgradient of the DMCA. These groundwater field investigation activities are described in detail below. The chemical analyses performed on these groundwater samples and the results of these analyses are discussed in Section 5.0.

4.1 MONITORING WELL DEVELOPMENT

4.1.1 Field Procedures

Well development activities, including purging and surging, were performed on all monitoring wells on April 25 and 26, 2011. Well development was conducted in general accordance with the LL Apartments RI/FS Work Plan (Floyd|Snider 2010). Work plan modifications are discussed in detail in Section 4.1.3 below. Well development was conducted by continuous pumping at a steady rate using a submersible 12-Volt, 2.0 gallon-per-minute (gpm) electric pump (whale pump) with disposable polyethylene tubing. The whale pump was surged in the well during purging by repeatedly raising and lowering the pump along the length of the screened interval to push water through the screen and into the surrounding sand filter pack. Non-disposable equipment was decontaminated between wells by pumping an Alconox Solution wash, followed by deionized water, through the pump.

Low turbidity conditions are desirable during well development and groundwater sampling activities due to the analytical sensitivity and low detection limits associated with dioxin/furan testing. Well development was considered complete when turbidity readings were approximately 50 nephelometric turbidity units (NTU) or less, and a minimum of 10 well volumes had been removed, with some deviations regarding equipment types and NTU readings during surging, as discussed further in Section 4.1.3.

4.1.2 Field Observations and Documentation

All wells were purged well in excess of 10 casing volumes to achieve turbidity levels less than 50 NTU. HC00-B310 achieved a turbidity of 49.9 NTU after purging 48 gallons of water (approximately 27 well volumes), and HC00-B312 achieved a turbidity of 42.3 NTU after purging 68 gallons (approximately 23 well volumes). Development of HC00-B311 was abandoned on April 25, 2011 after purging 104 gallons (approximately 67.5 well volumes) and measurable turbidity levels of larger grained sand particles still remained in the purge water stream. On April 26, 2011, purging at HC00-B311 recommenced with a larger, 2.8 gpm pump. An additional 36 gallons (approximately 23.5 well volumes) were purged, with turbidity reaching approximately 42 NTU between surging periods, but remaining as high as 100 NTU immediately subsequent to surging. Field staff noted large sand particles in the purge water, indicating possible intrusion of filter pack sand. Because the required purge volume of 10 well volumes for well development as specified in the DMCA Characterization Technical Memorandum (Floyd|Snider 2011) was met, and turbidity was satisfactorily low (less than 50 NTU) between surging periods, development of HC00-B311 was determined to be sufficient for sampling after purging a total of 140 gallons. A final sample was taken from this well with turbidity less than 5 NTU was subsequently achieved during low-flow groundwater sampling, as discussed in Section 4.2.2.

4.1.3 Minor Deviations from Work Plan

As discussed in the LL Apartments Data Report (Appendix F of the RI/FS), a surge block was stated as the preferred surging method in the LL Apartments RI/FS Work Plan (Floyd|Snider 2010). After discovering that the available surge block for 2-inch diameter wells fit too tightly to allow movement within the well casing, field staff employed an alternative method of surging the pump body to force water and fine particulate through the filter pack. This method was also employed for the monitoring wells in the DMCA. Additionally, development was abandoned at HC00-B311 without achieving a constant turbidity less than 50 NTU, as discussed above in Section 4.1.2.

4.2 GROUNDWATER SAMPLING

4.2.1 Field Procedures

Groundwater samples were collected from all monitoring wells on April 29, 2011, allowing an excess of 48 hours between development and sampling as specified in the DMCA Characterization Technical Memorandum (Floyd|Snider 2011).

Prior to sampling, depth to water was measured and recorded, with date and time, as the static depth to water on the Groundwater Sample Collection Form (Attachment H.4). After water depth measurement, a low-flow peristaltic pump was lowered into the well, centered on the well's submerged screen interval. Purging of the well was then conducted with low-flow rates not exceeding 0.5 liters per minute, in accordance with

the LL Apartments RI/FS Work Plan (Floyd|Snider 2010). During purging, field parameters (temperature, pH, dissolved oxygen, conductivity, salinity, and turbidity) were recorded at 3- to 5-minute intervals with a multi-parameter groundwater meter and dedicated nephelometric turbidity meter. The time, parameter values, and purge rate were recorded on the Groundwater Sample Collection Form for each set of readings (Attachment H.4).

When the field measurements for turbidity, dissolved oxygen, and conductivity were stable (within approximately 10 percent) for three consecutive readings and turbidity was less than 5 NTU, the groundwater sample was collected. The last set of field parameters measured during purging represent field parameters for the groundwater sample. All field measurements and observations were recorded on the Groundwater Sample Collection Form (Attachment H.4).

Groundwater samples were collected by directly filling laboratory-provided containers from the pump discharge line, using only dedicated (disposable) tubing.

Sample containers were filled, tightly capped, labeled, and immediately placed in a cooler maintained at a temperature of approximately 4º C using crushed ice. Samples were delivered to ARI in Tukwila, Washington, under standard chain-of-custody procedures.

4.2.2 Field Observations and Documentation

During collection of groundwater samples, no hydrocarbon odors or sheens were observed. Pumping rates ranged from 0.26 to 0.33 liters per minute, and final turbidity measurements ranged between 0.03 and 3.81 NTU. Field parameters stabilized in all wells within 25 minutes of beginning purging, with no drawdown observed.

Groundwater elevations prior to purging ranged from 275.49 feet NAVD88 at Well HC00-B312 to 271.67 feet NAVD88 at HC00-B311, indicating a hydraulic gradient from north-northwest to south-southeast. Monitoring well groundwater elevations and inferred groundwater flow direction are presented on Figure H.5.

4.2.3 Minor Deviations from Work Plan

All sampling procedures were conducted in accordance with the RI/FS Work Plan and DMCA Characterization Technical Memorandum (Floyd|Snider 2010, 2011), with minor exceptions. Groundwater samples for metals analysis were collected in laboratory-provided field-preserved bottles rather than being preserved at the analytical laboratory. Additionally, following submittal of the groundwater samples to the laboratory, the laboratory staff performed the standard preservative test and incorrectly concluded that the samples were also field-filtered and did not perform further filtration. The analytical results presented in Section 5.3, therefore, represent total rather than dissolved metals.

This page intentionally left blank.

5.0 Groundwater Analytical Results

5.1 ANALYTICAL METHODS

The three groundwater samples collected for the DMCA Investigation were analyzed for the following chemicals by the methods indicated below, in accordance with the DMCA Characterization Technical Memorandum (Floyd|Snider 2011):

- Arsenic and lead (total) by USEPA Method 200.8
- TPH (diesel range and oil range) by NWTPH-Dx
- TPH (gasoline range) by NWTPH-G
- cPAHs by USEPA Method 8270D
- PCP by USEPA Method 8041
- PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, and 1,2-DCA by USEPA Method 8260C
- BTEX by USEPA Method 8021
- Dioxins/furans by USEPA Method 1613

These samples were also analyses for total suspended solids (TSS) by SM 2540D and pH by USEPA Method 150.1. The chemical analyses were performed by ARI with Frontier Analytical Laboratory performing the dioxin/furan analyses.

Analytical results for the groundwater samples are presented in Table H.2 and detected concentrations of the PCOCs are presented in Figure H.6. Analytical reports, including Chain-of-Custody Forms, are presented in Attachment H.2.

5.2 DATA QUALITY

A Level III Data Quality Review (Summary Validation) was performed on all analytical data, except dioxins/furans, which had a Level IV, Tier III Data Quality Review (Full Validation). All data validation was performed by EcoChem, Inc. of Seattle, Washington. Refer to Attachment H.3 for the complete EcoChem Data Validation Report.

Data validation was based on the QC criteria as recommended in the methods identified in the SAP/QAPP (Floyd|Snider 2010) and in the National Functional Guidelines for Organic and/or Inorganic Data Review (USEPA 2008 and 2004). The dioxin/furan data were also evaluated using the *USEPA National Functional Guidelines for Chlorinated Dioxin/Furan Data Review* (USEPA 2005).

As determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable, as demonstrated by the surrogate, LCS, and MS/MSD recoveries. All benzo(a)pyrene values were qualified with a “UJ” flag due to

percent recovery lower than the LCS/LCSD control limit, and the dioxin/furan congener OCDF value in sample B-312 was also qualified for the same reason. Precision was otherwise determined acceptable as demonstrated by the MS/MSD RPD values. No other data were qualified, and all data are determined to be acceptable for use.

5.3 ANALYTICAL RESULTS

Lead, TPH, cPAHs, PCP, chlorinated VOCs, and BTEX were not detected in any of the groundwater samples collected from the DMCA. Arsenic was detected in all three samples at low levels, with concentrations ranging from 0.3 to 0.7 mg/L. A single dioxin/furan congener, 1,2,3,4,6,7,8,9-octachloro dibenzo-p-dioxin, was detected in the three groundwater samples, with associated dioxin/furan TEQs ranging from 0.004 to 0.008 pg/L.

6.0 Site Survey Methods and Results

A licensed Port survey crew surveyed all test pit and monitoring well locations, as well the extents of current soil berms, silt fences and fill gravel, between April 26 and April 29, 2011. Horizontal data were reported in NAD83, Washington State Plane North Elevation, vertical data were reported in the NGVD29 datum and subsequently converted to NAVD88 by Floyd|Snider for mapping purposes. Monitoring well elevations were measured at ground surface and at the top of the well casing at the northernmost-facing measuring point. The test pit locations, monitoring well locations, and physical features were surveyed by the Port to a horizontal and vertical closure of 1:5,000, according to the requirements specified in the AO. Survey results are shown on the data report figures.

This page intentionally left blank.

7.0 Investigation-Derived Waste

All water generated by well development and groundwater sampling activities was collected and transferred to new, Department of Transportation-approved 55-gallon steel drums. Drums were lidded, sealed, labeled as non-hazardous (purge) water waste with indelible marker, and stored on-site. Waste profiling was coordinated by the Port. On September 21, 2011, 5 drums containing investigation-derived waste (IDW) water generated during sampling activities were transported from the Site as Non-RCRA, Non-Washington State Dangerous Waste. The drums were transported to the Clean Harbors Environmental Services Grassy Mountain Landfill in Grantsville, Utah for disposal.

This page intentionally left blank.

8.0 References

Floyd|Snider. 2010. *Remedial Investigation/Feasibility Study Work Plan, Port of Seattle Lora Lake Apartments*. Prepared for Port of Seattle. 30 July.

———. 2011. *Dredged Materials Disposal Area Characterization—Lora Lake Parcel*. Prepared for Port of Seattle. 14 April.

Hart Crowser. 2000. *Site and Exploration Plan, Miller Creek Detention Facility*. September.

HNTB. 2005. *Port of Seattle Sea-Tac International Airport 3rd RW 2006 Embankment Expansion, Grading/Utility/Fencing Plan, Work Area 26*. 20 October.

Stirling Consulting. 2011. *History of the Port of Seattle Lora Lake 1982 Dredged Material Containment Area*. Prepared for Port of Seattle. August.

U.S. Environmental Protection Agency (USEPA). 2004. *USEPA National Contract Laboratory Program National Functional Guidelines for Inorganic Data Review.* OSWER 9240.1-45, EPA 540-R-04-004. Office of Superfund Remediation and Technology Innovation (OSRTI), Washington, D.C. October.

———. 2005. *USEPA Contract Laboratory Program, National Functional Guidelines for Chlorinated Dioxin/Furan Data Review* EPA-540/R-05/001. September.

———. 2008. *USEPA Contract Laboratory Program, National Functional Guidelines for Organic Data Review*. EPA-540/R-99/008. October.

Washington State Department of Ecology (WSDOE). 2007. *Model Toxics Control Act Regulation*. Chapter 173-340 WAC. 12 October.

———. 2009. Agreed Order No. DE-6703 issued to the Port of Seattle.

Port of Seattle
Lora Lake Apartments Site

Remedial Investigation/ Feasibility Study

Volume II

Appendix H
1982 Dredged Material Containment Area Data Report

Tables

FINAL

Table H.1
1982 Dredged Material Containment Area Soil Analytical Results

	Location	DMA-TP1			DMA-TP2		DMA-TP3			DMA-TP4		DMA-TP5			DMA-TP6	
	Sample ID	DMA-TP1-0-3-041911	DMA-TP1-3-4.5-041911	DMA-TP1-4.5-5.5-041911	DMA-TP2-1.5-3-041911	DMA-TP2-3-4-041911	DMA-TP3-2-3-042011	DMA-TP3-3-4-042011	DMA-TP3-5-6-042011	DMA-TP4-0-1.5-042011	DMA-TP4-1.5-2-042011	DMA-TP5-1.5-2-042011	DMA-TP5-1.5-2-042011-D	DMA-TP5-2-3-042011	DMA-TP6-0-2.5-041911	DMA-TP6-2.5-5-041911
	Sample Date	04/19/2011	04/19/2011	04/19/2011	04/19/2011	04/19/2011	04/20/2011	04/20/2011	04/20/2011	04/20/2011	04/20/2011	04/20/2011	04/20/2011	04/20/2011	04/19/2011	04/19/2011
	Sample Depth	0–3 feet	3–4.5 feet	4.5–5.5 feet	1.5–3 feet	3–4 feet	2–3 feet	3–4 feet	5–6 feet	0–1.5 feet	1.5–2 feet	1.5–2 feet	1.5–2 feet	2–3 feet	0–2.5 feet	2.5–5 feet
Analyte	**Unit**															
Conventionals																
Total Organic Carbon	%	0.871	7.23	0.562	2.05	0.617	1.32	6.3	0.519	11.1	0.259	10.7	11.2	0.168	0.586	0.495
Total Solids	%	88	81.8	89.4	85.1	89.6	82.3	34.3	85.4	33.4	84.1	48	50.1	79.8	88	89.2
Metals																
Arsenic	mg/kg	8	15	6	10	5 U	7	50	7	60	6 U	50	47	6 U	6	7
Lead	mg/kg	15	18	29	18	2 U	10	165	3	119	2	160	153	2 U	7	8
Total Petroleum Hydrocarbons																
Gasoline Range Hydrocarbons	mg/kg	4.1 U	5.4 U	4 U	4.6 U	5.9	4.4 U	14 U	3.5 U	23 U	4.4 U	18	23	4.6 U	3.9 U	3.6 U
Diesel Range Hydrocarbons	mg/kg	5.5 U	6 U	5.5 U	5.6 U	5.5 U	5.8 U	16	5.7 U	14	6 U	21	20	6 U	5.6 U	5.6 U
Heavy Oil Range Hydrocarbons	mg/kg	11 U	22	23	19	11 U	18	95	11 U	100	12 U	120	110	12 U	11 U	11 U
Semivolatile Organic Compounds																
Pentachlorophenol	µg/kg	7 U	7.3 U	6.9 U	7.2 U	7 U	7.4 U	24	7 U	18 U	7.4 U	39 J	12 U	7.4 U	7 U	7 U
Carcinogenic Polycyclic Aromatic Hydrocarbons																
Benzo(a)pyrene	µg/kg	4.6 U	6.8	4.6 U	4.5 U	4.5 U	4.9 U	4.9 U	4.7 U	12	4.6 U	12 J	12 J	4.7 U	4.4 U	4.4 U
Benzo(a)anthracene	µg/kg	4.6 U	5.7	4.6 U	4.5 U	4.5 U	4.9 U	5.7	4.7 U	11	4.6 U	14 J	14 J	4.7 U	4.4 U	4.4 U
Benzofluoranthenes (total)[1]	µg/kg	4.6 U	18	4.6 U	4.5 U	4.5 U	6.3	23	4.7 U	44	4.6 U	54 J	57 J	4.7 U	4.4 U	4.4 U
Chrysene	µg/kg	4.6 U	13	4.6 U	4.9	4.5 U	10	18	4.7 U	32	4.6 U	44 J	47 J	4.7 U	4.4 U	4.4 U
Dibenzo(a,h)anthracene	µg/kg	4.6 U	4.4 U	4.6 U	4.5 U	4.5 U	4.9 U	4.9 U	4.7 U	4.8 U	4.6 U	4.9 UJ	4.8 UJ	4.7 U	4.4 U	4.4 U
Indeno(1,2,3-cd)pyrene	µg/kg	4.6 U	4.4 U	4.6 U	4.5 U	4.5 U	4.9 U	5.5	4.7 U	4.8 U	4.6 U	13 J	12 J	4.7 U	4.4 U	4.4 U
Summed cPAH TEQ[2,3]	µg/kg	0 U	9.3	0 U	0.049	0 U	0.73	3.6	0 U	18	0 U	21 J	21 J	0 U	0 U	0 U
Summed cPAH TEQ with One-Half of the Reporting Limit[2,4]	µg/kg	3.2 U	9.7	3.2 U	3.2	3.2 U	3.9	6.3	3.3 U	18	3.2 U	21 J	21 J	3.3 U	3.1 U	3.1 U
Volatile Organic Compounds																
Tetrachloroethene	µg/kg	0.6 U	0.8 U	0.7 U	0.8 U	0.7 U	0.7 U	2.3 U	0.5 U	2.5 U	0.6 U	1.5 U	1.6 U	0.7 U	0.7 U	0.6 U
Trichloroethene	µg/kg	0.6 U	0.8 U	0.7 U	0.8 U	0.7 U	0.7 U	2.3 U	0.5 U	2.5 U	0.6 U	1.5 U	1.6 U	0.7 U	0.7 U	0.6 U
cis-1,2-Dichloroethene	µg/kg	0.6 U	0.8 U	0.7 U	0.8 U	0.7 U	0.7 U	2.3 U	0.5 U	2.5 U	0.6 U	1.5 U	1.6 U	0.7 U	0.7 U	0.6 U
trans-1,2-Dichloroethene	µg/kg	0.6 U	0.8 U	0.7 U	0.8 U	0.7 U	0.7 U	2.3 U	0.5 U	2.5 U	0.6 U	1.5 U	1.6 U	0.7 U	0.7 U	0.6 U
1,2-Dichloroethane	µg/kg	0.6 U	0.8 U	0.7 U	0.8 U	0.7 U	0.7 U	2.3 U	0.5 U	2.5 U	0.6 U	1.5 U	1.6 U	0.7 U	0.7 U	0.6 U
Benzene	µg/kg	20 U	27 U	20 U	23 U	22 U	22 U	71 U	17 U	120 U	22 U	64 U	67 U	23 U	20 U	18 U
Ethylbenzene	µg/kg	20 U	50	20 U	23 U	22 U	22 U	71 U	17 U	120 U	22 U	64 U	67 U	23 U	20 U	18 U
Toluene	µg/kg	20 U	68	20 U	32	22 U	22 U	71	17 U	120 U	22 U	5200	6500	23 U	20 U	18 U
Xylene (meta & para)	µg/kg	41 U	54 U	40 U	46 U	44 U	44 U	140 U	35 U	230 U	44 U	130 U	130 U	46 U	39 U	36 U
Xylene (ortho)	µg/kg	20 U	27 U	20 U	23 U	22 U	22 U	71 U	17 U	120 U	22 U	64 U	67 U	23 U	20 U	18 U
Dioxins/Furans																
2,3,7,8-TCDD	pg/g	0.112 U	0.48 J	0.38 J	0.726 J	0.128 U	0.714 J	3.32	0.112 U	5.61	0.102 U	5.69	7.13	0.204 U	0.115 U	0.158 U
1,2,3,7,8-PeCDD	pg/g	0.288 J	0.861 J	0.678 J	1 J	0.219 U	1.18 J	5.53	0.179 U	9	0.157 U	8.52	10.6	0.215 U	0.224 J	0.187 U
1,2,3,4,7,8-HxCDD	pg/g	0.253 J	1.51 J	1.01 J	2.09 J	0.21 U	2.27 J	11.2	0.134 U	18.2	0.154 U	17	20.4	0.203 U	0.214 J	0.167 U
1,2,3,6,7,8-HxCDD	pg/g	0.641 J	5.37	5.04	8.29	0.271 U	7.99	45.9	0.174 U	72.5	0.194 U	66.7	79.2	0.252 U	0.667 J	0.672 J
1,2,3,7,8,9-HxCDD	pg/g	0.413 J	2.93 J	2.05 J	3.92 J	0.234 U	4.24 J	22	0.149 U	35.1	0.17 U	33.6	39.1	0.222 U	0.456 J	0.436 J
1,2,3,4,6,7,8-HpCDD	pg/g	10.2	119	109	187	1.26 J	185	1170	1.43 J	1820	1.09 J	1600 J	1910	1.85 J	11.1	11.8
Total OCDD	pg/g	73.5	945	984	1680	8.68 J	1560	11300	10.9	16800	8.93 J	14700	17400	14.2	72.1	79.4
2,3,7,8-TCDF	pg/g	0.675 J	0.88 J	0.33 J	0.819 J	0.113 U	1.32	3.39	0.112 U	5.48	0.103 U	5.88	6.99	0.147 U	0.488 J	0.42 J
1,2,3,7,8-PeCDF	pg/g	0.313 J	0.498 J	0.259 J	0.461 J	0.141 U	0.639 J	2.8 J	0.113 U	4.44 J	0.118 U	4.2 J	5.09	0.185 U	0.239 J	0.166 U
2,3,4,7,8-PeCDF	pg/g	0.308 J	0.615 J	0.366 J	0.668 J	0.154 U	0.869 J	4.77 J	0.125 U	7.17	0.123 U	7.29	9.22	0.2 U	0.383 J	0.357 J
1,2,3,4,7,8-HxCDF	pg/g	0.316 J	2.16 J	2.17 J	3.14 J	0.123 U	3.34 J	18.2	0.166 U	27.5	0.0961 U	24.6	29.8	0.214 U	0.635 J	1.02 J
2,3,4,6,7,8-HxCDF	pg/g	0.442 J	1.65 J	1.3 J	2.44 J	0.127 U	2.43 J	13.4	0.168 U	20.4	0.108 U	19.4	23	0.234 U	0.348 J	0.461 J
1,2,3,7,8,9-HxCDF	pg/g	0.0762 U	0.344 J	0.331 J	0.401 J	0.115 U	0.468 J	2.29 J	0.139 U	3.41 J	0.0921 U	3.4 J	4.04 J	0.196 U	0.145 J	0.174 J
1,2,3,4,6,7,8-HpCDF	pg/g	4.5 J	28.7	25.2	43.7	0.251 J	41.5	274	0.325 J	412	0.237 J	364	448	0.299 J	2.3 J	2.74 J
1,2,3,6,7,8-HxCDF	pg/g	0.256 J	1.17 J	0.784 J	1.62 J	0.123 U	1.76 J	9.43	0.155 U	13.7	0.0986 U	13.3	16.3	0.225 U	0.278 J	0.306 J
1,2,3,4,7,8,9-HpCDF	pg/g	0.394 J	1.66 J	1.73 J	2.31 J	0.166 U	2.43 J	14.3	0.111 U	23.1 J	0.132 U	20.5	25.2 J	0.173 U	0.309 J	0.45 J
Total OCDF	pg/g	15.5	76	73.2	123	0.522 J	98.5	732	0.874 J	1150	0.561 J	914	1140	1.04 J	4.56 J	4.8 J
Summed Dioxin/Furan TEQ[5,6]	pg/g	0.867 J	4.94 J	4.15 J	7.08 J	0.0179 J	7.34 J	41.1 J	0.0211 J	64.5 J	0.0161 J	59.4 J	71.9 J	0.0261 J	0.0829 J	0.613 J
Summed Dioxin/Furan TEQ with One-half of the Detection Limit[5,7]	pg/g	0.927 J	4.94 J	4.15 J	7.08 J	0.283 J	7.34 J	41.1 J	0.247 J	64.5 J	0.217 J	59.4 J	71.9 J	0.354 J	0.887 J	0.815 J

Notes:

1 Benzofluoranthenes (total) includes both benzo(b)fluoranthene and benzo(k)fluoranthene. Both analytes have a toxicity equivalency factor of 0.1, therefore the total of the two analytes is multiplied by 0.1 when calculating the cPAH TEQ.

2 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivancy Factors as presented in Table 708-2 of WAC 173-340-900 (WSDOE 2007).

3 Calculated using detected cPAH concentrations.

4 Calculated using detected cPAH concentrations plus one-half the reporting limit for cPAHs that were not detected.

5 World Health Organization 2005 Toxic Equivalency Factors used for calculation of dioxin/furan TEQ (Van den Berg et al. 2006).

6 Calculated using detected dioxin/furan concentrations.

7 Calculated using detected dioxin/furan concentrations plus one-half the detection limit for dioxins/furans that were not detected.

Abbreviations:

cPAH Carcinogenic polycyclic aromatic hydrocarbon
OCDD Octachlorodibenzo-p-dioxin
OCDF Octachlorodibenzofuran
TEQ Toxic equivalency quotient
WAC Washington Administrative Code
WSDOE Washington State Department of Ecology

Qualifiers:

J The analyte was analyzed for and positively identified, but the associated numerical value is an estimated quantity.
U Undetected.
UJ Undetected with estimated concentration.

Table H.2
1982 Dredged Material Containment Area Groundwater Analytical Results

	Location	HC00-B310	HC00-B311	HC00-B312
	Sample ID	B310-042911	B311-042911	B312-042911
	Sample Date	04/29/2011	04/29/2011	04/29/2011
Analyte	**Unit**			
Metals				
Arsenic (total)	µg/L	0.7	0.4	0.3
Lead (total)	µg/L	0.1 U	0.1 U	0.1 U
Total Petroleum Hydrocarbons				
Gasoline Range Hydrocarbons	mg/L	0.25 U	0.25 U	0.25 U
Diesel Range Hydrocarbons	mg/L	0.1 U	0.1 U	0.1 U
Heavy Oil Range Hydrocarbons	mg/L	0.2 U	0.2 U	0.2 U
Semivolatile Organic Compounds				
Pentachlorophenol	µg/L	0.25 U	0.25 U	0.25 U
Carcinogenic Polycyclic Aromatic Hydrocarbons				
Benzo(a)pyrene	µg/L	0.01 UJ	0.01 UJ	0.01 UJ
Benzo(a)anthracene	µg/L	0.01 U	0.01 U	0.01 U
Benzofluoranthenes (total)[1]	µg/L	0.01 U	0.01 U	0.01 U
Chrysene	µg/L	0.01 U	0.01 U	0.01 U
Dibenzo(a,h)anthracene	µg/L	0.01 U	0.01 U	0.01 U
Indeno(1,2,3-cd)pyrene	µg/L	0.01 U	0.01 U	0.01 U
Summed cPAH TEQ[2,3]	µg/L	0 UJ	0 UJ	0 UJ
Summed cPAH TEQ with One-Half of the Reporting Limit[2,4]	µg/L	0.0071 UJ	0.0071 UJ	0.0071 UJ
Volatile Organic Compounds				
Tetrachloroethene	µg/L	0.02 U	0.02 U	0.02 U
Trichloroethene	µg/L	0.02 U	0.02 U	0.02 U
cis-1,2-Dichloroethene	µg/L	0.02 U	0.02 U	0.02 U
trans-1,2-Dichloroethene	µg/L	0.02 U	0.02 U	0.02 U
1,2-Dichloroethane	µg/L	0.02 U	0.02 U	0.02 U
Benzene	µg/L	1 U	1 U	1 U
Ethylbenzene	µg/L	1 U	1 U	1 U
Toluene	µg/L	1 U	1 U	1 U
Xylene (meta & para)	µg/L	1 U	1 U	1 U
Xylene (ortho)	µg/L	1 U	1 U	1 U
Dioxins/Furans				
2,3,7,8-TCDD	pg/L	1.09 U	1.32 U	1.25 U
1,2,3,7,8-PeCDD	pg/L	1.73 U	1.99 U	1.64 U
1,2,3,4,7,8-HxCDD	pg/L	1.81 U	1.77 U	2.37 U
1,2,3,6,7,8-HxCDD	pg/L	2.22 U	2.22 U	2.99 U
1,2,3,7,8,9-HxCDD	pg/L	1.97 U	1.95 U	2.62 U
1,2,3,4,6,7,8-HpCDD	pg/L	2.27 U	2.65 U	2.65 U
Total OCDD	pg/L	27.5 J	12.8 J	14.8 J
2,3,7,8-TCDF	pg/L	0.86 U	0.9 U	0.91 U
1,2,3,7,8-PeCDF	pg/L	1.13 U	1.4 U	1.17 U
2,3,4,7,8-PeCDF	pg/L	1.2 U	1.59 U	1.26 U
1,2,3,4,7,8-HxCDF	pg/L	1.54 U	1.26 U	1.9 U
2,3,4,6,7,8-HxCDF	pg/L	1.62 U	1.34 U	2.04 U
1,2,3,7,8,9-HxCDF	pg/L	1.61 U	1.32 U	2.01 U
1,2,3,4,6,7,8-HpCDF	pg/L	1.7 U	1.84 U	2 U
1,2,3,6,7,8-HxCDF	pg/L	1.45 U	1.25 U	1.85 U
1,2,3,4,7,8,9-HpCDF	pg/L	2.74 U	2.74 U	3.01 U
Total OCDF	pg/L	4.25 U	3.89 U	4 UJ
Summed Dioxin/Furan TEQ[5,6]	pg/L	0.00825 J	0.00384 J	0.00444 J
Summed Dioxin/Furan TEQ with One-half of the Detection Limit[5,7]	pg/L	2.3 J	2.56 J	2.53 J

Notes:

1 Benzofluoranthenes (total) includes both benzo(b)fluoranthene and benzo(k)fluoranthene. Both analytes have a toxicity equivalency factor of 0.1; therefore, the total of the two analytes is multiplied by 0.1 when calculating the cPAH TEQ.

2 Calculation of cPAH TEQ concentrations was performed using the California Environmental Protection Agency 2005 Toxic Equivancy Factors as presented in Table 708-2 of WAC 173-340-900 (WSDOE 2007).

3 Calculated using detected cPAH concentrations.

4 Calculated using detected cPAH concentrations plus one-half the reporting limit for cPAHs that were not detected.

5 World Health Organization 2005 Toxic Equivalency Factors used for calculation of dioxin/furan TEQ (van den Berg et al. 2006).

6 Calculated using detected dioxin/furan concentrations.

7 Calculated using detected dioxin/furan concentrations plus one-half the detection limit for dioxins/furans that were not detected.

Abbreviations:

cPAH	Carcinogenic polycyclic aromatic hydrocarbon
OCDD	Octachlorodibenzo-p-dioxin
OCDF	Octachlorodibenzofuran
TEQ	Toxic equivalency quotient
WAC	Washington Administrative Code
WSDOE	Washington State Department of Ecology

Qualifiers:

J	The analyte was analyzed for and positively identified, but the associated numerical value is an estimated quantity.
U	Undetected.
UJ	Undetected with estimated concentration.

Port of Seattle
Lora Lake Apartments Site

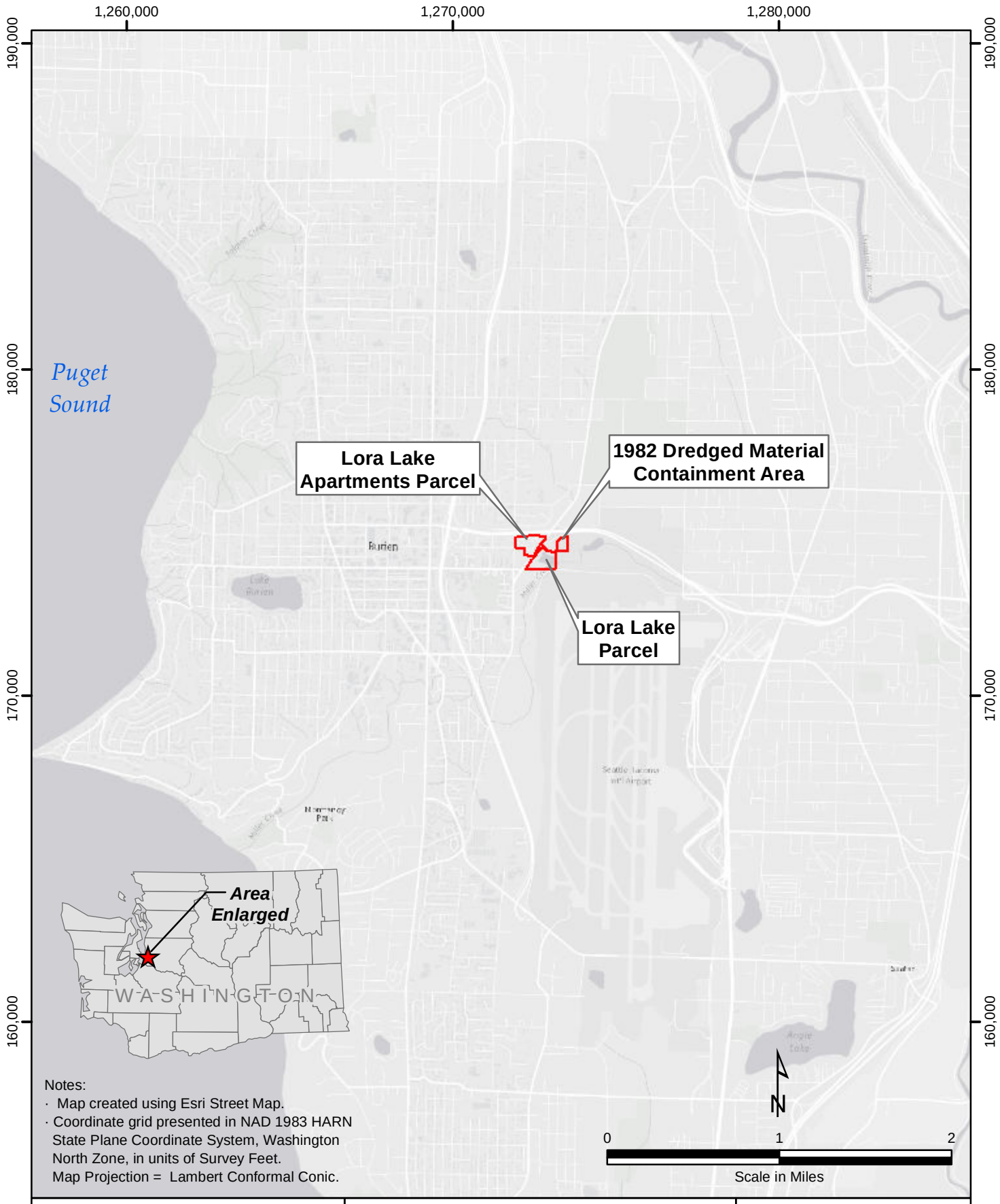
Remedial Investigation/ Feasibility Study

Volume II

Appendix H
1982 Dredged Material Containment Area Data Report

Figures

FINAL



Notes:
- Map created using Esri Street Map.
- Coordinate grid presented in NAD 1983 HARN State Plane Coordinate System, Washington North Zone, in units of Survey Feet.
  Map Projection = Lambert Conformal Conic.

FLOYD | SNIDER
strategy • science • engineering

Remedial Investigation/Feasibility Study
Port of Seattle
Lora Lake Apartments Site
Burien, Washington

Figure H.1
Vicinity Map

I:\GIS\Projects\POS_LLA\MXD\T6030\Appendix H\Figure H.1 Vicinity Map.mxd
9/15/2014

1,272,000 1,272,500 1,273,000 1,273,500

175,000 174,500 174,000

Legend

- Topographic Contour (in Feet NAVD88)
- Tax Parcels
- Approximate Extent of 1982 Dredged Material Containment Area

Notes:

- Topographic contours derived from Bare-Earth Return LiDAR data provided by the Puget Sound LiDAR Consortium.
- Topographic contours presented in units of feet relative to North American Vertical Datum 1988.
- Tax parcel boundaries based on King County tax parcel data.
- Aerial image provided by Port of Seattle and dated March 20, 2011.
- Coordinate grid presented in NAD 1983 HARN State Plane Coordinate System, Washington North Zone, in units of Survey Feet. Map Projection = Lambert Conformal Conic.

Abbreviations:

- HARN = High Accuracy Reference Network
- NAD = North American Datum
- NAVD88 = North American Vertical Datum of 1988

SR 518

SOUTH 150TH STREET

8TH AVE SOUTH

DES MOINES MEMORIAL DRIVE

LORA LAKE APARTMENTS PARCEL

1982 DREDGED MATERIAL CONTAINMENT AREA

PORT OF SEATTLE PROPERTY

Lora Lake

LORA LAKE PARCEL

PORT OF SEATTLE PROPERTY

N

0 150 300

Scale in Feet

FLOYD | SNIDER

strategy ▪ science ▪ engineering

Remedial Investigation/Feasibility Study
Port of Seattle
Lora Lake Apartments Site
Burien, Washington

Figure H.2
Site Topography

I:\GIS\Projects\POS_LLA\MXD\T6030\Appendix H\Figure H.2 Site Topography.mxd
9/15/2014

1,273,000 1,273,300 1,273,600 1,273,900

174,700

174,400

Legend

- Floyd|Snider Test Pit
- Existing Monitoring Well
- Approximate Extent of 1982 Dredged Material Containment Area[1]

Notes:
1. 1982 Dredged Material Containment Area falls outside Designated Wetland boundaries.
   · Aerial image provided by Port of Seattle and dated March 20, 2011.
   · Coordinate grid presented in NAD 1983 HARN State Plane Coordinate System, Washington North Zone in units of survey feet. Map Projection = Lambert Conformal Conic.

Abbreviations:
· HARN = High Accuracy Reference Network
· NAD = North American Datum

TP-1
TP-2
TP-3
TP-4
TP-5
TP-6
HC00-B312
HC00-B310
HC00-B311

LORA LAKE

N

0 100 200

Scale in Feet

FLOYD | SNIDER
strategy ▪ science ▪ engineering

Remedial Investigation/Feasibility Study
Port of Seattle
Lora Lake Apartments Site
Burien, Washington

Figure H.3
1982 Dredged Material Containment Area
Sampling Locations

I:\GIS\Projects\POS_LLA\MXD\T6030\Appendix H\Figure H.3 Test Pit and GW Well Locations.mxd
9/15/2014

1,273,000 1,273,300 1,273,600 1,273,900

174,700

174,400

Legend

- Floyd|Snider Test Pit
- Existing Monitoring Well
- Approximate Extent of 1982 Dredged Material Containment Area[1]

Notes:
1. 1982 Dredged Material Containment Area falls outside Designated Wetland boundaries.
- The TEQs for cPAHs presented on this figure were calculated using detected concentrations plus one-half the reporting limit for analytes that were not detected.
- The TEQs for dioxins/furans presented on this figure were calculated using detected concentrations plus one-half the detection limit for analytes that were not detected.
- Aerial image provided by Port of Seattle and dated March 20, 2011.
- Coordinate grid presented in NAD 1983 HARN State Plane Coordinate System, Washington North Zone in units of survey feet. Map Projection = Lambert Conformal Conic.

Abbreviations:
- cPAH = Carcinogenic polycyclic aromatic hydrocarbon
- DMCA = Dredged Material Containment Area
- ft = Feet
- HARN = High Accuracy Reference Network
- µg/kg = Micrograms per kilogram
- mg/kg = Milligrams per kilogram
- NAD = North American Datum
- pg/g = Picograms per gram
- TEQ = Toxic equivalency quotient

Qualifier:
- J = Contaminant of concern was detected but the result is qualified

LORA LAKE

N

0 100 200

Scale in Feet

TP-1

Analyte	Result	Unit	Depth (ft)
Arsenic	8	mg/kg	0 – 3
	15	mg/kg	3 – 4.5
	6	mg/kg	4.5 – 5.5
Lead	15	mg/kg	0 – 3
	18	mg/kg	3 – 4.5
	29	mg/kg	4.5 – 5.5
TPH-Heavy Oil	22	mg/kg	3 – 4.5
Range	23	mg/kg	4.5 – 5.5
cPAH TEQ	9.7	µg/kg	3 – 4.5
Ethylbenzene	56	µg/kg	3 – 4.5
Toluene	68	µg/kg	3 – 4.5
Dioxin/Furan TEQ	0.927 J	pg/g	0 – 3
	4.94 J	pg/g	3 – 4.5
	4.15 J	pg/g	4.5 – 5.5

TP-2

Analyte	Result	Unit	Depth (ft)
Arsenic	10	mg/kg	1.5 – 3
Lead	18	mg/kg	1.5 – 3
TPH-Heavy Oil	19	mg/kg	1.5 – 3
Range	5.9	mg/kg	3 – 4
cPAH TEQ	3.2	µg/kg	1.5 – 3
Toluene	32.0	µg/kg	1.5 – 3
Dioxin/Furan TEQ	7.08 J	pg/g	1.5 – 3
	0.283 J	pg/g	3 – 4

TP-3

Analyte	Result	Unit	Depth (ft)
Arsenic	7	mg/kg	2 – 3
	50	mg/kg	3 – 4
	7	mg/kg	5 – 6
Lead	10	mg/kg	2 – 3
	165	mg/kg	3 – 4
	3	mg/kg	5 – 6
TPH-Diesel Range	16	mg/kg	3 – 4
TPH-Motor Oil	18	mg/kg	2 – 3
	95	mg/kg	3 – 4
cPAH TEQ	3.9	µg/kg	2 – 3
	6.3	µg/kg	3 – 4
Pentachlorophenol	24	µg/kg	3 – 4
Toluene	71	µg/kg	3 – 4
Dioxin/Furan TEQ	7.34 J	pg/g	2 – 3
	41.1 J	pg/g	3 – 4
	0.247 J	pg/g	5 – 6

TP-4

Analyte	Result	Unit	Depth (ft)
Arsenic	60	mg/kg	0 – 1.5
Lead	119	mg/kg	0 – 1.5
	2	mg/kg	1.5 – 2
TPH-Diesel Range	14	mg/kg	0 – 1.5
TPH-Heavy Oil	100	mg/kg	0 – 1.5
Range	18	µg/kg	0 – 1.5
Dioxin/Furan TEQ	64.4 J	pg/g	0 – 1.5
	0.217 J	pg/g	1.5 – 2

TP-5

Analyte	Result	Unit	Depth (ft)
Arsenic	50	mg/kg	1.5 – 2
Lead	160	mg/kg	1.5 – 2
TPH-Gasoline Range	23	mg/kg	1.5 – 2
TPH-Diesel Range	21	mg/kg	1.5 – 2
TPH-Heavy Oil Range	120	mg/kg	1.5 – 2
cPAH TEQ	21 J	µg/kg	1.5 – 2
Pentachlorophenol	39 JN	µg/kg	1.5 – 2
Toluene	6500	µg/kg	1.5 – 2
Dioxin/Furan TEQ	59.4 J	pg/g	1.5 – 2
	0.354 J	pg/g	2 – 3

TP-6

Analyte	Result	Unit	Depth (ft)
Arsenic	6	mg/kg	0 – 2.5
	7	mg/kg	2.5 – 5
Lead	7	mg/kg	0 – 2.5
	8	mg/kg	2.5 – 5
Dioxin/Furan TEQ	0.887 J	pg/g	0 – 2.5
	0.815 J	pg/g	2.5 – 5

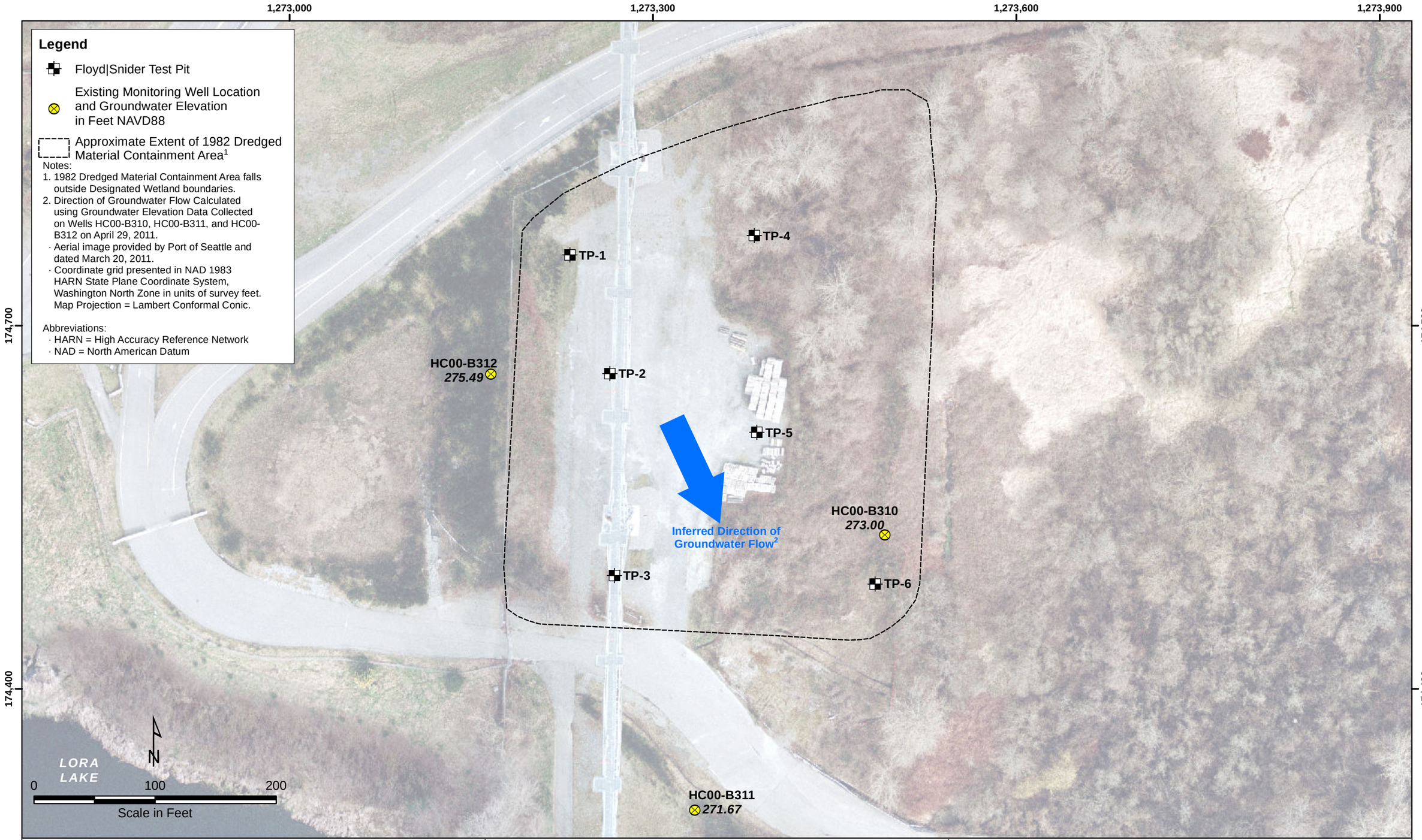
HC00-B312 HC00-B310 HC00-B311

FLOYD | SNIDER
strategy • science • engineering

Remedial Investigation/Feasibility Study
Port of Seattle
Lora Lake Apartments Site
Burien, Washington

Figure H.4
Detected Concentrations of Preliminary Contaminants of Concern in DMCA Soils

I:\GIS\Projects\POS_LLA\MXD\T6030\Appendix H\Figure H.4 Detected PCOC Concs in DMCA Soils.mxd
9/15/2014



FLOYD | SNIDER
strategy ▪ science ▪ engineering

Remedial Investigation/Feasibility Study
Port of Seattle
Lora Lake Apartments Site
Burien, Washington

Figure H.5
Groundwater Elevations and Inferred Flow Direction

I:\GIS\Projects\POS_LLA\MXD\T6030\Appendix H\Figure H.5 GW Elevations and Flow Direction from Site Wells.mxd
9/15/2014

1,273,000 1,273,300 1,273,600 1,273,900

174,700

174,400

Legend

- Floyd|Snider Test Pit
- Existing Monitoring Well
- Approximate Extent of 1982 Dredged Material Containment Area[1]

Notes:
1. 1982 Dredged Material Containment Area falls outside Designated Wetland boundaries.
- The TEQs for dioxins/furans presented on this figure were calculated using detected concentrations plus one-half the detection limit for analytes that were not detected.
- Aerial image provided by Port of Seattle and dated March 20, 2011.
- Coordinate grid presented in NAD 1983 HARN State Plane Coordinate System, Washington North Zone in units of survey feet. Map Projection = Lambert Conformal Conic.

Abbreviations:
- DMCA = Dredged Material Containment Area
- HARN = High Accuracy Reference Network
- µg/L = Micrograms per liter
- NAD = North American Datum
- pg/L = Picograms per liter
- TEQ = Toxic equivalency quotient

Qualifier:
- J = Contaminant of concern was detected but result is qualified.

TP-1
TP-2
TP-3
TP-4
TP-5
TP-6
HC00-B312
HC00-B310
HC00-B311

HC00-B312		
Analyte	**Result**	**Unit**
Arsenic	0.3	µg/L
Dioxin/Furan TEQ	2.53 J	pg/L

HC00-B310		
Analyte	**Result**	**Unit**
Arsenic	0.7	µg/L
Dioxin/Furan TEQ	2.3 J	pg/L

HC00-B311		
Analyte	**Result**	**Unit**
Arsenic	0.4	µg/L
Dioxin/Furan TEQ	2.56 J	pg/L

LORA LAKE

N

0 100 200

Scale in Feet

FLOYD | SNIDER
strategy ▪ science ▪ engineering

Remedial Investigation/Feasibility Study
Port of Seattle
Lora Lake Apartments Site
Burien, Washington

Figure H.6
Detected Concentrations of Preliminary Contaminants of Concern in DMCA Groundwater

I:\GIS\Projects\POS_LLA\MXD\T6030\Appendix H\Figure H.6 Detected PCOC Concs in DMCA Groundwater.mxd
9/15/2014

Port of Seattle
Lora Lake Apartments Site

Remedial Investigation/ Feasibility Study

Volume II

Appendix H
1982 Dredged Material Containment Area Data Report

Attachment H.1
Test Pit Logs

FINAL

FLOYD | SNIDER
strategy • science • engineering

Test Pit ID: TP-1

Excavation Date: April 19, 2011
Logged By: Kristin Anderson
Excavated By: Port of Seattle
Equipment Type: Excavator, 12' reach
Sample Method: Stainless Steel Spoon
Excavation Length/Width: 12ft x 2ft
Excavation Depth (ft bgs): 7 ft
Groundwater ATD (ft bgs): 7 ft

Coordinate System: NAD83/NGVD29
Ground Surface Elevation: 278.7 ft NGVD29
Latitude/Northing: 174758.3 ft NAD83
Longitude/Easting: 1273231.6 ft NAD83
Test Pit Location: Northwest Corner

Client: Port of Seattle
Project: POS-LL
Task: 6020
Address: STIA 3rd Runway Seatac, WA

Remarks: Excavation terminated at 7 ft bgs due to extensive groundwater infiltration

PID (ppm)	SAMPLE INTERVAL	SAMPLE ID	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS (color, texture, moisture, MAJOR CONSTITUENT, odor, stainng, sheen, debris, etc.)
			0	SW	moist, brown medium SAND with trace silt and gravel. no odor.
0.4			1		
1.4	0-3 ft	DMA-TP1-0-3-041911			
			2		construction debris- broken concrete and silt fence at 2 ft bgs
0.1				SW-SM	moist, gray-brown coarse SAND with SILT and rounded GRAVEL. more abundant gravel than above, some clasts >6' diameter. no odor. grades to dark gray at 3 ft, slight organic odor.
			3		
0.6	3-4.5 ft	DMA-TP1-3-4.5-041911			
			4	SW	moist, dark gray-brown SAND grades to gray, medium SAND with gravel and trace silt
6.0					
	4.5-5.5 ft	DMA-TP1-4.5-5.5-041911	5	SM	moist, dark brown SILTY SAND. grass and roots at 5.5 ft. layers appeart to be bedded-possible dredge material?
3.7				SW	moist dark brown SAND with peat. groundwater infiltration at 7 ft
			6		
0.8	6-7 ft	DMA-TP1-6-7-041911			
			7		

Notes:
FT BGS = feet below ground surface
ppm = parts per million
--- Dashed contact line in soil description indicates a gradational contact
USCS = Unified Soil Calssification System
▼ = denotes groundwater table

FLOYD | SNIDER
strategy • science • engineering

Test Pit ID: TP-2

Excavation Date: April 19, 2011
Logged By: Kristin Anderson
Excavated By: Port of Seattle
Equipment Type: Excavator, 12' reach
Sample Method: Stainless Steel Spoon
Excavation Length/Width: 10 ft x 2 ft
Excavation Depth (ft bgs): 5.5 ft
Groundwater ATD (ft bgs): 5 ft

Coordinate System: NAD83/NGVD29
Ground Surface Elevation: 276.0 ft NAVD29
Latitude/Northing: 174660.5 ft NAD83
Longitude/Easting: 1273264.4 ft NAD83
Test Pit Location: West of Approach Lights

Client: Port of Seattle
Project: POS-LL
Task: 6020
Address: STIA 3rd Runway
Seatac, WA

Remarks: Excavation terminated at 5.5 ft bgs due to extensive groundwater infiltration

PID (ppm)	SAMPLE INTERVAL	SAMPLE ID	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS (color, texture, moisture, MAJOR CONSTITUENT, odor, stainng, sheen, debris, etc.)
			0	GW	angular GRAVEL with moist, brown SAND. no odor.
0.7			1	SW	moist, gray medium SAND. rootlets, no odor
					approx 3 mm lense of fine-grained material at 2 ft bgs
0.3	1.5-3 ft	DMA-TP2-1.5-3-041911	2	SM	moist, dark brown SILTY SAND with peaty material and rootlets. bedded appearance, with slight organic odor- possible dredge material.
3.4			3	SW	moist, blue-gray coarse SAND. no silt or gravel, no odor
	3-4 ft	DMA-TP2-3-4-041911			
2.5			4		
	5-5.5 ft	DMA-TP2-5-5.5-041911	5		fine-grained pockets and groundwater infiltration at 5 ft

Notes:
FT BGS = feet below ground surface
ppm = parts per million
--- Dashed contact line in soil description indicates a gradational contact
USCS = Unified Soil Calssification System
▼ = denotes groundwater table

FLOYD | SNIDER
strategy • science • engineering

Test Pit ID: TP-3

Excavation Date: April 20, 2011
Logged By: Kristin Anderson
Excavated By: Port of Seattle
Equipment Type: Excavator, 12' reach
Sample Method: Stainless Steel Spoon
Excavation Length/Width: 10 ft x 2 ft
Excavation Depth (ft bgs): 6 ft
Groundwater ATD (ft bgs): 4.5 ft

Coordinate System: NAD83/NGVD29
Ground Surface Elevation: 274.9 ft NGVD29
Latitude/Northing: 174493.7 ft NAD83
Longitude/Easting: 1273268.1 ft NAD83
Test Pit Location: Southwest Corner

Client: Port of Seattle
Project: POS-LL
Task: 6020
Address: STIA 3rd Runway Seatac, WA

Remarks: Excavation terminated at 6 ft bgs due to extensive groundwater infiltration

PID (ppm)	SAMPLE INTERVAL	SAMPLE ID	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS (color, texture, moisture, MAJOR CONSTITUENT, odor, stainng, sheen, debris, etc.)
			0	GW-GM	angular and rounded GRAVEL with moist, coarse brown SAND and SILT. no odor.
			1		
			2	SW-SM	moist, gray medium SAND with SILT and GRAVEL. no odor.
1.5	2-3 ft	DMA-TP3-2-3-042011			grades to gray-brown at 2.5 ft bgs
			3	SM	moist, dark brown fine SILTY SAND with peaty matter and rootlets. bedded appearance, with slight organic odor. some dark gray bedded layers- possible dredge material
1.8	3-4 f	DMA-TP3-3-4-042011	4		
				SW	wet, gray coarse SAND with light brown pockets. rounded gravels, very trace silt, no odor. groundwater infiltration at 4.5 ft
			5		
1.3	5-6 ft	DMA-TP3-5-6-042011	6		

Notes:
FT BGS = feet below ground surface
ppm = parts per million
--- Dashed contact line in soil description indicates a gradational contact
USCS = Unified Soil Calssification System
▼ = denotes groundwater table

FLOYD | SNIDER
strategy • science • engineering

Test Pit ID: TP-4

Excavation Date: April 20, 2011
Logged By: Kristin Anderson
Excavated By: Port of Seattle
Equipment Type: Excavator, 12' reach
Sample Method: Stainless Steel Spoon
Excavation Length/Width: 8ft x 2 ft
Excavation Depth (ft bgs): 2 ft
Groundwater ATD (ft bgs): 1.5 ft

Coordinate System: NAD83/NGVD29
Ground Surface Elevation: 273.5 ft NGVD29
Latitude/Northing: 174774.3 ft NAD83
Longitude/Easting: 1273383.6 ft NAV83
Test Pit Location: Northeast Corner

Client: Port of Seattle
Project: POS-L
Task: 6020
Address: STIA 3rd Runway Seatac, WA

Remarks: Excavation terminated at 2 ft bgs due to extensive groundwater infiltration

PID (ppm)	SAMPLE INTERVAL	SAMPLE ID	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS (color, texture, moisture, MAJOR CONSTITUENT, odor, stainng, sheen, debris, etc.)
0.6	0-1.5 ft	DMA-TP4-0-1.5-042011	0	SM	moist, dark black-brown SILTY SAND with rootlets and organic matter. slight organic odor.
			1		very fast groundwater inflitration at 1.5 ft bgs
0.4	1.5-2 ft	DMA-TP4-1.5-2-042011		SW	wet, gray and light brown, medium SAND. no odor. moist at 2 ft.
			2		

Notes:
FT BGS = feet below ground surface
ppm = parts per million
--- Dashed contact line in soil description indicates a gradational contact
USCS = Unified Soil Calssification System
▼ = denotes groundwater table

FLOYD | SNIDER
strategy • science • engineering

Test Pit ID: TP-5

Excavation Date: April 20, 2011
Logged By: Kristin Anderson
Excavated By: Port of Seattle
Equipment Type: Excavator, 12' reach
Sample Method: Stainless Steel Spoon
Excavation Length/Width: 10 ft x 2 ft
Excavation Depth (ft bgs): 4.5 ft
Groundwater ATD (ft bgs): 3 ft

Coordinate System: NAD83/NGVD29
Ground Surface Elevation: 274.3 ft NGVD29
Latitude/Northing: 174611.7 ft NAD83
Longitude/Easting: 1273385.6 ft NAV83
Test Pit Location: East of Approach Lights

Client: Port of Seattle
Project: POS-LL
Task: 6020
Address: STIA 3rd Runway Seatac, WA

Remarks: Excavation terminated at 3 ft bgs due to extensive groundwater infiltration

PID (ppm)	SAMPLE INTERVAL	SAMPLE ID	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS (color, texture, moisture, MAJOR CONSTITUENT, odor, stainng, sheen, debris, etc.)
			0	GW-GM	rounded and angular GRAVEL with moist, brown medium SILTY SAND. no odor. some large cobbles > 6" diameter
			1		
16.3	1.5-2 ft	DMA-TP5-1.5-2-042011		SM	moist, dark brown SILTY SAND with peat. organic odor, rootlets and woody fragments.
			2	SW	moist, light blue-gray and tan medium SAND. no odor. groundwater infiltration at 3 ft bgs
1.3	2-3 ft	DMA-TP5-2-3-042011			
			3	SM	grades to moist, light blue-gray and tan fine SILTY SAND. no odor.
1.0	3.5-4.5 ft	DMA-TP5-3.5-4.5-042011	4		

Notes:
FT BGS = feet below ground surface
ppm = parts per million
--- Dashed contact line in soil description indicates a gradational contact
USCS = Unified Soil Calssification System
▼ = denotes groundwater table

FLOYD | SNIDER
strategy • science • engineering

Test Pit ID: TP-6

Excavation Date: April 19, 2011
Logged By: Kristin Anderson
Excavated By: Port of Seattle
Equipment Type: Excavator, 12' reach
Sample Method: Stainless Steel Spoon
Excavation Length/Width: 10 ft x 2 ft
Excavation Depth (ft bgs): 6.5 ft
Groundwater ATD (ft bgs): 6 ft

Coordinate System: NAD83/NGVD29
Ground Surface Elevation: 274.4 ft NGVD29
Latitude/Northing: 174486.9 ft NAD83
Longitude/Easting: 1273483.4 ft NAV83
Test Pit Location: Southeast Corner

Client: Port of Seattle
Project: POS-LL
Task: 6020
Address: STIA 3rd Runway Seatac, WA

Remarks: Excavation terminated at 6.5 ft bgs due to extensive groundwater infiltration

PID (ppm)	SAMPLE INTERVAL	SAMPLE ID	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS (color, texture, moisture, MAJOR CONSTITUENT, odor, stainng, sheen, debris, etc.)
0.1	0-2.5 ft	DMA-TP6-0-2.5-041911	0	SW/SW-SM	moist, brown medium-fine SAND with pockets of gray SILTY SAND. no odor.
0.8			1		
			2		
			3	SW-SM	moist, dark brown SAND with SILT. gravel content increases with depth. pockets or black-brown SILTY SAND with woody material and red staining. no odor
0.6	2.5-5 ft	DMA-TP6-2.5-5-041911	4		light blue-gray and fine at 4 ft bgs with red-orange oxide staining and some dark woody fragments.
0.7			5		
	5-6 ft	DMA-TP6-5-6-041911	6		wet at 6 ft bgs.

Notes:
FT BGS = feet below ground surface
ppm = parts per million
--- Dashed contact line in soil description indicates a gradational contact
USCS = Unified Soil Calssification System
▼ = denotes groundwater table